

# PLUREL



Instruments and tools

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STRATEGIES AND SUSTAINABILITY ASSESSMENT  
TOOLS FOR URBAN-RURAL LINKAGES,  
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## PLUREL XPLORER

**Information platform for peri-urbanisation based  
on PLUREL products**

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## Abstract

The PLUREL Xplorer is an integrative framework for the study of rural-urban interactions. It appears as a web based online information platform for users interested in processes of peri-urbanisation and their respective relation to sustainable development. It features all PLUREL activities and products but may easily be extended to other knowledge sources of rural-urban interactions in Europe, its sub-regions or regions abroad.

Linked to a web-based data management system and GEO-portal, the Xplorer provides information to processes, problems and places of peri-urbanisation in Europe and its regions. The tool integrates and links the various sub-products of the PLUREL project. It aims at supporting planning and policy discussions on rural-urban land use interactions at European and at regional level.

Targeted user groups include planners, policy makers, stakeholders, practitioners, scholars and researchers dealing with rural-urban interactions and sustainable peri-urban development.

The merit of the Xplorer lies in the condensation and configuration of knowledge produced within PLUREL into a format that is of use for further application. The front door (user entry) features a modular design similar to the *apps* system. Short, illustrated fact sheets guide the user through the knowledge bits and allow for immediate download of sophisticated background information taking the form of reports, figures, maps, sketches or videos. Interactive design elements allow support the intuitive comprehension of causal interrelations between knowledge bits.

The back door (supplier entry) is constructed in form of a web-based fact sheet and file upload system that collects content and meta-information of knowledge produced in PLUREL in a consistent and standardised form. Standardisation also allows for supplier entries from outside the PLUREL community and beyond the lifetime of the project.

The engine itself is developed as a Java Client-Server application using Java WebStart technologies for front door applications, and Java Servlets and JDBC database connectors for back door functionalities. This way, the system is platform independent.

Since the end of March 2011, the Xplorer final version is online at <http://plurel.ait.ac.at/plurel/xplorer/>. It is also accessible via the main PLUREL project homepage under [www.plurel.net](http://www.plurel.net).

Müncheberg and Vienna, March 2011



**Classification of results/outputs:**

For the purpose of integrating the results of this deliverable into the PLUREL Xplorer dissemination platform as fact sheets and associated documentation please classify the results in relation to spatial scale; DPSIR framework; land use issues; output indicators and knowledge type.

<b>Spatial scale for results:</b> Regional, national, European	<b>Regional, National, RUR-Type specific, European</b>
<b>DPSIR framework:</b> Driver, Pressure, State, Impact, Response	<b>DPSIR</b>
<b>Land use issues covered:</b> Housing, Traffic, Agriculture, Natural area, Water, Tourism/recreation	<b>All relevant land use issues covered</b>
<b>Scenario sensitivity:</b> Are the products/outputs sensitive to Module 1 scenarios?	<b>The Xplorer includes the scenarios, scenario-dependent as well as scenario-independent results of PLUREL</b>
<b>Output indicators:</b> Socio-economic & environmental external constraints; Land Use structure; RUR Metabolism; ECO-system integrity; Ecosystem Services; Socio-economic assessment Criteria; Decisions	<b>The Xplorer comprises all indicator sets on the European and regional level derived, analysed and assessed in PLUREL.</b>
<b>Knowledge type:</b> Narrative storylines; Response functions; GIS-based maps; Tables or charts; Handbooks	<b>Online dissemination platform</b>
<b>How many fact sheets will be derived from this deliverable:</b>	<b>2 directly (PLUREL Xplorer, Short Manual), 160 in sum</b>



# Introduction

As defined in the New Implementation Plan (NIP) of 2009, the main task of Module 5 is to synthesise results from all PLUREL modules into products that are of use for specific user groups inside and outside the scientific community. The main output of WP 5.3 is the concept and implementation of the PLUREL Xplorer.

## PLURELS WP5.3

The main output of WP 5.3 is the PLUREL Xplorer [pronunciation: ik-'splör-ər], which serves as integrative framework for all PLUREL activities and their interrelations and reveals their causal interlinkages. This result exploration tool integrates and links the various sub-products of the PLUREL project. It aims at supporting planning and policy discussions on rural-urban land use interactions at European and at regional level.

WP 5.3 is responsible for developing the concept [ZALF, Germany] for this end product of PLUREL and the subsequent technical implementation [AIT, Austria]. One of the key tasks is the knowledge integration [ZALF, Germany] into the PLUREL Xplorer. Here, the result is the data and fact sheet implementation for each PLUREL product and sub-product. For this purpose, an interactive web template for fact sheets of all PLUREL products was developed. The task of WP5.3 is also the processing of the product information from all PLUREL partners to derive consistent and comparable descriptions to feed into the PLUREL Xplorer. Special consideration is paid to information requirements from stakeholders and end users.

It is the role of WP5.3 to assist all PLUREL partners in correctly compiling all meta-information and necessary dimensions for all PLUREL products. It is to be noted that success of PLUREL Xplorer is subject to targeted contributions from all PLUREL partners.

### Objectives of the deliverable

This deliverable report serves as an update for the former deliverable report 5.3.2 Concept of the PLUREL Xplorer - Design, functionality & technical implementation of March 2010. It refines and further specifies the concept of the PLUREL Xplorer based on stakeholder needs while concretising its technical implementation.

The updated D5.3.2 at hand comprises the concept and the integration of all identified products into the Xplorer and the documentation of the technical implementation of the back door (supplier entry, upload system) and the front door (user entry, download system) of the PLUREL Xplorer.

This deliverable is the written documentation of the PLUREL Xplorer, which is online available at <http://plurel.ait.ac.at/plurel/xplorer> as well as at the PLUREL main homepage at [www.plurel.net](http://www.plurel.net).

### Structure of the deliverable

The deliverable D5.3.2 at hand elucidates the concept for the PLUREL Xplorer. It comprises the updated concept and approach for the PLUREL Xplorer, while clarifying the underlying structure and complementary ordering principles of the result exploration tool. Attention is paid especially to the knowledge integration, condensation and configuration into a format suitable for user application, because a broad variety of PLUREL's results was implemented into one online tool with a sophisticated, but easy-to-use Graphical User Interface (GUI). The deliverable continues with the written documentation of the technical implementation of the PLUREL Xplorer from both sides, back door (supplier entry and fact sheet upload) and front door. It closes with a detailed description of the PLUREL Xplorer user entry and information download.

# Concept for the PLUREL Xplorer

PLUREL aimed at synthesising a result exploration tool, the PLUREL Xplorer, to support planning and policy discussions on rural-urban land use interactions at European and at regional level. It contains an impact analysis application component and integrates the different PLUREL products on their relevant spatial scales into an online available platform.

The first concept for this enhanced scope of the PLUREL Xplorer was developed and presented at the 4<sup>th</sup> PLUREL General Assembly (The Hague, 30<sup>th</sup> October 2008). The elaboration of this concept was carried out in cooperation with PLUREL task forces 1 (Product and Knowledge Chains), 2 (Indicator Framework) and 3 (SIAT-RUR). After the 2<sup>nd</sup> Annual Review of PLUREL, the objectives have been further refined and specified, particularly in relation to end users requirements. Also the project orientation towards specific final products has been profiled more clearly. The strengthened end user orientation is reflected in clearer product orientation of the deliverables. The adaptation and specification of the concept for the PLUREL Xplorer resulted in the deliverable report on the concept for the PLUREL Xplorer (former: SIAT-RUR) D5.3.1 which was submitted in May 2009.

After the Midterm review meeting, where an updated concept based on the above mentioned deliverable D5.3.1 was presented and discussed, iterative discussions in WP 5.3 resulted in an updated, more user-friendly version of the PLUREL Xplorer. The graphical user interface was adapted as well. A functional prototype was presented to the consortium during the 6<sup>th</sup> PLUREL General Assembly in Montpellier in October 2009. During the Interim Review Meeting in June 2009, reviewers uttered that the concept for the PLUREL Xplorer and so the adjacent document are to be understood as "living document". This is due to the fact that the requirements towards the final information dissemination platform are constantly changing with the constitution of the project results.

The deliverable at hand depicts the final concept, implementation and layout of the PLUREL Xplorer of March 2011 as a follow-up of the fruitful discussions within the PLUREL consortium, with stakeholders and iterative discussions in WP5.3 during the project period.

## End user requirements

Stakeholder deliberations were analysed with regards to expectations and needs for the PLUREL Xplorer as an interactive information platform. This analysis was based on (a) existing documents from Module 3 stakeholder work, (b) continuous interaction with stakeholders through a web forum particularly installed for PLUREL stakeholders, (c) stakeholder discussions at the PLUREL project meetings and (d) interaction with a wider stakeholder group, particularly the CURE and PURPLE network.

Concluding, the general requirements from end users at European and at case study level could be outlined as follows:

- To understand what is happening and why with respect to land use changes in peri-urban regions
- To identify the drivers for land use changes, their dynamics and interrelations
- To understand how governance systems interfere with exogenous driving forces for land use dynamics
- To understand how impacts of land use dynamics can be analysed
- To understand the interrelationships between land use dynamics and sustainable development options
- To study how specific themes, such as e.g. climate changes, biodiversity, water quality or migration interrelate with land use dynamics, what are the causal chain relationships

- To analyse examples from other regions about problems, strategies and solutions related to land use dynamics

The PLUREL Xplorer concept therefore aims at answering the end users' questions and meeting their requirements by displaying all PLUREL results from different perspectives by revealing their causal interlinkages.

#### **State of the art of information systems**

In general, concepts are an abstract idea defined as a "unit of knowledge" built from other units which act as a concept's characteristics. Concepts are vital to the development of scientific knowledge and for structuring the units the concept is built of. In the PLUREL context, the concept for the PLUREL Xplorer explains how the single products of the project are integrated into an analytical thread of rural-urban interactions. To achieve this integration, a certain abstraction is necessary. It is to be seen as a generalisation to reduce the information content of the concept, typically in order to retain only information which is relevant for a particular purpose. The latter parts on knowledge integration and technical implementation of this deliverable concretise this elaborated concept.

The PLUREL Xplorer's overall aim is to a) disseminate the knowledge on peri-urban relationships gathered within the PLUREL project and b) provide a discussion support system on peri-urban interlinkages for stakeholders at different levels. The Xplorer shall be used beyond the lifetime of the PLUREL project and shall be expandable to knowledge source outside the PLUREL project.

In recent years, both funding organisations and general academia call for a better integration of research results into the policy-making world (Sieber et al. 2010, Oxley et al. 2005). In order to tackle the "information gap" between researchers and policy-makers which inhibits a practical implementation of research results into policies, a range of tools and systems has been developed (Helming et al. 2011A). Among various ways to overcome the "information gap" between researchers and policy-makers, environmental information systems (EIS) have become a prominent way to make information available to non-academic audience. There have been various attempts to exactly define EISs, but these definitions largely depend on the perspective of the person defining it (Denzer 2005). EISs can take many forms, from raw data provision in paper or electronic format to decision-support systems (DSS) based on spatial and dynamic simulation models (Argent and Grayson 2001). A DSS can be defined as an interactive computer-based system that can help decision makers utilise data and models to solve a decision problem (Malczewski 1999). Following Matthies et al. (2007), a DSS is characterised by the fact it (1) uses data and models, (2) provides an easy, user-friendly interface, (3) can incorporate the decision-makers own insights, (4) is built by an interactive process, often including end-users, (5) supports one or more phases of decision-making, and (6) may include a knowledge component.

The PLUREL project considers how urban expansion effects the request of transportation, food supply chains, environment and recreation services and the pressures and impacts that these will put on rural land. Interactions between urban and rural land uses are considered as well as social, economic and ecological impacts. Neither the European Commission nor any other authority on European level does have a direct mandate for urban development policies. Although rural-urban interlinkages play an important role in the Sustainable Development context, the theme is rather regarded to be of lower policy relevance respectively as difficult to handle. It is partly decided at business level and partly decided by conglomerations of communities and partly by European regulations. Therefore the decision making structures are not evident and many stakeholders on many different government levels exist, which complicates the whole issue.

Consequently the PLUREL Xplorer was conceptualised as a discussion support tool integrating PLUREL activities and their interrelations rather than as a direct policy impact assessment tool. The PLUREL Xplorer takes a hybrid approach between pure IT-

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based data provision and a decision support system. As a result, it serves as a common platform for disseminating the project's results while revealing their interlinkages and causal chain relationships. Due to its technical design, the dissemination platform is further on a starting point for a dynamic portal on peri-urbanisation.

The PLUREL Xplorer focuses on decision-makers, including spatial planners, administrators, and other practitioners in the realm of land use and urban planning. In contrast to the pure presentation of scientific data, the PLUREL Xplorer turns research outcomes into accessible, practical information, and explains and interprets theoretical research findings. Additionally to offering three entry points to the exploration of the data, the user may choose between several levels of analysis during the process of data exploration and gets support in understanding their linkages and underlying dynamics. Another important characteristic is that the PLUREL Xplorer takes a scenario approach which allows the end-users a foresight approach on possible developments in their own respective area of interest.

A DSS classically generates policy strategies or policy impacts within the boundaries of the underlying model, following a query of the end-user. The PLUREL Xplorer, in contrary, presents ready-made, structured and inter-linked insights from seven undertaken case studies regarding policy strategies and policy impact assessments in peri-urban areas. As the PLUREL Xplorer aims at supporting discussion rather than giving particular advice on policy decisions regarding specific problems, we therefore propose the term "discussion support system". A discussion support system thus differs from a decision support system in that it conveys insights from research in textual form without offering the possibility to adjust the outcomes to a specific problem at hand. As an overall characteristic, the PLUREL Xplorer organises and interlinks the scientific insights from the PLUREL project into an accessible, applicable and appealing format. Designing research insights accessible means, from a practical perspective, that the design of the system takes into account the technical possibilities and requirements of the end-user. The system is based on readily available software and technical components, which facilitate its access and use. Additionally, all information is written in a simple but precise language targeted at lay or semi-expert audience. However, conveying research findings in an understandable and concise manner without compromising the complexity of the issue is seen as a challenge (van Delden et al. 2010).

Applicable refers to the necessity that end-users easily understand the system and run it intuitively. Additionally, van Delden (2007) argues that the designed support systems must connect to the context of the end-user's problems, and also relate to their decision-making process. The end-users should perceive the system as practicable and useful. Therefore, the logical organisation of the information should be prioritised. In this regard, the PLUREL Xplorer allows approaching the scientific insights from three different entry points (namely principles, problems and places). The data is organised in causal-chain relationships which allows the end-users to understand the underlying logic and the interlinkages of the information. Lastly, appealing refers to the visually attractive and inviting graphical user-interface of the system.

In order to make research insights and consequently the designed system accessible, applicable and appealing, it is crucial to include end-users from the start of the system development process (Fürst et al. 2010, Helming and Perez-Soba, 2011). Identifying end-users' information requirements can be the most time-consuming task in the whole process (Thomas 2001). Involving end-users in the system design has posed several challenges. Oxley et al. (2005) observe different aspects in this regard. First, scientists and policy-makers seem to speak „different languages“ in terms of coming from different working backgrounds. Scientists may have over-simplistic ideas on how policy and decision making works, and the different working environments they come from can impede effective communication and mutual understanding. Second, the authors mention different horizons of perceived problems: While scientists often focus on one research problem, policy makers as well as other affected stakeholders may have other agendas,

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depending on the scale the problem is looked at, e.g. at national or regional level. The third set of lessons learnt by Oxley et al. (2005) refers to their experience that scientists and end users may make different kinds of diagnoses about the cause of a problem. This challenge calls for designing the tool flexible enough to include many different views on the problem.

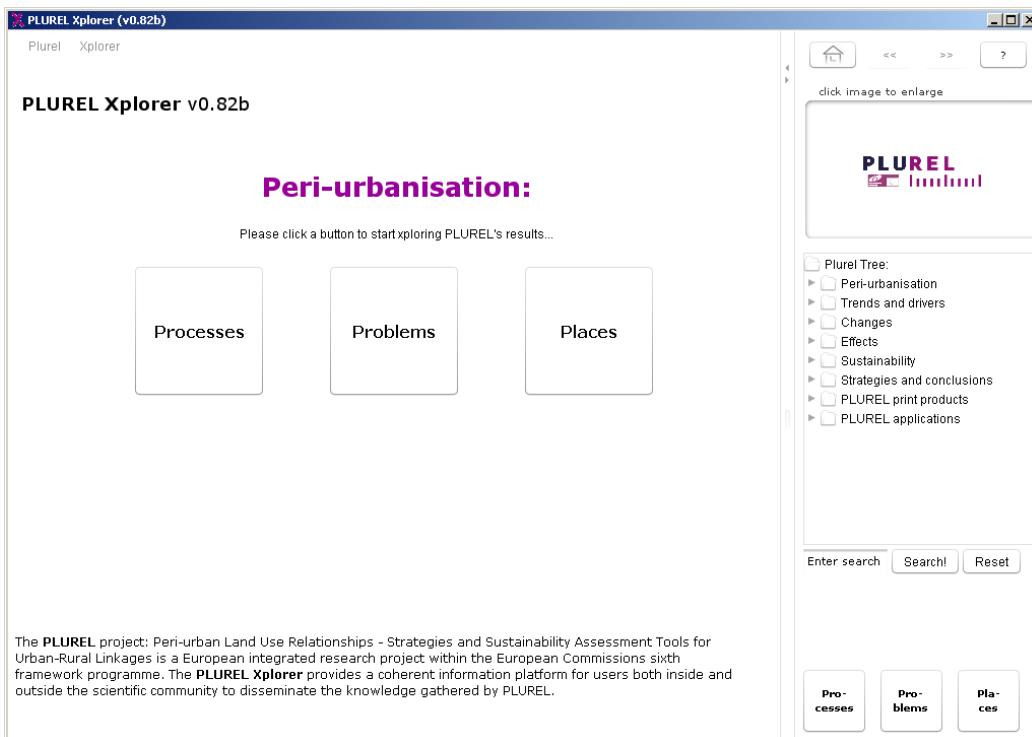
The PLUREL Xplorer offers an IT-based knowledge platform which presents policy strategies and impact assessments of land use policies in the peri-urban by presenting structured and interlinked research findings from the PLUREL project. Its major strength lies in the fact that it conveys research insights from several case studies in an accessible, applicable and appealing way in order to support policy discussion. We introduced the concept of “discussion support system” in order to demarcate it from a raw data provision and decision support tools.

The underlying concept for the PLUREL Xplorer is structured along an analytical cascade based on the DPSIR concept (Gabrielsen and Bosch, 2003). Its main task is to integrate the various products of PLUREL into one coherent information platform. Here, a variety of products belongs to a certain thematic area covered within the project. These products take the form of scientific reports and databases as well as input documents for stakeholders and practitioners with a focus on peri-urban land use change and its consequences. Each PLUREL result/product is accompanied by structured fact sheets containing e.g. maps, graphs, tables and reports. The PLUREL Xplorer features both, quantitative and qualitative information. Based on this concept and a careful analysis of the outcomes of other modules’ activities, the design features, operational elements and resultant structure of PLUREL Xplorer have been iteratively specified during the last months.

The DPSIR framework was developed by the European Environment Agency (Gabrielsen and Bosch, 2003) to mediate between different disciplinary viewpoints and to agree on a common understanding of causal chain relationships between society and environment. It is defined as „the causal framework for describing the interactions between society and the environment adopted by the European Environment Agency: Driving forces, Pressures, States, Impacts, and Responses“. The approach has since been used in many studies where interaction between human behaviour and environment was at stake (Niemeijer and De Groot 2006). It is particularly useful when scientific process knowledge has to be translated into knowledge for policy support, such as e.g. in the Thematic Strategy for Soil Protection of the European Commission (Van-Camp et al. 2004) or in land use impact assessment (Helming et al., 2011). The specific strength of the DPSIR concept lies in its adaptability to many different objectives and scales of analysis. (Fricke and Helming, 2009). However, various discussions within the PLUREL project, especially with practitioners and M3 researchers proofed that this concept is far away from the real-world terminology of the practitioners (who are an important user group of the PLUREL Xplorer) – it is seen as too abstract. Therefore the DPSIR chain used in the PLUREL Xplorer is “translated” into a real-world context. The used terms and illustrations for intuitive understanding were negotiated with different work groups of PLUREL in order to achieve a coherent wording throughout all PLUREL outputs.

### Implementation: Three Complementary Ordering Principles

The start screen of the PLUREL Xplorer illustrates the multiple entry points into the analyses provided by PLUREL. The user can choose from which perspective he or she would like to start his or her journey through PLUREL's knowledge, from the side of causal chain relationships (processes) from the thematic side (problems) or from the geographical side (places).



*Fig. 1                  Xplorer start screen*

The three ordering principles work like a matrix. All fact sheets, i.e. all PLUREL products, are assigned to the first ordering principle, the Principles and Processes of Peri-Urbanisation. A smaller subset of fact sheets is also assigned to the “problems/ potential solutions” button. By choosing this thematic perspective on rural-urban interlinkages as entry point into PLUREL's results, the user is at first led to an overview of the eight relevant topics related to peri-urbanisation processes. Within each of the thematic sub-areas, the fact sheets and so the content is structured according to the “principles and processes” section in form of a result tree, where all fact sheets related to the topic are sorted by the six sub-steps of this category.

For example, if one wants to learn about the drivers of land use change in peri-urban relationships in relation to landscape, a combination of these two topics leads to a fact sheet comprising the required information.

In the following, the three ordering dimensions (process of peri-urbanisaiton, problems or peri-urbanisation, places of peri-urbanisation) are described in detail.

## 1. Principles and Processes of Peri-Urbanisation



This first button comprises the six sub-steps of the DPSIR cycle. They are interlinked and rather to be seen as an analytical cycle, not as a chain. That means that e.g. reactions can feed back into the drivers of the future. Some products (especially on the case study scale) can be found in more than one of the six sub-steps. This is due to the fact that it proved complicated for practitioners to state whether a reaction is a response to a certain driver or a certain policy decision influenced a driving force of land use change.

This first ordering principle is consistent with the DPSIR analytical chain, but uses a more user-friendly, real-world language. It transfers the abstract terminology of science into practitioners' more concrete wording. To clarify and define certain terms and principles of rural-urban interlinkages, general principles and the used methodologies are explained as a first step.

In general, PLUREL end users are interested in the effects of land use changes on peri-urban interlinkages as these land use dynamics may cause serious environmental and specific spatial development problems in the rural-urban areas. Different processes leading to these land use changes and resulting impacts of these land use changes are of a certain interest to the end user. Topic-related principles comprising definitions, e.g. of peri-urbanisation, need to be clarified in order to obtain a consistent understanding and provide a basis for further discussions. Therefore the cognition and analysis of these principles and processes in the rural-urban relationship are the first possible entry point into the PLUREL results. Recognising the causal chain relationships of land use change, e.g. what drives land use change in the rural-urban context and what are possible impacts of land use changes in relation to sustainable development, supports the user in understanding, sharing and steering these processes.

Certain impact issues may describe a state while on the other hand being a driver of land use change in the rural-urban context. So the position of the used indicators and related impact issues within the DPSIR framework is variable, while being always related to land use change. Although this variability is taken into account especially in the indicator selection, the single products of PLUREL have to be assigned to a rather fixed position in this framework in order to ease the cooperation between the project partners. These specifications and assignments were developed and agreed iteratively in close cooperation with all project partners.

This ordering principle/ dimension of the Xplorer comprises all products of PLUREL M1, M2, M4 and M5. Some of them cover the complete analytical chain, such as the *Assessment of Sustainability Impacts of (peri-) urban land use changes* (M2) and the *Pan-European spatially explicit model linking changes in socioeconomic indicators and land use* (M4). By pressing the "Principles and Processes" button in the Xplorer, all fact sheets (and so all products) are accessible.

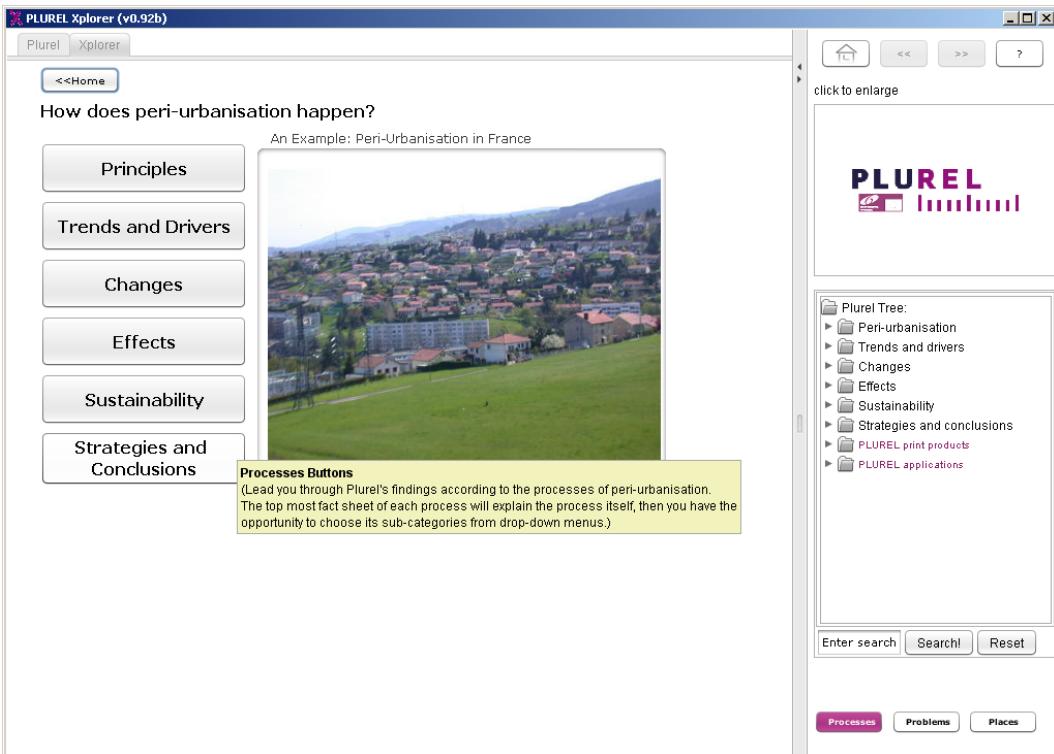


Fig. 2: *The Principles and Processes of Peri-urbanisation button reveals six sub-categories.*

a. *Principles* of peri-urbanisation are defined here. The project terminology is clarified and used methodologies are highlighted. This topic comprises general information on the PLUREL project as well as concepts and frameworks for the analysis of rural-urban relationships such as the complexity concept, system dynamics model and valuation methods, e.g. benefit transfer and CBA.

b. *Trends & Drivers* of peri-urbanisation are displayed here. Potential futures are shown as well on European as on case study scale. More precisely, this topic comprises Scenario Regionalisation maps and descriptions at European scale (M2) while it covers the case study scale by sub-regional delineation maps and driver dependent RUR elasticity (M2). PLUREL scenarios as well as underlying driving force assumptions are featured here.

c. *Changes* of land use are the focal lens of all PLUREL analyses. Therefore this topic consists of the land use change maps at European and at regional level for the different scenarios of peri-urbanisation. RUR typologies and their dynamics are also featured here. All analyses of the PLUREL Xplorer are conducted through the lens of land use changes. Because of its importance as main pressure in the peri-urbanisation process, this step is the central of the six steps within this ordering principle.

d. *Effects* of these land use changes are displayed by RUR-type specific response functions (M2), spatially explicit response functions for land use change modelling (M2) and the implementation of response functions at NutsX-scale. Relationships between Effects and Sustainability are covered by the application of regional variability of urbanisation-impact-relationships to land use maps (M2). Indicators of ecosystem services and quality of life related to peri-urbanisation scenarios are available here.

e. *Sustainable?* Here, the impacts of land use change are valued. This sub-step is covered by a Classical CBA on existing policies (M4), Choice Experiments (M4), detailed

impact analysis using a response function approach for several aggregated indicators (M5) and the interactive Impact Analysis Tools on European and case study scale (M5).

f. *Reactions* are integrated in the national spatial planning policies and governance typology (M2), the compendium on national spatial planning policies in Europe (M2), Migration Hot Spots (M2), the MOLAND application in the case studies Leipzig, Haaglanden, Koper and Montpellier (M2) and the handbook for practitioners (M5).

## 2. Problems / Solutions of Peri-Urbanisation

This second entry point of the PLUREL Xplorer is problem-oriented and also linked to potential solutions for the problems the end user has in mind. As mentioned above, PLUREL end users are interested in the effects of land uses change on peri-urban interlinkages. Thus the key issue and focal lens of the analytical string of PLUREL is land use or rather land use change. As end users may not be aware of the position of their question within the analytical cycle of principles and processes, thematic areas also play a significant role in characterising PLUREL's products. Certain interest groups, e.g. farmers' associations, are presumably interested in a certain form of land use, e.g. agriculture, which is subsumed under the term "landscape".

The PLUREL Xplorer therefore enables the user to regard causal chain relationships of land uses changes from a specified perspective. The eight problem/solution fields are (1) Governing & Policy Instruments, (2) Sustainable development, (3) Quality of Life, (4) Population and Household structure, (5) Economic development and working places, (6) Commuting, (7) Energy Consumption and Air pollution, (8) Landscape (comprising agricultural land use, open space for recreation as well as open space for biodiversity).



Most of the PLUREL results cover several or all issues. In order to compare case studies and derive common understandings of causal relationships in rural-urban interlinkages, the regions' stakeholders identified several issues of high significance for Sustainable Development in all the regions. These topics are correspondent to the thematic areas.

Where possible, PLUREL products were assigned to these eight categories. Some of them cover more than one thematic area, e.g. a spatial planning strategy related to housing can be integrated into "governing and policy instruments" as well as into "housing".

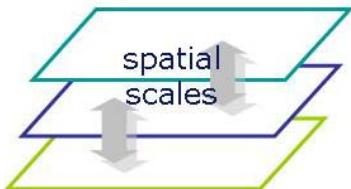
Other products, such as the spatially explicit scenarios, do not fit into this scheme. The results are nevertheless accessible via the "Principles and Processes" button and the "Places" button.

Sorted by the thematic area they are covering, products elaborated by all PLUREL modules are packaged here and can be identified starting from this entry point into the PLUREL Xplorer.

## 3. Places of Peri-Urbanisation

In the context of the spatial scale, the PLUREL analyses are operating at specific spatial scales from European (M1) to regional (M2) to local city region (M3, M4) level. This spatial scale might also be of interest for the end user of the PLUREL Xplorer.

From an end user perspective, most of the European stakeholders do have an interest in European issues, illustrated by detailed exemplary case studies, while the local stakeholders are interested in a more regional perspective. A careful design of case study examples here allows for a general comparability among other cases and on the level of RUR-Types, among comparable regions in Europe. National level stakeholders might be interested in linking the overall European perspective with the detailed knowledge gained in case study examples.



In terms of PLUREL analyses, the most results of M2 have a spatial level that is more detailed than the general view of M1 (NUTS0, NUTS1). Partly, a local resolution (NUTS5) is used to work with spatially explicit situations of the cases. Methodologically M2 deals primarily with rather regional aspects relating these to EU-policies relevant on that spatial and organisational level. In order to address the Pan-European impact of EU-policies on the land use relationships, M2 cooperates with M 1, where European trends in driving forces and their impact on the relationships between NUTS1 and NUTS2-regions will be studied. From that discussion appropriate adaptations or specification of the results were forwarded to M3, M4 and M5 in order to enhance the discussion with the local stakeholders in the cases as well as the modelling approaches.

It is important to notice, that the same or similar topics are analysed at different spatial scales. Hence, the operational spatial level of PLUREL Xplorer always depends on the respective modules' output. Summarising, a lot of the PLUREL products are spatially explicit, either on a European scale or on a specific case study scale.

Here they are applied in all or only in some of the case studies or they may draw general conclusions on the case study scale. Some of the products deal with general principles and are assigned to both or none of the spatial scales. They are then accessible via the thematic categories under "Problems/Potential Solutions" and the "Principles and Processes".

On the European Scale, products include: the national spatial planning policies and governance typology (M2), the compendium on national spatial planning policies in Europe (M2), the Scenario Regionalisation maps and descriptions at European scale (M2), the basic (generic) Response Functions (M2), the application of regional variability of urbanisation-impact-relationships to land use maps (M2), the implementation of Response Functions at NutsX scale (M2), the assessment of Sustainability Impacts (or degree of objective achievement) of (peri-) urban land use changes (M2), Migration hot spots (M2), the qualitative typology of regional planning strategies and policy measures (M2), the framework for the evaluation of economic impacts of transportation provision (M2), the indicator framework (M4), pan-European spatially explicit model linking changes in socioeconomic indicators and land use (M4) as well as classical CBA on existing policies (M4) and the iIAT Europe (M5).

On the RUR-Typology scale, the following products were identified: The RUR typologies (M2), the sub-regional delineation map (M2), the driver dependent RUR elasticities (M2), the qualitative typology of regional planning strategies and policy measures (M2), and RUR-type specific Response Functions (M2).

On the case study scale, the following products can be found: The Scenario Regionalisation description at case study level (M2), the MOLAND application in the case studies Leipzig, Haaglanden, Koper and Montpellier (M2), generic System Dynamics Model (M4), generic ABMland (M4), choice experiments (M4), a preference simulator for Quality of Life (M4), the demonstration of Generic System Dynamics Model (M4) and the iIAT for case studies (M5).

# Knowledge Integration

In order to best integrate PLUREL results into the PLUREL Xplorer, the following concrete events and activities have been conducted since the first concept for the PLUREL Xplorer in May 2009 (D5.3.1). During the two remaining years of the project, besides the further development of the PLUREL Xplorer concept, WP5.3 main focus was on the integration of the PLUREL products into the PLUREL Xplorer.

To fit into the overall design of the PLUREL Xplorer, all research results were classified into the six dimensions of the “Principles and Processes” button. Here, a close cooperation with all modules and work packages responsible for final products was conducted, based on the PLUREL Xplorer matrix with the product chain results (compare to D 5.3.1). Here, to arrange all the products (i.e. PLUREL results) in the PLUREL Xplorer so that they can easily be found by the user, a so-called Input Matrix was built. It requested the mentioned six dimensions by module leaders for each product or sub-product. To gather this information, an input matrix was circulated among the partners. These matrices were successfully discussed in at the internal project meeting in Koper in 2009 with Module 2 and 4. Continuous modifications of the assignments took place in close cooperation with all project partners, especially the module coordinators. To ease the compilation of the necessary information and to straighten the work process, the Input-Matrix was included into the template for PLUREL deliverables (compare to p.4 *Classification of results/outputs* of the deliverable at hand). Iteratively the information input into the PLUREL Xplorer was clarified with all module leaders and work package members after the modification of the concept, especially adapted assignments within the “Processes” dimension.

Another fundamental criterion of WP 5.3 was to identify and synthesise the complementarities between the different research elements of PLUREL. This activity required a continuous updating with other developments within the project. Here it is to note that the role of WP5.3 was to assist all PLUREL partners in correctly compiling all meta-information and dimensions for all PLUREL products. Nevertheless partners had to contribute targeted towards the PLUREL Xplorer.

The overall task of WP 5.3 was to process the gathered product information from all PLUREL partners to derive consistent and comparable descriptions which can be fed into the PLUREL Xplorer. Here, special consideration was paid to information requirements from stakeholders and end users. For this purpose, the fact sheet concept and the interactive web template for the fact sheets of all PLUREL products were developed.

## Fact Sheet Concept

Each product and information in the PLUREL Xplorer is accompanied by a fact sheet that provides very short but concise information about the type of knowledge entailed in this product, the methodology employed to derive it, the scale and extent of the information, the application context and the author. The purpose of the fact sheets is to maximise transparency and user friendliness of the Xplorer. It was a short and comprehensive text that gives the reader the basic information on a certain PLUREL product, like the abstract of a scientific paper. Further on, fact sheets link to the detailed reports, modelling results, graphs, maps and further results of the modules. They serve as an “incentive” for the user to further browse through the results. Therefore a prescribed structure (see below) with a limited number of characters was set up in the web template for the upload.

In order to gather the information that describes the final PLUREL results, the above mentioned web-form was set-up (see chapter *technical implementation* for illustration). Here, PLUREL partners were able to write and edit the specific fact sheets related to their products that serve as the main input for the PLUREL Xplorer. The results of the project partners were queried in an easy to edit form that minimises the work load of PLUREL partners while ensuring comparability in structure and a pre-defined format that

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supports the end user in finding the information he or she is looking for. As mentioned above, fact sheets were limited to a certain amount of characters and bound to a strict outline given in the Upload Template to enable certain homogeneity for all PLUREL results in the PLUREL Xplorer. Further information on the web-template for the fact sheet upload is given later in this deliverable.

In general, the long handling time was needed to perform a quality check of the fact sheet content concerning the used terminology, the rural-urban context, the general legibility of the fact sheets as well as the availability of illustrations and adjacent documents. From a technical point of view, all 161 fact sheets were extracted from the database in html-format, were edited according to the internal reviewer's suggestions and remarks, and finally exported into a pure text-structure to simplify the process of re-importing the changed fact sheets into the Xplorer database.

#### **Fact Sheet Structure**

To allow for a structured display of the contained information, each fact sheet follows a similar structure and is accompanied by an illustration or image that serves as an eye-catcher.

The fact sheets start with explaining the overall issue of the fact sheet, i.e. the respective PLUREL product, its aim and specific objectives. Following, the relation between the single product and peri-urbanisation is highlighted. The materials and methodology section of each fact sheet briefly explains the used approach and gives insight into input and output variables and modelling uncertainties, where applicable. Closing, the results of the respective sub-product of PLUREL are presented and interpreted. Conclusions are drawn. A references and further reading section finally links to underlying databases, reports, graphical illustrations, PLUREL's GeoPortal or the data management system, external sources such as the MOLAND website, which leads to further PLUREL products as well as to other interesting web-resources mentioned by the respective author (*also compare to chapter PLUREL Xplorer – layout and structure: Fact Sheet Content*). Clicking one of the internal links lets the user download the files from the server and view/save them on their computers.

All fact sheets were grouped and classified into the three complementary ordering principles of the PLUREL Xplorer mentioned before. An overview table on all PLUREL Fact Sheets is attached in the appendix.

# Transfer into a Graphical User Interface

During the last three years of the project lifetime, the PLUREL XPLORER changed from a “simple” cube to a more sophisticated user interface with more options for navigating. The challenge here was to handle the complexity of PLUREL research within one single product while maintaining the user interface (front door) as clear, easy to use and robust as possible. Through iterative feedback from stakeholders within and beyond the PLUREL consortium the graphical user interface was improved towards more user friendliness and end users requirements.

Originally starting with a cubic shape for navigating through the six dimensions of the PLUREL results, an alternative navigation system was presented at the Midterm Review Meeting in Brussels in June 2009. Here the cube was one option for navigating among a result tree, questions and a full text search option (compare to D5.3.1 for further information). This conceptional prototype derived from the product chains of PLUREL was further developed based on stakeholders’ feedback at various occasions. This preliminary user interface was sophisticated, but too complicated to use.



Fig. 3.: Development of the PLUREL XPLORER front door

First iterative discussions in WP 5.3 resulted in the front door GUI of the Xplorer Release version of March 2010, where the applied three complementary ordering principles (processes, problems, places) for the fact sheets and so the related PLUREL products are reflected in the three *apps* of the start screen of the PLUREL Xplorer. These *apps* fully represent the information and actions available to the user by simply clicking on them. The right side of the screen provides illustrations of the three *apps* that *become alive* once an *app* was chosen.

Based on user feedback during the internal project meeting in Manchester in May 2010 and further iterative discussions within WP 5.3, the GUI for the final PLUREL Xplorer developed. The improvements of the GUI at hand are the simplicity and reduction to necessary navigation elements. The three *apps*, the main navigation elements, are now visible at any point within the Xplorer. The minimalism of the GUI is the counterpart to the fully implemented, diverse and complex knowledge integration and technical implementation at the rear.

# Front door: Graphical User Interface

The Xplorer has been designed as PLUREL's project result dissemination platform, but is also capable of serving data that will be added after the project's lifetime. To accomplish this dissemination task, Xplorer has been designed as a user friendly application with a clean GUI and straightforward functionalities.

The PLUREL Xplorer consists of two client components (PLUREL Xplorer itself and Fact Sheet Upload), a database and a file repository for additional data to be attached to the fact sheets, the latter two situated on a web-server.

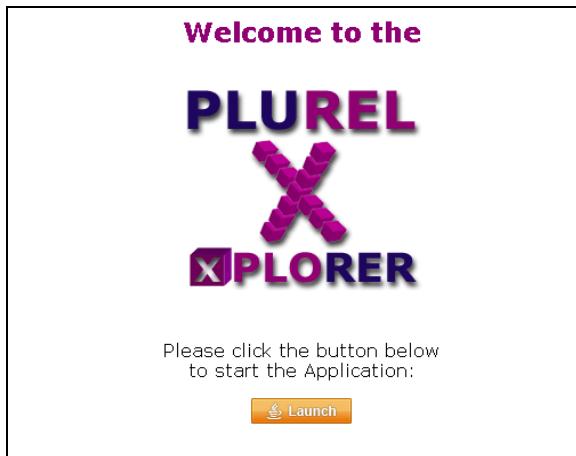


Fig. 19: Xplorer Start Page

A click on the “Launch” button starts the Xplorer application and the user is presented the following start screen.

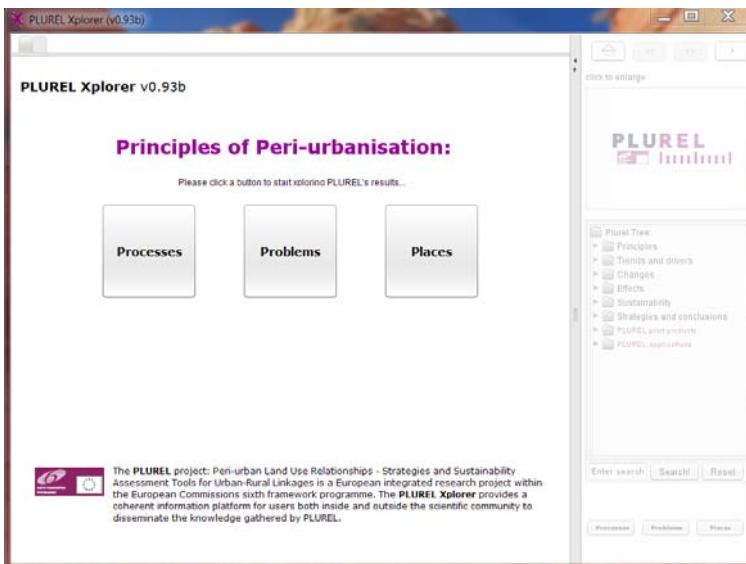


Fig. 20: Xplorer Start Screen

The screen has two main areas:

The main frame, on the left hand side, covering 2/3 of the available space and displaying the main structure of the Xplorer as well as the actual fact sheets, and an Navigation Bar on the right hand side, that resembles the user's position within the Xplorer's conceptual framework, respectively its fact sheet structure.

When starting the application, the user has four possibilities:

### 1. Processes Button



Clicking the processes button takes the user to a subsequent window where the user has the opportunity to choose between 6 subcategories of the peri-urban processes, represented as 6 buttons (Fig. 21.)

<<Home

How does peri-urbanisation happen?

An Example: Peri-Urbanisation in France

Principles	
Trends and Drivers	
Changes	
Effects	
Sustainability	
Strategies and Conclusions	

Fig. 21: Xplorer: Processes Window

A click on one of them leads the user to the actual fact sheet frame (Fig. 22).

The screenshot shows a software interface titled 'Fact Sheet Menu'. A dropdown menu is open, showing 'Principles' as the selected item. Below it, other options like 'Trends and drivers', 'Changes', 'Effects', 'Sustainability', 'Strategies and conclusions', 'PLUREL print products', and 'PLUREL applications' are listed. The main content area is titled 'Intro into peri-urbanisation (Thomas Sick Nielsen - Copenhagen)'. It contains several sections: 'What is the issue?', 'Methodology and Materials:', and 'Results and Conclusion:'. Each section contains descriptive text. There are also buttons for 'A+' and 'A-' at the top right of the content area.

Fig. 22: Xplorer: Fact Sheet Frame

The fact sheet frame itself contains two other possibilities of navigating through the content: The user can either choose from a menu tree, holding all menu items of the fact sheet structure (Fig. 23) or use subsequent drop down menus to navigate from one fact sheet to another within the menu structure hierarchy (Fig. 24).

This screenshot shows the 'Fact Sheet Menu' with 'Principles' selected. A detailed menu tree is displayed on the left side. The 'Sustainability' branch is expanded, showing 'Choice experiments', 'Impact assessment using response functions', 'Results of impacts assessment Europe', 'Integrated impact analysis tool (IIAT)', and 'CBA Europe'. To the right of the menu, there is a large image of a classical building with four columns, labeled 'click to enlarge'. Below the image, there are two buttons: 'Combined effects in Europe' and 'Combined effects in the case study regions'. At the bottom of the screen, there is a navigation bar with icons for back, forward, and search.

Fig. 23: Xplorer: Full Menu Structure

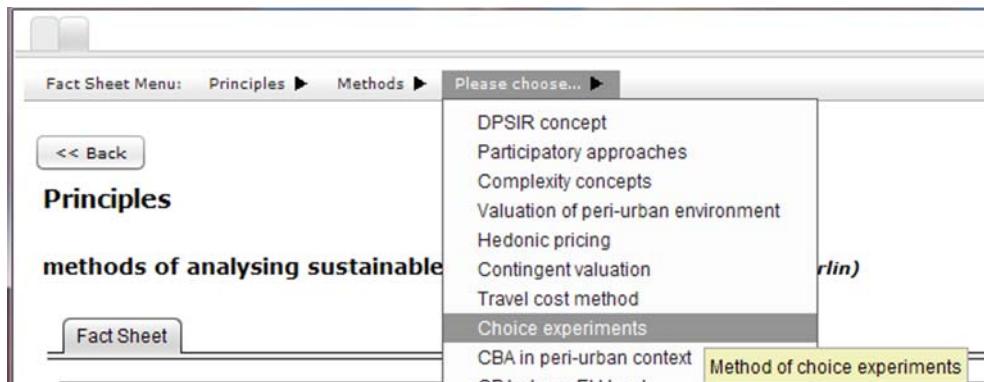


Fig. 24: Xplorer: Single Drop Down Menu

## 2. Problems Button



A click on the “Problems” button leads to another frame holding 8 “problem” categories, also designed as buttons (Fig. 25). The idea behind these “problems” buttons is, to give the user the opportunity to browse the fact sheets and their contained information from different perspectives.

<< Home

What are the problems of peri-urbanisation?

Population & Household Structure

Sustainable Development

Governing & Policy Instruments

Commuting

Quality of Life

Energy Consumption & Air Pollution

Landscape

Economic Development & Working Places

Click on one of the buttons and see the available fact sheets for each problem in the window below

Fact Sheet	Authors
GIS recreation	Sjerp de Vries, Carmen Aalbers -
A system dynamics model for peri-urbanisation	Dagmar Haase - Berlin
ABMLand	Mark Rounsevell - Edinburgh
Effects of peri-urbanisation on agricultural production	Ingo Zasada, Regine Berges - Mü
Effects of peri-urbanisation on ecological regulation and biodiversity	Ingo Zasada, Regine Berges - Mü
Effects of peri-urbanisation on recreation	Ingo Zasada, Regine Berges - Mü
Ecological indicator climate regulation	Nina Schwarz - Leipzig
Ecological Indicator food provision	Franziska Kroll - Kiel
Ecological and social indicator recreation	Dagmar Haase - Berlin
Ecological and social indicator energy provision	Franziska Kroll - Kiel
Ecological indicator potential evapotranspiration	Franziska Kroll - Kiel
Ecological indicator biodiversity potential	Michael Strohbach - Leipzig
Leipzig-Halle region: Parthe floodplain protection	Annette Bauer - Leipzig
Ecological Indicator water provision	Franziska Kroll - Kiel
Ecological indicator carbon storage	Michael Strohbach - Leipzig

Fig. 25: Xplorer: Problems Window

Clicking on one problem category triggers a database search and displays the fact sheets that correspond to the problem category the user has searched for.

### 3. Places Button



The “Places” button navigates the user to an interactive map window holding a map of Europe and the PLUREL case study regions, where fact sheets can be searched according to their geographical localisation.

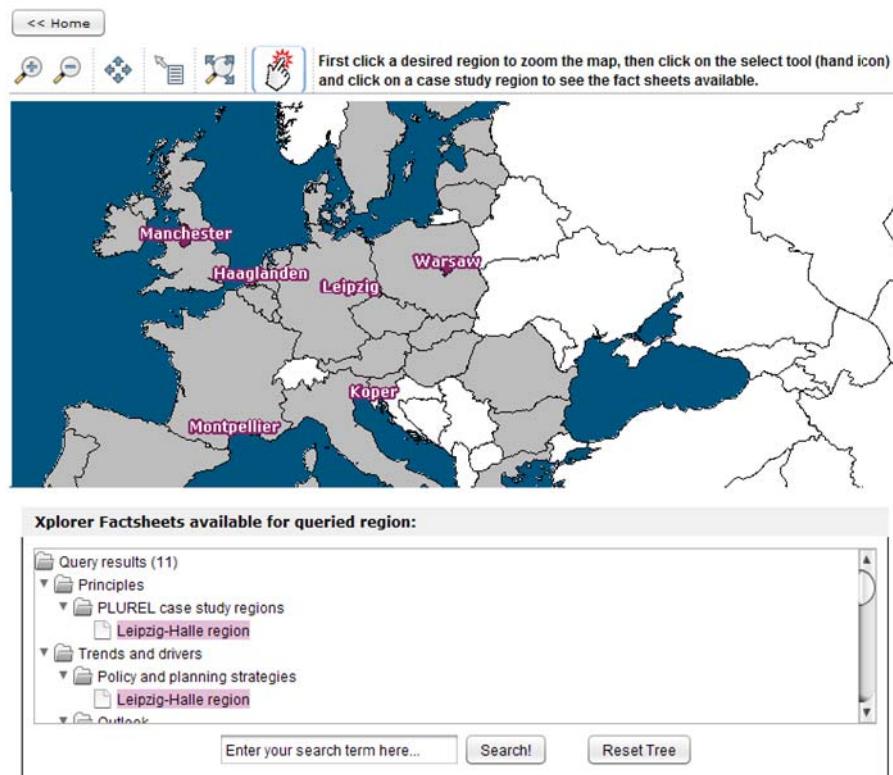


Fig. 26: Xplorer: Places Window

A click on a fact sheet in the result table leads the user to the fact sheet.

#### 4. Full Text Search

The fourth possibility to enter the system is to use the full text search facility on the start screen of the Xplorer where the user can enter a keyword of interest (Fig. 27).

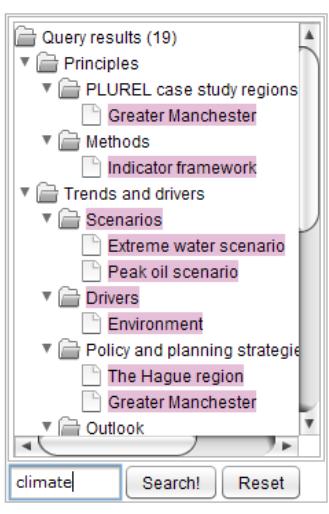


Fig. 27: Xplorer: Full Text Search

#### Fact Sheet Content

The Xplorer fact sheets are divided into four paragraphs ("What is the Issue?", "Methodology and Material", "Results and Conclusion", "Further Reading" (if available)) to allow for a structured display of the contained information.

Fig. 28: Xplorer: Fact Sheet (detailed)

The fact sheet text may also contain web links to external pages and applications, like e.g. the PLUREL iIAT (Fig. 29, Fig. 30) or the MOLAND website, which leads to further PLUREL products and information. Additionally the fact sheets might be printed and the font size of the fact sheets text might be adjusted via +/- buttons.

social and the environmental.

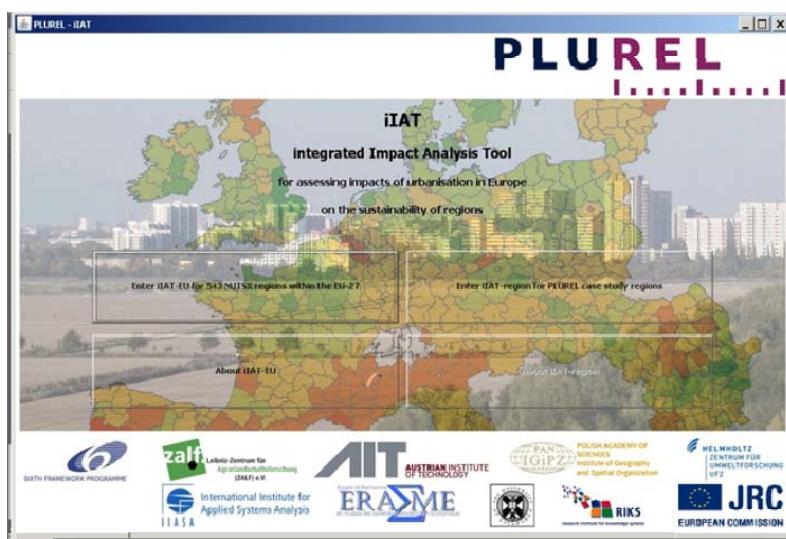
The iIAT supports decision-making and scoping EU27 and the regional. As it integrates all three planning.

[Start the iIAT application](#)

#### Methodology and Materials:

Physically, the PLUREL iIAT is an internet accessible surface that enables an easy and holistic perception of different thematic scopes and different scales.

*Fig. 29: Xplorer: iIAT Link*



*Fig. 30: Xplorer Application Link: iIAT Application (Start Screen)*

If there are further reading links available they will be displayed on the bottom of each fact sheet (Fig. 31).

•  
**Results and Conclusion:**  
[Start the iIAT application](#)  
**Further reading:**  
[UGEC Newsletter: iIAT \(pdf\) by Dagmar Haase et al. \(2009\)](#)

*Fig. 31: Xplorer: Further Reading Links*

### The Xplorer Navigation Bar

The right hand side Navigation Bar consists of four elements: The Navigation Buttons (on top), the “Problems” image, the Navigation Tree and the position indicators (at the bottom).



The Navigation Buttons let you navigate through the Xplorer by either clicking the Home Button (“house icon”) or clicking the “Forward” or “Backwards” buttons (which will lead you to recently visited fact sheets). The Help Button (“?”) opens the Xplorer user manual.

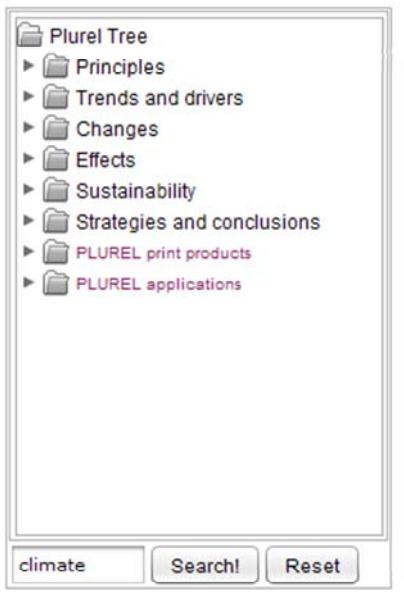
Fig. 32: Fact Sheet Navigation Buttons

click to enlarge



The “Problems” image displays an exemplary image for each problem or fact sheet chosen.

Fig. 33: Xplorer: Problems Image



The “Navigation Tree” shows the actual position within the Plurel fact sheet hierarchy and lets the user navigate to certain fact sheet by clicking on the tree leafs.

Fig. 34: Xplorer: Navigation Tree



Within the tree the user has also access to the Plurel print products and applications, which have been developed during the project.

Fig. 35: Xplorer: Plurel Print Products and Applications



The Position Indicators at the bottom show your position within the Xplorer categories.

Fig. 36: Xplorer: Position Indicators

Like its counterpart, the Fact Sheet Upload has also been designed as a WebStart application and is loaded via a JNLP link from its start page.

## Back door: Fact Sheet Upload

### *Functionalities*

The Fact Sheet Upload application is used to upload fact sheet data –such as textual information, maps, tables, pdfs and images- to be displayed in the Xplorer application. The users start the application by entering the PLUREL website at AIT (<http://plurel.ait.ac.at/plurel/factsheetupload/>, Fig. 4) and clicking the “Launch” button.

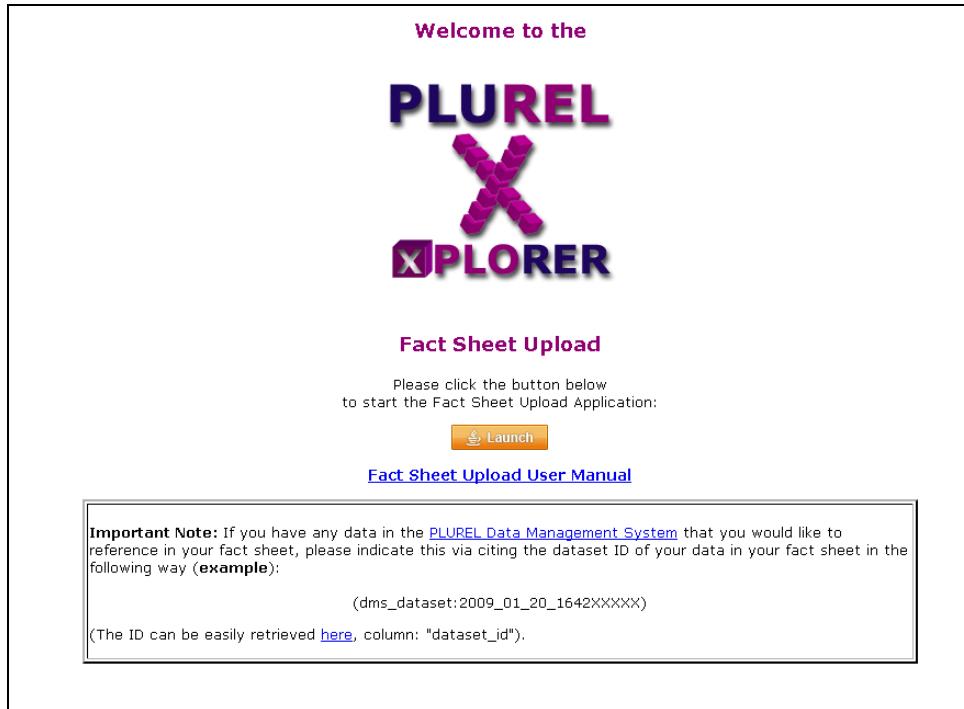


Fig. 4: Fact Sheet Upload: Start Page

This will start a Java Webstart application and the following start screen will be displayed (Fig. 5):

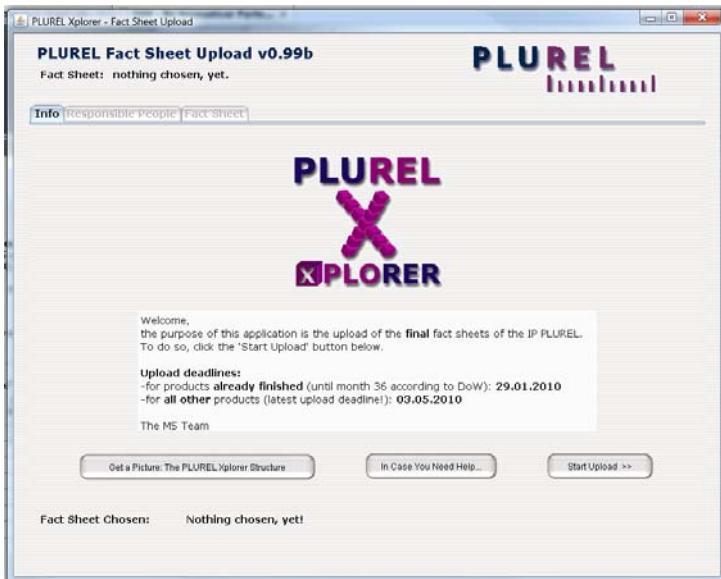


Fig. 5: Fact Sheet Upload Application: Start Screen

Here the user has three possibilities, represented as three buttons:

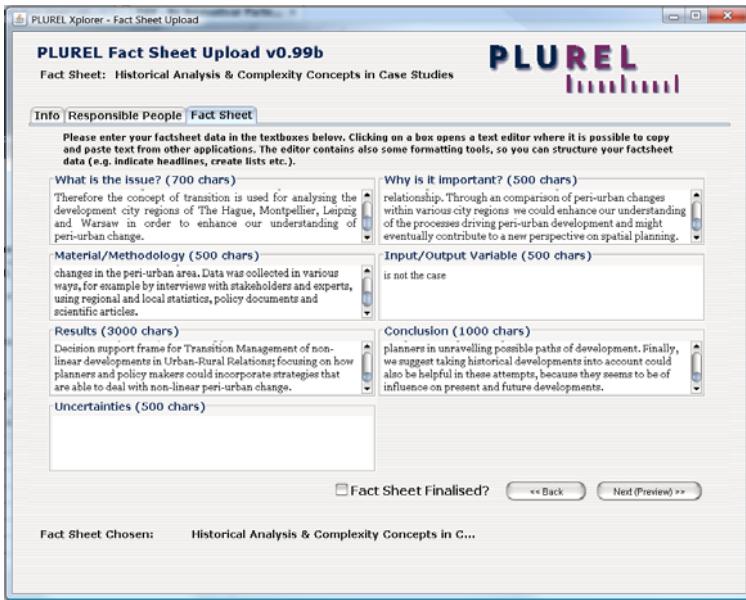
1. The first button (on the left hand side) lets the user examine the PLUREL fact sheet structure
2. The second button (in the middle) shows contact information in case the user needs help (either technical or concerning content)
3. The third button (on the right hand side) starts the upload process

After clicking the "Start Upload >>" button the user is presented a table (Fig. 6) holding information on the fact sheets that have been agreed upon beforehand. Each fact sheet has one or more people responsible for who should upload the fact sheet data according to the deadlines stated on the opening screen of the application.

Name	Responsible For Which Fact Sheet?	Uploaded?	Deadline	P&P	Problems	Places	I?	P?	T?	M?
Sarah Mubareka, Anton	Future land use change scenarios - MOLAND results for Koper region	2010-02-19	2010-05-03	Changes	Koper	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kelli Nilsson, Thomas	The PLUREL Project	2010-02-18	2010-01-29	Principles		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sieg Nielsen										
Gertrud Jorgensen, Dagmar Haase	Future land use change scenarios - underlying storylines for Leipzig-Halle region	2010-02-17	2010-05-03	Trends&Driv	Leipzig	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wim Timmermanns, Gert, do Roo, Ward Rauws	Historical Analysis & Complexity Concepts in Case Studies	2010-02-19	2010-01-29	Trends&Driv		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hedwig van Delden, Francisco Escobar	Future land use change scenarios - MOLAND results for Greater Manchester		2010-05-03	Changes	Manchester	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Francisco Escobar, Jean-Pierre Cherry	Future land use change scenarios - MOLAND results for Montpellier		2010-05-03	Changes	Montpellier	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annette Bauer	Leipzig-Halle region case: Strategy 2: Regional Development Concepts strategy	2009-11-03	2010-01-29	Trends&Driv/Governing & Reactions		<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annette Bauer	Leipzig-Halle region case: Strategy 3: Parthe floodplain protection	2009-11-03	2010-01-29	Trends&Driv/Governing & Reactions	Leipzig	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

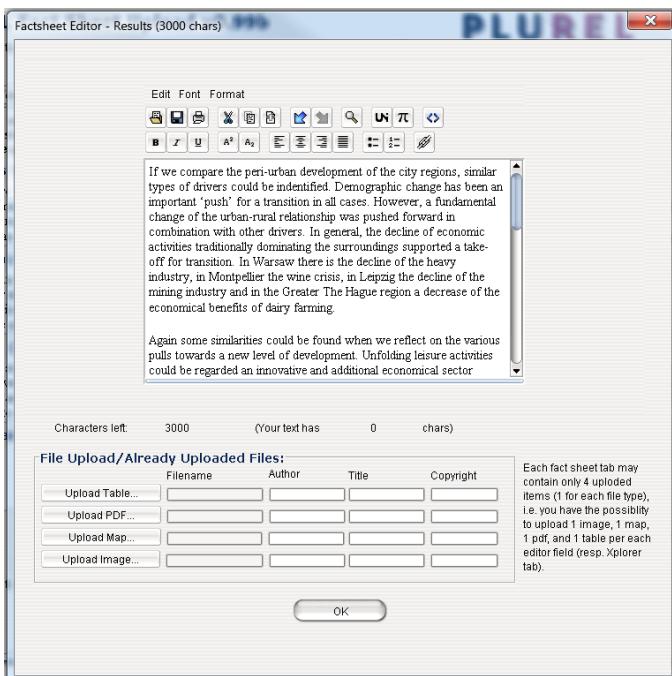
Fig. 6: Fact Sheet Upload Application: Main Table: Fact Sheets and Responsibilities

After choosing one of the fact sheets and clicking on "Edit>>" the user is led to the actual fact sheet editor screens. Each fact sheet consists of 7 sub-categories ("What is the Issue?", "Why is it Important", "Methodology", "Variables", "Results", "Conclusion", "Uncertainties"), so the editor screen is divided into 7 editor frames.



*Fig. 7: Fact Sheet Upload Application: Main Editor Window*

Clicking on one of the editor frames, a new window is opened, giving the user the possibility to enter his or her data more comfortably (than in a small frame) in a large window, which also allows for the upload of additional data, such as maps, tables, pdfs and images. Furthermore, the editor window provides several layout possibilities, such as the addition of Internet links and the creation of bullet lists and html tables.



*Fig. 8: Fact Sheet Upload Application: Fact Sheet Editor Window*

As depicted in Fig.8 the editor window also gives the opportunity to upload additional data in form of map, table, image or pdf files.

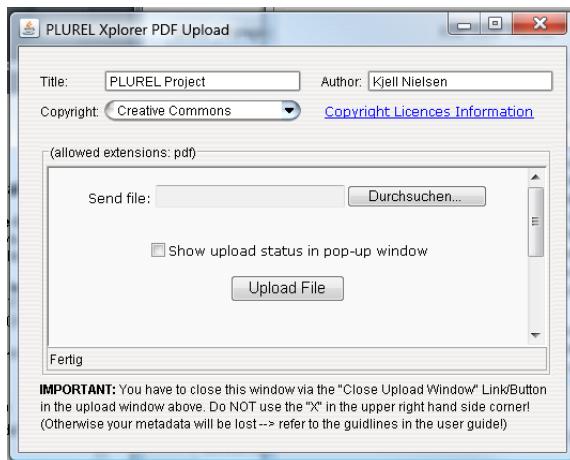


Fig. 9: Fact Sheet Upload Application: Additional File Upload

After entering all required information, the user has the possibility to check all his/her data entered via a fact sheet preview (Fig. 10) and to print out the fact sheet (if desired).

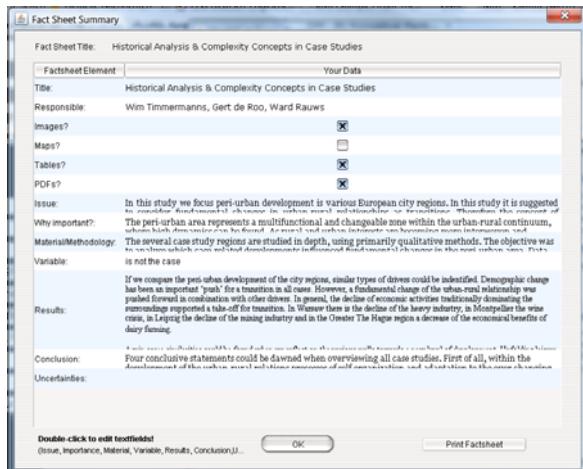


Fig. 10: Fact Sheet Upload Application: Fact Sheet Preview

In the end the fact sheet will be uploaded via the “Upload” button (Fig. 11) and the entered data will be stored within the Xplorer database while additionally uploaded files will be stored in the file system of the server.



Fig. 11: Fact Sheet Upload Application: Upload Button

The final screen lets the user choose if he or she wants to upload another fact sheet or if they want to close the application (Fig. 12).

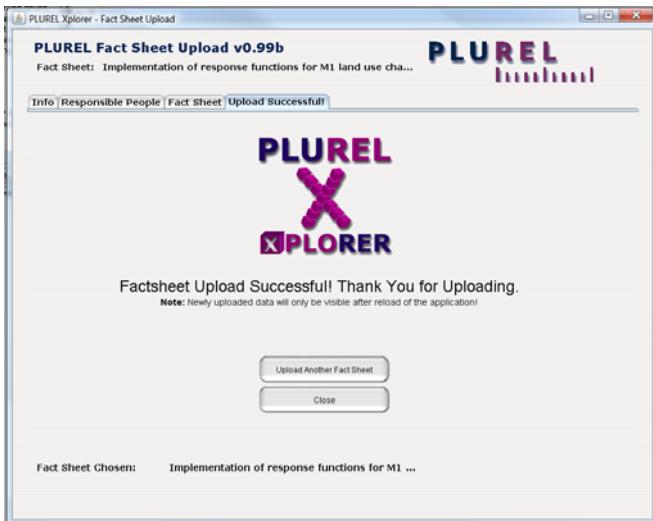


Fig. 12: Fact Sheet Upload Application: End screen

## Technical Implementation

### Why has Java been used?

Since the PLUREL applications shall be used by a wide range of users (mostly via the Internet) it was crucial to use technologies that were platform independent. Therefore the Fact Sheet Upload and the Xplorer have been developed as a Java Client-Server application, using Java WebStart technologies on the client side, Java Servlets and JDBC database connectors on the server side, since Java is using a so called Virtual Machine (VM) to run its code that exists for a variety of different platforms (including MS Windows, Linux, Apple OS and other operating systems) (Fig.13).

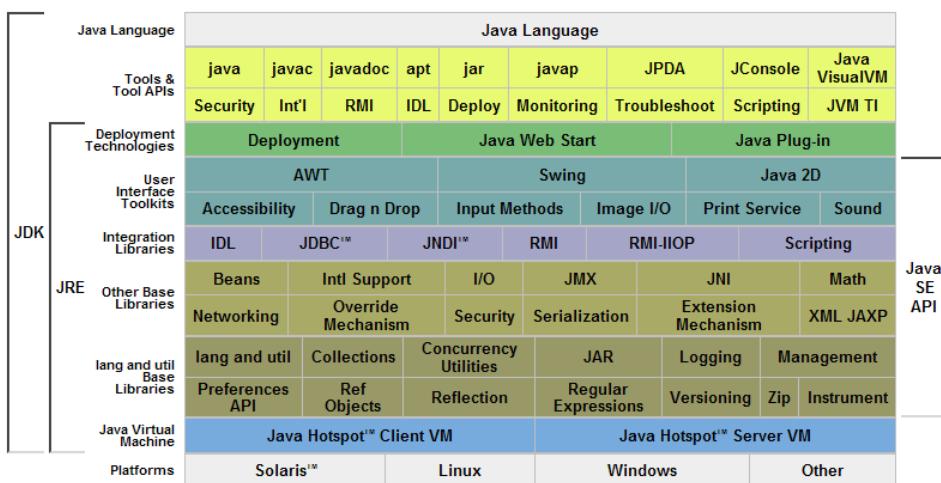


Fig. 13: Java Platform  
(source: <http://upload.wikimedia.org/wikipedia/en/5/58/JavaPlatform.png>)

Java has also been chosen because it is a well documented, advanced object oriented programming language that was explicitly designed to satisfy the needs of web based applications including support of different internet protocols and sophisticated data base connections via the Java Data Base Connectivity (JDBC) interface eg (Fig. 14).

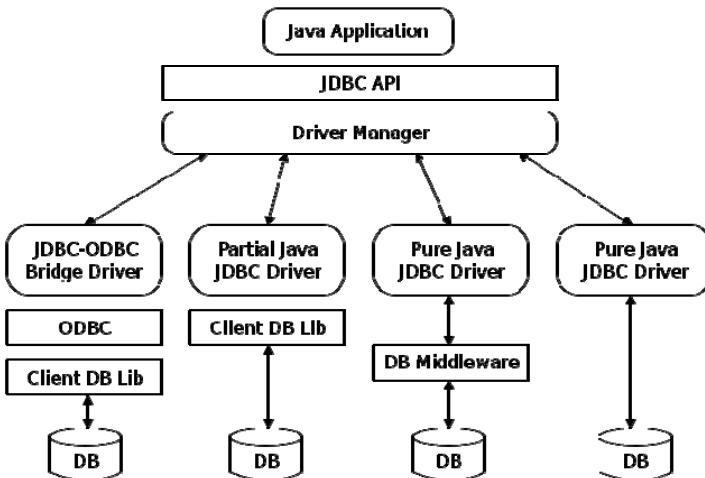


Fig. 14: JDBC Structure

(source:

[http://upload.wikimedia.org/wikipedia/de/thumb/5/57/JDBC\\_Treiber\\_Typen.svg/699px-JDBC\\_Treiber\\_Typen.svg.png](http://upload.wikimedia.org/wikipedia/de/thumb/5/57/JDBC_Treiber_Typen.svg/699px-JDBC_Treiber_Typen.svg.png))

Available for a variety of data bases, JDBC also provides an interface with the open source relational data base PostGreSQL, which has been used to build the PLUREL Xplorer project result data base.

The PLUREL Xplorer's client-server approach has several advantages compared to a server based approach, where all data as well as all functionality is implemented on the server side: On the one hand the client-server technique is based on a client program running on the user's computer which communicates with the server via network connections, taking some load from the server machine, on the other hand –more important- it allows for a much wider range of functionalities on the client side, since the client is not restricted to server side technologies only, i.e. browser and internet based functions.

On the server side data exchange is realised by the use of Java's Servlet technology. According to Wikipedia a "Servlet is an object that receives a request and generates a response based on that request"<sup>1</sup>. The request itself consists of an SQL request sent to the server which is executed by the Servlet. The response is then received by the client and displayed to the user.

On the client side, a so called Java Webstart (JWS) application, based on the Java Network Launching Protocol (JNLP) is used as a Graphical User Interface (GUI) to interact with the user. Java Webstart allows to develop fully featured applications that are capable of all functionalities of desktop programs but can be started from the Internet via certified (so called *signed*) Java archives (jar files → Java executables) via a Webstart link.

<sup>1</sup> [http://en.wikipedia.org/wiki/Java\\_Servlet](http://en.wikipedia.org/wiki/Java_Servlet), 16.12.2009

### Database: PostGreSQL

As stated on PostGreSQL's homepage, PostgreSQL is an open-source descendant of the data base POSTGRES 4.2, developed at Berkeley Computer Science Department at the University of California. It supports SQL standard features like:

- complex queries
- foreign keys
- triggers
- views
- transactional integrity
- multiversion concurrency control

And users might extend these functionalities by adding new elements like

- data types
- functions
- operators
- aggregate functions
- index methods
- procedural languages

As PostGreSQL is open source software, its structure is transparent, it has a large user community and help infrastructure, an elaborated documentation, it is available free of charge and it is –most important- a very reliable data base system, which made it a good choice for the PLUREL fact sheet data base.

### Database: Table Structure

The Xplorer data base consists of five tables. Those are:

#### 1. Main Factsheet Table

In this table each row is unique, meaning that each row exists only once (primary key, here: "idxpfs"). Every time a user uploads a new version of his or her fact sheet the corresponding fact sheet row is overwritten. Hence, only the most recent version is stored.

The screenshot shows a PostgreSQL table viewer window titled 'xpfs @plurel.public (sfs\_test) ~ Table'. The table structure is as follows:

idxpfs	factsheetname_edited	modul	responsible	deadline	assignment_ok_date	uploaddate	editdate
400	Intro into peri-urbanis	6	Thomas Sick Nielsen	2010-07-07	(null)	2010-07-17	2010-07-17
461	Energy & Air Pollution	5	Katharina Fricke, Andri	(null)	(null)	(null)	(null)
1	Guidelines to handle c	3	Wim Timmermans, Ge	2010-01-29	(null)	2010-08-09	2010-08-09
14	Governing strategies	3	Judith Westerink, Pat v	2010-01-29	(null)	2010-07-05	2010-07-05
15	Governing strategies	3	Irene Burkhardt, Martin	2010-01-29	(null)	2009-09-01	2009-09-01
16	Governing strategies	3	Anton Perpar, Marina	2010-05-03	(null)	2010-07-26	2010-07-26
13	Economic Drivers	1	Baptiste Boitier	2010-01-29	(null)	2010-07-27	2010-07-27
17	Governing strategies	3	Annette Bauer	2010-01-29	2009-11-02	2010-08-26	2010-08-26
21	Future land use chang	2+3	Gertrud Jorgensen, Pal	2010-05-03	2009-11-26	2009-09-10	2009-09-10
24	Future land use chang	2+3	Gertrud Jorgensen, Da	2010-05-03	2009-11-26	2010-07-19	2010-07-19
25	Future land use chang	2+3	Gertrud Jorgensen, Iov	2010-05-03	2009-11-26	2010-09-15	2010-09-15
18	Governing strategies	3	Joe Ravetz	2010-05-03	(null)	2010-07-28	2010-07-28
33	Land use change scen	1	Sophie Rieckebusch	2010-01-29	2009-10-29	2010-01-14	2010-01-14
34	Land use change scen	1	Sophie Rieckebusch	2010-01-29	2009-10-29	2010-01-14	2010-01-14
41	Migration trends affec	2	Susana Alves	2010-01-29	2009-11-26	2010-06-29	2010-06-29
48	Land use and spatial	3	Judith Westerink, Pat v	2010-01-29	(null)	2010-07-05	2010-07-05
49	Land use and spatial	3	Irene Burkhardt, Martin	2010-01-29	(null)	2009-09-01	2009-09-01
50	Land use and spatial	3	Anton Perpar, Marina	2010-01-29	(null)	2010-07-26	2010-07-26
51	Land use and spatial	3	Annette Bauer	2010-01-29	2009-11-02	2010-08-26	2010-08-26
53	Land use and spatial	3	Jean-Pierre Chery, Frar	2010-01-29	(null)	2010-06-21	2010-06-21
55	Future land use chang	2+3	Francisco Escobar, Jud	2010-05-03	2009-11-26	2010-07-27	2010-07-27

At the bottom of the viewer, the SQL query is shown: `SELECT * FROM "public"."idxpfs" LIMIT 162`. The status bar indicates "Record 1 of 162 in page 1".

Fig. 15: Main Fact Sheet Table ("xpfs" - partial view)

## 2. Fact Sheet History Table

To keep a history or log of the uploaded fact sheet data, a second (equally structured) table exists where even the fact sheet id is not unique and new entries are added (not overwritten), leading to a version history of fact sheets. This table also exists as a backup facility if a user deletes something within his or her fact sheet that should not have been deleted.

## 3. File Upload Metadata Table

Since the Xplorer upload facility features an (optional) file upload, a third table has been implemented. It stores metadata on the uploaded files (author, title, copyright and file name) (Fig. 16).

	id	tables	maps	pdfs	images	tab	unique_id
	character_v	character_v	character_v	character_v	character_varving[]	character_v	[PK] character_v
18	67	{...}	{...}	{...}	{...}	methodology	67_methodology
19	67	{...}	{...}	{...}	{...}	results	67_results
20	67	{...}	{...}	{...}	{...}	uncertainties	67_uncertainties
21	67	{...}	{...}	{...}	{...}	variable	67_variable
22	91	{...}	{...}	{...}	{...}	conclusions	91_conclusions
23	91	{...}	{...}	{...}	{...}	important	91_important
24	91	{...}	{...}	{...}	{...}	issue	91_issue
25	91	{...}	{...}	{...}	{...}	methodology	91_methodology
26	91	{...}	{...}	{...}	{...}	results	91_results
27	91	{...}	{...}	{...}	{...}	uncertainties	91_uncertainties
28	91	{...}	{...}	{...}	{...}	variable	91_variable
29	99	{...}	{...}	{...}	{...}	conclusions	99_conclusions
30	99	{...}	{...}	{...}	{...}	important	99_important
31	99	{...}	{...}	{...}	{...}	issue	99_issue
32	99	{...}	{...}	{...}	{...}	methodology	99_methodology
33	99	{...}	{...}	{...}	{...}	results	99_results
34	99	{...}	{...}	{...}	{...}	uncertainties	99_uncertainties
35	99	{...}	{...}	{...}	{...}	variable	99_variable

Fig. 16: File Upload Metadata Information Table

## 4. Xplorer Menu Table

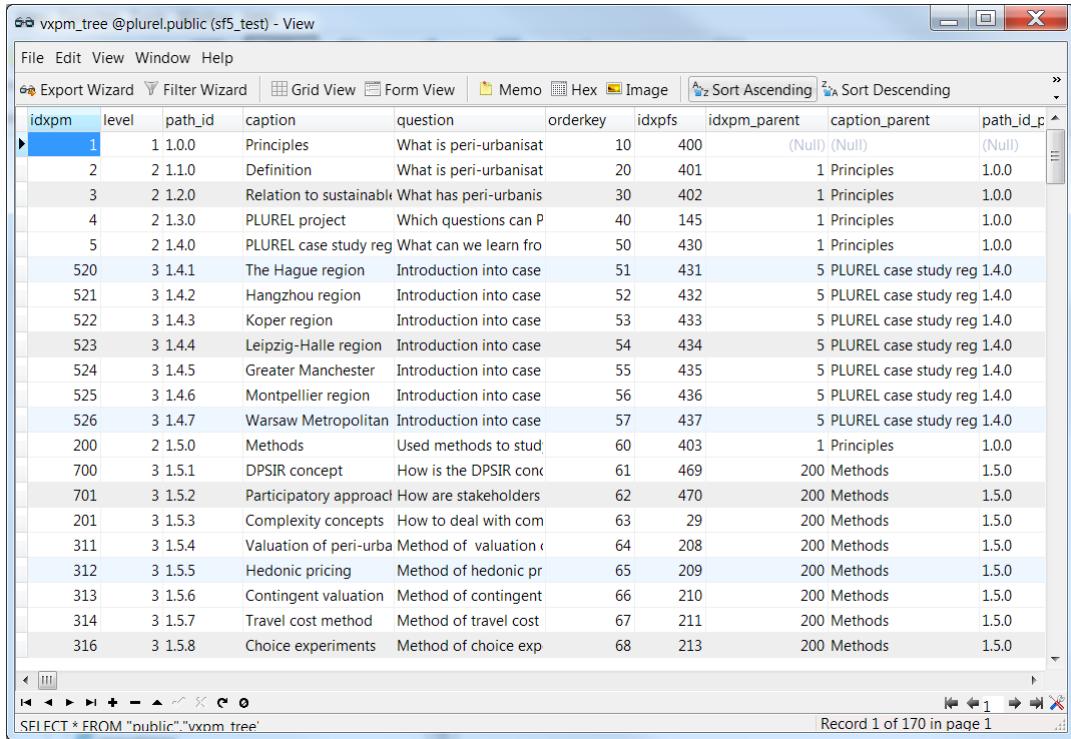
The 4th table holds the menu entries for the Xplorer and is used to provide a dynamic menu structure within the Xplorer application.

	level_1_level_1_b	level_1_join	level_2	level_3	factsheet_j_path_id	
	charak	character_varving(255)	character_varving(255)	character_varving	integer	character_v
46	Sustain	How does peri-urbanisation affect sustainability?	Sustainability: How does peri-urbanisation affect sustainability?	Assessment of Sustainability in landscape & habitat	130	5.5.8
47	Sustain	How does peri-urbanisation affect sustainability?	Sustainability: How does peri-urbanisation affect sustainability?	Assessment of Sustainability in landscape & recreation	131	5.5.9
48	Sustain	How does peri-urbanisation affect sustainability?	Sustainability: How does peri-urbanisation affect sustainability?	CBA case study	Main Info	999999
49	Sustain	How does peri-urbanisation affect sustainability?	Sustainability: How does peri-urbanisation affect sustainability?	[Link to IAT principle]	Main Info	999999
50	Sustain	How does peri-urbanisation affect sustainability?	Sustainability: How does peri-urbanisation affect sustainability?	How can the sustainability of the area be improved?	Main Info	999999
51	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are functional relationships?	Main Info	999999
52	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Main Info	Main Info	999999
53	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Haaglanden	Main Info	999999
54	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Koper	Main Info	999999
55	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Leipzig	Main Info	999999
56	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Leipzig: Ecological	Main Info	999999
57	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Leipzig: Ecological	Main Info	999999
58	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Leipzig: Ecological	Main Info	999999
59	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Leipzig: Ecological	Main Info	999999
60	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Manchester	Main Info	999999
61	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Montpellier	Main Info	999999
62	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	What are effects of peri-urban Warsaw	Main Info	999999
63	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	Future economic development	Main Info	999999
64	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	Future economic development	Main Info	999999
65	Effects	Which effects does Peri-Urban areas have?	Effects: Which effects does Peri-Urban areas have?	Future economic development	Main Info	999999

Fig. 17: Xplorer Menu Table

## 5. Xplorer Tree Table

A fifth table holds a tree structure of all Plurel fact sheets, in order to be able to display the structure of the fact sheet database to the user.



The screenshot shows a Microsoft Access database window titled "vxmlm\_tree @plurel.public (sf5\_test) - View". The window contains a grid view of a table with the following columns: idxpm, level, path\_id, caption, question, orderkey, idxpdfs, idxpm\_parent, caption\_parent, and path\_id\_p. The data in the grid represents a hierarchical structure of fact sheets, with levels ranging from 1.0.0 down to 3.1.5.8. The "idxpm" column contains primary keys like 1, 2, 3, 4, 5, 520, 521, 522, 523, 524, 525, 526, 200, 700, 701, 201, 311, 312, 313, 314, and 316. The "path\_id" column shows the full path of each fact sheet, such as "1.0.0", "2.1.1.0", "3.1.2.0", etc. The "caption" and "question" columns provide descriptive text for each entry. The "orderkey" column is used for sorting. The "idxpdfs" and "path\_id\_p" columns contain null values. The "idxpm\_parent" column indicates the parent fact sheet for each entry. The "caption\_parent" column also indicates the parent fact sheet. The "level" column shows the depth of each fact sheet in the hierarchy. The bottom of the window shows the SQL query: "SELECT \* FROM 'public'.'vxmlm\_tree'".

idxpm	level	path_id	caption	question	orderkey	idxpdfs	idxpm_parent	caption_parent	path_id_p
1	1	1.0.0	Principles	What is peri-urbanist	10	400	(Null)	(Null)	(Null)
2	2	1.1.0	Definition	What is peri-urbanist	20	401	1	Principles	1.0.0
3	2	1.2.0	Relation to sustainable	What has peri-urbanis	30	402	1	Principles	1.0.0
4	2	1.3.0	PLUREL project	Which questions can P	40	145	1	Principles	1.0.0
5	2	1.4.0	PLUREL case study reg	What can we learn fro	50	430	1	Principles	1.0.0
520	3	1.4.1	The Hague region	Introduction into case	51	431	5	PLUREL case study reg	1.4.0
521	3	1.4.2	Hangzhou region	Introduction into case	52	432	5	PLUREL case study reg	1.4.0
522	3	1.4.3	Koper region	Introduction into case	53	433	5	PLUREL case study reg	1.4.0
523	3	1.4.4	Leipzig-Halle region	Introduction into case	54	434	5	PLUREL case study reg	1.4.0
524	3	1.4.5	Greater Manchester	Introduction into case	55	435	5	PLUREL case study reg	1.4.0
525	3	1.4.6	Montpellier region	Introduction into case	56	436	5	PLUREL case study reg	1.4.0
526	3	1.4.7	Warsaw Metropolitan	Introduction into case	57	437	5	PLUREL case study reg	1.4.0
200	2	1.5.0	Methods	Used methods to stud	60	403	1	Principles	1.0.0
700	3	1.5.1	DPSIR concept	How is the DPSIR conc	61	469	200	Methods	1.5.0
701	3	1.5.2	Participatory approach	How are stakeholders	62	470	200	Methods	1.5.0
201	3	1.5.3	Complexity concepts	How to deal with com	63	29	200	Methods	1.5.0
311	3	1.5.4	Valuation of peri-urba	Method of valuation	64	208	200	Methods	1.5.0
312	3	1.5.5	Hedonic pricing	Method of hedonic pr	65	209	200	Methods	1.5.0
313	3	1.5.6	Contingent valuation	Method of contingent	66	210	200	Methods	1.5.0
314	3	1.5.7	Travel cost method	Method of travel cost	67	211	200	Methods	1.5.0
316	3	1.5.8	Choice experiments	Method of choice exp	68	213	200	Methods	1.5.0

Fig. 18: Xplorer Tree Data Table

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## Appendix 1: Xplorer Manual

### Plurel Xplorer Manual v 1.1

Dear Xplorer User,

This manual should give you an overview of the Plurel Xplorer's graphical interface and its functionalities. The colors of the info boxes mean the following:

Main Navigation Elements

Navigation Elements  
leading to and/or  
controlling fact sheets

**X PLUREL Xplorer (v0.91b)**

**PLUREL Xplorer v0.91b**

**Principles of Peri-urbanisation:**

Please click a button to start exploring PLUREL's results...

**Start Buttons**  
(These three buttons symbolize the three ways of approaching Plurel's findings:

1. Structured as processes
2. Grouped as problem fields
3. Visualised as geographic locations

The PLUREL project: Peri-urban Land Use Relationships - Strategies and Sustainability Assessment Tools for Urban-Rural Linkages is a European integrated research project within the European Commissions sixth framework programme. The **PLUREL Xplorer** provides a coherent information platform for users both inside and outside the scientific community to disseminate the knowledge gathered by PLUREL.

**X PLUREL Xplorer (v0.91b)**

**How does peri-urbanisation happen?**

An Example: Peri-Urbanisation in France

**Processes Buttons**  
(Lead you through Plurel's findings according to the processes of peri-urbanisation. The top most fact sheet of each process will explain the process itself, then you have the opportunity to choose its sub-categories from drop-down menus.)

**Plurel Tree:**

- Peri-urbanisation
- Trends and drivers
- Changes
- Effects
- Sustainability
- Strategies and conclusions
- PLUREL print products
- PLUREL applications

Enter search Search! Reset

Processes Problems Places

**X PLUREL Xplorer (v0.91b)**

Plurel Xplorer

Fact Sheet Menu: Peri-urbanisation ► Please choose...

Peri-urbanisation  
Trends and drivers  
Changes  
Effects  
Sustainability  
Strategies and conclusions ► Policies  
PLUREL print products  
PLUREL applications

Regional planning strategies ► Instruments and strategies

What is the issue?

Over 70% of Europe's population now lives in urban areas, which in turn...  
The importance of peri-urbanisation stems from its increasing importance for sustainable and competitive regions in the EU should consider this...  
Methodology and Materials:  
The uncertainties of peri-urbanisation relate to the future. Will the trend...  
Results and Conclusion:  
These changes caused by increasing urbanisation are most dynamic...

Fact Sheet Menu Tree  
(A click on the "Fact Sheet Menu" button opens the Plurel Menu Tree to provide a full overview over the fact sheet titles. Tooltips provide additional explanations.)

click to enlarge

A+ A-

Plurel Tree:  
Peri-urbanisation  
Trends and drivers  
Changes  
Effects  
Sustainability

The Hague region: Agriculture strategy  
The Hague region: Recreation strategy  
The Hague region: Identity strategy  
Hangzhou region case - strategy 1  
Hangzhou region case - strategy 2  
Hangzhou region case - strategy 3  
Koper region: Agriculture strategy  
Koper region: Recreation strategy  
Koper region: Rural development strategy  
Leipzig-Halle region: Green corridors  
Leipzig-Halle region: Regional development concepts  
Leipzig-Halle region: Parthe floodplain protection  
Greater Manchester: The Green Belt  
Greater Manchester: EU strategies  
Greater Manchester: Infrastructure strategy  
Montpellier region: Schema of Territorial Coherence (SCoT)  
Montpellier region: Regional planning and local development  
Montpellier region: Risk management and flood prevention  
Warsaw Metropolitan area case - strategy 1  
Warsaw Metropolitan area case - strategy 2  
Warsaw Metropolitan area case - strategy 3

Enter search Search! Reset

Processes Problems Places

Plurel Xplorer

Fact Sheet Menu: Peri-urbanisation ► Methods ► Please choose... ►

<< Back

**Peri-urbanisation**

Under construction by Haase - Berlin

Fact Sheet

Drop Down Menus  
(The three drop down menus provide a structured way to browse through the fact sheet content)

What is the issue?

This factsheet informs about the main quantitative methods used in the analysis:

- The cellular RUG-urbanisation-Model,
- The cellular automata model MOLAND for
- Regression models to determine the imp
- Ecosystem services models,
- A quality of life adaptive conjoint study (Qo
- An economic evaluation.

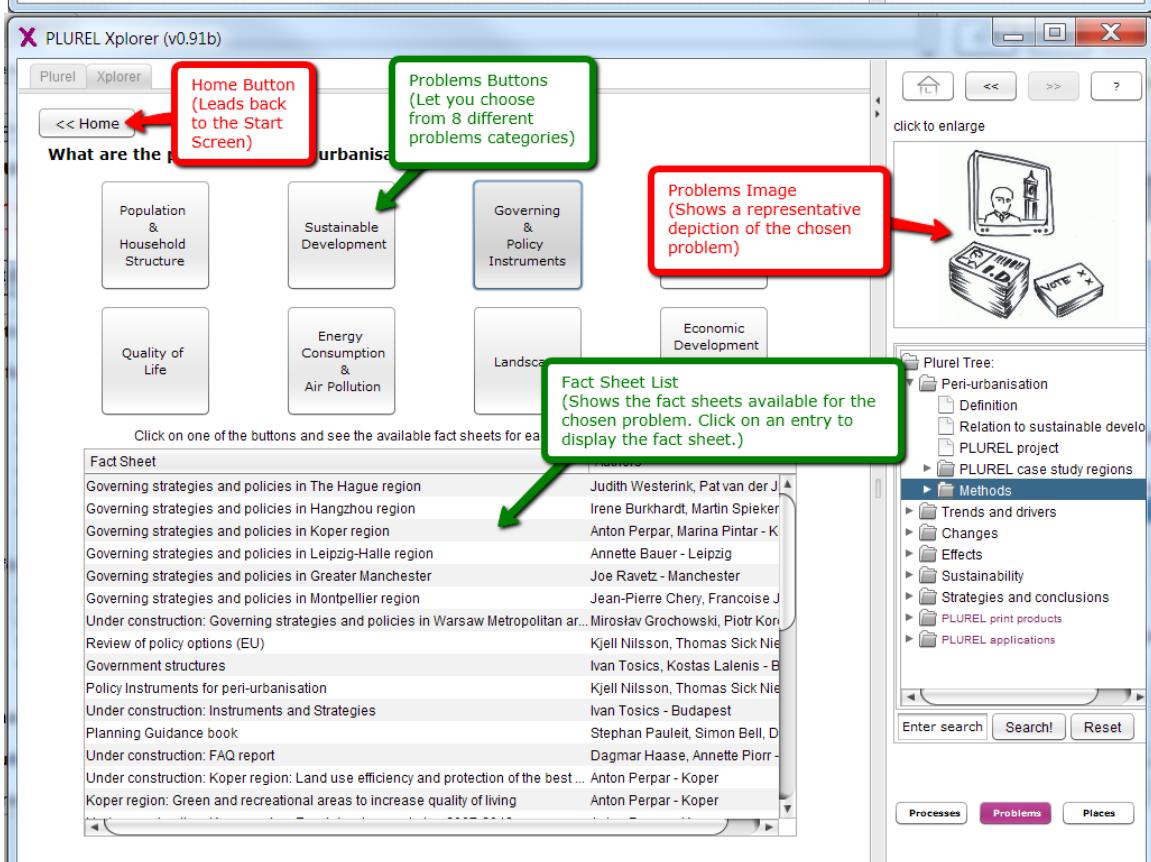
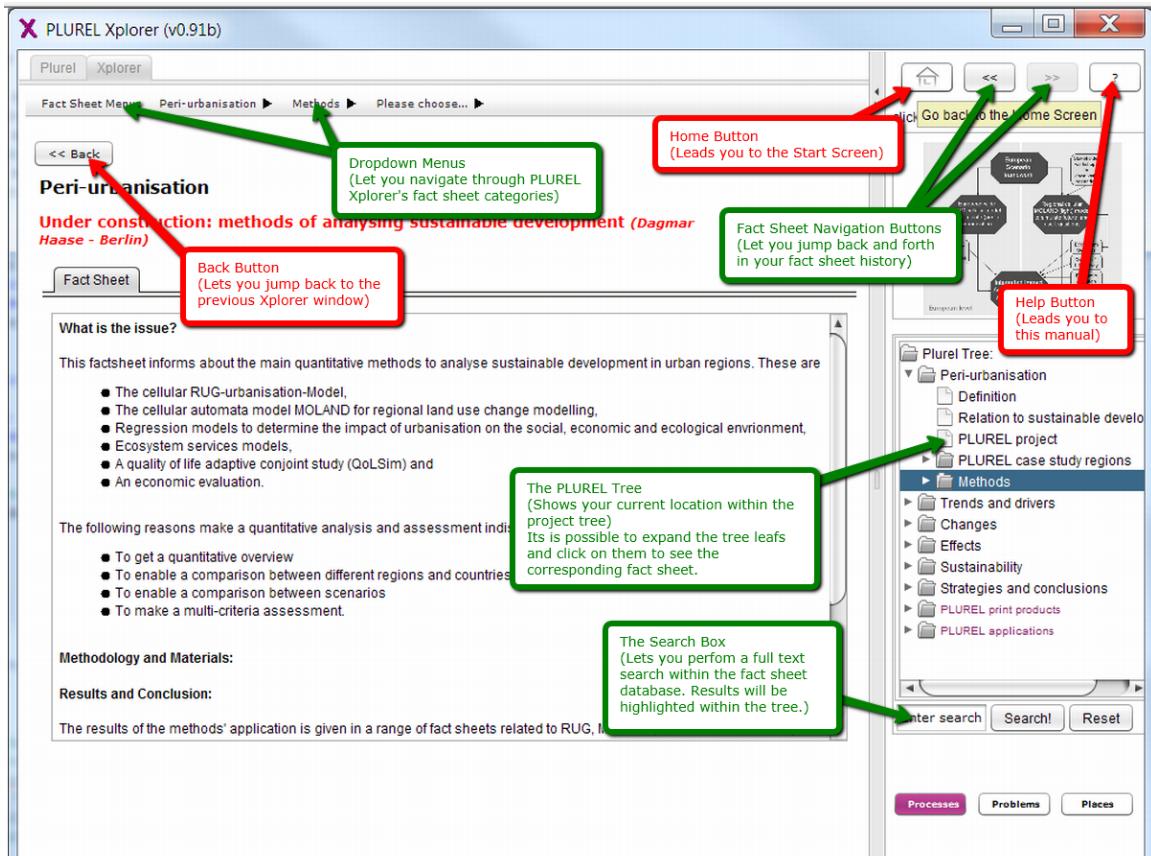
The following reasons make a quantitative analysis:

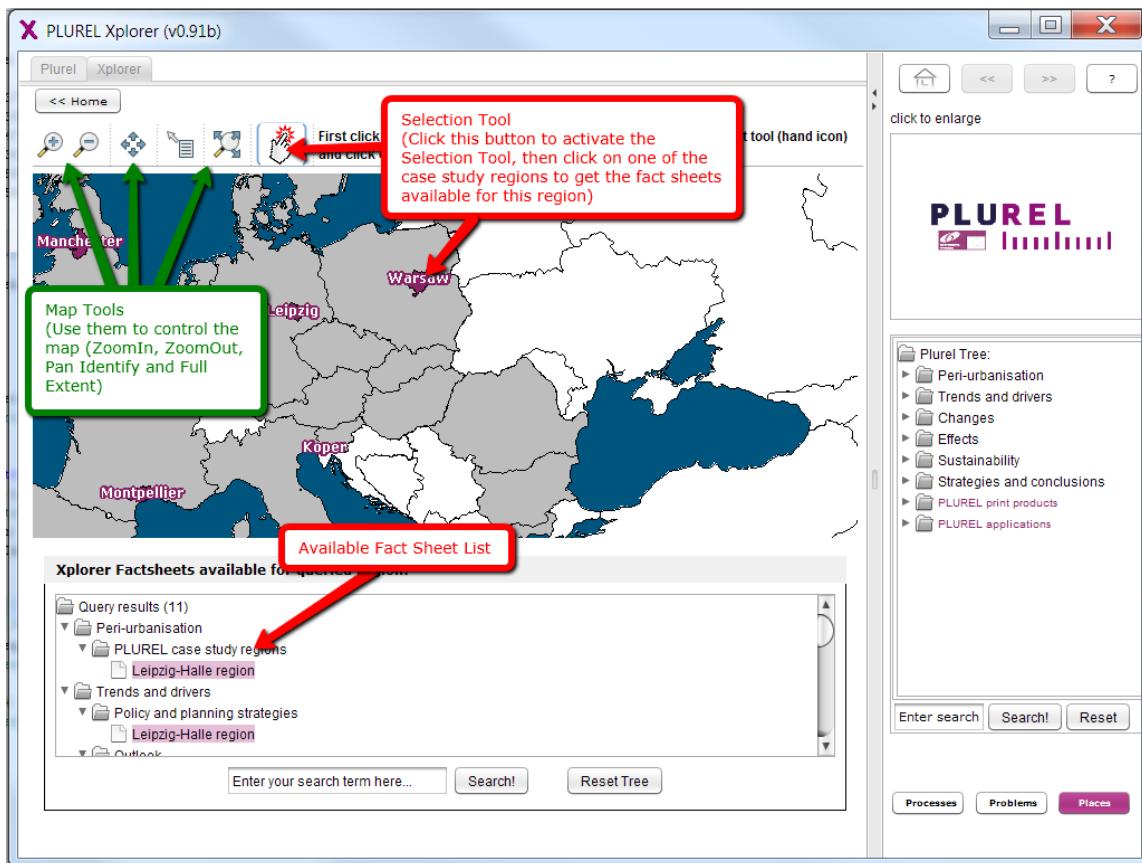
- To get a quantitative overview
- To enable a comparison between different regions and countries
- To enable a comparison between scenarios

DPSIR concept  
Participatory approaches  
Complexity concepts  
Valuation of peri-urban environment  
Hedonic pricing  
Contingent valuation  
Travel cost method  
Choice experiments  
CBA in peri-urban context  
CBA at pan EU level  
System dynamics model  
RUR-typology  
Response functions  
Quality of life simulator  
Indicator framework  
Simulation of peri-urbanisation  
MOLAND  
ABMLand  
IIAT Europe  
IIAT case study regions

Dagmar

Method of contingent valuation





# Appendix 2:

## PLUREL Xplorer fact sheets

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# 1 Peri-urbanisation

*What is peri-urbanisation about?*

## FS 400 Intro into peri-urbanisation

By Thomas Sick Nielsen - Copenhagen

### What is the issue?

Over 70% of Europe's population now lives in urban areas, which in turn have grown in area by almost 80% over the last fifty years. The most obvious signs of this shift towards urbanisation are urban sprawl and the emergence of peri-urban areas as urban growth has often favoured low density suburbs and adjacent peri-urban regions. The results of the peri-urbanisation trend are changes of land use and functional linkages between urban and rural areas with deep consequences both for people's quality of life, for the environment and what is called ecosystem services, i.e. the demand for and supply of water, food and recreation in natural settings

The importance of peri-urbanisation stems from its increasing importance as settlement area. Any forward looking strategy for sustainable and competitive regions in the EU should consider drivers and pressures of peri-urban land use changes. Focussing on either urban or rural areas may produce *spill overs* to the peri-urban while peri-urban land use changes will affect environmental objectives, quality of life, social cohesion, costs etc. and therefore needs to be managed carefully.

### Methodology and Materials:

The uncertainties of peri-urbanisation relate to the future. Will the trend continue? What if the oil prices go up and transport gets more expensive? Other questions relate to the sustainability impacts in different contexts and the possibility to govern the peri-urban to achieve more sustainable outcomes. The PLUREL project applies scenario methodology, detailed case studies, and sustainability impact assessment to answer these questions.

### Results and Conclusion:

These changes caused by increasing urbanisation are most dynamic, intense and visible in the peri-urban zones where land uses often rapidly and lastingly change from nature and agriculture into urban areas or are subject to modifications in the interest of the increasing and very mobile urban population.

The peri-urban generally falls between policy agendas or focuses for research, which are often either rural/nature oriented; or urban oriented. The peri-urban also often contradicts existing administrative divisions, e.g. in spatial terms where the peri-urbanisation trend and functional dependencies often stretches far beyond the range of administrative bodies and co-operations created to solve the problems of Europe's urban regions. The peri-urbanisation trend affects a wide urbanising field where urban activities and land uses increasingly blend with and increasingly pushes back agricultural land uses.

Most European research projects that have targeted sustainable development in conjunction with land use has been either rural (e.g., EURURALIS, MULTILAND, SENSOR, SEAMLESS) or urban (e.g. MOLAND, PROPOLIS). Only a few like SELMA, SCATTER and URBS PANDENS have had an explicit focus on the tendencies towards de-concentration / urban sprawl in urban areas and its effect on quality of life and sustainability. Sprawl and de-concentration processes are important parts of the rural, peri-urban and urban relationship, however the effects in rural areas that supply the land for urban expansion and supply many of the ecosystem services have largely been neglected in such *urban* projects. Only a few European projects have dealt with the interface between rural and urban areas - under the heading *peri-urban* areas. The pressure from urban development on rural areas was the main issue in the projects NEWRUR and RURBAN. In the NEWRUR project the dynamics of the development of peri-urban regions was analysed. The project points to the divergence between peri-urban development patterns and European Spatial Development Perspective (ESDP) objectives, especially urban containment and some recommendations for the regulation of peri-urban land use change are given. The RURBAN project had a considerably different character and maintained a *rural perspective on urban pressure*. The project pointed towards a need to consider how *rural goods and services* (houses, second houses, landscapes, nature etc.) could be used to build new relationships in areas under pressure and contribute to enhancement of the rural landscape. The main contribution of the PLUREL project and the PLUREL XPLORER will be a view to the totality of the wide rural-urban region in which peri-urbanisation takes place. PLUREL delivers analysis of the peri-urbanisation trend for policy support, considering *urban* as well as *rural* perspectives at relevant geographical scales.

To conclude, the peri-urban areas deliver many of the eco-system services consumed by the urban areas: food, drinking water, and waste disposal and the peri-urban will most likely play a prominent role in the development of sustainable urban futures. Most approaches to policy or research has maintained an either rural/nature focus or an urban focus. This may produce *spill overs* to the peri-urban while peri-urban land use changes will affect environmental objectives, quality of life, social cohesion infrastructure costs etc. and therefore needs to be managed carefully.

## 1.1 Definition

*What is peri-urbanisation?*

### FS 401 Definition of peri-urbanisation

By Thomas Sick Nielsen - Copenhagen

#### What is the issue?

Europe is a highly urbanised continent with 75% of the population living in cities today and 80% in the near future. But the transformation of many cities in Europe in recent decades is, however, not characterised by a continued growth of the major urban centres. Instead a form of urbanisation emerged which integrates whole regions of big and small cities and towns and rural areas into urban-rural regions. Urban transformations and the increasing urban influence outside the urban core and continuous urban areas can be summarised by the term peri-urbanisation.

Peri-urbanisation incorporates complex patterns of flows and integrates rural areas into the system of an urban region. The blending of rural and urban land uses and activities in integrated regions sets a new context for sustainable development and poses a challenge to European objectives such as quality of life and competitiveness. The impacts and significances of these processes, as well as how to turn them towards sustainable development, is the main issue of the PLUREL project

#### Methodology and Materials:

This fact sheet is based on a review of literature and policy documents as well as the experiences with practical and empirical definitions of the peri-urban areas developed within the PLUREL project.

Uncertainties and difficulties relate especially to the delineation of the peri-urban areas which may be based on interaction patterns, locational properties, functions and land use patterns and trends of an area. Access to relevant data generally determines how accurately peri-urbanisation trends can be identified. PLURELs delineation of peri-urban areas across the EU is based on access to cities and land use patterns as the best possible definition at this scale.

#### Results and Conclusion:

Although the terms peri-urban and peri-urbanisation are commonly used in different contexts, they are only vaguely defined. Often it is used to describe newly urbanised zones at the fringes of cities, especially in developing countries, which are then called the peri-urban interface. The Council of Europe (2007) defines peri-urban as a transition area moving from strictly rural to urban, related to a high pressure towards urban development. The development is, however, not limited to pure physical urban development, but often marked by the emergence of urban activities in rural areas like hobby farms and second homes.

Peri-urban overlaps with other terms describing different forms of developments between urban and rural. A long used term is ex-urban, originally coined by Auguste C. Spector in 1955. In his book he describes the development of a wealthy ring of rural areas around New York City, characterised by commuting to the urban core. Today many of these areas could also be called suburban and it has been argued that ex-urbanisation does not differ from suburbanisation.

Another term describing a form of urban-rural dynamics is "counter-urbanisation". That implies a general turnaround of urbanisation, i.e. a growth in migration from the city to the countryside, and was observed in the 1960s and 1970s in the United States and Western Europe. Besides the relocation of services and industry into rural areas, the development of part-time farming, second homes and retirement migration play an important role in this process.

To conclude, urban transformations and the increasing urban influence outside the urban core and continuous urban areas can be summarised by the term peri-urbanisation. Peri-urbanisation means shifting from mainly rural towards urban land uses and activities. Urban activities and populations may have an increasing role in an area without simultaneous growth in urban land uses. This makes peri-urban areas difficult to identify. Empirical definitions may be based on interaction patterns, locational properties, functions and land use patterns and trends of an area. PLURELs delineation of peri-urban areas across the EU is based on distance to cities and land use patterns.

## 1.2 Relation to sustainable development

*What has peri-urbanisation to do with sustainable development?*

### FS 402 Peri-urbanisation and sustainable development

By Thomas Sick Nielsen - Copenhagen

#### What is the issue?

The concept of ‘sustainable development’ evolved in response to the environmental and social impacts of economic activity. The 1987 Brundtland report framed it as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainable development of peri-urban areas raises many questions as sustainability combines economic, social and environmental goals, both locally and globally, and in both the short and longer term. In addition to this peri-urban areas comprise a complex mix of pressures, drivers and processes in many different sectors, at different spatial scales.

Increasing urbanisation implies larger peri-urban territories. How these territories develop and are managed affects the resource demands, environmental impacts, quality of life, functioning and competitiveness of rural-urban regions. As land use changes and especially urbanisation tend to be difficult to reverse the peri-urbanisation process and urban-rural relations should have a prominent place when sustainable development paths are considered for Europe's rural-urban regions.

#### Methodology and Materials:

Major uncertainties stem from the many actors and decision makers operating in the peri-urban and their logics. Conflicts exist between local and regional perspectives; environmental, social, and economic considerations; and finally between present and future generations. The main challenge for sustainable peri-urban development is to identify strategies which are able to create win-win solutions to promote sustainable land use systems in the peri-urban areas.

#### Results and Conclusion:

In the next 40 years current projections show a rapid growth in the urban areas of developing countries of up to 3 billion people. Current trends show that a majority of residents will live in slums or chaotic settlements lacking basic infrastructure and much of this ‘urban’ development is likely to be in peri-urban areas.

The peri-urban areas of the EU are likely to grow rapidly but still enjoy good material standards. The low density areas which are characteristic for the peri-urban are highly dependent on fossil-fuel based transport, energy, food etc. So there is a need to demonstrate sustainability ‘pathways’ for the EU, national and local urban development, focusing on the peri-urban territory, which can provide for human needs while sustaining ecological systems and resources on a global scale. In practical

terms there are urgent questions - e.g. what is the most carbon efficient settlement pattern? How can food systems be restructured for the lowest impact?

The importance of peri-urban areas for sustainable development stems from their inter-dependencies with urban areas and the 'functions' or 'services' delivered from natural or urban systems. 'Ecosystems services' describe the interactions between the physical environment and human economies or societies. Urban, peri-urban or rural systems likewise, provide a range of social / economic functions or services, which depend on the urban system or hierarchy; "quality of life" is a basic concept to measure the living conditions which are also part of sustainability.

Such functions and services exchanges between urban and peri-urban areas can be quite direct. In pre-industrial times, there were direct linkages in the flow of resources between towns and the surrounding countryside. Local farmers produced food for the urban population, but they also collected latrines in the city, and spread nutrients on their fields. In the 21<sup>st</sup> century many drivers of peri-urban change tend to be global forces of economic, social and cultural change. But from a sustainability point of view re-establishing local linkages where these are most efficient and sustainable, such as in water and waste management, food and energy production, supply of raw materials can be beneficial.

The rural landscape also provides other goods beneficial for the urban community, e.g. biodiversity, air quality, ground water protection, areas for recreation and health promotion etc. The concept of sustainability, especially when discussed in the context of European policy strategies as the Common Agricultural Policy, is often interpreted as multifunctionality of land use.

Multifunctionality can be defined as the joint production of commodity outputs, which are typical market products (e.g. cereals, milk) and non-commodity outputs, also as by-products of agricultural production, and which fulfil public or private needs.

To summarise, the increasing urbanisation in Europe and the world implies larger peri-urban territories. How these territories develop and are managed affects the resource demands, environmental impacts, quality of life, as well as the functioning and competitiveness of rural-urban regions. Peri-urbanisation trends may be in direct conflict with environmental objectives such as nature conservation and biodiversity - and may also have long term impacts on resource demand and supply if not adequately managed. The peri-urbanisation process will also be an important factor affecting the form, functioning and quality of life of future rural-urban regions. Due to the many actors and conflicts of interest the main challenge for sustainable peri-urban development is to identify strategies which are able to create win-win solutions to promote sustainable land use systems in the peri-urban areas.

## 1.3 PLUREL project

*Which questions can PLUREL answer?*

### FS 145 The PLUREL Project

*By Kjell Nilsson, Thomas Sick Nielsen - Copenhagen*

#### What is the issue?

**PLUREL** (Peri-urban land use relationships – Strategies and sustainability assessment tools for urban-rural linkages) is an Integrated Project funded within the 6th Research Framework Programme of the European Union. 36 partners from 14 European countries and China participate in the project. It is coordinated by the University of Copenhagen. The project started in 2007 and will terminate in 2010.

Six European case studies were chosen to explore in depth the land use relationships between rural and urban areas: Warsaw, Leipzig, Haaglanden, Manchester, Montpellier, and Koper. Additionally, one case study in China (Hangzhou) was included. The case studies reflect the variability of geographical, economic and social conditions prevailing in Europe. The case study in China provided an additional view.

[PLUREL Website](#)

**PLUREL** is focused on sustainable land use development in urban regions which face inner-city decline and suburban growth encroaching on surrounding rural areas. Today, there is a clear distinction between urban and rural issues. It is time to leave that division and turn into a more holistic, territorially oriented perspective. **PLUREL** will highlight this and give a science-based input to the debate.

#### Methodology and Materials:

**Module 1** describes the underlying driving forces and global trends.

**Module 2** translates these general trends into demands on land use, resources and public participation.

**Module 3** studies the regional scenarios and strategies to steer developments in the urban fringe.

**Module 4** has emphasis on interactive impact assessment of different strategies in case study regions.

**Module 5** synthesises the results into knowledge resources and tools for stakeholders at regional, national and EU-level.

### 1.3.1 Products

1. **PLUREL XPLORER with integrated Impact Analysis Tools (iIAT), map resources, and MOLAND LIGHT** - An online tool allowing users to browse the evidence on peri-urban land use relationships, and the gateway to provide online-access to all displayable outputs of **PLUREL**.
2. **The book 'Peri-urban development in Europe' and the policy brochure on peri-urban issues** - Print products that synthesise the results from across the **PLUREL** project.

### Results and Conclusion:

The **PLUREL** project aims to achieve a deeper understanding of the changing relationships between urban and rural land use with an emphasis on the most dynamic portion, that of peri-urban areas. It develops methods and tools to assess the environmental, social and economic impacts of land use changes. Potential strategies and good practice examples will be identified in order to promote the sustainable development of land use systems in Rural-Urban Regions(), especially the peri-urban areas.

The project's objectives are:

1. To develop land use scenarios for Rural-Urban Regions (RURs) in Europe, improving the understanding of the economic, social and environmental issues lying behind land use dynamics in the urban, peri-urban and rural RUR sub-regions.
2. To analyse and model the relationships between land use changes and the provision of resources and functions (e.g. residential, transport, environmental and recreational services) of RURs at a European and a case study level.
3. To analyse the implications of planning policies and strategies as well as governance structures on the sustainability of land use, particularly in peri-urban areas by exploring selected case study regions in detail and in collaboration with local stakeholders. This allows identifying strategies for sustainable peri/urban development.
4. To assess the environmental, social and economic impacts of land use changes induced both by global and regional driving forces and by regional development strategies using a Multi Criteria Assessment approach.
5. To enhance learning, cooperation and communication between policy makers, stakeholders, planners and researchers.

### Further reading:

- [PLUREL Structure](#) (image) by Kjell Nielsen
- [PLUREL Project](#) (image) by Kjell Nielsen
- [PLUREL Participants](#) (table) by Kjell Nielsen
- [PLUREL Project Cases](#) by Kjell Nielsen
- [Newsletter No. 1](#) (pdf) by Kjell Nielsen et.al.

- [PLUREL Website](#)

## 1.4 PLUREL case study regions

*What can we learn from European case study regions?*

### FS 430 Governance patterns and performance of regional strategies in peri-urban areas

By Carmen Aalbers, Katharina Eckerberg - Wageningen, Copenhagen

#### What is the issue?

This fact sheet compares the performance of different strategies for peri-urban areas, reflecting upon their critical policy dimensions and their contributions to sustainable development of rural urban regions, the urban fringe, and rural parts in specific. Competition over land use generally characterises areas in the urban fringe which serve many interests. Policy makers and other local actors act not only through formal policies but also through informal approaches. Some interests are inherently private and their development primarily guided by economic gain, others are public goods that require attention through government action at national and sub-national levels

Urban fringe areas show competition over land uses and are areas with fragmented jurisdictions and multiple-level policies, across government levels, between governments at the same level, across sectors, and among public-private actors. Problems of implementation deficits with sector-based strategies are commonplace with fragmented institutionalisation, calling for increased co-ordination and integration mechanisms (Tatenhove et al 2000), which is especially important for sustainable development.

#### Methodology and Materials:

This study was based on a governance case study research in 6 urban regions in Europe and 1 in China. We analysed multilevel governance through the lens of the policy arrangement concept, distinguishing between the rules of the game, the land and financial resources employed, the coalitions or cooperations that are formed and the discourses developed to share the way in which problems are defined, reproduced and transformed in particular sets of practices, giving meaning to problems.

The comparison uses the case study reports which describe drivers of regional land-use changes, responses in terms of formal and informal governing actions, and impacts in terms of land use changes as results of governing actions.

#### Results and Conclusion:

##### Land use changes:

The urban fringe can show great contrast, accomodating both very wealthy and very deprived communities. The studies present a picture of congested cores versus rural decline in the urban regions. Residents flee compact cities in search of better living environments, investors make

money, and those who cannot afford to leave or prefer an urban way of life stay behind. Without adequate transport facilities, this leads to congested infrastructure.

### **Rules of the game:**

In most of the studied regions, the problems and opportunities of peri-urban areas fall into a policy gap between urban and rural policy regimes. In the former East European context there are few statutory coordination and control mechanisms, and little public control of current land use development. In the West European cases new policy instruments emerged to halt biodiversity loss and provide green space for urban citizens. But these are generally located outside the extensive and dense urban fabric. These cases show inadequate integration between parallel initiatives.

### **Financial and land resources:**

All cases point to the steadily rising land prices in the fringe, pressure on local politicians and planners to allow for economic development and expansion of industry and housing at the expense of green open spaces and nature. The levy of local taxes also contributes to the tendency to prioritise new settlements in order to create a sufficient tax base for the provision of public services. Financial compensation to farmers and others who help provide ecological services in the peri-urban areas are noted as important. EU schemes for environment and rural development and the European Fund for Rural Development (EFRD) are highly relevant, but do not target the the peri-urban areas specifically. Subsidies to coordinated actions by cooperating municipalities are beneficial to coordinate land use developments in the urban fringe. A combination of financial and land policy instruments might reduce the strong pressure on agriculture in the urban fringe: lease of state-owned land to business and farmers, land banking, subsidies, land price fixation. Also polycentric development patterns might help diminishing scarcity of green open spaces in the urban fringe.

### **Policy coalition development:**

There is considerable lobbying from commercial interests to allow for expansion of housing into the peri-urban areas. Environmental groups, on the contrary, advocate increased protection of natural areas. Participation of the general public remains a major challenge to policy development in the peri-urban areas, due to loosely tied constituencies. Most regional policies are weak in social and environmental performance because the main powerful actors have a biased vision. But there are positive lessons to be learnt such as from Montpellier agglomeration where politicians and planners have cooperated in a regional effort to develop the peri-urban area in a more sustainable way. (for recommendations see report).

### **Further reading:**

PLUREL deliverable report: [Instruments and strategies for sustainable land use in peri-urban areas](#)

## **1.4.1 The Hague region**

*Introduction into case study region The Hague*

### **FS 431 Introduction into The Hague region**

*By Judith Westerink, Pat van der Jagt - The Hague*

## **What is the issue?**

The Hague region (1 million inhabitants) is an urban polycentric region, part of Randstad Holland in the West of The Netherlands, situated at the North Sea coast. Its main cities are The Hague (474.000 inhabitants), Delft (95.000) and Zoetermeer (118.000), but the region has a number of other towns and villages, some of which have grown together with the urban fabric of The Hague (Voorburg, Leidschendam, Rijswijk). It is not an isolated city region: to the South it borders Rotterdam region and to the North Holland Rijnland with among others the city of Leiden.

Population growth in the region is slow (1% on average in 2006), but there are differences between municipalities. The expectations are that population growth in the region will continue to decline and will stabilise at 0,3% per year in 2030. Currently, Pijnacker-Nootdorp is the fastest growing municipality. A stagnating population growth will not mean a building stop, however. Declined neighborhoods will need to be renewed, but more importantly, household size is diminishing.

## **Methodology and Materials:**

The following methods were used:

- Interviews
- Questionnaires
- Document study
- Action research

City regions in The Netherlands have limited power and resources with respect to planning. In planning, their assignment is to organise cooperation between municipalities. The Hague Region is therefore very active in initiating and participating in concertation and political networks, not only with the municipalities but also with neighbouring regions and higher tiers of the government. The political agreement is one of its instruments.

## **Results and Conclusion:**

The cities and towns in the region all have a distinct character, due to their location, history and economic activities. The Hague is the largest city of the region. It is the residence of the government, although Amsterdam is the capital city of The Netherlands. The presence of the government has attracted many embassies and international institutions to The Hague, among which the International Court of Justice. The city likes to present itself as the ‘international city of peace and justice’. Delft has a technical university, which has attracted knowledge institutes and innovative companies. Zoetermeer is a satellite city of The Hague, which grew from a village with 10.000 inhabitants in 1960 to a city of 100.000 in 1990. Many inhabitants of Zoetermeer work in The Hague. The city has a developing sports and leisure sector. An important economic sector in the region, with a high impact on the landscape, is greenhouse horticulture. The main greenhouse areas in The Netherlands are found in The Hague Region; in Westland and around Pijnacker.

Because of the unstable and wet peat soils, towns and cities in this part of The Netherlands developed on higher grounds, such as new and old dunes (The Hague, Wassenaar, Rijswijk, Voorburg) and river banks (Delft). This led to a clear distinction between ‘urban’ and ‘rural’. However, most of the suburban expansions and the whole city of Zoetermeer were necessarily built on lower grounds, by lack of suitable land, and because improved building and pumping technology allowed this. Dune reserve Meijendel was spared from construction, because of its importance in coastal defense and drinking water production. Bordering Meijendel, the municipality of Wassenaar also managed to maintain a green character. It is known for its estates and expensive villas. It is one of the three ‘richest’ municipalities in The Netherlands.

The region has very little space for urban expansion. The peri-urban areas inside the region have become ‘green enclaves’ between cities. Meadow landscapes are now considered scarce and policy makers are considering planning instruments for protection, similar to those that are used for natural reserves. Especially the city of The Hague is ‘cornered’. It is ‘squeezed’ between the sea (West), greenhouses (South), a nature reserve (North) and urban fabric of other towns (South). For that reason, The Hague has been expanding outside its borders. First, Zoetermeer was built since the seventies (but it remained a separate municipality). More recently, large urban expansions were built near Nootdorp (Ypenburg) and Leidschendam (Leidschenveen). These areas were added to the territory of the municipality of The Hague. Currently, the town of Pijnacker is growing fast because of the housing expansions at its South.

To conclude, urban fabric in The Hague Region has been gradually expanding, but in a ‘controlled’ way. The map of the region looks quite ‘organised’ as a result of this, with distinct urban, agricultural, natural and industrial land uses. The research gives insight into several strategies of The Hague Region to work together with the municipalities and other tiers of government, in order to preserve the quality of the landscape and that of neighbourhoods, for a competitive region.

### **Further reading:**

Impressions from the case study area:

- [Cycling below sea level in Midden Delfland with Rotterdam in the background](#) (images) by Judith Westerink
- [New The Hague neighbourhood of Ypenburg](#) (images) by Judith Westerink
- [City centre of Delft](#) (images) by Judith Westerink
- [In Vlietlanden the wet peatlands can be experienced](#) (images) by Judith Westerink
- [Westland is a 'sea of glass', here seen from Midden-Delfland](#) (images) by Judith Westerink

### **1.4.2 Hangzhou region**

*Introduction into case study region Hangzhou*

By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit -  
Munich, Hangzhou

### **What is the issue?**

The City of Hangzhou is located at the lower reaches of the Qiantang River at Hangzhou Bay in the southern part of the Yangtze River Delta, and at the southern end of the Beijing-Hangzhou Grand Canal. It was founded about 2200 years ago while first human settlements can even be traced back more than 5000 years ago. After the foundation of the People's Republic of China, Hangzhou became the capital of Zhejiang Province. Today, Hangzhou - a city of approximately 4 million inhabitants - is facing enormous pressure from urban development. The major challenge for Hangzhou is to balance economic development with the protection of natural environment and local culture during rapid peri-urbanisation.

Hangzhou is a typical Chinese metropolis. Its peri-urban areas are characterised by a mix of land uses, and also a mix of land ownership and jurisdictions. The unbalanced development resulted into different levels of urbanisation and environmental quality. Furthermore, new developments put heavy pressure on cultural and natural resources. Hangzhou adopted a number of strategies to address these challenges that can provide lessons to other peri-urban areas in China.

### **Methodology and Materials:**

The study employed the assessment framework produced from “Framework for Assessment of Reports” to evaluate the development strategies in three case study areas in the peri-urban. The assessment was undertaken by a research group including both Chinese and European researchers. It is based on documentary analysis (planning and regulation documents, government reports, statistics, journals, etc.), informal interviews, target group meetings and workshops, and field visits.

### **Results and Conclusion:**

Among the PLUREL case studies, Hangzhou is the largest agglomeration both in terms of population and surface area. The peri-urban area of Hangzhou as a whole can be described as a dynamic transition zone. The built-up city area grows rapidly both in terms of a densified core city as well as expanding into the city fringe. In this way part of the once peri-urban area has already been incorporated into the core city while the peri-urban area gradually stretches out into the rural surroundings. Due to the difficulties in getting sufficient information for the whole peri-urban area, not least due to the great speed of urban development, it was agreed to concentrate on characteristic sub-cases to analyse in more detail the challenges of peri-urbanisation and strategies that affect land use change in these zones. The selection of case study areas was based on round table discussions with various stakeholders. Three study areas outside the actual core city were selected, representing different geographical and socio-economical parts of the peri-urban area and also different urbanisation pressures and development paces.

The selected case study areas are not representative for all peri-urban zones but nevertheless, they

were considered well-suited to study the most important challenges for sustainable peri-urbanisation in Hangzhou. Also, they analyse strategies adopted by local government to respond to these challenges. The Zhubantang area in the southwest represents an attempt to combine moderate urban development with tourism and protection of the cultural and ecological heritage. The Xixi wetland area in the west serves as a case where landscape restoration is combined with development of up-market residential areas. The scale of the restoration project and the speed of its implementation are rather unique, not least by European standards. Finally, the Binjiang district represents the case of a rapid large scale development from rural to urban structures and from low to highly productive industries. It is based on strong top-down planning and some mechanisms to efficient urban management have been adopted.

To conclude, Hangzhou is a typical Chinese metropolis with a large agglomeration of both population and surface areas. Its rapid urbanisation has resulted in great pressure on its cultural and natural resources. The evaluation of the planning strategies for the 3 case study areas helped to identify the following challenges and solutions to promote sustainable land use in the peri-urban areas:

- Enhancement of the relationship between peri-urban areas and city core;
- Improvement of regional equity;
- Control of sprawl and protection of farmland;
- Balancing development with eco-system protection;
- Protection of rights and benefits of farmers;
- Establishment of efficient government structures;
- Encouraging bottom-up initiatives;
- Making flexible plans;
- Use of financial tools to guide preferable development;
- Plan monitoring and evaluation of implementation;
- Development of transport and other public infrastructures.

#### **Further reading:**

- [Location of Hangzhou](#) (maps) by Fei Yany
- [Case study areas](#) (maps) by chinese partners

### **1.4.3 Koper region**

*Introduction into case study region Koper*

#### **FS 433 Introduction into Koper region**

*By Anton Perpar, Marina Pintar - Koper*

#### **What is the issue?**

The Municipality of Koper, situated on the Slovenian coast, is one of the PLUREL's case studies. Its total area is 311 square km, with 17.6 km of coastline. The municipality territory includes more than one hundred settlements and had a population of 52,212 in the first half of 2010. The administrative centre of the municipality is the city of Koper (about 24,000 inhabitants) where most of the administrative, economic and cultural activities are concentrated. The peri-urban area experiences high pressure concerning future development, while the rural hinterland is more sparsely populated.

Koper is the only commercial port and an important industrial centre of Slovenia with a diversified economy. The port continues to be a very important actor, with a major economic and spatial influence on the city and its surroundings, and even on the national economy. A highly diversified peri-urban land use and an increasing development pressures call for a sustainable land use planning. The area is attractive; population growth is mostly a result of immigration.

#### **Methodology and Materials:**

The following methods have been used:

- Semi-structured interviews,
- Questionnaires,
- Workshops with significant actors in space,
- Analysis and study of existing documents and studies,
- Statistical analysis of existing data,
- GIS tool for spatial presentation of the situation on maps.

The Municipality of Koper has the power and resources in terms of planning, except for the area of the Port of Koper which is under national spatial planning decisions and plans. PLUREL is contributing to the planning discourse. Discussions on workshops between researchers, stakeholders and planners, along with MOLAND modelling results for the Koper region, contributed to a better proposal of the new spatial documents.

## **Results and Conclusion:**

The location of the city on the coast and the medieval city centre provide some limitations for future development. In addition, the Port of Koper occupies a lot of space and constrains the city's development. Settlement and the development of economic activities are therefore directed even more into the peri-urban area, which also experiences the highest pressure concerning future construction and other interventions. The peri-urban area is characterised by highly diversified land use. It acts as a settlement area, as well as a green and recreational area. Favourable conditions enable agricultural activities, while new infrastructure and industrial zones are also being constructed there. A major part of the municipality is formed by the rural hinterland, which is sparsely settled but has unique cultural and natural heritage values and a rich biodiversity.

The Municipality of Koper is currently preparing new spatial documents. The strategic issues that dominate planning discussions are manifold. They include the adjustment of different development needs and assurance of spatial efficiency in the sense of rational space arrangement and protection of natural resources (best agricultural land, forests, natural areas etc.). Other issues central to the planning discourse are assurance of high quality living conditions (green and recreational areas), efficient public transportation, conditions for economic development (industrial and trade zones) and maintenance of the cultural landscape and natural and cultural heritage in urban and rural parts of the municipality.

The aim of the new spatial documents of the Municipality of Koper is to promote a more optimal and more sustainable land use, taking into account the aspects of natural resources (soil quality, environmentally important areas, important forest areas, etc.), the initiatives of local people and other actors and future development/spatial needs. New spatial documents should be supported by professional arguments and result of an inter-sectoral approach to planning.

## **Further reading:**

- [Koper area](#) (images) by Google
- [KOPER\\_location\\_map](#) (maps) by Perpar et al
- [Koper\\_analysis\\_report](#) (pdf) by Perpar et al, 2010

### **1.4.4 Leipzig-Halle region**

*Introduction into case study region Leipzig-Halle*

#### **FS 434 Introduction into Leipzig-Halle region**

*By Annette Bauer, Dagmar Bankamp - Leipzig*

#### **What is the issue?**

The bi-polar urban region in Eastern Germany with its cores Leipzig and Halle underwent population changes in the past decades. Since the 1970s, the region has lost inhabitants (Nuissl and Rink, 2005), and only the population of Leipzig is growing since recently (Stat. Landesamt, 2009).

In the early 1990s, commercial and residential sprawl was observed in peri-urban areas (Haase and Nuissl, 2007). It still occurs today, though its scope is much reduced.

Due to the fragmentation of responsibilities in land use planning, steering these developments is a complex task and requires extensive coordination.

The simultaneity of urban development and partial population shrinkage is not only a phenomenon which affects eastern German cities but an increasing number of European large cities, as a report by EUROCITIES suggest (Kabisch et al., 2009). This makes Leipzig-Halle an extremely interesting and challenging case study to learn from.

## **Methodology and Materials:**

This report is based on (1) an analysis of regional population data, (2) an examination of land use as well as GIS data in order to outline the land use development in the last decades and (3) a description of the formal planning system as well as plans and policy documents.

The report received input from PLUREL delineation and classification of European regions (Loibl and Köstl, 2008). The descriptions of formal land use planning, governance as well as three strategies for area protection are the basis for an assessment of spatial planning strategies.

## **Results and Conclusion:**

### **Population development**

Between 1990 and 2006 the number of inhabitants of the Leipzig-Halle case study region decreased from 1.35 to 1.22 million (-10,4%) with further declining tendency. The majority of the population decrease took place between 1990 and 2000 (Stat. Landesamt, 2010). Halle lost 24% of its population between 1990 and 2006 (2006: 235.720 inhabitants) with an ongoing decline. In the same time, Leipzig lost 9,1% of its inhabitants with a gentle population incline of 2,4% (+13.370) since 2000 (2006: 506.578 inhabitants) (Stat. Landesamt, 2010). The surrounding areas show a slightly different pattern. The Saale district lost 1,2% (-2.498) of its population (2006: 206.146 inhabitants) after a rise of 4,2% until 1999. In the neighbouring Leipzig district the number of inhabitants sank by 4,5% (-12.767) to 268.820 inhabitants in 2006 after a slight increase of 0,3% (+741) until 2000 (Stat. Landesamt, 2010).

### **Land use change**

Using the European land cover data set CORINE, a range of land use changes in the region of Leipzig-Halle was identified between 1990 and 2000: major land consumption took place in the peri-urban area around both cities. These are predominantly land cover changes from open land to either residential, transport or commercial land (EEA, 2006). Due to large soft coal resources in the surroundings of both core cities Leipzig and Halle, land use change was found to be from open land to mineral extraction sites (Schwarz et al., 2010). Since the late 1990s the residential but also the commercial sprawl has abated considerably.

### **Formal planning system and unitary reform**

Steering urban growth is more complicated than elsewhere, because the region of Leipzig-Halle belongs to two different federal states, Saxony and Saxony-Anhalt. These differ in their planning legislation and procedures and joint governance structures are not much developed (Sinn et al.

2008). In 1999, Leipzig has been able to annex most of its suburban surroundings, reconfiguring the city's boundaries closer to a functioning unit (City of Leipzig 2007). Nevertheless, conflicts between urban and peri urban municipalities in terms of land preparation and competition for residents and investors arose (Haase, A. et al. 2010).

### **Planning strategies**

While there are many spatial planning strategies for directing or containing development in the Leipzig-Halle peri-urban area, they are extremely diverse: Strategies differ with regard to how they are implemented, at which spatial scale they are implemented and the extent to which different policy-sectors are addressed. This diversity of conception and processes is even quite plain when strategies with similar aims are analysed.

To conclude, the bi-polar urban region with its cores Leipzig and Halle underwent population changes in the past decades. Today, growth and shrinkage occur in vicinity within the region. Major land consumption took place in the peri-urban area around both cities. This has abated considerably but still is an ongoing process. Steering urban growth is a complex task which requires extensive coordination. Because of administrative fragmentation and intermunicipal competition, the regional prerequisites for this task are unfavourable.

While there are many spatial planning strategies for directing or containing development in the Leipzig-Halle peri-urban area, they are extremely diverse. Because of intermunicipal competition and fragmentation, strategies at the regional level with high statutory support seem particularly suitable for steering growth and shrinkage.

### **1.4.5 Greater Manchester**

*Introduction into case study region Greater Manchester*

#### **FS 435 Introduction into Greater Manchester**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

Greater Manchester (GM) is a conurbation of over 2.5 million people in the industrial heart of the North West region of England. It grew as the world centre of the textile industry, and now has a diverse economy of about 30 billion GDP. It has the largest finance, law, media, creative industries and higher education clusters outside of London. It also has some of the highest unemployment, pollution and crime rates in the UK. The peri-urban areas show a 200 year history of settlement patterns: not so much new urban sprawl, but a more diverse picture of more older scattered development looking for new roles, with more recent prosperous suburban development.

Manchester's population has recently started growing after decades of decline. But while peri-urban development is limited by the Green Belt and similar policies, social / economic / cultural change is still rapid. The issue is how to respond to new transitions and policy agendas in the peri-urban, including climate change and green infrastructure, social cohesion and quality of life, and local economic development.

## **Methodology and Materials:**

The overall research approach for Manchester was to explore diversity of thinking and evidence - Combination of technical modelling and social-policy analysis - Combination of structured scenario development and free interview techniques - A generally grounded institutional / constructionist / policy analysis approach, with a range of different methods.

The Manchester case helped to highlight some important themes in PLUREL:

- Tension between globalisation and localisation, and between alternative views on sustainability;
- Systems perspectives on spatial ecology, relational governance, and policy integration;
- Structural perspectives on liberalisation, modernisation and elite / periphery landuse relationships.

Manchester is a large and complex city-region, and there are major uncertainties in policy, economics and social changes. This study took an action-research approach by focusing on the stakeholders and decision-makers who are most involved in shaping the future of the city-region. So the issue of technical uncertainty is shifted towards an issue of ‘pro-active opportunity’, where research and policy are each interacting.

## **Results and Conclusion:**

Greater Manchester (GM) is a conurbation of 2.5 million people, in 10 municipalities, with an area of 1280 km<sup>2</sup>. As a larger city-region, roughly at 1 hour commuting distance, it has a population of nearly 4 million. At its core, the city of Manchester was one of the world’s first industrial and global trading cities. Its population grew rapidly from 1750-1900, and then declined after 1950 due to industrial restructuring. Since 1990, the population has begun to return to the city centre and some regeneration areas, and many inner city neighbourhoods have stabilised, but some continue to be fragmented and chaotic. The outer suburbs were developed mainly from 1920-1980 with lower densities and some of these are wealthy, others are ‘peripheral’ public housing estates with high deprivation and exclusion.

Regarding geography, the Manchester city-region is surrounded on the north and east by low hills, the site of historic industrial activity, and on the south and west by farmland and mixed metropolitan peri-urban areas. The location is at a national crossroads, halfway between Scotland and London, and is also the gateway to the ‘peripheral’ North West region, and a playground for wealthy commuters and tourists.

Regarding peri-urban development and landuse: Between settlements, farming has declined, much former industrial pollution has been cleaned up, natural areas have been conserved, and much countryside is accessible to the public. The previously polluted industrial river valleys were turned into country parks. However there are many lower quality areas, which are still heavily damaged by urban infrastructure and commercial development. The orbital motorway cuts right through most of the green areas which surround the central conurbation.

Regarding governance structures, the GM area is a demonstration of fragmented governance, split between 10 independent units. There are experiments in progress with new forms of partnerships and consortiums. The previous UK government set up a ‘City-Region Pilot’ programme, with a set of multi-stakeholder ‘Commissions’ on environment, economy, transport etc. The new UK

government of 2010 decided to abolish all regional strategies (spatial, economic, infrastructure) and shift everything to the local level. It is not yet clear how the city-region of 10 authorities, or the wider urban-region of 22 authorities can work with this move, and whether there will be formal or informal coordination.

Overall, the Manchester city-region shows one possible future path for other areas. There is a strong spatial planning system, and much experience in partnership agencies and multi-functional land-use, which has helped in the greening of the peri-urban environment. However there are also powerful forces of globalisation and privatisation, social exclusion and fragmentation, which increase the challenge of the peri-urban agenda.

### **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on land use in the urban fringe, Greater Manchester report](#)

#### **1.4.6 Montpellier region**

*Introduction into case study region Montpellier*

##### **FS 436 Introduction into Montpellier region**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

#### **What is the issue?**

Montpellier is a city in southern France. It is the capital of the Languedoc-Roussillon region, as well as of the Hérault department. Montpellier is one of the 10th biggest cities of the country, and is also the fastest growing city in France over the past 25 years. This population growth leads to considerable urban sprawl. In such a framework, the Montpellier region has to face new issues that are representative of the French context for metropolitan areas. What strategies have to be developed by the Montpellier region to ensure sustainable urban growth? Is the development of peri-urban areas a sustainable strategy? If it is not, how to deal with such places?

It is really urgent today to take this issue of peri-urban development into account as it leads to a crisis both in housing and in agriculture. Indeed, as Montpellier is a very attractive region and especially in peri-urban areas around the city core, land prices are rising. Under pressure, farmers have to sell their lands as their farming systems are no longer economically competitive in a context of globalisation and peri-urbanisation.

#### **Methodology and Materials:**

These driving forces led to both a large population mix and to socio-spatial segregation, uncoordinated development and changing peri-urban landscapes. This led to the creation of a new local authority, Montpellier Agglomeration, at the end of 2001. This local government combines 31

municipalities and is in charge of several major public policies. Among these public policies formerly implemented by municipalities are: spatial planning at regional scale, collective transport, water management and housing policies.

The creation of Montpellier Agglomeration brought about deep changes in local governance and planning practices. How does this new authority address the challenges of sustainable development at regional scale? Are peri-urban areas considered as an issue in such a framework? What are the governance issues, and what development strategies have been elaborated? What spatial planning tools are implemented? Are they relevant in terms of sustainable development?

Will the strict development of rules initialised with the SCoT (Scheme of Territorial Coherence) of Montpellier Agglomeration be proceeded in the future? Will they be extended to the entire city-region by a unified government operating on an enlarged perimeter? Or will there be a back turn to former liberal land policy, with a high risk of on-going or new urban sprawl? Besides, climate change and the rise in sea level can also be very important for the future development of the Montpellier region.

## **Results and Conclusion:**

Due to the attractiveness of the Mediterranean coastal region where it is located, Montpellier presents a positive migration balance and population keeps on growing in the city-region. Urban sprawl caused deep changes in peri-urban landscapes during last decades, with individual housing plots spreading around all villages. New buildings took place where vineyards used to be the quasi-unique land-use because of historical specialisation in table-wine mass-production. This sector is more and more weakened by economic crisis, as most other traditional agricultural sectors. The local economy now largely depends on tertiary activities, such as tourism, education, research, medicine, and new technologies.

In the French context of decentralisation and spatial planning reform, and the regional context of high demographic growth of the city-region of Montpellier, some conclusions can be drawn from this case study. The institution of a new local government, Montpellier Agglomération, empowered to elaborate and implement coordinated development policies at regional scale, especially in the field of spatial planning, allows with no doubt the emergence of a strong territorial project that focuses on peri-urban areas. An "iron will" development policy and high technical competences helped drawing and implementing an ambitious territorial project, the SCoT. The territorial development project and the political leadership have been strong enough to federate uncoordinated, even formerly competing municipalities, after decades of uncoordinated development a consensus has finally been achieved. An innovative prescriptive spatial planning document has been drawn at regional scale: strengths of the SCoT are its ambitious objectives and strict development rules for saving space. As a counterpart of previous points, and maybe as a result of the emergency character of the SCoT, the weaknesses of the SCoT are: lack of public consultation, lack of involvement of some major stakeholders, insufficient or inadequate support to peri-urban farming, a key sector for the future of peri-urban areas.

Some recommendations for improved strategies taking into account peri-urban areas are: Strengthening the support to the SCoT's objectives by improving a shared vision of regional sustainable development. Besides, reflections on the place and roles of farming in peri-urban sustainable land use relationships have to be improved. Support has to be given to innovating farming systems as peri-urban sustainable land use. Consistently, increased involvement of farmers

in policy making is required regarding the management of peri-urban areas.

### **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on land use in the urban fringe, Montpellier report](#)

## **1.4.7 Warsaw Metropolitan area**

*Introduction into case study region Warsaw Metropolitan area*

### **FS 437 Introduction into Warsaw Metropolitan area**

*By Mirosław Grochowski, Piotr Korcelli - Warsaw*

#### **What is the issue?**

The Warsaw Metropolitan Area is located in the Mazovian (*Mazowieckie*) voivodship. This is the largest voivodship in Poland in terms of area and population (area: 35 598 sq. km. - 11,4% of the Polish territory; 5 millions inhabitants (13,1% of Poland's population). The City of Warsaw has 1,7 millions inhabitants (population density: 3291/sq km); with the neighbouring municipalities that compose Warsaw Metropolitan Area approximately 3 million (population density: 474/sq. km). The area of the WMA is 6205 sq. km.; area of Warsaw is 517 sq. km. The Mazovian voivodship is divided into 42 counties (powiats). There are 314 municipalities in the region, and 230 of them are rural.

After 1990, the WMA has experienced rapid changes in terms of land use. In the WMA metropolitan area, the progressing concentration of the principal modern development factors can be observed: science, innovativeness, technological progress and highly-skilled personnel in selected areas and places. Warsaw becomes a growth pole of the WMA and the region (mazowieckie voivodship). Development of the region and the WMA are polarised.

#### **Methodology and Materials:**

The main goal was: Analysis of strategies to identify their strengths and weaknesses, "common interests" of these strategies and areas of potential conflicts resulting from the formulated strategic goals. Selection of strategies was based on the following criteria: spatial range of a strategy, thematic range of a strategy, main objectives of a strategy, role for the development of the WMA.

Still there is no legal entity at the sub-regional level that is responsible for the WMA development. The legislative gap may seriously impede efforts to coordinate local and sub-regional as well as regional development initiatives.

## **Results and Conclusion:**

The complex development problems are being addressed by programmatic and spatial planning activities undertaken by authorities from two administrative tiers: the region (strategies and plans for the region and the WMA) and the municipality (development plans and strategy for the city of Warsaw). Development strategies were formulated in the process of extensive consultations with a variety of stakeholders and partners. Reviewing strategies and their evaluation by interested parties / stakeholders allows to draw the conclusion that development goals formulated in these three documents refer correctly to challenges of future development and set appropriate development paths. This is definitely the strength of the strategies. There are also no conflicts that result from the formulation of strategic goals. However, none of the key players from regional or local level managed to bring together all interested parties in order to coordinate the implementation of activities.

The analysis of strategies and other documents bring the conclusion that even if documents are prepared properly, according to rigid methodology, they may not be transferred into real world action. Goals, objectives, rules and guidelines incorporated in documents from national and regional level are formulated in a general way. Thus it is pretty easy to prove that goals from the strategies and plans prepared at the municipality level are not in conflict with them. It is just a question of wording and interpretation.

## 1.5 Methods of analysing peri-urbanisation

*Used methods to study peri-urbanisation*

### FS 403 Methods of analysing sustainable development

By Dagmar Haase - Berlin

#### What is the issue?

This factsheet informs about the main quantitative methods to analyse sustainable development in urban regions. These are

- The cellular RUG-urbanisation-Model,
- The cellular automata model MOLAND for regional land use change modelling,
- Regression models to determine the impact of urbanisation on the social, economic and ecological environment,
- Ecosystem services models,
- A quality of life adaptive conjoint study (QoLSim) and
- An economic evaluation.

The following reasons make a quantitative analysis and assessment indispensable:

- To get a quantitative overview
- To enable a comparison between different regions and countries
- To enable a comparison between scenarios
- To make a multi-criteria assessment.

#### Results and Conclusion:

The results of the methods' application is given in a range of fact sheets related to RUG, MOLAND, the iIAT and QoLSim (see References and Further Reading).

## **Further reading:**

[Methods overview](#) (pdf) by Dagmar Haase

### **1.5.1 How is the DPSIR concept applied in PLUREL?**

#### **FS 469 DPSIR**

*By Katharina Fricke - Müncheberg*

#### **What is the issue?**

The PLUREL project focused on the effects of land uses change on peri-urban interlinkages. These land use dynamics may cause serious environmental and specific spatial development problems in the rural-urban areas. Different processes leading to these land use changes and their resulting impacts are of a certain interest to the public. Therefore the cognition and analysis of these processes in the rural-urban relationship are the first possible entry point into the PLUREL results. Recognising the causal chain relationships of land use change, e.g. what drives land use change in the rural-urban context and what are possible impacts of land use changes in relation to sustainable development supports the user in understanding and steering these processes. In general, all analyses are conducted through the lens of land use changes, which is seen here as the main pressure.

To agree on a coherent thread and structure the PLUREL XPLORER, the DPSIR framework (Smeets and Weterings, 1999) was employed. To mediate between different disciplinary viewpoints and agree on a common understanding of causal chain relationships between society and environment, this concept was developed by the European Environment Agency (EEA). It is an advancement of an earlier version developed by the OECD (OECD 2001) and is defined as ?The causal framework for describing the interactions between society and the environment adopted by the European Environment Agency: *Driving forces, Pressures, States, Impacts, Responses?* (EEA). This approach has since been adopted in various studies whenever interaction between human behaviour and environment was a matter of concern (Niemeijer and De Groot, 2006). It is particularly useful when scientific process knowledge has to be translated into knowledge for policy support. The specific strength of the DPSIR concept lies in its adaptability to many different objectives and scales of analysis.

#### **Methodology and Materials:**

Various discussions within the PLUREL project, especially with practitioners proofed that this concept is seen as useful, but nevertheless far away from the real-world terms of the practitioners as it is too abstract. Therefore the used analytical cascade is consistent with the DPSIR analytical chain, but uses a more user-friendly, real-world language. It transfers the abstract terminology of science into practitioners? more concrete wording, namely the analytical cascade of processes of peri-urbanisation, trends and drivers, changes, effects, sustainability and strategies and conclusions.

In the PLUREL context, the basic definition of *Drivers*, *Pressures* and *Impacts* is straightforward. In an introductory part, **processes of peri-urbanisation** are defined and explained. Land use **changes** are defined as the central pressure. They are affected by external economic, social, environmental and technological **trends and drivers**. The role of **effects** is taken by numerous social, economic and environmental parameters that are affected by land use changes. The analysis chain departs from the economic setting (Trends and Drivers) that is translated into a geophysical setting (land use changes) and further into an integrated system of the social, economic and environmental settings (effects). While the first part translates drivers into changes by quantitative modelling and stakeholder involvement for scenario visualisations, the second part of translating these changes into effects needs to also include normative components in order to embrace the value based character of the sustainability definition (WCED, 1987). This was obtained by expanding the **sustainability** component of the framework into two complementary impact steps by regarding Quality of Life indicators as well as Ecosystem Services. Subsequent, a multifunctionality approach is undertaken to aggregate indicators and their valuations into an integrated assessment of the room for manoeuvre within sustainability choices (Potschin and Haines-Young, 2008). This analytical design aims to integrate the top-down data and indicator based modelling with a bottom-up, value driven participatory approach. The component of **strategies and conclusions** is also taken up in the analytical design of PLUREL. In its logical setting, this component is covered by policy decisions in reaction to simulated impacts. Hence, best practice examples give an idea of possible development options.

## Results and Conclusion:

As a first step, principles and **processes of peri-urbanisation** are defined. The project terminology is clarified and the used methodologies are highlighted. This topic comprises general information on the PLUREL project as well as concepts and frameworks for the analysis of rural-urban relationships. All PLUREL case studies are introduced.

Then, **trends and drivers** of peri-urbanisation are displayed. Potential futures are shown as well on European as on case study scale. More precisely, this topic comprises on the European scale scenario regionalisation maps and descriptions at the European scale while it covers by sub-regional delineation map and driver dependent Rural-Urban Region (RUR) elasticities on the case study scale. The PLUREL scenarios as well as the underlying driving force assumptions are featured here.

**Changes** of land use are the focal lens of all PLUREL analyses. Therefore this topic consists of the land use change maps at European and at regional level for the different scenarios of peri-urbanisation. RUR typologies and their dynamics are also featured here.

The **effects** of these land use changes are displayed by RUR-type specific response functions, spatially explicit response functions for land use change modelling and the implementation of response functions at NutsX-scale. Relationships between Effects and Sustainability are covered by the application of regional variabilities of urbanisation-impact-relationships to land use maps. Indicators of ecosystem services and quality of life related to peri-urbanisation scenarios are available.

In the **sustainability** section, the impacts of land use change are valued. This sub-step is covered by external costs and benefits of selected environmental and social impacts of land use change, marginal external cost and benefit values from existing studies. The interactive Impact Analysis Tools (iIAT) for the European and the case study scale are described and interlinked here.

**Strategies and conclusions** are integrated in the national spatial planning policies and governance typology, and especially the compendium on national spatial planning policies in Europe.

### **Further reading:**

- European Environmental Agency (EEA): European environment outlook. EEA report no. 4/2005. Copenhagen, 2005.
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- Smeets E. & R. Weterings: Environmental indicators: typology and overview. Report nr. 25. European Environmental Agency (EEA). Copenhagen, Denmark, 1999.
- Svarstad, H.; Petersen, L.K.; Rothman, D., Siepel, H.; Wätzold, F. (2008): Discursive biases of the environmental research framework DPSIR. Land Use Policy 25 (2008): 116-125
- WCED - World Commission on Environment and Development: Our Common Future. New York: Oxford University Press, 1987.

### **1.5.2 How are stakeholders involved in PLUREL?**

#### **FS 470 Participatory Approaches**

By Katharina Helming, Katharina Fricke - Müncheberg

#### **What is the issue?**

One of PLUREL's objectives is to enhance learning, cooperation and communication between policy makers, stakeholders, planners and researchers. Potential strategies and good practice examples are identified in order to promote the sustainable development of land use systems in rural-urban regions, especially the peri-urban areas. Covering development of rural-urban-regions in policy making and planning demands for a deliberate process with participatory decision making. Ex-ante analysis of potential outcome of possible futures supports this process.

## **Methodology and Materials:**

PLUREL has developed a platform of cooperation with the project's stakeholders (the Board of Stakeholders) in which regional planners from the regional authorities of the case study areas are predominant. Also in the exchanges between case studies the regional planners are the main interlocutors of the researchers. They have an interest in land use developments in the peri-urban area. The actors are those stakeholders that are actively engaged in the decision making for the urban fringe by using the political space that the government structure and spatial planning system creates.

In general, the stakeholders ask for scenarios and models illustrating the spatial development in their regions as well as dynamic decision support systems, giving a clear picture of the impacts of specific policy measures. The interests of stakeholders also relate to enhancing understanding and better organising the processes in decision making in planning of peri-urban issues in rural-urban regions.

## **Results and Conclusion:**

Transdisciplinary research-practice cooperation was essential in the PLUREL project in order to develop knowledge and tools that are useful for practitioners. The main tasks were:

- To develop common concepts and language
- To co-develop foresight scenarios, jointly identify research needs and emerging issues of peri-urbanisation.
- To co-design the platforms for information and dissemination of PLUREL knowledge

For the case study level PLUREL combined detailed collaborative case studies and stakeholder scenarios for peri-urban development pressures, planning and governance systems ? with the development of quantitative land use scenarios, for the assessment of peri-urban land use relationships and sustainability impacts, both from regional policies and external driving forces.

At European level, PLUREL cooperated with two stakeholder groups, PURPLE and CURE: PURPLE (*Peri-Urban Regions Platform Europe*) is a network of regions that endeavours sustainable rural and agricultural development in peri-urban regions. A close linkage between PURPLE and PLUREL promotes both the dissemination of the knowledge on rural-urban interlinkages gained in the project and at the same time support the network's targets. CURE (*Convention for a Sustainable Urban and Rural Europe*) is an initiative commenced by partners representing different sides of the urban or rural issue. CURE partners share the commitment to focus on how cities and rural regions can work together to achieve sustainable future for both sides. The close thematic link to several of PLUREL research themes could profit from a closer interaction of both, the CURE network and the PLUREL project.

## **Further reading:**

PURPLE  
CURE

### **1.5.3 How to deal with complexity?**

#### **FS 29 Complexity concepts**

*By Wim Timmermans - The Hague*

#### **What is the issue?**

In this study we focus on the multifunctional peri-urban zone in which we expect non-linear development to take place. We discuss the possible consequences of this perspective for analysing the urban-rural relationship and planning interventions in the peri-urban development. It is suggested to consider fundamental changes in urban-rural relationships as transitions. Transitions provide us with an alternative perspective which could contribute to planning mechanisms that strengthen the supportive role of planning by influencing spatial development processes instead of controlling spatial development.

The classical contrast between the urban and the rural is diminishing and therefore giving rise to a third type of landscape, the peri-urban area. This area represents a changeable zone within the urban-rural continuum, where high dynamics can be found. As rural and urban interests are becoming more interwoven and complex so is the urban-rural relationship. In order to enhance our understanding of peri-urban processes we suggest incorporating a non-linear perspective on spatial developments.

#### **Methodology and Materials:**

Through a literary review and discussion sessions with experts a theoretical framework of the concept of transition is constructed. Subsequently, this concept is used to study the city regions in depth, using primarily qualitative methods, focusing on which developments influenced fundamental changes in the peri-urban area. Data is collected in various ways, for example by interviews with stakeholders and experts, using regional and local statistics, policy documents and scientific articles.

#### **Results and Conclusion:**

We define a transition as a gradual, continuous process of structural change within a society or culture. Transitions can be seen as the outcome of the constant dynamism of complex systems, such as the peri-urban area, due to non-linear, self-organising behaviour driven by co-evolutionary interactions. Within a transition process four phases could be distinguished:

- predevelopment
- take-off
- acceleration and

- stabilisation.

During these phases a dynamic equilibrium of stable and dynamic elements constantly shifts and enables a system to evolve. By looking into the various cases, we were able to distinguish different phases of dynamics which subsequently can be considered as transitional phases. In all cases the development of the peri-urban area was influenced by processes originating from the macro, meso as well as micro level. Besides, the various drivers for change are distinguished as so-called push or pull-factors. Periods dominated by push factors are often marked by decreasing coordination and supply-driven development, away from an "old level of stability".

Subsequently, by the creation or emergence of pull factors coordination is increasing and developments mostly are characterised by a demand driven economy. The "pushes and pulls" of the various cases enhanced our understanding of non-linear peri-urban development and might provide insights in European trends. Though the uniqueness of each system embedded in their own specific context creates diverging paths of development. All over, the various city regions could learn from their partners when taking into account the different local conditions, processes and time frames.

In general, the concept of transition could help us to observe and to understand the emergence of a reality within cities and regions. In response to this, we suggest planning to enhance static traditions, by encouraging co-adaptation and co-accommodation between the flows of case situation and contextual environment. Although non-linear peri-urban developments are evolving as a result of self-organising behaviour and autonomous drivers to a certain extent, spatial planners can play a vital role in guiding peri-urban change. Spatial planners as well as policy makers have to become aware of different push and pull factors, autonomous or induced processes, opportunities and conditions, in order to reduce unwanted path dependencies. By using a multilevel framework they could anticipate on macro developments and facilitate and initiate bottom-up experiments on the micro level. Since multiple transitions could occur in the future, anticipation and adaptation become the key-issues.

#### **Further reading:**

PLUREL deliverable report: [A historical analysis of cases, context and functional causes of transitions and the way these transitions were supported by planning and management](#)

#### **1.5.4 Method of valuation of peri-urban environment**

##### **FS 208 Valuation of Peri-Urban Environment**

*By Tim Taylor - Bath*

##### **What is the issue?**

Valuation of the peri-urban environment is one method of showing the impacts of particular policies in the planning context. Using methods from environmental economics, monetary values are placed on environmental goods where possible - giving policy makers further information about the social values placed on environmental quality in the peri-urban context.

Valuation is increasingly important as policy makers attempt to assess societal values in cost-benefit analysis and as part of multi-criteria analysis of given policy options.

### **Methodology and Materials:**

Various market and non-market methods exist in the literature. Market techniques are appropriate where there is an impact on a marketed good - though distortions may need to be taken into account. Non-market techniques include replacement cost, cost of illness and productivity loss methods. Revealed preference include travel cost and hedonic analysis. Stated preference methods include contingent valuation and choice experiments. "Benefit transfer" helps move values from one site to another.

In valuing the environment, it is essential to understand well the good in question being valued. Primary valuation studies are often costly, but depending on the nature of the problem, may be necessary if major expenditure is being planned. Looking at past studies is important, and here databases such as [EVRI](#) can be useful.

There are a number of uncertainties involved in valuing the environment. The methods used capture different aspects of value - so double counting is a major risk that should be avoided. Of particular concern is the uncertainty in transferring results from a study case to another location using the benefit transfer method. These uncertainties often lead to ranges in values being presented rather than one single value.

### **Results and Conclusion:**

Valuation methods are used in cost-benefit analysis to answer questions such as:

*"What is the value of green open space?"*

*"What are the relative benefits of keeping vineyards compared with converting them to golf courses?"*

*"What are the impacts of different land policies on recreation?"*

Valuation is important in the appropriate setting of planning policy in the peri-urban context. A number of methods exist in economics to assist with measuring the benefits of projects in monetary terms. Not everything can have a money value placed on it, however, so outputs of this should be used alongside other measures of benefits and costs.

### **1.5.5 Method of hedonic pricing**

#### **FS 209 Hedonic Pricing**

*By Tim Taylor - Bath*

#### **What is the issue?**

The hedonic pricing method involves measuring welfare effects of changes in environmental goods and services on the value of marketed goods. It has been used extensively in e.g. estimating environmental change on housing prices and for estimating premia applied to risks in the workplace.

Hedonic pricing is favoured by some, as it examines real markets - as opposed to e.g. contingent valuation where hypothetical markets are constructed.

### **Methodology and Materials:**

To isolate the impact that changes in peri-urban environmental attributes have on house prices, it is essential to define a statistical function that relates house prices to the factors that go into determining the price. This would include characteristics of the house (e.g. number of bedrooms), characteristics of the neighbourhood (e.g. crime rate) and environmental characteristics (e.g. distance to green space).

To estimate the hedonic function a lot of data is needed. This includes data on prices of houses (both sold and unsold, ideally), data on the nature of the house, neighbourhood data and environmental data.

A number of uncertainties exist in the application of the method. The first has to do with information - do the buyers have full information in purchasing the house? This is questionable, though increasing use of the internet may increase the level of awareness of environmental attributes such as green space. Difficulties can arise if market segmentation is not considered in the analysis. Mispecification of the functional form and price intervention may also limit the application of this method.

### **Results and Conclusion:**

There is a vast collection of evidence on the application of the hedonic pricing method to issues in peri-urban environments. From this, a range of values can be extracted for application in contexts relevant to the peri-urban context. These include values for open space, for green belt, for facilities such as schools.

Hedonic pricing is one of a number of approaches that can be used to place a monetary value on the peri-urban environment. It is quite data intensive, but increasingly it is being coupled with GIS methods to estimate values that may be of use to policy makers in the peri-urban context.

### **1.5.6 *Method of contingent valuation***

#### **FS 210 Contingent Valuation**

*By Tim Taylor - Bath*

#### **What is the issue?**

The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystem and environmental services.

This method is aimed to directly ask individuals how much they are prepared to pay for specified effects that a land use policy may have. The willingness to pay (WTP) for the proposed effect is the amount of money that can be subtracted from a person's income at the higher level of environmental

quality for him to keep his utility unchanged, and is the theoretically correct measure of the value individuals place on the change.

The contingent valuation is a stated preference method. Those methods must be preferred to revealed preferences methods where there is no marketplace or when the goods are not yet in the market. The contingent valuation method was selected in this case because of the importance of non-use values, and their potentially significant levels. It can be used to estimate both use and non use values.

### **Methodology and Materials:**

Questionnaires can be developed on a case by case base. These are subject to pretesting and focus groups. A key issue is the "payment vehicle" - generally a tax measure, but it can also be a voluntary contribution to a fund (though the latter is generally felt to be weaker by economists). The results are subject of statistical analysis to check they are consistent and to obtain the willingness to pay.

Such studies are costly and much time is needed to design them appropriately. Inputs will include descriptions of the goods, understanding of the demography and comments from focus groups.

The outputs will include an understanding of the value of the good in question - in terms of average willingness to pay - and how this varies with sociodemographics (e.g. the impact of rising income on environmental preferences),

There are a number of uncertainties in the application of this method. These include the specification of the good - misspecification is a major problem for interpretation of the results. How to deal with protest bids also can lead to uncertainty. Using appropriate guidelines can help reduce the uncertainty - e.g. the use of focus groups is essential.

### **Results and Conclusion:**

Contingent valuation studies give evidence as to the willingness to pay for the environmental good in question. Past studies in the peri-urban context have included the valuation of the protection of forests, the value of urban parks and valuation of health impacts (which may be associated with road developments).

CVM is a popular, though costly, method to obtain values for the environment. In the peri-urban context it has previously been applied to obtain values for policy makers in terms of transport, forestry and open spaces.

#### **1.5.7 *Method of travel cost method***

##### **FS 211 Travel Cost Method**

*By Tim Taylor - Bath*

## **What is the issue?**

The travel cost method uses observed behaviour to see to which degree people value environmental assets. In the peri-urban context it has previously been used to assess values of forests and recreational areas.

The travel cost method is a useful method as it is based on real data. Often, data is easily available from prior surveys or visitor books. As it is an established economic method, policy makers can easily relate to it.

## **Methodology and Materials:**

The method uses observed trip data and data on the related costs to estimate the response of demand to travel cost increases. The "choke price" can be identified - which is the price at which no one comes to the site. This may be at a large distance from the site. The method either looks at individuals or at zonal travel data.

There are a number of uncertainties in the use of this method, and care is needed in the study design. Notably, the existence of alternative sites needs to be considered, along with multi-purpose trips. The statistical methods used can also affect the results.

## **Results and Conclusion:**

No primary study was conducted as part of this research. However, the results of travel cost studies are useful in aiding policy makers assess how much people value access to forests and other amenities.

This method offers much potential to those in peri-urban contexts. Placing the value on a site of interest can be essential in deriving the appropriate policy - e.g. in terms of a multifunctional peri-urban landscape with recreation, the recreational aspect can be valued using this method.

### **1.5.8 *Method of choice experiments***

#### **FS 213 Choice experiments**

*By Tim Taylor - Bath*

## **What is the issue?**

The Discrete Choice Experiments is a questionnaire-based technique which asks respondents to choose their preferred alternative among two or more scenarios. It is assumed that individuals prefer the alternative which offers the highest level of utility.

It has been extensively used for assessing the Willingness To Pay (WTP) of the general public for goods, services and public programs that are difficult to price as they are not traded in any market. This technique can also provide information on the trade offs that the general public is willing to make on different characteristics of a proposed public program.

The method unveils respondents' preferences and WTP for the characteristics of a public program that the policy maker is interested in. It may be used to answer questions such as:

- How much is the public willing to pay for the provision of improved public transport?
- Is the public willing to pay more for improving public transport for protecting green open spaces?

### **Methodology and Materials:**

We used the Discrete Choice Experiments method in three case studies, Warsaw, Leipzig-Halle and The Hague, to compare respondents' WTP for specified effects of land use policies across the three areas. The output from the analysis of the Discrete Choice Experiments data has been used for the Cost Benefit Analysis.

### **Results and Conclusion:**

Results from the analysis of the data from the Discrete Choice Experiments questionnaire are presented in the case study fact sheets for Leipzig, Warsaw and The Hague (see further reading). After preliminary research and discussion with stakeholders about the most important effects of land use policies, we focused on three selected effects that appeared to be most relevant in the three case studies:

- improvement in air pollution from transport
- protection of cultural heritage monuments
- development of new housing

These three effects, in addition to a cost to the respondent, expressed as a one-off tax to implement the effects of the hypothetical policies, describe the characteristics of the land use policies.

Characteristics of the policies and the different levels that these characteristics may take on are reported in a [table](#).

We used two levels each for the improvements in air pollution and for the protection of cultural heritage buildings to account for policies that would improve the current situation. For housing, in addition to the current situation where buildings and green open areas are kept as they are now, we used two other levels to consider the development of housing in green open spaces or through the refurbishment of abandoned and idled building.

As typical of Discrete Choice Experiments studies, different respondents received different Discrete Choice Experiments questions that differed for the levels of the characteristics of the policies. To do so we used an experimental design created with the software Ngene (ChoiceMetrics, 2009) producing for each country 18 different choice sets, split into three blocks composed by six choice-sets each. To avoid ordering bias, within each block we randomized the order of the Discrete Choice Experiments questions.

The questionnaire used in the three case studies can be adapted to other case studies to assess the general public's preferences for specified effects of land use policies.

In summary, the application of the Discrete Choice Experiments method to assess the WTP of the general public for specified characteristics of land use policies may provide useful information to

the policy makers interested in allocating a limited budget to implement a land use policy. We used the Discrete Choice Experiments method to investigate how the WTP of the general public for specified characteristics of land use policies differ across case studies, as the WTP is affected by both populations' characteristics and features of the areas being studied.

For further information please contact [mboeri01@qub.ac.uk](mailto:mboeri01@qub.ac.uk)

#### **Further reading:**

### **1.5.9 Method of cost benefit analysis (CBA) in peri-urban context**

#### **FS 220 CBA in Peri-Urban Context**

*By Tim Taylor - Bath*

#### **What is the issue?**

Cost benefit analysis (CBA) is one tool that can be used to aid policy makers in making decisions. It places monetary values on different aspects of costs and benefits and gives a common metric for the evaluation of appropriate policy.

CBA is important as it provides a mechanism to compare environmental and non-environmental effects in a common metric. It is required for large capital investments in a number of countries - and can provide important insights into those impacts that are most important.

#### **Methodology and Materials:**

CBA is based around economic methods to value the environment. In the peri-urban context, costs and benefits of interventions can be identified in changing land use from one type to another. Placing values on these where possible, these are then forecast into the future using socioeconomic scenarios where possible. Discounting is then applied to take into account time preference. Consideration of irreversible effects of policy can be made. Sensitivity analysis can test the key assumptions.

CBA is based around a number of assumptions, hence there are a number of uncertainties. Some of these are considered in sensitivity analysis - and care needs to be taken to present those impacts that cannot be put into money terms clearly. In the peri-urban context, for example, it is often difficult to place values on biodiversity (though some have done so).

#### **Results and Conclusion:**

The results are presented in terms of the *net present value* of the project or policy. A benefit/cost ratio can be calculated - if this is above 1 then the project's benefits outweigh the costs.

This method has been applied in a number of case studies around Europe.

CBA is one of a number of tools that can be used to assess peri-urban planning policy. It has been used in a number of contexts at a local level - and draws on environmental valuation methods to assess impacts in monetary terms - so that costs and benefits can be truly weighed. Innovative methods of CBA now include explicit consideration of the irreversibility of impacts - so that points of no return can be explicitly considered.

### **1.5.10 *Method of cost benefit analysis (CBA) at pan EU level***

#### **FS 229 Cost benefit analysis at pan EU level**

*By Tim Taylor - Bath*

#### **What is the issue?**

In principle, policy making at pan-EU level on peri-urban environments needs to be informed by an appropriate understanding of the relative costs and benefits of the policy. A methodology has been developed to help in doing this - based on cost-benefit analysis. The traditional approach has been extended to take into account irreversibility.

The method is important as it provides the basis for the appropriate evaluation of pan-EU policy on peri-urban areas. In the future, it may be that peri-urban policy is discussed at pan-EU level, as the importance of such areas becomes more apparent to policy makers.

#### **Methodology and Materials:**

The method first requires a quantification of the implications of policy on land use at the pan-EU level. This can be used as the basis for evaluating the likely environmental and economic implications of the policy. A traditional comparison of the costs and benefits of various policies can be constructed, by applying monetary values where possible to the impacts expected. Then costs and benefits need to be classified as irreversible or reversible and the analysis extended to factor this in.

#### **Results and Conclusion:**

This method has not as yet been applied to the pan-EU level, owing to a lack of pan-EU policy at this level. It remains useful, however, in providing the framework for future analysis of policies at this scale. This method can be used to evaluate the impacts of pan EU policy in peri-urban areas. It has not yet been applied this scale as the subsidiarity principle applies to policy at this level.

### **1.5.11 Method of System dynamics model**

#### **FS 28 A system dynamics model for peri-urbanisation**

By Dagmar Haase - Berlin

#### **What is the issue?**

This system dynamics model for peri-urbanisation demonstrates dynamics and feedbacks between demography, housing preferences and supply of residential land use.

The model approach aims at being a helpful tool for understanding complex housing demand-supply processes based on household location preferences, choices and feedbacks of this decision-making.

Demographic change, suburban growth and inner-city shrinkage are challenges for urban planners and policy-makers in post-industrial, modern societies. Simulation models can help to understand complex dynamics and to derive scenarios for the future. The shrinkage of urban regions is a trend in numerous parts of Europe but is not included very well in urban simulation models so far.

#### **Methodology and Materials:**

The system dynamics model presented uses population and household dynamics to compute a household-preference driven demand for eight types of urban structural residential areas. The respective supply in turn influences this demand. Housing stock is based on the demand-supply ratio, residential vacancy and demolition.

There are a range of uncertainties in the model which are typical for every model. Most uncertainties are related to

- input data
- model functions
- representativeness of the calibration cases.

#### **Results and Conclusion:**

The results of the population development simulations show that current shrinking cities and urban regions can expect very different futures: further decline is only one of them. In accordance with recent findings on re-urbanisation trends in urban regions formerly faced with population decline both baseline and growth scenarios indicate that urban regions might grow again following a phase of decline.

We observe an increase of single households, young and elderly. This leads to an increase in the total housing demand. In contrast, the shrinkage scenario does not show an increase in the number of single households or housing demand in the long-term.

The simulations show that residential vacancies will remain regardless of population growth. At the

same time, our model shows that regardless population shrinkage and oversupply of flats, there is a negative net-demand on living space in affordable prefabricated housing estates as the percentage of low-income households will increase. These findings help planners to modify or adapt their views on desired or undesired urban futures.

### Further reading:

PLUREL deliverable report: [Conceptual and quantitative system dynamics integrated framework to analyse rural-urban land use relationships including growth and shrinkage in a generic way](#)

## 1.5.12 *Typology of rural urban relationships (RUR)*

### FS 37 RUR-typologies

By Klaus Steinnocher, Wolfgang Loibl - Vienna

#### What is the issue?

Rural-Urban Areas (RURs) build functional urban regions with core city areas, peri-urban commuter belts and the rural hinterland. RUR typology shall support the exploration of pressure patterns as response to land-use and interactions, related to urban and peri-urban development. The EU Commission announces NUTS 3 regions as appropriate to examine regional trends and EU policy effects. As PLUREL concentrates on the impacts of peri-urban development and related planning policies, the assessment shall refer to these NUTS 3 regions, requiring a typology which also refers to these regions.

Different RUR-types may show typical regional development trends and pressure patterns and dynamics, requiring different policy strategies to cope with these patterns.

Quantifying different driver-pressure relations demands a flexible typology, applying the appropriate features to the respective driver-pressure issue. On the other hand the typology has to be scarce enough to remain manageable. A compact set of few RUR types supports impact assessment for assessing driver-pressure relations and planning policy advice.

#### Methodology and Materials:

The task is divided into

- the definition of urban region types appropriate for the investigation of regional development,
- clustering of NUTS 3 regions to RURs (in case of large or several urban centres) - based on GIS analysis and
- the assignment of RUR types to the RURs based on geospatial indicators and statistical data.

Delineating RURs by NUTS3 polygon borders does not allow an exact discrimination of the core cities influence sphere.

The available data set for the spatial delineation and classification is limited and concentrates on structural data, while the classification should also consider functional issues. Publicly available data are CORINE land cover 2000 (100x100m cells) and EUROSTAT population data for NUTS 3 and Lau 2. Additionally population data for urban center points have been applied for 5000 settlements. EEA population density maps have been made available for detailed analysis.

A typology is often a subjective decision depending on selected indicators following a certain purpose and depending on certain constraints in terms of available data.

In our case only population data are available for NUTS3 regions, and during the project period, in which the typology was conducted only a derived population density map was available for sub-NUTS3 levels making use of CORINE land cover to allocate densities.

Interaction data could unfortunately not be made available for entire EU27.

## **Results and Conclusion:**

3 sets of typologies have been developed, to be applied as appropriate RUR type set for further analysis:

1. morphology: number and distribution of core city(ies) and sub-centres
2. spatial dynamics - core city versus peri-urban area development
3. city shapes - compactness versus fractality

### **1. RUR morphology typology**

For peri-urban development analysis, mono- and poly-centricity must be examined separately, as they trigger different pressures. Mono-centricity conveys urban core growth and in centre-less peri-urban surroundings scattered settlement growth known as urban sprawl. Poly-centricity, controlled by planning policy, relieves pressures from open space by concentrating activities in urban sub-centers. Following types are established:

Morphology type	description
1. mono-centric	regions with core city w/out notable peri-urban sub-centers, 3 sub-types by core size: very large, large, medium
2. urban poly-centric	regions with core city(-ies) and peri-urban sub-centres
3. dispersed poly-centric	regions with several (medium-sized) peri-urban centres
4. rural	rural regions without notable centres but dispersed smaller settlements

The classification is based on ranking of cities by population per NUTS 3 region. Cities with more

than 100.000 inhabitants are defined as core cities, other urban areas with 10.000 and more inhabitants are defined as urban centers. RURs with core cities or urban centers are classified as urban. RURs with more than one core city or additional sub-centers are classified as polycentric. Mono-centric RURs with overlapping core city buffers are clustered to poly-centric RURs. RURs without centers are classified as rural.

## 2. RUR dynamics typology

The urban region life-cycle builds waves of urbanisation, sub-urbanisation and counter-urbanisation, resulting in different regional development: core city growth as effect of urbanisation, poly-centric growth as effect of controlled sub-center development, urban sprawl as effect of uncontrolled peri-urban development, etc. RUR sub-regions show either identical or oppositional dynamics in core cities and surroundings:

Dynamics type	Core city	Peri-urban and rural areas
GG	Growth	Growth
DG	Decline	Growth
GD	Growth	Decline
DD	Decline	Decline

The classification focuses on recent short term dynamics of urban centres and peri-urban surroundings. Dynamics have not been explored by land-use data, because 1990 and 2000 CORINE land cover data do not exist for all countries and the results turn out as insufficient: a minimum mapping threshold excludes areas <25ha and a change threshold excludes land use changes < 5ha, inhibiting accurate land use change detection. Therefore population data for different years serve as land-use activity proxy for dynamics monitoring.

The typology sets can be applied separately as necessary for the certain issues.

Concluding, different national dynamics and demographic settings and wealth conditions lead to different population structures, economic development and transportation modes resulting in different urban and peri-urban development. The RUR types show following distribution:

- Morphology: Polycentric RURs are concentrated in England , in North-Central Europe, Slovakia, Western Hungary, and Northern Italy. The most rural RURs are located in the EU27 periphery (North, South, East) in the Alpine Region and scattered over France and Germany (due to small NUTS regions).
- Dynamics: A general (population) decline is concentrated in Eastern Europe, in peripheral, rural RURs in the Mediterranean area, in Scandinavia and the Baltic region. In Eastern Germany and the Ruhr-valley a decline is observed, also in northern France and in the Alpine area. RURs in Poland frequently demonstrate positive trends.

Core cities mostly show similar trends as the non-urban surroundings, but with certain exceptions.

## **Further reading:**

PLUREL deliverable report: [Review of existing rural-urban region typologies](#)

PLUREL deliverable report: [Quantitative classification of the major European rural-urban regions](#)

### **1.5.13 Concept of response functions**

#### **FS 39 Response functions (principles)**

*By Annette Piorr - Müncheberg*

#### **What is the issue?**

Urbanisation leads to significant changes in the social, economic and environmental setting of EU regions. A response function (RF) is a quantitative representation of a functional relationship between ?drivers? connected to urbanisation and ?sustainability indicators?. Drivers are specific land uses, distance to city centre, GDP or population density whereas the sustainability indicators describe landscape bound recreation, biodiversity, commuting and traffic, population, employment, housing, household structure and emissions. The RF is developed either generically or case-based for the pan-European situation or clusters of regions. The aim is to derive regression models with the best possible explanatory value for impact analysis of developments at NUTSX level or specific for Rural Urban Regions (RUR). The European Urbanisation Impact Model (EUI-Model) comprises all quantitative Response Functions at NUTS X for EU27. Possible forms of outputs are maps or graphs, which are fed into the iIAT.

RF are the backbone for the analysis of regional effects of urbanisation in the EU. They are mathematical expressions by which a quantification of the potential impacts of urbanisation trends on single indicators for the social, economic and environmental functions of a region is possible. When future driver values from the (RUG model) are fed into the RF, the impact of certain urbanisation trends can be evaluated. Therefore RF are an important means for policy support.

#### **Methodology and Materials:**

Most PLUREL RFs have been built on European databases with EU27 coverage at NUTSX, e.g. EUROSTAT data. The RFs on household structure and on emissions are mainly related to demographic projections resulting in changed population densities or GDP changes. RF for landscape structure, biodiversity, work and recreation refer to changes of artificial surface area, based on Corine Land Cover (CLC). RF for commuting and housing have been derived on more detailed datasets from different RUR types and by using more specific models that consider data which do not underlie continuous monitoring at European scale.

The PLUREL response functions (RF) are generic regression functions with dependent and independent variables being represented by quantitative indicators at NUTS3/NUTS2 level. Independent input variables are land cover related and socio-economic indicators, like urban area, GDP and population. Output variables are indicators which describe the social, economic and

environmental setting of a region, e.g. number of people older than 60, unemployment rate, commuting rate or age-dependent housing choice.

## Results and Conclusion:

There are three types of underlying equations. The functions do not necessarily need to be linear, they can also be logarithmic or else.

### Type 1: General regression function

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times In3_{2025} + ? + k$$

With:  $y$  = Output variable, example single person households

$In1$  = Input variable 1 value at a certain time slice, e.g. population

$In2$  = Input variable 2 value at a certain time slice, e.g. artificial surface

$In3$  = Input variable 3 value at a certain time slice, e.g. GDP

$a, b, c$  = Regression coefficient different for each input variable

$k$  = Constant

### Type 2: A function for each RUR type

$$\text{RUR type 1: } y_{\text{type1}} = a_{\text{type1}} \times In1_{2025} + b_{\text{type1}} \times In2_{2025} + c_{\text{type1}} \times In3_{2025} + ? + k_{\text{type1}}$$

$$\text{RUR type 2: } y_{\text{type2}} = a_{\text{type2}} \times In1_{2025} + b_{\text{type2}} \times In2_{2025} + c_{\text{type2}} \times In3_{2025} + ? + k_{\text{type2}}$$

RUR type 3: ?

With:  $y$  = Output variable for specific RUR type, example commuting

$In1$  = Input variable 1 value at a certain time slice, e.g. population

$In2$  = Input variable 2 value at a certain time slice, e.g. employment

$In3$  = Input variable 3 value at a certain time slice, e.g. distance to centre

$a$  = Regression coefficient for  $In1$ , different for each RUR type

$b$  = Regression coefficient for  $In2$ , different for each RUR type

$c$  = Regression coefficient for  $In3$ , different for each RUR type

$k$  = Constant, different for each RUR type

### Type 3: Integration of static variables

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times SV1 + d \times SV2 + e \times SV3 + ? + k$$

With: like Type1,

$SV1$  = Static variable 1, e.g. typical fuel consumption per country

$SV2$  = Static variable 2, e.g. coastal area

Etc.

## Further reading:

PLUREL deliverable reports:

- [Modelling Approach for Response Functions on Agricultural Production, Ecological Regulation and Recreation Function](#)
- [Delineation of Response Functions](#)

Figures for the different RF types:

- [Figure 1:](#) Example for Type 1 RF: Relation between employment rate and artificial surface

(representing the share of urban area). Calculated by PAS, Warsaw.

- [Figure 2](#): Example for Type 2 RF for each RUR Type: Probability of commuting in relation to distance to the urban centre. Provided by SYKE, Helsinki.
- [Figure 3](#): Example for Type 3 RF: The graph shows the Type 1 RF between artificial surface and the amount of unfragmented landscape (size of the area not dissected by streets or settlements). The box below shows the RF enhanced by static variables like the location in the Mediterranean or the amount of rural area, which cannot be displayed in a graph. This RF was provided by ZALF, Müncheberg.

### **1.5.14 How can we simulate the quality of life at pan EU level?**

#### **FS 311 Quality of Life on pan European level**

*By Simon Bell - Edinburgh*

##### **What is the issue?**

Here, the effect of land use change on quality of life at the European level is examined. Land use change can affect quality of life in several different ways, and on different people in different ways. The factors used here are associated with land use change and do not cover social or economic issues directly. The indicators chosen were derived from a review of indicator sets and are:

- quality of residence,
- air quality,
- noise pollution,
- access to shops,
- access to green space,
- commuting time and
- safety and security of the area.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments, a number of factors may affect how satisfied people are with their living environment. As land use changes, these factors may also change for the better or worse.

## **Methodology and Materials:**

The method used empirical data collected through a technique known as adaptive conjoint. 250 samples of people from different age groups living in each of 8 rural-urban regions across Europe were collected and analysed. The results are fed into a simulator, known as Quality of Life Simulator or QoLSim , which enables planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by people according to different classifications.

The input variables collected in the study were a number of demographic factors for the people questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The output variables are relative levels of importance of quality of life indicators and the potential change in quality of life when different scenarios of land use change are presented.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

## **Results and Conclusion:**

Quality of life in rural urban regions can be subject to improvement or deterioration as a result of many factors. The results show that of all the quality of life factors studied, safety and security are the most important while accessibility to green space is least important.

With the QoLSim, it is possible to test how different people react to possible changes in these by predicting when they are likely to consider that the environment has become too unsatisfactory for them to live there any more, or where another environment has become more attractive. These choices depend on the type of person or their life stage and they change over time. By developing a tool for modelling behaviour it is possible to predict what changes to land use may affect people for the better or worse. This can provide valuable information for planners and policy makers.

## **Further reading:**

Affonso Zuin, Simon Bell (2010): QoLSim ? a Conjoint Analysis-based simulator for residential location choice likelihood, in: Kabisch, Sigrun; Kunath, Anna; Feldmann, Hildegard (editors): Vulnerability, risk and complexity: impacts of global change on human habitats. IAPS 21 Conference. [IAPS 21 Conference.](#)

### **1.5.15 Which indicators are used and why?**

#### **FS 312 Indicator framework**

*By Franziska Kroll, Felix Müller - Kiel*

## **What is the issue?**

The PLUREL indicator framework for evaluating impacts of land use changes on environmental, social, and economic indicators at case study level is presented here. The selection process of indicators is documented and discussed in detail in the attached report.

Complex processes and relationships, such as the various effects of land use changes, can be represented by a systematic indicator framework. This framework simplifies the reality to its most important and measurable components. It aims at bringing to light the most important impacts of land use changes on each sustainability aspect.

## **Methodology and Materials:**

Indicator selection procedure:

- Development of an a priori theoretical model
- Derivation of a preliminary indicator list based on the theoretical model and discussions in workshops
- Analysis of indicator relations in an integrated indicator matrix
- Selection of key indicators based on matrix results and stakeholder feedback
- Data collection for key indicators
- Quantification of key indicators and illustration as maps and rural-urban gradients

The indicators are chosen in order to reflect rural urban problems related to land use changes as comprehensively as possible. However, these problems and the available data vary from case study to case study and the choice of indicators is not objective, but intersubjective, although founded on a theoretical model.

## **Results and Conclusion:**

Here, the key indicators are listed.

### **Ecological indicators:**

### **Social indicators:**

- Population density
- Settlement population density
- Household size
- Housing area per person
- Mean age
- Quality of life, regarding:
  - Air quality

- Access to public green space
- Availability and access to public transport
- Availability of shopping facilities
- Noise pollution
- Area safety and security
- House or flat suitability
- Waste collection

#### **Economic indicators:**

- Unemployment rate
- Commuting distance
- GDP
- External costs green space
- Costs carbon stock
- Costs of air pollution

To assess the consequences of land use changes it is necessary to use a set of key variables which can be quantified. The application of such indicators in sustainability evaluation has to consider environmental, social and economic variables. To guide the selection of indicators, a conceptual theoretical indicator framework was developed. It is based on the DPSIR model (Driver - Pressure - State - Impact - Response) and incorporates the concepts of ecosystem services, ecosystem integrity and quality of life as impact components.

This comprehensive indicator framework can now be applied in various European rural-urban regions. The illustrations of indicator results as rural-urban gradients provide a clear overview of rural-urban relations and can be used to depict the potential of exchange processes between cities and their hinterlands.

#### **Further reading:**

PLUREL deliverable report: [Indicator framework for evaluating impacts of land use changes on environmental, economic and social indicators](#) (Report including lists of key indicators, description of the selection process, and fact sheets on each indicator on quantification and significance for Rural-Urban Regions)

### **1.5.16 How can we simulate processes of peri-urbanisation with the RUG model?**

#### **FS 32 Simulation of land use change and peri-urbanisation**

*By Sophie Rickebusch - Edinburgh*

#### **What is the issue?**

Future land-use patterns in peri-urban areas depend largely on changes in the density and location of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport

network?

Understanding the effects of planning policy, amongst other factors, on land-use patterns is key to making the decisions which will help create a more sustainable future for peri-urban regions.

### **Methodology and Materials:**

The RUG model runs on a 1 x 1 km grid. It evaluates each grid cell's potential for settlement according to its characteristics. It then allocates the regional (NUTS 2) projections of artificial surfaces across the grid using a set of equations linking location preference and planning constraints to cell characteristics. The equation parameters vary to reflect differences between four scenarios:

The main RUG inputs are projections of the quantity of artificial surfaces per NUTS 2 region for 2015 and 2025, obtained by linear regression from projections of population () and GDP (Gross Domestic Product) per capita () .

Location preference depends on travel times (which vary according to the scenario) to the nearest medium and large cities, commuting distance, relative importance of natural vs. social environment and distance from the coast. Planning constraints include planning strategy (compact vs. *laissez-faire*) and the presence of flood risk zones.

### **Results and Conclusion:**

In all scenarios and for most countries, there is a greater increase in artificial surfaces in urban/peri-urban areas than in rural areas. The differences between scenarios in that respect are not significant. This is a continuation of current trends, where more people migrate into cities and surrounding areas than out.

Within the urban/peri-urban area on the other hand, there are significant differences between the scenarios. At one end of the scale, the *hyper-tech* scenario shows mostly growth in peri-urban areas. This is also the scenario in which the difference between urban/peri-urban and rural is the smallest, i.e. there is a fair amount of growth in rural areas too. At the other extreme is the *peak oil* scenario, where most of the growth is concentrated in the urban core of the cities.

The scenarios also differ in their maximum local growth intensity: *hyper-tech* has the largest values and *fragmentation* the lowest. In all scenarios, there are areas, particularly in the centre of cities, where the projected proportion of artificial surfaces goes above 1 (100%). This has to be interpreted as a densification of the built-up surfaces, with growth occurring also in the third dimension: more multi-storey buildings, above- and below-ground.

The results from the RUG model show that although all four scenarios involve growth in built-up surfaces, the location of this growth varies considerably. It follows that the pressure on the environment from this increase in artificial surfaces depends to a large extent on the scenario and the planning policy contained in each storyline. For instance, although the *fragmentation* scenario has the lowest densification values, the *peak oil* scenario probably has a lesser impact because growth is concentrated in areas which are already highly urbanised.

Although all the scenarios have positive and negative aspects, some have more desirable outcomes than others. By taking this into account, planners may choose policies which favour sustainable growth while mitigating some of the less desirable side effects.

### **Further reading:**

RUG model outputs:

- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A1 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A2 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B1 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B2 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)

RUG model outputs including technological change (transport time costs):

- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A1 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A2 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B1 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B2 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)

### **1.5.17 MOLAND**

*MOLAND simulation model*

#### **FS 429 Simulation of land use change with MOLAND**

*By Francisco Escobar - Ispra*

#### **What is the issue?**

Moland is a model that simulates land use change. Please look at tab "Materials and Methods" and "References and further reading".

## **Methodology and Materials:**

On the core of Moland is a cellular automata model, where “complexity emerges from interactions of very simple rules applied at local level in simple individuals i.e. cells. Hence the state of each cell in an array depends on the previous states of the cells within a neighbourhood, according to a set of transition rules”. Moland requires a good knowledge of the principles driving the model in order to achieve a reasonable calibration as well as to drive scenarios realistically.

### **Input data:**

Land use maps for two dates, transport network, digital elevation model, land use zoning, demographic data, socio-economic data, other maps

### **Output data:**

Simulated land use maps according to selected scenarios of development

## **Results and Conclusion:**

The methodological approach was divided into the following steps:

1. Definition of scenarios by local stakeholders, based on IPCC-SRES scenarios (Those are scenarios from the Intergovernmental Panel on Climate Change)
2. Compilation of input data: land use (1990 and 2000), transport network (roads), zoning and suitability maps, statistical data (GDP and population);
3. Calibration of the model (using the period between 1990 and 2000);
4. Running of model, under different scenarios;
5. Production of outputs (land use maps and statistics);
6. Analyses of the output results.

MOLAND has been applied to four areas in PLUREL

### **Further reading:**

[MOLAND Model](#) (pdf) by C. Lavalle

## **1.5.18 ABMLand**

*What is ABMLand?*

### **FS 61 ABMLand**

*By Mark Rounsevell - Edinburgh*

## **What is the issue?**

A growing interest in non-rational behaviour in human decision-making reflects a paradigm shift away from other forms of land use models in favour of Agent Based Models (ABM). ABM offers new analytical methods for developing land use change scenarios by combining the intuitive appeal of social verbal theories with the rigour of mathematical models to understand social dynamics and decision making. Residents, planners and developers seek to achieve their goals, but they also interact with one another at the local level. Individual behaviour and local interactions can lead to aggregate patterns of land use of surprising complexity and ABM can help to understand how these processes unfold. ABMLand is such a land use simulation model.

ABM represents the next generation of land use change models. The novelty of ABM lies in its ability to capture the heterogeneity of agents, the dynamics of their interactions and their behaviour in response to the geography of physical space. Thus, ABM is useful in exploring scenarios of land use, where decisions of land users are influenced not only by changes in economic and physical environments, but also by their social and cultural values.

## **Methodology and Materials:**

ABMLand is a simulation model developed using the REPAST software. The model describes a range of key decision agents in terms of their behavioural rules and their interactions with other agents. A generic model has been developed for testing purposes with hypothetical agents, and a calibrated version of the model implemented for the Koper case study. Simulations allow the evolution of peri-urban land use to be visualised with maps and the progression of agent satisfaction to be monitored.

Spatial inputs include: Population profile per unit area (census), current land use and land cover, road and rail networks, public transport, water courses, soil quality, DTM (slope and aspect), future land use (planner defined).

Non-spatial inputs include: resident location preferences (from conjoint survey), development plans decisions, noise and air pollution, criminal offences per police unit, rate of residential, commercial, industrial growth, and development densities.

Calibration of the individual agent rule base depends on the availability of information about agent behaviour. Such behavioural information can be derived from the literature, from social survey or from planning guidelines, but the quality of the model is strongly dependent on uncertainties within this information and how rules are interpreted from these data. The model would also benefit from having behavioural rule that are updated as agents learn in response to changing circumstances.

## **Results and Conclusion:**

Spatial outputs include: land use/land cover, including landscape metrics (e.g. mean-patch size, edge-to-area ratio, number of patches, largest patch size, etc...), location of features of interest, population per grid cell, urban sprawl metrics, utility of resident population - partial utilities (i.e. to evaluate specific components of utility affected by different scenarios), noise map (dB). Non-spatial outputs include: population and demographics for the region, remaining high-quality farmland, proportion of different land use types, survey analysis and agent types.

Resident households evaluate their expected quality of life obtained at a future location based on

their preferences for the availability of social, economic, and ecological services available at a given location. Because defining the quality of life for any one individual or household is subjective we develop quality of life evaluation using utility theory and a series of normalised utility functions. Because the neighbourhoods social, economic, and ecological characteristics change over time, residents iteratively evaluate their utility.

When a resident's utility drops below a specified threshold it may choose to reside in other locations. Because there is a transaction cost associated with relocation this cost is included in the utility threshold necessary to trigger relocation. Relocation may occur when either: the social or natural environment changes and renders the agent utility for that location below a predefined threshold, or the agent changes (e.g. household stage change) and has the means to relocate.

The preferences of residential household agents are established empirically from their location-based utility using an adaptive conjoint analysis conducted in the Slovenian case study Koper in May 2010. Conjoint analysis comprises: estimating respondent value systems, collecting trade-offs, and making choice predictions. To accommodate different relative perceptions of factor values, the analysis sets forth a value system that is analogous to small, medium, large, or poor, good, best for each location attribute evaluated by respondents.

An attempt was made to classify the conjoint survey respondents based on preferences for eight factors (i.e. access to green space, shops, public transport; level of noise and air pollution; quality of waste collection; safety; and house condition). Results showed a lack of structure in the preference data and further attempts to predict preferences based on respondent attribute data (e.g. marital status, age, income, etc.) using regression trees, also resulted in poor R values (0.49 and 0.26 for the Manchester and Koper case studies, respectively). These results provide further evidence for use of agent-based approaches to represent variability among actors and decision-makers in land-use systems since mathematical and statistical models that represent the average household would not be able to accurately generalise acquired preference data.

Concluding, ABMland represents our departure from previous approaches to model peri-urban land use change at the regional scale. Its principle advantages are the capacity to reflect the behaviour of individual land users and their interactions across a range of different land use and land cover types. Early agent-based models were explicitly devised to have the simplest possible rules necessary to produce the desired behaviour. ABM has undergone an evolution towards increasingly complex and empirically grounded models, used to produce results of increasing specificity. ABMland has contributed to the evolution of such models by considering a wide range of agents involved in the process of urban growth. Periurban models have tended in the past to focus on the decisions of residential agents. For the first time, ABMland has modelled residents, developers, planners and other agent groups and their interactions in a consistent modelling framework.

### **Further reading:**

PLUREL deliverable report: [Conceptual description of agent-based models to incorporate the decision making process regarding land use change in rural-urban regions](#)

PLUREL deliverable report: [Conceptual and implemented agent-based model for a generic Rural-Urban Region to analyse the influence of communication patterns on urban land use change](#)

PLUREL deliverable report: [Report on location patterns of business agents in the rural-urban system](#)

## 1.5.19 iIAT Europe

*Integrated impact analysis tool for Europe*

### FS 92 iIAT Europe application

By Annette Piorr - Müncheberg

#### What is the issue?

The European integrated Impact Analysis Tool (iIAT-EU) is a new decision-support tool based on the European Urbanisation Impact Model (EUI Model). It compiles results from quantitative modelling of urbanisation and expected impacts on sustainable development, both at the European scale and for European regions. The iIAT-EU covers 543 NUTSX regions of the EU-27. Users can conduct an integrated analysis of the situation in 2000, and of the four PLUREL scenarios. Indicator choice offers two options: an aggregated sustainability analysis which considers a predefined set of indicators covering the economic, environmental and social dimension, and a free selection of 3-12 out of 25 indicators with relevance for urban-rural functions. Selection and output presentation is possible via map viewer, or for integrated results as spidergrams.

The iIAT-EU's main purpose is to transfer knowledge generated in PLUREL about the impacts of urbanisation on the most relevant urban rural functions at different spatial scales. Furthermore, the objective is to create awareness on how sustainability is affected at different scales for different types of regions. Moreover, iIAT-EU helps identify where policy action might be necessary, both thematically and spatially.

[Start the iIAT application](#)

#### Methodology and Materials:

Based on quantitative modelling utilising European data at NUTS2 and NUTS3 level, impacts of urbanisation are calculated with the EUI Model as response functions between social, economic or environmental indicators and the share of artificial surface growth, GDP or population dynamics per region. Results for 25 indicators, baseline situation, 4 scenarios and two time slots are transformed into standardised values in order to unify the scale of output data values between indicators.

#### Results and Conclusion:

Each NUTSX region is characterised by an urban structure, and a bio-physical, socio-economic and regulatory profile, represented by the attributes of different typologies. The latter include, for example, rural-urban-region-type, spatial planning type or level of vulnerability, innovation and accessibility. In the functionality of iIAT-EU, these act as filter for the generation of grouped average indicator values ([Tab.2](#)). The user can select a fixed list of sustainability indicators or choose up to 12 indicators out of 25 ([Tab.1](#)). Integrated result presentation is displayed in spidergrams, while for single indicators also maps can be produced. The option for comparisons by making use different spatial scales, different typologies, scenarios or times exists.

The iIAT-EU is an internet tool that allows for result presentation from the EU modelling algorithm of PLUREL. The user can choose the (1) spatial aggregation level: single NUTS regions, predominantly urban, peri-urban or rural regions, other groups regions of similar characteristics (making use of 11 different typologies), national and EU-27 scale ([Tab.2](#)). (2) the scenario; (3) different times and (4) different indicators. A map viewer facilitates guided choices. Click here to visit the PLUREL iIAT-EU

### **Further reading:**

PLUREL deliverable report: [Description of methodology of iIAT at pan-European level](#)

[How to use the iIAT \(image\)](#)

### **1.5.20 iIAT case study regions**

*Integrated impact analysis tool for case study regions*

#### **FS 99 iIAT case study regions application**

*By Dagmar Haase, Nina Schwarz - Leipzig*

#### **What is the issue?**

The integrated Impact Analysis Tool (iIAT) synthesises the modelling results from the impact analysis of land use changes into one tool. It is a tool for an integrated result presentation of a broad impact analysis (IA) and multi-purpose and interactive in nature. It allows for integration of manifold aspects of problems of land use and its functions and services related to urbanisation and considers conflicts of interest of different stakeholders (e.g. residents, planners, developers) within a planning processes. It covers all dimensions of sustainability, namely the economic, the social and the environmental.

The iIAT-Region approach allows for selecting or adapting the above mentioned comparisons to create a visualisation of impact analysis results for the case study regions. This visualisation provides a quick scan of different future land use scenarios and their impacts on ecological, social and economic indicators.

#### **Methodology and Materials:**

Physically, the PLUREL iIAT is an internet accessible tool that displays results in form of spidergrams, which provide a surface that enables an easy and holistic perception of multilevel information. Here, a variety of [indicators](#) is used. Although it not a participatory model, the iIAT-Region facilitates participatory decision processes of practitioners or policy makers.

## **Results and Conclusion:**

As output the iIAT computes interactively composed integrated spidergrams for a) different land use scenarios per urban region, b) a range of indicators comparing different urban regions and c) a single indicator displayed for different urban regions and scenarios.

Results are displayed as changes compared to land cover in the year 2000 rather than as absolute values. This enables comparisons across case studies.

## **Further reading:**

PLUREL deliverable report: [Interactive Impact Analysis Tool based on Multi Criteria-Assessment for key indicators at case study level](#)

[UGEC Newsletter: iIAT](#) (pdf) by Dagmar Haase et al. (2009)

[Indicator list iIAT EU27 and Region](#) (pdf) by Annette Piorr, Dagmar Haase

## 2 Trends and drivers of peri-urbanisation

*What drives peri-urbanisation?*

### FS 404 What are trends and drivers of peri-urbanisation?

By Katharina Fricke - Müncheberg

#### What is the issue?

The development of rural-urban regions is affected by global and general development trends. The ongoing metropolisation process and mega-city region growth affects migration and population allocation between regions in Europe and thus urban growth and peri-urbanisation. Most economies are increasingly concentrated in urban centers, but spatial streams of urban development vary between European countries. Here, pre-existing settlement patterns are important constraining factors. Changes of peri-urbanisation processes are driven by a complex set of factors which cannot easily be forecasted, but are well suited for the development of scenarios for the analysis of drivers and associated pressures and impacts.

Understanding these trends as drivers of land use change as well as the implications of land use change on quality of life and subsequent behaviour is also important for development of policy.

#### Methodology and Materials:

Quantitative scenarios and narrative storylines of alternative future trends are developed. They are in line with the development of the European-level driving forces of economy, demography, social dynamics, environment and technology that are appropriate to urban-rural issues and related to the concerns of end users.

PLUREL has developed driver scenarios (based on IPCC-SRES narratives) for European regions until 2025 and 2050 based on economic, demographic, technological, and climate change. These scenarios are analysed for their impacts on urbanisation patterns and impacts in European rural-urban regions. The adaptation of the scenarios reflects urbanisation processes, spatial policy, urban-regional governance, and other important drivers that act at various spatial scales. The basic data are either modelled statistically (in the case of the economic and demographic scenarios) or described in narrative form. The model NEMESIS is used for the economic modelling. Results are brought into a spatially explicit model.

#### Results and Conclusion:

Trends and drivers of peri-urbanisation in the PLUREL context cover a comprehensive analysis of economic, social, environmental and technological driving forces. Assumptions on the potential development of peri-urbanisation in Europe and on case study scale are made. This section of the PLUREL Xplorer displays all PLUREL results that are related to the future: the four PLUREL scenarios and their storylines, the driving forces of the peri-urbanisation processes, detailed policy and planning strategies of the case studies, an outlook on the development perspectives of the case studies. Further on, an introduction into the complexity of peri-urbanisation is given.

**Further reading:**

PLUREL deliverable report: [Scenario framework to consider future drivers of change on peri-urban land use relationships](#)

PLUREL deliverable report: [Typology of regional and local driving forces acting on the generic urban region types](#)

## 2.1 Scenarios

*How to design future perspectives driving peri-urbanisation?*

### FS 5 Scenario principles

*By Joe Ravetz - Manchester*

#### What is the issue?

The future of Europe's peri-urban city-regions is uncertain, with many questions to explore:

- Are urban areas changing and transforming into a completely new type of human settlement?
- Are rural areas obsolete, or do they have a new kind of role in an urbanised society?
- Will new development in the peri-urban areas increase the divide between rich and poor?

For such questions there are few clear answers or accurate forecasts. Instead, exploring future scenarios can be more useful. Scenarios provide a structure for imagining future possibilities, testing uncertainties, analysing impacts, and constructing policy responses.

The dynamics of peri-urban development and landuse change are complex and multi-level, beyond the capacity of any technical modelling, or policy analysis method. So it is essential to work with scenarios: these will combine technical analysis and modelling, with more qualitative issues which explore social, cultural, economic and political changes (EEA, 2007).

As in the [graphic](#), scenarios work best with a combination of stories, simulation models, images and visions.

#### Methodology and Materials:

PLUREL developed a scenario framework, based on the IPCC report 'SRES' (Special Report on Emissions Scenarios). This included:

- Applying the global scenarios to the EU, up to 2025 and 2050.
- Exploring possible 'shocks', i.e. rapid & important changes.
- Focus on peri-urban issues

The result is a 2 x 2 [framework](#):

- Global top-down vs local bottom up dynamic

- Private enterprise vs public community focus

Scenarios help to explore uncertainties in a structured way, to enable links to technical modelling, policy analysis and debate. The uncertainties can be further analysed into quantitative / qualitative: exogenous / endogenous (outside / inside the boundary); or risk / opportunity, i.e. the implications for users and their responses.

One of the most topical kind of uncertainty is the *sustainability* criteria: where one person's sustainability is another's nightmare.

## **Results and Conclusion:**

The results are shown as 4 scenarios: (the references A1, B2 etc show the structure of the IPCC scenarios:

- A1 – ‘hyper-tech’: rapid technology innovation and counter-urbanisation
- A2 – ‘extreme water’: rapid climate change and defence of the cities.
- B1 – ‘peak oil’: energy price shock and retreat from the peri-urban.
- B2 – ‘fragmentation’: communities in retreat with polarisation of cities.

The results are in the outlines below: each contains an example ‘shock’, and a focus on peri-urban landuse and development issues. The summary table is attached.

### **A1 – ‘hyper-tech’ scenario: globalised and privatised**

This shows a world of rapid economic growth, global population that peaks in mid-century, and the rapid innovation and spread of new technologies, such as information and communications (ICT), nano- and bio-technology. For peri-urban areas in Europe, small ‘polycentric’ towns and cities become even more popular. New ICT and transport modes enables many to work from home or the local town, leading to rapid peri-urbanisation and ‘metropolisation’ of rural areas.

### **A2 – ‘extreme water’ scenario: localised and privatised**

A more mixed future of self reliance, local enterprise and preservation of local identities. Slower population growth and innovation, but more rapid effects of climate change. Peri-urban areas are badly affected; vulnerable city-regions such as London or the Randstad spend large sums of money on defence and adaptation. There is chaotic social change and pressure on urban infrastructure and services.

### **B1 – ‘peak oil’ scenario: globalised government**

Here there is a global consciousness of sustainable development, across government, business and citizens. But there is a ‘shock’ with a peak oil crisis. For peri-urban areas, rising energy prices start to limit commuting distances. While many start tele-working, most return to larger cities and towns, and many remoter areas decline.

## B2 – ‘fragmentation’ scenario: localised communities

Across Europe there is a fragmentation of society, and many local communities retreat into their own groups and cultures. Cities become dispersed as younger migrants dominate city centres, and older natives move to the new peri-urban enclaves. Many peri-urban areas become ‘peri-society’ areas.

Overall, exploring peri-urban futures needs both stories and simulations. For instance, does the ‘peak oil’ scenario mean that people will cluster in large cities, or migrate outwards to a wired-up countryside? So much depends on lifestyles, values, policies and cultures.

In conclusion, the PLUREL scenarios provide a starting point to explore the possibilities. They shine a light into 4 ‘cloudy crystal balls’ (EEA, 2000), not so much to forecast the future, but to help understand and work with it.

### Further reading:

EEA (European Environment Agency), 2000. *Cloudy Crystal Balls – An assessment of recent European and global scenario studies and models*. Environmental Issues Series 17, EEA, Copenhagen.

EEA, 2007. *Land-use scenarios for Europe: qualitative and quantitative analysis on a European scale*: Technical Report 09/2007

Ravetz, J (2000) *City-Region 2020: integrated planning for a sustainable environment*; London, Earthscan

- [D1-3-2 Scenario framework](#) (pdfs) by JR
- [Plurel scenario summary table](#) (tables) by Joe Ravetz

### 2.1.1 Hyper-tech scenario

*Example future hyper-tech*

#### **FS 6 Storyline of the hyper-tech scenario**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

There are questions about the dynamics of peri-urban city-regions, in the face of rapid and unpredictable change.

This 'Hyper-tech' scenario is the closest to existing trends of globalisation and economic development, and so might show the most likely possibilities for the future. However it should not be taken as a business as usual forecast, rather as one of many alternatives.

This scenario – A1 ‘Hyper-tech’ is especially important, because it is likely to push existing urban and regional systems to their limits, and maybe beyond. It shows a future world of rapid economic growth and more efficient technologies, which rapidly change lifestyles and working patterns. Wider peri-urban areas are likely to be transformed by a new social and economic logic for cities and regions.

### **Methodology and Materials:**

The PLUREL scenario framework was adapted from the global scenarios of the IPCC, in three main stages:

- Applying the global scenarios to the EU space.
- a series of plausible ‘shocks’, i.e. rapid and important changes in particular sectors or themes.
- implications for urbanisation and peri-urban land use change.

Scenarios by their nature are working with uncertainties. As far as possible this is done in a structured way which enables links to modelling, policy analysis and public debate on priorities and decisions. The uncertainties can be further analysed into quantitative / qualitative: exogenous / endogenous (outside / inside the unit of analysis): or risk / opportunity, i.e. the implications for users.

### **Results and Conclusion:**

This scenario shows a globalised and privatised world. With a rapid development in Information and Communication Technology, leading to reduced commuting and transport needs, there are few constraints on urban development and land use change.

- High GDP growth at 3.5%;
- Overall population peaks and then declines;
- High rates of international migration and social change;
- Medium / high population growth: low mortality; medium fertility; and medium mortality.
- Urbanisation is at a low rate of growth: in contrast to peri-urban and rural population growth which is relatively high.

General storyline: Global cooperation and high economic growth lead to innovation and rapid technological development. Investment in Research and Development is high and nations share knowledge and pool resources in a global research market place. Energy prices decline because supply is driven by new developments in renewable energy production and nuclear fission. There is a narrowing of wealth disparities worldwide and global equity is enhanced. A virtuous circle is created with technological development leading to greater economic growth and investment in

R&D.

People are able to reduce commuting through tele-working and consequently there is a re-population of rural areas. Rural areas are more strongly dependent on service industries and agriculture plays a minor part in the rural economy, not least because genetic technology has brought rapid improvements in crop productivity and so needs less productive agricultural land. Most farmers are engaged in landscape gardening as they are paid to maintain the countryside for its aesthetic value for residents. Population increases because of a decline in the mortality rate arising from advances in medicine and better health care. There is also substantial immigration flows due to high levels of economic growth in Europe.

Implications for peri-urban development: Small polycentric towns and cities become increasingly popular as a place to live as a compromise between the rural idyll and the need for social services such as schools, health care and cultural activities. New transport technologies lead to more rapid journeys and the expansion of the commuting distances around towns and cities. This leads to increased peri-urbanisation and urban sprawl, with consequences for environmental impacts and the provision of urban services. As people move out of larger cities, mono-centric urban areas struggle to generate sufficient tax revenue to maintain infrastructure. Such cities lose further importance as new technologies allow business to be conducted in a small number of mega-finance centres: e.g. London, Frankfurt, Paris and Edinburgh.

Overall, this ‘Hyper-tech’ scenario might appear to be like fiction. But only 30 years ago, so was, for example, the wireless / laptop / mobile combinations which we now use everyday. For peri-urban areas there are big questions coming from this scenario – does a Hypertech future mean that the population will spread itself wider, or cluster in high-tech urban environments, or build walls to divide the rich from the poor? These are to be explored in the case studies.

#### Attachments:

- [Hyper-tech scenario \(A1\)](#) (images) by Joe Ravetz

### 2.1.2 Extreme water scenario

Example future extreme water

#### **FS 7 Storyline of the extreme water scenario**

*By Joe Ravetz - Manchester*

##### **What is the issue?**

There are many questions about the dynamics of peri-urban city-regions, in the face of rapid and unpredictable change. This ‘Extreme Water’ scenario follows the current trends of privatisation and regionalisation (following the credit crisis), and asks ‘what if’ climate change was driving rapid and chaotic urban change. The ‘Extreme Water’ A2 scenario is particularly topical, as it demonstrates the power of climate change to push urban and regional systems to their limits. Peri-urban development is likely to be quite uneven, more vulnerable to environmental hazards and other uncertainties. This affects not only areas subject to flood risk or sea-level rise, but the dynamics of urbanisation across the EU.

## **Methodology and Materials:**

The PLUREL scenario framework was adapted from the global scenarios of the Intergovernmental Panel on Climate Change ([IPCC](#)), in three main stages:

- Applying the global scenarios to the EU space.
- A series of plausible ‘shocks’, i.e. rapid and important changes in particular sectors or themes.
- Implications for urbanisation and peri-urban land use change.

Scenarios by their nature are working with uncertainties. As far as possible this is done in a structured way which enables links to modelling, policy analysis and public debate. This 'Extreme Water' scenario raises a connected chain of uncertainties: the rate and nature of climate change; its physical impact; the social / economic / urban consequences; and the kind of response and adaptation which can be made.

## **Results and Conclusion:**

This scenario shows a more localised and privatised kind of society; climate change reaches a tipping point , leading to rapid sea level rise, flooding and water resource constraints. Peri-urban development is uneven, and more vulnerable to environmental and other kinds of hazards.

- Population increases, with continuous pressure on urbanisation
- Economic growth is higher at 3.2% average.
- Urbanisation proceeds with a high growth: but peri-urban and rural population growth is relatively low.
- Rural economies shift back towards more localised products and markets.
- Cities become more hazardous in summer heat waves, but rural areas also suffer.
- In response, new possibilities emerge: floating houses and coastal settlements; migratory lifestyles for northern summers and southern winters.

General storyline: in ‘Extreme Water’, also known as ‘Europe H2O’, water crises become commonplace across Europe. A year does not go by without a major event, and in some cities and regions development activities are seriously constrained. Driving forces include climate change and associated impacts including sea level rise, increased precipitation (and hence greater flooding) in northern Europe, and lower rainfall (and therefore droughts) in southern Europe. Implications for the peri-urban: areas that experience limitations in available water supplies and regular flooding become marginalised in favor of more resilient and less vulnerable locations. Pockets of growth and decline emerge. Affluent yet vulnerable cities and regions, including London, Madrid and the Randstad, spend huge sums of money on adaptation strategies. Extreme summer heat and drought in Southern states hits the tourism industry. Related businesses suffer, leading to urban decay. At the same time, reduced water supplies for irrigation constrain agriculture, with widespread land abandonment. The Baltic States and other northern areas may benefit from these changes. Overall, this ‘Extreme Water’ scenario seems to paint a picture of doom. But as the impacts of climate change increase, so might the capacity to respond to them. For peri-urban areas there are big questions – will urbanisation avoid hazardous areas or adapt to them with floating houses? Or, will the landscape structure turn to dust in the summer drought, or can we find ways of adaptation and stabilisation? These are to be explored in the case studies.

## **Further reading:**

[Intergovernmental Panel on Climate Change \(IPCC\)](#)

### **2.1.3 Peak oil scenario**

*Example future peak oil*

#### **FS 8 Storyline of the peak oil scenario**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

There are questions about the dynamics of peri-urban city-regions in the face of rapid and unpredictable change. This 'Peak Oil' scenario seems to represent some of the aspirations for sustainability, but also some of the fears of 'big government'. It then combines with a very topical 'what if' question on the peak oil crisis. This scenario – 'Peak Oil' – is important, because it is likely to change the direction of development in existing urban and regional systems. It shows a future world of resource constraints and explores the implications for peri-urban development, in both activity and landuse.

#### **Methodology and Materials:**

The PLUREL scenario framework was adapted from the global scenarios of the Intergovernmental Panel on Climate Change ([IPCC](#)), in three main stages:

- Applying the global scenarios to the EU space.
- Some plausible 'shocks', i.e. rapid changes in particular sectors or themes.
- Implications for urbanisation and peri-urban land use change.

The main role of scenarios is to explore uncertainties. As far as possible this is done in a structured way which enables links to modelling, policy analysis and public debate. This 'Peak Oil' scenario raises a chain of uncertain cause-effect links, to be explored further: the energy transition itself, its effects on the EU economy and society, the implications for peri-urban development and landuse, and the feedback from landuse patterns to urban energy systems.

#### **Results and Conclusion:**

This scenario shows a globalising and public policy-focused society. There is an energy price shock, leading to rapidly increasing energy and transport costs, with consequent changes in mobility, employment, trade flows, and patterns of urban development. The overall parameters of this scenario include:

- EU population peaks and then declines;

- Economic growth is lower, with GDP at 2.25% average growth;
- Urbanisation is at a medium rate of growth: peri-urban and rural population growth is relatively very low
- General technological optimism and strong policy platform, so that the pressures coming from the peak oil shock, can be managed.
- Policy is focused on globalised and networked forms of ‘sustainable communities’ in urban & rural situations;

There are many implications for peri-urban landuse and development:

- Increased public transport and demand management, will concentrate development in larger centres.
- Reduced use of private cars will rapidly affect new road development, with effects on the location of employment and services;
- Increased costs of freight transport will change supply chains and logistics, particularly for bulk products from agriculture, forestry and minerals;
- Farming and the food sector is also strongly affected, being heavily oil-dependent: a shift towards more extensive and local cultivation.
- Tourism and leisure are also heavily car dependent, and the shift has serious effects on many rural economies.
- Pressure for alternative energy sources, and consequent demands on land use: biomass or biofuel crops: wind, water, bio-gas or solar;
- In spite of stronger climate change policies, there would also be likely pressures for fossil fuel developments, such as surface coal mining or secondary fuels.

Overall, this ‘Peak Oil’ scenario might appear to be at an extreme end of the range of probability. But many industry and academic studies now show that such an event is expected, sometime between 2015 – 2050. The balance of market and state in this scenario is also an aspiration more than a reality, but the equally deserving of exploration. For peri-urban areas there are big questions – does this Peak Oil future mean that development returns to the cities, or localises in the country? Will alternative energy sources be ready in time, and what might be the effects on landuse and location?

### **Further reading:**

[Intergovernmental Panel on Climate Change \(IPCC\)](#)  
[Peak oil scenario \(B1\) \(images\)](#) by Joe Ravetz

#### **2.1.4 Fragmentation scenario**

*Example future fragmentation*

#### **FS 9 Storyline of the fragmentation scenario**

*By Joe Ravetz - Manchester*

## **What is the issue?**

The future of peri-urban city-regions is quite uncertain, in the face of rapid and unpredictable change. This ‘fragmentation’ scenario is a topical exploration of ‘what if’ some current social and cultural trends combine to produce a more rapid change or ‘shock’. While ‘local sustainable communities’ are still the aspiration of many, the result may be clearly sustainable for some, at the cost of exclusion for others. Peri-urban spatial governance may have a crucial role to play. The ‘fragmentation’ scenario is important, firstly as it reflects many current trends, with a peri-urban area controlled by wealthy landowners and commuters, serviced by a working under-class who can no longer afford to live there. It is also interesting as it questions the assumptions in urban-regional modelling of smooth gravity functions and transparent land markets. The future logic of urban and rural relations may be rather different.

## **Methodology and Materials:**

The PLUREL scenario framework was adapted from the global scenarios of the Intergovernmental Panel on Climate Change ([IPCC](#)), in three main stages:

- Applying the global scenarios to the EU space.
- A series of plausible ‘shocks’, i.e. rapid and important changes in particular sectors or themes.
- Implications for urbanisation and peri-urban land use change.

This scenario points to a research agenda beyond the technical models. The fragmentation of society reflects current trends in places such as North America, but is clearly a complex dynamic of social emergence. If the fragmentation is assumed as an exogenous force, then landuse implications can be explored: an even more topical question looks the other way, at the possible effects of landuse and spatial development policies on the structure of society.

## **Results and Conclusion:**

The Fragmentation scenario shows a localised / regionalised level of activity, driven more by a public governance dynamic. This brings both positive and negative effects: there is increased localisation of communities, but also problems of division and exclusion between social and economic groups, such as natives and migrants, wealthy and poor. This has a powerful effect on peri-urban development.

- Overall population change is medium growth;
- Fertility, mortality and migration are all at medium levels;
- Economic development is low with GDP at 2.25% growth.
- Urbanisation is at a medium rate of growth: peri-urban and rural population growth is also medium.
- Generally there is a focus on the dynamics of local and regional ‘sustainable communities’ in urban and rural situations.
- There are divergences and competition between communities and regions, accelerated by more localised forms of governance and economic activity.

Transition / shock agenda: This scenario type is often referred to in the ‘sustainability’ corner, with

the aspiration of living more localised and low impact lifestyles, in harmony with families and neighbours. However, a quite plausible transition (more than a shock) agenda is introduced here. The effect of localised communities may be to enhance social divisions and exclusion of marginalised groups. The demographic ageing effect may be to reinforce the fragmentation of older and younger residents, of incoming or native dwellers. The effect may be not only social and cultural, but also physical, as social groups retreat into green enclaves, gated communities, behind security barriers. This also has an economic effect of depressing trade, competitiveness and innovation. On the plus side, there is a resurgence of local democracy, collective responsibility and social enterprise activity. Implications for peri-urban development:

- The already fragmented peri-urban landscape becomes further segmented into particular social groups, ethnic or religious groups.
- In such isolation, fundamentalism increases and so does the distrust between each group. Although much of the land area is public, and used for local food production, there are complex rules on access and land use.
- There are ‘green enclaves’ of apparently high quality communities and settlements, but existing only behind security gates and fences.
- Due to the general slow-down, some more remote rural areas become depopulated and in some cases almost empty, as the demographic structure filters out younger people.

Overall, this fragmentation scenario shows how policy aspirations can so easily produce the opposite effects: how the agenda for local ‘sustainable communities’ can lead to walls, enclaves and large communities of the excluded. The peri-urban may then be the natural place for this fragmentation, hidden behind a surface of environmental sustainability, as in the illustration.

#### **Further reading:**

[Intergovernmental Panel on Climate Change \(IPCC\)](#)  
[scenario B2 image](#) (images) by Joe Ravetz

## 2.2 Drivers of peri-urbanisation

*What drives peri-urbanisation in the future?*

### FS 10 Scenario driving forces

*By Joe Ravetz - Manchester*

#### What is the issue?

Peri-urban areas on the urban-rural interface are often fast changing. Many spatial development policies try to limit this, and provide a structure for urban development. But even with a stable urban structure, rapid social / economic / cultural change can still happen inside and around it. Most peri-urban areas are in rapid transition, driven by the dynamics of agglomeration and globalisation. To understand this we need to look at ‘driving forces’ – the causes of such change, upstream or external to the peri-urban area. The analysis of drivers of change is at the centre of the research agenda, but this is not a simple task. We might say that demographic migration ‘drives’ the development of the peri-urban area: or, that development of the peri-urban also drives migration: or, there is some higher level dynamic such as globalisation, which is driving both these phenomena. The diagram shows different layers and levels of these forces.

#### Methodology and Materials:

The PLUREL scenario modelling looked at economics, demographics, environment, and infrastructure. Each of these uses a model structure (for environment a qualitative model was used): but these assume the driving forces (e.g. GDP, population) as based on conventional growth & development. Another approach looks at ‘peri-urban landuse relationships’. The development of scenarios through the project also explores other kinds of dynamics – cultural, political, structural. In each of the above drivers, there is a technical research agenda, which can be quantified and modelled. But each of the scenarios also suggests a qualitative research agenda. For instance, one of the main parameters in urban modelling is the gravity function: this varies between the scenarios, but also changes its structure. A globally networked future will have a different type of function to that of a fragmented or collapsing urban future. Further research may follow up this question.

#### Results and Conclusion:

The main types of forces include: **Demography and social forces:**

- While fertility and mortality rates are relatively slow to change, over several decades there may be very different demographic profiles.
- International and inter-regional migration are more volatile, and dependent on policy and global economic swings, and could change rapidly.
- Urban-rural in/out-migration is dependent on spatial policy, the state of the cities or rural areas, and transport / communications.
- Lifestyle perceptions of city or rural quality of life, leisure and tourism, also affect the trends

of peri-urbanisation.

### **Economic and employment forces: this is the most commonly modelled:**

- Economic growth in general drives the rate of urbanisation. The rate of savings and capital investment drives expansion of the building stock & land-use conversion.
- Economic structures and employment patterns also affect the trends of peri-urbanisation, e.g. if home-working for the service industries becomes major.
- Business technology will affect not only employment but supply chain logistics, the distribution of production, services and consumption.
- Agglomeration dynamics: growth & specialisation in labour markets, services, infrastructure etc., with powerful incentives for peri-urban locations.

### **Environmental forces:**

- Climate change impacts: sea-level rise & fluvial flooding; extreme weather events & hazards; soil erosion & habitat change.
- One likely climate change impact: urban environments become more unpleasant and hazardous, but how much and when is uncertain.
- Water resource and flood management issues will put pressure on peri-urban development, particularly in arid climates or areas vulnerable to flooding.
- Energy demands may put pressure on peri-urban areas for production of bio-mass.

### **Urban development and spatial forces:**

- Housing investment: housing forms & patterns: housing & density are all relevant to the growth and pattern of peri-urban development;
- Transport and communications are central to the peri-urban agenda: infrastructure can enable in / out-migration, counter-urbanisation, or re-urbanisation.
- Spatial planning policy may aim to manage or contain growth in larger cities, smaller cities and towns, or smaller rural settlements, or not at all.

### **Rural development & environmental forces:**

- Agriculture, particularly the CAP(Common Agricultural Policy of the EU) reforms relating to intensive or extensive production, are a major influence on land-use change.
- Rural development forces are dependent on the scenario type, i.e. whether localising or globalising forces are dominant.

### **Structural & cultural issues:**

- The dominance of urban over rural interests;
- The dominance of urban/rural elites over the majority;
- The rural image as desirable & safe, in contrast to the crowded & dangerous city

In reality, each of these factors are inter-connected with others and there are many more in the complex system of peri-urban development. For peri-urban scenarios many questions remain: e.g. in a 'Hyper-tech' future, will the population spread wider, or cluster in high-tech urban environments, or build walls to divide the rich from the poor? No technical model on its own can

fully answer such questions, so a scenario-focused investigation is essential.

### Further reading:

- [Scenario driving forces](#)
- [Scenario driving forces - relationships](#)
- [Scenario driving forces - economic](#)

## 2.2.1 Environment

*How might the environment develop?*

### FS 11 Environmental drivers

*By Jeremy Carter - Manchester*

#### What is the issue?

The natural environment has long been the provider of urban resources such as water or minerals, and the ‘receptor’ of urban development. Now the balance is being turned around. As more of the EU is urbanised, the environment becomes a precious resource to be safeguarded, and a limit to urban development. Meanwhile, the environmental agenda is shifting from the local to global scales, and issues such as climate change, food security and resource depletion now dominate. The graphic (Fig.1) shows how environmental drivers are tangled up with social / economic / technology drivers, both direct and indirect. As the world urban population is projected to grow from 50% to 70%, the peri-urban environmental agenda will be more important: for local issues of urban quality of life, and the global issues of climate change & resource depletion. In areas of rapid urban sprawl, the impacts are higher, and capacity to respond is lower. In more stable peri-urban areas there are questions about local food & energy, low-impact transport, and flood risk vs. development pressure.

#### Methodology and Materials:

This study took a qualitative approach to the wider scope of environmental impacts and responses for the peri-urban. It looked at 4 key drivers: climate change, agriculture, energy and transport, with 4 research questions:

- Current trends in each environmental driver;
- Impacts of each on environmental quality (air, biodiversity, soil and water).
- Future projections with a scenarios approach.
- Implications for peri-urban landuse & development

The policy responses to the above then raise further uncertainties:

- Current policy agendas including CAP, Cohesion Funds, the Convention on Biological

- Diversity (CBD), EU Landscape Convention: with policies on energy, waste, water supply and flood protection
- New policy agendas, with gaps in powers and resources, such as, local food systems, multi-functional land use, and green infrastructure
- ‘Non-policy’ issues such as fragmentation of the tax base or opposition from local communities

## **Results and Conclusion:**

### **Agriculture and rural development:**

- Competition for scarce water resources will increase, with difficult choices between farming vs urbanisation;
- As water bodies become drier, settlements may be abandoned. Lack of water may constrain new development in some regions.
- Organic & niche farming may reinvigorate declining peri-urban communities.
- With higher income and employment, local economies may grow with services improving accordingly.

### **Climate change: impacts, adaptation, and effects of mitigation policy:**

- While there are large uncertainties on impacts, the variability and extreme events in local climates are very likely to increase;
- The peri-urban area is one of the main resources for urban adaptation, via green infrastructure, flood protection, and micro-climate regulation
- Changes in urban form, for example drives towards compact settlements and the protection and enhancement of greenspace areas.
- Increased use of peri-urban land to produce renewable energy, e.g. biomass production, energy from waste, wind turbines and solar panels. **Energy & transport:**
- Both fossil & renewable energy sources put pressure on peri-urban spaces and infrastructure;
- Transport is the major cause of urban and peri-urban air pollution: and also the most direct influence on peri-urban development.
- Climate emissions policy favours public transport, with effects on commuting patterns and settlement structure. **Also there are underlying challenges in environmental policy:**
- Synergistic / cumulative effects can magnify the problems: e.g. the EU heat wave of 2005 showed that mortality was increased by social exclusion, particularly for the older.
- Resilience – this is both a physical concept and an economic and socio-cultural-political agenda.
- Investment – as climate risks and impacts cross boundaries of territories and sectors, it is more difficult to allocate costs, benefits and investment needs. And the climate change ‘policy horizon’ fixes at a convenient date of 2050 or 2100, while the need for investment has to look beyond.
- Policy integration – many of these pressures and responses are in conflict, with few clear answers on how policy integration works, who should be involved, where are the boundaries, and how the resources can be found.

The Environment is an increasingly considered factor in peri-urban development policy. In many

parts of the EU the local environment is improving, but at the same time standards and expectations from the public and from stakeholders are also rising. High quality environments with green infrastructure are now realised to be essential for economic development, public health and community well-being, as well as providing resources and functions such as water, flood protection, and climate adaptation. In practice there are conflicts with the economic development agenda and its by-product of urban sprawl. There is a realisation that environmental policy is not often simple or direct, rather we need to look at a whole city-region system and the role of the peri-urban in it.

### **Further reading:**

- [environmental drivers](#) (images) by Joe Ravetz
- [D1-3-3 environmental drivers](#) (pdfs) by JC

## **2.2.2 Population in Europe**

*How might population develop in Europe?*

### **FS 12 Demographic projections for Europe**

*By Vegard Skirbekk - Laxenburg*

#### **What is the issue?**

Planning and forecasting tools are essential for developing sustainable rural-urban land use relationships such that ways can be devised to support the urbanisation process in the EU, mitigating its negative impacts. We present population projections for sub-nationals in the EU based on different scenarios of peri-urban land use and demographic states. Our purpose is to offer new insights into probable population scenarios which are explicitly guided by the degree of urbanisation.

#### **Methodology and Materials:**

For each PLUREL scenario (), a likely future trajectory for each of the various demographic components, namely fertility, mortality, international migration and internal migration, are assessed at the national and NUTS2 levels (NUTS2 is a geocode standard for referencing the area of the EU into smaller subdivisions). The likely future demographic trajectories for each PLUREL scenario are then used to find the closest match with the demographic scenarios at the national and NUTS2 levels in the available data. The age (single age) and sex structure for the three NUTS2 scenarios (baseline, low and high) for 17 EU countries were obtained from Eurostat. Data for France and the UK were not available from Eurostat. We collected data for the UK from four different statistical offices for each of the territories: England, Wales, Scotland and Northern Ireland. For France, we purchased data from INSEE (National Institute for Statistics and Economics Studies, [www.insee.fr](http://www.insee.fr)). Output: Probabilistic Population Projections for EU27

## **Results and Conclusion:**

At the national level, the results of the projection for the four national scenarios were prepared by four broad age groups for males and females separately for all 27 EU countries for the period 2005-2050 in five year intervals. At the NUTS2 level, the results of the projection for the four national scenarios are presented in an excel file by single age (0, 1, 2,..., 80+) for males and females separately for 17 EU countries. An example of a region in Austria is presented in Table 4. Some specific characteristics of the projected population can be estimated by looking at the overall movement of projected estimates from 2005-2050 for the 27 EU countries. For illustration, the age groups have been divided into young (0-14), working age 1 (low labour force participation, 15-24), working age 2 (high labour force participation, 25-64), and retired age (65+). Table 3 shows that the young age population will steadily decline after 2020-2025. This is consistent with the four scenarios. Despite a decline from 2005 to 2010 for the 0-14 age groups in all scenarios, the low productivity and high productivity working age population (15-24 and 25-64, respectively) appear to have increased in numbers during that time, but in the coming decades their numbers appear to fall on average. Expectedly, the age group 65+ will experience a steady increase until 2050. This is true for all scenarios. Interesting conclusions can be drawn from the above. First, the general upward trend for the retired population through the decades implies that changes in urbanisation scenarios would not alter the natural progression rate from working age to retired. The crucial demographic states that are contingent upon environmental and social factors would be less affected than the younger and working age population. Degrees of urbanisation and the extreme environmental states would certainly affect the productivity of the working class and the health status of the young age population. Hence, conducive demographic-environmental and social changes would keep the demographic growth momentum constant. Exceptions, which result from different scenarios, are thus expected to change the population pattern in the future, which is evident from the decadal changes (in most cases decline) in the numbers within the age components.

## **Further reading:**

- PLUREL deliverable report: [Demographic projections for NUTS2 regions in EU countries based on national probabilistic population projection](#)
- [EU 25 probabilistic projection by age and sex](#) (image) by Vegard Skirbekk

### **2.2.3 Population in Europe/ NUTS 2**

*How might population develop in Europe on regional scale?*

#### **FS 455 Demographic projections for Europe on NUTS 2 level**

*By Vegard Skirbekk - Laxenburg*

#### **What is the issue?**

In Europe, the sub-national projections are carried out by several European national statistical offices (NSO) as well as by Eurostat. Admittedly, performing projections at sub-national levels is

challenging and involves far more complexity than at national levels as the volume of data requirements commensurate with the number of regions. Based on the regional demographic, projections are carried out and the final results are prepared either with the bottom-up or top-down approach. The relevance of population forecasting at sub-national levels has been extensively documented in recent demographic and economic growth literature by eliciting its importance with regard to issues such as just allocation of resources and planning, inter-generational equity and planning. In keeping with the objectives of PLUREL, which emphasise the importance of developing new strategies and planning and forecasting tools that are essential for developing sustainable rural-urban land use relationships such that ways can be devised to support the urbanisation process in the EU, mitigating its negative impacts, we present population projections for sub-nationals in the EU based on different scenarios of peri-urban land use and demographic states.

### **Methodology and Materials:**

Eurostat data were used. The national level probabilistic population projection is available for three broad age groups (0-14, 15-64 and 65+) and is not disaggregated by sex. The disaggregation was performed by taking the age-sex structure of Eurostat's national population projection (variant method) for each of the broad age groups. The Eurostat national population projection is available for three scenarios (high, medium and low). In the probabilistic projection, the 80% uncertainty interval for fertility, mortality and migration was taken from Eurostat's low and high variant. The age (single age) and sex structure for the three NUTS2 scenarios (baseline, low and high) for 17 EU countries were obtained from Eurostat. We collected data for the UK from four different statistical offices for each of the territories: England, Wales, Scotland and Northern Ireland. For France, we purchased data from INSEE (National Institute for Statistics and Economics Studies). The NUTS2 projection from the five sources (four for the UK and one from France) are mostly for a single baseline scenario, hence, for these countries, the NUTS2 level data is for a single scenario. The consequence is that the age-sex (there is no sex disaggregation for France) proportional distribution for these countries at the NUTS2 level is the same for all four PLUREL scenarios. The data for the NUTS2 level are presented in single year age groups for males and females separately for the period 2005-2030 in five year intervals. Admittedly, performing projections at sub-national levels is challenging and involves far more complexity than at national levels as the volume of data requirements commensurate with the number of regions. Moreover, additional but important difficulties emerge after collecting and preparing data as future assumptions for the trajectories of each of the demographic components at the sub-national level need to be specified. Based on the regional demographic, the projections are carried out and the final results are prepared either with the bottom-up or top-down approach. The bottom-up approach requires adding up the sub-national level population projection for recover data at the higher level of aggregation. Similarly, in the top-down approach, the projected numbers at the sub-national level are adjusted to match the projection results at the higher order of aggregation (for example at the national level).

### **Results and Conclusion:**

This report presents results of the projected population of the EU countries at the NUTS2 level for four PLUREL scenarios: , , and .

We utilise data at the national level from a probabilistic population projection of EU27 countries. The initial data at the NUTS2 level comes from Eurostat and the national statistical agencies of France and the UK. For each PLUREL scenario, a likely future trajectory for each of the various

demographic components, namely fertility, mortality, international migration and internal migration, are assessed at the national and NUTS2 levels. The likely future demographic trajectories for each PLUREL scenario are then used to find the closest match with the demographic scenarios at the national and NUTS2 levels in the available data. The final projections at the NUTS2 level for the four PLUREL scenarios are prepared by merging the two sets of data, namely the national level probabilistic population projection and the projection at the NUTS2 level, ensuring the internal consistency in terms of age-sex structure at the two levels of aggregation. First, the general upward trend for the retired population through the decades implies that changes in urbanisation scenarios would not alter the natural progression rate from working age to retired. The crucial demographic states so contingent upon environmental and social factors would be less affected than the younger and working age population. Degrees of urbanisation and the extreme environmental states would certainly affect the productivity of the working class and the health status of the young age population. Hence, conducive demographic-environmental and social changes would keep the demographic growth momentum constant. Exceptions, as evinced through different scenarios, are thus expected to change the population pattern in the future, which is evident from the decadal changes (in most cases decline) in the numbers within the age components. Similar conclusions can be drawn from other NUTS2 countries, e.g., France, UK and Poland.

#### **Further reading:**

[Population change for the NUTS2 regions using PLUREL scenario hyper tech](#) (image) by Vegard Skirbekk PLUREL deliverable report: [Demographic projections for NUTS2 regions in EU countries based on national probabilistic population projection](#)

#### **2.2.4 Population in case study regions**

*How might population develop in case study regions?*

##### **FS 202 Demographic projections at the local level for case study regions**

*By Vegard Skirbekk - Laxenburg*

#### **What is the issue?**

This fact sheet presents results of the projected population of selected EU case studies at the local level for four scenarios under the PLUREL framework: "Hyper-tech" (A1), "Extreme water" (A2), "Peak oil" (B1) and "Fragmentation" (B2). We utilise data at the local level as well as national level as appropriate to each featured case study. Data was mainly obtained from the local statistical offices. We present the results of detailed population analyses for five cities or areas, namely the Hague region (Haaglanden, the Netherlands), Koper region (Slovenia), Leipzig-Halle region (Germany), Greater Manchester (UK) and Warsaw Metropolitan region (Mazowieckie, Poland). Published are the detailed population pyramids for the starting and ending year population of the projections, life expectancy, fertility and migration data, all for each four future scenarios. The relevance of population forecasting at local levels has been extensively documented in recent demographic and economic growth literature. The importance of understanding population

dynamics with regard to efficient intergenerational allocation of resources and planning has been the reason for the increased attention to this field of science. At sub-national levels, population forecasting is useful in regional planning, thus principally underlining the significance of micro-planning in a macro setting. In Europe, sub-national level projections are carried out by several national statistical offices (NSO) as well as by Eurostat.

### **Methodology and Materials:**

Cohort-component projections models were used. These are essentially what-if predictions of the future, where population trends are determined by a set of assumptions. These assumptions could reflect a continuation of past trends or an investigation on what would happen if there is a (constant) change in one or more of the demographic variables. These assumptions are often stated as the total fertility rate, life expectancy at age 0, and net migration. Decisions on future assumed trajectories in the components, also called the scenario or variant selection, determines the projected trajectory of the population size and structure. The method is well suited for testing out different policy or other options to see a hypothetical range of future scenarios. We utilise data at the local level as well as national level as appropriate to each featured case study. Data was mainly obtained from the local statistical offices.

- Detailed demographic information for the base population, structured by age (5 year group) and sex
- Migration, fertility and mortality estimates and assumptions for future trajectories
- Detailed demographic information for the base population, structured by age (5 year group) and sex
- Migration, fertility and mortality estimates and assumptions for future trajectories

The cohort-component model is a deterministic population projection method, which means that it does not describe uncertainty, but refers to a set of scenarios chosen to represent plausible, possible or relevant (e.g., to investigate the impact of a policy change) future paths of migration, fertility and mortality.

### **Results and Conclusion:**

We present the results of detailed population analyses for five cities or areas, namely the Hague region (Haaglanden, the Netherlands), Koper region (Slovenia), Leipzig-Halle region (Germany), Greater Manchester (UK) and Warsaw Metropolitan region (Mazowieckie, Poland). We developed detailed population pyramids for the starting and ending year population of the projections, life expectancy, fertility and migration data, all for each four future scenarios. The approximately 40-page appendix in the report gives the detailed numbers of men and women in 5-year age groups for the projected scenarios and states, urban, peri-urban and rural, as applicable for each case. We present population projections at the local level for selected cases in the EU based on different scenarios of future energy dependency, economic growth, land use and societal well-being formulated for demographic states. Our purpose is to offer new insights into possible population scenarios which are explicitly guided by the degree of urbanisation. More than mere proportional changes are expected to occur in mortality, fertility and migration behaviour among local populations despite striking similarities in their socio-economic-demographic and environmental characters. The combination of the demographic factors renders the full demographic dynamics that will lead to differential patterns in population forecasts in the decades ahead.

## **Further reading:**

[Demographic projections for NUTS2 regions in EU countries based on national probabilistic population projection](#) [Projection of Koper, based on the "Fragmentation" \(B2\) scenario for Slovenia](#) (images) by Vegard Skirbekk

### **2.2.5 Later-life migration**

*How might the later-life population behave?*

#### **FS 200 Prospects for later-life migration in urban Europe**

*By Vegard Skirbekk - Laxenburg*

#### **What is the issue?**

This fact sheet is about the effects of an ageing population in terms of urban development and retirement migration. The need for more accurate forecasts of future migration flows has increased with the relative importance of migration vis-à-vis other components of population dynamics. Although forced international migration has been given considerable research attention in recent years, also other migration types, in particular later-life migration, become increasingly important. In the coming decade, the large baby boom generation will reach retirement age. Institutions and other government agencies seek to develop strategies for ensuring adequate health, housing, welfare and aged care services provision to the growing elderly population. Later-life migration thus becomes also central to transportation needs, resource use, and service provision. National strategies to adapt to population ageing and shifts in regional population age structure are commonly based upon regional population projections, which are produced by the national statistics offices.

#### **Methodology and Materials:**

In addition to the literature review, we analyse net migration for people born 1935-1948 in per cent of the population in the age group 2005. Migrants are defined as people who have moved more than 30 km and also moved to another municipality. Most areas that gain population are popular second home, summer recreation or ski resort areas. In Sweden for example, the area close to Finland in the north has close cultural ties with Finland and may have retirement migration in the future as it attracts also migrants from Finland that have worked in other parts of Sweden. The areas that people are migrating from the most are big city areas in general, and in the north of Sweden, especially a mining town (Kiruna) up in the north. We identify and discuss some of the main relevant socioeconomic and demographic trends that could affect later-life migration flows in Europe in the context of imminent population aging. While we do not expect that such a discussion will eliminate uncertainty surrounding migration forecasts, we do expect to provide a reasonable framework on which to argument potential bounds and likely scenarios of migration to today's developed societies for the future.

## **Results and Conclusion:**

The age-specific migration rates in Europe and in other developed countries have been fairly stable over time. The expected increase in elderly population will generate a substantially increased pool of potential retirement migrants. Given that the age-specific migration rates will remain stable over the next 30 years, it is thus likely that the overall level of retirement migration will increase substantially. The timing and sequencing of life course events has changed significantly over the last decades (Shanahan 2000). Thus we see a delay in marriage, childbearing, the "empty-nest" stage and, consequently, retirement. The size of baby boom cohort, however, varies between countries and between regions, resulting in an unequal degree of numerical ageing. For example, in western German regions this cohort is larger than in the eastern parts, suggesting a future increase of in-migration of retirees who are in pursuit of more affordable housing from the west to the east of Germany. While the implications of retirement migration are primarily associated with the transfer of resources, moves of the old-old are more linked to the costs of service provision and care. The potential benefits of the in-movement of wealthy retirees, however, may be outweighed by the cost of providing health and care services if the retirement migrants decide to age-in-place. In general, later-life migration is closely linked to changes in the population geography of the elderly. These changes have widespread implications for regional economies, housing demand, as well as the provision of health facilities and services. The planning and policy implications of this type of human mobility will become even more important once the oldest members of the large baby boom cohort reach retirement age in the near future.

### **Further reading:**

[Net migration by NUTS 2 region in Sweden for people born 1935-1948 in percent of the population in the age group 2005](#) (images) by Vegard Skirbekk

## **2.2.6 Migration**

*How might the migration develop?*

### **FS 41 Migration trends affecting peri-urbanisation**

*By Susana Alves - Edinburgh*

#### **What is the issue?**

Migration is the issue that leads to changes in the ethnic make up of rural urban regions and also affects land use in a variety of ways. The issue is both intra- and extra-European in nature as a result of different migration pressures.

Migration is important because the Europe of the next decades will see very little demographic growth in a number of countries except through migration. Intra-European migration leads to a lowering of the population of some countries or regions as out-migration takes place while extra-European migration, inwards from many other countries, places pressure on urban areas in terms of numbers and density of population while also placing pressures on social cohesion.

## **Methodology and Materials:**

Data and statistics as well as qualitative information about migration trends were reviewed and analysed to develop a model of how migration trends work now and in the future. In absence of recent statistics from many countries it was necessary to develop qualitative response functions for a range of NUTSX regional typologies to describe how migration trends affect land use (NUTS is a geocode standard for referencing the area of the EU into smaller subdivisions). The storylines in the 4 scenarios were then used as a basis for looking at possible future trends.

In input variables are derived from a broad review of statistics and trends about migration and its resulting ethnicity (based on several recent reports from different agencies including Eurostats). These data were then assessed qualitatively in terms of the effect on land use - for example leading to urban densification or rural abandonment and from this a series of maps were drawn up as the output variables as well as some qualitative response functions related to the 4 PLUREL scenarios. The main uncertainties in the study presented here lie in the sources and reliability of available data which is partly due to different definitions of migration applied in different countries, partly due to an absence of data from some countries and also due to different scales of resolution. Furthermore, the lack of recent census data on migration means that some of the trends taking place are not visible in the available statistics.

## **Results and Conclusion:**

A pattern of land use change was found to develop as a result of the migration changes already underway and also projected to occur in the future. These were classified as a series of land use types resolved to NUTSX, ranging from abandoned rural to prosperous urban. The effects are likely to be more pronounced for many rural areas in terms of visible land use change but are more difficult to see in some urban areas where the land use changes are mainly densification and multiple-occupancy of houses in some places. Some migration hotspots could be found, such as the south coastal areas of Spain and Portugal, where international retirement migration has been a feature leading to suburbanisation of rural areas with no urban core. Other significantly affected regions include eastern Europe where both movement of rural populations to cities and migration to other countries to work leaves many abandoned or marginal rural areas. Urbanisation of rural areas close to existing urban areas tends to occur through migration from city to countryside where gentrified rural areas result which may become the next type of urban fringe. There are differences in the distribution of prosperity around European regions as a result of the trends in migration, with the commuting ring around many cities remaining prosperous while inner cities become densified and concentrated with populations mainly comprising ethnic minorities. The source locations for these non-European migrants are closely related to the former colonial empires of many countries so that those which no such empires tend to remain less under pressure. The scenarios from PLUREL all show a general increase in migration within and into Europe except that of the scenario Hyper-tech where the general increase in prosperity tends to reduce the push factors leading to reduced intra-European migration. However, in all cases in-migration from outside Europe remains a strong factor. Since almost all such immigrants gravitate to the cities where there is already a core of people from their own community this reinforces the tendency for migration pressures to remain high in certain regions, more so than others. Owing to a lack of data - partly owing to the fact that much recent migration has taken place between census dates and also due to the large proportion of migration remaining illegal and invisible, it remains necessary to use qualitative response functions and the results of the study are highly speculative as regards the land use changes. Once fresh census data that captures better the spatial distribution of the migrant population is available the picture in city regions will be able to be deciphered in more detail.

The conclusions of this study are that migration from a range of locations and of a series of different types is and will remain a major driver of land use change. The model of migration, based on a combination of push and pull factors, gives a reasonable description of the mechanisms and drivers of migration and it is a fact that intra-European migration leads to land use change at both ends of the migration process - on the area left by the migrating population and on the area to which they go, for instance land abandonment in the areas from which they migrate and urban densification in the areas to which they migrate. The migration type likely to have greatest impact under any of the 4 scenarios is that of immigration from outside Europe, a process which will tend to increase or reinforce the ethnic diversity in some regions but not in others. The main affected regions lie in countries where people from their former colonies look to the "mother country" as a desirable place.

### **Further reading:**

[Response functions on migration, ethnicity and ageing at NUTSx](#) (pdf) by Simon Bell, Susana Alves, Eva Siverinha de Oliveira and Affonso Zuin

## **2.2.7 Economy**

*How might the economy develop?*

### **FS 13 Economic Drivers**

*By Baptiste Boitier - Paris*

### **What is the issue?**

We present in this fact sheet four medium-term scenarios (up to 2025) for the European economy at macroeconomic and sectoral level. These scenarios are based on the adaptation of drivers that were used in the PLUREL scenarios (demography, world demand, oil price as well as policies on energy and Research and Development). The analysis is based on the macro-econometric model NEMESIS. These four economic scenarios are the basis of the PLUREL drivers for peri-urban relationships analysis and forecasts. The goal of this fact sheet is to provide the four possible economic futures up to 2025 for the EU, and thus create the economic context in which the other PLUREL studies operate. It also gives quantitative economic results that will be used by partners to analyse peri-urbanisation. Finally, it allows the PLUREL project to take into account four general world economic contexts and show the consequences for the economy of EU countries.

### **Methodology and Materials:**

We start from the qualitative description of the four PLUREL scenarios. We transcribe them in quantitative drivers for the NEMESIS model either by replacing exogenous variables or by changing parameters. Subsequently, we simulate the NEMESIS model, which is a macro-econometric model for EU-27 (except Bulgaria and Cyprus) and compute 30 production sectors, 27 consumption goods and several economic indicators such as gross domestic product, employment,

or energy consumption etc. Input variables come from the qualitative description of the PLUREL scenarios as well as their interpretation to build the general economic context outside EU and to quantify the NEMESIS drivers (demography, oil price, policies, etc.).

The outputs are databases, tables and figures representing around 50 socio-economic variables at European, national and NUTS-2 level for 2005 to 2025 in a 5 years' interval. Please refer to the uploaded files to see the outputs details.

## **Results and Conclusion:**

### **GDP**

In the "hyper-tech" scenario (scenario A1), Research and Development (R&D) investment effects start progressively and European GDP, in 2025, is about 3.8%, R&D investment efforts made by member states boost European economic performance. In contrast, in the "fragmentation" scenario (B2), European GDP grows at 2.1% in 2025, due to both demand that the EU is confronted with and low R&D intensity, strongly constraining the European economy. In the "peak oil" scenario (B1), the inflationary impact of a high oil price on Europe reduces GDP growth rate. European GDP growth rate starts at 3.4% in 2009, to reach 1.4% in 2015 when the oil price is maximum.

Substitution of oil energy with other sources of energy and the reduction of energy consumption lead to a decrease in the oil price. This reduction in payment for energy allows the European economy to progressively reach 2.5% of GDP growth rate in 2025. In the "extreme water" scenario (A2), European GDP growth rate is relatively steady, fluctuating between 2.3% and 2.75%.

### **Employment**

Employment grows relatively quickly at the beginning of the period in all scenarios. In fact, most European countries have a higher number of unemployed people. New workers are therefore relatively easy to find for firms. But year after year, labour force becomes scarcer, leading to an increase in wages, and finally reducing the employment growth rate. Furthermore, there is a deceleration, until 2015, and a subsequent decrease, of the growth rate of the 25 to 65 years old age class which is the major class contributing to labour force. **Sectoral production**

In all scenarios, agriculture shows the weakest production growth rate. The agricultural goods are quite unaffected by total consumption variation. The energy sector also grows relatively slower than other sectors. In fact, a moderate increase in energy consumption and decrease of energy intensity result in moderate economic development for the energy sector. High technological goods sectors have a strong growth in the "hyper-tech" (A1) and "extreme water" (A2) scenarios; these sectors are boosted by product innovation. Services benefit from an increase in households' purchasing power while industrial sectors face a moderate growth rate of their production penalised by an increase in productivity. **Sectoral employment**

In most of the scenarios, the evolution of sectoral European employment is very heterogeneous. In agriculture, loss of workplaces is between 6,4 million and 5,5 million, depending on the scenario. In Romania for instance, loss of workplaces is about 1,5 million. The weakness of revenue generated by agriculture production as well as the increase in agricultural productivity make farmers withdraw from agriculture and shift to other activities. Productivity gains lead to a reduction in work places in industry and agriculture, but the employment opportunities created in services counterbalance this loss and allow at least to maintain the number of total jobs. The four scenarios ()developed are distinguished by a contrasted set of assumptions regarding demography, oil price, world demand, Research and Development efforts and policies.

To sum up the economic results, in the "hyper-tech" (A1), European GDP grows quickly to reach 3.8% in 2025, boosted by investment in Research and Development, the "peak oil" scenario (B1) and the "extreme water" scenario (A2) have a GDP growth rate higher than 2.5%, in 2025. And finally, the "fragmentation" scenario (B2) has the weakest GDP growth rate with 2% in 2025. The

scenarios with high economic growth create more jobs but the difference between scenarios is smaller than for GDP, mainly due to labour productivity increase and wages pressure. Sectorally, agricultural production is relatively stable among scenarios, high technology sectors and services are boosted by Research and Development investments, whereas industry and energy sectors are constrained by productivity increase and/or by energy cost.

**Further reading:**

- [Economic\\_results\\_and\\_Assumptions](#) (pdf) by Université de Paris 1
- [Illustrative results for Europe](#) (image) by Université de Paris 1
- [NEMESIS Outputs](#) (table) by Université de Paris 1

## 2.3 Policy and planning strategies

*What are policy and planning strategies for the future?*

### FS 103 Assessment of spatial planning and governance strategies

By Carmen Aalbers - Wageningen

#### What is the issue?

Within PLUREL, a Joint Assessment Framework was developed that included local knowledge. The regional practitioners were asked on what aspects they generally assess their projects and policies if they qualify them in terms of successful or not successful. Also the researchers contributed to the list of criteria on which all seven case studies would assess the strategies they were studying. The use of a common assessment framework is needed to enable the comparison of strategies in a later phase, and to allow for reference to critical factors such as contextual setting when studying the performance differences between the strategies. The assessments provide critical knowledge about how the strategies work, and relate to the formal government structure. This is needed to compare between the strategies and to provide end users from different regions with a good data base of approaches that they can understand and adopt or adapt to their regions for more sustainable development of the urban fringe. It also provides data for distinguishing general patterns that require policy actions from national and EU level.

#### Methodology and Materials:

The assessment criteria were developed via a transdisciplinary approach - local and international workshops with regional practitioners to provide criteria issues on which they think the governing process should be assessed and what type of outputs should be investigated. Here, a Joint Assessment Framework ([JAF](#)) was used. Structured interviews of practitioners and joint meetings between practitioners and researchers were held to fill in the multiple choice questionnaire. The assessments have been performed in different ways between the regions. Some researchers only asked a number of practitioners to assess the strategies, whereas others also assessed the strategies themselves. In another region, a recombination of assessment criteria was used. These differences make the findings less significant, as they are harder to compare. For each case study the Joint Assessment Framework asks to categorise 3 local planning strategies studied according to their field of action. Next it is asked to assess the strategies concerning their outcomes:

- Is the strategy resilient - robust and flexible (> 25 years)?
- Does it serve multiple objectives - employ synergy or create many "winners"?
- Is the strategy effective - produces the outcomes it was designed for?
- Does it push land use away, creating new land use conflicts elsewhere or at another level, or not?
- Does it strengthen the unique qualities of the area it pertains to?
- Does it contribute to a sustainable dispersion of land use at a regional level with a balance between resource availability and use?

- Does the strategy enable existing rural types of land use to stay or to develop?
- Does it create new or additional urban economy?
- Does it lead to accessibility for city people to peri-urban, open landscapes/agricultural land?
- Does the strategy protect land with best agricultural production capacity?

Thirdly the joint assessment framework asks the researchers about the process comprised by the strategy.

- Does the **strategy** help decision-making by illuminating a complex situation?
- Does it raise awareness among different actors, which?
- Does it involve different actors, which?
- Does the strategy enable bottom-up initiatives by citizens or business, semi-private organisations?
- Is there a clear time span for meeting the objectives contained in the strategy?
- Are the objectives of the strategy clearly defined and in a comprehensible manner?
- Is there a legal, statutory, financial or cultural commitment to support the process?
- Does the strategy provide for monitoring and evaluation of its internal and external consistency and impacts over time, using existing available data?
- Does the strategy empowers certain actors, which? Does it restricts free riding behaviour, are the costs incurred with those who carry the benefits?
- Is the design of the strategy area based, tailored to the specific actors, land use pattern, land market and legislation and - timewise - influencing the right decisions at the right moment?

## **Results and Conclusion:**

The single assessments are reflected in the descriptions of the regional strategies in the Xplorer (see further reading). Both the analysis reports and the assessment reports were the basis for the international comparison of "governance patterns and performance of regional strategies in peri-urban areas". The assessments of the strategies and suggestions for their improvement are furthered by the case study researchers on the basis of scenario studies translating worldwide developments into local changes (storylines, developed together with local practitioners/actors). Koper region, Leipzig-Halle region and The Hague region used the international comparison and the quantitative impact assessment for the enhancement of the analysed strategies. Due to time constraints this was unfortunately not possible for all case study regions within the project lifetime.

## **Further reading:**

[Strategy, effects, effectiveness and assessment](#) (image) by Carmen Aalbers

[Process of practitioners' involvement in assessment and comparison](#) (image) by Carmen Aalbers

### **2.3.1 The Hague region**

*Current governing strategies and policies in The Hague region*

## FS 14 Governing strategies and policies in The Hague region

By Judith Westerink, Pat van der Jagt - The Hague

### What is the issue?

The Hague region is a formal city region based on WGR+ (Joint Regulations Act), by which municipalities are forced to cooperate on issues like planning and public transport. The Hague Region consists of 9 municipalities. The city region is a layer between the municipalities and the province (in this case South Holland). The Netherlands has 12 provinces. The city region has limited authority on land use planning and very little budget of its own. City regions are cooperation and concertation bodies. Governance is their core-business, since they need to work together with other tiers of government and private parties to reach their goals. This fact sheet is about peri-urban governance.

Planning is increasingly a governance process. Planning deals with people's landscapes, biodiversity, traveling time and homes. It deals with areas that cross municipal boundaries and with large economic interests. Cooperation and concertation are essential, especially in highly dynamic peri-urban areas, between governments and with private parties and residents.

### Methodology and Materials:

An issue of concern is the balance between process and results. Concertation processes may slow down decisions considerably, or even prevent decisions from being taken at all. However, decisions with insufficient support in society and other governments are also a threat to sustainable landuse and landscape quality. Governance can have several weaknesses, some of which were observed in the Netherlands. Transparency and doing justice to the interests of all groups do not automatically increase with the number or duration of consultations. Certain actors may be able to greatly influence decisions because they hold strong positions in the lobbying networks. The question is how to include the interests of other groups, which do not have these positions in the formal and informal networks, in governance.

### Results and Conclusion:

As co-operative body of municipalities, the formal powers and tasks of the city region with respect to planning are limited. The municipalities have planning autonomy, but the provincial authorities have the formal authority to influence the municipal plans. The city region draws up a regional structure plan (RSP) in consultation with the municipalities. In the case of The Hague region, the provincial authorities agreed to incorporate the RSP in the provincial plans. The state (Ministries of Planning, Housing and the Environment (VROM) and of Agriculture, Nature and Food Quality (LNV)) operates at greater distance, although state funding provides much of the budget for The Hague region. The regional water boards represent an additional democratic government layer, focusing on the functional (and especially in this region critical) tasks of water management. The Hague region participates in several administrative networks. Examples of these are the *Zuidvleugel* ('South Wing') network, and until recently the Regio Randstad network, which have no formal powers, but act as 'hubs' in wider networks of politicians and officials, developing policy and enabling lobbying for certain objectives and projects. On a European scale, The Hague region (through Regio Randstad) is actively participating in PURPLE, a network of regions. Important private actors are companies, institutes, property developers, farmers, nature conservation

organisations and environmental groups. All of these groups have non-governmental bodies to represent their interests, which are lobbying actively. Several area-based civil society organisations are active in the urban fringe areas in The Hague region, or parts of them. Attempts are being made to connect discourses and spatial concepts to several of these areas in order to emphasise their importance. Less active lobbyists include recreationists and, more generally, city-dwellers. The growing population of ethnic minorities in particular does not appear to take part in the discussions about meaningful green open space in and around the cities. The main goals for The Hague region are international competitiveness and – to boost this – a favourable climate for the establishment of business and international institutions. The green open landscape, which offers many opportunities for recreation, is seen as an important factor to make the region attractive for international companies and institutions and their employees. The characteristic agricultural landscape of the region is regarded as having become scarce, and further urbanisation is viewed as undesirable. The Hague Region and the South Wing part of the Randstad conurbation aim to implement 80% of their construction projects within the current urban fabric (infill policy). This is to be combined with improvements to public transport and the network of cycle tracks, while access by road is also to be improved. The case of The Hague region suggests that the administrative level of the city region in the Netherlands has its limitations in terms of planning and governance in the urban fringe:

- The most important green urban fringe areas are institutionally fragmented: parts of these areas are located outside The Hague region and belong to other city regions.
- The city of The Hague is quite dominant in the collaboration between the municipalities.
- The tasks, formal powers and budgets with respect to planning and landscape are limited.

For its financial resources it depends on national funds and the cooperation of its municipalities. *Concertation is the region's 'niche' when it comes to planning*. From a governance perspective, this could be a very effective niche. However, if concertation is the *only* resource, this may make the regional authority vulnerable and highly dependent on competences with respect to process management, facilitation, communication and networking.

### **Further reading:**

- [Municipalities of The Hague region](#) (maps) by Co Onderstal
- [The Hague region Analysis report](#) (pdfs) by Aalbers et al
- [Peri-urban enclaves of The Hague Region](#) (maps) by Co Onderstal

### **2.3.2 Hangzhou region**

*Current governing strategies and policies in Hangzhou region*

#### **FS 15 Governing strategies and policies in Hangzhou region**

*By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit - Munich, Hangzhou*

## **What is the issue?**

Hangzhou is a rapidly growing urban - rural region in Eastern China. Most of the growth takes place in the peri-urban areas. Hangzhou has developed innovative approaches for land use planning. The report analyses the main issues of peri-urbanisation in Hangzhou and the approaches adopted in planning to address these challenges. Strategies for peri-urban areas are explored in detail in three embedded cases. Urbanisation in China is of greatest importance both for China and the world. On the one hand, urbanisation is considered a key to economic and social development of China. On the other hand, it puts great pressures on society and the environment. Development of sustainable land use systems is a key to overall sustainability of rural-urban regions.

## **Methodology and Materials:**

The study was jointly undertaken by a team of Chinese and European researchers. It is based on documentary analysis (planning regulations and documents, statistics, maps, etc.), informal interviews, stakeholder workshops, field visits and interpretation of remote sensed data for delineation of peri-urban areas. While being mainly descriptive, it serves as a basis for the assessment of selected land use strategies in Hangzhou.

## **Results and Conclusion:**

The area of HangzhouCity proper covers 3,068 km<sup>2</sup> with a population of 3.74 million registered urban residents in 2003. As a consequence of the Chinese opening policy and consequent economic development, both urban and rural areas in Hangzhou experienced rapid development from 1978 to the early 1990s and the city sprawled outwards. The effects of quick expansion led to an imbalanced urban spatial structure and put farmland under pressure. The reform of administrative divisions, by which adjacent towns and villages became part of Hangzhou city, laid the foundations for the long-term, coordinated urban development of Hangzhou. Importantly, the idea of a monocentric city was abandoned in favour of polycentricity in order to relieve the pressure from the urban core. New centres were created in the west and the south.

The three cases and corresponding strategies of peri-urban development that were analysed are:

1. Xixi wetland area: successful case of the restoration of a large former wetland area which had been destroyed by uncontrolled sprawl and environmental pollution. Restoration of the wetlands and their protection in a NationalWetlandPark was at the core of the strategy to combine nature protection with development of tourism and high quality residential areas around the wetland.
2. Zhubantang area: the area is located to the west of Hangzhou city centre. It is characterised by traditional farming activities, including tea production, in a attractive landscape setting. However, the Zhubantang area was lagging behind in terms of social and economic development due to strong environmental restrictions and lack of infrastructure. Development of tourism facilities and of creative industries (in particular animation industries) are main elements of the new strategy to speed up economic growth and social development while protecting the natural and cultural heritage.
3. Binjiang is located in the south of Hangzhou. Designation as an economic growth zone has led to an inefficient, monostructured pattern of industrial areas. Adoption of a new strategy converted the area into a mixed use area with urban facilities. The report describes the main

elements of this strategy.

Compared with the European cases, urban dynamics in Hangzhou are outstanding. Distinctive strategies for dealing with the specific challenges of peri-urbanisation were presented. These case studies show that specific approaches to peri-urban land use planning are now being developed and implemented. Hangzhou must be considered an advanced case in this respect. The strategies are adapted to local conditions and needs. They are comprised of top-down planning instruments combined with economic incentives and social programmes (e.g. to compensate farmers who lost land). While there are apparent successes in achieving a better planned urban development, huge challenges still remain ahead. In particular protection of valuable farmland, environmental protection and social issues (farmers, migrant workers) need to be mentioned. To successfully address these issues may require fundamental changes, for instance in land use rights, the tax system and strengthening of bottom-up elements in planning.

### **2.3.3 Koper region**

*Current governing strategies and policies in Koper region*

#### **FS 16 Governing strategies and policies in Koper region**

*By Anton Perpar, Marina Pintar - Koper*

##### **What is the issue?**

The current planning system on national (Slovenia) and local level (Municipality of Koper) is described here. Slovenia has got no official regional structure yet, so tasks and responsibilities regarding spatial planning are presented here at the local and national level. The main aim of spatial planning, which is quite centralised in Slovenia, is to enable harmonious spatial development, balancing the different needs and interests of development with public benefits in the field of environmental protection, maintaining the natural and cultural heritage, protecting natural sources, defence and protection against natural and other catastrophes (ZPNačrt, 2007). Spatial planning is very important for harmonious spatial development and sustainable use of natural resources. Such development can be assured by the adjustment of development needs with protection demands in space in such a way as to achieve rational land use for individual activities. At the same time expression of interests, opinions and initiatives of all interested parties must be granted.

##### **Methodology and Materials:**

Current policies and planning strategies were studied from official documents of different ministries of the Government of Slovenia, discussed on workshops and in interviews with different spatial actors. Input variable were interviews and spatial documents and studies, such as the Act on Spatial Planning. Output variables were the description of current policies, principles of spatial planning, as well as spatial planning problems.

## **Results and Conclusion:**

In the field of spatial planning and management, the state prepares laws, policies, and other instruments, which are adopted by the National Assembly or the Government of the Republic of Slovenia. They define the spatial planning system and provide strategic spatial development objectives and guidelines. In addition to spatial development laws and strategic documents, the state also has the authority to take measures concerning spatial development activities and construction of national significance. The state uses laws and other strategic documents to provide frameworks for spatial planning at the regional and local levels. The state has the authority to monitor the legality of spatial planning at lower levels. If the local community fails to perform its tasks in the area of spatial management and planning, the state has the right - in special cases - to take alternative action. The state has also the responsibility to:

- Conduct and implement land policy,
- Maintain the spatial data system,
- Develop and encourage professional work in spatial planning, and
- Participate in matters of spatial planning and management at the international level.

Local communities have the original right to spatial management and planning of their territories, with the exception of spatial development activities that are under the direct jurisdiction of the state. Local communities are obliged to perform activities in the field of spatial planning and management, as well as planning pursuant to adopted laws, standards and criteria. Their principal task in connection with spatial management and planning is the concern for rational, mixed, and sustainable land use, as well as economic use of land plots in accordance with the principles of high quality living, working and recreation, and a healthy environment. In decision-making procedures, they are responsible for the direct participation of all involved and interested parties. They also care for and maintain the identity of the community by considering and protecting the natural and built characteristic features. Municipal spatial planning documents are adopted by municipalities (municipal council), but their conformity with national spatial planning documents must be confirmed by the Minister of the Environment and Spatial Planning. The Ministry of the Environment and Spatial Planning exercises supervision over municipal spatial planning documents. The purpose of the supervision is to check the activities of municipalities, which are obliged to follow goals and guidelines from national planning documents in their planning documents. In the Slovenian spatial planning system, spatial planning documents are organised hierarchically at national and local levels, whereby documents at lower levels may not be in conflict with documents at higher levels. National spatial planning documents are prepared by the Ministry of the Environment and Spatial Planning, while municipal documents are prepared by municipalities. Municipalities are responsible for the preparation and adoption of Municipal Spatial Planning Documents. Their basic task is to represent the public interest, and act in accordance with the law and superior spatial planning documents. An initiative for changing municipal spatial planning documents can be given by anyone, provided that such an initiative is well grounded.

## **Further reading:**

[Report on regional planning and decision making and its impact on land use in the urban fringe, Koper report](#)  
[Spatial Planning Act: ZPNačrt](#)

## 2.3.4 Leipzig-Halle region

*Current governing strategies and policies in Leipzig-Halle region*

### FS 17 Governing strategies and policies in Leipzig-Halle region

By Annette Bauer - Leipzig

#### What is the issue?

This fact sheet provides an overview on the spatial planning strategies concerning the Leipzig-Halle urban fringe. It aims to answer the following questions: How is land use be steered and directed? In particular, which alternatives exist to influence shrinkage and growth of the built environment in the Leipzig-Halle urban fringe? The past, rapid development of housing and industry in the urban fringe is considered a problem by interviewed stakeholders in the Leipzig-Halle region, as this coincided with population shrinkage (Sinn et al., 2008). Consequently such new development was not met by an equal demand by residents, firms and enterprises. Thus, there is generally a need for spatial planning strategies to direct and limit new development.

#### Methodology and Materials:

The following results are based on the identification and analysis of spatial planning strategies in the Leipzig-Halle case study (Sinn et al., 2008). A documentary analysis of strategies was carried out. Its focus lay on strategic topics and the strategies' conceptions. Then, a typology of strategies was developed in order to determine their essential appropriateness for limiting new development in the urban fringe. This overview and analysis of spatial planning strategies in the Leipzig-Halle region was used as background for the evaluation of selected spatial planning strategies in PLUREL Module 3 (see section "further reading").

#### Results and Conclusion:

The typology described below are constructed around the dimensions *spatial range* and *statutory support* of spatial planning strategies. **Spatial range:** spatial/administrative unit at which a strategy is implemented. Resulting types are local authority, region, federal state **Statutory support:** the level of statutory support available for the implementation of strategies. Resulting types are strategies with low (e.g. city networks), medium (e.g. contractual, inter municipal cooperation) and high statutory support (e.g. development plans) The typology was developed to judge the essential suitability of strategies for steering urban growth and shrinkage. Strategies at the regional level with high statutory support were considered particularly appropriate for this task. Application to Leipzig-Halle case study see attachment (Sinn et al., 2008). Based on the definition of strategy types, three regional strategies were selected for an in-depth analysis of their outcomes and processes: the Green Corridors strategy with strong statutory support, the Parthe floodplain protection strategy with medium statutory support and the Green Ring with weak statutory support. Further, the selection of strategies was informed by interviews with spatial planning practitioners, emphasising the need to protect cultural landscapes and green open spaces in the urban fringe against development (Sinn et al., 2008). The selected strategies contribute to this end, though in widely different ways, which

makes them particularly useful for a comparison. The regional level is well developed concerning spatial planning. However, not all strategies appear appropriate for limiting land consumption in the urban fringe. Strategies with some degree of statutory support were considered particularly appropriate for this task. Three strategies with differing degrees of statutory support were subject to an in-depth analysis and evaluation.

### **Further reading:**

- Haase, D., Bauer, A., Reuther, I., Schiffers, B., Schwarz, N., Seppelt, R., Weinert, J., 2009, PLUREL Regional workshop, Spatial Development in the Leipzig-Halle region, Helmholtz Centre for Environmental Research, Leipzig.
- Nuissl, H. and Rink, D., 2005, The "production" of urban sprawl in Eastern Germany as a phenomenon of post-socialist transformation, Cities, Vol. 22, No.2, pp. 123-134.
- Sinn, A., Haase, D., Walde, A., 2008, Analysis of regional spatial planning and decision-making strategies and their impact on land use in the urban fringe, Helmholtz Centre for Environmental Research - UFZ Leipzig.

### **2.3.5 Greater Manchester**

*Current governing strategies and policies in Greater Manchester*

#### **FS 18 Governing strategies and policies in Greater Manchester**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

The Manchester city-region shows a restructuring industrial city-region. It has a polycentric structure, with strong spatial governance (by UK standards), and a long history of urban fringe / peri-urban policies. Two area types were selected for more indepth study and consultation, each with active stakeholder organizations:

- South Pennine uplands: mixed industrial settlements, commuter towns, small scale agriculture, leisure and tourism.
- Red Rose Forest: Community Forest NW area, an area of mixed industrial settlements, with a partnership programme to rebuild a multi-functional green infrastructure.

Manchester shows a contrast to other higher growth EU city-regions: the population has recently started growing after decades of decline. While urban development is constrained by the Green Belt and similar policies, social / economic / cultural change and transitions in the peri-urban area are rapid. The issue is then how to respond to new policy agendas: climate change and green infrastructure, social cohesion and quality of life, and local economic development in the peri-urban.

## **Methodology and Materials:**

The research approach aimed to explore underlying ‘transitions’ in the peri-urban, mainly through structured interviews and workshops:

- Metropolization: an ‘urban transition’, networked across wider peri-urban and rural areas;
- Cultural capitalism: a ‘global transition’ with new economic / social structures;
- ‘Spatial ecology’: a ‘green infrastructure’ transition, with ‘localization’ and new identities of place.

Analysing policy and governance is surrounded with uncertainty: there are different views, the situation is changing, there is no single right boundary, and the impact / outcome of policies is difficult to define. With a ‘relational governance’ approach, the main system-level qualities can become more clear: innovation, intelligence, resilience qualities for governance and policy development.

## **Results and Conclusion:**

The restructuring of peri-urban Manchester continues. Globalization drives high value mobile industries, which move to greenfield sites near motorways & airports. The inner city is seen as polluted, unsafe, and failing in public services, so households with the choice relocate into rural areas. Many of these suffer from declining economies, so newcomers are not always a bad thing, except when they force up values and displace local people and businesses. Farming declines and shifts towards garden centres and horse stables. Local tourism picks up the industrial heritage theme by catering for mobile professionals, and becomes the default choice for struggling local businesses and employees. Some of the outward spread of urban development is limited by Green Belt and similar spatial policies. Overall the shape of the city-region is moving towards the globalized metropolitized ‘agglomeration’, with transport stress & social / political fragmentation. The fact that there is no overall peri-urban ‘strategy’ is part of the problem: there are different policy responses for different themes at different spatial scales, which do not coordinate. The peri-urban areas are the location of most urban infrastructure, with high levels of urban pressure and pollution. Many areas are reclaimed for multi-functional leisure and amenity uses, but with conflicts between conservation and airports, motorways and business parks. Transport congestion is severe on road and rail, and the fragmentation of public transport is a problem, particularly in the peri-urban. The spatial planning system up to 2010 had 3 main levels (the new government of 2010 is shifting everything to the local level, and the details are to be worked out):

- National government sets overall planning policy, with ‘national policy statements’, and the Infrastructure Planning Commission for major projects;
- "Regional Spatial Strategy" is prepared by a consortium of local authorities, to manage housing allocations, infrastructure and criteria for development;
- Local Development Frameworks show the spatial criteria and landuse maps at the municipality level.
- Also, Multi-Area Agreements are important for coordination of clusters of municipalities.

There are some important spatial policy agendas: Green Belt, with a ring around the urban area of ‘no new development’, which covers 47% of Greater Manchester. There is brownfield policy, that more than 60% of new development should be on recycled urban land (Greater Manchester has achieved nearly 80%). Behind these is a general policy assumption that that open land is protected,

unless there are specific reasons for its development. Overall the Manchester city-region shows one possible path for other areas looking towards a post-industrial future. There is a strong spatial planning system, and long experience in partnership agencies and multi-functional land-use, which has helped in the greening of the peri-urban environment. There are also powerful forces of globalization and privatization, social exclusion and fragmentation. These raise challenges for governance and spatial policies.

#### **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on land use in the urban fringe, Greater Manchester report](#)

### **2.3.6 Montpellier region**

*Current governing strategies and policies in Montpellier region*

#### **FS 19 Governing strategies and policies in Montpellier region**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

#### **What is the issue?**

France was characterised by a historically highly centralised power which has, during the last decades, turned to a decentralised territorial administration. In the process of urban planning, state officers play a role of advice and give the state position on main issues of urban planning. State officers also control the decisions made by the locally elected. Except concerning some issues of national interest, all decisions on urban planning are made locally, in respect of national law. Thirty years after the first step of decentralisation, but less than 10 years after the creation of Montpellier Agglomeration as local government, what are the governing strategies and policies in Montpellier region? The recent facts regarding territorial governance in Montpellier region are the creation of Montpellier Agglomération associating 31 municipalities and the drawing up of its territorial coherence scheme. Concerning periurban areas, it is important to know the respective power of national and local governments. Knowledge about decision arenas and stakeholders involvement also matters, as local factors interacting with global driving forces on the future of periurban land use relationships.

#### **Methodology and Materials:**

The different steps of the creation of Montpellier as new inter-municipal cooperation establishment were analysed, as well as its operating in the management of new development policies. Strategies developed in spatial planning were our focus. National legal framework in the field of urban planning was studied and related to local spatial planning. This concerns first of all the SCoT (Scheme of Territorial Coherence), its preparation, design and implementation. Main variables to study territorial governance are: administrative perimeters; rules of decisions, the way they are made and implemented; population (number, social composition...); decision arenas; stakeholders, their power, interests, involvement, alliances etc. Governance tools are rules and decision making

agencies. Output variables are laws or document expressing policies (values, political choices and orientations etc.). A major issue for the governance of Montpellier city region is the possible enlargement of its perimeter in order to establish an unified local government for the whole urban area that would be powerful to deal with sustainable development issues. But there is no current political agreement on this project. This scenario also induces the risk of excess centralisation on Montpellier city.

### **Results and Conclusion:**

In 2000, the national “urban solidarity and renewal law” set up new urbanism rules with the local urbanism plan PLU. This law now also imposes spatial planning at the inter-communal level with the scheme of territorial coherence, SCoT (Schéma de COhérence Territoriale). Consistently, SCoT and PLU should be compatible, and participative methods are also supposed to be implemented in the local planning process. The main planning tools and strategic issues for public policies are

- An “Urbanism code” at the national level
- The Regional Scheme for Sustainable Territorial Development, which is a global document indicating general objectives for regional planning at the regional level
- The central document SCoT (Scheme of Territorial Coherence) with other documents, such as the Plan of Urban Mobility at the sub-regional level which is the most important level in the French planning system as it deals with the scale of functional urban regions
- PLU (Local Urbanism Plan) and Area of Concerted Planning at the commune level.

The recent striking facts regarding territorial governance in Montpellier city region are the creation of Monpellier Agglomération and the drawing up of its territorial coherence scheme SCoT. The city-region of Montpellier has one of the highest demographic growth rates in France for the last decades but this growth was only - hardly - managed at the commune level, with no planning scheme at the scale of the functional urban area. Montpellier Agglomération was created in 2001 (38 communes with more than 400,000 inhabitants). But a difficulty lay in the sharing of power of decision in the communautary council: with nearly 250,000 inhabitants, Montpellier city representatives have a 50 % vote power. It ended in local political conflict: 7 surrounding communes went out of Montpellier Agglomération, which remained with 31 communes left in 2005. Some economical issues of the creation of Montpellier Agglomération regarded tax sharing and new forms of competition among communes, according to other gains and costs of economic activities and infrastructures: what will be the territorial solidarity among members of Montpellier Agglomération? Main environmental issues are quality of life, housing and transportation, water and waste management, preservation of open spaces, management of natural risks. The SCoT has been drawn up from 2002 to the end of 2005 and different experts contributed to the diagnosis and to the final planning scheme. Different state officers were also associated, with an advisory role. After the legal “public utility enquiry”, the SCoT was approved by the Communautary council in february 2006. It sets the main planning orientations in Montpellier Agglomération for the next 10 years. As Montpellier Agglomération only associates 31 municipalities now, it does not control the whole territory of the functional urban area (93 municipalities). The local government in charge of the SCoT, Montpellier Agglomération, can be considered as the most powerful stakeholder regarding the management of peri-urban land use. Their main objective is to carry on feeding local economic growth on the basis of growing population. But, this development has to be coordinated between municipalities and realised with higher density in order to spare space and preserve the long term attractiveness of the city region. The preservation of farmland and farming in urban fringes then appears as a challenge for Montpellier Agglomération. Farmers are major stakeholders

for land use in peri-urban areas; though they do not hold a strong position in relation to Montpellier Agglomération and generally in the territorial governance arena on this issue. Besides, as Montpellier Agglomération and the SCoT are quite recent, stakeholders are searching for new positions and interactions.

#### **Further reading:**

- [Key rural-urban issues and stakeholders in Montpellier region](#) (pdfs) by Jennifer Buyck, Francoise Jarrige, 2008

### **2.3.7 Warsaw Metropolitan area**

*Current governing strategies and policies in Warsaw Metropolitan area*

#### **FS 20 Governing strategies and policies in Warsaw Metropolitan area**

*By Mirosław Grochowski, Piotr Korcelli - Warsaw*

#### **What is the issue?**

The Warsaw Metropolitan area is an example of a mono-centric urban system. The city of Warsaw and the surrounding municipalities experience fast and dynamic development that has crucial impact on environment and future spatial conditions of development. It especially concerns peri-urban areas. The urban pressure comes from migrations of population and migration of firms that locate themselves in the most attractive area for business development in Poland. Immigrants are looking for jobs opportunities. Identification of drivers and trends of development is the first step before formulating strategies to deal with development problems and challenges. Metropolitan cities and metropolitan areas are perceived as "engines" for economic development of regions and localities. Spontaneous development processes may damage assets that are now attractive for newcomers (both people and firms). That's why development policies at regional and local levels must be focused on protection of these assets and setting rules for sustainable development.

#### **Methodology and Materials:**

Identification of drivers and trends was performed based on:

1. Information gathered during field studies in selected municipalities of the Warsaw Metropolitan area (interviews with representatives of local governments);
2. Information gathered during studies on behaviour of firms (location preferences, motivation of firms owners, perception of environment for business development);
3. Analysis of statistical data on changes in location of population and businesses.

We used data and information on population number and density, number of firms and information on their profile (type of activities: products, services), and changes in land use pattern.

The Warsaw Metropolitan area is strongly differentiated in terms of level of economic development

and land use pattern. The trends and drivers identified are of universal nature. However, it is necessary to analyse specific local conditions to decide about the most important drivers and potential consequences for environment conditions and functionality of the whole system.

## **Results and Conclusion:**

The main drivers identified are:

- Needs and preferences of people that cannot be met in their former places of residence;
- New life style of the "metropolitan class" - people from Warsaw that are looking for better living conditions which (as they believe) can be found in the suburbs or areas that are located relatively close to Warsaw; rising economic status of population that enables them to choose place of residence;
- Free mobility that results from the lack of any restrictions when it comes to the choice of place of residence;
- Availability of land for development in the vicinity of Warsaw;
- rising costs of living in Warsaw;
- Polarisation of development in the region of mazowieckie voivodship that results in differentiated opportunities and chances of getting access to goods and services.

These drivers bring changes to the pattern of population distribution and location of firms. The trends of the relative centralisation are very strong and stable. They contribute to the rising urban pressure and trigger changes in the land use pattern. The identified trends are perceived by many municipalities surrounding Warsaw as chances for development. This is the reason why they decide to dedicate more and more land for development in terms of building industrial or housing areas. Results of analysis indicate, that municipalities are focused on development of land for housing purpose. The reason is that more inhabitants will contribute to the tax base development and will improve the financial situation of municipalities. Local authorities are focused on looking for new sources of income. There is no critical analysis of potential results of the increased number of population. Results of the studies justify the opinion that development processes are not being seen from the perspective of the whole Warsaw Metropolitan area but from the perspective of individual municipalities. This leads to fragmentation of responsibilities for sustainable development of the Warsaw Metropolitan Area. There are no legal regulations to govern development in the Warsaw Metropolitan area. There are no legal or administrative instruments to stop or guide suburbanisation in the region.

Development processes in the Warsaw Metropolitan area are similar to those from well developed countries in the EU and other regions. Results of the studies prove that the similar path of development will bring the same or similar results in terms of spatial and functional structure of the region. Lack of proper response from public authorities will contribute to chaotic development and negative environmental consequences. It also concerns peri-urban areas.

## **Further reading:**

- [systemic conditions for spatial planning](#) (images) by PAS
- [Warsaw Metropolitan Area in the region](#) (images) by MBPR Warsaw

## 2.4 Outlook

*What might the future look like?*

### FS 406 Future perspectives of peri-urbanisation in city regions

By Gertrud Jorgensen - Copenhagen

#### What is the issue?

In general, scenarios provide a structure for imagining future possibilities, testing uncertainties, analysing impacts, and constructing policy responses. The dynamics of peri-urban development and land use change are complex and multi-level, beyond the capacity of any technical modelling or policy analysis method. So it is essential to work with scenarios: they combine technical analysis and modelling with more qualitative issues which explore social, cultural, economic and political changes (EEA, 2007). In PLUREL, the MOLAND model was used to simulate further land use in the case study regions of The Hague, Koper, Leipzig-Halle and Greater Manchester. To ensure that the analysis of spatially explicit scenarios for these case studies is robust and coherent, a common scenario framework was developed. For each case a baseline scenario exists plus two further scenarios that reflect different pressures from socio-economic drivers on the one hand, and different planning responses on the other hand. Moreover, the case study specific scenarios need to be compatible with the overall scenarios used:

The common framework is important for the overall robustness of the scenario building, especially for the possibility to make cross-case analyses and comparisons.

#### Methodology and Materials:

Based on the mentioned PLUREL scenarios, local stakeholders defined their specific scenarios. The discussions based on a matrix (see ?references and further reading?) was co-developed by researchers and stakeholders from the respective regions. General storylines were specified and enriched with local details, e.g.: what means "high population growth" in your region? The general storyline for all case studies comprised a population growth as well as an increase in working places under a weak planning regime, comparable to the PLUREL hyper-tech scenario. The second general scenario resembles the peak-oil scenario with a low-growth storyline under a strong planning regime. A third scenario for the case studies is a smart growth scenario with a strong growth under strong planning conditions. For each of the four case studies two scenarios besides the basic scenario were selected, specific story lines developed and the scenarios were finally modelled using the MOLAND model:

The case-study specific scenarios do not necessarily represent predictions of the future; they rather identify various development pathways under certain conditions or assumptions. The purpose of the case-specific scenarios is to model and so visualise these possibilities as a discussion basis for local stakeholders. Therefore it was decided to simulate rather extreme scenarios in order to visualise obvious differences among the scenarios.

## **Results and Conclusion:**

The attached matrix reflects the possible scenarios for the case study regions. Here, the vertical reflects the difference between low growth and high growth in economic and demographic terms, under the assumption that a growing population and economy results in an increase in pressure on the intake of new urban land. The horizontal reflects liberal (weak) versus strict planning regimes, under the assumption that these will influence urban growth directions and spatial patterns.

The centre of the matrix represents a business as usual scenario, which is different from case to case, depending on the local conditions. In general, the applied scenario framework worked out and allows for the comparison among the case study specific scenarios.

## **Further reading:**

### [Matrix of development scenarios for the case study regions](#)

EEA, 2007. Land-use scenarios for Europe: qualitative and quantitative analysis on a European scale: Technical Report 09/2007

## **2.4.1 The Hague region**

*Development perspectives of peri-urbanisation in The Hague region*

### **FS 21 Future land use change scenarios - underlying storylines for The Hague region**

*By Gertrud Jorgensen, Pat van der Jagt, Judith Westerink - Copenhagen, The Hague*

#### **What is the issue?**

Scenarios are used to try to get more insight in complex futures. In the case of The Hague region, we developed storylines with stakeholders for futures that might become reality. What would happen with economy, population, land use, landscape and quality of life? Are the authorities sufficiently prepared for these futures? Do the current strategies hold up in those situations?

Through interaction with each other, the stakeholders are encouraged to start thinking 'out of the box' and to make connections that models cannot easily produce. The future cannot be predicted: we only know that it will be different from today and from the past. Still, society expects governments expected to be prepared for anything and to shape the prerequisites for a sustainable society for next generations. Interrelationships between all kinds of factors that influence our future are complex. Still, it is very useful to think about 'what might happen'. The unlikely has happened before.

#### **Methodology and Materials:**

In a 2-day workshop, stakeholders developed storylines for the following scenarios, based on the PLUREL scenario framework:

- Peak oil: globalisation, world market, international cooperation and strong planning on

- environmental and social values. Shock: extremely high energy prices.
- Fragmentation: regionalisation, bottom- up policy development and strong planning on environmental and social values. Transition: fragmentation.

Four current strategies were confronted with these futures.

### **Results and Conclusion:**

The Peak oil scenario painted quite a favorable picture of The Hague Region. International cooperation and the world market are already important for the regional economy and there is little industry. Peak oil would not lead to a deep economic crisis, like in other regions. The greenhouse sector would find new opportunities in energy production. Strong planning would lead to implementation of the current Regional Structure Plan, with the majority of urbanisation inside current urban fabric, with concentrations around public transport knots. Multifunctional, multi-layered and intensive landuse would be necessary because of scarcity of space and the required quality of life. This policy would leave most of the green peri-urban enclaves intact. However, land prices would still be very high, too high for a viable agricultural sector, which is deemed indispensable for the maintenance of the landscape. A landbanking strategy would suit well in this situation, in which the government would purchase the land and lease it out to farmers. Green and Blue Services, however (local agri-environmental schemes) would be less useful. Discourse development, trying to make green space important, could maybe play a role at policy level. The Fragmentation scenario, which is often regarded as the 'sustainability corner', would be disastrous for The Hague region in economical terms because the region depends on globalisation. Fragmentation and international distrust would lead to protection of markets and an insufficient answer to the problem of climate change. The region would aim for self-sufficiency in drinking water, energy and food, but many food products still need to be produced elsewhere because of limited space and the soil type. Fragmentation and bottom-up initiative would lead to social injustice, because housing projects would predominantly serve the rich and the handy. The greenhouse sector would collapse, but then recover. There will be space for urbanisation in the greenhouse areas, however. Protection of green open space would become problematic, because of private initiative and lack of funds with the government. In spite of population shrinkage, there will still be urbanisation pressure. Furthermore, there will be development of private parks and campings. The strategy of reurbanisation would be used to prevent deterioration of the urban core, but financing would be problematic. Restructuring the greenhouse areas would postpone the need to build in green open space. Green and Blue Services would be an option, but they would need private funding. Land banking would not work by lack of funds. Discourse development may be an important instrument in the Fragmentation scenario, although the many subcultures may not make it easy. The storylines are used as input for the MOLAND model. This should lead to insights to land use changes in the context of different futures.

#### **2.4.2 Koper region**

*Development perspectives of peri-urbanisation in Koper region*

#### **FS 23 Future land use change scenarios - underlying storylines for Koper region**

*By Gertrud Jorgensen, Anton Perpar, Marina Pintar - Copenhagen, Koper*

## **What is the issue?**

Three land use scenarios were run for the Koper municipality from 2007 to 2025. The parameters for the scenarios - the storylines - were set in collaboration with local stakeholders at the PLUREL meeting in Koper in March 2009. The scenarios were developed within the framework described in fact sheet . Three scenarios were chosen, a "Business as usual scenario", a "Hyper-tech" (A1) and "Peak oil" (B1), in order to describe drivers and planning options as different as possible. This fact sheet describes the scenario storylines and input to the scenario building, while fact sheet describes the actual results. Building of storylines in cooperation with stakeholders is necessary for the trustworthiness of the final scenarios and for their relevance for the planning process in the region.

## **Methodology and Materials:**

The scenarios were chosen and the storylines developed at a meeting with stakeholders in Koper in March 2009. Storylines and data input were further detailed in cooperation between JRC and planners and researchers from case study Koper. Input variables are storylines, land use maps, local, national and European statistics on population growth, economic variables and planned infrastructure. Output are coherent storylines, that will serve as input for spatially specific land use scenarios. The scenario building was conducted via the model Moland in conjunction with the development of storylines. This way, it was possible to visualise uncertainties of development and their consequences. This approach can assist in regional planning because the impacts of scenario parameters can be seen on the surrounding area's land use.

The main use of the model's output should be the incentive to "see" and try to understand spatial processes through their possible effects instead of relying on the model to accurately predict the future.

## **Results and Conclusion:**

All scenarios were built on the following common characteristics of Koper: In the historical city centre, development is limited, while the peri-urban fringe is dynamic and undergoing massive change. There is competition for the best agricultural land between agriculture and housing. More than one third of the municipality is Natura 2000 area. The peri-urban area has diverse land use and large vacant areas.

There is a large port which occupies a significant land mass and has an important economic role in the municipality as well as in the country. There is also a vast rural hinterland where inhabitants have abandoned the traditional way of life in favour of more urban lifestyle; this is encouraged by increased mobility and accessibility to urban centres. The scenarios are characterised as follows:

### **Business as usual**

Economy and population is steadily growing. Employment increases in the services sector, while it is steady in industry. Energy production is on the rise. Employment in agriculture steadily increases, while land area for this sector is decreasing. Individual houses are mainly found in the peri-urban and rural areas, and mainly as densification along roadsides, but also the coast is attractive for apartment buildings. There is a significant increase in individual housing, a small increase in block housing and a large increase in residence buildings. Commerce and services remain near the city centre. Zoning is happening only for Natura 2000 areas. **Hyper-tech scenario**

This scenario is characterised by very high economic growth. The population reaches a peak growth and a decline after 2020. There is avid building with few (if any) zoning restrictions in order to emphasise absence of planning. The scenario includes an economically driven plan with

concentration on tourism and the port sector with an increase in hotels and associated infrastructure, and a decrease in zoning of natural areas near the coastline. Building is unrestricted and the port grows inland. There is a new access to the port, a new highway to Izola and a selected variant for the motorway from Koper to Dragonja. Also, there is a new rail access to the port and a railway to Trieste. New “seeds for growth” are planted by the municipality (marina, swimming pool, sports complex). **Peak oil scenario**

This scenario is characterised by services and information technology rather than by industry and production. Emphasis is placed on social issues and environmental sustainability. The population reaches a peak and declines after 2020. Building is restricted using strong zoning restrictions. Soil fertility classification is respected and Natura 2000 is zoned for no building. There are economic incentives for agriculture and a tendency to allocate in the hinterland, also with eco-tourism.

Densification happens within the areas of the port but the port does not spread. Housing is encouraged in the hinterland to relieve pressure on the coastline. Infrastructure is a branching rail to hinterland and from Koper to Izola. It is possible for modellers, land use researchers and stakeholders together to agree on three different, yet coherent and possible scenarios for future development of a rural-urban region. It is possible to develop these storylines into spatially specific land use scenarios that illustrate consequences in terms of land use for the specific scenarios (see fact sheet ).

#### **Further reading:**

[MOLAND\\_Koper](#) (pdf) by Sarah Mubareka

### **2.4.3 Leipzig-Halle region**

*Development perspectives of peri-urbanisation in Leipzig-Halle region*

#### **FS 24 Future land use change scenarios - underlying storylines for Leipzig-Halle region**

*By Gertrud Jorgensen, Dagmar Haase - Copenhagen, Leipzig*

#### **What is the issue?**

This factsheet explores the underlying storylines of the land use change modelling (using the model MOLAND) in the case study Leipzig-Halle.

Three land use scenarios were run for Leipzig from 2007 to 2025. The parameters for the scenarios - the storylines - were set in collaboration with local stakeholders in February 2009. The scenarios were developed within the framework described in fact sheet . Three scenarios were chosen, a business as usual scenario, a Hyper-tech and a Eco Environmental (Peak oil), in order to describe drivers and planning options as different as possible. Explorative and quantitative storylines are an indispensable base for any kind of quantitative and spatially explicit land use (change) modelling: it provides the framework of imaginable futures of the region and relates the past development to it.

#### **Methodology and Materials:**

The methodology includes a kind of explorative (qualitative) and quantitative (trend) scenario

technique. We developed a scenario variable matrix using: the total population, the GDP of the region, and the role of the planning (strong, weak).

Scenarios were developed in cooperation with stakeholders at a workshop held in February 2009. Storylines and data input were further developed in cooperation between JRC, planners and researchers from case study Leipzig.

Input variables were storylines, land use maps, local, national and European statistics on population growth, economic variables and planned infrastructure. Output are coherent storylines, that will serve as input for spatially specific land use scenarios. Scenario building in Moland and development of storylines is a tool to visualise uncertainties of development and their consequences. Thus it can assist in regional planning because the impacts of scenario parameters can be seen in the surrounding area's land use.

### **Results and Conclusion:**

Three storylines for the future were developed.

Business as usual scenario, based on a moderate growth in GDP and population, based on logistics and manufacturing. Planned infrastructure is taken into account.

The Hyper-tech scenario foresees stronger growth in population and an economy based more on services and knowledge based industries. Passive planning leads to peri-urbanisation.

The Eco-environmental scenario also foresees growth, primarily in services. A strong urban regeneration policy is foreseen. The storylines for Leipzig-Halle reflect the imaginable futures of population, economy and planning impact in the urban region of Leipzig-Halle. They were accepted by the stakeholders of the region.

Thus it is possible for modellers, land use researchers and stakeholders together to agree on three different, yet coherent and possible scenarios for future development of a rural-urban region. It is possible to develop these storylines into spatially specific land use scenarios that illustrate consequences in terms of land use for the specific scenarios.

### **Further reading:**

- [Booklet Scenario Workshop Leipzig-Halle 2009](#) (pdf) by Dagmar Haase et al.

### **2.4.4 Greater Manchester**

*Development perspectives of peri-urbanisation in Manchester*

#### **FS 25 Future land use change scenarios - underlying storylines for Greater Manchester**

*By Gertrud Jorgensen, Joe Ravetz - Copenhagen, Manchester*

### **What is the issue?**

Scenarios are a structured way to explore the future. They can help to anticipate possible risks and

opportunities in the face of rapid and unpredictable change. The PLUREL project applies 4 main scenario storylines to explore the possible futures for peri-urban areas across Europe. This sheet looks at the application of these scenarios to the Manchester case study (i.e. the Manchester "Rural Urban Region"). This includes

- Main drivers of change and scenario issues in the Manchester city-region.
- Results from the MOLAND modelling
- Implications for policy and further research.

The Manchester city-region is changing rapidly. The economic and social structure is in flux, even while much of the landuse is set in the formal spatial planning system. The scenario method enables exploration of topical questions: e.g. how to fund green infrastructure in an age of deficits and privatisations? Or, how can local market towns co-exist with globalised business parks?

### **Methodology and Materials:**

Key parameters in spatial development are being formed as inputs to the Moland Manchester model:

- Housing forms, patterns, and landuse density are all relevant to the growth and pattern of peri-urban development;
- Transport infrastructure may promote in- or out-migration, counter-urbanisation, or re-urbanisation.
- Spatial planning policy may aim to manage or contain growth in larger cities, smaller cities and towns, or smaller rural settlements.

We have also explored challenges, dilemmas, contradictions and conflicts. These can open up new possibilities and/or opportunities, which more straight line scenarios might miss. For instance:

- Is the landscape mainly for production / leisure / nature conservation, and who are the winners or losers in these options?
- Will peri-urban areas be peripheral and dependent, or the valued "green heart" to the cities which are both loved and hated?

### **Results and Conclusion:**

**Hyper-tech scenario (A1):** In the Manchester city-region, the city / airport / business park system grows as a global hub. Economic growth is strong and the pressure for development is intense. This leads to value "peaks" in popular locations, with house prices of five or ten times the average. One effect is that other locations become sinks for people not on the housing ladder, where social problems multiply, next door to their wealthy neighbours.

**Extreme water scenario (A2):** Most rivers now produce a 100-year flood every other year: the flood retention areas are used to capacity, displacing parkland, farmland and habitats: and the ideal of planned multi-functional land use in the peri-urban becomes very difficult. The residential areas which are regularly flooded seem to be always in the poorest neighborhoods: this raises class and racial tensions almost to breaking point, as the rich on the hills are accused of letting stormwater roll down onto their neighbors. As public finances are very short, at a time of economic stagnation, there is little funding for flood defences.

**Peak oil scenario (B1):** scenario In peri-urban areas there is continuing flux of new population movements, and changes in the lives of existing residents. Peak oil affects production and consumption chains in food and farming: construction materials: industrial manufacturing: energy, water and waste: and many logistics-based service sectors, such as tourism, catering, and retail in general. Around the conurbation the peri-urban area takes on a new importance, as the primary site for newly localised supply chains, which have to compete with the growing demand for high-quality living and working environments. Overall the policy aspiration is to reshape the peri-urban into a model sustainable city-region: but this generates strong resistance. Essential services such as vehicle recycling go underground, as do cultural demands such as youth events.

**Social fragmentation scenario (B2):** The dreams of campaigners seem to be coming true, with a shift towards the local community for many kinds of social and economic life. This can generate a high quality of life for communities with good levels of housing, jobs and opportunities. But for communities who are already disadvantaged or excluded, segmentation can be a downward spiral. But many communities build fences and gates: the high value environments of the Pennine uplands and the Cheshire lowlands are protected with a range of social and economic thresholds, such as schools, family ties, small business levies etc. Lower value communities tend to be pushed towards lower value locations, in the shadow of grey infrastructure such as motorways, heavy industry, waste management and waste water plants. The alternative possibilities for urban and spatial development are the subject of PLUREL, and yet they do not always link very directly to the "driving force scenarios". Location choices and urban form patterns are clearly the outcome of many forces, only some of which are described in the driving forces scenarios. Others are the outcome of accidents of geography, history or politics: the uncertainties of lifestyle and behaviour: or the not always rational choices of businesses or policy makers. For example under the Hyper-tech scenario (A1), does the new information technology enable the population to live and work in the countryside, or to commute greater distances, or to live in the middle of the city with a better quality of life? Each of these possibilities is plausible, and each is very sensitive to the future of peri-urban areas.

#### Further reading:

- [Summary of model inputs](#) (tables) by JR
- [D3-4-3 future scenarios in Manchester](#) (pdfs) by JR
- [Summary of spatial scenarios](#) (tables) by JR

## 2.5 Peri-urbanisation is complex

*How complex is peri-urbanisation?*

### FS 29 Complexity concepts

*By Wim Timmermans - The Hague*

#### What is the issue?

In this study we focus on the multifunctional peri-urban zone in which we expect non-linear development to take place. We discuss the possible consequences of this perspective for analysing the urban-rural relationship and planning interventions in the peri-urban development. It is suggested to consider fundamental changes in urban-rural relationships as transitions. Transitions provide us with an alternative perspective which could contribute to planning mechanisms that strengthen the supportive role of planning by influencing spatial development processes instead of controlling spatial development. The classical contrast between the urban and the rural is diminishing and therefore giving rise to a third type of landscape, the peri-urban area. This area represents a changeable zone within the urban-rural continuum, where high dynamics can be found. As rural and urban interests are becoming more interwoven and complex so is the urban-rural relationship. In order to enhance our understanding of peri-urban processes we suggest incorporating a non-linear perspective on spatial developments.

#### Methodology and Materials:

Through a literary review and discussion sessions with experts a theoretical framework of the concept of transition is constructed. Subsequently, this concept is used to study the city regions in depth, using primarily qualitative methods, focusing on which developments influenced fundamental changes in the peri-urban area. Data is collected in various ways, for example by interviews with stakeholders and experts, using regional and local statistics, policy documents and scientific articles.

#### Results and Conclusion:

We define a transition as a gradual, continuous process of structural change within a society or culture. Transitions can be seen as the outcome of the constant dynamism of complex systems, such as the peri-urban area, due to non-linear, self-organising behaviour driven by co-evolutionary interactions. Within a transition process four phases could be distinguished:

- predevelopment
- take-off
- acceleration and
- stabilisation.

During these phases a dynamic equilibrium of stable and dynamic elements constantly shifts and

enables a system to evolve. By looking into the various cases, we were able to distinguish different phases of dynamics which subsequently can be considered as transitional phases. In all cases the development of the peri-urban area was influenced by processes originating from the macro, meso as well as micro level. Besides, the various drivers for change are distinguished as so-called push or pull-factors. Periods dominated by push factors are often marked by decreasing coordination and supply-driven development, away from an "old level of stability".

Subsequently, by the creation or emergence of pull factors coordination is increasing and developments mostly are characterised by a demand driven economy. The "pushes and pulls" of the various cases enhanced our understanding of non-linear peri-urban development and might provide insights in European trends. Though the uniqueness of each system embedded in their own specific context creates diverging paths of development. All over, the various city regions could learn from their partners when taking into account the different local conditions, processes and time frames. In general, the concept of transition could help us to observe and to understand the emergence of a reality within cities and regions. In response to this, we suggest planning to enhance static traditions, by encouraging co-adaptation and co-accommodation between the flows of case situation and contextual environment. Although non-linear peri-urban developments are evolving as a result of self-organising behaviour and autonomous drivers to a certain extent, spatial planners can play a vital role in guiding peri-urban change. Spatial planners as well as policy makers have to become aware of different push and pull factors, autonomous or induced processes, opportunities and conditions, in order to reduce unwanted path dependencies. By using a multilevel framework they could anticipate on macro developments and facilitate and initiate bottom-up experiments on the micro level. Since multiple transitions could occur in the future, anticipation and adaptation become the key-issues.

### **Further reading:**

PLUREL deliverable report: [A historical analysis of cases, context and functional causes of transitions and the way these transitions were supported by planning and management](#)

#### **2.5.1 Complexity in the case study regions**

*How complex is peri-urbanisation in the case study regions?*

##### **FS 1 Guidelines to handle complexity in the case study regions**

*By Wim Timmermans, Gert de Roo, Ward Rauws - The Hague*

##### **What is the issue?**

In this study we focus on peri-urban development in various European city regions. In this study it is suggested to consider fundamental changes in urban-rural relationships as transitions. Therefore, the concept of transition is used for analysing the development of city regions of The Hague, Montpellier, Leipzig and Warsaw in order to enhance our understanding of peri-urban change. The peri-urban area represents a multifunctional and changeable zone within the urban-rural continuum, where high dynamics can be found. As rural and urban interests are becoming more interwoven and complex so is the urban-rural relationship. Through a comparison of peri-urban changes within

various city regions we can enhance our understanding of the processes driving peri-urban development and may eventually contribute to a new perspective on spatial planning.

## **Methodology and Materials:**

The case study regions are studied in depth, using primarily qualitative methods. The objective was to analyse which case-related developments influenced fundamental changes in the peri-urban area. Data was collected in various ways, for example by interviews with stakeholders and experts, using regional and local statistics, policy documents and scientific articles.

## **Results and Conclusion:**

If we compare the peri-urban development of the city regions, similar types of drivers could be identified. Demographic change has been an important "push" for a transition in all cases. However, a fundamental change of the urban-rural relationship was pushed forward in combination with other drivers. In general, the decline of economic activities traditionally dominating the surroundings supported a take-off for transition. In Warsaw there is the decline of the heavy industry, in Montpellier the wine crisis, in Leipzig the decline of the mining industry and in the Greater The Hague region a decrease of the economical benefits of dairy farming.

Again some similarities could be found when we reflect on the various pulls towards a new level of development. Unfolding leisure activities could be regarded an innovative and additional economical sector driving peri-urban development. Examples are: the open mine casts which are turned into recreation and nature lakes in Leipzig, the link between farming and tourism in Montpellier, the multifunctional mix in Marchfeld West outside Vienna and the leisure area, the "Big V" in The Hague region. Furthermore, organisational and institutional reorientation of effective spatial management of peri-urban areas is progressing in all cases. Inter-communal organizations are introduced to contribute to an integrated urban-rural relationship. However, the uniqueness of each system embedded in their specific context creates diverging paths of development. As a consequence of the diverging paths of development, each case has its own timeframe and development processes rarely evolve in parallel. Moreover, the case studies raised awareness that peri-urban development is partly driven by interlinked autonomous processes of which some might extend beyond the scope of traditional planning strategies. Therefore, it could be argued that in managing non-linear system behaviour planning should not focus on predicting future development. Instead, it should be concerned with anticipation of the emerging autonomous processes. Another fact sheet is available on this subject: ;providing information on the theoretical background and the synthesising report "Peri-urban dynamics; the exciting phenomenon of transition". Four conclusive statements could be drawn when overviewing all case studies. First of all, within the development of the urban-rural relations processes of self-organisation and adaptation to the ever changing context could be identified. Therefore, an integrating concept complexity theories in spatial planning could be supportive in understanding of peri-urban development. Secondly, relatively stable stages and more dynamic phases can be identified in peri-urban development processes. Thirdly, we suggest that the distinction of 'push and pull' factors could enhance our understanding of drivers behind processes of structural change. In addition, international comparison of 'push and pull factors' could be beneficial for planners in unravelling possible paths of development. Finally, taking historical developments into account could be helpful in these attempts, because they seem to be of influence on present and future developments.

## 2.5.2 System dynamics model

*A system dynamics model for peri-urbanisation*

### FS 28 A system dynamics model for peri-urbanisation

By Dagmar Haase - Berlin

#### What is the issue?

This system dynamics model for peri-urbanisation demonstrates dynamics and feedbacks between demography, housing preferences and supply of residential land use.

The model approach aims at being a helpful tool for understanding complex housing demand-supply processes based on household location preferences, choices and feedbacks of this decision-making. Demographic change, suburban growth and inner-city shrinkage are challenges for urban planners and policy-makers in post-industrial, modern societies. Simulation models can help to understand complex dynamics and to derive scenarios for the future. The shrinkage of urban regions is a trend in numerous parts of Europe but is not included very well in urban simulation models so far.

#### Methodology and Materials:

The system dynamics model presented uses population and household dynamics to compute a household-preference driven demand for eight types of urban structural residential areas. The respective supply in turn influences this demand. Housing stock is based on the demand-supply ratio, residential vacancy and demolition.

There are a range of uncertainties in the model which are typical for every model. Most uncertainties are related to

- input data
- model functions
- representativeness of the calibration cases.

#### Results and Conclusion:

The results of the population development simulations show that current shrinking cities and urban regions can expect very different futures: further decline is only one of them. In accordance with recent findings on re-urbanisation trends in urban regions formerly faced with population decline both baseline and growth scenarios indicate that urban regions might grow again following a phase of decline.

We observe an increase of single households, young and elderly. This leads to an increase in the total housing demand. In contrast, the shrinkage scenario does not show an increase in the number of single households or housing demand in the long-term. The simulations show that residential vacancies will remain regardless of population growth. At the same time, our model shows that regardless population shrinkage and oversupply of flats, there is a negative net-demand on living space in affordable prefabricated housing estates as the percentage of low-income households will

increase. These findings help planners to modify or adapt their views on desired or undesired urban futures.

**Further reading:**

PLUREL deliverable report: [Conceptual and quantitative system dynamics integrated framework to analyse rural-urban land use relationships including growth and shrinkage in a generic way](#)

# 3 Changes of peri-urbanisation

*What happens when peri-urbanisation takes place?*

## FS 408 Processes of peri-urbanisation

By Katharina Fricke - Müncheberg

### What is the issue?

Rural-urban regions are spatial clusters of three interrelated regional sub-systems ? the urban core, the peri-urban surroundings and the rural hinterland, characterised by different structure, functions and relations which are reflected through different land use classes. Peri-urbanisation processes follow mostly growth dynamics in terms of population, workplaces and built-up area, resulting in a range of pressures, e.g. in urban centres the pressures of high population, workplace and service density together with high traffic volumes and density, leads to significant degrees of surface sealing resulting in a lack of land for building purposes a lack of green space, lack of groundwater recharge, heat island effects and other environmental effects which decrease urban attractiveness and reduce the quality of life.

### Methodology and Materials:

Land use relationships and interactions between rural, peri-urban and urban areas of rural-urban regions in the EU are identified, modelled and projected. We set up and apply a typology of rural-urban regions in Europe at NUTS X scale based on land cover pattern, land use structure and their respective dynamics. Additionally urban, peri-urban and rural regions based on population densities are delineated. A typology of national planning policies and governance is developed on basis of a policy analysis, including the participation of partners in the case study regions. Land use patterns and further data depicting land use relationships between rural, peri-urban and urban areas are analysed at European scale and at case study scale. The land use change due to peri-urbanisation is simulated for the case study regions in cooperation with stakeholders: spatially explicit regional development scenarios are carried out with the MOLAND land use change model according to regional development strategies and planning policies.

### Results and Conclusion:

The processes of peri-urbanisation and the related land use change plays the essential role in the PLUREL project. It is the focal lens of all PLUREL analyses. Here, the trends and drivers of peri-urbanisation are directly translated into the changes of land use in a geophysical setting. This section of the PLUREL Xplorer displays the simulation of peri-urbanisation and explains the methodology behind as well as the potential development scenarios. Comparable regions in Europe are analysed and highlighted. Further on, peri-urbanisation processes in the PLUREL case study regions are analysed and specific modelling results are shown.

## 3.1 Simulation of peri-urbanisation

*How can we simulate processes of peri-urbanisation with the RUG model?*

### FS 32 Simulation of land use change and peri-urbanisation

By Sophie Rickebusch - Edinburgh

#### What is the issue?

Future land-use patterns in peri-urban areas depend largely on changes in the density and location of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport network? Understanding the effects of planning policy, amongst other factors, on land-use patterns is key to making the decisions which will help create a more sustainable future for peri-urban regions.

#### Methodology and Materials:

The RUG model runs on a 1 x 1 km grid. It evaluates each grid cell's potential for settlement according to its characteristics. It then allocates the regional (NUTS 2) projections of artificial surfaces across the grid using a set of equations linking location preference and planning constraints to cell characteristics. The equation parameters vary to reflect differences between four scenarios: The main RUG inputs are projections of the quantity of artificial surfaces per NUTS 2 region for 2015 and 2025, obtained by linear regression from projections of population () and GDP (Gross Domestic Product) per capita (). Location preference depends on travel times (which vary according to the scenario) to the nearest medium and large cities, commuting distance, relative importance of natural vs. social environment and distance from the coast. Planning constraints include planning strategy (compact vs. *laissez-faire*) and the presence of flood risk zones.

#### Results and Conclusion:

In all scenarios and for most countries, there is a greater increase in artificial surfaces in urban/peri-urban areas than in rural areas. The differences between scenarios in that respect are not significant. This is a continuation of current trends, where more people migrate into cities and surrounding areas than out. Within the urban/peri-urban area on the other hand, there are significant differences between the scenarios. At one end of the scale, the *hyper-tech* scenario shows mostly growth in peri-urban areas. This is also the scenario in which the difference between urban/peri-urban and rural is the smallest, i.e. there is a fair amount of growth in rural areas too. At the other extreme is the *peak oil* scenario, where most of the growth is concentrated in the urban core of the cities. The scenarios also differ in their maximum local growth intensity: *hyper-tech* has the largest values and *fragmentation* the lowest. In all scenarios, there are areas, particularly in the centre of cities, where the projected proportion of artificial surfaces goes above 1 (100%). This has to be interpreted as a

densification of the built-up surfaces, with growth occurring also in the third dimension: more multi-storey buildings, above- and below-ground. The results from the RUG model show that although all four scenarios involve growth in built-up surfaces, the location of this growth varies considerably. It follows that the pressure on the environment from this increase in artificial surfaces depends to a large extent on the scenario and the planning policy contained in each storyline. For instance, although the *fragmentation* scenario has the lowest densification values, the *peak oil* scenario probably has a lesser impact because growth is concentrated in areas which are already highly urbanised. Although all the scenarios have positive and negative aspects, some have more desirable outcomes than others. By taking this into account, planners may choose policies which favour sustainable growth while mitigating some of the less desirable side effects.

### **Further reading:**

RUG model outputs:

- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A1 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A2 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B1 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B2 in 2015 and relative difference \(percentage\) with current \(2000\) values](#)

RUG model outputs including technological change (transport time costs):

- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A1 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario A2 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B1 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)
- [proportion of artificial surfaces \(CLC classes 1-11\) under scenario B2 in 2025 and relative difference \(percentage\) with current \(2000\) values](#)

### **3.1.1 Hyper-tech future**

*Simulation of peri-urbanisation in the hyper-tech future*

#### **FS 33 Land use change scenario hyper-tech (A1)**

*By Sophie Rickebusch - Edinburgh*

#### **What is the issue?**

Future land-use patterns in peri-urban areas depend largely on changes in the density and location

of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport network? Understanding the effects of planning policy, amongst other factors, on land-use patterns is key to make the decisions which will help create a more sustainable future for peri-urban regions.

### **Methodology and Materials:**

See . The equation parameters follow the *hyper-tech* scenario storyline ().

### **Results and Conclusion:**

In the *hyper-tech* scenario, there is a greater increase in artificial surfaces in urban/peri-urban areas than in rural areas, but the difference is not as marked as in other scenarios. This is a continuation of current trends, where more people migrate into cities and surrounding areas than out, even though in this case there is also a fair amount of growth in rural areas. Within the urban/peri-urban area on the other hand, this scenario differs from the others: in more than half of the 25 EU member countries, peri-urban areas see more growth than urban areas. This scenario is therefore characterised by a high amount of urban sprawl into peri-urban and even rural areas. For most regions (NUTS 2), the *hyper-tech* scenario gives the largest regional growth, as compared to the other scenarios. Because peri-urban and rural areas cannot absorb all this growth, it also remains quite high in urban areas, in apparent contradiction with scenario assumptions. This leads locally to very high *peaks* of densification (proportions of artificial surfaces >1, i.e. more building in the third dimension), particularly in highly-urbanised regions such as Inner London (UKI1). The impact of the *hyper-tech* scenario in terms of urban growth is considerable, particularly in peri-urban areas. Not only is the growth rate in general very high, but lax planning policies lead to urban sprawl and counter-urbanisation. On the positive side, this is partly due to technological developments, such as more efficient transport and teleworking, which could be a step towards a more sustainable future.

### **3.1.2 Extreme water future**

*Simulation of peri-urbanisation in the extreme water future*

#### **FS 34 Land use change scenario extreme water (A2)**

*By Sophie Rickebusch - Edinburgh*

#### **What is the issue?**

Future land-use patterns in peri-urban areas depend largely on changes in the density and location of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport network? Understanding the effects of planning policy, amongst other factors, on land-use patterns

is key to making the decisions which will help create a more sustainable future for peri-urban regions.

## **Methodology and Materials:**

See .

The equation parameters follow the *Extreme Water* scenario storyline ().

## **Results and Conclusion:**

In the *extreme water* scenario, there is a greater increase in artificial surfaces in urban/peri-urban areas than in rural areas, but the difference is not as marked as in the *peak oil* and *fragmentation* scenarios. This is a continuation of current trends, where more people migrate into cities and surrounding areas than out, even though in this case there is also some growth in rural areas. Within the urban/peri-urban area, the *extreme water* scenario shows only slightly more growth in urban than in peri-urban areas. This scenario is characterised by a fair amount of urban sprawl into peri-urban and even rural areas, though not as much as in the *hyper-tech* scenario. Out of the four scenarios, *extreme water* has either the largest (a few regions) or second largest regional growth. Growth therefore tends to be quite high in urban and peri-urban areas and slightly less so in rural areas. This leads locally to very high *peaks* of densification (proportions of artificial surfaces >1, i.e. more building in the third dimension), particularly in highly-urbanised regions such as Inner London (UKI1), though these are not as extreme as in the *hyper-tech* scenario. The impact of the *extreme water* scenario in terms of urban growth is quite high, particularly in peri-urban areas. The growth rate is generally high and lax planning policies lead to urban sprawl. This is only curbed by the relative unattractiveness of rural areas, which suffer more from water-related problems such as drought and flooding.

### **3.1.3 Peak oil future**

*Simulation of peri-urbanisation in the peak oil future*

#### **FS 35 Land use change scenario peak oil (B1)**

*By Sophie Rickebusch - Edinburgh*

#### **What is the issue?**

Future land-use patterns in peri-urban areas depend largely on changes in the density and location of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport network? Understanding the effects of planning policy, amongst other factors, on land-use patterns is key to making the decisions which will help create a more sustainable future for peri-urban regions.

## **Methodology and Materials:**

See

The equation parameters follow the *peak oil* scenario storyline:

## **Results and Conclusion:**

In the *peak oil* scenario, there is a much larger increase in artificial surfaces in urban/peri-urban areas than in rural areas. This is a continuation - and possibly acceleration - of current trends, where more people migrate into cities and surrounding areas than out. Within the urban/peri-urban area, this scenario shows much higher growth in the urban than in the peri-urban areas. This scenario is characterised by extremely compact city development, mostly constrained to the core urban areas. The *peak oil* scenario usually has the second lowest regional growth or the lowest in some regions/countries (mostly situated in southern Europe). Growth occurs mostly in urban areas, though it is not totally absent in peri-urban and even rural areas. Although growth is overall quite low, the compact development still leads to local *peaks* of densification (proportions of artificial surfaces >1, i.e. more building in the third dimension), particularly in highly-urbanised regions such as Inner London (UKI1). The *peak oil* scenario has the lowest impact of all in terms of urban growth. This is due to the combination of a moderate to low growth rate, strict planning policies and a strong reliance on public transport, which keep the development very compact. According to the scenario storyline, this is a reaction to an oil price shock. A more pro-active way to a sustainable future would be to encourage compact development (through stricter planning policies and better public transport) without waiting for an oil price shock.

### **3.1.4 Fragmentation future**

*Simulation of peri-urbanisation in the fragmentation future*

#### **FS 36 Land use change scenario fragmentation (B2)**

*By Sophie Rickebusch - Edinburgh*

#### **What is the issue?**

Future land-use patterns in peri-urban areas depend largely on changes in the density and location of artificial surfaces (defined as CORINE land-cover level 1, class 1). Through scenario analysis of urban land-use change using the RUG (Regional Urban Growth) model, we address some of the following questions: where will these changes occur? How can they be influenced by planning policy and household preferences? What is the role of technological development in the transport network? Understanding the effects of planning policy, amongst other factors, on land-use patterns is key to making the decisions which will help create a more sustainable future for peri-urban regions.

## **Methodology and Materials:**

See

The equation parameters follow the *fragmentation* scenario storyline:

### **Results and Conclusion:**

In the *fragmentation* scenario, as in *peak oil*, there is a much larger increase in artificial surfaces in urban/peri-urban areas than in rural areas. This is a continuation of current trends, where more people migrate into cities and surrounding areas than out. Within the urban/peri-urban area, this scenario shows higher growth in the urban than in the peri-urban areas, though it is not as extreme as in *peak oil*. The *fragmentation* scenario is characterised by fairly compact city development, with some sprawl into peri-urban areas. This scenario generally has the lowest regional growth, except for a few regions/countries (mostly situated in southern Europe) where it is second-lowest. Growth occurs primarily in urban and peri-urban areas, though there is some counter-urbanisation. Because of the low overall growth and only moderately compact development, the local *peaks* of densification (proportions of artificial surfaces >1, i.e. more building in the third dimension) in highly-urbanised regions such as Inner London (UKI1) are not as high as in other scenarios. The *fragmentation* scenario has a fairly low impact in terms of urban growth. This is due to the combination of low growth rate and fairly strict planning policies, which keep the development quite compact, with a moderate amount of urban sprawl and counter-urbanisation. On the down side, the observed spread is partly due to the fragmentation of society into different age groups, ethnicities, etc., which leads to clustered communities in different parts of the peri-urban areas and *green enclaves* in rural areas.

### **Further reading:**

- [View on Montpellier Agglomération](#) (images) by Montpellier Agglomération, 2009
- [Languedocian corridor](#) (images) by Jennifer Buyck, 2010

## 3.2 Regions in comparison

*Are there regions in Europe that have similar futures?*

### FS 37 RUR-typologies

*By Klaus Steinocher, Wolfgang Loibl - Vienna*

#### What is the issue?

Rural-Urban Areas (RURs) build functional urban regions with core city areas, peri-urban commuter belts and the rural hinterland. RUR typology shall support the exploration of pressure patterns as response to land-use and interactions, related to urban and peri-urban development. The EU Commission announces NUTS 3 regions as appropriate to examine regional trends and EU policy effects. As PLUREL concentrates on the impacts of peri-urban development and related planning policies, the assessment shall refer to these NUTS 3 regions, requiring a typology which also refers to these regions. Different RUR-types may show typical regional development trends and pressure patterns and dynamics, requiring different policy strategies to cope with these patterns. Quantifying different driver-pressure relations demands a flexible typology, applying the appropriate features to the respective driver-pressure issue. On the other hand the typology has to be scarce enough to remain manageable. A compact set of few RUR types supports impact assessment for assessing driver-pressure relations and planning policy advice.

#### Methodology and Materials:

The task is divided into

- the definition of urban region types appropriate for the investigation of regional development,
- clustering of NUTS 3 regions to RURs (in case of large or several urban centres) - based on GIS analysis and
- the assignment of RUR types to the RURs based on geospatial indicators and statistical data.

Delineating RURs by NUTS3 polygon borders does not allow an exact discrimination of the core cities influence sphere. The available data set for the spatial delineation and classification is limited and concentrates on structural data, while the classification should also consider functional issues. Publicly available data are CORINE land cover 2000 (100x100m cells) and EUROSTAT population data for NUTS 3 and Lau 2. Additionally population data for urban center points have been applied for 5000 settlements. EEA population density maps have been made available for detailed analysis. A typology is often a subjective decision depending on selected indicators following a certain purpose and depending on certain constraints in terms of available data. In our case only population data are available for NUTS3 regions, and during the project period, in which the typology was conducted only a derived population density map was available for sub-NUTS3 levels making use of CORINE land cover to allocate densities. Interaction data could unfortunately not be made available for entire EU27.

## Results and Conclusion:

3 sets of typologies have been developed, to be applied as appropriate RUR type set for further analysis:

1. morphology: number and distribution of core city(ies) and sub-centres
2. spatial dynamics - core city versus peri-urban area development
3. city shapes - compactness versus fractality

**1. RUR morphology typology** For peri-urban development analysis, mono- and poly-centricity must be examined separately, as they trigger different pressures. Mono-centricity conveys urban core growth and in centre-less peri-urban surroundings scattered settlement growth known as urban sprawl. Poly-centricity, controlled by planning policy, relieves pressures from open space by concentrating activities in urban sub-centers. Following types are established:

Morphology type	description
1. mono-centric	regions with core city w/out notable peri-urban sub-centers, 3 sub-types by core size: very large, large, medium
2. urban poly-centric	regions with core city(-ies) and peri-urban sub-centres
3. dispersed poly-centric	regions with several (medium-sized) peri-urban centres
4.rural	rural regions without notable centres but dispersed smaller settlements

The classification is based on ranking of cities by population per NUTS 3 region. Cities with more than 100.000 inhabitants are defined as core cities, other urban areas with 10.000 and more inhabitants are defined as urban centers. RURs with core cities or urban centers are classified as urban. RURs with more than one core city or additional sub-centers are classified as polycentric. Mono-centric RURs with overlapping core city buffers are clustered to poly-centric RURs. RURs without centers are classified as rural. **2. RUR dynamics typology** The urban region life-cycle builds waves of urbanisation, sub-urbanisation and counter-urbanisation, resulting in different regional development: core city growth as effect of urbanisation, poly-centric growth as effect of controlled sub-center development, urban sprawl as effect of uncontrolled peri-urban development, etc. RUR sub-regions show either identical or oppositional dynamics in core cities and surroundings:

Dynamics type	Core city	Peri-urban and rural areas
GG	Growth	Growth
DG	Decline	Growth
GD	Growth	Decline
DD	Decline	Decline

The classification focuses on recent short term dynamics of urban centres and peri-urban surroundings. Dynamics have not been explored by land-use data, because 1990 and 2000 CORINE land cover data do not exist for all countries and the results turn out as insufficient: a minimum mapping threshold excludes areas <25ha and a change threshold excludes land use changes < 5ha,

inhibiting accurate land use change detection. Therefore population data for different years serve as land-use activity proxy for dynamics monitoring. The typology sets can be applied separately as necessary for the certain issues. Concluding, different national dynamics and demographic settings and wealth conditions lead to different population structures, economic development and transportation modes resulting in different urban and peri-urban development. The RUR types show following distribution:

- Morphology: Polycentric RURs are concentrated in England , in North-Central Europe, Slovakia, Western Hungary, and Northern Italy. The most rural RURs are located in the EU27 periphery (North, South, East) in the Alpine Region and scattered over France and Germany (due to small NUTS regions).
- Dynamics: A general (population) decline is concentrated in Eastern Europe, in peripheral, rural RURs in the Mediterranean area, in Scandinavia and the Baltic region. In Eastern Germany and the Ruhr-valley a decline is observed, also in northern France and in the Alpine area. RURs in Poland frequently demonstrate positive trends.

Core cities mostly show similar trends as the non-urban surroundings, but with certain exceptions.

### **Further reading:**

PLUREL deliverable report: [Review of existing rural-urban region typologies](#) PLUREL deliverable report: [Quantitative classification of the major European rural-urban regions](#)

### **3.2.1 Results**

*How do these regions look like?*

#### **FS 38 Delineation of RUR typologies**

*By Tanja Tötzer, Wolfgang Loibl - Vienna*

#### **What is the issue?**

Rural Urban Regions (RUR) are complex spatial systems consisting of urban centre -, peri-urban - and rural sub-regions providing different functions, and releasing different activities of the inhabitants causing pressure on the landscape as response of these activities. Intensive activities take place in the urban centres, moderate ones in the peri-urban, and in the rural areas, activities decline with growing distance to the centres. The division into RUR sub-regions considers these differences in land use relationships. Different RUR-types may show typical regional development trends, pressure patterns and dynamics, requiring certain policy strategies to cope with. The urban, peri-urban and rural areas within a RUR reflect the intraregional differences in terms of urbanisation. Exploring impacts of these activities in the RUR and the relations between the sub-regions requires their spatial delineation. Quantifying different driver-pressure relations demands flexible typologies based on available data for entire Europe. A classification of RUR types supports assessing driver-pressure relations and elaborating appropriate planning policies.

## **Methodology and Materials:**

NUTS-3 regions were initially defined as RUR (NUTS is a geocode standard for referencing the area of the EU into smaller subdivisions). Urban centres were identified taking land cover and population data. Centres above 100.000 inhabitants were recognised as urban cores. Adjacent areas within an influence sphere circle with higher population density were defined as peri-urban. The remaining RUR area was considered as rural hinterland, although NUTS3 borders do not reflect exactly the extent of the RUR's influence. NUTS-3 regions with overlapping influence spheres were merged to RUR clusters. Four data sets available for EU27 were applied: CORINE land cover 2000 - 100x100 m raster data (EEA, around 30 land use classes, among them urban fabric, commercial area, traffic area, parks, agriculture, natural vegetation and forests), population numbers 2000/ 2001 for NUTS3 regions and urban centre points (Eurostat), population density raster data, weighted by land use (JRC, 100x100m raster). RURs must match NUTS3 regions or NUTS3 region clusters, because of statistical data availability. The sub-region delineation is coarse due to limited data availability – only considering land use and population density as characteristics to distinguish the sub-regions. Therefore, there is uncertainty regarding the definition of the RUR borders.

## **Results and Conclusion:**

First, the 1200 NUTS3 regions have been aggregated to 900 RURs. Each RUR has been (finally) divided into urban-, peri-urban and rural sub-regions. The delineation allowed further analysis regarding trends and impacts of urbanisation today as well as in the future as described in the developed scenarios. Two RUR typologies have been developed and applied to the RURs for further land use relationship analysis - and planning policy advice:

1. Morphology: number and allocation of core city(ies) and sub-centres
2. Spatial dynamics: core city versus peri-urban dynamics

### **RUR morphology typology**

The most important distinction criteria were mono- and poly-centricity, as they trigger different pressures. Mono-centricity conveys urban core growth and urban sprawl. Poly-centricity, controlled by planning policy, relieves pressures from open space by concentrating activities in urban centres and sub-centres. The following morphology types have been defined:

1. **Mono-centric:** Regions with a core city, with or without notable peri-urban sub-centres, three sub-types by core size: very large, large, and medium
2. **Urban poly-centric:** Regions with core city(-ies) and peri-urban sub-centres
3. **Dispersed poly-centric:** Regions with several (medium to small) peri-urban centres
4. **Rural:** Rural regions without centres but dispersed small settlements

The classification was based on the cities's ranking by population number. Cities above 100.000 inhabitants were defined as core cities, other urban areas above 10.000 inhabitants were defined as urban centres. RURs with urban centres were classified as urban. RURs with more than one core city or additional sub-centres were classified as polycentric. Adjacent RURs with overlapping influence spheres were clustered to poly-centric RURs. RURs without centres were classified as rural. **RUR dynamics typology**

The urban region life-cycle builds waves of urbanisation, sub-urbanisation and counter-urbanisation, resulting in different regional development: core city growth as effect of urbanisation,

poly-centric growth as effect of controlled sub-centre development, urban sprawl as effect of uncontrolled peri-urban development, etc. RUR sub-regions show identical or oppositional dynamics in centres and surroundings:

Dynamics type	Core city	Peri-urban and rural areas
GG	Growth	Growth
DG	Decline	Growth
GD	Growth	Decline
DD	Decline	Decline

The classification focuses on recent short term dynamics of urban centres and peri-urban surroundings. Dynamics have not been explored by land-use data, because CORINE land cover data 1990 and 2000 do not exist for all countries and the results turn out as insufficient: a minimum mapping threshold excludes areas < 25ha and a change threshold excludes land use changes < 5ha, inhibiting accurate land use change detection. Therefore population data for different years serve as land-use activity proxy for dynamics monitoring. Different national dynamics and demographic settings and economic conditions lead to different population structures, wealth development and mobility requirements resulting in different urban and peri-urban development. The RUR types show following distribution: **Morphology:** Polycentric RURs are concentrated in England, in North-Central Europe, Slovakia, Western Hungary, and Northern Italy. The most rural RURs are located in the EU27 periphery (North, South, East) in the Alpine Region and scattered over France and Germany (due to small NUTS regions).

**Dynamics:** A general (population) decline is concentrated in Eastern Europe, in peripheral, rural RURs in the Mediterranean area, in Scandinavia and the Baltic region. In Eastern Germany and the Ruhr-valley a decline is observed, also in northern France and in the Alpine area. RURs in Poland frequently demonstrate positive trends.

Core cities mostly show similar trends as the non-urban surroundings, but with certain exceptions.

#### Further reading:

- [RUR Delineation](#) (images) by Wolfgang Loibl et al.
- [RUR Delineation Case Study Regions](#) (images) by Wolfgang Loibl et al.
- [RUR Map](#) (maps) by Wolfgang Loibl et al.

### 3.3 Case study regions

*How does peri-urbanisation look like in ...?*

#### FS 47 Governance and spatial planning case studies (introduction)

By Carmen Aalbers - Wageningen

##### What is the issue?

Here we provide a selection of governance and spatial planning strategies in six urban regions in Europe and one in China: Warsaw, Montpellier Agglomeration, Greater Manchester, Leipzig-Halle region, Koper region, the Hague Region and Hangzhou. These regions serve as case studies for analysis of strategies and processes of peri-urbanisation. Not only official policies, but also informal strategies, results and outcomes, and the influence of a wider range of actors have been analysed. Also financial analysis and impact assessments have been applied to a number of these regions. The case studies produce knowledge that is relevant to end users and hence to the implementation of research results into practice. Case studies provide common ground for shared action between researchers (Birgersson, Malbert, Strömberg 2001). Both are needed for sustainable land use developments in the urban fringe.

##### Methodology and Materials:

A trans-disciplinary approach was adopted to include practitioners' knowledge & concerns. The studies also inform the modeling and policy comparison analysis. The analysis and assessments of the different governing strategies follow a 'Joint Analytical Framework' and a 'Joint Assessment Framework'. Both were developed on the basis of trans-disciplinary research proposals from the research teams and regional actors, employing a common glossary of terms. The transdisciplinary approach entailed a risk for the scientific soundness of the research. The voice of regional practitioners in the choice of strategies to study, contributed to an amalgam of strategies, differing in degree of complexity, intersectoral comprehensiveness, demanding an extreme effort to deduce any sensible patterns and conclusions. Political motivated actions of practitioners also puts the research and publication of its findings at risk.

##### Results and Conclusion:

The Analysis reports describe the urban region, following the boundaries of the administrative unit concerned. (Stadsgewest, Agglomération, etc.) They summarise land use and spatial developments and major strategic issues for each of the case study regions. Second, the formal government and spatial planning system is described. A third chapter describes three spatial planning and/or governance strategies in detail, uncovering interactions between the different actors involved, what matters to them, and how they influence the urban rural interactions and the fringe. The effects in terms of sustainable development of the urban fringe and power is the subject of the second round of case study reports, the Assessment reports. For some strategies this assessment is done ex-ante, for most ex-post. Regional practitioners submitted the strategies to be studied. Over time the focus

of regions could change following their local political dynamics, while a research team was still busy with studying the requested strategy. Regions were asked to formulate their questions. Questions or issues they raised were:

- Is the research socially / society relevant?
- Challenge the perception of the balance between humans and landscape. It is a two-directional process, be aware of too much urban centism.
- Who demands density?
- Are people able to live where they would like live? Do the people have a choice where to live or is their choice restricted to their income?
- Who has which share in the costs (money). Who pays for green, who benefits from it?
- How optimal is this long discussion in our regions. How do other regions reach consensus?
- What about land policy instruments?
- We want an explanation of strategies in both governance and spatial concepts.

The regions were invited to submit a request for indicators to include in the modeling. Most of this could not be catered for by the research, since the data are not available. This is of concern to European statisticians when focusing their data collection. By involving stakeholders, research is more likely to encounter new and relevant research questions. But if data are lacking and time does not allow to collect them, opportunities for meaningful innovations are aborted. The practitioners and a wider international group of practitioners (PURPLE) were asked to formulate what they want to get out of PLUREL. The case study practitioners requested a reviewer session at the end of each conference, to have a platform for expressing their views, advice, warnings. We offered this and also a position in an advisory Board. Gradually this Board obtained political power in the research. For a forthcoming article on the research-practice cooperation in PLUREL please contact [Carmen.aalbers@wur.nl](mailto:Carmen.aalbers@wur.nl)) The seven regional case study reports present the results of the case studies that respond to the common research questions - depending on the extent to which the regional teams have respected the Joint Analytical Framework. The reports provide more elaborate information on the strategies studied (see "references and further reading") in the case study regions.

The regional assessment reports are combined into one overall report demonstrating the workings and impacts of the strategies in relation to the planning and physical context of the regions. These overall contexts are generalised in the regional typologies.

The regional developments are studied by means of land use scenarios as well. These can be found in the factsheets 'processes of land use change'. The underlying storylines were developed with stakeholders (see "references and further reading").

### **Further reading:**

- [Table \(tables\) by Carmen Aalbers](#)
- [Researchers and practitioners discussing developments \(images\) by Carmen Aalbers](#)

#### **3.3.1 The Hague region**

*Land use in The Hague region*

## FS 48 Land use and spatial development in The Hague region

By Judith Westerink, Pat van der Jagt - The Hague

### What is the issue?

The Hague Region, with 1 million people, is situated in the urbanised West of the Netherlands. To the South is mainport Rotterdam, to the West the North Sea coast, to the East the Green Heart and to the North Schiphol airport and Amsterdam. The region is polycentric: Delft and Zoetermeer are the main towns next to the city of The Hague. A large part of the region is below sea level. Only one third of the area consists of the traditional meadow landscape. The region is home to the largest concentration of greenhouse horticulture in the country. Traffic congestion is a big problem. There is no space left for expansion of any land use type. Planning in this region is a major challenge. The case of The Hague Region is interesting to other city regions. Many cities are located at river estuaries, surrounded by the best agricultural land. Everywhere, city dwellers need recreational space and quality of life. The Netherlands has a long tradition of strong planning, but also more recent experiences with more space for development. Old and new strategies for sustainable urban-rural relationships and green peri-urban areas can be inspiring for other city regions.

### Methodology and Materials:

Planning and governance were studied for The Hague Region based on interviews with government officials of different tiers and other stakeholders, study of policy documents and participation in meetings and projects. Of special interest were strategies for planning and governance of the peri-urban areas.

The most important issues were

- Governance and planning of peri-urban areas
- Actors and their strategies
- With a focus on agriculture, recreation and culture/identity.
- Several peri-urban enclaves were described as embedded cases.

### Results and Conclusion:

The Hague Region is situated in the West of the Netherlands along the North Sea coast. It is one of the most urbanised areas in the country, home to nearly 1 million people, on a 410 km<sup>2</sup> area. It coincides with the territories of nine municipalities: Delft, The Hague, Leidschendam-Voorburg, Midden-Delfland, Pijnacker-Nootdorp, Rijswijk, Wassenaar, Westland and Zoetermeer. The Hague Region is a regional authority in which these municipalities cooperate.

#### Land use (2004, %)

- Urban: 17.2
- Arable land: 1.7
- Greenhouses: 10.5
- Meadow: 29.5
- Water: 8.3

- Forest: 10.7
- Nature: 6.3
- Other: 15.7

### **Recent land use developments are:**

- Large, concentrated housing sites on the urban fringe.
- Many new offices being built in the city of The Hague.
- Large-scale rural land acquisition by the state for recreation, nature development and water storage.
- Agricultural land use clearly divided into ‘glass’ (greenhouse horticulture) and ‘grass’ (dairy farming)
- Climate change presenting a serious planning challenge since most of the area is below sea level. Until now, the most concrete planning measure has been land purchase for water storage.

Although population growth is diminishing (< 1% per year) and expected to drop below 0,5% around 2015 (CBS 2009), the number of households in The Hague Region is expected to grow, mainly due to the shrinking number of persons per household. The proportion of inhabitants of foreign (especially non-European) origin is growing, especially in the cities. The Hague Region has some important traditional man-made landscapes (meadows, rural estates) and nature reserves (dunes, marshes). So far, the countryside has been strictly protected from urbanisation by planning instruments. The buffer zone policy, dating from the 1950s, has been very successful. More recently, however, conservation in the strictest sense has given way to the philosophy of ‘*Conservation through development*’, leading to more flexible planning instruments. Greenhouse horticulture is an economically profitable sector, and pressure to expand will remain high. Meanwhile, areas dominated by meadows have become so scarce that there is now political support for protection measures. The very high land prices are making it difficult for young farmers to start or expand a farm. With the average age of farmers rising, it is feared that agricultural land use will no longer be safeguarded in parts of the urban fringe. On the other hand, the dairy farming sector is still economically viable. Farmers are increasingly seen as ‘stewards of the landscape’.

Urban fringe areas are described as poorly accessible and poorly equipped for recreation. They are increasingly perceived as ‘cluttered’ by roads and urban sprawl. Urbanisation in this region is no longer being driven by population growth, but by a decreasing number of persons per household and changing housing preferences. The services economy is still coming up, old-fashioned industrial land use types have never been dominant but are still diminishing. Many office towers are being built around The Hague Central Station and developments around Delft Central Station are planned. As a result of urbanisation and the growth of greenhouse horticulture, the traditional meadow landscape is becoming scarce. The role of agriculture in the region is changing, as are society’s views about the countryside. Although especially cyclists use the green peri-urban areas as recreational space, these areas are still perceived by other groups and policy makers as poorly accessible and devoid of facilities.

### **Further reading:**

- [The Hague Region Analysis report](#) (pdf) by Aalbers et al
- [Reconstruction of area around Delft central station](#) (image) by Judith Westerink
- [Public transport in new neighbourhood Ypenburg](#) (image) by Judith Westerink

- [Where meadows meet greenhouses, Midden Delfland](#) (image) by Judith Westerink
- [Land use map of The Hague Region](#) (maps) by Co Onderstal
- [Vliet near Delft](#) (image) by Judith Westerink
- [Delftse Hout peri-urban part](#) (image) by Judith Westerink
- [View on Delft from Midden-Delfland](#) (image) by Judith Westerink

### 3.3.2 Hangzhou region

*Land use in Hangzhou region*

#### FS 49 Land use and spatial development in Hangzhou region

By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit - Munich, Hangzhou

##### What is the issue?

Hangzhou is a rapidly growing urban - rural region in Eastern China. Most of the growth takes place in the peri-urban areas. Hangzhou has developed innovative approaches for land use planning. The report analyses the main issues of peri-urbanisation in Hangzhou and the approaches adopted in planning to address these challenges. Strategies for peri-urban areas are explored in detail in three embedded cases. Urbanisation in China is of greatest importance both for China and the world. On the one hand urbanisation is considered a key to economic and social development of China. On the other hand, it puts great pressures on society and the environment. Development of sustainable land use systems is a key to overall sustainability of these rural-urban regions.

##### Methodology and Materials:

The study was jointly undertaken by a team of Chinese and European researchers. It is based on documentary analysis (planning regulations and documents, statistics, maps, etc.), informal interviews, stakeholder workshops, field visits and interpretation of remote sensed data for delineation of peri-urban areas.

##### Results and Conclusion:

The area of Hangzhou City proper covers 3,068 km<sup>2</sup> with a population of 3.74 million registered urban residents in 2003. As a consequence of the Chinese opening policy and consequent economic development, both urban and rural areas in Hangzhou experienced rapid development from 1978 to the early 1990s and the city sprawled outwards. The effects of quick expansion led to an imbalanced urban spatial structure and put farmland under pressure. The reform of administrative divisions, by which adjacent towns and villages became part of Hangzhou city, laid the foundations for the long-term, coordinated urban development of Hangzhou. Importantly, the idea of a monocentric city was abandoned in favour of polycentricity in order to relieve the pressure from the urban core. New centres were created in the west and the south. The three cases and corresponding strategies of peri-urban development that were analysed are:

1. Xixi wetland area: successful case of the restoration of a larger former wetland area which had been destroyed by uncontrolled sprawl and environmental pollution. Restoration of the wetlands and their protection in a National Wetland Park was at the core of the strategy to combine nature protection with development of tourism and high quality residential areas around the wetland.
2. Zhubantang area: the area is located to the west of Hangzhou city centre. It is characterised by traditional farming activities, including tea production, in an attractive landscape setting. However, the Zhubantang area was lagging behind in terms of social and economic development due to strong environmental restrictions and lack of infrastructures. Development of tourism facilities and of creative industries (in particular animation industries) are main elements of the new strategy to speed up economic growth and social development while protecting the natural and cultural heritage.
3. Binjiang is located in the south of Hangzhou. Designation as an economic growth zone has led to an inefficient, monostructured pattern of industrial areas. Adoption of a new strategy converted the area into a mixed use area with urban facilities. The report describes the main elements of this strategy

Compared with the European cases, urban dynamics in Hangzhou are outstanding. Distinctive strategies for dealing with the specific challenges of peri-urbanisation were presented. These case studies show that specific approaches to peri-urban land use planning are now being developed and implemented. Hangzhou must be considered an advanced case in this respect. The strategies are adapted to local conditions and needs. They are comprised of top-down planning instruments combined with economic incentives and social programmes (e.g. to compensate land lost farmers). While there are apparent successes in achieving a better planned urban development, huge challenges still remain ahead. In particular protection of valuable farmland, environmental protection and social issues (farmers, migrant workers) need to be mentioned. To successfully address these issues may require fundamental changes, for instance in land use rights, the tax system and strengthening of bottom-up elements in planning.

#### **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on land use in the urban fringe, Hangzhou report](#)

### **3.3.3 Koper region**

*Land use in Koper region*

#### **FS 50 Land use and spatial development in Koper region**

*By Anton Perpar, Marina Pintar - Koper*

#### **What is the issue?**

The historical development of land use, present land use and main trends in the Municipality of Koper from economic, social and environmental points of view are described, followed by a

description of the government system and planning policies. Strategies, as a response to spatial problems and future development needs, are described as well. The aims of the strategies are a more efficient land use and protection of the best agricultural land in the municipality and especially in peri-urban areas, green and recreational areas that will contribute to an increase quality of living and the implementation of the Rural Development Plan 2007-2013 for Slovenia on the municipality territory. The current spatial situation is a result of historical and present land use. The Municipality of Koper is currently in the process of preparing new spatial documents. An analysis of the present spatial situation and problems has therefore been prepared, some future trends in population and economic growth are being studied and modelled, and proposals from local people, local communities and other actors are being collected.

### **Methodology and Materials:**

In order to analyse the situation, trends, spatial problems and stakeholders' perceptions, as well as aims and strategies of different actors, various methods have been used, such as: literature review, analysis of the situation based on statistical and GIS data of the area, stakeholders' analysis, interviews and workshops. **Input variables** were statistical data (population, migrations, data about present land use, data about the economic situation) and data derived from interviews.

**Output variables** were strategies for the Municipality of Koper as a result of a workshop's discussion between stakeholders and researchers.

### **Results and Conclusion:**

The territory of the municipality can be divided into urban, peri-urban and rural. The old city centre of Koper and the surrounding highly populated area can be defined as urban. The location of the city on the coast, and the medieval city centre provide some limitations for future development. In addition, the Port of Koper occupies a lot of, otherwise urban, space. Settlement and the development of economic activities are therefore directed even more into the peri-urban area, where there is also the highest pressure for future construction and other interventions. The peri-urban area has very diversified land use: as a built-up area for settlement, as a green and recreational area, favourable conditions for agriculture enable agricultural activities, and new infrastructure and industrial zones are also being constructed on contact areas between urban and peri-urban belts. A major part of the municipality is formed by the rural hinterland, which is sparsely populated, but has a unique cultural heritage. The area is also very rich and diversified from an environmental perspective, with a well preserved cultural landscape and biodiversity. In addition to the town, the surrounding rural areas are also undergoing economic and social development. Analysis of the spatial situation and existing settlement in the municipality shows a characteristic distribution of the territory into three semi-circular belts in line with an urban-rural division:

1. The first belt is the city of Koper, its old centre and immediate surroundings including the coast,
2. The second belt is the peri-urban area with existing settlement network,
3. The third belt is open space and settlements in the rural hinterland.

The Municipality of Koper is currently in the process of preparing new spatial documents. The strategic issues that dominate planning discussions in the Municipality of Koper are: the adjustment of different development needs in the municipality, assurance of spatial efficiency in the sense of

rational space arrangement and protection of natural resources (best agricultural land, forests etc.), assurance of quality living conditions (green and recreational areas), efficient public transport, conditions for economic development (industrial and trade zones), maintenance of the cultural landscape and natural and cultural heritage in both urban and rural parts of the municipality. In order for the proposal of a new municipality spatial plan to assure sustainable land use, some strategies were selected and accepted at a workshop between stakeholders and researchers: "Land use efficiency and protection of the best agricultural land", "Green and recreational areas to increase quality of living" and "Rural Development Plan for Slovenia 2007-2013". The strategy "Land use efficiency and protection of the best agricultural land" will try to prepare a tool which will contribute to a more optimal and sustainable land use planning. It will first focus on the primary soil quality and qualities important for the individual sectors (forestry, water management, environmental protection etc.) and subsequently on inter-sectorial cooperation. The second strategy "Green and recreational areas to increase quality of living" will help to recognise the importance of such areas and their integration in the spatial planning process. The aim is also to create a policy on green area allocation. The third strategy will try to stimulate the implementation of rural development measures from Rural Development Plan for Slovenia 2007-2013. Available measures and support mechanisms from this programme can steer the development of the Slovene's Istria countryside.

### **3.3.4 Leipzig-Halle region**

*Land use in Leipzig-Halle region*

#### **FS 51 Land use and spatial development in Leipzig-Halle region**

*By Annette Bauer - Leipzig*

##### **What is the issue?**

The bi-polar urban region with its cores Leipzig and Halle underwent considerable population changes in the past decades. Within the region, population growth and shrinkage occur in vicinity. In the early 1990s commercial and residential sprawl were observed in peri-urban areas (Haase and Nuissl, 2007). Commercial and residential growth still occurs today, though its scope is much reduced. In urban areas, residential vacancies increased and brownfields developed (Haase et al., 2007). The simultaneity of peri urban growth and residential vacancy in urban areas is considered a problem by spatial planning practitioners. The simultaneity of urban development and partial population shrinkage is not only a phenomenon which affects eastern German cities but an increasing number of European large cities, as a report by EUROCITIES suggest (Kabisch et al., 2009). This makes Leipzig-Halle an extremely interesting and challenging case study to learn from.

##### **Methodology and Materials:**

This report is based on interviews with practitioners in spatial planning from the Leipzig-Halle region. The focus was on the stakeholders' perceptions of peri-urban development. Land use as well as GIS data was analysed in order to outline the land use development in the last decades.

## **Results and Conclusion:**

### **Land use change**

Using the European land cover data set CORINE a range of land use changes in the region of Leipzig-Halle between 1990 and 2000 were identified: major land consumption took place in the peri-urban area around both cities. These are predominantly land cover changes from open land to either residential, transport or commercial land (EEA, 2006) and we find different forms of residential and commercial sprawl (Haase and Nuissl, 2007). Commercial development took place along the axis between Leipzig and Halle close to the airport Leipzig-Halle and to the Motorway A 14. There have been arising conflicts within urban and peri urban municipalities in terms of land preparation and competition for residents and investors (Haase, A. et al., 2010). Due to large soft coal resources in the surroundings of both core cities, Leipzig and Halle, land use change was found to be from open land to mineral extraction sites (Schwarz et al., 2010). Since the late 1990s the residential but also the commercial sprawl around Leipzig-Halle has abated considerably. This is accompanied by housing vacancies in the core cities and urban brownfield development (Nuissl and Rink, 2005). Rural land use changes took place mainly in terms of a de- or intensification of agricultural production and, but only occasionally, a loss of arable land due to residential or commercial sprawl. Remarkable changes took place in the former mineral extraction areas in the south of Leipzig where large lignite opencast mines have been converted into large lake areas, arable or forest land (Schwarz et al., 2010).

**Problem perceptions and aims**  
Interviewees, planning practitioners from the Leipzig-Halle region, emphasise the negative effects of expansive urban development. This concerns rising infrastructure costs, development pressure on floodplains and the reduction of the cities' tax base. Furthermore, the coincidence of residential vacancy and development as well as the oversized, ill-connected design of some of the new commercial development is pointed out. Oversized peri-urban development, it is argued, is spurred by municipal competition for residents and commercial/industrial investors. Generally, interviewees claim that it should be attempted to retain the peri-urban area for recreation, tourism and agriculture and to direct development to the urban brownfields (Sinn et al. 2008). Remarkable land use changes are observed in peri urban and urban parts of the Leipzig-Halle case study region. This concerns residential and commercial growth in the fringe and brownfield development in urban cores. These development are judged critically by spatial planning practitioners for fiscal and environmental reasons.

### **Further reading:**

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### 3.3.5 Greater Manchester

*Land use in Greater Manchester*

#### **FS 52 Land use and spatial development in Greater Manchester**

*By Joe Ravetz - Manchester*

##### **What is the issue?**

What kind of spatial strategy is active in the peri-urban Manchester city-region, for what kind of objectives, and how well does it work? In principle the UK spatial planning regime is focused on containing urban growth, recycling urban land, and encouraging 'sustainable communities'. In practice, the pressures of social / cultural / economic change are very strong. While in many areas spatial planning policies are thought to be successful, the community and identity of local places is easily lost or overtaken. This is important not only for local reasons in Manchester. There are other high growth areas of the EU which will in the future reach the limits of their capacity, and look for solutions which balance urban development / growth, with sustainability / non-material quality of life. For the research agenda on governance and public choice, there are questions on how to achieve policy integration between spatial, economic, social and other agendas.

##### **Methodology and Materials:**

The research looked beyond the surface, to explore peri-urban 'transitions', through structured interviews and workshops:

1. Metropolisation: an 'urban transition', networked across wider peri-urban areas;
2. Cultural capitalism: a 'global transition' – new patterns of globalising economic / social structures;
3. 'Spatial ecology': a 'green infrastructure' transition with new forms of 'localisation'.

Research of this type is surrounded by uncertainty and fuzziness of definitions and cause-effect interactions. The approach here is with policy / institutional analysis, which focuses on the 'discourse' or common narrative, and sorts the evidence, claims and counter-claims on that basis. Through extended consultation and dialogue, not only the robustness, but the 'relevance' of the research findings can be tested.

## **Results and Conclusion:**

Spatial governance and planning policy can only act effectively with a clear ‘agenda’ and definition of ‘what is the problem’? Such questions can get political: one person’s problem is another’s solution: and any policy creates winners and losers. There are different spatial strategy ‘agendas’, from urban and rural dynamics, and from a growth or a conservation focus:

1. Urban containment / sustainability; with policies such as Green Belt, this uses the peri-urban areas mainly as a physical boundary for the city.
2. Urban development & expansion; this focuses on feeding the city with infrastructure, such as roads, airports, business parks and retail parks.
3. Rural conservation / sustainability; here the countryside is seen as an asset for a mainly urban population, enhancing landscape and ecological qualities.
4. Rural development & enterprise – favours small business development which can conflict with the conservation agenda.

This helps to see the range of problems and opportunities, and where current policies are working / in conflict / missing.

1. At the regional level the North West Spatial Strategy prioritises the re-use of urban land and containment of urban growth through Green Belt and similar policies. Peri-urban areas are seen as a ‘problem’ area, in that any development may detract from open land and landscape.
2. At the urban level there is a priority for recycling of urban land, higher densities in existing settlements, social housing included with private developments. But the pressures for commercial services and industrial development are very strong, so that many out-of-town developments continue to be built.
3. At the landscape level, there is recognition that Green Belt, Areas of Landscape Value and similar policies generally serve their purpose of containment. But there is often a lack of positive benefits for land quality or landuse.
4. For transport, there is a general policy direction in favour of public transport, but there are institutional problems, and road building still claims the majority of funding.
5. There was a proposal for a Greater Manchester Congestion Charge in 2008, with the income to be used for public transport. This was voted down, as the public did not seem to trust the municipalities with their money.

The sub-areas show variations. The Pennine uplands is limited by geography, and spatial planning has a difficult balance between local social needs and economic development. The Community Forest area needs spatial planning to encourage multi-functional landuse but this does not fit easily with the regime. Spatial governance in the UK is itself in continuous change, shifting from a landuse zoning approach towards a more responsive ‘framework’ and ‘criteria-based’ approach. On the ground in peri-urban areas there are very practical hard choices, e.g. between social housing, parking, local services, inward investment and so on. It seems that the ideal of ‘policy integration’ has still a long way to travel.

## **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on](#)

### **3.3.6 Montpellier region**

*Land use in Montpellier region*

#### **FS 53 Land use and spatial development in Montpellier region**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

##### **What is the issue?**

With economic changes, social evolution (white collars looking for quiet housing in periurban villages around Montpellier, "all-car" way of life), Montpellier area became a place characterised by a young population (students, young adults who work in new industry), great demographic growth and great pressure on housing, with an extension of peri-urban area, as response. In such a context, in 1999, the agglomeration of Montpellier had 290,000 inhabitants and the urban area (with rural neighbourhoods) had 460,000 inhabitants. What changes in terms of land use and spatial development were brought about by such demographic growth? Understanding the evolution of land use is necessary to develop sustainable spatial strategies and face existing problems and pressures. Strategic issues had to be prioritised, and six were pointed out by stakeholders. Land pressure due to housing, agriculture under pressure, tourism integration, traffic pressure, water management, flood prevention, and high value nature at risk strongly affect land management in peri-urban fringes of Montpellier.

##### **Methodology and Materials:**

Studying peri-urban areas in a political sciences perspective, we relate them to a political level of decision, a local government. This is the case when we study Montpellier Agglomération in the PLUREL project: the sustainable peri-urban land use relationships we are looking for concern all open spaces - either agricultural or natural - submitted to urbanisation pressure, located in the administrative perimeter of the 31 member-municipalities of Montpellier Agglomération. The French definition of peri-urban municipalities is based on:

1. Urban spaces present agglomerated population in densely built-up areas and rural areas show open spaces with sparse population; in between, peri-urban areas are characterised by the alternation of built-up with open spaces.
2. More than 40% of the working population living in peri-urban areas commute to the central city or to a surrounding municipality of the first ring of the urban pole.

Though the SCoT (Scheme of Territorial Coherence) improved spatial planning in Montpellier region, some problems are still threatening sustainable land use. Agricultural crisis keeps farm revenue low compared to alternative land development potential earnings, so, with on-going demographic growth and increasing housing demand, economic pressure on land mutation is still high. The SCoT orientations are also implemented in Montpellier Agglomeration, but development pressure is stepping out of administrative boundaries.

## **Results and Conclusion:**

Looking at spatial dynamics in peri-urban areas, we noticed an important demographic growth associated with rapid changes of land uses (specially due to urban sprawl). As development processes tend to push peri-urban areas outwards, their geographical limits are not stable in space nor in time. We underlined the meaning of peri-urban areas in relation with socio-spatial segregation. Some sociologists describe current socio-spatial segregation process in France according to three trends (Donzelot, 2004): gentrification of old city centres (for the wealthiest), relegation into the suburbs ("ghettos" for the poorest) and peri-urbanisation as a safe haven, place of refuge for the middle classes ("entre soi"). In Montpellier Agglomération, different kinds of socio-spatial segregation processes undoubtedly took place among arriving population during the growth of peri-urban villages. Almost all social housing was concentrated in Montpellier city at the creation of Montpellier Agglomération for example. Whatever the type of segregation and the resulting population mix, in this case a common delineation of belongingness stands out among peri-urban populations between (to draw it roughly) native people - most of them are of agricultural origins: their family was historically growing grape and owning land - and newcomers - usually with urban origins and no or very old rural roots. As a consequence, peri-urban areas are characterised by cohabitation issues among residential populations of different profiles. Apart from their residential function, peri-urban areas are frequented by different kind of users, for different kinds of uses. This multifunctionality includes:

1. Productive use for farming
2. Different kinds of outdoor recreative uses: walking, cycling, horseback riding, bird watching, etc.
3. Environmental services such as waste treatment, water quality preservation, flood expansion field, biodiversity conservation, etc.

Peri-urban spaces also matter because of the landscape they provide. And in a more symbolic way, they play a role in local identity (vectors of symbolic function). As a conclusion, we can say that peri-urban areas are located around cities and are characterised by rapid spatial and social changes, mainly due to urban sprawl. This includes quite diverse morphological, social and economic characteristics. Whatever their diversity may be, peri-urban areas present priority issues in term of sustainable development. Paradoxically, peri-urban areas are seldom put at the heart of public debate and are too frequently missing in public policies. Lost somewhere between urban policy or urban design and rural or agricultural policy, peri-urban areas hardly receive dedicated public policies. In a context of central state disengagement and growing power of local governments, this makes it particularly appropriate to study the governance of peri-urban areas.

## **Further reading:**

PLUREL deliverable report: [Reports on regional planning and decision making and its impact on land use in the urban fringe, Montpellier report](#)

1. [Rural, urban and peri-urban typologies](#) (image) by Jennifer Buyck, 2010
2. [Peri-urban areas near Montpellier](#) (image) by Jennifer Buyck, 2009
3. [Green open spaces around Montpellier Agglomération](#) (image) by Jennifer Buyck, 2009
4. [Seafront near Montpellier](#) (image) by Jennifer Buyck, 2009

## 3.4 Land use changes

*Future land use change scenarios - MOLAND results for*

### FS 409 Peri-urbanisation and land use

*By Gertrud Jorgensen - Copenhagen*

#### **What is the issue?**

Peri-urban areas are by definition landscapes in the vicinity of urban cores, or in urban regions, and as such influenced by urban development. The way urban development in the region is planned and controlled may have considerable influence on the economic development as well as the possibility to preserve a high quality of green spaces, agriculture and natural areas. Scenarios are a structured way to explore the future. They can help to anticipate possible risks and opportunities in the face of rapid and unpredictable change and so to steer urban development.

#### **Methodology and Materials:**

In PLUREL, the MOLAND model was used to simulate the further land use in the case study regions of The Hague, Koper, Leipzig-Halle and Greater Manchester. To ensure that the analysis of spatially explicit scenarios for these case studies is robust and coherent, a common scenario framework was developed. For each case, a baseline scenario exists plus two further scenarios that reflect different pressures from socio-economic drivers on the one hand, and different planning responses on the other hand. The common scenario framework was enriched with local knowledge, so the underlying storylines were developed.

#### **Results and Conclusion:**

Regarding peri-urban land use, the national framework for planning varies from spatially explicit national plans to more governance based goal orientation and guidance to local authorities. None of these can be said to be more efficient than the other. Strong regional bodies, though, seem to be important for any effectiveness of planning in urban regions. Interesting aspects are that planning policies must have time to be efficient and that strong regional bodies are needed. Also the specific regulation instruments must be appropriate. Specific economic incentives, such as transfer of development rights are in the focal point, too. Spatial strategies come in simple visionary forms or in more complex and analytical forms - suitable for public acceptance or administration.

All case studies have a coherent planning system. Rural policies and urban attractiveness policies may be important measures to strengthen the role of agriculture and make urban life more attractive, thus lowering the pressure on peri-urbanisation. The evidence from the case studies generally confirms the role of national planning levels as well as the need for clear visions and strategies and policy integration. The alternative possibilities for urban and

spatial development are the subject of PLUREL, and yet they do not always link very directly to the general "driving force scenarios". Location choices and urban form patterns are clearly the outcome of many forces, only some of which are described in the general scenarios. Others are the outcome of accidents of geography, history or politics: the uncertainties of lifestyle and behaviour: or the not always rational choices of business or policy makers. Each of these possibilities is plausible, and each is very sensitive to the future of peri-urban areas. Therefore, the case-sensitive modelling of scenarios and the respective development of local storylines for the scenarios helps regional bodies to be more efficient in dealing with urban growth and peri-urbanisation at an appropriate scale.

### **Further reading:**

PLUREL deliverable report: [Conceptual description of agent-based models to incorporate the decision making process regarding land use change in rural-urban regions](#)

#### **3.4.1 The Hague region**

*Land use change simulation for The Hague region*

#### **FS 55 Future land use change scenarios - MOLAND results for The Hague region**

*By Francisco Escobar, Judith Westerink - Ispra, The Hague*

What is the issue?

We present the MOLAND results for Den Haag case study. These maps correspond to the spatial scenarios: "Business-as-usual", "Fragmentation" and "Peak-oil" for the years 2015, 2025 and 2040. This test case series produces scenario runs for different test cases using the MOLAND land use model. Each test case is unique in its geography, society and policy choices. The land use model handles each test case independently with unique datasets as provided by the stakeholders. Here, we look at the behaviour of the South-Holland province according to two scenarios described by the local stakeholders, and one scenario run for all test cases: Business as usual.

Methodology and Materials:

Three scenarios were run for South-Holland from 2004 to 2040: Business as Usual, Peak Oil and Fragmentation (see "references and further reading")<sup>F</sup>. The parameters for the scenarios were set in collaboration with local stakeholders at several meetings spanning 2008-2009. The methodological sequence included discussions with stakeholders, data acquisition and manipulation, ingestion into the MOLAND model, calibration. The final step was to extract statistics from the results and to prepare the data for export to allow stakeholders to perform their own analyses. Main input consisted of several geo-referenced layers of which the most relevant are: LGN Dutch National Land Cover for 1995 and 2004. Road and rail networks as well as waterways were also ingested into the model. Zoning and suitability maps were

created in-house. Main output of the model was a land cover map for each of the scenarios for each of the dates (2015, 2025 and 2040) as well as maps representing the calculated indicators (see report and maps attached). The report explains at length possible uncertainties related to results obtained in this case study. They are mainly related to data quality issues as well as to the own nature of modeling processes.

#### Results and Conclusion:

Results show that economic incentives for actual use of the land in economic terms helps to protect what the Dutch have defined as being “natural” land (i.e. including agriculture). Although the scenarios are all run with identical zoning and suitability maps, it is these economic incentives which lead to expanded arable lands and farmsteads, whose economic implications span from residences to tourism. It was evident when running the scenarios that the zoning map did not allow for a reallocation of land uses which were on the decline, such as the port and the greenhouses. Despite this, some work areas and urban areas were allowed to expand in these brownfields. In any case, the B1 and B2 scenarios were able to restrict loss of natural areas to a higher degree than the business as usual scenario. When the scenario results are compared to one another in terms of the criteria set by the indicators, the differences in the outcomes are evident. All scenarios used the same zoning restriction maps and the same suitability maps. The main differences are in the accessibility maps between the Peak-oil scenario and the other two; the demand for arable land in the Peak-oil scenario and the decline in the port area in both the Peak-oil and the fragmentation scenarios. Workplaces and rural residential housing crop up in the Delft-Rijwijk-Nootdorp triangle and farmsteads appear in the Peak-oil scenario where agricultural subsidies allow this sector to grow prosperously. In terms of total land change, the two scenarios show drastic increase in vacant urban land. This can be rectified by using a more generous zoning map which allows the reallocation of land uses associated with declining economic sectors, namely the port and greenhouses.

#### Further reading:

- [FactSheet\\_Moland\\_DenHaag](#) (pdf) by Mubareka-Escobar-JRC
- [Report Moland Den Haag](#) (pdf) by Mubareka-JRC
- [Frag\\_2015\\_DenHaag](#) (image) by Mubareka-Escobar-JRC
- [BAU\\_2040\\_DenHaag](#) (maps) by Mubareka-Escobar
- [BAU\\_2025\\_DenHaag](#) (images) by Mubareka-Escobar-JRC
- [BAU2015\\_DenHaag](#) (maps) by Mubareka-Escobar-JRC
- [Fragmen\\_2040\\_DenHaag](#) (images) by Mubareka-Escobar-JRC
- [Frag\\_2025\\_DenHaag](#) (maps) by Mubareka-Escobar
- [Peak-oil\\_2040\\_DenHaag](#) (images) by Mubareka-Escobar
- [PeakOil\\_2025\\_DenHaag](#) (maps) by Mubareka-Escobar

### 3.4.2 Koper region

#### *Land use change simulation for Koper region*

By Anton Perpar - Koper

### **What is the issue?**

The results of the modelling of future land use change scenarios (MOLAND modelling) for the Koper case study are presented here based on the selected three scenarios: "Business as usual" as a testing scenario, "Hyper-tech" and "Peak-oil".

The Municipality of Koper is in an evolutionary phase-preparing new spatial documents. Results from MOLAND modelling can assist some decisions about future development directions and regional planning because the impacts of scenario parameters can be seen on the land use. Results can help to choose the most sustainable way of development and to protect natural resources i.e. best quality agricultural land and environmental important natural areas (biodiversity protection).

### **Methodology and Materials:**

Results are based on MOLAND modelling. Based on cellular automata, the model is able to capture the complexity and random nature of urban growth and its implications on peri-urban and rural land while being able to handle large geographical areas. The majority of the work occurs before the actual running of scenarios with the model: decision about scenarios, evaluating indicators, generating maps, running scenarios, calibration, model set up, statistic data ingestion, spatial data ingestion.

Input variable were:

1. Land use 2000 and 2007,
2. Administrative divisions map,
3. Zoning map,
4. Digital elevation model,
5. Roads network map 2000 and 2007,
6. Rail network,
7. Suitability maps-defined according to the criteria: presence of land use in 2000&2007, data-driven slope and altitude criteria, soil quality for agricultural classes.
8. Statistical data on population and jobs.

Output were maps (areas where land use changes occurred (2007 to 2025) for each scenario, community land use changes...) MOLAND is a tool to assist spatial planning decision but it is not an urban planning tool to be used to assist in the detailed plans within the confines of a city. Results of the model depends on quality of input data and scenarios storylines which can be more realistic or more abstract ones.

### **Results and Conclusion:**

The summary of the findings are as follows:

[Open interactive MOLAND map for Koper](#) ( Geoportal ) Results show a significant decrease in vacant urban zones for all scenarios; growth in all economic sectors and in residential areas. This is especially true for the "Hyper-Tech" scenario. The utilisation of

otherwise vacant but dense urban land through the process of densification suggests that initiatives brought forward in this scenario may add value to the municipality. Housing predominantly occupies best soils. For the "Peak-oil" scenario, incentives for agricultural exploitation and strong zoning impediments results in a revival in the municipality's hinterland, even to the remotest rural areas. A growth in housing and services in these areas are the result of incentives to grow permanent crops. The "Peak-oil" scenario also results in an exploitation of best soils for agriculture, whereas moderate soils are reserved for housing. Comparing the projections of scenario results for 2025 shows that the "Hyper-Tech" and "Business as usual" scenarios do not differ very much one from another: built up classes grow at the expense of vacant urban and pastures. The "Peak-oil" scenario differs mainly because of the land use demand for agricultural land. The preference for good soils for this land use class, reflected in the zoning maps, results in crops predominantly replacing the pasture land use class. The "Peak-oil" scenario shows a change in occupation of moderate quality soils by residential buildings, whereas the "Hyper-Tech" and "Business as usual" scenarios shows residences dominating the best soils. Since permanent crop is part of an economic sector (agriculture) the "Peak-oil" shows the best soils as being dominated by economically significant land use. Poor soils are not built upon; this is because these soils are in the areas which are unsuitable for building. They remain fairly stable throughout all of the scenarios. The model's output from the "Business as usual" scenario shows that the current development trends could be improved in terms of sustainability and that some progress in that sense could be derived from the proposed strategies. The results of the MOLAND are interesting because they show possible land use changes for each scenario, even more useful is the spatial distribution of the land use classes which are the value added by the MOLAND model. The principal findings of modeling for the Koper case study were summarised in three main sectors of land use changes: economic, residential, natural land cover and presented also on a municipal level, commune level inside the municipality and by soil typology. Principal findings:

9. The "Peak-oil" scenario favours the distribution of jobs and services throughout the region through the promotion of the agricultural sector;
10. The "Hyper-Tech" scenario results in fewer large agglomerated vacant areas in the peri-urban zone, but more vacant areas in the rural zone;
11. The "Peak-oil" scenario restricts building in the peri-urban area but encourages this growth in the rural hinterland;
12. Development by "Business as usual" trends could be improved in terms of sustainability.

#### **Further reading:**

13. [Results MOLAND-Koper \(pdf\)](#) by Sarah Mubareka
14. [Koper \(images\)](#) by Horst Thaller

### **3.4.3 Leipzig-Halle region**

*Land use change simulation for Leipzig-Halle region*

## FS 57 Future land use change scenarios - MOLAND results for Leipzig-Halle region

By Laura Petrov, Dagmar Haase - Ispra, Leipzig

### What is the issue?

We applied the MOLAND model to Leipzig's region, in order to simulate land use evolution (2000-2025), considering different scenarios developed by local stakeholders - "Business-as-usual", "Hyper-Tech", "Peak Oil" and "Fragmentation". In the beginning of the 21<sup>st</sup> century, Leipzig's region has almost 500.000 inhabitants. This city has a tradition as centre of commerce (its Fair is considered one of the oldest trade fairs), but has also consolidated, during the last few years, its industrial importance due to the recent location of facilities of vehicle and automotive components industry and also as an international logistics node.

### Methodology and Materials:

The methodological approach is divided into the following steps:

- Definition of scenarios by local stakeholders, based on IPCC-SRES scenarios;
- Compilation of input data: land use (1990 and 2000), transport network (roads), zoning and suitability maps, statistical data (GDP and population)
- Calibration of the model (using the period between 1990 and 2000)
- Running of model, under different scenarios;
- Production of outputs (land use maps and statistics);
- Analyses of the output results

The accuracy of the model is strictly related to the achieved calibration. During calibration, spatial patterns of land use are analysed and transition rules are defined, according to the potential of each cell to change to another land use class.

### Results and Conclusion:

By comparing scenario results , it can be seen that farm/valuable land changes are more intense in Hyper-tech scenario (-4%) and not so significant in Fragmentation scenario (-1.6%). On the opposite side, new urban land emerges mainly on Hyper-tech scenario (23%), and Fragmentation register the smallest increase (8.7%). These results must be analysed considering the "shock" storylines and overall trends introduced in each scenario. If in Hyper-tech scenario, there is a "passive management leading to peri-urbanisation and metropolisation of rural area" (which is expressed in the values achieved), in Fragmentation scenario the emphasis is in the "high environmental protection: green ring map" (table 2 & 4). However, Fragmentation scenario results do not express a major problem: social exclusion.

# 4 Effects of peri-urbanisation

*Which effects does peri-urbanisation have?*

## FS 410 Effects of peri-urbanisation

By Katharina Fricke - Müncheberg

### What is the issue?

Urbanisation has arguably been the most significant process of land use change in Europe since the Second World War. The most obvious signs of this shift towards urbanisation are urban sprawl and the emergence of peri-urban areas, characterised by scattered built-up residential, industrial or commercial areas and dense transport networks, but also by the establishment in some places of green belts, recreational facilities, urban woodlands and golf courses, the conversion of farmstead complexes into housing and changes from conventional agricultural land uses into hobby farms and rural areas within easy reach of the city.

### Methodology and Materials:

The changing nature of the relationships between rural and urban land uses has deep consequences both for people's quality of life, for the environment and ecosystem services. These changes are most dynamic, intense and visible in the peri-urban zones which are therefore the main object of study in PLUREL.

To understand the processes that drive land use changes, effects are analysed to improve knowledge, and to create better methods and tools to assess the future social, environmental and economic impacts of these changes. Only then can effective planning strategies to achieve sustainable land use systems be identified.

### Results and Conclusion:

The different spatial patterns, cultures, planning policies, and various driving forces of urban growth or decline result in changes of land use. The functional linkages between urban and rural areas are effected as well. As mentioned above, the shifting relationships between rural and urban land uses have deep consequences both for people's quality of life, for the environment and ecosystem services. To better analyse and understand these effects, they are distinguished into the effects of peri-urbanisation in different types of European regions and under different scenario assumptions. Detailed effects in the case study regions are analysed, among them the economic development and the quality of life. The choice of the used indicators is explained in the respective fact sheets as well.

## 4.1 Effects in different region types

*What are the effects in different region types on?*

### FS 411 Regional effects of peri-urbanisation

By Annette Piorr - Müncheberg

#### What is the issue?

PLUREL creates maps that show the regional effects of urbanisation on the following urban-rural functions: household structure, economy and employment, emissions, agriculture, landscape and environment, and recreational value. Most important outputs are maps on changes between the baseline situation in 2000 and the PLUREL scenarios time slices. Outputs can be carried out for different scales and in different formats: In general it is Pan-European maps with classified values for the main indicators of the European Urbanisation Impact Model (EUI Model) at NUTS X resolution for the EU-27. Urban growth is a common European research and policy issue. Nevertheless, particular regionalised impacts on all dimensions of sustainability show major variations and need to be taken into consideration. (i) The degree of urbanisation and (ii) the spatial framework (bio-physical, socio-cultural, regulative regime) within the respective urban regions reflect the heterogenic European pattern of regional conditions. The adaptation of the EUI Model to the regional variability allows for inter-regional comparability and user relevance in regional policy and planning.

#### Methodology and Materials:

Basis for these maps are simulation models based on mathematical algorithms that measure urbanisation as a function of changes in artificial surface, population density or GDP (dependent variables). As these models are data based, a value for each NUTSX region, generated from historical data analysis is available. The PLUREL future development scenarios deliver the changes in the dependent variables. So a specific value for a future situation for each scenario can be modelled. The following thematical issues are covered:

1. household structure, age structure
2. economy and employment
3. emissions
4. agriculture
5. landscape, environment, recreational value.

#### Results and Conclusion:

Most important outputs are maps on changes between scenarios time slices etc. Outputs are available for different scales and in different formats: Maps at EU-27 scale with a NUTSX resolution are the most common ones. Other formats are distribution diagrams, spidergrams (as basis for integrated assessment). Results feed into the PLUREL iIAT-EU. The database on

'Regional effects of urbanisation' provides the basis for the user determined result mapping via the iIAT-EU. The creation of maps works within the iIAT-EU at different spatial scales. It is a main component of the interactive character of PLUREL research. Furthermore, a particular value of the modelling chain behind the maps lies in its 'living' character: underlying databases can be updated and model quality can be improved with the availability of new or better data. Hence, also the update of maps is possible. Independent from this, the classification of values for output presentation can be changed according to the particular purpose. A single sub-product is the report on response functions for migration. It describes and maps hot spots of the spatial representation of migration (qualitatively), by making use of census data, and Corine Land Cover- based land use changes. PLUREL provides maps that show the regional effects of urbanisation on the following urban-rural functions: household structure, economy and employment, emissions, agriculture, landscape and environment as well as recreational value. They are accessible via the Xplorer .

#### **4.1.1 Population and household structure**

*Population and household structure*

##### **FS 62 Regional effects of land use change on population and household structure**

*By Tanja Tötzer, Wolfgang Loibl - Vienna*

##### **What is the issue?**

Urban regions are a major source for air pollution. But the relations are complex: large scale industry as well as energy production/conversion sites for urban supply (refineries, power plants, district heating etc.) are frequently located in peri-urban regions. Pollutant emissions from households and traffic are concentrated in the urban centres and along the major roads. This fact sheet describes the land use relationships driving air pollution patterns due to activities from housing, traffic and commerce in RURs related with energy demand and activity density. Response functions for air pollution are presented for RUR types and RUR - sub-regions of entire EU 27. Population is, on the one hand, the most important driver affecting land use as described in the issue section: changes in land use pattern depend mostly on changes in population numbers and allocation preferences. On the other hand, population is the very receptor affected by negative impacts evolving through land use change.

##### **Methodology and Materials:**

First population structure related aspects had been investigated through statistical analysis for certain case regions and case countries, where data were available. Later land use – population relations have been explored considering CORINE land cover data, and GDP development. Finally RUG model input and results concentrating on artificial surface shares in the sub-regions of the RURs have been analysed, to be discussed in the response function fact sheet. **Input variables** were population, age classes, education classes, household size classes, employment numbers, GDP, CORINE land cover and RUG model data (the latter for response function development).

**The outputs** were statistical analysis results as well as spatial analysis results. The results serve to prepare the response functions describing population-related effects on land use change. The

presentations refer to observed data with little uncertainty, the RUR typologies and delineation of urban versus peri-urban regions is somehow subjective and has some limitations because of data availability restricted to population and land cover data, lacking interaction data.

## **Results and Conclusion:**

The analyses provide insights regarding the quantification of urbanisation effects. A disadvantage is that only little statistical data are available for entire Europe at NUTS 3 level, which shows limits conducting statistical analysis. The data exploration shows that the population and urban change dynamics of urban cores match mostly the dynamics in the peri-urban areas. Only certain constellations show opposite trends:

1. In mono-centric RURs (in Spain and France) some peri-urban areas show a population decline, while the urban core areas show population growth.
2. In poly-centric RURs (in Poland, Germany, Hungary, northern France) some of them show population growth in the peri-urban areas while the urban core population has declined.
3. Regarding rural polycentric RURs and centre-less rural regions the most regions show declining population numbers (not often in France, Spain, Portugal, southern Italy, northern UK, Bavaria and Alpine Austria).

(See attached figures and the analysis descriptions in the related pdf-file: see "references and further reading".) The wealth of population and the wealth of a region show influence on urban land use in terms of land consumption for housing purposes. Exploring land-consumption per capita versus regional GDP per capita some significant national peculiarities can be observed. The assumption, that the amount of land consumption shows high coincidence with size of GDP could be partly confirmed. The highest land consumption-rates show generally Scandinavian urban regions while many urban areas in southern Europe (Italy, Spain) with low GDP rates show less land consumption. But there exist also some certain deviations which indicate opposite trends: e.g. in Belgium, especially the rather poor Walloon conurbations, show higher land-consumption despite lower income. On the other hand the conurbations with largest urban cores like London or Paris show less land consumption despite highest GDP values. This let assume that above a certain urban density threshold land consumption per capita will decline even when the income of the local population is increasing. Land use change is the effect of people's action. The most important indicator explaining land use and land use change refers to population, e.g. certain population densities leading to specific land consumptions. Positive regional development, attracting more people and entrepreneurs, resulting in growing regional income (indicated through GDP) leads to accelerated land consumption resulting in urban sprawl, if no planning strategies against are applied or until the distance to the large urban cores is too long to settle and commute. The observed turn may happen because of

1. a certain size of the urban core resulting in large distance to peri-urban areas, acting as a barrier to occupy new more rural land and commute to the centre
2. a certain density of urban cores where density evolves to be attractive to stay in the centre instead of living in the peri-urban
3. established planning policies to avoid further negative impacts which we observed to increase in the past.

## **Further reading:**

- [RUR-typology-population allocation and dynamics](#) (pdf) by Wolfgang Loibl
- [Land consumption and regional income](#) (image) by Wolfgang Loibl
- [Population dynamics: urban versus per-urban](#) (image) by Wolfgang Loibl

### **4.1.2 Economic development and working places**

*Economic development and working places*

#### **FS 64 Regional effects of land use change on economic development and working places**

*By Piotr Korcelli, Elzbieta Kozupela - Warsaw*

##### **What is the issue?**

Urban regions are a major source for air pollution. But the relations are complex: large scale industry as well as energy production/conversion sites for urban supply (refineries, power plants, district heating etc.) are frequently located in peri-urban regions. Pollutant emissions from households and traffic are concentrated in the urban centres and along the major roads. This fact sheet describes the land use relationships driving air pollution patterns due to activities from housing, traffic and commerce in RURs related with energy demand and activity density. Response functions for air pollution are presented for RUR types and RUR - sub-regions of entire EU 27. Population is, on the one hand, the most important driver affecting land use as described in the issue section: changes in land use pattern depend mostly on changes in population numbers and allocation preferences. On the other hand, population is the very receptor affected by negative impacts evolving through land use change.

##### **Methodology and Materials:**

First population structure related aspects had been investigated through statistical analysis for certain case regions and case countries, where data were available. Later land use – population relations have been explored considering CORINE land cover data, and GDP development. Finally RUG model input and results concentrating on artificial surface shares in the sub-regions of the RURs have been analysed, to be discussed in the response function fact sheet. **Input variables** were population, age classes, education classes, household size classes, employment numbers, GDP, CORINE land cover and RUG model data (the latter for response function development).

**The outputs** were statistical analysis results as well as spatial analysis results. The results serve to prepare the response functions describing population-related effects on land use change. The presentations refer to observed data with little uncertainty, the RUR typologies and delineation of urban versus peri-urban regions is somehow subjective and has some limitations because of data availability restricted to population and land cover data, lacking interaction data.

## **Results and Conclusion:**

The analyses provide insights regarding the quantification of urbanisation effects. A disadvantage is that only little statistical data are available for entire Europe at NUTS 3 level, which shows limits conducting statistical analysis. The data exploration shows that the population and urban change dynamics of urban cores match mostly the dynamics in the peri-urban areas. Only certain constellations show opposite trends:

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3. Regarding rural polycentric RURs and centre-less rural regions the most regions show declining population numbers (not often in France, Spain, Portugal, southern Italy, northern UK, Bavaria and Alpine Austria).

(See attached figures and the analysis descriptions in the related pdf-file: see "references and further reading".) The wealth of population and the wealth of a region show influence on urban land use in terms of land consumption for housing purposes. Exploring land-consumption per capita versus regional GDP per capita some significant national peculiarities can be observed. The assumption, that the amount of land consumption shows high coincidence with size of GDP could be partly confirmed. The highest land consumption-rates show generally Scandinavian urban regions while many urban areas in southern Europe (Italy, Spain) with low GDP rates show less land consumption. But there exist also some certain deviations which indicate opposite trends: e.g. in Belgium, especially the rather poor Walloon conurbations, show higher land-consumption despite lower income. On the other hand the conurbations with largest urban cores like London or Paris show less land consumption despite highest GDP values. This let assume that above a certain urban density threshold land consumption per capita will decline even when the income of the local population is increasing. Land use change is the effect of people's action. The most important indicator explaining land use and land use change refers to population, e.g. certain population densities leading to specific land consumptions. Positive regional development, attracting more people and entrepreneurs, resulting in growing regional income (indicated through GDP) leads to accelerated land consumption resulting in urban sprawl, if no planning strategies against are applied or until the distance to the large urban cores is too long to settle and commute. The observed turn may happen because of

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2. a certain density of urban cores where density evolves to be attractive to stay in the centre instead of living in the peri-urban
3. established planning policies to avoid further negative impacts which we observed to increase in the past.

## **Further reading:**

- [RUR-typology-population allocation and dynamics](#) (pdf) by Wolfgang Loibl
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- [Land consumption and regional income](#) (image) by Wolfgang Loibl
- [Population dynamics: urban versus per-urban](#) (image) by Wolfgang Loibl

### **4.1.3 Energy consumption and air pollution**

*Energy consumption and air pollution*

#### **FS 65 Regional effects of land use change on energy consumption, air pollution**

*By Wolfgang Loibl - Vienna*

##### **What is the issue?**

Urban regions are a major source for air pollution. But the relations are complex: large scale industry as well as energy production/conversion sites for urban supply (refineries, power plants, district heating etc.) are frequently located in peri-urban regions. Pollutant emissions from households and traffic are concentrated in the urban centres and along the major roads. This task describes the land use relationships driving air pollution patterns due to activities from housing, traffic and commerce in RURs (Rural-Urban Regions) related with energy demand and activity density. Response functions for air pollution are presented for RUR types and RUR - sub-regions of entire EU 27. When exploring and assessing land use related impacts of urban activities, air pollution turns out as a major pressure on environment and population. Changes in land use pattern, in the amount of activities, in the applied technologies and fuel types have much effect on changes on environmental impacts.

##### **Methodology and Materials:**

Air pollution is a response of certain human activities generating emissions. Allocating these activities (through proxy data, related to land use and the allocated population resulting in population density) and relating emission factors to these activities, the emission amount can be allocated resulting in spatial emission patterns within the RURs, spatially explicit driver–pressure–impact relations may analyse reflecting spatial patterns of human activities. Regional air pollution data for entire Europe are estimated yearly through the CORINAIR (CORe INventory of AIR emissions) project and made available for various air emission sectors and pollutant components and provided as emission sums for 50x50 km grid cells covering Europe. The spatial disaggregation by emission sectors and components to RUR sub-regions is carried out applying data on land use and population, regional GDP and national energy consumption data by fuel type.

##### **Results and Conclusion:**

Those emission sectors are taken into account which allows for a spatially explicit relation with driving forces and where data are available, at European scale and NUTS 3 level.

The explored sectors are: Emissions from residential, institutional and commercial heating, emissions from manufacturing processes, emissions from road transport. Emissions from agricultural activities are investigated in a different task. Emissions from large point sources are excluded as they cannot be allocated at local scale for entire Europe (without detailed information). Such large point sources (power plants, refineries, fossil fuel extraction, waste processing) are statistically treated as “singular events” with stochastic allocation from a statistical viewpoint, where peri-/urban development changes cannot be predicted. CO (carbon monoxide), NOx

(nitrogen oxide) and HC (Hydrocarbons, accurately NMVOC = Non-methane volatile organic compounds) emissions are considered as major impacts and are judged to allow a proper estimation and spatial allocation. Considered emission sectors and components cover 90% CO emissions, above 60% NOx emissions and 80% HC emissions. SOx (sulfur oxide) emissions are of less importance because of decreasing sulphur content in fuels and advanced cleaning technologies. Particulate matter (PM) data show high uncertainty and are thus excluded. NH3 (ammonia) emissions from agriculture refer to a different task. Emission pressure is estimated by the linear regression models with different plausibility for the set of emission sectors and emission components related to the RUR-sub-regions. Urban/peri-urban population-related emissions show high coincidence between observed and modelled results – NOx estimations are highly plausible, CO and HC match little due to a fuel mix causing high CO & HC emission variability. Rural population-related results show less coincidence: NOx estimations are plausible, but CO and HC match very little. Urban/peri-urban and industry emission estimations show partly implausible results. HC model results show highest coincidence. Industry emissions in rural sub-regions show no plausible results, because of a stochastic scattering of production activities. Estimation of urban/peri-urban road traffic emissions show a high coincidence of observed and modelled data in urban and peri-urban sub-regions. Rural road traffic emissions show - for all components - less coincidence in rural sub-regions. The most applied important variables – indicating to reflect drivers causing pressure are: Population and population density (per sub-region), GDP per capita (per Nuts 2 region), Energy consumption/production indicators (per country) . The list shows that there are different influences related to local scale – population, regional scale - regional GDP and to national scale – energy production/consumption indicators. Population is the variable with the highest explanation share - and thus influence share. Not land use is the main driver, but population behaviour and dynamics. Thus land use change is the effect of people's action, causing air pollution.

### **Further reading:**

PLUREL deliverable report: [Report on response functions for energy consumption and air pollution \(urban / traffic emissions and exposure\)](#)

## 4.2 Effects of different scenarios

*What are the effects of different scenarios on ?*

### FS 39 Response functions (principles)

By Annette Piorr - Müncheberg

#### What is the issue?

Urbanisation leads to significant changes in the social, economic and environmental setting of EU regions. A response function (RF) is a quantitative representation of a functional relationship between ?drivers? connected to urbanisation and ?sustainability indicators?. Drivers are specific land uses, distance to city centre, GDP or population density whereas the sustainability indicators describe landscape bound recreation, biodiversity, commuting and traffic, population, employment, housing, household structure and emissions. The RF is developed either generically or case-based for the pan-European situation or clusters of regions. The aim is to derive regression models with the best possible explanatory value for impact analysis of developments at NUTSX level or specific for Rural Urban Regions (RUR). The European Urbanisation Impact Model (EUI-Model) comprises all quantitative Response Functions at NUTS X for EU27. Possible forms of outputs are maps or graphs, which are fed into the iLAT. RF are the backbone for the analysis of regional effects of urbanisation in the EU. They are mathematical expressions by which a quantification of the potential impacts of urbanisation trends on single indicators for the social, economic and environmental functions of a region is possible. When future driver values from the (RUG model) are fed into the RF, the impact of certain urbanisation trends can be evaluated. Therefore RF are an important means for policy support.

#### Methodology and Materials:

Most PLUREL RFs have been built on European databases with EU27 coverage at NUTSX, e.g. EUROSTAT data. The RFs on household structure and on emissions are mainly related to demographic projections resulting in changed population densities or GDP changes. RF for landscape structure, biodiversity, work and recreation refer to changes of artificial surface area, based on Corine Land Cover (CLC). RF for commuting and housing have been derived on more detailed datasets from different RUR types and by using more specific models that consider data which do not underlie continuous monitoring at European scale. The PLUREL response functions (RF) are generic regression functions with dependent and independent variables being represented by quantitative indicators at NUTS3/NUTS2 level. Independent input variables are land cover related and socio-economic indicators, like urban area, GDP and population. Output variables are indicators which describe the social, economic and environmental setting of a region, e.g. number of people older than 60, unemployment rate, commuting rate or age-dependent housing choice.

#### Results and Conclusion:

There are three types of underlying equations. The functions do not necessarily need to be linear,

they can also be logarithmic or else. **Type 1: General regression function**

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times In3_{2025} + ? + k$$

With: y = Output variable, example single person households

In1 = Input variable 1 value at a certain time slice, e.g. population

In2 = Input variable 2 value at a certain time slice, e.g. artificial surface

In3 = Input variable 3 value at a certain time slice, e.g. GDP

a, b, c = Regression coefficient different for each input variable

k = Constant

**Type 2: A function for each RUR type**

$$\text{RUR type 1: } y_{\text{type1}} = a_{\text{type1}} \times In1_{2025} + b_{\text{type1}} \times In2_{2025} + c_{\text{type1}} \times In3_{2025} + ? + k_{\text{type1}}$$

$$\text{RUR type 2: } y_{\text{type2}} = a_{\text{type2}} \times In1_{2025} + b_{\text{type2}} \times In2_{2025} + c_{\text{type2}} \times In3_{2025} + ? + k_{\text{type2}}$$

RUR type 3: ?

With: y = Output variable for specific RUR type, example commuting

In1 = Input variable 1 value at a certain time slice, e.g. population

In2 = Input variable 2 value at a certain time slice, e.g. employment

In3 = Input variable 3 value at a certain time slice, e.g. distance to centre

a = Regression coefficient for In1, different for each RUR type

b = Regression coefficient for In2, different for each RUR type

c = Regression coefficient for In3, different for each RUR type

k = Constant, different for each RUR type

**Type 3: Integration of static variables**

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times SV1 + d \times SV2 + e \times SV3 + ? + k$$

With: like Type1,

SV1 = Static variable 1, e.g. typical fuel consumption per country

SV2 = Static variable 2, e.g. coastal area

Etc.

## Further reading:

PLUREL deliverable reports:

1. [Modelling Approach for Response Functions on Agricultural Production, Ecological Regulation and Recreation Function](#)
2. [Delineation of Response Functions](#)

Figures for the different RF types:

1. [Figure 1:](#) Example for Type 1 RF: Relation between employment rate and artificial surface (representing the share of urban area). Calculated by PAS, Warsaw.
2. [Figure 2:](#) Example for Type 2 RF for each RUR Type: Probability of commuting in relation to distance to the urban centre. Provided by SYKE, Helsinki.
3. [Figure 3:](#) Example for Type 3 RF: The graph shows the Type 1 RF between artificial surface and the amount of unfragmented landscape (size of the area not dissected by streets or settlements). The box below shows the RF enhanced by static variables like the location in the Mediterranean or the amount of rural area, which cannot be displayed in a graph. This RF was provided by ZALF, Müncheberg.

## 4.2.1 Population, household structure

*Effects of peri-urbanisation on population and household structure*

### FS 67 Effects of peri-urbanisation on population, household structure

By Tanja Tötzer, Wolfgang Loibl - Vienna

#### What is the issue?

Population is triggering land use and land use change. Growth dynamics in the urban and peri-urban areas depend mostly on population dynamics which trigger the demand for housing, shopping and recreation facilities as well as the number and location of workplaces due to the availability of skilled employees. The population's demand for goods and services produced in the vicinity also triggers peri-urbanisation. Activities that are allocated in different areas release traffic flows and the transportation of goods. All these activities are causes of certain pressures on the peri-urban regions. So, on the one hand population is the most important driver affecting land use. But on the other hand population is also the very receptor of negative impacts of land use change. Population growth results directly in an increase of artificial land surface, which varies between the urban, the peri-urban and the rural sub-regions. An effective planning policy to steer peri-urbanisation demands considering the effects of the different allocation and density patterns.

#### Methodology and Materials:

At first, population structure related aspects have been investigated through statistical analysis for certain case regions and case countries, based on data availability. Further land use ? population relations have been explored considering CORINE land cover data and GDP development. Finally the RUG model input and results concentrating on artificial surface shares in the sub-regions of the rural urban regions (RURs) have been analysed. Used input variables for modelling the effects of peri-urbanisation on population and household structure are population data by age classes, by education classes, households by size classes, employment numbers, and GDP provided either for NUTS2, NUTS3 data, derived for RURs and RUR sub-regions. CORINE land cover data (settlement area) and artificial surface estimations based on the RUG model results are available as 100x100m raster cells aggregated for NUTSx regions, for RUR regions as well as for the RUR sub-regions. The calculations refer to observed data with little uncertainty. Nevertheless, the RUR typologies and delineation of urban versus peri-urban regions is rather subjective: Furthermore, the typology has some limitations due to data availability in terms of population and land cover data. Interaction data are lacking.

#### Results and Conclusion:

The analyses provide some insights regarding the quantification of peri-urbanisation effects. The wealth of population and the wealth of a region has a certain influence on urban land use in terms of land consumption for housing purposes, despite some significant national peculiarities can be observed. The highest land consumption rates occur in Scandinavian urban regions while many urban areas in southern Europe (Italy, Spain) with low GDP ratios show less land consumption. On

the other hand the conurbations with largest urban cores like London or Paris show less land consumption despite highest GDP values. This leads to the assumption that above a certain urban density threshold land consumption per capita declines even if the income of the local population is increasing. To estimate future development of certain population indicators, response functions have been developed to relate artificial surface projections, population projections as well as GDP projections with population indicators. In general, the demographic development leads to a further increase of the older population and a general decrease of the young population with regional differences throughout Europe. The assumptions of the B2 scenario ? social fragmentation ? have only limited effect on the age class distribution. Population shares with higher education numbers increase primarily in those areas where the proportion was rather small before. Household number growth is expected to be more and more decoupled from population dynamics: Even areas with declining population show growing household numbers. Self-determined lifestyles result in a decline of the average household size: the number of 1 to 2 persons households is increasing, while 4 and more persons - household numbers show a further decrease with some variation in certain countries and with different shares in urbanised versus peri-urban to rural regions. While in urban areas these lifestyle trends started decades ago and continue, the population in rural areas, adopting urban lifestyles, catches up with declining household sizes. As growing household numbers demand new dwelling areas, urbanised areas and / or peri-urban areas will grow ? depending on the scenario and the underlying assumptions. Here the A1 and A2 scenarios lead to faster peri-urban growth of artificial surface, while the B1 and B2 scenarios lead to counter-urbanisation aiming at a higher concentration in cities and less peri-urban sprawl.

Different growth patterns of the peri-urban settlement area can be expected for the coming decade. The hot spot areas with fastest peri-urban settlement growth are to be observed in South England, the Benelux, Northern Italy and large parts of Germany. Moderate growth is likely to occur in France, UK, Central Europe, eastern European capital regions, and along the coastal regions of the Mediterranean and Southern Scandinavia. Concluding, land use change is the effect of people?s action. The most important indicator explaining land use and land use change are population dynamics resulting in certain population densities or land consumptions. Positive regional development, which attracts more people and entrepreneurs and results in growing regional income (indicated through GDP), leads to accelerated land consumption. This leads to further urban sprawl, if no planning strategies are applied. A limiting factor to urban sprawl is the distance to the large urban cores and so the commuting time. The observed change of these general patters may be due to

1. a certain size of the urban core resulting in large distances to peri-urban areas, acting as a barrier to occupy more rural land and commute to the centre.
2. a certain density of urban cores if the density evolves to be attractive to stay in the centre instead of living in the peri-urban.
3. established planning policies to avoid further negative impacts as observed in the past.

### **Further reading:**

[Graphs and Figures \(pdf\)](#)

## **4.2.2 Economic development and working places**

*Effects of peri-urbanisation on economic development and working places*

## FS 68 Effects of peri-urbanisation on economic development, working places

By Piotr Korcelli, Elzbieta Kozupela - Warsaw

### What is the issue?

The land use changes in rural, urban, as well as peri-urban areas, as projected till 2025 on the basis of alternative sets of assumptions, i.e. scenarios (), have certain implications for spatial economic change. Spatial patterns of economic activity can be evaluated by means of sustainability criteria. Here, sustainability is interpreted in terms of territorial cohesion which represents one of the major development goals defined in the EU Lisbon Treaty. Sustainability is expressed by the distribution of values of selected economic indicators within the set of NutsX units. The results are relevant for spatial development policy, at both the European Union and a national level.

### Methodology and Materials:

The data used in this analysis pertained to Gross Domestic Product (GDP), population size, as well as the area covered by artificial surface and its share in the total land area, all projected for 2015 and 2025, according to four development scenarios. These data were used to calculate future employment and GDP per capita ? in Purchasing Power Parity (PPS) rates ? on the basis of observed data. The total employment rate, as well as sectoral employment shares, were projected for the NutsX units. Referring to modelling uncertainties, the growth of the gross domestic product ? PPS per capita values over the projection period is excessively high, at least in some spatial units. The recalculation of the index values using a revised population projection figure might be a solution here.

### Results and Conclusion:

The highly urbanised NUTS units, i.e. those with the high shares of artificial surface in the total land area, are generally characterised by relatively high GDP ? PPS per capita values. This association, identified for 1996 - 2000, continues through the projection period. Nevertheless, the distribution of the projected GDP values changes. More specifically, the share of units with values above the mean indicator value increases. This suggests some increase in territorial cohesion, i.e. the sustainability level.

In comparison with observed patterns, i.e. one for the year 2000, the total employment rate values decrease mainly in South Western Europe, while they show increase in selected countries of East-Central Europe. The patterns for the hyper-tech scenario and the extreme water scenario are almost identical; the same is true for the peak oil and the fragmentation scenario. In the former two scenarios the number of NutsX units with relatively high employment rate values is markedly higher than in the peak oil and the fragmentation scenarios. Considering individual sectoral employment shares, differences among the individual scenarios are noticeable. The decrease of the share of sector one (agriculture, hunting, forestry, fishery) employment by the year 2025 is the strongest according to the hyper-tech scenario. With respect to sector two (industry, mining, electrical power, construction), which also experiences a shrinking share in general, the drop is the steepest in the case of the peak oil scenario. Sector three (services) gains in terms of its employment share, especially in those regions that experience a rapid contraction of employment in agriculture and industry. Spatial distribution of the service sector share, in the year 2025, is particularly flat according to the peak oil scenario. The share of sector four (administration and finances)

experiences a trend towards more uniform distribution across the EU, with decreases in countries characterised by relatively high shares in the year 2000, and, rather large increases (by 5 to 10 percentage points) in those where which the initial shares were as small as 15-25 percent. Again, the peak oil scenario generates the most uniform spatial pattern across the EU by the year 2025. The redistribution of relative GDP ? PPS per capita values, as resulting from the individual, scenario ? based projections, indicates some decrease of spatial disparities which are observed at NutsX level. This suggests an increasing territorial cohesion which is considered as one of sustainability - related development goals. An extension of this analysis, so as to include aggregation of the spatial units into predominantly urban, peri-urban and rural types, would allow us to arrive at more specific, policy ? relevant conclusions.

Changes in the total employment rate, as well as shares of individual sectors in the total employment give evidence of relative convergence across the EU. This trend is most noticeable in the case of the peak oil scenario.

### **Further reading:**

#### **4.2.3 Housing**

##### *Effects of peri-urbanisation on housing*

##### **FS 42 Effects of peri-urbanisation on demand and housing preferences**

*By Nathalie Bertrand, Tina Rambouillet - Montpellier*

##### **What is the issue?**

Response functions relate the impact of driving forces trends: demographic changes, economic and technological development, climate change - on the level of pressure (residential, transportation, recreation, food supply, etc.). The purpose of our task here was to build a quantitative relation between housing demand and two main driving forces: demographic trends and land-use change. We merge household location choice with life-cycle model and validate our models with French data. The final model allows simulation of the impact of demographic driven evolution of household location choices and then on housing demand for each PLUREL scenario at each of the 6 RUR-typologies. For most developed countries, with the slow down of population growth, the proportion of elderly persons is going to increase. The number of households increases more quickly than the population. The aged households are in average of a smaller size. Then, ageing of the population will entail an additional housing demand. The spatial repartition of this additional housing demand according to RUR-type will require far-reaching economic and social adjustments.

##### **Methodology and Materials:**

We adopt a standard approach in urban economics, by nesting a model of household location choice with a simplified life-cycle model. The response function is quantified by estimating the residential choice location of three social classes of households (retirees, middle-aged and young). We used the

1999 Census Data for the Montpellier NUTS3 region. From Census data, we could obtain the variable *housing demand*, which is the share of housing inhabited by each social class at the municipality level, and at municipality sub-types. Also, we could obtain the variable *residential location choice*, which is the household's choice of residential zone.

## Results and Conclusion:

Based on the Montpellier NUTS-3 data, our empirical analysis showed that location patterns as the factors influencing housing demand vary strongly with the life-cycle stage of the household. Young households are massively attracted by the urban pole of the area for several reasons: proximity to employment centre, urban amenities and public services. Segregations indices confirmed that young households represent the most segregated and centralised social group in the area. Also there is almost no spatial autocorrelation for young distribution, as result of their high concentration in one spatial unit (MontpellierCity). Thus, for young households, location characteristics (urban amenities) are primordial in their location choice and more important than their housing needs.

Middle-aged households show a completely different location behaviour: they prefer peri-urban and rural zones, but in proximity of urban centres. There are several reasons: they need proximity to employment but at the same time, middle-aged households are usually bigger families, with higher housing demand, which could not be satisfied in urban centres. This location pattern will influence segregation indices, middle-aged households being the less segregated social group and with a quite correlated spatial distribution. At the same time, their centralisation stays relatively important.

According to the housing demand equation, for middle-aged households, the degree of urbanisation has a low impact on their location choice, but on the contrary, they have important needs for urban services (education, social and health facilities) and natural amenities, more agricultural amenities than forest amenities due to the geographical configuration of the region. We can state that for the middle-aged households, contrary to young, even if they have strong preferences for urban amenities, the housing needs are more important in their trade-off for location choice decision.

Retirees have different behaviour and location patterns. There are no more employment reasons to choose urban areas and other factors emerge such as public services and natural amenities. Thus retirees have very decentralised locations, in peri-urban and rural zones. We distinguished "young" retirees such an apart social group, because we can find some working households. This characteristic will make some differences between two categories of retirees. The households from first class of retirees are less segregated and prefer relatively more centralised location than the second class. However, the empirical model predicts a higher housing demand in the urban center of Montpellier than the actual spatial distribution for three social classes of households, except for young households. This situation could be a consequence of the strong difference on public services between Montpellier and the rest of the region.

### 4.2.4 Commuting

*Effects of peri-urbanisation on commuting*

#### FS 69 Effects of peri-urbanisation on commuting

By Mika Ristimäki, Panu Kontio, Ville Helminen - Helsinki

## **What is the issue?**

In rural-to-urban regions commuting reflects the interaction between urban and peri-urban areas. Urban sprawl enlarges the functional regions of commuting and increases population in car dependent areas. As a result of decentralisation and dispersion, the commuter flows that have traditionally been oriented towards urban core are changing into criss-cross patterns. *The response function of commuting* uses empirical data on commuting to illustrate and model the interaction between the urban core and the surrounding region. *The distance decay curve* of commuting illustrates how in-commuting to the core decreases as a function of distance in different urban areas. Transport is one of the major sources of greenhouse gas emissions. Commuting is the single most important factor determining daily travel patterns. Being relatively stable in space and time, commuting trips determine the urban region transport systems. Commuting can be seen as a measure of spatial interaction in urban-rural structure: it acts as a cost factor, influencing location choices of individuals and firms and, on the other hand, commuting itself is a result of these choices.

## **Methodology and Materials:**

The commuting datasets included data about the amount of employed persons and their living and working places. Datasets were first analysed in a GIS and later with statistical tools. Total number of employees and the proportions of employees that commute to the core were classified based on distance between living place and city centre. Finally, a distance decay curve representing the probability of commuting to the core from different distances, based on logistic regression was obtained. The dependent variable "proportion of workers commuting to the core" is explained by the independent variable "distance to the centre". Distance to the centre is calculated as Euclidean distance between the midpoint of the city centre and the living place. The output of the analysis is a distance decay curve for commuting. The shape of the curve is controlled by two parameters: probability of commuting to the core at the border of the core area and the distance decay effect.

## **Results and Conclusion:**

The result of the response function is a curve describing the probability of commuting to the core from different distances. The core area is defined as a circle with 10 km radius (big cities) or 5 km radius (small cities) around the city centre. The results of the response function were summarised of as archetypical commuting curves representing "pure" RUR-types (Rural-Urban-Region). Monocentric and polycentric urban forms differ considerably in terms of commuting patterns. In a monocentric urban form, urban density and distance to the centre are interlinked and these are also the dominant factors affecting commuting distance. In a polycentric structure, there are several work destinations within the same distance and thus, commuting patterns vary more. The curves reveal the extent of functional commuting areas and the level of centralisation of workplaces in different rural-urban structures. Commuting is closely interlinked with the urban spatial structure. It acts as a cost factor that influences location choices of individuals and firms. The maps of "commuting probability" derived from archetypical commuting curves were used in RUG-modelling together with information on relative travel times in order to create an index of "remoteness" from large/capital and medium cities. The result of the RUG-modelling is the change in artificial surface in four scenarios for 1 x 1 km cells for entire Europe. Commuting is also a result of location choices individuals and firms make in housing and labour markets. Changes in the commuting gradient are responses to several dynamics occurring in the urban-rural continuum. Two

evident dynamics influencing the curve parameters are changes in locations of work and population, i.e. centralisation versus sprawl, and changes in transport systems, i.e. accessibility. The factors behind individual level choices such as the place of residence, the job and travel mode form complex interrelationships. The future development of major commuting patterns is interlinked with general urbanisation trends. In the attached figure four corners (A-D) represent the cases where urban centre attracts commuters differently from surrounding area. The urbanisation trend determines the location preferences of individuals and employment, which also changes the directions of commuting. Workplaces are either centralising or decentralising and commuting areas are either expanding or shrinking. The urban structure determines the number of existing commuting directions. In the different future scenarios urban areas have different commuting gradients. Monocentric urban form is an easier target for planning of public transportation whereas dispersed form, in general, enforces car-dependency. Polycentric urban form may in theory minimise commuting cost by shrinking the distance between settlement and employment. Sustainable polycentric urban structure requires a public transport network that can manage commuting between several centres. Changes in urban structure are particularly clear in the periphery of the cities. Peri-urban development has been characterised by urban sprawl with low densities and fragmented structure. New patterns of settlement and employment require new patterns of mobility and transport. In peri-urban areas distances tend to be longer with more complex flow networks. Peri-urban public transport systems are usually not strong enough to prevent car-dependency. These changes have an effect on commuting. Peri-urbanisation increases the variation of origins and destinations of trips but decreases the options of modal choice. Monocentric and polycentric urban forms differ considerably in terms of commuting patterns. In a monocentric urban form, urban density and distance to the centre are interlinked and these are also the dominant factors affecting commuting distance. In a polycentric structure several destinations exist within the same distance. In such case commuting patterns vary more.

#### Further reading:

- [Deliverable report on commuting](#) (pdf) by Ville Helminen, Mika Ristimäki, Panu Kontio, Hannu Rita, Maria Vuori
- [Response function for commuting figures](#) (pdf) by Ville Helminen, Mika Ristimäki, Panu Kontio
- [Framework for assessing the impacts of urbanisation trends on commuting](#) (image) by Ville Helminen, Mika Ristimäki, Panu Kontio

#### 4.2.5 Energy consumption and air pollution

*Effects of peri-urbanisation on energy consumption and air pollution*

##### **FS 70 Effects of peri-urbanisation on energy consumption, air pollution**

*By Wolfgang Loibl - Vienna*

## **What is the issue?**

In general, urban regions are a major source of air pollution. But the issue is far more complex as large scale industry as well as energy production/conversion sites for urban supply (e.g. refineries, power plants, district heating etc.) are frequently located in the peri-urban regions. Pollutant emissions from households and traffic are concentrated in the urban centres and along the major roads. The effects of peri-urbanisation on energy consumption and air pollution describe the land use relationships that drive air pollution patterns due to activities from housing, traffic and commerce in rural-urban regions (RURs) related to energy demand and the activity density. Response functions for air pollution () are presented for RUR types and RUR - sub-regions of entire EU 27.

When exploring and assessing land use related impacts of urban activities, air pollution turns out as a major pressure on environment and population. Changes in land use pattern, applied technologies and fuel types have large scale effects on the environment.

## **Methodology and Materials:**

Air pollution is a result of certain human activities generating emissions. Allocating these activities through proxy data, related to land use and the allocated population resulting in population density and relating emission factors to these activities, the emission amount can be allocated. This results in spatial emission patterns within the RURs, where spatially explicit driver?pressure?impact relations may be analysed that reflect spatial patterns of human activities. Regional air pollution data for entire Europe are estimated yearly through the CORINAIR (CORe INventory of AIR emissions) project and made available for various air emission sectors and pollutant components and provided as emission sums for 50x50 km grid cells covering Europe. The spatial disaggregation by emission sectors and components to RUR sub-regions applies data on land use and population, regional GDP and national energy consumption data by fuel type.

## **Results and Conclusion:**

Those emission sectors which allow a spatially explicit relation with driving forces are taken into account, based on the respective data availability at European scale and NUTS 3 level. The explored sectors are:

1. Emissions from residential, institutional and commercial heating,
2. Emissions from manufacturing processes,
3. Emissions from road transport.

Emissions from agricultural activities are not taken into account here. Emissions from large point sources are excluded as they cannot be allocated at local scale for entire Europe (without detailed information). Such large point sources such as power plants, refineries, fossil fuel extraction and waste processing are statistically treated as ?singular events? with from statistical viewpoint stochastic allocation where peri-/urban development changes cannot be predicted. CO, NOx and HC (Hydrocarbons, accurately NMVOC = Non-methane volatile organic compounds) emissions are considered as major impacts and allow for a proper estimation and spatial allocation. Considered emission sectors and components cover 90% CO emissions, above 60% NOx emissions and 80% HC emissions. SOx emissions are of less importance because of decreasing sulphur content in fuels and advanced cleaning technologies. Particulate matter (PM) data show high uncertainty and are

thus excluded. NH<sub>3</sub> (ammonia) emissions from agriculture are not analysed here. Emission pressure is estimated by the linear regression models with different plausibility for the set of emission sectors and emission components related to the RUR-sub-regions. Urban/peri-urban population-related emissions show high correlation between observed and modelled results ? NOx estimations are highly plausible, CO and HC match little due to a fuel mix causing high CO & HC emission variability. Rural population-related results show less coincidence: NOx estimations are plausible, but CO and HC match very little. Urban/peri-urban and industry emission estimations show partly implausible results. HC model results show the highest coincidence. Industry emissions in rural sub-regions show no plausible results because of a stochastic scattering of production activities.

Estimation of urban/peri-urban road traffic emissions show a high correlation of observed and modelled data in urban and peri-urban sub-regions. Rural road traffic emissions show ? for all components - less correlation rural sub-regions. The most applied important variables ? indicating to reflect drivers causing pressure are:

1. Population and population density (per sub-region),
2. GDP per capita (per Nuts 2 region),
3. Energy consumption/production indicators (per country)

The list shows that there are different influences related to local scale ? population, regional scale - regional GDP and to national scale ? energy production/consumption indicators.

Population is the variable with the highest explanation share - and thus influence share. So population behaviour and dynamics is the main driver. Thus land use change is the effect of people? s action, causing air pollution. GDP is a driver to enhance energy efficiency and thus to reduce emission volume per capita. Economic scenarios leading to less GDP growth assume less increase of energy efficiency and less decrease of emission volume.

### **Further reading:**

PLUREL deliverable report: [Response functions for energy consumption and air pollution](#)

### **4.2.6 Agricultural production**

*Effects of peri-urbanisation on landscape and agricultural production*

#### **FS 124 Effects of peri-urbanisation on agricultural production**

*By Ingo Zasada, Regine Berges - Müncheberg*

##### **What is the issue?**

Urban growth most exclusively takes place on former agricultural land contributing to spatial disruption and restructuring of agricultural landscape. Together with its socio-economic transitions, urbanisation results in altered farm structure and production output, here defined as Agricultural Production Function. The results for urban land use changes in the four scenarios from the Regional

Urban Growth (RUG) model were applied to the generic Response Functions (RF) on the Agricultural Production Function of the European Urbanisation Impact model (EUI model). The resulting indicator values for future situations are used within the European integrated Impact Analysis Tool (iIAT-EU). European regions have already experienced considerable urbanisation related loss in (high quality) farmland. Agriculture represents the main actor in landscape. It provides valuable goods and services, such as the production of food. It further contributes to rural viability and employment and provides positive environmental externalities. In addition to the status quo possible future developments of agricultural production need to be assessed for their impact on the regions' sustainability.

## **Methodology and Materials:**

The RFs have been developed based on regression analysis, estimating the causal relationship between urban growth and the state of Agricultural Production Function (LINK ZUM PDF). To analyse the future effects, the artificial surface in the different scenarios (time steps 2015, 2025), derived from the RUG model, were aggregated for entire NUTSX regions. These values were fed into the RF of the EUI model as main explanatory variable. As a result, different values for indicators influencing the Agricultural Production were calculated. Those variable values were validated, normalised and the set was aggregated to the Agricultural Production Index for each NUTSX, four scenarios and two time steps. Input variable is the Share of Artificial Surface for the four different scenarios at NUTSX level for the time steps 2000, 2015, 2025. The indicator set consists of the Change of Agricultural Area, Standard Gross Margin and Part-time farm holders, and the aggregated Agricultural Production Index.

## **Results and Conclusion:**

### **Baseline Scenario**

The agricultural production index values of the baseline scenario shows that especially in prime agricultural areas in Denmark, the Benelux countries, Northern France, Southern Spain and some other regions agricultural production is taking place eminently. On the contrary, the values in Sweden, Finland, Estonia and Latvia on the one side and regions forming an arc from Northern Spain, across the Alps towards inner Romania on the other side are very low, representing typically less-favoured areas. **Comparison 2000-2025**

Comparing the changes of the agricultural production index between 2000 and the scenario situations, in most of the regions the index values decrease, mainly between zero and five percent. Steep increase can be found in Northern Scandinavian regions instead. A strong decrease is modelled for regions in Central Sweden and Finland, Estonia and Latvia, Scotland, in Spain and a line of regions from South-Eastern England, towards the Benelux States, Germany, Austria to Slovenia. This is especially an issue for regions which had already unfavourable agricultural production conditions in the baseline scenario. **Scenario comparison**

The changes between the scenarios differ only in some regions. In the A1 (Hyper Tech) scenario agricultural production decreases strongest. Slightly less is the decrease for the other economically focussed scenario A2 (Extreme Water). In both B scenarios the projections for agricultural production tend more towards increased values. Comparing them, in B2 (Fragmentation) Spain shows lower values for agricultural production than in B1 (Peak Oil), still some other regions show higher values than in B1. According to the modelling results, it has been revealed that there is a clear tendency of an erosion of agricultural production potential in Europe by settlement growth across all scenarios, although economic growth scenario A1 is characterised by the strongest

decrease of agricultural production. Cross-regional comparisons, however, show significant regional differences, suggesting a strong influence of the regional framework. Whereas particularly rural areas in Eastern and Southern Europe enjoy increasing agricultural potentials, the hinterlands of urbanised and metropolitan centres are facing further shrinkage of their agricultural potential. City regions are less able to provide the own demand of agricultural goods nearby, increasing the regions' dependencies on external imports, reducing the resilience against global changes, such as scarcity of food and increasing prices. Aiming at limiting the complexity of the response model for future agricultural production, the modelling process has been conducted focussed on the influence of urban growth and under the assumption of stable framework conditions. Uncertainties regarding the future estimations occurred as the modelling process only takes the urbanisation-related share of agricultural changes into account, which is most relevant in peri-urban areas, but less important in the rural hinterlands, which are facing urban pressure in the same way.

#### **Further reading:**

- [Figure 1: Map of the Baseline scenario results for the agricultural production index and changes](#) Figure 2-5: Changes between 2000 and 2025 in the index describing the status of the potential agricultural production of each NUTSX region in the different scenarios
- Response Functions for the Agricultural Production Function (pdf)

#### **4.2.7 Ecological regulation**

*Effects of peri-urbanisation on landscape and the ecological regulation*

#### **FS 125 Effects of peri-urbanisation on ecological regulation and biodiversity**

*By Ingo Zasada, Regine Berges - Müncheberg*

##### **What is the issue?**

Landscape changes related to urbanisation degrade the ecological integrity (soil functions, hydrological balance and local climate) and alter the framework conditions for species and their habitats. As the urban area will further expand in Europe in the future, the question raises as to what the potential future effects of this growth will be. The results for urban land use changes in the four scenarios from the Regional Urban Growth (RUG) model were applied to the generic Response Functions (RF) on Ecological Regulation and Biodiversity of the European Urbanisation Impact model (EUI model). The resulting indicator values for future situations are used within the European integrated Impact Analysis Tool (iIAT-EU). The growth of urban areas reduces the regional capacity to provide drinking water, mitigate local climatic stress, control floods and buffer pollution. Moreover, anthropological disturbances of habitats and species such as disruption of open spaces by infrastructure network or edge effects and pollution from urban areas increase. Therefore, possible future developments of the ecological regulation and biodiversity need to be assessed for the sustainability impact analysis.

## **Methodology and Materials:**

The RFs have (zu PDF verlinken) been developed based on regression analysis, estimating the causal relationship between urban growth on the one hand and the state of landscape and ecology on the other hand. To analyse the future effects, the artificial surface in the different scenarios (time steps 2015, 2025), derived from the RUG model, were aggregated for entire NUTSX regions. These values were fed into the RF of the EUI model as main explanatory variable. As a result, different values for indicators influencing Ecological Regulation and Biodiversity were calculated. Those variable values were validated, normalised and the set was aggregated to the Ecological Regulation and Biodiversity Index for each NUTSX, four scenarios and two time steps. **Input variable** is the Share of Artificial Surface for the four different scenarios at NUTSX level for the time steps 2000, 2015, 2025. The indicator set consists of Density of Endangered Bird Species (biodiversity), Heavy Metal Emission Volume Index (emission volumes), Landscape Shape Index, Interspersion and Juxtaposition Index (landscape structure), Effective Mesh Size (fragmentation), Green Background Index (naturalness of landscape) and the aggregated Ecological Regulation and Biodiversity Index.

## **Results and Conclusion:**

### **Baseline Scenario**

The effects of urbanisation on ecological integrity of landscape ? biodiversity and the ecological regulation function of soil, water and climate in European regions has been covered by single direct and indirect as well as one aggregated indicator ? measured and observed for the baseline situation 2000 as well as modelled for the future situations 2015 and 2025. **Comparison 2000-2025**

For the baseline situation 2000, the aggregated index clearly reveals the relationship between the degree of urbanisation and the ecological integrity in Europe ? low values in areas of Southern UK, Northern France, the Benelux countries and large parts of Germany and Poland. High values in Scandinavia, the Alps, the Baltic countries and in the Mediterranean. **Scenario comparison**

The future situations draw a heterogeneous picture ? throughout Europe both urbanised and rural areas face pressure on landscape and ecological integrity. Especially the A1 scenario shows a strong shrinkage of the environmental potential at hand. In most regions the change is about -5% of the index value and below. The less economic growth-related scenarios such as B2 reveal a less accelerated process of ecological erosion in the urbanised regions. The implementation of the response function with the RUG model results allows for estimations on the development of ecological regulation and biodiversity in the four PLUREL scenarios. Results indicate general negative development of the index in all scenarios in almost all regions. Throughout all scenarios, results have revealed that particularly the ecological regulation function and biodiversity will face enormous additional pressure by urban development. Scenario A1, which assumes a more sprawling and dispersed development are most responsive. Thus more habitats will be affected than when the urban regions would grow more compact, which is assumed in scenario B1 ?Peak Oil?.

There is hardly a homogenous pattern of responsiveness of regions. Between Scandinavia and South of Spain, habitats are increasingly shrinking, disturbed or destroyed by the expansion of settlements and infrastructure. This might have to do with the economic and welfare catching-up and cohesion process of lagging regions, which will be expressed within urban growth. In what way and to which degree the ecological regulation functions and biodiversity are affected by urban growth is also depends on the legislation and international agreements like the Habitats Directive. They strongly limit the anthropogenic influence. Those aspects have not been integrated in the modelling of further urban sprawl and are thus not reflected in the results of the RFs implementation.

## **Further reading:**

- [Figure 1: Map of the Baseline scenario results for the ecological regulation and biodiversity index.](#)
- [Response Functions for the Ecological Regulation and Biodiversity Function](#)

## **4.2.8 Recreation**

*Effects of peri-urbanisation on landscape and recreation*

### **FS 127 Effects of peri-urbanisation on recreation**

*By Ingo Zasada, Regine Berges - Müncheberg*

#### **What is the issue?**

Recreation represents an important social function, particularly in densely populated areas. At the same time it is highly sensitive for urbanisation processes and structural changes in landscapes. The task is to estimate potential future effects of urban growth in Europe on the recreational potential of landscapes ? its Recreation Function. The results for urban land use changes in the four scenarios from the Regional Urban Growth (RUG) model were applied to the generic Response Functions (RF) on Recreation Function of the European Urbanisation Impact model (EUI model). The resulting indicator values for future situations are used within the European integrated Impact Analysis Tool (iIAT-EU). The extent and quality of green open spaces, natural amenities and aesthetical landscapes contribute to the recreational potential of regions. Recreation is an important aspect for human health, still urbanisation affects this function by transforming the landscape. Therefore, in addition to the status quo, possible future developments of the recreation function need to be assessed for the sustainability impact analysis.

#### **Methodology and Materials:**

The RFs (link zu PDF) have been developed based on regression analysis, estimating the causal relationship between urban growth and the state of Recreation Function. To analyse future effects, the artificial surface in the different scenarios (time steps 2015, 2025), derived from the RUG model, were aggregated for entire NUTSX regions. These values were fed into the RF of the EUI model as main explanatory variable. As a result, different values for indicators influencing the Recreation Function were calculated. Those variable values were validated, normalised and the set was aggregated to the Recreation Function Index for each NUTSX, four scenarios and two time steps. **Input variable** is the Share of Artificial Surface for the four different scenarios at NUTSX level for the time steps 2000, 2015, 2025. The indicator set consists of Heavy Metal Emission Volume Index (environmental quality), Landscape Shape Index, Interspersion and Juxtaposition Index (landscape structure), Effective Mesh Size (fragmentation), Green Background Index (naturalness of landscape) and the aggregated Recreation Function Index.

## **Results and Conclusion:**

### **Baseline Scenario**

The baseline scenario confirms a large value variety for Cultural and Recreation Function across Europe. Particularly metropolitan regions show low values, whereas especially the very peripheral regions in Northern and Eastern Europe as well as in the most parts of the coastal and alpine regions could preserve high recreational values. **Comparison 2000-2025**

Concerning future developments, it is clearly indicated that regions with urban growth also face reduced recreational potential through increased fragmentation and emissions, landscape transformations and conversion of natural land. All regions in all scenarios show a decreasing development of the index value. Especially NUTSX regions with low index values in the baseline situation 2000 will be affected. **Scenario comparison**

Some differences can be observed in comparison between the different scenarios. The ?Hyper Tech? scenario A1 has the strongest decrease, where rural areas are supposed to experience high urban growth. As similarities between the scenarios, there is evidence that regions in Spain, Portugal, Greece and Ireland are most affected. The majority of regions with changes below -5% or even -10% can be found in the Hyper-tech scenario (A1). Only in Romania, Hungary and Southern Poland, and some other regions the changes in the index value are above -5%. Regarding the changes in the other scenarios, more and more regions show changes above -5% from the Extreme water scenario (A2) to the Fragmentation scenario (B2) to the Peak oil scenario (B1). The implementation of the response function by the RUG model results allows for estimations on the development of the recreational potential of a region in the four PLUREL scenarios. It can be stated that the cultural and recreational functions of a landscape ? the most important aspect of quality of life ? is highly responsive to urban growth. Under the assumed urban development a massive erosion of the recreational value of landscapes need to be taken into consideration. Particularly in former less urbanised, rural areas additional urbanisation leads to an accelerated reduction of the recreational value. People appreciate the country side, but if too many people move there, the appearance of the landscape will be changed. The other three scenarios have a lesser effect on the recreational potential of the regions. Especially the B- scenarios ?Peak Oil? (B1) and ?Fragmentation? (B2) show a more moderate impact on the index. So the more environmental approach of the B1 scenario, including the shock of peak oil, has the smallest effect on the recreational potential, followed by the B2 scenario with a more dispersed settlement structure. The future development of the cultural and recreation function of landscape is based on a modelling approach, which particularly focuses on the influence of urban growth, assuming stable framework conditions without changing other influencing factors.

### **Further reading:**

- [Map of the Baseline scenario results for the recreation index \(figure 1\) and changes between 2000 and 2025 in the index describing the status of the recreation potential of each NUTSX in the different scenarios \(figure 2-5\)](#)
- [Response Functions for the Recreation Function \(pdf\)](#)

## 4.3 Indicator framework

*Which indicators are used in the case study regions?*

### FS 312 Indicator framework

By Franziska Kroll, Felix Müller - Kiel

#### What is the issue?

The PLUREL indicator framework for evaluating impacts of land use changes on environmental, social, and economic indicators at case study level is presented here. The selection process of indicators is documented and discussed in detail in the attached report. Complex processes and relationships, such as the various effects of land use changes, can be represented by a systematic indicator framework. This framework simplifies the reality to its most important and measurable components. It aims at bringing to light the most important impacts of land use changes on each sustainability aspect.

#### Methodology and Materials:

Indicator selection procedure:

1. Development of an a priori theoretical model
2. Derivation of a preliminary indicator list based on the theoretical model and discussions in workshops
3. Analysis of indicator relations in an integrated indicator matrix
4. Selection of key indicators based on matrix results and stakeholder feedback
5. Data collection for key indicators
6. Quantification of key indicators and illustration as maps and rural-urban gradients

The indicators are chosen in order to reflect rural urban problems related to land use changes as comprehensively as possible. However, these problems and the available data vary from case study to case study and the choice of indicators is not objective, but intersubjective, although founded on a theoretical model.

#### Results and Conclusion:

Here, the key indicators are listed.

#### Ecological indicators:

#### Social indicators:

1. Population density
2. Settlement population density

3. Household size
4. Housing area per person
5. Mean age
6. Quality of life, regarding:
  - Air quality
  - Access to public green space
  - Availability and access to public transport
  - Availability of shopping facilities
  - Noise pollution
  - Area safety and security
  - House or flat suitability
  - Waste collection

### **Economic indicators:**

1. Unemployment rate
2. Commuting distance
3. GDP
4. External costs green space
5. Costs carbon stock
6. Costs of air pollution

To assess the consequences of land use changes it is necessary to use a set of key variables which can be quantified. The application of such indicators in sustainability evaluation has to consider environmental, social and economic variables. To guide the selection of indicators, a conceptual theoretical indicator framework was developed. It is based on the DPSIR model (Driver - Pressure - State - Impact - Response) and incorporates the concepts of ecosystem services, ecosystem integrity and quality of life as impact components.

This comprehensive indicator framework can now be applied in various European rural-urban regions. The illustrations of indicator results as rural-urban gradients provide a clear overview of rural-urban relations and can be used to depict the potential of exchange processes between cities and their hinterlands.

### **Further reading:**

PLUREL deliverable report: [Indicator framework for evaluating impacts of land use changes on environmental, economic and social indicators](#) (Report including lists of key indicators, description of the selection process, and fact sheets on each indicator on quantification and significance for Rural-Urban Regions)

## 4.4 Effects in Leipzig-Halle region

*What are effects of peri-urbanisation?*

### FS 413 Effects of peri-urbanisation in city regions

*By Dagmar Haase, Nina Schwarz - Leipzig*

#### What is the issue?

There are manifold effects of peri-urbanisation in city regions. To name the most important, PLUREL was looking at:

1. Increase of impervious surface and soil sealing
2. Decrease of climate regulation and air filtration by open and vegetated surfaces
3. Increase of the urban heat island
4. Decrease of agricultural productivity and food production potential
5. Decrease of outdoor recreation potential within the city region
6. Increase of surface water flows and decrease of flood regulation capacity.

In order to reduce urban land consumption and to achieve a more sustainable settlement development an assessment of the social, economic and most importantly the environmental effects of urbanisation has to be carried out (Nuissl et al., 2008).

#### Methodology and Materials:

Material and methods are each described for the respective indicator. Please refer to "references and further reading".

#### Results and Conclusion:

Results and conclusion are each described for the respective indicator. Please refer to "references and further reading".

#### Further reading:

[Assessment of land consumption](#) (pdf) by Nuissl, Hase, Lanzendorf, Wittmer

### 4.4.1 Recreation

*How is recreation affected by peri-urbanisation?*

## **FS 140 Ecological and social indicator recreation**

By Dagmar Haase - Berlin

### **What is the issue?**

The fact sheet describes a procedure to assess the impact of land use changes on the availability and accessibility of urban green space in the PLUREL case study regions.

Urban green spaces (UGS), urban flora and fauna provide a lot of recreation (plus aesthetic and educational) services to the local population and thus play an important role as determinant of life quality for citizens of urban regions.

Urban green spaces (UGS) provide a lot of recreation services to the residents and thus play an important role as determinant of life quality for citizens of urban regions. UGS hold space for recreation, regulate the micro-climate or reduce noise and thus represent a service for man by nature. Given that city regions are ‘people places’, attempts to preserve nature and ecosystems within city regions can only be successful if they meet the needs and the wishes of the residents.

### **Methodology and Materials:**

UGS supply was computed using a GIS-selection procedure identifying and extracting all UGS land use types. UGS demand per capita was determined as the UGS supply of a municipal local district divided by the number of people.

UGS accessibility is calculated using the GIS-tool “multiple closest facilities” to determine the distances between number of people and UGS.

Uncertainties in the indicator calculation may occur due to the use of not suitable input data, data aggregation and standardisation procedures.

### **Results and Conclusion:**

The results of this assessment can be found in accompanying maps and tables and area also incorporated in the iIAT.

The demand on UGS in the urban centres of Leipzig and Halle is highest due to high population densities. But not only in the core cities, also in the peri-urban areas of post-socialist urban sprawl we find comparatively lower per capita values of UGS. In the peripheral parts of the rural-urban region the amount of UGS increases. Compared to the per capita amount, the accessibility of UGS is best in the core cities since many residents reach larger park or forest areas within a short (walking) distance than in the peri-urban or rural areas.

Changes in the recreation potential from 1990 to 2000 using CORINE land cover data were found in so far that the per capita values in the peri-urban ring around Leipzig and the axis between Leipzig and Halle decreased as the number of people dramatically increased.

## **Further reading:**

[Reference List](#) (pdf) by Dagmar Haase

### **4.4.2 Food provision**

*How is food provision affected by peri-urbanisation?*

#### **FS 139 Ecological Indicator food provision**

*By Franziska Kroll - Kiel*

#### **What is the issue?**

The food production indicator quantifies the ecosystem service “food provision” for several years and scenarios. The food production is calculated in GJ/ha per land cover type as an approximation, resulting in a spatial explicit map of food production in the region and rural urban gradients of food production.

Food provision is a fundamental ecosystem service, which has to be provided by rural areas to supply the urban population with food. The higher the percentage of consumed food that is produced in the region, the lower the energy costs for transportation and the export of environmental and social problems into other regions. Recent changes in land cover and land use in rural urban areas have important impacts on food provision, e.g. the sealing of fertile soils due to urban sprawl.

#### **Methodology and Materials:**

The food produced is calculated in GJ/ha land cover type as an approximation by using statistical data of crop composition and crop yield on district level. A correlation and regression analysis between crop yield and soil fertility data is conducted in order to include a spatial explicit soil fertility map. Indicator values per land cover class for MOLAND scenarios are calculated with help of linear trend curves.

**Input variables:** Corine Land Cover, MOLAND scenarios, soil fertility, crop composition on district level (%), harvest yield per crop on district level (dt/ha), non-food crops (%), fodder crops (%), caloric value per crop type (Gj/dt)

**Output variables:** Food production (GJ/ha) per land use type and soil fertility class

Apart from the uncertainties concerning MOLAND land cover scenarios, the linear trend curve used for the calculation of indicator values for year 2025 is a questionable scenario. It has been used in order to simplify the calculation and reduce the number of input factors.

## **Results and Conclusion:**

Food production in the Leipzig case study region (in GJ) increased from 1990 to 2000 and again to 2007 due to a higher productivity per hectare and a decrease in animal stocks. Thus, less fodder production resulted, which led to a higher amount of food energy directly usable by humans. These two processes have a stronger influence on the food production development than the parallel ongoing increase of bio energy crops on arable land. The decrease of agricultural land in the region due to urban sprawl does not have a visible effect on the total food production as it is more than outweighed by the increased productivity. However, the expansion of urban area occurs on the most fertile soils which are located around the city centres, especially around Halle. If the increase of productivity per hectare will follow a linear trend curve until year 2025, it will still outweigh the reduction of total agricultural area in all three scenarios.

The food production per hectare is the highest in the western and southern part of the case study region, as the most fertile soils can be found here. Additionally, the percentage of bread cereals in comparison to other crops is higher in the western part of the study region which results in a higher mean food energy value per hectare.

There are four major processes going on, which are influencing food production in the region. Two of them, the expansion of urban area on fertile soils and the increase of bio energy crops on arable land have a negative impact on food production. However, the other two have a higher and positive influence on the total food production, namely the increase in productivity per hectare and the decrease of fodder production. Although the total food production is enough to fulfil the caloric needs of the population in the region, food is imported to offer a greater food variety. The import of food, e.g. meat, represents an import of elsewhere provided ecosystem services into the region. This service import might rise in the future, if the increase of food productivity cannot compensate the expansion of urban area and increase of bioenergy crop cultivation any longer.

### **Further reading:**

[Maps and rural-urban gradients of the indicator "food provision"](#) (pdf) by Franziska Kroll

### **4.4.3 Energy provision**

*How is energy provision (solar energy, wind energy, water energy, bioenergy) affected by peri-urbanisation?*

#### **FS 141 Ecological and social indicator energy provision**

*By Franziska Kroll - Kiel*

#### **What is the issue?**

The indicator “energy provision” describes all energy provided by ecosystems or natural resources for human use. It includes human inputs that are necessary for energy conversion. It is calculated in GJ/ha for several years including MOLAND scenarios for the case study of Leipzig-Halle (see

"references and further reading"). All energy that is produced in the region is considered and assigned to the respective energy providing land cover types (solar energy --> urban and industrial areas, wind energy --> arable land, bio energy --> arable land and forests, brown coal --> mining sites). Thereby, spatially explicit energy provision maps and rural urban gradients of energy provision are produced.

Energy provision is an important ecosystem service, especially for urban regions, which are the world's main energy consuming regions. Many land cover types in the rural urban regions themselves have the capacity to provide renewable energy and thereby to contribute to a sustainable development. Therefore, it is essential to analyse, how land use changes in rural urban regions can influence the regional amount of energy provision.

### **Methodology and Materials:**

The production of final energy by wind-, and solar energy plants, bio energy crops, wood and brown coal in the case study region is calculated in GJ for years 1990, 2000 and 2007, using regional statistical data. The amount of energy is then related to the respective land cover types and calculated in GJ per hectare. Scenarios have been calculated using MOLAND land cover maps and linear trend curves for indicator values per land cover type.

**Input variables:** Corine Land Cover, MOLAND scenarios, river map, location and energy production of wind, solar and water energy plants, energy produced of bioenergy crops cultivated in the region, energy produced of wood grown in the region, brown coal extraction

**Output variables:** Energy produced per hectare arable land, forest, urban and industrial area and water area (Gj/ha)

Apart from uncertainties of MOLAND scenario results, the probability of linear future trends of energy provision per land cover type is questionable. Nevertheless, linear trends have been used for the scenarios due to simplification reasons.

### **Results and Conclusion:**

The energy provision in the case study region has changed considerably from 1990 to 2007. In 1990, the only energy source used in the region was lignite. However, it was intensely used and provided almost 20000GJ per hectare mining area. In the following years, the amount of lignite extracted was reduced by almost two third, and renewable energy sources were more and more used. In 2000, a small amount of energy per hectare was produced on arable land (bio energy crops and wind energy plants, in average less than 10GJ/hectare), and urban and industrial area (solar energy plants, in average less than 0.1GJ/ha) with wind energy being the most important renewable energy source. In 2007, the use of all renewable energy sources increased, especially the use of wind energy in the western part of the case study area. Still, lignite remained the most important energy source. Following the trend, renewable energy provision is assumed to increase in the scenarios, however without meeting the energy demand in the region, which was  $120\text{GJ} \cdot 10^6$  in 2007.

During the last two decades, more and more land cover types were discovered to be usable for energy production purposes. Nowadays, the energy providing capacities of almost all land cover types are used, be it for installing solar, water or wind energy plants or transforming crops and

wood into bio energy. Still, the amount of energy that is produced by renewable energy sources is low in comparison to non-renewable energy sources, in this case brown coal, which is still highly necessary to meet the energy demand in the region. For the provision of energy, land use changes are much more important than land cover changes. For example, the total amount of agricultural area is less important than the relation of food crops to energy crops. Due to this fact, differences in energy provision between the three scenarios are difficult to predict.

### Further reading:

[Results of indicator "energy provision"](#) (pdf) by Franziska Kroll

## 4.4.4 Potential evapotranspiration

*How is potential evapotranspiration affected by peri-urbanisation?*

### FS 143 Ecological indicator potential evapotranspiration

By Franziska Kroll - Kiel

#### What is the issue?

Evapotranspiration as part of the hydrological cycle is an important ecosystem integrity indicator and strongly related to land use types. The evapotranspiration is quantified for several years in mm/day\*m<sup>2</sup>.

The process of evapotranspiration consumes energy and therefore has a cooling effect and a positive impact on micro climate regulation. This is especially important in cities, which often suffer from the so called "urban heat island" effect due to their high amount of sealed surfaces. Land use changes in peri-urban regions have a direct effect on evapotranspiration and thereby on micro climate regulation and quality of life.

#### Methodology and Materials:

Potential evapotranspiration is calculated in mm/day\*m<sup>2</sup> per land cover type using the Haude formula and the Blaney-Criddle formula. Temperature data and relative humidity data are used for years 1990 and 2000 from the German meteorological service. For the scenario calculation, mean values for 1979-2008 are applied. The rural urban gradients are calculated by producing twenty concentric buffer rings around the city centre of Leipzig with a diameter of 1km each.

**Input variables:** Corine Land Cover, MOLAND scenarios, Mean temperature, Mean relative humidity, Mean temperature at 2pm, Haude factor per land cover type, Mean daily percentage of total annual day time hours **Output variables:** Potential Evapotranspiration in mm/day\*m<sup>2</sup> per land cover type

The calculation of pot. evapotranspiration using the Haude formula is one of many different

existing methods. It is a simple and easy to apply method that uses air temperature, vapour pressure and the empirical determined Haude Factor as input data. The Haude factor exists for some important land use types, but had to be estimated for others. The formula calculates the potential evapotranspiration. The real evapotranspiration is lower than this, depending on soil moisture and soil properties.

## Results and Conclusion:

Evapotranspiration is strongly related to land cover types. Wetlands and water bodies show the highest potential evapotranspiration (~1480mm/m<sup>2</sup>\*a), followed by pastures and urban green (~430mm/m<sup>2</sup>\*a), agricultural areas (~420mm/m<sup>2</sup>\*a) and forests (~390mm/m<sup>2</sup>\*a). Artificial surfaces are characterised by the lowest potential evapotranspiration (~20-220mm/m<sup>2</sup>\*a). Therefore, a clear rural urban gradient of potential evapotranspiration can be observed. However, the climatic changes between the considered years have a stronger impact on changes in evapotranspiration than land use changes.

Potential evapotranspiration is the lowest in the city centre of Leipzig and increases with distance from the centre, due to the higher amount of natural land cover types in suburban and rural areas. Although the climatic differences have a stronger influence on changes in evapotranspiration in the considered years, ongoing soil sealing in the peri-urban region has a negative impact on evapotranspiration and micro-climate regulation. Against the background of global climate change, it is especially important to increase evapotranspiration in the city centres and peri-urban regions by preserving and enlarging green areas, which can also be done by roof top and facade greenery.

### 4.4.5 Climate regulation

*How is climate regulation affected by peri-urbanisation?*

#### FS 138 Ecological indicator climate regulation

By Nina Schwarz - Leipzig

##### What is the issue?

This fact sheet describes the procedure of assessing land use change impacts on local climate regulation in PLUREL case studies.

Local climate regulation is one of the environmental indicators used for impact assessment at the regional scale. This indicator refers to impacts on local climate in the sense of altering temperatures due to changing thermal properties of surfaces and albedo. It does not cover impacts on global climate (see indicator for this).

Local climate regulation is an important urban ecosystem service: Green areas like parks, urban forests, lawns and gardens as well as water surfaces of streams, lakes and ponds provide fresh and cool air for the population.

Accordingly, local climate regulation is a valuable service for the inhabitants of a rural-urban region, because it reduces the extent of the urban heat island and is thus important for maintaining quality of life and adapting rural-urban regions to climate change.

### **Methodology and Materials:**

The method uses lookup-tables that link land cover classes to land surface emissivity. Land surface emissivity stems from Landsat remote sensing data. For each lookup-table, the date and time of acquisition as well as all other technical information is given.

The following index is created for each land use  $i$  to show differences in thermal emissions:

$$\text{emissionIndex}[i] = \text{emission}[i] / \text{emission}[\text{forest}] \cdot 100 - 100$$

For assessing impacts of land use changes in a given case study, the case-study specific look-up table is needed as an input, plus quantified information on land use change. The latter can be either a table with changes in  $\text{km}^2$  or a GIS map. Land use change information has to use MOLAND classes to be compatible with the lookup table.

The output format depends on the input and is either a table or a map of indexed land surface temperatures.

Uncertainties remain within the methodology because first, there is only one time step to derive the lookup-table; second, differences in land surface temperature and air temperature, and third, different dates of data collection for emissivity and land cover.

Compared to alternative approaches (literature values for land cover classes versus processes models of the atmosphere), this methodology is suited for stakeholders with GIS skills while still using case-study specific data.

### **Results and Conclusion:**

The results of this assessment can be found in accompanying maps and tables and are also included in the iIAT.

#### **Leipzig-Halle**

Results show that compared to 2000, land use changes in 2025 imply a negative trend for climate regulation. This is due to the conversion of forested areas to built-up and agricultural land.

These negative developments mainly take place in the inner peri-urban areas, which are within the administrative boundaries of the two cities Leipzig and Halle, but characterised by low densities and suburbanisation. These indicators are assessed worse compared to the status in 2000 as the expansion of built-up land in these areas leads to an overall decrease and a fragmentation of urban green space.

#### **Koper**

Compared to land use in 2000, results for climate regulation indicate positive developments in the

different scenarios: For the Hyper-tech as well as Business as Usual and Peak Oil scenarios, the mean land surface emissivity decreases, so that the urban heat island is reduced.

This is due to the increase in forested areas and the decrease of agricultural land (which has a rather high emissivity).

Results of the indicator analysis regarding climate regulation show plausible results for the MOLAND scenarios in the two case studies.

For Leipzig-Halle, results indicate that climate regulation might be threatened by future developments and should be considered in future spatial planning.

For Koper, the results regarding climate regulation are more positive, as emissivity decreases in every scenario. However, other indicators have to be assessed as well and might show negative trends, eg. regarding food provision because of decreasing agricultural areas.

#### **Further reading:**

#### **4.4.6 Biodiversity potential**

*How is biodiversity potential affected by peri-urbanisation?*

##### **FS 144 Ecological indicator biodiversity potential**

*By Michael Strohbach - Leipzig*

#### **What is the issue?**

Biodiversity is the variability of living organisms and includes the ecosystems of which they are part. In general, it covers a wide range of scales, from genes to ecosystems. It is the basis for all ecosystem functions and services and therefore directly linked to human well-being. Biodiversity is closely connected to land cover and land use. Because the term is so broadly defined, we focus on the potential of the landscape to provide habitat for diverse species communities –the biodiversity potential. This fact sheet provides information on the biodiversity potential in the case study regions.

Biodiversity in rural-urban regions is a key for the provision of local ecosystem services. Rural-urban regions often have a high land cover and land use diversity and are therefore rich in biodiversity. Land cover change, especially urbanisation, has led to a decline of biodiversity in many parts of the world including Europe.

## **Methodology and Materials:**

We used breeding bird species that indicate diverse habitats for the assessment of the biodiversity potential. Habitat models that build on the statistical relationship between land cover and the presence and absence of the indicator species were developed. Several models were then combined to estimate the probability that an area is occupied by many of those species. This value is the biodiversity potential. The models can be applied to different land cover maps or land cover scenarios.

**Input:** breeding bird survey on 1 km by 1 km scale, simplified CORINE land cover maps, maps of temperature, precipitation, and rivers

**Model:** random forest machine learning technique

**Output:** maps of the biodiversity potential for agricultural and forest species on 1 km by 1km scale. If the value is 1, the biodiversity potential is highest, if it is 0, the potential is lowest.

Some uncertainties arise from the coarseness of the land cover data in terms of spatial resolution and number of land cover classes. The advantage of the method is that probabilities are calculated, rather than explicit species occurrence.

Besides land cover change there are many other factors that influence biodiversity which are not covered by the model. In addition one has to keep in mind that MOLAND does not model changes in forest cover or agricultural use.

## **Results and Conclusion:**

Results can be found in accompanying maps and are also included in the iIAT.

The results for the Leipzig-Halle case study show a good agreement between indicator species number and biodiversity potential (Spearman rank correlation of 0.85 between agricultural species number and biodiversity potential and 0.74 between forest species number and biodiversity potential).

The biodiversity potential for both agricultural as well as forest species is generally low as the area is dominated by intensively used agriculture. The highest forest biodiversity can be found in the floodplain forest between Leipzig and Halle as well as in forests in the west and east of the case study area. Areas with a high potential for agricultural species can be found south-west of Leipzig, between Leipzig and Halle, north-west of Halle and in the north-east of the case study area.

Predicted changes between 1990 and 2000 are mainly positive for forest biodiversity due to afforestations in the former mining areas. The three development scenarios (see "references and further reading") show negative impacts south of Leipzig and Halle. Agricultural species are more sensitive to development in the region. This is due to the fact that habitat for agricultural species is more abundant in first place and that development in the case study area usually happens on agricultural land and not in forests.

The biodiversity potential allows identifying areas that are most likely to lose or gain biodiversity from land cover change. Development should be restricted to areas with low biodiversity potential. Especially the floodplains should not be built. This is also important for other environmental issues.

## **Further reading:**

- [Literature](#) (pdf) by Michael Strohbach
- [Number of indicator species](#) (pdf) by Michael Strohbach
- [Changes of biodiversity potential of the Leipzig case study](#) (pdf) by Michael Strohbach
- [Modelling input](#) (pdf) by Michael Strohbach

### **4.4.7 Carbon storage**

*How is carbon storage affected by peri-urbanisation?*

#### **FS 300 Ecological indicator carbon storage**

*By Michael Strohbach - Leipzig*

#### **What is the issue?**

Terrestrial carbon, stored in living and dead biomass and in soils, is an important part of the global carbon cycle. Atmospheric carbon can be sequestered into the terrestrial stock and released from it. The amount of stored carbon varies across different land cover types and geographical regions. Land cover change from an ecosystem with high carbon storage to an ecosystem with low storage leads to the release of carbon to the atmosphere and vice versa. This fact sheet provides information on a method to quantify terrestrial carbon storage in the case study regions.

Land use and land cover change is a major source of anthropogenic carbon dioxide emissions. Land cover change in rural-urban regions is therefore directly linked to the global carbon cycle and the issue of climate change.

#### **Methodology and Materials:**

We derived average above ground carbon storage for the simplified CORINE land cover classes from own field observations. Using these, the emissions caused by land cover change can be estimated. The below ground carbon storage was derived from European soil maps. The assumption was made that the soil under sealed areas is lost. Using sealing rates for the land cover classes, we derived carbon stocks for 1990, 2000 and the MOLAND scenarios.

**Input:** simplified CORINE land cover map; above ground carbon storage, derived from field data in the Leipzig case study area; maps of the organic carbon and the top soil packing density in the soils of Europe, (packing density “Medium, 1.4 – 1.75 g/cm<sup>3</sup>” was replaced by 1.575 g/cm<sup>3</sup>, “Low, <1.4 g/cm<sup>3</sup>” was replaced by 1.225 g/cm<sup>3</sup>)

**Output:** Maps of carbon storage in mass of carbon per area and total mass, changes in carbon stocks

Some uncertainties arise from the coarseness of the land cover data in terms of spatial resolution and number of classes. Vegetation differs strongly across Europe – therefore the above ground carbon storage could not be estimated for the case study regions in Southern Europe. The

uncertainty of below ground carbon is great, especially considering the soil packing density. Focus should be on the order of magnitude and the relative changes rather than on absolute values.

### **Results and Conclusion:**

Results of this assessment can be found in accompanying maps and are also included in the iIAT. The main carbon stocks can be found in the flood plain forest between Leipzig and Halle as well as in the west and the east of the case study area. The below ground carbon stock is at least a magnitude larger than the above ground carbon. Afforestation and succession on former lignite mining areas lead to an increase in above ground stocks between 1990 and 2000. However, this is superimposed by the decrease of the carbon stock through surface sealing. Land cover change resulting from all three scenarios, will lead to the depletion of the carbon stock. Depletion is highest in the *Hyper-tech* scenario for the Leipzig region.

Due to the fact that forest cover is low in the whole case study area and that land cover change will mainly happen on agricultural land, impacts on above ground carbon stocks are small. However, development will certainly lead to a loss of soil carbon, especially in the peri-urban area. Large scale afforestation would need to continue in order to offset these emissions. Rather than developing new land in the peri-urban area, land should be recycled within the built environment. The *Eco-environment* scenario which is based on strict protection rules and little growth is most conserving.

### **Further reading:**

- [Literature](#) (pdf) by Michael Strohbach
- [Carbon Stock of the Leipzig Region](#) (pdf) by Michael Strohbach
- [Changes in carbon stock for the Leipzig case study](#) (pdf) by Michael Strohbach

### **4.4.8 Water provision**

*How is water provision affected by peri-urbanisation?*

#### **FS 206 Ecological Indicator water provision**

*By Franziska Kroll - Kiel*

#### **What is the issue?**

The indicator “water provision” describes the amount of clean water (filtered by soils) in m<sup>3</sup> per hectare that is supplied by ecosystems via groundwater recharge. It was calculated for the Leipzig-Halle case study area for several points in time, including MOLAND scenarios.

Water provision is especially important in rural urban regions, as urban population, industry and commerce consume a large amount of water, which cannot be imported from far distant regions. Groundwater is especially suitable for urban water provision, as the water has already been cleaned

by soils. However, groundwater recharge decreases due to additional soil sealing at the urban fringe. Thus, urban sprawl has a negative impact on the water provision in rural urban regions.

### **Methodology and Materials:**

The TUB-BGR approach (Wessolek et al. 2004) was applied, which uses regression functions to calculate percolation rates for non artificial land cover types. Indicator values for time-points in the past were calculated on a 1kmx1km solution, whereas for future scenarios average values per land cover type were calculated. Rural-urban gradients of water provision are calculated by using a concentric ring approach with the city centre of Leipzig as centroid.

**Input:** CORINE land cover, MOLAND land cover scenarios, Medium corrected annual precipitation [mm], Medium corrected precipitation in summer [mm], Medium potential evapotranspiration [mm], Groundwater level [dm], Usable field capacity [mm], Actual root depth [dm]

**Output:** Infiltration rate per land cover type [ $\text{m}^3/\text{ha}$ ]

The used method for the calculation of percolation rates is a simplification of reality, as it only distinguishes between five different vegetation types (agriculture, grassland, mixed-forest, broad-leaved forest, coniferous forest). The groundwater recharge for artificial areas is slightly underestimated, as no percolation was assumed for these areas as approximation. For the scenario calculations, the climatic conditions are assumed to stay constant.

### **Results and Conclusion:**

In the Leipzig-Halle case study area, the water supply decreased from 1990 to 2000 and again to 2007 due to additional soil sealing, which reduced the percolation rate. The main land cover changes influencing the water supply were the increase of industrial, traffic and urban fabric at the urban fringes of Leipzig and Halle. This decrease of water provision due to additional soil sealing continues in the scenarios, but at different extents. Compared to 369.3 million  $\text{m}^3$  in 1990, the water provision in the case study region hypothetically decreases until 2025 by 8.7 million  $\text{m}^3$  in the eco-environmental scenario, 13.6 million  $\text{m}^3$  in the business as usual scenario, and 16.6 million  $\text{m}^3$  in the hyper-tech scenario.

The water supply in the Leipzig-Halle region decreased from 1990 to 2007, mainly in the suburban areas, despite the restoration of several mineral extraction sites, whose areas then contributed to the water supply instead of the demand. Still, these land cover changes were not enough to compensate the reduced water supply due to additional soil sealing. Water provision further decreases in all three scenarios to a different extent. The extent of a further decrease determines the extent of a possible decline of the water level or the amount of necessary water imports into the region.

### **Further reading:**

[Results of the indicator water provision \(pdf\)](#) by Franziska Kroll

## 4.5 Quality of life

*What is about quality of life - does it get better?*

### FS 311 Quality of Life on pan European level

By Simon Bell - Edinburgh

#### What is the issue?

Here, the effect of land use change on quality of life at the European level is examined. Land use change can affect quality of life in several different ways, and on different people in different ways. The factors used here are associated with land use change and do not cover social or economic issues directly. The indicators chosen were derived from a review of indicator sets and are:

- quality of residence,
- air quality,
- noise pollution,
- access to shops,
- access to green space,
- commuting time and
- safety and security of the area.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments, a number of factors may affect how satisfied people are with their living environment. As land use changes, these factors may also change for the better or worse.

#### Methodology and Materials:

The method used empirical data collected through a technique known as adaptive conjoint. 250 samples of people from different age groups living in each of 8 rural-urban regions across Europe were collected and analysed. The results are fed into a simulator, known as Quality of Life Simulator or QoLSim , which enables planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by people according to different classifications.

The input variables collected in the study were a number of demographic factors for the people questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The output variables are relative levels of importance of quality of life indicators and the potential change in quality of life when different scenarios of land use change are presented.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

## **Results and Conclusion:**

Quality of life in rural urban regions can be subject to improvement or deterioration as a result of many factors. The results show that of all the quality of life factors studied, safety and security are the most important while accessibility to green space is least important.

With the QoLSim, it is possible to test how different people react to possible changes in these by predicting when they are likely to consider that the environment has become too unsatisfactory for them to live there any more, or where another environment has become more attractive. These choices depend on the type of person or their life stage and they change over time. By developing a tool for modelling behaviour it is possible to predict what changes to land use may affect people for the better or worse. This can provide valuable information for planners and policy makers.

## **Further reading:**

Affonso Zuin, Simon Bell (2010): QoLSim ? a Conjoint Analysis-based simulator for residential location choice likelihood, in: Kabisch, Sigrun; Kunath, Anna; Feldmann, Hildegard (editors): Vulnerability, risk and complexity: impacts of global change on human habitats. IAPS 21 Conference. [IAPS 21 Conference](#).

### **4.5.1 in The Hague region**

*How will quality of life be affected by peri-urbanisation in The Hague region*

#### **FS 84 Quality of Life in The Hague region**

*By Affonso Zuin, Simon Bell - Edinburgh*

#### **What is the issue?**

This factsheet examines the effect of land use change on quality of life in the Hague rural urban region. This region has particular characteristics as a result of its location, the vast areas of glasshouses, the coastal dunes and a multi-cultural society. Housing options include renting and owning. Land use change and urbanisation is a big issue so that understanding how this can affect quality of life is important for policymakers aiming to provide attractive locations for living through the provision of "green and blue" services.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments a number of factors may affect how satisfied people are with their living environment. As land use changes, so these factors may also change for the better or worse.

#### **Methodology and Materials:**

We used empirical data collected through a technique known as adaptive conjoint. Samples of

people from different age groups living in different sectors of the Hague rural-urban region were collected and analysed. The results were fed into a simulator, known as "QoLSim" (Quality of Life Simulator), which enables regional planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by local people according to different classifications.

The **input variables** collected in the study were a number of demographic factors for the people questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The **output variables** are relative levels of importance of quality of life indicators and the potential change in quality of life in different scenarios of land use change.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

## Results and Conclusion:

[QoL results for TheHague region](#) (pdf)

## Further reading:

[QoL results for TheHague region](#) (pdf)

Impressions from the case study area:

- [New Ypenburg, The Hague](#) (image) by Judith Westerink
- [Cyclists have just passed tunnel under highway, near Delft](#) (image) by Judith Westerink
- [New neighbourhood in Rijswijk, built inside existing urban fabric](#) (image) by Judith Westerink
- [Old houses along the Vliet, Delft](#) (image) by Judith Westerink
- [Nineteen sixties housing, Delft](#) (image) by Judith Westerink
- [Poptahof, Delft](#) (image) by Judith Westerink
- [New The Hague neighbourhood of Ypenburg](#) (image) by Judith Westerink

## 4.5.2 in Leipzig-Halle region

*How will quality of life be affected by peri-urbanisation in Leipzig-Halle region*

### FS 86 Quality of Life in Leipzig-Halle region

*By Affonso Zuin, Simon Bell, Dagmar Haase, Nadja Kabisch - Edinburgh, Leipzig*

## What is the issue?

This factsheet examines the effect of land use change on quality of life in the Leipzig rural urban region. Leipzig has been noted as a shrinking city with vacant city centre areas and redundant housing from socialist times, while suburbs grew. The need to reestablish Leipzig as a dynamic city requires novel policies and approaches which have potentially major effects on city structure and land use balances, especially the reuse of brownfield land. Thus quality of life needs to be taken into account because it is one major factor affecting how likely people are to come to or stay in Leipzig.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments a number of factors may affect how satisfied people are with their living environment. As land use changes, so these factors may also change for the better or worse.

## Methodology and Materials:

We used empirical data collected through a technique known as adaptive conjoint. Samples of people from different age groups living in different sectors of the rural-urban region were collected and analysed. The results are fed into a simulator, known as "QoLSim" (Quality of Life Simulator), which enables planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by people according to different classifications.

The **input variables** collected in the study were a number of demographic factors for the people questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The **output variables** are relative levels of importance of quality of life indicators and the potential change in quality of life when different scenarios of land use change are presented.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

### 4.5.3 in Greater Manchester

*How will quality of life be affected by peri-urbanisation in Greater Manchester*

#### FS 87 Quality of Life in Greater Manchester

By Affonso Zuin, Simon Bell - Edinburgh

## What is the issue?

This fact sheet examines the effect of land use change on quality of life in the Greater Manchester

rural urban region. Manchester is a polycentric metropolitan region with large variations in wealth and environmental quality, with large ethnic diversity and much post industrial land. There are also imbalances of accessibility to green areas and the transport network tends to split up the green networks. While a dynamic area the quality of the living environment, related to land use pressures, is an important aspect to be addressed. Differences in perception of quality of life among different ethnic groups might be expected.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments a number of factors may affect how satisfied people are with their living environment. As land use changes, so these factors may also change for the better or worse.

### **Methodology and Materials:**

The method used empirical data collected through a technique known as adaptive conjoint analysis. 200 samples of people from different age groups living in different sectors of the rural-urban region were collected and analysed. The results are fed into a simulator, known as "QoLSim" (Quality of Life Simulator), which enables planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by people according to different classifications.

The input variables collected in the study were a number of demographic factors for the people questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The output variables are relative levels of importance of quality of life indicators and the potential change in quality of life when different scenarios of land use change are presented.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

### **Results and Conclusion:**

The results show a strong pattern of importance levels of the different factors used as indicators of quality of life, with safety and security ranking the highest and access to green space ranking lowest. There is some difference between residents of different parts of the region and among demographic variables such as age. These results are not absolute - just because access to green space comes at the bottom of the list does not mean it is not important.

The quality of life indicators are predicted by loading different scenarios in the QoLSim tool, and differ according to land use changes. When evaluating these differences, it can be seen that the proportions of satisfaction levels vary between different demographic groups.

The conclusions of the work on quality of life show that people are sensitive to changes in their living environment and that the factors chosen as indicators show changes when the land use changes suggested by different scenarios are calculated in terms of the effects on the indicators. The

effects of these can be translated into anticipated levels of preference very readily through the QoLSim tool and the resulting spidergrams can be added to the ecological indicators to present a broader picture of the impact of land use change to the environment of Greater Manchester.

### **Further reading:**

- [QoLResults Manchester](#) (pdf) by OPENspace
- [Relative importances of quality of life indicators in Greater Manchester](#) (image) by Affonso Zuin, Simon Bell

### **4.5.4 in Warsaw Metropolitan area**

*How will quality of life be affected by peri-urbanisation in Warsaw Metropolitan area*

#### **FS 89 Quality of Life in Warsaw Metropolitan area**

*By Affonso Zuin, Simon Bell - Edinburgh*

#### **What is the issue?**

This fact sheet examines the effect of land use change on quality of life in the Warsaw rural urban region. Land use change can affect quality of life in several different ways, and on different people in different ways. The factors used here are associated with land use change and do not cover social or economic issues directly. The indicators chosen were derived from a review of indicator sets and are: quality of residence, air quality, noise pollution, access to public transport, access to shops, access to green space, waste collection and safety and security of the area.

Quality of life is one of the factors used to test sustainability. It is important because it is a way of testing the level of the social, economic or environmental circumstances of individuals or groups in society. There are many different measures used in assessments for various purposes. In changing urban environments a number of factors may affect how satisfied people are with their living environment. As land use changes, so these factors may also change for the better or worse.

#### **Methodology and Materials:**

The method used empirical data collected through a technique known as adaptive conjoint analysis. 263 samples of people from different age groups living in different sectors of the rural-urban region were collected and analysed. The results are fed into a simulator, known as "QoLSim" (Quality of Life Simulator), which enables planners to test the effects of different scenarios of land use change and the way they affect the quality of life indicators as perceived by people according to different classifications.

The **input variables** collected in the study were a number of demographic factors for the people

questioned, including gender, age, country of origin, relative income, satisfaction with their living condition, location in the rural-urban region and some lifestyle factors. The **output variables** are relative levels of importance of quality of life indicators and the potential change in quality of life when different scenarios of land use change are presented.

The main uncertainties arise as a result of the sample size which, because of the distribution of the samples across the rural-urban region may be small units in certain places. The conjoint approach is data-efficient as, although the overall sample size is small, the number of combinations tested for preferences is very large.

### **Results and Conclusion:**

The results show a strong pattern of importance levels of the different factors used as indicators of quality of life, with safety and security ranking the highest and access to green space ranking lowest. There is some difference between residents of different parts of the region and among demographic variables such as age. These results are not absolute - just because access to green space comes at the bottom of the list does not mean it is not important.

When evaluating the differences of quality of life indicators likely as a result of land use changes predicted by loading different scenarios in the QoLSim tool it can be seen that the proportions of satisfaction levels between different demographic groups vary.

The conclusions of the work on quality of life show that people are sensitive to changes in their living environment and that the factors chosen as indicators show changes when the land use changes suggested by different scenarios are calculated in terms of the effects on the indicators. The effects of these can be translated into anticipated levels of preference very readily through the QoLSim tool and the resulting spidergrams can be added to the ecological indicators to present a broader picture of the impact of land use change to the Warsaw environment.

### **Further reading:**

- [QoL results for Warsaw Region](#) (pdf) by OPENspace
- [Relative importance of quality of life indicators for Warsaw](#) (image) by Affonso Zuin, Simon Bell
- [Map showing distribution of questionnaire respondents in Warsaw rural urban region](#) (maps) by Affonso Zuin, Simon Bell

# 5 Sustainability

*How does peri-urbanisation affect sustainability?*

## FS 421 Impacts on sustainable development

By Katharina Fricke - Müncheberg

### What is the issue?

The concept of "sustainable development" evolved in response to the environmental and social impacts of economic activity.

Due to the diverse concept of sustainable development, which combines economic, social and environmental goals, both locally and globally, and in both the short and longer term, the application of this concept to peri-urban land use and peri-urbanisation raises many questions. It is also due to the nature of the peri-urban areas, generally a complex mix of pressures, drivers and processes in many different sectors, at different spatial scales. The implication is that the peri-urban sustainability agenda is complex and inter-connected, with many layers which need careful analysis. This is certainly a challenge, and is one of the main results of the PLUREL research.

### Methodology and Materials:

The functional relationships between land use changes and impact issues relevant for sustainability are represented with response functions (RF) for application at the pan-European level. Response functions are meant to quantify functional relationships for issues of specific relevance for peri-urban regions, while the degree of quantification depends on the availability of data. The impact assessment of land use change in rural-urban regions is based on selected indicators covering the three sustainability dimensions. Indicators are calculated based on land use pattern and related activity/proxy variables (economy, ecology, quality of life etc.) for EU-scale related to NUTS3 regions and sub-regions. However, the indicators are also specifically related to the problem in question, namely land use changes in European rural-urban regions. Therefore, it was necessary to not only indicate urban conditions, but also the suburban and rural counterparts and the interrelations between them. The impact analysis procedure allows for thematic grouping of indicators, e.g. on the economic, environmental and social perspective of sustainability, or on quality of life issues.

### Results and Conclusion:

Here, the impacts of peri-urbanisation are valued. This PLUREL Xplorer section integrates the top-down data and indicator based modelling with a bottom-up, value driven participatory approach.

It comprises the results of choice experiments in selected case studies, a European impact assessment approach using response functions and displays the results of this assessment. The integrated Impact Analysis Tool (iIAT) as well as the Cost-Benefit-Analysis (CBA) results on European and on case study level is also of importance.

## 5.1 Choice experiments

*How do people value peri-urbanisation in the case study regions?*

### FS 213 Choice experiments

By Tim Taylor - Bath

#### What is the issue?

The Discrete Choice Experiments is a questionnaire-based technique which asks respondents to choose their preferred alternative among two or more scenarios. It is assumed that individuals prefer the alternative which offers the highest level of utility.

It has been extensively used for assessing the Willingness To Pay (WTP) of the general public for goods, services and public programs that are difficult to price as they are not traded in any market. This technique can also provide information on the trade offs that the general public is willing to make on different characteristics of a proposed public program.

The method unveils respondents' preferences and WTP for the characteristics of a public program that the policy maker is interested in. It may be used to answer questions such as:

1. How much is the public willing to pay for the provision of improved public transport?
2. Is the public willing to pay more for improving public transport for protecting green open spaces?

#### Methodology and Materials:

We used the Discrete Choice Experiments method in three case studies, Warsaw, Leipzig-Halle and The Hague, to compare respondents' WTP for specified effects of land use policies across the three areas. The output from the analysis of the Discrete Choice Experiments data has been used for the Cost Benefit Analysis.

#### Results and Conclusion:

Results from the analysis of the data from the Discrete Choice Experiments questionnaire are presented in the case study fact sheets for Leipzig, Warsaw and The Hague (see further reading). After preliminary research and discussion with stakeholders about the most important effects of land use policies, we focused on three selected effects that appeared to be most relevant in the three case studies:

1. improvement in air pollution from transport
2. protection of cultural heritage monuments
3. development of new housing

These three effects, in addition to a cost to the respondent, expressed as a one-off tax to implement

the effects of the hypothetical policies, describe the characteristics of the land use policies. Characteristics of the policies and the different levels that these characteristics may take on are reported in a [table](#).

We used two levels each for the improvements in air pollution and for the protection of cultural heritage buildings to account for policies that would improve the current situation. For housing, in addition to the current situation where buildings and green open areas are kept as they are now, we used two other levels to consider the development of housing in green open spaces or through the refurbishment of abandoned and idled building.

As typical of Discrete Choice Experiments studies, different respondents received different Discrete Choice Experiments questions that differed for the levels of the characteristics of the policies. To do so we used an experimental design created with the software Ngene (ChoiceMetrics, 2009) producing for each country 18 different choice sets, split into three blocks composed by six choice-sets each. To avoid ordering bias, within each block we randomized the order of the Discrete Choice Experiments questions.

The questionnaire used in the three case studies can be adapted to other case studies to assess the general public's preferences for specified effects of land use policies.

In summary, the application of the Discrete Choice Experiments method to assess the WTP of the general public for specified characteristics of land use policies may provide useful information to the policy makers interested in allocating a limited budget to implement a land use policy.

We used the Discrete Choice Experiments method to investigate how the WTP of the general public for specified characteristics of land use policies differ across case studies, as the WTP is affected by both populations' characteristics and features of the areas being studied.

For further information please contact [mboeri01@qub.ac.uk](mailto:mboeri01@qub.ac.uk)

### 5.1.1 The Hague region

*How do people value peri-urbanisation in The Hague region?*

#### FS 216 Results of choice experiments applied to The Hague region

By Marco Boeri - Belfast

#### What is the issue?

We use a Discrete Choice Experiments (CE) questionnaire to elicit citizens' preferences and Willingness to Pay (WTP) for different effects of proposed land use policies in the region of The Hague.

Assessing the WTP for the effects of land use policies provides policy makers with information on how the benefits of public programs are perceived by the general public. Such knowledge may be useful for deciding how to best allocate public moneys before a land use policy is implemented.

## **Methodology and Materials:**

The method used to assess these values is the Discrete Choice Experiments method (for more information see the related fact sheet ). In our survey, we investigated citizens' preferences and WTP, expressed as a one-off tax, for three hypothetical effects of a land use policies by administering a CE internet based questionnaire. The output of the Multinomial Logit model (MNL) used for the analysis of the CE data is reported in the attached table and described in the Results section.

Results from the analysis of the Discrete Choice Experiments are used as an input for the Cost Benefit Analysis (see fact sheet on ) and to implement the Benefit Transfer Method to assess the effects of the selected policies on other case studies as well.

## **Results and Conclusion:**

After initial analysis and discussion with PLUREL stakeholders about the most important effects related to land use policies, we focused on three selected effects that appeared to be relevant:

1. improvement in air pollution from transport
2. protection of cultural heritage monuments
3. a) development of new housing in green open spaces
4. b) development of new housing by refurbishing idled buildings, hence protecting green open spaces.

Descriptive statistics for our sample are as follows:

Males comprise 51% of our sample; the average age is 46 years.

The structure by age of the sample is:

11.83% is between 18 and 25 years old;  
15.78% is between 26 and 35 years old;  
31.36% is between 36 and 50 years old;  
32.74% is between 51 and 65 years old and  
8.28% is over 65 years old.

Among our respondents,

39.64% are married,  
16.7% live with a partner,  
30.5% are single;  
9.86% are divorced and  
3.16% are widower.

Most respondents (60.75%) have a job. Of those 69.48% being in full time employment, 21.75% in part time employment and 8.77% being self employed. Only 6.9% are students, 14.6% are retired and 8% are homemakers. Annual household's income before tax is on average 30 670¤.

Results from the Multinomial Logit model (MNL) used to analyse the Discrete Choice Experiments data are shown in the table attached. It is important to note that the results are coherent with

economics prior expectations. For example, the coefficients for the tax and for the current situation are negative suggesting that, ceteris paribus, respondents do not prefer more expensive public programs, or keeping the current situation.

The table also shows that people care for preserving cultural heritage monuments and support interventions aimed at reducing air pollution and greenhouse gases emissions from transport. When we look at the effects of housing, we find that respondents' utility is not significantly affected by accommodating the demand for new housing by refurbishing abandoned and idled buildings, as the associated coefficient is indeed not significantly different from zero, and they are strongly against developing new apartment complexes in green open spaces.

We find that respondents are on average willing to pay 58.33 € for the effects of reduced air pollution and greenhouse gases emissions obtained by improving transport. They are also on average willing to pay 21.67 € for protecting cultural heritage monuments. Looking at housing, respondents' WTP is strongly negative and equal to minus 178.33 € for developing apartment complexes in green open spaces.

Citizens in The Hague are in favour of a policy to reduce air pollution and greenhouse gases emissions by improving transport and to protect cultural heritage monuments, whilst they are against any new housing developed in green open spaces. Respondents do not consider that the demand for new housing should be addressed by refurbishing abandoned and idled buildings. It seems indeed that the demand for new housing is not perceived as an important problem in The Hague.

Further applications on other regions or valuing other characteristics of land use policies can be done by tailoring the survey instrument to the characteristics of the case study.

For further information please contact [mboeri01@qub.ac.uk](mailto:mboeri01@qub.ac.uk)

#### **Further reading:**

[The Hague questionnaire administered](#) (pdf) by Marco Boeri

[CE Results for Haaglanden](#) (table) by Marco Boeri

#### **5.1.2 Leipzig-Halle region**

*How do people value peri-urbanisation in Leipzig-Halle region?*

#### **FS 215 Results of choice experiments applied to Leipzig-Halle region**

*By Marco Boeri - Belfast*

## **What is the issue?**

We use a Discrete Choice Experiments (CE) questionnaire to elicit citizens' preferences and Willingness to Pay (WTP) for different effects of proposed land use policies in the Leipzig-Halle region.

Assessing the WTP for the effects of land use policies provides policy makers with information on how the benefits of public programs are perceived by the general public. Such knowledge may be useful for deciding how to best allocate public moneys before a land use policy is implemented.

## **Methodology and Materials:**

The method used to assess these values is the Discrete Choice Experiments method (for more information see the related fact sheet ). In our survey, we investigated citizens' preferences and WTP, expressed as a one-off tax, for three hypothetical effects of a land use policies by administering a CE internet based questionnaire. The output of the Multinomial Logit model (MNL) used for the analysis of the CE data is reported in the attached table and described in the Results section.

Results from the analysis of the Discrete Choice Experiments are used as an input for the Cost Benefit Analysis (see fact sheet on ) and to implement the Benefit Transfer Method to assess the effects of the selected policies on other case studies as well.

## **Results and Conclusion:**

After initial analysis and discussion with PLUREL stakeholders about the most important effects related to land use policies, we focused on three selected effects that appeared to be relevant:

1. improvement in air pollution from transport
2. protection of cultural heritage monuments
3. a) development of new housing in green open spaces
4. b) development of new housing by refurbishing idled buildings, hence protecting green open spaces.

For more details on the questionnaire design see

Descriptive statistics for our sample are as follows.

Males comprise 42% of our sample; the average age is 34 years.

The structure by age of the sample is:

29.39% is between 18 and 25 years old;  
35.11% is between 26 and 35 years old;  
23.87% is between 36 and 50 years old;  
9.86% is between 51 and 65 years old and  
1.78% is over 65 years old.

Among our respondents,  
21.30% are married,  
32.74% live with a partner,  
36.88% are single;  
8.28% are divorced and  
0.79% is widower.

Most respondents (61.74%) have a job and 20.12% are full time students. 4.54% are retired and 5.52% are homemakers. Annual household's income before tax is on average  $\diamond$  28 355.

Results from the Multinomial Logit model (MNL) used to analyse the Discrete Choice Experiments data are shown in the table attached. It is important to note that the results are coherent with economics prior expectations. For example, the coefficients for the tax and for the current situation are negative suggesting that, *ceteris paribus*, respondents do not prefer more expensive public programs, or keeping the current situation.

The table also shows that people care for preserving cultural heritage monuments and support interventions aimed at reducing air pollution and greenhouse gases emissions from transport. When we look at the effects of housing, we find that respondents' utility is not significantly affected by accommodating the demand for new housing by refurbishing abandoned and idled buildings, as the associated coefficient is indeed not significantly different from zero. In addition, respondents are strongly against developing new apartment complexes in green open spaces.

We find that respondents are on average willing to pay 58.33  $\diamond$  for the effects of reduced air pollution and greenhouse gases emissions obtained by improving transport. They are also on average willing to pay 21.67  $\diamond$  for protecting cultural heritage monuments. Looking at housing, respondents' WTP is strongly negative and equal to minus 178.33  $\diamond$  for developing apartment complexes in green open spaces.

Citizens in Leipzig-Halle are in favour of a policy to reduce air pollution and greenhouse gases emissions by improving transport and to protect cultural heritage monuments, whilst they are against any new housing developed in green open spaces. Finally respondents do not consider responding to the demand for new housing by refurbishing abandoned and idled buildings. It seems indeed that the demand of new housing is not perceived as an important problem in Leipzig-Halle.

Further applications on other regions or valuing other characteristics of land use policies can be done by tailoring the survey instrument to the characteristics of the case study.

For further information please contact [mboeri01@qub.ac.uk](mailto:mboeri01@qub.ac.uk)

#### **Further reading:**

[Leipzig questionnaire administered](#) (pdf) by Marco Boeri

[Choice experiment results for Leipzig](#) (table) by Marco Boeri

### **5.1.3 Warsaw Metropolitan area**

*How do people value peri-urbanisation in Warsaw Metropolitan area?*

#### **FS 214 Results of choice experiments applied to Warsaw Metropolitan area**

*By Marco Boeri - Belfast*

#### **What is the issue?**

We use a Discrete Choice Experiments (CE) questionnaire to elicit citizens' preferences and Willingness to Pay (WTP) for different effects of proposed land use policies in the metropolitan area of Warsaw.

Assessing the WTP for the effects of land use policies provides policy makers with information on how the benefits of public programs are perceived by the general public. Such knowledge may be useful for deciding how to best allocate public moneys before a land use policy is implemented.

#### **Methodology and Materials:**

The method used to assess these values is the Discrete Choice Experiments method (for more information see the related fact sheet ). In our survey, we investigated citizens' preferences and WTP, expressed as a one-off tax, for three hypothetical effects of a land use policies by administering a CE internet based questionnaire. The output of the Multinomial Logit model (MNL) used for the analysis of the CE data is reported in the attached table and described in the Results section.

Results from the analysis of the Discrete Choice Experiments are used as an input for the Cost Benefit Analysis (see fact sheet on ) and to implement the Benefit Transfer Method to assess the effects of the selected policies on other case studies as well.

#### **Results and Conclusion:**

After initial analysis and discussion with PLUREL stakeholders about the most important effects related to land use policies, we focused on three selected effects that appeared to be relevant:

1. improvement in air pollution from transport
2. protection of cultural heritage monuments
3. a) development of new housing in green open spaces
4. b) development of new housing by refurbishing idled buildings, hence protecting green open spaces.

For more details on the questionnaire design see

Descriptive statistics for our sample are as follows: Males comprise 53% of our sample; the average age is 33 years.

The structure by age of the sample is:  
28.32% is between 18 and 25 years old;  
39.80% is between 26 and 35 years old;  
26.73% is between 36 and 50 years old;  
3.76% is between 51 and 65 years old and  
1.39% is over 65 years old.

Among our respondents,  
43.56% are married,  
19.80% live with a partner,  
31.68% are single;  
4.36% are divorced and  
0.59% is widower.

Most respondents (75.25%) have a job. Only 2.97% are students, 1.98% is retired and 3.96% are homemakers. Annual household's income before tax is on average PLN 61,130.

Results from the Multinomial Logit model (MNL) used to analyse the Discrete Choice Experiments data are shown in the table (see further reading). It is important to note that the results are coherent with economics prior expectations. For example, the coefficients for the tax and for the current situation are negative suggesting that, *ceteris paribus*, respondents do not prefer more expensive public programs, or keeping the current situation.

The table also shows that people do not care too much for preserving cultural heritage monuments, as the associated coefficient is indeed not significantly different from zero, but strongly support interventions aimed at reducing air pollution and greenhouse gases emissions from transport. When we look at the effects of housing, we find that respondents prefer to accommodate the demand for new housing by refurbishing abandoned and idled buildings, rather than by developing new apartment complexes in green open spaces.

We find that respondents are on average willing to pay PLN 120.00 for a reduction in air pollution and greenhouse gases emissions obtained by improving transport. Looking at housing, respondents are willing to pay PLN 103.33 for refurbishing abandoned and idled buildings, whilst their WTP is strongly negative and equal to minus PLN 280.00 for developing apartment complexes in green open spaces.

The results suggest that, whilst the problem of housing is seen as a major problem for Warsaw, the general public opposes to accommodate the demand for new housing by developing new apartment complexes in green open spaces. This demand for new housing should be addressed by refurbishing abandoned and idled buildings. We also noticed that respondents do not perceive protecting cultural heritage monuments as a problem important enough to be incorporated into a land use policy. Citizens in Warsaw are also in favour of a possible policy to reduce air pollution and greenhouse gases emissions by improving transport.

Further applications on other regions or valuing other characteristics of land use policies can be done by tailoring the survey instrument to the characteristics of the case study.

For further information please contact [mboeri01@qub.ac.uk](mailto:mboeri01@qub.ac.uk)

**Further reading:**

[Warsaw questionnaire administered](#) (pdf) by Marco Boeri

[CE Results for Warsaw](#) (table) by Marco Boeri

## 5.2 Impact assessment using response functions

*Concept of response functions for impact assessment*

### FS 39 Response functions (principles)

By Annette Piorr - Müncheberg

#### What is the issue?

Urbanisation leads to significant changes in the social, economic and environmental setting of EU regions. A response function (RF) is a quantitative representation of a functional relationship between ?drivers? connected to urbanisation and ?sustainability indicators?. Drivers are specific land uses, distance to city centre, GDP or population density whereas the sustainability indicators describe landscape bound recreation, biodiversity, commuting and traffic, population, employment, housing, household structure and emissions. The RF is developed either generically or case-based for the pan-European situation or clusters of regions. The aim is to derive regression models with the best possible explanatory value for impact analysis of developments at NUTSX level or specific for Rural Urban Regions (RUR). The European Urbanisation Impact Model (EUI-Model) comprises all quantitative Response Functions at NUTS X for EU27. Possible forms of outputs are maps or graphs, which are fed into the iAT.

RF are the backbone for the analysis of regional effects of urbanisation in the EU. They are mathematical expressions by which a quantification of the potential impacts of urbanisation trends on single indicators for the social, economic and environmental functions of a region is possible. When future driver values from the (RUG model) are fed into the RF, the impact of certain urbanisation trends can be evaluated. Therefore RF are an important means for policy support.

#### Methodology and Materials:

Most PLUREL RFs have been built on European databases with EU27 coverage at NUTSX, e.g. EUROSTAT data. The RFs on household structure and on emissions are mainly related to demographic projections resulting in changed population densities or GDP changes. RF for landscape structure, biodiversity, work and recreation refer to changes of artificial surface area, based on Corine Land Cover (CLC). RF for commuting and housing have been derived on more detailed datasets from different RUR types and by using more specific models that consider data which do not underlie continuous monitoring at European scale.

The PLUREL response functions (RF) are generic regression functions with dependent and independent variables being represented by quantitative indicators at NUTS3/NUTS2 level. Independent input variables are land cover related and socio-economic indicators, like urban area, GDP and population. Output variables are indicators which describe the social, economic and environmental setting of a region, e.g. number of people older than 60, unemployment rate, commuting rate or age-dependent housing choice.

## **Results and Conclusion:**

There are three types of underlying equations. The functions do not necessarily need to be linear, they can also be logarithmic or else.

### **Type 1: General regression function**

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times In3_{2025} + ? + k$$

With:  $y$  = Output variable, example single person households

$In1$  = Input variable 1 value at a certain time slice, e.g. population

$In2$  = Input variable 2 value at a certain time slice, e.g. artificial surface

$In3$  = Input variable 3 value at a certain time slice, e.g. GDP

$a, b, c$  = Regression coefficient different for each input variable

$k$  = Constant

### **Type 2: A function for each RUR type**

$$\text{RUR type 1: } y_{\text{type1}} = a_{\text{type1}} \times In1_{2025} + b_{\text{type1}} \times In2_{2025} + c_{\text{type1}} \times In3_{2025} + ? + k_{\text{type1}}$$

$$\text{RUR type 2: } y_{\text{type2}} = a_{\text{type2}} \times In1_{2025} + b_{\text{type2}} \times In2_{2025} + c_{\text{type2}} \times In3_{2025} + ? + k_{\text{type2}}$$

RUR type 3: ?

With:  $y$  = Output variable for specific RUR type, example commuting

$In1$  = Input variable 1 value at a certain time slice, e.g. population

$In2$  = Input variable 2 value at a certain time slice, e.g. employment

$In3$  = Input variable 3 value at a certain time slice, e.g. distance to centre

$a$  = Regression coefficient for  $In1$ , different for each RUR type

$b$  = Regression coefficient for  $In2$ , different for each RUR type

$c$  = Regression coefficient for  $In3$ , different for each RUR type

$k$  = Constant, different for each RUR type

### **Type 3: Integration of static variables**

$$y = a \times In1_{2025} + b \times In2_{2025} + c \times SV1 + d \times SV2 + e \times SV3 + ? + k$$

With: like Type1,

$SV1$  = Static variable 1, e.g. typical fuel consumption per country

$SV2$  = Static variable 2, e.g. coastal area

Etc.

## **Further reading:**

PLUREL deliverable reports:

1. [Modelling Approach for Response Functions on Agricultural Production, Ecological Regulation and Recreation Function](#)
2. [Delineation of Response Functions](#)

Figures for the different RF types:

1. [Figure 1:](#) Example for Type 1 RF: Relation between employment rate and artificial surface (representing the share of urban area). Calculated by PAS, Warsaw.
2. [Figure 2:](#) Example for Type 2 RF for each RUR Type: Probability of commuting in relation to distance to the urban centre. Provided by SYKE, Helsinki.
3. [Figure 3:](#) Example for Type 3 RF: The graph shows the Type 1 RF between artificial surface and the amount of unfragmented landscape (size of the area not dissected by streets or

settlements). The box below shows the RF enhanced by static variables like the location in the Mediterranean or the amount of rural area, which cannot be displayed in a graph. This RF was provided by ZALF, Müncheberg.

## 5.3 Results of impacts assessment: Europe

*Results of sustainability impact assessments using response functions on EU level*

### FS 422 Impact Analysis

By Annette Piorr - Müncheberg

#### What is the issue?

Urban expansion has many negative impacts. These impacts depend to a large extent on the spatial pattern of urban growth: poly-centric development is less harmful than unlimited urban sprawl. In PLUREL we analyse the spatial pattern of growth based on Corine Land Cover data, and bring them together with other statistical data, in order to reach a regionally differentiated picture of urbanisation and its impacts all over Europe. This allows identifying hot spots of desired and undesired impacts of urbanisation driven land use changes. The impacts we analyse in PLUREL at EU scale are related to households, employment, emissions, agriculture, landscape and recreation, and biodiversity.

It is important to collect regionally differentiated knowledge on the degree of urbanisation, currently and in future, and on the related impacts. The reason is that European policies, governance processes, financial support, but also restrictions encourage and urge to best exploit regional potentials and risks of the functions we refer to. PLUREL analysis for the EU-27 per NUTSX region supports such efforts.

#### Methodology and Materials:

Impact analysis is carried out data based, making use of EUROSTAT data. They are processed in the European Urbanisation Impact Model (EUI Model) based on regression models. The EUI Model relates urbanisation, measured as change of artificial surface, population density or GDP, to indicator variables for the economic, social and environmental functionality of a region, e.g. employment, single person households or endangered bird species. Normalisation of values (modelling results) over all NUTSX regions, scenarios and time steps allow for inter-regional and scenario comparisons.

#### Results and Conclusion:

For the user determined integrated result retrieval and visualisation the tool iIAT-EU has been designed. (see iIAT ).

#### Further reading:

[Land use change balance calculation for peri-urban land use changes in European Rural-Urban Regions](#)

## Description of methodology of iAT at pan-European level

### **5.3.1 Economic development and working places**

*What does peri-urbanisation mean for economic development and working places?*

#### **FS 94 Impact assessment results for economic development and working places**

*By Piotr Korcelli, Elzbieta Kozupela - Warsaw*

##### **What is the issue?**

The land use changes in rural, urban and peri-urban areas, as projected till 2025 on the basis of alternative sets of assumptions, i.e. scenarios, have certain implications for spatial economic change. Spatial patterns of economic activity can be evaluated from the point of view of sustainability criteria. In the present study sustainability is interpreted in terms of territorial cohesion which represents one of the major development goals, as defined in the [EU Lisbon Treaty](#). Sustainability is expressed by the distribution of values of selected economic indicators within the set of NUTS X units.

The results are relevant for spatial development policy purposes, at both the European Union, and a national level.

##### **Methodology and Materials:**

The data used in this analysis pertained to GDP, population size, as well as the area covered by artificial surface and its share in the total land area, all projected for 2015 and 2025, according to four development scenarios. These data were used to calculate future employment and GDP per capita - in Purchasing Power Parity rates - on the basis of observed data.

The input variables pertained to GDP, population number, and area covered by artificial surface, for 2015 and 2025, according to the four PLUREL development scenarios, as well as GDP- PPS per capita and total employment rate for the year 2000. The output included GDP and employment indicators for NUTS X units in the four development scenarios for the projection years 2015 and 2025.

The growth of gross domestic product - PPS per capita values over the projection period seems to be excessively high, at least in the case of some spatial units. Recalculation of the index values may be attempted, using the revised population projection figures.

##### **Results and Conclusion:**

The highly urbanised NUTS units, those with high shares of artificial surface in the total land area, are generally characterised by relatively high GDP - PPS per capita values. This association, identified for 1996 - 2000, continues though the projection period. Nevertheless, the distribution of

projected GDP values changes. More specifically, the share of units with values above the mean indicator value increases. This suggests some increase in territorial cohesion, i.e. the sustainability level. At the same time, differences between individual scenarios in this respect are not pronounced.

The redistribution of relative GDP - PPS per capita values, as resulting from the individual, scenario- based projections, indicates some decrease of spatial disparities which are observed at NUTS X level. This suggests an increasing territorial cohesion which is considered as one of the sustainability - related development goals. An extension of this analysis, so as to include aggregation of the spatial units into predominantly urban, peri-urban and rural types, would allow for deriving more specific, policy- relevant conclusions.

Concluding, commuting is closely interlinked with the urban spatial structure. Directions of major commuting flows tend to depend on the alternatives. Monocentric and polycentric urban forms differ considerably regarding commuting patterns.

In a monocentric urban form, urban density and distance to the centre are interlinked and are also the dominant factors affecting commuting distance. In a polycentric structure, proximity between centres means that there are several destinations within the same distance. In such cases, there is more variation in commuting patterns. These alternatives are available through a transport network. Commuting is a result of location choices made by individuals and firms in terms of the housing and labour markets. Changes in the commuting gradient are responses to several dynamics occurring in the urban-rural continuum. Two evident dynamics influencing the curve parameters are changes in locations of work and population, i.e. centralisation versus sprawl, and changes in transport systems, i.e. accessibility. The factors behind individual level choices such as place of residence, job and travel mode form more complex interrelationships.

#### **Further reading:**

- [PLUREL deliverable report: Response functions for transport and commuting](#)

## 5.4 Integrated impact analysis tool (iIAT)

*How can the sustainability of the peri-urbanisation effects be assessed at European scale?*

### FS 91 iIAT principle

By Annette Piorr, Dagmar Haase - Müncheberg, Berlin

#### What is the issue?

The integrated Impact Analysis Tool (iIAT) synthesises the modelling results from the impact analysis of land use changes of the EU project PLUREL on peri-urban land use relationships into one tool. It is a tool for an integrated result presentation of a broad impact analysis and multipurpose and interactive in nature. It allows for integration of manifold aspects of problems of land use and its functions and services related to urbanisation and considers conflicts of interest of different stakeholders within a planning process. It covers all dimensions of sustainability, namely the economic, the social and the environmental.

The iIAT supports decision-making and scoping processes of sustainable land (use) management at two scales: the EU27 and the regional. As it integrates all three dimensions of sustainability into one spidergram it facilitates integrated planning.

[Start the iIAT application](#)

#### Methodology and Materials:

Physically, the PLUREL iIAT is an internet accessible tool that displays results in form of spidergrams, which provide a surface that enables an easy and holistic perception of multilevel information. The iIAT provides an in-depth view into different thematic scopes and different scales, chosen according to individual user interest. The tool accesses the impact assessment result database of the PLUREL, and generates the demanded outputs in the graphical user interface (GUI).

Uncertainties in developing and using the iIAT occur due to the following reasons:

1. uncertainties in input data
2. uncertainties in indicator and response function calculation
3. uncertainties in aggregation of values and in standardisation.

#### Results and Conclusion:

[Start the iIAT application](#)

## **Further reading:**

[UGEC Newsletter: iIAT](#) (pdf) by Dagmar Haase et al. (2009)

### **5.4.1 Combined effects in Europe**

*Combined effects of peri-urbanisation in Europe*

#### **FS 450 Combined effects of peri-urbanisation in Europe**

*By Annette Piorr - Müncheberg*

#### **What is the issue?**

The iIAT-EU (European integrated Impact analysis Tool) of PLUREL allows for the analysis of combined effects of land use changes due to urbanisation. It is possible to use a predefined set of sustainability indicators, or to choose impact indicators from a list of 25 single indicators. The possibility to choose not only different impact indicators, but also different spatial aggregation methods (e.g. regions of similar type) is the particular added value of the combined impact analysis, for planners, politicians, researchers, stakeholders and the interested public.

Each European region has a specific profile that determines its response to global drivers, urbanisation trends, related land use changes and the impacts of these. Therefore it is important not only to allow a broad view over various sustainability indicators, but also to better understand the combined trends and their effects.

#### **Methodology and Materials:**

Impacts of urbanisation are analysed to different scenarios and time slices separately, based on the regression modelling and value normalisation of the European Urbanisation Impact Model (EUI Model). In this form they enter the common database of the iIAT-EU that allows retrieval according to user demands. Normalisation is carried out in a uniform procedure, per indicator over all NUTSX regions, scenarios and time slots.

#### **Results and Conclusion:**

The choice which impacts of urbanisation should be combined, is taken by the user of the iIAT-EU. As well a predefined set of indicators on sustainability impacts can be used, as the free choice option (selection of up to 12 indicators out of 25). The map viewer facilitates choice of indicators, but also aggregation level (by typologies, spatial units), that allows for identification of similar or extremely different regions and their comparison. Comparisons over time steps allow analysing the intensity in which impacts develop, for single regions or aggregated groups.

Data retrieval and visualisation (by spidergrams or maps) of effects of urbanisation on free chosen a) indicator lists b) levels of spatial aggregation c) time steps and d) scenarios allow users to filter the specific information of interest. PLUREL researchers provided a database of normalised values of all modelling results at NUTSX scale for the whole EU-27. The iIAT-EU is an online tool that

technically allows for combined urbanisation effect analysis..

## Further reading:

### 5.4.2 Combined effects in the case study regions

*Combined effects of peri-urbanisation in case study regions*

#### FS 451 Combined effects of peri-urbanisation in case study regions

By Dagmar Haase, Nina Schwarz - Leipzig

#### What is the issue?

The combined effects of land use changes are evaluated using an integrated and multicriteria assessment scheme brought into one stand-alone tool, the iIAT. This kind of assessment uncovers the impacts of urban land use change on ecosystem services, quality of life and economic valuation. Therefore this assessment is decisive when evaluating future land development strategies in the light of sustainability.

#### Methodology and Materials:

For the assessment of the combined effects of urban land use change itself the following methods were applied: (1) development of a list of relevant indicators (see pdf), (2) a range of impact functions/models (described in separate factsheets), (3) their application to the Corine land Cover and MOLAND maps and (4) the integration of all indicator values in the iIAT-Region tool.

**Input variables** are Corine Land Cover maps, supplementary GIS data and MOLAND maps, **output variables** are GIS maps, tables and, finally, aggregated indicator values that depict changes in the indicators between land use change scenarios and the status in the year 2000.

#### Results and Conclusion:

Results are available for the three regions Leipzig-Halle (Germany), Koper (Slovenia) and Haaglanden (Netherlands) for three locally adapted land use change scenarios each and the years 2015 and 2025. The results of the impact assessment show considerable differences in both provisioning of ecosystem services and quality of life in the three case study regions depending on the land use scenario. The results for the three case study regions can be summarised as follows: The scenarios for Koper show that a likely increase of artificial surfaces in most of the scenarios will worsen the provision of ecosystem services and quality of life in the entire case study region.

Whereas the ecological conditions and the provisioning of ecosystems services in the urban parts of the Haaglanden region decrease, the quality of life slightly increases. For the Peak oil and Fragmentation scenarios the ecosystem services provision increases for the whole area.

The results for the Leipzig-Halle case study show that a more local development with limited economic growth would improve both the provision of ecosystem services and, simultaneously, the human quality of life. The business-as-usual scenario brings a further increase of artificial surfaces in the region, which would worsen the socio-environmental conditions, particularly in the urban and inner peri-urban parts.

**Further reading:**

PLUREL deliverable report: [Results of impact assessment for selected case studies](#)

## 5.5 CBA Europe

*What are the costs and benefits (CBA) of peri-urbanisation in Europe?*

### FS 229 Cost benefit analysis at pan EU level

By Tim Taylor - Bath

#### What is the issue?

In principle, policy making at pan-EU level on peri-urban environments needs to be informed by an appropriate understanding of the relative costs and benefits of the policy. A methodology has been developed to help in doing this - based on cost-benefit analysis. The traditional approach has been extended to take into account irreversibility.

The method is important as it provides the basis for the appropriate evaluation of pan-EU policy on peri-urban areas. In the future, it may be that peri-urban policy is discussed at pan-EU level, as the importance of such areas becomes more apparent to policy makers.

#### Methodology and Materials:

The method first requires a quantification of the implications of policy on land use at the pan-EU level. This can be used as the basis for evaluating the likely environmental and economic implications of the policy. A traditional comparison of the costs and benefits of various policies can be constructed, by applying monetary values where possible to the impacts expected. Then costs and benefits need to be classified as irreversible or reversible and the analysis extended to factor this in.

#### Results and Conclusion:

This method has not as yet been applied to the pan-EU level, owing to a lack of pan-EU policy at this level. It remains useful, however, in providing the framework for future analysis of policies at this scale. This method can be used to evaluate the impacts of pan EU policy in peri-urban areas. It has not yet been applied this scale as the subsidiarity principle applies to policy at this level.

### 5.5.1 CBA transportation

*What are the costs and benefits of transportation infrastructure investments?*

### FS 203 Economic evaluation of transportation infrastructure investment

By Eda Ustaoglu, Brendan Williams - Dublin

## **What is the issue?**

The economic evaluation of transport infrastructure investment reviews literature and proposes a generic Cost-Benefit Analysis (CBA) methodology for the scenario-based evaluation of transport-land-use impacts of rapid rail investments in the European Area. In this respect, the land use impacts of a *do minimum* scenario is compared with a *with rail* scenario; the former implying a more dispersed urban growth compared to the more compact forms of urban development potentially achieved through the land development impacts of rapid rail investments.

A Cost-Benefit Analysis approach is the used methodology for the evaluation of the impacts of these two alternative scenarios. Peri-urban development is a dynamic process in which the existing and future infrastructure provision plays a key role. This research explores the urban economic aspects of transport provision/ non provision of future development trends.

## **Methodology and Materials:**

Concerning the application of the Cost-Benefit methodology for the PLUREL case study regions in the context of scenario analysis carried out by the MOLAND model, there are constraints on the availability of data, which involves a focus on particular case studies (e.g. Dublin and Leipzig) and major priority cost elements of schemes.

By use of MOLAND scenario analysis and CBA techniques alternative growth strategies can be assessed. From this analysis issues arising and discussions as to best international practice in managing peri-urban change can be developed

## **Results and Conclusion:**

Here, the development of an adapted CBA approach to urban rail investment projects, which is to be used in the testing of various scenarios relating to urban form, was explored. This allows the CBA process to be used as a policy support tool in discussions of alternative development and investment decisions, such as compact versus dispersed urban form. This approach is intended to allow for the development of an improved quantitative evidence basis for decisions on infrastructure spending. Through the identification of standard criteria for inputs and evaluation, this approach assists in cross-national or cross-programme results analysis. In addition, it is possible that a variety of potential development scenarios can be developed and tested. Future research linked with this analysis will involve the testing of the model on two European cities e.g. Dublin and Leipzig with planned rail infrastructure investment.

## **Further reading:**

[Research Context](#) (pdf) by Eda Ustaoglu, Brendan Williams

[Stages of Proposed CBA Process](#) (image) by Eda Ustaoglu, Brendan Williams

[Cost-Benefit evaluation methodology](#) (pdf) by Eda Ustaoglu, Brendan Williams

[Input-Output summary](#) (pdf) by Eda Ustaoglu, Brendan Williams

# 6 Strategies and conclusions

*How can I react on peri-urbanisation?*

## FS 423 Planning and policy reactions

By Katharina Fricke - Müncheberg

### What is the issue?

Although different patterns across European countries exist, there are many local governments in the rural-urban region, while usually no supra-local level administrative unit exists for this area. Under such circumstances the public control over the market processes in the peri-urban area can be ensured through special public administration arrangements (e.g. introduce/empower metropolitan government structure, create compulsory associations of lower level administrative units) and/or through planning policies, giving control functions to higher level governments over the plans of the administrative units in the RUR area. The interplay of the government system and of the overarching planning policies shows the potential of public control over peri-urban development. The formal government system and planning policies assign the framework and the potential level of public control over market processes. Within this, the real strength of public control depends on the use of financial and regulatory instruments and different sectoral policies. The same applies for the regulatory instruments applied for large scale new developments, such as the procedure of changing the zoning ordinance, or the regulation of the financial conditions to issue building permissions, etc.

A particular value for end users, not only in the case study regions lies in the fact that the impact of regional planning and other policy strategies, can be observed in terms of the resulting land use changes and the connected implications can be assessed in terms of their suitability and effectiveness.

### Methodology and Materials:

Work on peri-urbanisation with specific cases is complementary to the European level approach but at a spatially more detailed level. Case study research aims to identify suitable strategies for developing sustainable land use relationships in peri-urban areas. This needs information on the real world frame conditions.

Case study region data and qualitative information are being assembled and arranged to facilitate the analysis of interaction and interdependence of economic development, land consumption, environmental status and quality of life within a case study urban region, as well as comparisons among the regions. The case studies are also used to relate results from analyses and stakeholder demands.

### Results and Conclusion:

The PLUREL Xplorer also features responses covered by policy decisions in reaction to simulated impacts. Hence, best practice examples give an idea of possible development options. This

important section of the PLUREL Xplorer covers a general introduction into European policies, government and governance as well as instruments and strategies and features detailed regional planning strategies from the PLUREL case studies.

## 6.1 Policies

### FS 424 Policies

By Kjell Nilsson, Thomas Sick Nielsen - Copenhagen

#### What is the issue?

The PLUREL projects focus and results are intrinsically linked to policies and policy development at the EU-level, as well as the national and regional level. PLUREL has peri-urban land use relationships as its main focus. This includes analysis of drivers, consequences, policies and scenarios for the future. Even though PLUREL aims for pan-European coverage, the principal focus is at the sub-regional level and balance between urban and rural land uses within Rural-Urban Regions.

Although the EU has no explicit competence in spatial development, its guidelines and policies are of importance for the general development. The ministers responsible for spatial planning have developed a set of territorial policy goals and priority topics during the last decades including territorial cohesion, polycentric development, territorial governance, risk-management and cultural and natural resources. These are all important issues in the context of Peri-urban land use relationships.

#### Methodology and Materials:

A review has been made of European policies connected to rural-urban land use relationships including European principles and guidelines, EU legislation and funding and EU policy areas affecting or explicitly dealing with peri-urban land use relationships.

#### Results and Conclusion:

Although the EU has no explicit competence in spatial development, its guidelines and policies are of importance for the general development. European policies have an impact on various levels of spatial development; the figure in the right hand navigation bar illustrates the different layers of spatial relevant policies. The Lisbon and Gothenburg agenda set the overall framework all EU policies relate to by emphasizing the two general goals:

1. Economic growth and employment
2. Sustainable development

Further, the European ministers responsible for spatial planning developed a set of territorial policy goals and priority topics during the last decades, documented in the ESDP and the CEMAT guidelines. In 2007 the Territorial Agenda was adopted, summarising major aims of territorial development including territorial cohesion, polycentric development and accessibility as well as ecological structures and cultural and natural resources. The European Commission's Green Paper

on "Territorial Cohesion", has sharpened the perspective on urban-rural linkages for a more balanced and harmonious development, as well as the challenge of the diverse settlement pattern of the EU. Consensus has pointed towards 6 strands for reinforcement of the territorial dimension in policy design and implementation:

1. Coordinated public policies at different levels
2. Better account of territorial impacts
3. Improved multi-level governance
4. The need for flexible, functional approaches - consideration of river basins, mountain areas, networks of towns, metropolitan areas, deprived neighbourhoods etc.
5. Territorial cooperation as a clear EU asset
6. Reinforced evidence base - better territorial knowledge.

Additionally to these overall goals and principles relevant for land use change and rural-urban relationships, several EU policies have an indirect but important influence on spatial development. The rural development policy is explicitly including "peri-urban areas under increasing pressure from urban centres", providing funds for the agrifood sector, protection and enhancement of natural resources as well as an attractive development in general. However, the explicit implementation is left to the member states and the regional programme managers. Similar to the rural development policy works the regional or cohesion policy. However, the cohesion policy might not have an impact on intra-regional development as such, but by enhancing attractiveness of regions it also results in a change of land use pressure inside certain regions. Besides these spatial relevant sector policies, the EU enforces legislation which is translated into spatial explicit instruments on sub-regional level; e.g. the Habitat and Birds Directive caused the development of Natura 2000 areas, an EU-wide network of nature protection areas. The implementation of Trans-European Networks through funding programmes is another sector policy having an impact on land-use change and rural-urban relations.

Spatial development policies in Europe are mainly a domain of the national states or their sub-entities like regions and municipalities, but, as written before, the EU has a crucial influence on spatial development in Europe with its various sectoral policies and the joint development of guidelines and principles with the member states. PLUREL is directly focused on several of the topics covered in these policies, while the others are dealt with indirectly as many have influences on urban-rural land use changes. PLUREL will contribute to the debate by improving the evidence base of territorial processes and the knowledge exchange on spatial policies. PLUREL's strategy hereby is a combination of a general easy accessible results platform (the PLUREL Xplorer at hand) and the active discussion with important stakeholder networks (PURPLE, CURE, DG Regio), fostering the importance of urban-rural linkages for a sustainable development in Europe.

### **Further reading:**

[PURPLE Network](#)

[Convention for Urban and Rural Europe \(CURE\)](#)

## 6.1.1 European policy options

*Which policy options concerning peri-urbanisation processes do exist on the European scale?*

### FS 100 Review of policy options (EU)

By Kjell Nilsson, Thomas Sick Nielsen, Ivan Tosics - Copenhagen, Budapest

#### What is the issue?

The PLUREL projects' focus and results are clearly linked to policies and policy development at the EU-level. Here, an overview of EU policies and guidelines relevant to urban-rural relationships and peri-urban development is given.

Although the EU has no explicit competence in spatial development, its guidelines and policies are of importance for the general development in peri-urban regions. The ministers responsible for spatial planning have developed a set of territorial policy goals and priority topics during the last decades including territorial cohesion, polycentric development, territorial governance, risk-management and cultural and natural resources. These are all important issues in the context of peri-urban land use relationships.

#### Methodology and Materials:

European policies connected to rural-urban land use relationships including European principles and guidelines, EU legislation and funding are reviewed within the scope of PLUREL. Furthermore results of PLUREL are summarised and set into perspective regarding local and regional policy issues here.

#### Results and Conclusion:

Although the EU has no explicit competence in spatial development, its guidelines and policies are of importance for the general development. European policies have an impact on various levels of spatial development; the figure on the right hand side illustrates the different layers of spatial relevant policies. The [Lisbon](#) and [Gothenburg](#) agenda set the overall framework all EU policies relate to by emphasising the two general goals:

1. Economic growth and employment
2. Sustainable development

Further, the European ministers responsible for spatial planning developed a set of territorial policy goals and priority topics during the last decades, documented in the [ESDP](#) (EU Ministers responsible for Spatial Planning 1999) and the [CEMAT](#) guidelines (2000). In 2007 the [Territorial](#)

[Agenda](#) (EU Ministers responsible for spatial planning and development 2007) was adopted, summarising major aims of territorial development including territorial cohesion, polycentric development and accessibility as well as ecological structures and cultural and natural resources.

The most recent discussion was initiated by the European Commission's [Green Paper on Territorial Cohesion](#) (2008), which further sharpened the role of urban-rural linkages for a more balanced and harmonious development, as well as the challenge of the diverse settlement pattern of the EU. The Green paper was up for debate until February 2009. In June 2009, the Commission published the [sixth interim report on economic and social cohesion](#) (European Commission 2009), where the last chapter synthesises the debate on the green paper. An overall aim for territorial cohesion was defined:

*"The goal of territorial cohesion is to encourage the harmonious and sustainable development of all territories by building on their territorial characteristics and resources."*

The rate of participation in the proceeding consultation process showed the importance of the topic. There was consensus on 6 strands regarding the reinforcement of the territorial dimension in policy design and implementation:

1. Coordinated public policies at different levels
2. Better account of territorial impacts
3. Improved multi-level governance
4. The need for flexible, functional approaches - consideration of river basins, mountain areas, networks of towns, metropolitan areas, deprived neighbourhoods etc.
5. Territorial cooperation as a clear EU asset
6. Reinforced evidence base - better territorial knowledge is needed

The discussion on a common territorial development policy continues with the last meeting in March 2010 in Spain, showing the relevance of territorial policy at European scale. This was also strengthened through the adoption of the Treaty of Lisbon (resp. the [Treaty on the Functioning of the European Union](#)) of the EU where Territorial cohesion is mentioned as a formal shared competence of the EU and its member states (European Union 2008, Article 4 § 2 and Title XVIII / Article 174). Certainly, spatial development policies in Europe are mainly a domain of the national states or their sub-entities like regions and municipalities, but the EU has a crucial influence on spatial development in Europe with its joint development of guidelines and principles with the member states. These are also reflected in the sectoral policies of the EU, which are discussed.

### **Further reading:**

[European general and territorial goals](#) (image)

PLUREL deliverable report: [Review of policy options of how to control rural ? peri-urban ? urban relationships in order to steer the development of Rural-Urban Regions](#)

## 6.1.2 European policy instruments

*Are there policy instruments for peri-urbanisation processes at European scale?*

### FS 102 Policy Instruments for peri-urbanisation

By Kjell Nilsson, Thomas Sick Nielsen

#### What is the issue?

The PLUREL projects' focus and results are clearly linked to policies and policy development at the EU-level. Although the EU has no explicit competence in spatial development, its guidelines and policies are of importance for the general development. Here, relevant sector policies are discussed which have an important influence on the territorial development in peri-urban areas.

#### Methodology and Materials:

European policies connected to rural-urban land use relationships including European principles and guidelines, EU legislation and funding are reviewed. Furthermore results of PLUREL are summarised and set into perspective regarding local and regional policy issues.

Although the European Union has no explicit competence in spatial development, its guidelines are of importance for the general development. Additionally to these overall goals and principles, several EU policies have an indirect but important influence on spatial development and thus on land use change and rural-urban relationships.

#### Results and Conclusion:

The EU acts in a wide range of policy areas which include **solidarity policies** (also known as cohesion policies) in regional, agricultural and social affairs, and **innovation policies**, supporting the development of state-of-the-art technologies in fields such as environmental protection, research & development and energy. To implement these policies, the EU uses a combination of mainly two sorts of instruments: **Legislation** including EU regulations, directives and decisions, and **funding** of certain activities or projects allocated in the financial agreement in 6 headings (see [Figure](#)).

The biggest shares of the current EU financial framework are allocated to heading 1b - Cohesion and heading 2 - Natural Resources. Funding dedicated to natural resources are implemented through the Common Agricultural Policy (CAP). Since 1999, the CAP is made up of two pillars: The market policy and the rural development policy. The **rural development policy** is explicitly including "*peri-urban areas under increasing pressure from urban centres*", providing funds for the agrifood sector, protection and enhancement of natural resources as well as an attractive development in general.

Similar to the rural development policy works the **regional or cohesion policy**. It provides funding for three objectives:

1. The **Convergence objective** is to promote development in the least-developed regions;
2. funds under the **Regional competitiveness and employment objective** are dedicated to promote innovation, entrepreneurship, environmental protection, accessibility, adaptability and improvement of job markets; <
3. and with the **Territorial co-operation objective joint**, cross-border problem solving in urban, rural and costal development are promoted.

The guidelines for the structural and cohesion funds were defined in the Community Strategy Guidelines on cohesion, where 3 priorities are stressed:

1. Making regions more attractive places in which to invest and work
2. Improving knowledge and innovation for growth
3. More and better jobs

However, the cohesion policy might not have an impact on intra-regional development as such, but by enhancing attractiveness of regions it also results in a change of land use pressure inside certain regions.

Besides these spatial relevant sector policies, the EU enforces legislation which is translated into spatial explicit instruments on sub-regional level. That means that many other sector policies can have considerable influence on land use development including Energy and transport, and Environment, e.g. the Habitat and Birds Directives Natura 2000 areas. Also other EU environmental legislation like also Directive on Air Quality and Water or the Directive on Strategic Environmental Assessment have impacts on future land use change.

Spatial development policies in Europe are mainly a domain of the national states or their sub-entities like regions and municipalities, but, as written before, the EU has a crucial influence on spatial development in Europe with its various sector policies and the joint development of guidelines and principles with the member states. Especially policies in environmental, transport and regional issues have an essential implication for territorial development in the regions set important framework conditions for the future development also in peri-urban areas.

### **Further reading:**

[EU budget allocation 2007-2013 \(image\)](#)

## **6.2 Government and governance**

*Government and governance*

### **FS 425 Government and governance**

*By Ivan Tosics - Budapest*

#### **What is the issue?**

In the market economies of Europe, spatial processes are determined by location choices of the "moving actors" (households, industry/businesses, retail/leisure centres). The free-market logic of land development usually leads to urban sprawl, as decisions are usually based on short-term considerations.

To achieve sustainable development, new developments in the Rural-Urban Regions (RUR) have to be controlled by the public sector. This might happen through the formal government system and planning policies; through financing and taxation systems and sectoral policies, and with regulations on new developments. Finally also informal, governance type processes might lead to better control over market processes.

Urban sprawl is a serious threat for sustainable development. The low density spread-out of households and businesses into peri-urban areas is harmful from an environmental and also from a social point of view in terms of segregation. The integration of smart, sustainable and inclusive aspects of urban development, needed to implement the EU2020 strategy, can only be fulfilled with strategies involving the whole territory of the RUR regions, led by the public sector in multi-level governance cooperation.

#### **Methodology and Materials:**

The formal government and planning systems have been reviewed for all 27 EU countries on the basis of national reports. Further instruments (financing and taxation systems, sectoral policies, tools to steer the land development process) have been studied mainly in the PLUREL case study regions, extended with some other regions, to cover all categories of the typology of government structures prepared in the project. Also the analysis of the informal governance type processes concentrated on the case study regions. Based on national reports, all 27 EU countries have been classified into 7 categories showing the potential strength of public control over land-use changes, through the formal government and planning systems.

Based on questionnaires for PLUREL case study (and other) regions, indicators have been elaborated to quantify the qualitative information. Finally, the results from the case study regions were analysed in qualitative way.

#### **Results and Conclusion:**

The typology of national planning strategies provided a quantitative scale showing the potential

maximum strength of public regulation over land-use change (through the formal government system and planning policies) in the EU countries.

The adjacent review of further (indirect) policy instruments has lead to quantitative assessments of the case study areas regarding the three main topics of the analysis.

In the case of **Haaglanden** and **Manchester**, a strong potential control can be seen parallel to moderate municipal interests to increase population. This suggests a high probability for an effective control over peri-urban land-use. **Leipzig**, **Montpellier** and **Bologna** seem to be in a less favourable, but still manageable situation.

Thessaloniki shows a potentially strong, hierarchical government and planning system, while municipalities are strongly interested in expansion, which can lead to conflicts in land-use decisions. **Koper**, **Warsaw** and **Budapest** have a much weaker government and planning framework. Municipalities have average interests to expand urban land-use, but most sectoral policies lead into this direction. In these regions (with the potential exception of Koper) the public control over land-use does not seem to be efficient.

The comparison of the results of the two analyses shows that regions in countries with weak control potential have strong interest in expanding urban areas while the local authorities have only a limited number of tools to control urban sprawl. Thus the public sector regulations and policies are not able to change the deficiencies of the formal government system and planning framework.

On the other hand, regions in countries with high control potential show more diverse results. While Haaglanden and Manchester seem to fulfil the possibility of strong control given by the formal government and planning systems, the case of the other regions seem to be different: the regulations and tools do not match the potential these regions could have in controlling peri-urban development.

The analysis of governance processes in the case study regions has lead to several interesting results. On the basis of these results it is clear that governance processes can be effective if they are based on a solid formal government and planning system - without that they have only very little potential to modify the strength of control over market processes in peri urban areas. Governance procedures, the agreements between local governments in policies or regulations which would not be compulsory according to the formal systems, can be very important.

However, it is highly unlikely that such agreements can be reached without strong backing of the formal government system and the financial and regulatory processes. Thus the correct setup of the formal institutional systems, policies and regulations is of prime importance to fight urban sprawl, and governance processes can become useful extensions, but can not substitute for these in the RUR regions.

Two extreme types of countries exist regarding public control over urban sprawl processes. There are countries (e.g. the Netherlands and UK) where the potentially strong control assured by the formal systems and planning policies is underpinned by regulatory tools and planning policies. These countries have good chances to control peri-urban developments.

The other extreme are those countries (mainly new EU member states) where the formal government system and planning policies are weak. In these countries neither regulatory tools and planning policies, nor governance processes can assure such a control. The most likely outcome is growing urban sprawl.

This analysis highlighted the importance of effective formal institutions, policies, regulations on RUR level, especially targeted to peri-urban areas. It raises some hypothetical models how the European level could contribute to the strengthening of these basic elements of the public control over peri-urban sprawl.

### **Further reading:**

PLUREL deliverable report: [National reports for all 27 EU countries regarding their formal government structures and national planning systems](#)

PLUREL deliverable report: [Review of further instruments with indirect effect on regulation of peri-urban land uses](#)

PLUREL deliverable report: [Assessment of European regional governance and government approaches to maintain green open space in the urban fringe](#)

### **6.2.1 Influence of government structures**

*How do government structures influence peri-urbanisation processes?*

#### **FS 101 Government structures**

*By Ivan Tosics, Kostas Lalenis - Budapest, Volos*

#### **What is the issue?**

The objective of the [typology of EU national governance and spatial planning systems](#) is to produce a systematic overview of existing planning and administrative systems that are influenced directly or indirectly by policies on national and EU-level, providing different frameworks in the context of governance for rural-urban region development planning. Instruments with effect on the peri-urban land uses, e.g. intergovernmental financial transfers, public subsidies, taxation tools, service pricing, tools to regulate development processes are analysed.

In the market economies of Europe, spatial processes are determined by the location choices of investors and the population. The free-market logic of land development usually leads to urban sprawl, as decisions are based on short-term considerations, and the costs of public infrastructure are not taken into consideration. To achieve sustainable development, new developments in the Rural-Urban Regions (RURs) have to be controlled by the public sector through the government system and/or the planning policies.

#### **Methodology and Materials:**

The review of national governance and planning systems has been developed for all 27 EU countries on the basis of national reports. With the help of expert evaluation each country has been classified with marks 1-7, showing the potential maximal level of public control over land-use

changes. In a qualitative matrix the functioning of the government system (fragmented/consolidated) and the planning policy system (strong/weak control through supra-local government levels) are the two dimensions.

As input for the typology, national reports for all 27 EU countries, mainly on the basis of desk research - extended, where needed - were prepared with concrete new information from experts of the given countries. The output is the classification of the countries into 7 categories according to the potential strength of public control over land-use changes, exerted through the formal government and planning systems.

Uncertainties result from the qualitative nature of the descriptions and expert evaluations, which may not be quantified in a fully objective way. The other factor is the possible differences at the regional level within the national states, which could not be handled within the frames of this project.

### **Results and Conclusion:**

The typology provides a generic approach for the understanding how the RURs relate to the level where land-use change decisions are taken within the administrative and planning system of a given country. The typology relates the RURs to the system of territorial governments: the size of the different units (local municipalities, supra-local entities), their power and the basic functions they perform, and the planning competencies ascribed to each NUTS level. Based on the results of the country reports, the countries under investigation can be classified as follows ([classification](#)) according to the two main dimensions of our analysis.

According to this table and the values assigned to each category, the potential strength of public regulation over land use change in the different countries can be quantified as follows:

Value	Countries
7	
6	Denmark, The Netherlands, Portugal, United Kingdom
5	Belgium, Cyprus, France, Germany, Greece, Ireland, Lithuania
4	Italy, Spain, Sweden
3	Austria, Bulgaria, Finland
2	Estonia, Latvia, Luxembourg, Malta, Poland, Slovenia
1	Czech Republic, Hungary, Romania, Slovakia

The results show a high diversity of government and planning systems in the EU countries from the perspective of land-use change. Regarding the potential control resulting from the national government and planning systems, Northern European countries (e.g. Denmark, the UK and the

Netherlands) show higher levels mostly because of their consolidated local government systems, while Southern European countries showing a higher potential (such as Cyprus, Greece or Portugal) have more fragmented local government systems, but stronger control by supra-local levels. Most new member states show a weak control potential, with the notable exemptions of Lithuania (where the tradition of strong planning is based on the presence of the former Western Soviet planning institutions) and Bulgaria (with a consolidated local government system).

The results show different values regarding the potential control resulting from the national government and planning systems. However, these values do not show the real strength of the public control over land-use change, as in practice these powers can be effected in different ways. Because of this, these values should be seen as a potential resulting from the government and planning systems. A hypothesis can be raised that the weak potential control is hard to overcome even if the willingness is given, while a high potential may or may not be used entirely, depending on the intentions of the public bodies in power.

Studies on other factors influencing the strength of the public control can be found below, studying the interests of public sector and its further instruments influencing land use change (e.g. financial incentives), and the role of governance respectively. The report "Instruments and strategies for sustainable land use in peri-urban areas" aims to give an overview about the links between these three aspects.

### **Further reading:**

PLUREL deliverable report: [Review of instruments with indirect effect on regulation of peri-urban land uses](#)

PLUREL deliverable report: [Assessment of European regional governance and government approaches to maintain green open space in the urban fringe](#)

PLUREL deliverable report: [Instruments and strategies for sustainable land use in peri-urban areas](#)

[Classification of EU countries](#) (image) by MRI

### **6.2.2 Governance and government approaches**

*Comparison of governance and government approaches for open space maintenance*

#### **FS 103 Assessment of spatial planning and governance strategies**

*By Carmen Aalbers - Wageningen*

##### **What is the issue?**

Within PLUREL, a Joint Assessment Framework was developed that included local knowledge. The regional practitioners were asked on what aspects they generally assess their projects and policies if they qualify them in terms of successful or not successful. Also the researchers contributed to the list of criteria on which all seven case studies would assess the strategies they

were studying. The use of a common assessment framework is needed to enable the comparison of strategies in a later phase, and to allow for reference to critical factors such as contextual setting when studying the performance differences between the strategies.

The assessments provide critical knowledge about how the strategies work, and relate to the formal government structure. This is needed to compare between the strategies and to provide end users from different regions with a good data base of approaches that they can understand and adopt or adapt to their regions for more sustainable development of the urban fringe. It also provides data for distinguishing general patterns that require policy actions from national and EU level.

### **Methodology and Materials:**

The assessment criteria were developed via a transdisciplinary approach - local and international workshops with regional practitioners to provide criteria issues on which they think the governing process should be assessed and what type of outputs should be investigated. Here, a Joint Assessment Framework ([JAF](#)) was used. Structured interviews of practitioners and joint meetings between practitioners and researchers were held to fill in the multiple choice questionnaire.

The assessments have been performed in different ways between the regions. Some researchers only asked a number of practitioners to assess the strategies, whereas others also assessed the strategies themselves. In another region, a recombination of assessment criteria was used. These differences make the findings less significant, as they are harder to compare.

For case study each region the Joint Assessment Framework asks to categorise 3 local planning strategies studied according to their field of action. Next it is asked to assess the strategies concerning their outcomes:

1. Is the strategy resilient - robust and flexible (> 25 years)?
2. Does it serve multiple objectives - employ synergy or create many "winners"?
3. Is the strategy effective - produces the outcomes it was designed for?
4. Does it push land use away, creating new land use conflicts elsewhere or at another level, or not?
5. Does it strengthen the unique qualities of the area it pertains to?
6. Does it contribute to a sustainable dispersion of land use at a regional level with a balance between resource availability and use?
7. Does the strategy enable existing rural types of land use to stay or to develop?
8. Does it create new or additional urban economy?
9. Does it lead to accessibility for city people to peri-urban, open landscapes/agricultural land?
10. Does the strategy protect land with best agricultural production capacity?

Thirdly the joint assessment framework asks the researchers about the process comprised by the strategy.

1. Does the **strategy** help decision-making by illuminating a complex situation?
2. Does it raise awareness among different actors, which?
3. Does it involve different actors, which?
4. Does the strategy enable bottom-up initiatives by citizens or business, semi-private organisations?
5. Is there a clear time span for meeting the objectives contained in the strategy?

6. Are the objectives of the strategy clearly defined and in a comprehensible manner?
7. Is there a legal, statutory, financial or cultural commitment to support the process?
8. Does the strategy provide for monitoring and evaluation of its internal and external consistency and impacts over time, using existing available data?
9. Does the strategy empowers certain actors, which? Does it restricts free riding behaviour, are the costs incurred with those who carry the benefits?
10. Is the design of the strategy area based, tailored to the specific actors, land use pattern, land market and legislation and - timewise - influencing the right decisions at the right moment?

### **Results and Conclusion:**

The single assessments are reflected in the descriptions of the regional strategies in the Xplorer (see further reading).

Both the analysis reports and the assessment reports were the basis for the international comparison of "governance patterns and performance of regional strategies in peri-urban areas". The assessments of the strategies and suggestions for their improvement are furthered by the case study researchers on the basis of scenario studies translating worldwide developments into local changes (storylines, developed together with local practitioners/actors). Koper region, Leipzig-Halle region and The Hague region used the international comparison and the quantitative impact assessment for the enhancement of the analysed strategies. Due to time constraints this was unfortunately not possible for all case study regions within the project lifetime.

### **Further reading:**

- [Strategy, effects, effectiveness and assessment](#) (image) by Carmen Aalbers
- [Process of practitioners' involvement in assessment and comparison](#) (image) by Carmen Aalbers

## 6.3 Regional planning strategies

*Regional Planning Strategies in*

### **FS 405 Regional planning strategies**

*By Carmen Aalbers - Wageningen*

#### **What is the issue?**

Governing approaches and spatial planning concepts have been studied in the 7 case study regions. In total 21 strategies in a more or less comparable way are described and assessed. Suggestions to their improvement are made, drawing from the results in other regions and from scenario discussions, using global scenarios, translating these to the local situation and reflecting about the performance of the strategies against the background of these scenario developments.

The studies of the strategies are a source of inspiration and insight that can be drawn from by practitioners. The materials provide insight into the mechanisms and influences of governing and can help practitioners improve the governing of land use developments in the urban fringe into more sustainable directions, achieving a more sustainable balance between resource use and resource provision in urban regions.

#### **Methodology and Materials:**

The researchers made an inventory of all actors relevant to the land use issue and strategies they studied. They interviewed representative persons from each actor group, using a list of generic interview questions provided in a Joint Analytical Framework, finding out what main sources of power/influence are and detecting discourses, and groups using the same discourse. Next the researchers assessed these strategies (see also fact sheet: ), and further tested them by means of scenarios.

#### **Results and Conclusion:**

Employing a research-practice cooperative approach (transdisciplinary approach) the researchers asked the regional practitioners from the case study areas to propose the major research issues concerning land use in the urban fringe. Practitioners asked for strategies that

1. reduce land pressure due to housing and business development in the urban fringe
2. strengthen agriculture in the urban fringe to resist urban pressure
3. to protect high value nature areas in the urban fringe at risk
4. to integrate leisure and tourism activity sustainable in the urban fringe.

Though these categories were prioritised, the strategies that were eventually studied involved often several of these land use issues. All studies described the formal policy and administrative setting, and some further investigated the formal comprehensive planning as a higher level strategy.

In the Hague Region, the studied strategies are

1. Green and blue ecological services to reward farmers.
2. the Strategy for Culture and Green Landscapes; stressing cultural heritage
3. A strategy of raising international competitiveness via the development of green open space.

In Koper region, the attractiveness of coastal regions and employment possibilities in the port are the main drivers of development. Strategies studied are

1. Land use efficiency and protection of the best agricultural land;
2. Green and recreational areas to increase quality of living and
3. the Rural Development Programme for Slovenia 2007-2013.

In the Leipzig-Halle region studied strategies are

1. the regional development concepts with financial support,
2. the green corridor strategy with strong statutory support and
3. the Parthe floodplain protection strategy with the member's commitment.

For Greater Manchester the studied strategies are

1. the Green Belt policy,
2. local social and economic development through local, national and EU schemes
3. a holistic approach in peri-urban areas / Green Infrastructure.

For Montpellier Agglomeration, the analysis comprised:

1. the Strategy for Territorial Governance via the development of a Cohesion Scheme (SCoT)
2. The use of landscape as a vector for regional development, creating synergy between different sectors
3. Flood risk management strategy

In the large urban region of Hangzhou (13.000 sq km), the strategies selected for study were:

1. Zhuantang Ecological restoration and controlled urban growth,
2. XiXi Wetland - Strategy for culture and landscape restoration, tourism and residential development
3. Binjiang Technology and Economic development.

Among the highlights are local differences in government settings and preferential policies for rural areas.

In the Eastern European Warsaw Metropolitan Area, a transition is ongoing with strong self government and limited coordination of developments in the urban fringe. Here, the following strategies are analysed:

1. Strategy of Mazovia Region Development;
2. Warsaw Metropolitan Spatial Development Plan and
3. Development Strategy of City of Warsaw are assessed.

## **Further reading:**

[CORINE Land cover map for the Montpellier region](#)

### **6.3.1 The Hague region: Agriculture strategy**

*The Hague region: Rewarding farmers for landscape management (agriculture)*

#### **FS 135 The Hague region: Rewarding farmers for landscape management (agriculture)**

*By Judith Westerink - The Hague*

#### **What is the issue?**

Peri-urban agriculture has to deal with problems such as high land prices and potential urbanisation, and challenges such as large numbers of visitors from the city, looking for recreational space. Rewarding farmers for landscape management is one strategy to strengthen agriculture in the urban fringe.

Agri-environmental schemes (AES) are very common: each European member state has to incorporate AES in their rural development plans. However, *local* agri-environmental schemes to reward "green and blue services" in the urban fringe are less common. The Hague Region has several initiatives of this kind, financed by local and regional authorities.

Green and Blue Services can be considered as a governance strategy, because the concept opens up the normally top-down and centralised agri-environmental policy development to bottom-up initiatives and local differentiation. Local stakeholders, such as farmers and environmental cooperatives may design tailor-made subsidy schemes in cooperation with local, regional and national authorities. Local AES may improve the match between demand from the city for landscape services and what farmers do.

#### **Methodology and Materials:**

Interviews were done with stakeholders in the region and complemented with literature study, to find out which actors (and which not) support the discourse behind the strategy. An assessment was done during meetings with stakeholders. An inventory was made throughout Europe to find similar initiatives. With some of the stakeholders behind these initiatives, a workshop was organised during a PLUREL conference. Also the scenario work for The Hague Region yielded insight in the performance of the Green and Blue Services strategy: How appropriate is the strategy in the case of different scenarios?

#### **Results and Conclusion:**

Ecological and water-related, or "green and blue" services have been defined as the provision of public efforts aimed at the achievement of public demands about nature, landscape, water management and recreational use (accessibility), which go beyond the obligatory measures laid down in laws and regulations, and for which a cost-recovering compensation is given. Examples

include the maintenance of shores and ditches, additional measures for meadow bird protection, or completely different farming systems.

The recreational, ecological and historical values of the meadow areas are being recognised by the local and regional authorities. More space is needed for recreational use. Multifunctional use of farmland is an interesting option, because of lower costs compared to land purchase and management by government agencies. Furthermore, agricultural use is seen as the best option for the preservation of the traditional man-made landscape.

Green and blue services serve ecological goals (landscape, biodiversity, water quality), social goals (recreation) and economic goals (economically viable farms). The strategy of green and blue services can be described as a hierarchy of objectives and means, depending on the actor involved and the main objective chosen. The table below could be specified in several ways. For instance, the objective of international competitiveness, which is important for The Hague Region can be translated into attractiveness - quality of life - opportunities for outdoor recreation - nearby and attractive urban fringe - accessibility of traditional farming landscape - support for public footpaths on farmland.

Trend	Problem	Main objective	Objectives of National government and The Hague Region	Instrument/means
Economic growth	High urbanisation pressure	Keeping scarce rural areas open	Enabling farmers to continue managing the rural areas	Green and Blue Services

The Hague Region has yielded several of the earliest green and blue services initiatives in the Netherlands, including the Green Fund for Midden Delfland and the Farming for Nature project in the Biesland polder. These two initiatives were developed in parallel, the Green Fund in 2003-2006 and Farming for Nature in 2003-2007. In addition to these schemes, which are currently operational, a scheme was started in the Land van Wijk en Wouden area, which resulted in the establishment of 6 walking trails on farmland. In 2008, a new pilot project started in this area, in cooperation with the Rijnland water board, to develop "blue" services aimed at water quality and aquatic ecology.

### Further reading:

[Workshop on local agri-environmental initiatives \(minutes\)](#) (pdf) by Marion Bogers

[European lessons for green and blue services in The Netherlands, working paper](#) (pdf) by Westerink, Santiago-Ramos and Buizer

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Haaglanden](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Haaglanden](#)

### Impressions from the region:

[The meadow landscape has many ditches and pollarded trees that need management](#) (image) by Judith Westerink

- [Traditional breed of cows in Midden-Delfland, suitable for wet circumstances](#) (image) by Judith Westerink  
[Gotwits and hares in Midden-Delfland](#) (image) by Judith Westerink  
[Public footpath on farmland, Biesland polder](#) (image) by Judith Westerink  
[Wet meadows in Vlietlanden, Midden Delfland](#) (image) by Judith Westerink

### 6.3.2 The Hague region: Recreation strategy

*The Hague region: Green space for everybody (recreation)*

#### **FS 136 The Hague region: Green space for everybody (recreation)**

*By Judith Westerink - The Hague*

##### **What is the issue?**

Recreational space is scarce and preferences are both changing and diverging. Different age groups and cultural groups have different recreational needs. The lay-out of current recreational areas is in many cases no longer suited to today's and tomorrow's needs. Furthermore, the peri-urban countryside is increasingly used as recreational space. Also the authorities see the potential of the cultural landscape for recreation and more specifically, attracting expatriate workers to the cities in the region. Purchase, layout and management of 'pure' recreational areas is expensive. A more multifunctional use of agricultural land could increase recreational possibilities at relatively low cost.

The visitors of the peri-urban 'countryside' are primarily of Western origin, while immigrants make more use of the urban parks, including the urban fringe parks. In compact cities, such as Delft, urban parks are often small and scarce. For people with limited mobility, such as many immigrants, the peri-urban area may not be the most feasible place for recreation. On the other hand, recreation may give extra meaning to and public support for the peri-urban open landscape.

##### **Methodology and Materials:**

Questionnaires were held with migrant visitors of a shopping centre in Delft about a nearby small city park and the peri-urban area of Midden Delfland. They were questioned about their recreational preferences and the use of the park and the peri-urban area.

Furthermore, expatriate inhabitants of The Hague Region, Amsterdam and Eindhoven were interviewed by telephone about their preferences when choosing a city to live and accepting a job, using a standardised questionnaire.

##### **Results and Conclusion:**

Few migrants were found who knew Midden Delfland, even less actually visited the area at some point in time. 62% never visited Midden Delfland. Of this group, two third had never heard of it. The others did not visit the area because of distance, lack of access, limited time or no interest. The neighbourhood park was used by 60% of the respondents, mainly families. Of the 40% not-

visitors, one third did not know the park. Other reasons not to go were distance, lack of time or no interest.

With respect to quality of life, expats found important (on a scale of 1-5, 5 as most important):

1. public transport 4.4
2. landscape 3.8
3. facilities for outdoor activity 3.5

With respect to residential environment:

1. safety 4.6
2. neighbourhood park 4.4
3. city park 4.2
4. natural areas 4.1
5. countryside 3.8

For migrants, nearby urban parks are of more importance for recreation than the peri-urban area. For expatriates, urban parks, the landscape and possibilities for outdoor activities are important factors in choosing a city to live and work in.

The argument that 'expats like landscape' is used in discourse development by The Hague Region to stress the economic importance of green space. International competitiveness is an issue with much political interest, especially for the city of The Hague.

#### **Further reading:**

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Haaglanden](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Haaglanden](#)

#### **Impressions from the region:**

[Walking in Vlietlanden nature reserve](#) (image) by Judith Westerink

[Delftse Hout peri-urban park](#) (image) by Judith Westerink

[Cycling in Midden Delfland](#) (image) by Judith Westerink

[Sailing in Vlietlanden, Midden-Delfland](#) (image) by Judith Westerink

[Renewed park in Poptahof, Delft](#) (images) by Judith Westerink

### **6.3.3 The Hague region: Identity strategy**

*The Hague region: Linking landscape to culture (identity)*

#### **FS 137 The Hague region: Linking landscape to culture (identity)**

*By Judith Westerink - The Hague*

## **What is the issue?**

### **Strategy to develop commitment: combining culture and landscape**

Strengthening the cultural historical layer within the green urban areas in The Hague Region is part of the formal policy of the city region. In 2008 an initiative started to explore significant combinations of landscape paintings of painters from the internationally well known School of the Hague and the current landscapes of The Hague Region. The initiative was adopted by the city region and resulted in an outdoor exhibition of landscape paintings.

The exhibition is an innovative way of

1. Strengthening the identity of these areas
2. Raising awareness of landscape under pressure
3. Attracting new user groups to the green open areas in the region
4. Serving as an instrument for landscape debate

### **Methodology and Materials:**

The outdoor exhibition contained 6 billboards that were placed at the locations in the city region where the paintings were made. In a meeting with the PLUREL stakeholders in the region we discussed further possibilities to elaborate the initiative and stakeholders' reactions to the assessment framework. In addition, a survey was done among residents visiting or passing by the exhibition.

### **Results and Conclusion:**

#### **Stakeholder meeting results**

The different ways how this strategy could play a role in the actual landscape was discussed and resulted in a set of new possible strategies. Criteria to assess these strategies were not explicitly mentioned in the discussion. First of all the question that had to be answered was if this combination of elements could be of interest for the relevant stakeholders. Some criteria or remarks were nevertheless more implicitly mentioned by the stakeholders when discussing the feasibility and legitimacy of the new suggested strategies.

#### **Questionnaire residents about outdoor exhibition**

1. For whom:

The initiative is strongly appreciated by most of the interviewees (73%) and is strongly related to age. The older people are, the more they appreciate this initiative. The appreciation of these type of initiatives is also very much related to the appreciation of the painting and not related to the working or living area (urban or rural) of the respondent.

2. New user groups:

The initiative is more appreciated by people visiting the area not so often than by people visiting the area often, but does not reveal information on new user groups. To get a clear information on this aspect, an initiative should be implemented in a longer lasting and more widely communicated initiative.

### 3. Effective instrument for landscape debate:

The qualitative remarks of the survey show a large number of peoples' commitment on the landscape in the region. 69% of the remarks made by the residents express their concern on the landscape issue. People are not fond of rebuilding old landscapes but more generally express their fear that open space or nature or meadows are disappearing in their environment and that the recreational pressure is therefore tangible. No one specifically mentioned the Hague School as being a special asset for the region. This aspect of identity is apparently not the first thing that people associate with the identity of the region and could therefore be weak in public support. One of the advantages of this instrument for landscape debate is the fact that the debate takes place surrounded by the relevant regional landscapes. It plays a role as a direct way of communicating to discuss the value of the surrounding landscape with the residents of the city region.

One of the trends in the Netherlands is the awareness that governance processes are more than rational processes and therefore requires other approaches to the planning process including emotional and cultural elements. Environmental changes are most of the time hard for people to digest. The situation in peri-urban areas is changing even more rapidly than in built-up areas and the awareness that residents and end users should have their say in a changing environment is widespread. It goes too far at this stage to see this strategy as a clear-cut instrument to seek local participation into specific regional strategies. But it can be seen as a first step to get local involvement or local entrepreneurs actions into more open planning processes. New ways based on public contact moments or opinion feelers, use the imagination and focus on a multi-layer value of places, including stories, place of birth, history and the emotional impact of change.

#### **Further reading:**

[Flyer of the outdoor exhibition \(pdf\)](#) by Pat van der Jagt

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Haaglanden](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Haaglanden](#)

#### **Impressions from the region:**

[Old city centre of Delft \(image\)](#) by Judith Westerink

[Painting in Midden-Delfland \(image\)](#) by Pat van der Jagt

[Billboard near Stompwijk \(image\)](#) by Judith Westerink

[On horseback \(image\)](#) by Pat van der Jagt

[Westland, where greenhouses replaced allotment gardens \(image\)](#) by Pat van der Jagt

### **6.3.4 Hangzhou region: Economy and Conservation**

*Hangzhou region: Balancing protection and economic growth in Zhuantang*

## **FS 304 Hangzhou region: Balancing protection and economic growth in Zhuantang**

*By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit - Munich, Hangzhou*

### **What is the issue?**

Zhuantang area is located in the southwest of Hangzhou at a distance of approximately 15 kilometers from the city core. The area is rich in natural resources and green spaces. In order to achieve a good spatial structure and to enhance Hangzhou's role as an international scenic tourist city, Zhuantang area has been designated as a protection zone to preserve its natural landscapes and water resources. There are strict limits to control its development, which caused the decline of its economy. Therefore, the major issue for the Zhuantang area is how to balance protection with economic growth.

The conflict between economic development and environmental protection is common to most peri-urban regions. Solving this conflict is not only crucial to improve the living conditions of local people. More important, observing the interaction among different players is essential to understand the conflicts and make effective strategies. Experiences from this case can be of use in other places both in China and in European countries.

### **Methodology and Materials:**

The study employed the assessment framework produced from the "Framework for Assessment of Reports" (Aalbers, 2008) to evaluate the development strategies in Zhuantang area. The assessment was undertaken by a research group including both Chinese and European researchers. It is based on documentary analysis of planning and regulation documents, government reports, statistics, journals, etc., informal interviews, target group meetings and workshops, and field visits.

This study is rather a qualitative research than a quantitative research to assess development strategies of Zhuantang area. Therefore, it does not involve input/output variables. The results of this study serve as an input into the case study chapter of the book "Peri-urban futures: land use and sustainability".

Zhuantang adopted some economic patterns with small impacts on the environment. Nevertheless, the scale of these economies is currently not large enough to really make good profits. It is uncertain to what extent this economic pattern can improve local economy. Therefore, it deserves further investigation and monitoring to measure the impacts of these economies.

### **Results and Conclusion:**

Three major strategies were identified and assessed in Zhuantang area.

#### **1. Environment and natural resource protection.**

"Protection" is the most important theme of Zhuantang, since Zhuantang has a valuable natural environment, and more important, it is the drinking water source for the entire city of Hangzhou. Therefore, there have been severe restrictions to control Zhuantang's

development. In recent years, the protection strategy has shifted from mere protection to a new concept called "active protection".

The rationale of this strategy is that the protection of the environment and natural landscapes should be prioritized. Then an appropriate development pattern should be adopted, which can alleviate the environment pressures as well as support the local economy. Under this strategy, green agriculture has been supported to increase its organic food production; public infrastructures have been improved; green industries and recycling economy have been encouraged.

## 2. Development of tourism.

Zhuantang has attractive natural landscapes, so its tourism has been developed for a long time. In 1992, Zhijiang National Tourism Holiday Resort was established. The resort is one of the 12 national tourist and holiday resorts approved by the State Council. Therefore, it enjoyed preferential policies to improve tourism development. For example, foreign funded enterprises which invested in tourist projects with 10-year operation have been exempted from income tax in the first two years starting in the first profit making year. With various preferential policies, the resort has attracted millions of domestic and international investments.

However, a government report pointed out that the tourism development of Zhuantang did not actually benefit its local economy as most tourism development projects are independent from Zhuantang with little economic connection with it. Furthermore, tourism projects are managed by three different governing bodies at the same level. As a consequence, Zhuantang government has less power to make decisions and has little share of the profits.

## 3. Development of cultural and creative economy.

Under the concept of "active protection", cultural and creative economy is strongly supported and encouraged in Zhuantang because of its low environmental impacts. In 2007, the School of Visual Art under the China Academy of Art was located in Zhuantang. This school is expected to attract a number of design companies and encourage artists to exhibit their work. Therefore, Zhuantang is imagined as "the town of art and design". Development of rural tea houses and home inns is another important cultural economy for Zhuantang. Customers can experience farmers' life style and enjoy famous tea. This in return can contribute to local economy.

Zhuantang did well to protect its eco-environment and natural landscapes. It shows that the peri-urban areas with sensitive ecosystems should pay special attention to environment protection, even if the protection may cost some development opportunities. The "active protection" strategy is a valuable quest for balancing economic growth with eco-protection. The efforts to develop some economic patterns with low environment pressure provide also helpful lessons.

However, it needs to be realised that the government structure should be streamlined and clarified to establish efficient governance which benefits local economy. Furthermore, those adopted strategies are not flexible to deal with future changes; and plan monitoring and bottom-up initiatives are weak. Therefore, this study recommends that strategy making should be based on a scenario approach to make flexible plans; and more approaches should be taken to monitor plan implementation and encourage bottom-up initiatives.

## Further reading:

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- PLUREL deliverable report: [Regional planning and decision making and its impact on land](#)

### use in the urban fringe of Hangzhou

- PLUREL deliverable report: Enhanced planning strategies and decision making for urban fringes in Hangzhou

## 6.3.5 Hangzhou region: Wetland Areas

*Hangzhou region: Xixi Area - Between residential development, resettlement, wetland preservation and commercial development*

### **FS 305 Hangzhou region: Xixi Area - Between residential development, resettlement, wetland preservation and commercial development**

*By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit - Munich, Hangzhou*

#### **What is the issue?**

Xixi area is located approximately 5 kilometers away from city core. It was endowed with rich water networks and wetlands. But those valuable natural resources were encroached by rapid urban sprawl. In order to preserve wetlands, the establishment of XixiWetlandPark began in 2004 which also brought some issues. The primary issue is how to balance preservation with commercial development. Another issue is how to protect the rights and benefits of land lost farmers. Furthermore, residential developments in Xixi were driven by private investors, so the market failures like insufficient public facilities and infrastructures need to be fixed.

Xixi is a typical peri-urban area undergoing rapid urbanisation with impacts on sensitive ecosystems. The analysis of its development strategies not only illustrates the effects of these strategies, more importantly, it can shed some lights on peri-urban areas with similar issues.

#### **Methodology and Materials:**

The study employed the assessment framework produced from the "Framework for Assessment of Reports" (Aalbers, 2008) to evaluate the development strategies in Xixi area. The assessment was undertaken by a research group including both Chinese and European researchers. It is based on documentary analysis of planning and regulation documents, government reports, statistics, journals, etc., informal interviews, target group meetings and workshops, and field visits.

This study is rather a qualitative research than a quantitative research to assess development strategies of Xixi area. Therefore, it does not involve input/output variables. The results of this study serve as an input into the case study chapter of the final book "Peri-urban futures: land use and sustainability".

Balancing economic development with protection of the environment is a big challenge. Whether strategies adopted in XixiWetlandPark can finally achieve their goals largely depends on its long-term commercial operations and effective management. So the effects of these strategies deserve further investigations and monitoring.

## **Results and Conclusion:**

Three major strategies were identified and assessed in Xixi area.

### 1. Planning of Jiangcun.

Residential developments of Jiangcun were driven by market force at first from the early 1990s. Planning to manage local development was not in the public focus. Therefore, the land was used unsustainable. In addition, the market could not provide sufficient public facilities and infrastructures to support the local development.

To solve these problems, Hangzhou government made a comprehensive plan for Jiangcun, and invested over 8 million Euros to improve public facilities and infrastructures. Arterial streets were widened; the quality of pavements was improved for a number of roads; Zijinggang Campus of the Zhejiang University was located in Jiangcun, together with several schools and kindergartens. The development strategies also supported local business by building the Western City Square, which is the largest commercial center in west Hangzhou. These strategies have helped Jiangcun to become attractive for both living and investing.

### 2. Supporting the livelihood of land-lost farmers.

Xixi Wetland project will resettle more than 2500 rural households involving 13 000 farmers. Great efforts had been taken to assist their livelihoods. Resettlement houses have been built to accommodate land lost farmers. They can also get a land compensation fee, resettlement subsidy (including a self-employment subsidy) and compensation for crops. Furthermore, those farmers enjoy the priority in employment in XixiWetlandPark.

However, there are some arguments against the compensation rate and the way forcing some farmers to leave. They stated that the compensation is far less than the land's value when developed into commercial use; local governments forced some farmers to leave by cutting off their water and electricity supplies.

### 3. Construction of Xixi Wetland Park.

In response to the decline of wetlands, Hangzhou government began a large construction project in 2004 to establish **XixiWetlandPark**. The project is composed of three phases. Its core area will cover 10.08 square kilometres when completed. The project aims to create a win-win situation between environmental protection and commercial development.

Therefore, when natural wetlands were preserved at its maximum extent, commercial and service businesses were put in proper locations.

Furthermore, the project management also received special attention. The governing body of the project includes a vice city mayor of Hangzhou, a vice district major of West Lake District, and more than 100 officials through all the major departments. More important, the governing body has a streamlined structure for effective planning and management of the park.

The development process of Xixi area reflects both some general issues of peri-urbanisation in Hangzhou and specific features as regards the impact of strategic decision-making. Firstly, development strategies of Jiangcun show how government responds to pre-development and fix market failures; secondly, Xixi area illustrates a comprehensive approach to assist land lost farmers. Thirdly, Xixi Wetland Park is an innovative and comprehensive protection project in combining tourism development and environmental restoration. It has received wide attention in China. It can be considered as a model for areas with similar challenges.

However, strategy assessment shows that those development strategies are not resilient to cope with future changes, and are weak in plan monitoring and bottom-up initiatives. Therefore, we recommend that a scenario approach should be adopted. Plan monitoring and bottom-up initiatives

should be encouraged.

#### **Further reading:**

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- [Binjiang case](#) (image)
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Hangzhou](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Hangzhou](#)

### **6.3.6 Hangzhou region: Promotion of sustainable development**

*Hangzhou region: Promotion of sustainable development in Binjiang*

#### **FS 306 Hangzhou region: Promotion of sustainable development in Binjiang**

*By Irene Burkhardt, Martin Spiekermann, Yonjonn He, Jianjun Yang, Fei Yang, Stephan Pauleit - Munich, Hangzhou*

#### **What is the issue?**

Binjiang District is located approximately 7 km away from the city core at the south bank of Qiantang River, with a total area of 73.3 square kilometres. It is connected with the city core of Hangzhou through three bridges. It is to become the future sub-civic centre and location for high-tech industries of Hangzhou. Binjiang District has become the most vigorous economic growth zone of Hangzhou based on software industry, integrated circuit (IC) design, animation industry, and communication industry. The major issue of Binjiang District is how to promote sustainable development in a government led approach.

Binjiang District is a typical peri-urban area which is going through complete government top-down planning and management. Therefore, it is a good arena to observe the impacts of development strategies as well as the role of government in peri-urban development. More importantly, Binjiang District is an ideal place to study the relationships between peri-urban areas and the whole city, since it is expected to become Hangzhou's sub center.

#### **Methodology and Materials:**

The study employed the assessment framework produced from the "Framework for Assessment of Reports" (Aalbers, 2008) to evaluate the development strategies in Binjiang District. The assessment was undertaken by a research group including both Chinese and European researchers. It is based on documentary analysis of planning and regulation documents, government reports, statistics, journals, etc., informal interviews, target group meetings and workshops, and field visits.

This study is rather a qualitative research than a quantitative research to assess development strategies of Binjiang District. Therefore, it does not involve input/output variables. The results of this study serve as an input into the case study chapter of the final book "Peri-urban futures: land use and sustainability".

Currently, Binjiang District's residential development is not balanced with its industrialisation process. So the District should pay special attention to avoid being a "ghost town", where people work at day time and leave at night. Although more residential development is under planning, it needs more time to attract people to live in. Therefore, the balance between residential and industrial development is uncertain.

## **Results and Conclusion:**

Three major strategies were identified and assessed in Binjiang District.

### **1. Preferential policies to support high-tech industry.**

The development of Binjiang District benefits from the exceptionally advantageous policies. The preferential policy that the state grants to the high-tech industrial development and the special policy endowed by the municipal government of Hangzhou, as well as the preferential policies that Binjiang District grants to foreign-invested enterprises create a good environment for investment in high-tech and high-additional-value industries. Furthermore, the efficient and low-cost urban management model promotes industrial development. The district government of Binjiang sets up government institutions according to "small institution and better service" as well as "simplification, unification and efficiency", and improves the efficiency and level of administrative services.

### **2. Supporting land lost farmers.**

Binjiang District has acquired a large number of farmlands to meet land demand for commercial and industrial uses. In order to guarantee the livelihood of those land lost farmers, the government made great efforts to build resettlement houses and employ special policies to ensure that land lost farmers can afford housing. In addition, Binjiang District integrates those who are transformed from farmers to citizens into the urban employment system, and helps them in finding jobs, getting training to qualify for jobs or becoming self-employed. Binjiang District also gives incentives and preferential supporting policies to encourage enterprises in the District to employ the local unemployed land-lost farmers. Moreover, Binjiang District provides social security for land-lost farmer to ensure their basic lives. With these policies, the farmers in Binjiang District enjoy a better quality of life.

### **3. Establishment of the White Horse Lake Ecological and Creative Zone**

The so-called White Horse Lake area has various natural and cultural landscapes, like water networks, wetlands, mountains, history-rich villages and bridges, etc. In 2008, White Horse Lake Eco-Creative Town Plan was completed. The plan aims to develop the White Horse Lake area as a multi-functional national cultural and creative center, which combines recreation, living, retail business, R&Ds, design companies, etc. Furthermore, this area is expected to integrate urbanity with the qualities of a rural environment. The ancient villages and farmlands will be preserved, as well as the natural landscapes. This strategy is considered as a good model to create synergies between economic development and protection of the natural environment, as well as between modern urban life and rural cultural history.

The land use pressure of Hangzhou's city core is becoming more and more serious. The

development of "new centers" is one way to deal with it. Binjiang District is an example of this approach. It is a top-down planning approach to create a high-tech center where the government plays a leading role. The preferential policies adopted present a valuable lesson to guide desirable developments. Its government structure also displays a good example to establish a streamlined and efficient government in peri-urban area. Furthermore, Binjiang displays creative approaches to help land lost farmers get reemployed and integrate their social security into urban development. However, strategy assessment shows that those development strategies are not resilient to cope with future changes, and are weak in plan monitoring and bottom up initiatives. Therefore, we recommend that scenario strategy should be adopted; plan monitoring and bottom up initiatives should be encouraged.

### **Further reading:**

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Hangzhou](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Hangzhou](#)

### **6.3.7 Koper region: Agriculture strategy**

*Koper region: Land use efficiency and protection of the best agricultural land*

#### **FS 132 Koper region: Land use efficiency and protection of the best agricultural land**

*By Anton Perpar - Koper*

#### **What is the issue?**

"Land use efficiency and protection of best agricultural land" is one of the strategies for the Koper case study region. A clear and science-based policy on spatial development and land use should provide a tool for the preservation of valuable agricultural land and production capabilities. Additionally, it should define rules for resolving disputes between land use needs. The idea is to prepare a tool that will help planners to use already available built-up land or to re-activate abandoned urban areas. The tool shall support planners to prefer using the least quality agricultural land as a first choice when planning to locate a new construction on agricultural land.

The pressures of urbanisation have caused the sealing and destruction of quality agricultural land in the peri-urban area. Suburbanisation and individual house construction along main roads have diminished land use efficiency and caused a decrease in agricultural production in the Municipality of Koper.

## **Methodology and Materials:**

The strategy "Land use efficiency and protection of best agricultural land" has been selected on a workshop between PLUREL stakeholders and researchers in Koper.

To prepare a tool, different spatial sectors were asked to prepare their professional statements and display them on maps. Here, the agricultural sector needs to prepare a detailed map on the basic soil quality which is based on various parameters and shows different quality classes of agricultural land, that resemble the actual production capabilities of soils.

Input variables for the tool are:

1. sectoral maps based on digital data (soil quality, forest typology, natural areas, present land use...),
2. digital data.

The output of the tool will be a

1. zoning map as well as a
2. proposal for new spatial plan for the Municipality of Koper.

The main concern is that agriculture will pull the shortest straw in terms of land competition because it is not economically competitive. A compromise solution could be to re-activate agricultural production in the (former) rural hinterland, but the fear is that that is rather a "harvest for subsidies" than yielding the intended effect.

The current spatial structure is less favourable to agricultural production. Since the urban areas are inevitably bound to spread and are constrained by the sea on one side, the alternative so far is spreading inland, where the majority of the best soils for agriculture are. This conflict creates the need to balance urban growth with soil and agricultural production protection. Inevitably there is a need for compromise, since spatial allocation of activities cannot be freely directed, it follows an intrinsic logic.

## **Results and Conclusion:**

The existing system of land evaluation in Slovenia is not relevant anymore. Recent expert recognitions show that soil characteristics are not the only parameter that determines production potential and consequently the economical potential of agricultural land. Further very important factors are suitability (e.g. land exposition) of the land for certain agricultural production, availability of agricultural infrastructure, possibility of carrying out a economically sound agricultural production, accessibility of the agricultural plots, and isolation from pollution sources.

Due to the above mentioned, the existing agricultural land categorisation needs to be changed or upgraded. Soil quality, specific suitability of agricultural land and a certain agricultural branch, possibility the introduction of new production approaches (e.g. sustainable and ecological production), and some other parameters, which importantly influence agricultural land productivity, should be taken into account. This higher complexity of the categorisation should be diversified additionally by spatial criteria and in cases of special agricultural branches even in production areas, for example districts or any differently defined spatial regions.

This strategy prepares a tool which contributes to a more suitable and sustainable land use planning in the municipality and enables development of the municipality in an appropriate way. It will first

focus on the primary soil quality and qualities important for the individual sectors (forestry, water management, environmental protection, etc.) and subsequently on inter-sectorial cooperation to find optimal land use solutions in the new municipal spatial documents.

For the best agricultural land, the following principle should be taken into consideration: the higher the quality of the land, the more strict criteria should be applied to change the land designation, because the economy of agricultural production on such land is higher. A similar process should be in force for the agricultural land in bigger complexes, especially for the complexes, where the basic infrastructure which is required for intensive agricultural production, is already built.

After preceding reconciliation with the other interests, the agricultural land with high and good soil production potential for agriculture should be zoned as the best agricultural land, based on environmental and spatial constituent vulnerability.

The strategy "Land use efficiency and protection of the best agricultural land" tries to find solutions for all three main land use issues for the Koper case: land use pressure due to housing and the maintenance of agriculture and biodiversity in the area where there is the highest pressure, namely in the peri-urban area.

### **Further reading:**

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Koper](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Koper](#)

[Land use map of Koper](#) (map) by Anton Perpar

### **6.3.8 Koper region: Recreation strategy**

*Koper region: Green and recreational areas to increase quality of living*

#### **FS 133 Koper region: Green and recreational areas to increase quality of living**

*By Anton Perpar - Koper*

#### **What is the issue?**

Urban sprawl and unorganised spatial development have produced a state in which green and recreational areas are scarce and do not provide an adequate quality of living in the peri-urban area. Also investors who build new apartments do not care about planned green areas and try to increase built-up area to maximise their profit. Roadside construction and lack of organised settlements centres makes it difficult to plan and allocate green areas, thus diminishing the quality of living. Recognising the importance of such areas and their integration in the spatial planning process is essential to guarantee a higher living standard of the population in the peri-urban area. This is the basic aim of the strategy "Green and recreational areas to increase quality of living".

One good example in the Koper region is Škocjanski zatok, a nature reserve, which is located on the

outskirts of the coastal city of Koper and consists of a brackish lagoon surrounded by reedbeds and agricultural land which is to be turned into a freshwater marsh. With its rich flora and fauna presents also an attractive area near the city available for walking, spending free time in natural environment etc.

### **Methodology and Materials:**

The strategy "Green and recreational areas to increase quality of living" has been selected on a workshop between PLUREL stakeholders and researchers in Koper. The Municipality of Koper is preparing new spatial documents and the discussion about green and recreational areas is very welcome. The discussion and the strategy can lead to a better proposal for the new spatial plan where such areas will be an important element. Green and recreational areas are analysed and spatially located in the proposals of the new spatial documents of the municipality.

Input data for the strategy are:

1. maps with existing natural, green and recreational areas (e.g. a proposed landscape park in the Dragonja valley, nature reserve Škocjanski zatok, walking and cycling paths, sport areas etc.),
2. map of NATURA 2000 areas,
3. proportion of built-up and green and recreational areas

The intended output of the strategy consists of:

1. a proposal for green and recreational areas in the new spatial plan of the Municipality of Koper and
2. standards for the proportion of built-up and green and recreational areas.

### **Results and Conclusion:**

Green systems inside and between settlements have to be formed, connecting urban green areas, water areas and littoral areas, agricultural land and forest areas. The green system has ecological and social functions and influences the quality of life. Green areas form the green system of settlement. Their internal connections and connections with other systems are inevitable.

With the planned green areas conservation and recreational areas management, the ratio between urban and natural areas is maintained. In the rural hinterland, the possibility of multifunctional use of recreational areas with agricultural and forest areas should be turned to advantage. Green and open areas, crucial for the green system of a town in an ecological and social sense, should be protected before the land designation.

The balance between the open and built up areas is important in broader town areas. Segmentation with vegetation, especially with forest, agricultural and other green areas, presents a protection against the fusion of settlements, or fusion of single rounded up settled areas in bigger homogenous built-up areas. Man made or natural borders of a settlement have to be restored and protected for the recognition of the border of a certain settlement.

Green and recreational areas are very important in urban and peri-urban areas as they diversify the landscape, create a spatial order and carry on ecological processes on a small scale, thus increasing

the living standard of the inhabitants. By planning and creating green areas inside urban ones it is possible to mitigate the negative environmental effects of cities as well as to have a more aesthetic and pleasant living space. Urban sprawl has forced green areas farther away from the settlements. In turn this creates the need for the population to use transport means to reach recreational areas. This diminishes the sustainability of spatial development and decreases the quality of living in the municipality.

Summarising, the recognition of the importance of green and recreational areas and their integration in the spatial planning process is essential to guarantee a higher living standard of the population in the peri-urban area.

Overall this strategy will help to recognise the importance of green and recreational areas and their integration in the spatial planning process. These areas are essential to guarantee a higher living standard of different population groups (e.g. citizens, tourists, etc.), particularly in the peri-urban area. The aim is to create a consistent policy on green area allocation.

#### **Further reading:**

[Green system of Koper \(image\)](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Koper](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Koper](#)

#### **6.3.9 Koper region: Rural development strategy**

*Koper region: Rural development plan 2007-2013*

**FS 134 Koper region: Rural development plan 2007-2013**

*By Anton Perpar - Koper*

#### **What is the issue?**

Rural areas represent a big part of the Municipality of Koper. They have many attractions, natural and cultural heritage, villages with unique Istrian architecture, traditional products etc.

Development measures can be financed from the municipality's budget or from national and European budgets and funds. Rural development in Slovenia in the period 2007 - 2013 is based on the Rural Development Plan for Slovenia. Measures can be implemented by farmers, local communities or municipalities. Therefore, it is very important to stimulate people from the municipality of Koper to implement such measures and to contribute to the development of the rural part of the municipality.

The implementation of the Rural Development Plan is especially important for the rural part of the Municipality of Koper, but the peri-urban part can benefit as well. The programme can help to

improve economic condition of agriculture and farms, it contributes to the quality of life in the villages and empowers rural economies with support for diversification on farms, development of rural tourism and micro-firms in the countryside.

### **Methodology and Materials:**

The Rural Development Plan for Slovenia has been prepared by the Slovenian Ministry of Agriculture with the cooperation of experts and different stakeholders from rural areas, NGOs etc. The implementation of the measures is defined on national level. The PLUREL stakeholders from Koper decided to use it as a strategy for rural part of the municipality. The Regional Agricultural Advisory Service informs farmers and local communities about the possible measures, stimulates their implementation and helps them to prepare the applications.

The main input for the strategy are rural development measures. The output comprises

1. an increased quality of life,
2. improved infrastructure as well as
3. an empowered rural economy.

### **Results and Conclusion:**

It is still too early to estimate the results of the strategy yet. The Rural Development Plan is aimed to be implemented until the end of 2013 and the results will depend also on farmers, local communities, micro-firms and other organisations - on how successful they will be with their applications for financial support from the programme.

The implementation of the measures from the Rural Development Plan (RDPS) 2007-2013 for Slovenia is particularly important for rural and peri-urban areas of the Municipality of Koper. Measures can contribute to the development of agriculture (e.g. investments in agricultural holdings, support for young farmers, early retirement schemes) and implement new production technologies (e.g. organic farming, integrated way of production etc.). The RDPS contributes also to more common local development and needs by e.g. village renewal measures and measures for the maintenance of rural natural and cultural heritage. It contributes to the improvement of the local economy through diversification on farms (i.e. farm tourism, processing of agricultural products) or the support of micro-firms. Further on, agro-environmental measures as part of RDPS contribute to the maintenance of biodiversity, water quality etc. Another possibility for the rural development of the Municipality of Koper is the LEADER programme, which is not assessed here.

### **Further reading:**

- [Rural areas in Koper](#) (image) by Anton Perpar
- [Urban-rural typology for Koper](#) (map)
- [Rural Development Plan of Slovenia 2007-2013](#) (pdf) by Ministry of Agriculture of the Republic of Slovenia
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Koper](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban](#)

### 6.3.10 Leipzig-Halle region: Green corridors

*Leipzig-Halle region: Green corridors*

#### FS 146 Leipzig-Halle region: Green corridors

By Annette Bauer - Leipzig

#### What is the issue?

The first assessed strategy for Leipzig-Halle was the aims and conception of the regional plan for the Leipzig region, in particular its 'Green Corridors' and the evaluation of Green Corridors.

The past, rapid development of housing and commerce in the Leipzig-Halle urban fringes is considered a problem by urban and regional planners (Sinn et al., 2008). Development was not met by an equal demand for these new residential and commercial areas. Furthermore, cultural landscapes and green open spaces were reduced. Green corridors are a relevant regional strategy for conserving areas at risk.

#### Methodology and Materials:

The documentary analysis of the regional plan was supported by a focus group of urban and regional planners on strengths and weaknesses of Green Corridors based on an evaluation framework (Aalbers, van Dijk, 2008). Main components of the framework document are criteria to characterise strategies in terms of outcomes and process.

#### Results and Conclusion:

Green Corridors are aims of statutory regional planning in Western Saxony. They link open spaces and unsealed surfaces in the environs of the city to urban green spaces. Furthermore, they are connected to a network of green open spaces in the adjacent Halle region. Green Corridors cover natural landscapes, in particular rivers, floodplains and forests, as well as "corridors" of unsealed land in between; including agricultural land and brownfields. The Green Corridors should be kept free of development and disruptive land uses (Regional Plan, 2008). Potential land use conflicts should be resolved in favour of the environment.

Generally, regional planning coordinates municipal land-use planning and development. Local preparatory land-use and development plans conform to its aims and principles (Federal state of Saxony, 2004). This means that municipalities actually implement the Green Corridors by considering them in preparatory land use and development planning.

Evaluation results, based on the subjective views of participants of a focus group, show that the following credentials may contribute to the successful performance of Green Corridors:

1. both statutory and financial support for the strategy,
2. a convincing concept that is easily communicated,
3. overlap between the Green Corridors and the Leipzig floodplain forests, very much appreciated by the public,
4. stakeholder involvement in the design and conception of Green Corridors,
5. importance for climate regulation, which increases the strategy's future relevance,
6. synergies with other local and regional strategies for nature protection and local recreation, such as the Green Ring Strategy ()

The following aspects may be detriment to the successful performance of Green Corridors:

1. costs and benefits are not equally divided between urban and peri-urban municipalities: peri-urban municipalities in particular are limited in their development options by Green Corridors,
2. the financial support of Green Corridors is not enough to outweigh the influence of investors,
3. the strategy does not create revenues or jobs (Bauer, 2010).

Green Corridors are a regional planning aim for maintaining a system of open spaces in the Leipzig environs. Green Corridors are designated by the regional planning association Western Saxony as part of the regional plan. They link urban, regional and supra-regional green open spaces. Land uses as diverse as forests, water-bodies and agriculture are subsumed under this category. Their commonality is unsealed surfaces. Within the Green Corridors, new development, such as housing, industry and infrastructure, is prevented. Among the benefits of the Green Corridor strategy are climate regulation, the protection of habitats and the improvement of urban design. Because of these benefits, the future resilience of the strategy is seen optimistic. As Green Corridors enclose the highly-valued and well-known floodplain forests, the strategy is communicable to the public without difficulties. Despite the fact that Green Corridors are well-established, failure of implementation does occur. While there is statutory support for the strategy, financial support is lacking. Because of this, developers can build up pressure against the strategy, in some cases with considerable success (Bauer, 2010).

### **Further reading:**

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- Freistaat Sachsen, 2004, (Federal state of Saxony, 2004), Raumordnung und Landesentwicklung in Sachsen, [www.landesentwicklung.sachsen.de](http://www.landesentwicklung.sachsen.de), retrieved 25.10.2009
- Regionaler Planungsverband Westsachsen, 2008, (Regional plan, 2008), Regionalplan Westsachsen 2008, Leipzig
- [The Location of the Case Study](#) (image) by Jens Weinert
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Leipzig](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Leipzig](#)

### **6.3.11 Leipzig-Halle region: Regional development concepts**

*Leipzig-Halle region: Regional Development Concepts strategy*

#### **FS 147 Leipzig-Halle region: Regional Development Concepts strategy**

By Annette Bauer - Leipzig

#### **What is the issue?**

The regional development initiative "Green Ring of Leipzig" is active in landscape conservation and management in the Leipzig urban fringe. Furthermore, it aims to encourage local recreation. To this end, infrastructure is constructed. The following sections outline the aim and conception of the Green Ring and present evaluation results. The "Green Ring of Leipzig" is a major strategy for landscape conservation, redevelopment and management in the Leipzig urban fringe. It aims to increase the accessibility of peri-urban landscapes and to raise awareness for their qualities.

#### **Methodology and Materials:**

A documentary analysis of concept and funding guidelines was carried out. Focus group meetings with urban and regional planners on strengths and weaknesses of the Green Ring based on an evaluation framework (Aalbers, van Dijk, 2008) were held. Main components of the framework document are criteria to characterise strategies in terms of outcomes and process.

#### **Results and Conclusion:**

The regional development initiative "Green Ring of Leipzig" is active in landscape conservation and management in the Leipzig urban fringe. Furthermore, it encourages residents to get to know the nearby natural and cultural landscapes. For this purpose, infrastructure for local recreation and tourism is constructed. Initiated in 1996 by Leipzig planning officials, the Green Ring focused on the restoration of fallow open-cast mines and industrial estates at first. Further areas of responsibility were the management of the remaining cultural landscapes and educational activities. Currently, 26 key projects are implemented. Regarding land use change, project number 8 "inter-municipal pool of compensation areas" is the most relevant. Today, the Green Ring covers diverse landscapes, including forests, urban and fringe green spaces, brownfields, farmland, rivers and floodplains (see: [www.gruener-ring-leipzig.de](http://www.gruener-ring-leipzig.de)).

The Green Ring consists of fourteen municipalities including Leipzig, two rural districts, civil society organisations, private firms and individual citizens. It is at this scale an important cooperation platform for urban and peri-urban as well as Northern and Southern Leipzig municipalities. The Green Ring is one of 30 so called Regional Development Concepts (REK) in Saxony (Federal State of Saxony, 2009). Since 1997, REK can receive funding through the Saxon funding guideline FR-Regio (FR-Regio, 2006).

Evaluation results, based on the subjective views of participants of a focus group, show that the following credentials may contribute to the successful performance of the Green Ring:

1. financial support for the strategy, options for co-financing,
2. statutory support for certain tasks, such as the intermunicipal pool of compensation areas,
3. professional, full-time management,
4. well-established initiative since 1997,
5. defined aims and objectives and correspondent projects,
6. platform for the coordination of landscape planning between Northern and Southern Leipzig municipalities,
7. creation of public support through visible outcomes, e.g. cycling paths,
8. synergies between municipalities: prospects for regional tourism and local recreation,
9. pooling resources in landscape planning.

The following aspects might be detrimental to the successful performance of the Green Ring:

1. differences in level of commitment among participants,
2. lack of prioritisation of the Green Ring's projects,
3. no means to enforce the strategy's aims and objectives, or to enforce commitment,
4. potentially conflicting aims related to the environment and to tourism/recreation (Bauer, 2010).

In conclusion, the "Green Ring" manages and promotes peri urban cultural landscapes. It implements a series of projects related to landscape management, water bodies and environmental technology. Furthermore, it is involved in diverse activities related to marketing and education. The strategies' outcomes include a set of preferred projects for regional development, an analysis of regional strengths and weaknesses and the improvement of peri-urban leisure infrastructures (walking and cycling paths). Professional, full-time management is a pre-requisite for the strategy's success. Visible outcomes, e.g. leisure facilities, help to create public support. Furthermore, the strategy creates synergies between municipalities in terms of developing prospects for regional tourism and recreation, which are beneficial for all. The Green Ring's implementation is hampered by the fact that not all municipalities are equally committed, that it cannot be enforced and that projects are not prioritised (Bauer, 2010).

### **Further reading:**

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- Freistaat Sachsen, 2009, (Federal State of Saxony, 2009), Aktionsräume der Regionalentwicklung, [www.landesentwicklung.sachsen.de](http://www.landesentwicklung.sachsen.de), retrieved 25.10.2009
- Freistaat Sachsen, Staatsminister des Innern, 2006, (FR-Regio, 2006), Richtlinie des Sächsischen Staatsministerium des Innern zur Förderung der Regionalentwicklung, [www.landesentwicklung.sachsen.de](http://www.landesentwicklung.sachsen.de), retrieved 25.10.2009
- Sinning, H., 2002, Leistungsfähigkeit und Grenzen kommunikativer Planungsinstrumente am Beispiel nachhaltiger Freiraumentwicklung in Stadtregionen. Dissertation, RWTH Aachen.
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Leipzig](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Leipzig](#)

## **6.3.12 Leipzig-Halle region: Parthe floodplain protection**

*Leipzig-Halle region: Parthe floodplain protection*

### **FS 148 Leipzig-Halle region: Parthe floodplain protection**

*By Annette Bauer - Leipzig*

#### **What is the issue?**

The aim and conception of the Parthe Floodplain Cooperation is analysed here. It is an example of inter-municipal cooperation in landscape planning in the Leipzig urban fringe focusing on the river Parthe and its floodplain forests.

Rivers and floodplains traverse administrative boundaries and thereby require inter-municipal or regional management approaches. This is particularly urgent in urban fringes due to increased development pressure, e.g. by housing and the commercial sector.

#### **Methodology and Materials:**

Interviews with urban planners on strengths and weaknesses of the Parthe floodplain cooperation were carried out based on a common assessment framework (Aalbers, van Dijk, 2008). Main components of the framework document are criteria to characterise strategies in terms of outcomes and process.

#### **Results and Conclusion:**

The protection of a floodplain and its riparian forests from development initiated a cooperation between the municipalities Leipzig, Taucha and Borsdorf in 1992. Taucha and Borsdorf, two medium-sized cities, are located in the peri-urban area north and north-east of Leipzig. The three municipalities synchronise preparatory landscape planning for the traversing Parthe River and its floodplains. Since 1992, the cooperation gained more and more influence by taking over new responsibilities like the management of landscape- and tourism-related projects and the organisation of a pool of compensation areas. Plans for the future include the improvement of a network of cycling paths and walking trails as well as the development of branches of the river (Parthe cooperation, 2009).

Apart from the three core members, the nearby municipalities Brandis and Gropösnitz participate. The Parthe cooperation collaborates with other regional development strategies. Furthermore, farmers, tourism associations and the German association for environmental protection (Naturschutzbund Deutschland e.V.) are involved in the project. There are short-term cooperations with civil society organisations, e.g. village councils and sports clubs, and the local economy, e.g. inns, for specific projects.

Evaluation results, based on the subjective views of participants of a focus group, show that the following credentials may contribute to the successful performance of the Parthe Floodplain Cooperation:

1. synergies through pooling qualified personnel and submitting joint bids for regional development funding,
2. voluntary commitment to the strategy,
3. baseline funding, complementary funding sources,
4. statutory support for landscape planning,
5. acquisition of trust,
6. efforts to balance of costs and benefits between the municipalities,
7. well-defined aims which are used for constant monitoring.

The following aspects might be detriment to the successful performance of the Parthe Floodplain Cooperation:

1. changing political coalitions and loss of political support,
2. predominance of economic rationale among mayors and city councils,
3. difficult conditions to balance interests of participants due to great differences in terms of influence and resources,
4. no means to enforce the strategy's aims, e.g. to prevent a municipality from permitting developments in its floodplains (Bauer, 2010).

The Parthe Floodplain Cooperation has steadily increased its range of services to its member municipalities and to the public. The Parthe Floodplain Cooperation is considered resilient for different reasons: Firstly, it provides incentives to the member municipalities to keep up their efforts. Secondly, the cooperation has so far managed to set itself achievable aims and was, within these limits, successful. This has created trust and has increased confidence in the cooperation's ability to cope with future tasks.

The Parthe cooperation is dependent on the financial support of its municipal members. Consequently, decisions are based on consensus and the Parthe cooperation has to convince its members to follow a proposed course of action (Bauer, 2010). The strategy's success depends on continued political support.

#### **Further reading:**

- Aalbers, C, van Dijk, T, 2008, [Framework for the Assessment of Regional Strategies](#), retrieved 07.07.10
- Zweckverband Parthenaue e.V., 2009, (Parthe cooperation, 2009), Aktuelle Projekte, [www.zv-parthenaue.de](http://www.zv-parthenaue.de), retrieved 03.11.09
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Leipzig](#)(Bauer, 2010)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Leipzig](#)

#### **6.3.13 Greater Manchester: The Green Belt**

*Greater Manchester: The Green Belt and related planning policies*

By Joe Ravetz - Manchester

### **What is the issue?**

The research question is, what kind of spatial strategy is used in the peri-urban Manchester city-region, for what kind of objectives, and how well does it work? In principle the UK spatial planning regime is focused on containing urban growth, recycling urban land, and encouraging "sustainable communities". In practice, the pressures of social / cultural / economic change are very strong. While in some areas spatial planning policies are thought to be successful, the community and identity of local places is easily overtaken.

This is important not only for local reasons in the Manchester city-region. There are other high growth areas of the EU which will in the future reach the limits of their capacity, and look for solutions which balance urban development and growth, with sustainability and quality of life. For the research agenda on governance and public choice, there are questions on how to achieve policy integration between spatial, economic, social and other agendas.

### **Methodology and Materials:**

The research approach focused on peri-urban transitions, mainly through structured interviews:

1. Metropolisation: an "urban transition", networked across peri-urban and rural areas;
2. Cultural capitalism: a "global transition", with globalising economic / social structures and activities;
3. Spatial ecology: a "green infrastructure transition", with "localisation" and new identities of place.

The case studies provide material which links across the PLUREL project:

1. - implement the scenarios
2. - validate the spatial analysis
3. - test the integrated modelling and
4. - demonstrate the policy implications

Spatial governance in the UK is itself going through continuous change, shifting from a land use zoning approach towards a more responsive framework and criteria-based approach. On the ground in peri-urban areas there are very practical hard choices, e.g. between social housing, parking, local services, inward investment and so on. It seems that the ideal of policy integration has still a long way to travel.

### **Results and Conclusion:**

Spatial governance and planning policy can only act with a clear agenda and definition of "what is the problem"? Such questions can get political, as every policy can create both winners and losers. There is a range of spatial strategy agendas, from urban and rural directions, and from a growth or a

conservation angle:

1. Urban containment / sustainability; with policies such as Green Belt, this uses the peri-urban areas mainly as a physical boundary for the city.
2. Urban development & expansion; this focuses on feeding the city with infrastructure such as roads, airports, business parks and retail parks.
3. Rural conservation / sustainability; here the countryside is seen as an asset for a mainly urban population, enhancing landscape and ecological qualities.
4. Rural development & enterprise - favours small business development which can conflict with the conservation agenda.

This helps to see the range of problems and opportunities, and where current policies are working / in conflict / missing.

At the regional level the NW Spatial Strategy prioritises the re-use of urban land and containment of urban growth through Green Belt and similar policies. Peri-urban areas are seen as a "problem area", in that any development may detract from open land and landscape.

At the urban level there is a priority for recycling of urban land, higher densities in existing settlements, social housing included with private developments. But meanwhile the pressures for commercial services and industrial development are very strong, so that many out-of-town developments continue to be built.

At the landscape level, there is recognition that Green Belt, Areas of Landscape Value and similar policies generally serve their purpose of containment. But there is often a lack of positive benefits for land quality or land use.

For transport, there is a general policy aspiration in favour of public transport, but there are institutional problems, and road building still claims the majority of funding.

There was a major proposal for a Greater Manchester electronic congestion charge in 2008, with the income to be used for public transport. This was voted down as the public did not seem to trust the municipalities with their money.

The sub-areas of Greater Manchester show variations. The Pennine uplands is limited by geography, and spatial planning has a difficult balance between local social needs and economic development. The Forest area needs spatial planning to encourage multi-functional landuse but this does not fit easily with the regime.

Spatial governance in the UK is itself going through continuous change, shifting from a landuse zoning approach towards a more responsive framework and criteria-based approach. On the ground in peri-urban areas there are very practical hard choices, e.g. between social housing, parking, local services, inward investment and so on. It seems that the ideal of policy integration has still a long way to travel.

### **Further reading:**

- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Greater Manchester](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban](#)

### **6.3.14 Greater Manchester: EU strategies**

*Greater Manchester: LEADER, Pillar 2 and other schemes*

#### **FS 150 Greater Manchester: LEADER, Pillar 2 and other schemes**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

Here we look at local economic and community development in the peri-urban area. This crosses many policy boundaries at regional, sub-regional and local levels. Rural development funding crosses over into peri-urban areas which occupy large parts of England: meanwhile urban funding can spread outwards (in some cases) to rural-metropolitan areas. The national Rural Development Programme for England (RDPE) aims to coordinate between farming and land management, and rural social / economic development, but this is a broad stretch. And at the moment the peri-urban is not really an issue or a territory, and so many problems are not solved and many opportunities are missed.

There is a big difference between a mono-functional commuter settlement which is dead in the daytime and dependent on carbon intensive transport and a multi-functional, vibrant mixed use market town, with high levels of social cohesion and cultural capital. It should be the goal of peri-urban economic development in the peri-urban to encourage the second.

#### **Methodology and Materials:**

The general approach is "spatial ecology" - where each part of a wider city-region has relationships with others, both in terms of space, and stakeholders, and institutions. In Manchester a range of methods was used:

1. Interviews and scenario workshops
2. Analysis of other regional research and policy studies
3. land use modelling with the Moland system
4. economic cost-benefit analysis
5. social quality of life

These results, in particular the analysis of spatial governance and the systems analysis, with social and economic studies, served as input for the further research.

There are many uncertainties in local economic / community development, but it is clear when it works. We need more holistic measures of wealth and prosperity, and better analysis of how policy may or may not enable the self-organisation qualities above. These are needed all the more in the wider peri-urban area, with conflicts between different social groups and their agendas.

## **Results and Conclusion:**

Economic development policy has in the past been dominated by EU funding. Most of the Manchester City-region was an Objective 2 area until recently. There is now much experimentation with hi-tech innovation alongside local development through social / community enterprise. Environmental policy has come up as a priority, and some of the most topical projects are integrated low carbon, climate adaptation, and green strategy. The LEADER programme which is now on the ground in the South Pennine part of the Manchester area, is based on locally-led actions covering three strands:

1. improving the competitiveness of farming and forestry sectors;
2. improving the environment and countryside;
3. rural quality of life and diversification of the rural economy.

The Rural Development Plan for England (RDPE) has a sub-regional peri-urban agenda (titled "rural") which is just now emerging. However as it is targeted only on the identified postcodes in the "rural" areas of Greater Manchester the funding is very modest, with many competing claims on it, and again it needs to be packaged with other sources for added value.

The Manchester case also looked at the dynamics of peri-urban wealth and poverty, which lie behind the current policy interventions:

1. Existing wealthy residents of peri-urban were often landed semi-aristocrats or merchants: over time their assets in land and property have consolidated.
2. Incoming wealthy households are attracted to high quality landscapes and can afford transport or high mobility occupations.
3. Existing low income households may find changes in the rural economy damaging to their living: insecure housing tenure adds to economic pressure.
4. Many low income households were relocated from the slums, through urban planning policy, to peripheral public estates, distant from employment and services.

Although these are distinct themes, many projects and policies involve each in combination. A good example is the award-winning local food scheme in the Pennine area, the Incredible Edible scheme (<http://www.incredible-edible-todmorden.co.uk/>). This can be enabled by spatial planning: funded by local economic development: depends for success on social capital and cohesion: produces food which contributes to public health and education: and also contributes to landscape protection, green infrastructure and climate adaptation.

Behind all this is the concept of sustainability. At the urban scale, we can see street level activities, public transport and dense mixed use neighbourhoods. We can see that a sustainable neighbourhood "self-organises" from multiple social, economic and cultural functions. In the peri-urban there are competing agendas between urban and rural, (communities and landscapes), so we look at both kinds of sustainability together:

1. sustainable communities, which self-organise with multiple interactions - economic, social, cultural and political. This will move towards social cohesion, local enterprise, cultural heritage, local resources, environmental protection etc.
2. sustainable landscapes, which also self-organise with multiple interactions.

Their co-evolution is to move towards ecological quality, ecosystems services, social and cultural capitals. This is the ultimate goal of local economic / social development in the peri-urban.

## **Further reading:**

- [Manchester local integrated development sketch](#)
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Greater Manchester](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Greater Manchester](#)

### **6.3.15 Greater Manchester: Infrastructure strategy**

*Greater Manchester: Infrastructure, including community forestry, climate adaptation and local food schemes*

#### **FS 151 Greater Manchester: Infrastructure, including community forestry, climate adaptation and local food schemes**

*By Joe Ravetz - Manchester*

#### **What is the issue?**

Climate change is a new agenda, with attention so far on rural and urban areas, but little on peri-urban landscapes. The effect on peri-urban areas of peak oil (see fact sheet for further information) or strong climate policy is to be explored. The wider Green Blue Infrastructure (GBI) agenda has brought new thinking on economic and social benefits: but still marginal in funding and land tenure. Community forestry is successful as a partnership programme: and there is a new local food and farming agenda, but as yet still marginal to the mainstream.

Peri-urban development is one of the fastest growing land uses in the EU, and especially vulnerable to climate change. In areas of unplanned urban sprawl, the impacts may be highest, and the capacity to respond may be lowest. In older urbanised areas, the goals of multi-functional land use need to be fitted to climate adaptation and mitigation. In all peri-urban areas, a planned and strategic adaptation to climate change is needed, and there are benefits if combined with other policies.

#### **Methodology and Materials:**

The general approach is "spatial ecology", where each part of a city-region is related to others. Here a range of methods was used:

1. Interviews and scenario workshops
2. Analysis of other green infrastructure studies, e.g. from Natural Economy NW
3. land use modelling
4. economic cost-benefit

These results supported other PLUREL analyses such as the analysis of spatial governance and a systems analysis, with social and economic studies.

There are many uncertainties and conflicts. The social / economic benefits of GBI are clear, but it is difficult to define or measure directly. While GBI is improving existing settlement structures it is quite straightforward. But in the wider peri-urban area, there are conflicts between economic development, private property, urban infrastructure, public access for leisure / tourism, and the needs of nature conservation.

## **Results and Conclusion:**

The research shows the links between GBI, climate impacts, mitigation, adaptation, and the wider urban system.

Climate impacts on the peri-urban environment, in the Manchester case:

1. Droughts and extreme heat periods
2. Flooding and extreme weather events
3. Soil erosion and landscape structure degradation
4. Invasive species and habitat decline or fragmentation

Climate mitigation linkages in the peri-urban environment:

1. New forms of renewable energy and distribution are being discussed: as oil prices rise in parallel with carbon policies, increased policy pressures for higher urban densities and clustered settlements.
2. At the same time, there is a certain policy pressure for attractive and high quality urban communities, to avoid outward migration. This equals a protection of carbon sinks and storage capacity.

Climate adaptation / GBI agenda includes:

1. GBI, open space design, multi-functional landuse, and ecological connectivity in the urban and peri-urban environment.
2. Redesign of built environment to defend against climate pressures and impacts (heat, droughts, storms, flood events, sea level rise)
3. Protection of critical urban infrastructure

There are also underlying challenges for GBI and climate policy:

1. Resilience - this is both a physical concept and an economic and socio-cultural-political concept.
2. Synergistic and cumulative effects are likely to drive the worst problems: e.g. the EU heat wave of 2005 contributed to ethnic tension and urban riots around Greater Manchester
3. Adaptability - there is great uncertainty on the climate change effects and impacts. So the redesign of the urban or peri-urban environment is not a simple change but rather an enhanced adaptability
4. Investment - as climate risks and impacts cross boundaries of territories and economic sectors, it is often more difficult to allocate costs, benefits and investment needs.
5. Long term investment - often the climate policy horizon stops at 2050 or 2100. As urban structures are 100 years or more, the long term view should be up front in planning and design.

6. Policy integration - many of the above pressures and responses are in conflict or trade-off.  
So there is an agenda about how policy integration can work: who can be involved, how the resources can be produced and why, in terms of evidence (which is quite uncertain at the moment).

Concluding, the GBI and climate agenda is urgent and topical. Many results show major social / economic benefits. But it is still often marginal - land and finance is difficult to find, and GBI is easily pushed aside by high value development. There is no clear definition between "sprawl" and "polycentricity", and no clear way to allocate responsibility for action. Even where GBI is successful, it does not always help in social and economic goals. Climate change is likely to force the GBI issue, by putting increasing physical pressure on ecosystems, with floods, droughts and storms. The Manchester case shows both successes and failures, and many remaining challenges.

#### **Further reading:**

- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Greater Manchester](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Greater Manchester](#)

#### **6.3.16 Montpellier region: Scheme of Territorial Coherence (SCoT)**

*The Scheme of Territorial Coherence (SCoT) of Montpellier Agglomération: Landscape as a vector for the metropolitan project*

#### **FS 308 The Scheme of Territorial Coherence (SCoT) of Montpellier Agglomération: Landscape as a vector for the metropolitan project**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

#### **What is the issue?**

The Scheme of Territorial Coherence (SCoT) of Montpellier Agglomeration shows an innovative perspective on landscape to transform the city and its peri-urban areas. Within the scope of PLUREL, the strategy developed in the SCoT was assessed to understand how and why a special attention to landscape can lead to a sustainable strategy of urban development. In spite of regarding Montpellier Agglomeration as a victim of urban pressure, the SCoT concept presents landscape and natural and agricultural areas as the base of territorial planning.

In 2006, the architect and planner Bernard Reichen won the French price of urbanism for his attention to territories as exposed in the SCoT of Montpellier Agglomeration. His project appears emblematic for a time where the concept of "tabula rasa" is no more available. The assessment of the role of landscape in the SCoT seems very important as it underlines the new possibilities of urban design demanded by land use changes on peri-urban areas.

## **Methodology and Materials:**

As the information contained in the written and graphical documents was not sufficient for a thorough analysis, we decided to interview the main actors of the project to underline the various representations of landscape. Seven actors were selected to represent the diversity of perspectives on landscape. The semi-structured interviews were based on a discussion opened by one question: "What is the project of the SCoT according to your point of view?"

A list of main issues to discuss has been established using the final documents of the SCoT and preliminary interviews: increasing housing and transportation offer, supporting the development of economic activities, protecting and emphasising landscapes were the basis of the interviews and of the analysis.

## **Results and Conclusion:**

Based on the results from the discussion on landscape, the formulation and if so, the rephrasing of the SCoT's objectives was analysed. General objectives of the project were expressed by the actors that imply some diverging perspectives on landscape and land use. A key objective, the venue of new inhabitants, involves that landscape in terms of the rural areas around cities, moves back (outwards) in front of the city. This is the representation of peri-urban landscape as *land store*. The objective of developing mobility, notably by public transportation, implies a fragmentation of landscape. With accessibility as an excuse, landscape is crossed, divided and thus weakened. In addition, the development of economic activities leads to the idea of landscape as *land storage*, which is then excluded from any other function in the economic development. Landscape can also be seen as a park in which farmers are gardeners. The objective of embellishing the housing environment implies that the city is an aggressive milieu opposed by the wellness of landscape.

These opinions on landscape are contested and rejected, by the planners in charge of the project. From this contrary views on landscape, a new landscape figure was developed with stakeholders during the different SCoT workshops. The pedagogical value of this work was stressed by all the actors interviewed. A real negotiation in a bottom-up approach took place during the project. At the end of these discussions, for the participants landscape appeared as a substance that had not to be protected or filled. Green spaces around cities could not be regarded anymore as spaces free for housing and landscape had not to be a victim of urban sprawl any longer.

Thus, a new definition of landscape emerged. It allowed a new formulation of the general objectives of the SCoT.

Landscape was perceived as a guarantee of urban quality and therefore presented as the warrant of territorial coherence. This implied the following change of priorities: from the city of mobility to the city of proximity and local identity. Landscape appeared as a special economic asset, active and establishing relations of interdependence with the urban milieu. The necessity of development intensification, concretised by the principle of space saving, then became obvious. Landscape is considered as a multi-scale system, as always changing and a potential carrier of latent projects. A strategy of planning was also imagined to be able to adapt the project to a changing environment. Thus, the objectives

1. preservation of the natural heritage,
2. pointing up of the city of proximity and
3. development intensification

were introduced, justified and organised.

In fact, the discussion about landscape allowed to bring actors and territories together, giving the possibility of individual appropriations. Therefore landscape was both an element of consensus and division. Further on, the perspective or perception of landscape developed by the project management group fed on this multiple identity. It became the filter through which general objectives of the actors were rephrased and harmonised in order to come to a sustainable strategy for peri-urban areas.

### **Further reading:**

- [Sight Inversion](#) (image) by Jennifer Buyck, 2009
- [Framework of natural and agricultural areas](#) (image) by Jennifer Buyck, 2009
- [Landscape as a vector for the metropolitan project](#) (pdf) by Jennifer Buyck, 2009
- [ScOT Planning, Town Planning, Local Planning](#) (pdf)
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Montpellier](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Montpellier](#)

### **6.3.17 Montpellier region: Regional planning and local development**

*From regional planning to local development: A view on the implementation of the SCoT in municipalities of Montpellier Agglomération*

#### **FS 309 From regional planning to local development: A view on the implementation of the SCoT in municipalities of Montpellier Agglomération**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

#### **What is the issue?**

The territorial coherence scheme (SCoT) of Montpellier Agglomeration aims at determining unsustainable land consumption by intensifying structured development on one hand and protecting natural and agricultural land on the other hand. A major issue is that the SCoT's recommendations are implemented by municipalities, which remain key authorities for the development regulation. Can the strategy of Montpellier Agglomeration be considered as successful in the fields of spatial planning and inter-communal cooperation? In order to answer this question, we focused on the three issues of territorial governance, intensified urban development and farming as a tool to manage urban/rural limit.

#### **Methodology and Materials:**

In 2006, the SCoT was released. It is too early to assert definitive answers to the questions:

1. **Territorial governance:** cooperation among local governments in the field of spatial planning
2. **Intensified urban development:** A major objective of the SCoT is to contain urban sprawl, in order to protect natural areas and landscapes of Montpellier Agglomeration.
3. **Agriculture in the city-region**, a development project: farming as a "natural way" to manage urban / rural limit in urban fringes?

Nevertheless, it is possible to come up with empirical evidence and a first analysis.

The research material mainly consists of studies in the villages of Castries, Fabrègues and Pérols (Montfraix, 2008. Delay, 2008) and other observations, meetings and interviews with stakeholders in the context of PLUREL.

Governance efficiency is characterised by political consensus and a rapid implementation of major policies, here: spatial planning. As different scales of local governments are associated in the implementation of the SCoT, the consistency between inter-municipal and municipal level is another important criteria of governance efficiency.

Expected impacts of new land use regulation on landowners strategy are analysed both by observations on land use changes and by interpretation of landowners behavior.

An uncertainty concerns the extension of strict urbanism rules at the scale of the whole urban area. As the complete city-region is under urbanisation pressure, spatial planning appears as a critical tool of sustainable development. Another uncertainty concerns the future of farming: Residential economy tends to be the new economic growth driver. The limit here is that the residential economy is largely based on amenities provided by open space, which it consumes in return.

## **Results and Conclusion:**

The first step of the process of regional planning and inter-communal cooperation can be considered as a success because Montpellier Agglomeration succeeded in achieving its SCoT very fast. As first inter-communal planning document for the city region and first SCoT in France, it is acknowledged as innovative and meaningful document in the field of regional planning.

Concerning the next step, the connection between regional and local planning, local actors have clearly understood the orientations of the SCoT and are willing to implement them in their local development projects. The regional planning process thus appears to be a learning process as well as a tool to build common knowledge and a common vision for the territorial governance of Montpellier city-region.

The strategy of intensified urban development implemented by Montpellier Agglomeration through its SCoT can be considered as successful according to several indicators:

1. A large public control on land to be developed
2. Managing new developments at local level: the success of urban studies

The changing of land cover on Fabrègues west fringe from 1971 to 2008 (C.Delay. 2008) shows an illustration of the generalised process of the dismantling of peri-urban structures in urban fringes. The traditional perennial crop, namely vine, disappeared during the period. In general, the farming area seems to remain, but annual crops succeeded to perennial ones. Scattered-site housing largely developed in urban fringes. Also, a land owners strategy has been tested (Montfraix 2008). Results show the impact of former urban zoning on land owners strategy: the proximity to the developed

land leads to anticipate a change in land status. The agricultural land use then changes; vineyards are cleared and annual crops succeed to perennial crop. A long term guarantee (15 years) for the agricultural status of land is a necessary but not sufficient condition to maintain farming dynamics in urban fringes. A farm-land status is not sufficient to stop development anticipations in urban fringes. Another criterion for the assessment and perception is necessary, that is legally binding to land owners and more credible in the long term to guarantee a non-building land status.

Securing the development zoning in the SCoT is not enough to:

1. reverse land owners strategies, because they do not know the SCoT, and have a long experience of changing urban limits. They rather believe in their own power of changing urban fringes by lobbying in local decision-making on future development zoning;
2. help farmers facing crisis in wine sector
3. allow/ encourage new farmers to settle and provide diversified agricultural supply: land owners are still reluctant to commit to long term land-rent contracts; as a consequence, access to farmland remains the limiting factor for future farmers to settle in urban fringes.

We can consider this strategy as successful but the role dedicated to farming as a "natural way" to manage urban/ rural limit in urban fringes shows greater difficulties in its implementation.

Three years after the SCoT has been adopted, speculative strategies are still observed. Land owners still see their personal profit in the development of their land. Combined with a general agricultural crisis, these anticipations weaken farming in urban fringes. Cooperation to help new farming activities emerge appears as a challenge for stakeholders concerned with peri-urban land use management.

Eventually, compared to the situation of other large French city-regions, the planning strategy of Montpellier Agglomeration appears as successful, and its SCoT is widely known for its strong recommendations to promote "smart growth". However, as far cooperation between the farm sector and the city is concerned, the situation has still to be improved.

#### Further reading:

- [Limits of the future urbanisation \(pdf\)](#) by Jennifer Buyck, 2009
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Montpellier](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Montpellier](#)

#### 6.3.18 Montpellier region: Risk management and flood prevention

*Risk management: An intervention of Montpellier Agglomération to prevent flooding in the place of La Lironde, municipality of Lattes*

**FS 310 Risk management: An intervention of Montpellier Agglomération to prevent flooding in the place of La Lironde, municipality of Lattes**

*By Jean-Pierre Chery, Francoise Jarrige, Jennifer Buyck - Montpellier*

## **What is the issue?**

Cevennol storms are autumn rainfalls with a rapid rise of the water level in the Mediterranean watersheds of Languedoc. Against this flood risk, all the territorial entities from the State to the municipalities are involved in policies to prevent flooding and protect the inhabitants and their goods.

In the Montpellier Agglomeration area, the strategies for risk management are illustrated at the example of the municipality of Lattes. Old dykes and housing estate developments in their neighbourhoods have alerted authorities. How can a public procedure for flood protection be integrated into the overall approach of sustainable development, such as the Scheme of Territorial Coherence (SCoT)Montpellier?

The strategy of Montpellier Agglomeration was designed according to these principles:

1. legal application of risk protection plan
2. management of land use with the priority of involving the local land owners. This point is clearly a economic position.

## **Methodology and Materials:**

This study uses interviews (4 participants: 3 from Montpellier Agglomeration, 1 scientist) and a documentary analysis of technical and administrative literature about the project. The risk protection plan is formal and materials are numerous. The legal procedure of the project is not completed: therefore the analysis concerns a strategy that is not fully accomplished. The study is a qualitative analysis. The output is a list of answers about assessment criteria, used for comparison and benchmarking.

The uncertainties affecting the analysis of the strategy are those that impact directly on it: the legal procedures concerning risk management, i.e. defining the decision-making at each step, are detailed and source of conflicts of interest. The strategy is therefore subject to many potential blockages, on aspects of form or substance. The project was also obliged to renew the development process in 2009.

## **Results and Conclusion:**

Beyond the prospect of compensation for lost properties and land exploitations in the area, Montpellier Agglomeration has planned to evaluate the impacts on natural habitats and to compensate the destruction of remarkable natural environment included in the Natura 2000 network. For the legal protection of the Agglomeration, it is necessary to take these aspects into account. The State administration was involved to define and implement an emergency procedure plan for the prevention of flood risk in the Lattes area, so that it may be valid in 2007: the process of *Plan de prévention des risques (PPR) par anticipation* (flood risk prevention plan in advance)from 2006.

### **Initial strategy**

The initial strategy was defined after an Impact Assessment (2005) for agriculture and environment issues was conducted. It proposed that new agriculture uses in the spillway area are adapted to future floods (fodder crops), taking into account that this type of production is deficient in other areas of the département of Hérault. Public meetings with neighbors were held. The first

proposition was about the location of the affected lands: land owners could rent their land for suitable crops. The land owners disagreed. So, the context of flood prevention resulted in a new procedure for Montpellier Agglomération: the purchase of all land in the spillway area; 60 hectares suitable for agriculture.

This initial strategy failed. As Montpellier Agglomération became the owner of the land in the spillway area, the future land use was independent from other land owners, but more related to the local population of the commune of Lattes. The Lironde spillway was achieved during the autumn of 2008. The next step in the commune of Lattes was to develop important dikes on the Lez banks near the urban area.

### **Second strategy**

The new strategy was developed during years 2008-2009: the Lironde spillway should become a recreation area (walk and bike paths) in an open landscape near the natural area of a pond in the south part of the commune. In 2010, landscaping is conducted: 8 000 trees and shrubs (e.g. hackberry, arbutus, pine, pistachio) will be planted on the edge of the spillway and on the slope outside the drainage areas.

Local cooperation between Montpellier Agglomeration and the Commune of Lattes aims at the development of education on flood risks. The local land use perception is modified with this new space for recreational use. Currently, first experiences with scholars are made (April 2010): planting activities and exploration of the natural area. In the future, cultural activities will accompany the development of archaeological sites in the vicinity of the Lironde spillway.

In conclusion, the flood protection project strategy of Montpellier Agglomeration is difficult to assess because of the lack of hindsight: it is quite new, and its start was made under an emergency principle which cannot be easily assessed. The local government (Montpellier Agglomeration, Communes) has achieved an easier to handle context for urban planning, linked to the SCoT for land tenure and land use changes in the impacted areas.

Over the long term, this type of restrictive projects can establish legitimacy for the Agglomeration level. In France, this level is still searching its legitimacy and its identity in the Communes that are more directly involved in the issue of natural risk for negative impacts. The Agglomeration has a clearer support than only local support ( e.g.land compensation, raising of risk awareness). While the strategy is quite constrained, potential benefits may appear.

### **Further reading:**

- [Flood prevention in Montpellier region](#) (image) by Jennifer Buyck, 2009
- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe in Montpellier](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Montpellier](#)

### **6.3.19 Warsaw Metropolitan Area: Development strategy**

*Warsaw Metropolitan Area: Development strategy of mazowieckie voivodship*

## **FS 301 Warsaw Metropolitan Area: Development strategy of mazowieckie voivodship**

*By Miroslav Grochowski - Warsaw*

### **What is the issue?**

Warsaw Metropolitan Area (WMA) is located in the mazowieckie voivodship (region). The WMA develops in a very dynamic way. The City of Warsaw plays a role of a growth pole both for the region (mazowieckie voivodship) and for the WMA. Processes of development result in sub-urbanisation, urban sprawl, and increasing pressure for land located within borders of the WMA. These issues shall be addressed by local and regional self-governments since they are responsible for spatial development and creation of appropriate conditions for social and economic development.

This strategy is an umbrella document that sets directions of the future development of the voivodship. Hence it is an important input document policy makers and planners at the municipality level.

### **Methodology and Materials:**

Here, the strategy document of mazowieckie voivodship was analysed. The strategy paper defines development goals for the region as well as for its sub-regions and indicates measures that will secure the implementation of this strategy. The strategy points out the role of Warsaw in the development of the region. It also stresses the role of rural areas in development processes. The analysis focuses on the relation between the development of Warsaw and its surrounding areas.

Official documents from the regional level (mazowieckie voivodship) were used to carry out the analysis.

The development strategy is a "living" document that is being revised and evaluated on regular basis. It is difficult to say to what extend the adopted approaches for the development of the rural and urban areas will improve the situation in the peri-urban zone.

### **Results and Conclusion:**

The strategy of the mazowieckie voivodship development is a comprehensive and ambitious strategy. It was prepared according to all rules that govern the preparation of strategic documents. Development goals formulated in these documents refer correctly to challenges of future development and set appropriate development paths. This is the strength of the strategy. However, the issue of peri-urban development seems to be addressed inefficiently. These areas are not delineated and are not perceived as areas of special values and under pressure.

The strategy provides information on so-called "areas of problems" that can be described as areas undergoing a structural crisis. These areas are located in peripheral parts of the region of Mazowsze and are predominantly rural with sub-regional urban centers.

According to the strategy, a sound economic situation of the region will allow implementing a cohesion policy and principles of sustainable development which will facilitate:

1. the development of the rural areas;
2. cohesive development of Warsaw and its environment;
3. harmonious development of the WMA metropolitan functions;
4. dynamic development of technical and social infrastructure;
5. elimination of areas of poverty;
6. improvement of the health and the quality of life of the inhabitants.

Due to its social and economic attractiveness, the metropolitan area is subject to a strong urban pressure which destroys the high natural and landscape values. The strategy calls for a change, however the WMA is not the only priority. The strategy comprises the attempt to balance interests of different groups coming from rural and urban parts of the region.

#### **Further reading:**

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Warsaw](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Warsaw](#)

### **6.3.20 Warsaw Metropolitan Area: Spatial Development Plan**

*Warsaw Metropolitan Area: Spatial Development Plan*

#### **FS 302 Warsaw Metropolitan Area: Spatial Development Plan**

*By Miroslav Grochowski - Warsaw*

#### **What is the issue?**

The Warsaw Metropolitan Area (WMA) Spatial Development Plan covers a much smaller area and is more specific, as it is required by the Law on Spatial Planning. There are four strategic goals in the Plan:

1. To secure sustainable development of the WMA and its surroundings
2. To increase attractiveness of WMA as a regional growth pole
3. WMA as an area of high quality of life
4. Harmonious spatial development of the WMA

The Plan puts emphasis on the creation of appropriate relationships both between Warsaw and its metropolitan area as well as among the municipalities within the WMA.

So far, the WMA develops without any plan. The analysed plan is the first that covers the metropolitan area. Its impact on the current development processes is limited. However, a vision of the future development of the WMA is given in the Spatial Development Plan.

## **Methodology and Materials:**

The analysis was focused on how the plan addresses issues of sustainable development within functionally integrated urban and rural areas. The Warsaw Metropolitan Area Development Plan and additional studies conducted in the process of the preparation of the plan were taken into consideration.

The plan has not been adopted yet. Under the rules of the Polish planning system it is difficult to determine its potential impact on development processes of the WMA.

## **Results and Conclusion:**

The plan presents detailed information on development directions for the whole WMA and its sub-regions. The Spatial Development Plan sets rules on how land shall be used in order to protect resources and assets. Further on, it advises on strategies of land development based on land values and location.

In conclusion, the evaluation of the Spatial Development Plan itself is supplemented with the evaluation of other strategic documents prepared for Warsaw and the region of Mazowsze.

## **Further reading:**

- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Warsaw](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Warsaw](#)

### **6.3.21 Warsaw Metropolitan Area: Warsaw Development Strategy 2020**

*Warsaw Metropolitan Area: Warsaw Development Strategy 2020*

#### **FS 303 Warsaw Metropolitan Area: Warsaw Development Strategy 2020**

*By Miroslav Grochowski - Warsaw*

## **What is the issue?**

In Poland, Warsaw is the most important regional and national cultural centre, the home of international institutions and the largest transport hub. The consolidation of metropolitan functions will increase the international status of the Polish capital and will allow it to compete successfully with other European metropolises. Warsaw's development will be harmonised with the development of its surrounding area (i.e. neighboring municipalities, the region, other cities). Potential competition must give way to a network of cooperative connections and collaboration of respective centers, whose specialisation will allow all participants to take advantage in the growth of the metropolitan area of Warsaw.

Warsaw is the key player in the region. Decisions concerning the development of Warsaw have direct and indirect impact on development processes in the WMA and the region of Mazowsze.

### **Methodology and Materials:**

In order to facilitate development of Warsaw, a development strategy till year 2020 was elaborated and adopted by the City Council. This strategy was the subject of the analysis at hand. Here, the aim was to identify how Warsaw places itself in the metropolitan context and what approaches to peri-urban areas development are being adopted. Results of a comprehensive monitoring of the strategy are not available, as the strategy covers the time period up to 2020.

### **Results and Conclusion:**

The strategy emphasises that an efficient function of the metropolitan area of Warsaw requires the cooperation of all local government units. According to the development strategy of Warsaw, the city will play a key role in the creation of the basis for the function of metropolitan structures. In cooperation with the Marshal of the mazowieckie voivodship, presidents and mayors of the towns and municipalities of the metropolitan area, goals and appropriate measures will be specified to ensure a fast development of the whole area.

The strategy also envisages the establishment of institutions that will deal specifically with the development of the metropolitan area of Warsaw. Business information systems will be established as well as databases to include land and building registers and data on investment sites as well as trends on the labour market. Another aim of the Development Strategy is to organise the spatial structure of the city, ensuring that dense green areas forming the basic natural system are excluded from building developments. Zoning will be carried out consistently with the requirements of the natural system and the functions of urbanised zones. Protection of the areas constituting the city's natural system, as well as green belts and borderlines, is a prerequisite for a good quality natural environment throughout the city. The strategy is the first strategic document that addresses the issue of the WMA management.

However, there is no evidence of activities undertaken by Warsaw's authorities to establish any formal structure that will be applied in guiding the development processes of the city and the WMA.

### **Further reading:**

- PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Warsaw](#)
- PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes in Warsaw](#)

## 6.4 Instruments and strategies

### FS 112 Instruments and Strategies

By Ivan Tosics - Budapest

#### What is the issue?

Within PLUREL, a systematic overview of public sector regulations, policies and tools with effects on the peri-urban land uses was produced. First financial instruments (e.g. intergovernmental financial transfers, public subsidies, taxation, service pricing) are analysed, followed by the overview of some of the sectoral policies (infrastructure development, housing, transport). Finally an overview is given about the regulatory tools local governments have to influence development processes. This analysis is a fine-tuning of the results of national reports for all 27 EU countries which analysed in more general way the existing planning and administrative systems providing the framework for the rural-urban regions' (RUR) processes.

Urban sprawl processes are not random outcomes, they are heavily influenced by many factors. The mentioned report on instruments and strategies concentrates on the effects of public sector regulations and policies which directly or indirectly influence land use decisions and urban sprawl processes.

The results show the importance of the different public sector regulations and policies, which otherwise remain often hidden and are missing from many explanatory works on urban sprawl processes.

#### Methodology and Materials:

Among the factors influencing the interests/motivations of the government actors in regard to the processes in the RUR area, the local governments' financing system, the taxation system and sectoral policies are discussed in detail.

Among the tools the public sector has to steer the land development process, regulations applied on new land developments in general, and rules applied in the case of concrete decisions on larger land developments are analysed.

Based on questionnaires prepared for the PLUREL case study (and few other) regions, indicators have been elaborated to quantify the qualitative information gained from the descriptions.

The values achieved by the case study areas are summarised according to the three main topics of the analysis in a way that for each topic the regions can have a value between 0 and 1 (higher values meaning less interest/motivation for urban sprawl and/or more control over it).

Uncertainties result both from the limited number of case study regions analysed and the accuracy of data collected.

## **Results and Conclusion:**

The results can be summarised along the three main topics of analysis as follows.

### Overview of the results (figure)

1. Regarding the **local governments' financing system** in some regions (e.g. The Hague, Manchester, Montpellier), the system does not motivate directly the municipalities to increase their population (which would lead to urban sprawl), while in other regions (e.g. Leipzig, Koper, Warsaw, Thessaloniki) such motivations are created by the financing system.  
Regarding **sectoral policies** The Hague stands out as very few of its analysed policies have a sprawl-oriented territorial impact, which does not mean that high demand or other pressures do not have such impacts.  
Regarding the **regulatory tools**, in some regions (e.g. Koper, Thessaloniki, The Hague, Leipzig) the municipalities are equipped with a broad range of tools which they can use to steer private developments. In the case of Thessaloniki we also see municipalities using innovative tools - but from the financial point of view they are more interested in new developments than municipalities in other regions.
2. On the basis of these results the analysed regions can be evaluated in the following way.  
In the case of **The Hague** and **Manchester** a strong potential control can be seen parallel to moderate municipal interests to increase population. This suggests a high probability for an **effective control over peri-urban land-use**.  
**Leipzig, Montpellier** and **Bologna** seem to be in a less favourable, but still **manageable situation**.
3. **Thessaloniki** shows a potentially strong, hierarchical government and planning system, while municipalities are strongly interested in expansion, which can lead to **conflicts in the land-use decisions**. **Koper, Warsaw** and **Budapest** have a much weaker government and planning framework. Municipalities have average interests to expand urban land-use, but most sectoral policies lead into this direction. In these regions (with the potential exception of Koper) the public control over land-use does not seem to be efficient.
4. Comparison with the single national reports
5. The results of the analysis can be compared to the outcomes of the single national reports, which provided a **quantitative scale showing the potential strength of public regulation over land-use change** in the different countries as follows:  
Potential strength of public regulation over land-use change (Table 1)
6. The results gained on the public sector regulations, policies and tools (with effects on the peri-urban land uses) compared with the classification, showing the potential strength of the control in the table above, leads to the following conclusions.

Regions in countries with weak control potential (values 1-2) show strong interest in expansion while local authorities have only a limited number of tools to control urban sprawl. On the other hand, regions in countries with high control potential (values 5-6) show more diverse results.

These results underpin the hypothesis that a weak potential control level assured by the formal government and planning systems is hard to overcome by regulations and policies, even if the willingness is given by the public actors. On the other hand, a high potential for control may or may not be used entirely, depending on the intentions of the public bodies in power.

## **Further reading:**

- PLUREL deliverable report: [National reports for 27 EU countries about their formal government structures and their national planning systems, with emphasis on the sub-national level](#)
- [Overview of the results](#) (image)
- [Potential strength of public regulation over land-use change](#) (table)

# 7 PLUREL print products

*PLUREL print products*

## FS 440 PLUREL print products

By Katharina Fricke - Müncheberg

### What is the issue?

The PLUREL project aims to achieve a deeper understanding of the changing relationships between urban and rural land use with an emphasis on the most dynamic portion, that of peri-urban areas. It develops methods and tools to assess the environmental, social and economic impacts of land use changes. Potential strategies and good practice examples are identified in order to promote the sustainable development of land use systems in rural-urban regions, especially the peri-urban.

Among web-based and stand-alone computer tools, PLUREL also produces printed products. These allow users to analyse the challenges they could be facing; to get state-of-the-art knowledge of sustainability implications of land-use relationships; to get information on best practise regional policies/strategies and their effects; and finally to carry on with their own analysis of regional land use changes and sustainability impacts as part of the planning process.

### Methodology and Materials:

To enhance learning, cooperation and communication between policy makers, stakeholders, planners and researchers, implications of planning policies and strategies as well as governance structures on the sustainability of land use, are analysed. This takes place particularly in peri-urban areas by exploring selected case study regions in detail and in collaboration with local stakeholders. This allows identifying strategies for sustainable peri/urban development.

All this is accompanied by a substantial set of new scientific approaches and methods in the upcoming realm of peri-urban research. Besides this scientific outcome the PLUREL-project is aiming at a range end-user oriented products that will help planners and policymakers in making surveys and assessment as part of the policy development process at regional and at the EU-level.

### Results and Conclusion:

PLUREL follows a clear end-user oriented dissemination and product strategy concerning e.g. written material, the availability of data, tools and training material. Concrete, printed PLUREL outputs are

1. a handbook of planning guidance and good practice examples targeting regional practitioners
2. a concise explanatory report on pressing topics of peri-urbanisation in Europe typically addressed from European and national policy makers or planners on supra-national or

national level

3. materials to promote adoption of the new knowledge from PLUREL
4. materials explaining the tools developed in PLUREL

The handbook synthesises the results from across the PLUREL project to help anyone who is concerned about land use dynamics in Rural-urban regions. The book integrates the EU-perspective and the generic lessons of the project with the contextual richness of the case studies from where the locally grounded development of strategies for the peri-urban provides inspiration for practitioners. The â??Frequently Asked Questionsâ?? publication addresses in a short form policy relevant key question raised by end-users towards sustainable peri-urban development in Europe.

Training and teaching materials cover material for integrative planning in peri-urban areas; demonstrations of MOLAND, ABM modelling approaches, systems dynamics approaches and contributions to planning processes for peri-urban areas, as well as integrated guidance for transition management and design of robust planning strategies.

## **7.1 Peri-urban futures: Land use and sustainability**

*Planning guidance book*

### **FS 114 Planning Guidance book - Peri-urban futures: Land use and sustainability**

*By Stephan Pauleit, Simon Bell, Duzan Doepel - Munich, Edinburgh, Rotterdam*

#### **What is the issue?**

The planning guidance book "Peri-urban futures: land use and sustainability" synthesises the results from across the PLUREL project in a suitable format for practitioners that have an interest in land use governance of peri-urban areas. The book provides an in-depth understanding of what are peri-urban areas, what are main issues concerning sustainability of land use systems in peri-urban areas, and what is good practice of land use governance in peri-urban areas.

The book is an indispensable reference for those who are involved in the planning and management of peri-urban land use because it provides for the first time an in-depth analysis of land use dynamics in Europe's peri-urban areas. The book is a compendium of good practice in strategies for sustainable development of peri-urban areas and it introduces much needed tools for the analysis of their sustainability impacts.

#### **Methodology and Materials:**

Six case studies of rural-urban regions across Europe and a Chinese case study are at the core of the book. These are jointly written by case study researchers and local stakeholders. Introductory chapters provide the pan-European context of processes of land use change while generic lessons for sustainable development of peri-urban areas drawn in the final chapters. The book is richly illustrated by maps, diagrams, photos and insert boxes.

The book draws on the results from the entire PLUREL project while the seven case studies are at its core.

#### **Results and Conclusion:**

Urbanisation is arguably the most significant process of land use change in Europe. The most obvious signs of this are the spread of built-up areas, and the creation of large transport networks, but the establishment of recreational facilities such as theme parks and golf courses and the conversion of farmsteads into residences and hobby farms in near-urban landscapes are also very visible markers of this drift to urbanisation.

The changing nature of the relationship between rural and urban land uses has deep consequences both for human quality of life and for the environment. The book provides the reader with:

1. An in-depth understanding of the nature of peri-urban areas across Europe, with a reference example in China

2. Main challenges for sustainability of land use in peri-urban areas.
3. Good practice for the governance of land use in peri-urban areas.
4. Novel tools for planning of peri-urban areas, including scenario methods and tools for analysis of sustainability impacts.

## **Table of contents:**

### Introduction

1. The dynamics of peri-urbanisation
2. Rural-Urban Regions - A spatial and logical concept to address peri-urbanisation
3. Methods, models and tools - the quantitative part of PLUREL
4. Haaglanden - Squeezed, wet and diverse
5. Warsaw - Spatial growth with limited controls
6. Manchester - Towards a green infrastructure for peri-urban sustainability
7. Leipzig-Halle - Between growth and shrinkage
8. Montpellier - New approaches for territorial coordination in the peri-urban
9. Koper - Finding the balance between spatial growth, agricultural land protection and nature conservation
10. Hangzhou - Managing rapid peri-urbanisation
11. Benchmarking of strategies for sustainable land use in peri-urban areas
12. Instruments and strategies for sustainable land use in peri-urban areas
13. What is the future of the rural urban region?

### **Further reading:**

- [Peri-urban futures: land use and sustainability](#)

## 7.2 FAQ report

### FS 115 FAQ report

By Dagmar Haase, Annette Piorr - Berlin, Müncheberg

#### What is the issue?

The objective of the FAQ report is to compile a list of frequently asked questions (FAQ) by regional and local stakeholders and to identify the answer potential that PLUREL can provide.

#### Methodology and Materials:

In terms of the methodology used it is a data collection. The results of the compilation are presented in a table. The list of questions bases on the participatory work conducted with regional partner from the case studies in PLUREL. A popular science description of main results is not foreseen.

#### Results and Conclusion:

The table collects the major questions asked by stakeholders in the case studies and during the case study meetings in PLUREL. It is structured in 3 major columns: the question itself, the answer by PLUREL in terms of results/facts and the responsible project partner(s).

#### Further reading:

[List of FAQ at regional level and answers by PLUREL](#) (pdf) by Dagmar Haase

## 7.3 PLUREL project deliverable reports

*PLUREL project deliverable reports*

### FS 800 PLUREL project deliverable reports

By Katharina Fricke, Andrea Bues - Müncheberg

#### What is the issue?

PLUREL produced a series of publicly available deliverable reports. They can be downloaded here.

### Trends and drivers of peri-urbanisation

PLUREL deliverable report: [Description of key macro-economic variables for NUTS 2 regions](#)

PLUREL deliverable report: [Calculation of land use prices and land claims at national level](#)

PLUREL deliverable report: [Demographic projections for all EU 25 countries](#)

PLUREL deliverable report: [Demographic projections for NUTS2 regions in EU countries based on national probabilistic population projection](#)

PLUREL deliverable report: [Effects of an ageing population in terms of urban development and retirement migration, discussing the regional population projections and its social impacts](#)

PLUREL deliverable report: [Impact of environmental drivers on peri-urban land use relationships](#)

PLUREL deliverable report: [Scenario framework considering future drivers of change on peri-urban land use relationships](#)

PLUREL deliverable report: [Impact of climate change, environmental sectors and environmental pressures on peri-urban land use relationships](#)

PLUREL deliverable report: [Typology of regional and local driving forces acting on the generic urban region types](#)

PLUREL deliverable report: [Future projections of technological change, including the transport network density, travel times and the ratio of urban to rural population](#)

### Peri-urbanisation and land use changes

PLUREL deliverable report: [Review of existing rural-urban region typologies](#)

PLUREL deliverable report: [Quantitative classification of the major European rural-urban regions](#)

PLUREL deliverable report: [Review of policy options for the development of Rural-Urban Regions](#)

PLUREL deliverable report: [Upscaling results from high-resolution spatially-explicit development scenarios](#)

PLUREL deliverable report: [Spatially-explicit development scenarios for Leipzig, Haaglanden, Montpellier and Koper](#)

PLUREL deliverable report: [Economic evaluation of scenarios in four case studies](#)

### Effects of peri-urbanisation

PLUREL deliverable report: [Response functions for open space \(for recreation / biodiversity\) and](#)

## soil functions

PLUREL deliverable report: [Response functions for population and household structure](#)

PLUREL deliverable report: [Response functions for social issues \(aging, education, ethnic aspects, social equity\)](#)

PLUREL deliverable report: [Response functions for housing and infrastructure network needs](#)

PLUREL deliverable report: [Response functions for economic development and work places](#)

PLUREL deliverable report: [Response functions for transportation and commuting](#)

PLUREL deliverable report: [Response functions for energy consumption and air pollution](#)

PLUREL deliverable report: [Response functions for food supply, water supply, water pollution and soil pollution](#)

## **Peri-urbanisation and sustainability**

PLUREL deliverable report: [Location patterns of business agents in the rural-urban system](#)

PLUREL deliverable report: [Indicator framework for evaluating impacts of land use changes on environmental, economic and social indicators](#)

PLUREL deliverable report: [Results of impact assessment for selected case studies](#)

PLUREL deliverable report: [Monetary valuation of the urban, peri-urban and rural service supply](#)

PLUREL deliverable report: [Methodology development for cost-benefit analysis of policy implementation](#)

PLUREL deliverable report: [Application cost-benefit-analysis to different policy-relevant land use scenarios](#)

PLUREL deliverable report: [Pan-European spatially explicit model linking land use changes with socioeconomic indicators](#)

PLUREL deliverable report: [Compilation of indicators and approach for their integration](#)

PLUREL deliverable report: [Assessment of European regional governance and government approaches to maintain green open space in the urban fringe](#)

PLUREL deliverable report: [A historical analysis of cases, context and functional causes of transitions supported by planning and management](#)

## **Strategies of peri-urbanisation**

PLUREL deliverable report: [National reports for 27 EU countries regarding the formal government structures and the national planning systems](#)

PLUREL deliverable report: [Review of further instruments with indirect effect on regulation of peri-urban land uses](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Greater Manchester](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Haaglanden](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Hangzhou](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Koper](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Leipzig-Halle](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in the urban fringe of Montpellier](#)

PLUREL deliverable report: [Regional planning and decision making and its impact on land use in](#)

## [the urban fringe of Warsaw](#)

PLUREL deliverable report: [Instruments and strategies for sustainable land use in peri-urban areas](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Greater Manchester](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Haaglanden](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Hangzhou](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Koper](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Leipzig-Halle](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Montpellier](#)

PLUREL deliverable report: [Enhanced planning strategies and decision making for urban fringes including scenarios for future land use development in Warsaw](#)

## **PLUREL applications and products**

PLUREL deliverable report: [Land use change balance calculation at RUR level](#)

PLUREL deliverable report: [Interactive Impact Analysis Tool based on Multi Criteria Assessment for key indicators at pan-European level](#)

PLUREL deliverable report: [Interactive Impact Analysis Tool based on Multi Criteria-Assessment for key indicators at case study level](#)

PLUREL deliverable report: [Concept for PLUREL Xplorer](#)

PLUREL deliverable report: [PLUREL XPLOREER dissemination platform](#)

PLUREL deliverable report: [MOLAND LIGHT version with generic parameter setting for each RUR region in EU27](#)

PLUREL deliverable report: [GIS Peri-urban Landscape Services: Attractiveness and Recreation](#)

PLUREL deliverable report: [Conceptual and quantitative system dynamics integrated framework to analyse rural-urban land use relationships](#)

PLUREL deliverable report: [Conceptual and quantitative system dynamics integrated framework to analyse rural-urban land use relationships including growth and shrinkage in the case study region Leipzig-Halle](#)

PLUREL deliverable report: [Conceptual description of agent-based models to incorporate the decision making process regarding land use change in rural-urban regions](#)

PLUREL deliverable report: [Conceptual and implemented agent-based model for a generic Rural-Urban Region to analyse the influence of communication patterns on urban land use change](#)

PLUREL deliverable report: [Frequently asked questions by regional stakeholders](#)

[Peri-urban futures: land use and sustainability \(book\)](#)

[Policy Brochure](#)

[Publication of cross-cutting papers on social and economic aspects](#)

[PLUREL Newsletter 1, 2, 3, 4, 5, 6, 7, 8](#)



# 8 PLUREL applications

*Interactive simulation and more*

## FS 428 Interactive simulation of peri-urbanisation

By Katharina Fricke - Müncheberg

### What is the issue?

The PLUREL project aims to achieve a deeper understanding of the changing relationships between urban and rural land use with an emphasis on the most dynamic portion, that of peri-urban areas. It develops methods and tools to assess the environmental, social and economic impacts of land use changes, among them interactive simulations of peri-urbanisation. Besides its scientific outcome the project produces relevant and practically usable end-user oriented products, among them

1. land use scenarios for Rural-Urban Regions (RURs) in Europe. They improve the understanding of economic, social and environmental issues lying behind land use dynamics in the urban, peri-urban and rural RUR sub-regions.
2. analyses and models of the relationships between land use changes and the provision of resources and functions (e.g. residential, transport, environmental and recreational services) of RURs at a European and a case study level.
3. assessments of the environmental, social and economic impacts of land use changes induced both by global and regional driving forces and by regional development strategies using a multi-criteria approach.

### Methodology and Materials:

PLUREL's research at the European level allows potential end users at European and national levels to assess the consequences of global and European drivers on the sustainability of land use in RURs. It provides descriptions and spatially explicit maps of future trends, and supports the understanding of the relationships between such trends and the provision of different land use functions in urban- peri-urban and rural sub-regions and related impacts on the sustainability of the RUR.

PLURELs research at the regional and case study level adds details to the pan-EU level as well as new knowledge based on context sensitive approaches as well as analysis of government and governance systems. At this level, analysis of regional trends, government and governance systems, and regional strategies is provided together with elaboration of policy scenarios and their land use change and sustainability impacts.

### Results and Conclusion:

The main task of the PLUREL project is to identify strategies which are able to create such win-win solutions to promote sustainable land use systems in the peri-urban areas. To support this, the integrated Impact Analysis Tool (IAT) allows end users to define their own weights of

sustainability indicators. This is a first step towards shaping a user defined sustainability choice space through the definition of sustainability weights and limits, resulting in distinct, user-tailored and thus broadly accepted measures to achieve a certain RUR development. Urbanisation related land use changes and their impacts on land use functions and their sustainability are described, analysed and assessed in an integrated manner using multi-criteria spidergrams developed in a participatory approach.

In general, methods for interactive and integrated assessment of the environmental, social and economic impacts of land use change scenarios in rural-urban regions at European level and peri-urban areas at regional case study level, including the multi-criteria assessment are developed and presented in the exploration tool for the interactive examination of all PLUREL results, the PLUREL Xplorer at hand. A synthesises of the results into knowledge resources and tools for planners and policy makers at regional, national and EU-level is given.

The results for the pan-EU level include: Land use demands from global scenarios; Sustainability impacts of peri-urban land use change at European level; Assessment of the pressures of land use changes; and Integrated Impact Analysis.

The results for the regional level include: developments in peri-urban areas in case regions; status and effectiveness of government and governance systems in European regions; strategies and scenarios for sustainable peri-urban development; land use changes scenarios; integrated impact analysis.

## 8.1 MOLANDlight

*What is MOLANDlight?*

### FS 3 MOLANDlight

*By Hedwig van Delden - Maastricht*

#### What is the issue?

Although land use change models can provide support to the planning and policy practice, there seems to be a barrier for actual uptake of these models in the planning and policy making community. A main reason for this is that planners and policy makers are not familiar with models and setting up a model for a specific region is generally quite time consuming. The land use model MOLANDlight takes up these challenges.

Without bridging the gap between the (scientific) models and the policy practice, these models will not be used for planning and policy support. Hence there is a lost opportunity to support this community in making use of new technologies that can help them in exploring the future and in understanding the impacts of policy alternatives on their own sector, as well as the possible side effect on other sectors.

#### Methodology and Materials:

MOLAND-Light is a simplified version of MOLAND in the sense that it works with generic data and parameters for Europe and hence doesn't require region-specific calibration. Furthermore the system has a simplified user interface that only provides access to the main drivers and indicators. The model incorporated in MOLAND-Light is exactly the same as that incorporated in MOLAND, meaning that the full methodology is used to calculate results.

Drivers or input variables incorporated in MOLAND-Light that can be changed by the user are population figures and area totals for industry and commercial activities, forest and agriculture. Drivers can be inserted in a time graph from 2000-2030.

Indicators or results computed by MOLAND-Light are land use maps, environmental indicators and socio-economic indicators. Results are computed on a yearly basis and provided as maps and animated gif files.

The simplifications made to MOLAND come at a cost. The land use categories in MOLAND-Light are much coarser than those normally used in MOLAND and the model makes use of those data sets that are available for the whole of Europe. As such, MOLANDlight does not provide users to include their region-specific data. Simplifications to the user interface limit the creation of scenarios for spatial planning and infrastructure as well as the adaptation of the model's parameters.

## **Results and Conclusion:**

MOLAND-Light allows a user to run scenarios that differ in land use demands. In this way users can assess the impacts of e.g. population growth on land use developments, socio-economic indicators and environmental indicators. Result maps from different scenarios can be compared in the Map Comparison Kit which can be downloaded free of charge through [www.riks.nl/mck](http://www.riks.nl/mck).

MOLAND-Light calculates results on a yearly basis from 2000 to 2030. Main types of results include:

1. Land use maps,
2. Environmental indicators: soil sealing, expansion of urban areas, forested areas, changes in forested areas, abandoned land,
3. Socio-economic indicators: urban clusters, distance from residential locations to work locations, distance from residential locations to recreational locations.

The main scientific challenge in the development of MOLAND-Light was to find out if it is possible to simulate each RUR region in Europe using the same data set and parameters. To find the correct parameter settings we have first applied MOLAND-Light to Valencia (a metropolitan monocentric RUR-region) and Patras (a regional RUR-region with a monocentric centre). Based on Corine land use data for the years 1990 and 2000 we have fine tuned the parameters in such a way that MOLAND-Light was able to represent a historic period realistically. Next, the model was tested with the same parameter settings for 2 other regions: Aachen-Duren-Maastricht-Heerlen (an urban polycentric RUR-region) and Warschau (a metropolitan monocentric RUR-region) for the same period (1990-2000). Results show that MOLAND-Light is able to simulate land use changes realistically and that it can outperform simple models over the historic period.

MOLAND-Light is developed in close collaboration with PLUREL stakeholders and project partners. Through two workshop sessions and questionnaire feedback the usefulness and usability of the system was tested and enhanced. Main input was provided on the drivers and the indicators and on the delineation of the regions, which changed from NUTS-3 regions to RUR-regions during the course of the development.

MOLAND-Light is developed using the Metronamica modelling framework. More information on this framework can be found on [www.metronamica.nl](http://www.metronamica.nl).

Land use change models have the capacity to analyse the spatial consequences of policy alternatives under a range of external conditions. They can be used to support policy making in stimulating and facilitating:

1. learning
2. awareness building
3. discussion

Making the original MOLAND land use change model simpler provides users with both benefits and limitations. Benefits of MOLAND-Light are that the system can be run for any RUR-region within Europe, without region-specific calibration. Providing the user with a limited set of inputs and outputs makes the operation of the system easier to understand. MOLAND-Light is therefore an excellent tool to obtain a first understanding of how a land use model could support planning and policy making.

Main differences between MOLAND and MOLAND-Light are summarised in the table below.

MOLAND	MOLAND-Light
Uses region specific data	Uses generic datasets
Full desktop application	Desktop component (Light part) and web component (link to MOLAND and data stored on JRC server)
Full functionality, training in application, calibration and use required	Limited functionality, to be used without training
Tool can be ?and is? used for policy support in regions worldwide	Not directly suitability for policy analysis, main focus is quick scan
Region-specific calibration	Generic parameter set for RUR regions in Europe

The MOLAND model is explained in . Main results of the MOLAND modelling work can be found under and

## 8.2 GIS recreation

*What is GIS recreation?*

### FS 4 GIS recreation

*By Sjerp de Vries, Carmen Aalbers - Wageningen*

#### What is the issue?

The peri-urban zone is becoming more important as an area where city dwellers go for outdoor recreation. But how important is it precisely, and are all parts of it equally important, or some more than others? Does it fulfill this recreational function in an optimal way, or are improvements required? The answer to such questions may help to guide policy makers to fully include the recreational function in spatial planning for this zone. The issue is whether it is possible to develop a highly operational method to indicate whether the peri-urban zone in its present form accommodates the recreational demand from nearby city dwellers, and if not, what should be changed.

Accommodating the recreational needs of citizens is important for several reasons. It contributes to their quality of life. Needs that are not met locally may lead to undesirable behaviour, such as more leisure mobility or less physical activity. Furthermore, by way of increasing the connectedness and personal significance of the peri-urban zone, recreational use builds social support for the landscape in this zone.

#### Methodology and Materials:

The method builds on an already operational method for confronting local demand for and supply of green space for recreational walking and cycling. The method thus far did not take the quality of the supply offered into account. Neither did it differentiate between population segments with different recreational needs and desires. So the objective is to refine the existing method by also taking desired and available qualities of the recreational opportunities into account.

Input variables for the GISrecreation are characteristics of the physical environment and spatially explicit demographic data. The first concern the capacity of an area for walking and cycling, and its recreational qualities, such as scenic beauty, noise level, facilities and amenities. The second is about the size of different types of demand. The output result is an indication of the suitability of areas for certain experiences and an overall indication of the match between local recreation demand and supply, quantitatively and qualitatively.

To what extent will it be possible to capture the suitability of an area for other desired recreational experiences than peace and quiet in terms of its physical characteristics? And if this is possible in principle, how about the required data, e.g. regarding relevant facilities and amenities for family outings? Are they available/obtainable at reasonable costs? Also the quantification of the local demand for certain experiences is an issue that has not been resolved yet.

## **Results and Conclusion:**

The first attempt was to qualify the local supply with regard to its suitability for experiencing peace and quiet (tranquillity). This is often demanded recreational experience with clear links to well-being (by way of offering restoration). Three aspects were deemed highly relevant: crowdedness, noise level and scenic beauty, especially naturalness. These aspects are important because they allow city dwellers to experience being away from their usual busy, noisy, urban environment for a while. Indicators were constructed for all three aspects. The indicator for crowdedness was available only for the local supply as a whole, whereas those for noise level and scenic beauty were available at the level of individual destination areas.

By way of validation average indicator values were calculated for each municipality in The Hague region. These values were compared with average local supply ratings of its inhabitants of the same aspect. These ratings were based on a large-scale survey (Woon 2006; about 9,000 participants). The analysis was limited to the municipalities with at least ten survey participants ( $n = 104$ ). The results showed that the available capacity per capita is useful as an indicator of the perceived crowdedness of the local supply. Perceptions of scenic beauty and noise level showed clear relationships with the conceptually corresponding indicators for the total local supply within reach. The three aspect ratings were averaged by measuring the peace and quiet that the local supply was perceived to offer to the local population. A regression analysis showed that, although partially overlapping, all three indicators contributed significantly. Precisely 70% of the variance in the average rating per municipality could be explained by the three indicators. The regression equation was used to create a map of the suitability of the local supply to offer peace and quiet, at the municipal level at which it was calibrated, as well as at the more detailed neighbourhood level.

The results thus far are quite promising. At least for one (important) motive, experiencing peace and quiet, it seems possible to qualify the local supply of recreational opportunities. But up till now this can not always be done at the level of individual destination areas. This is relevant because we would like to be able to indicate which parts of the peri-urban zone are especially suitable for which experience.

The next step will be to qualify the local supply with regard to another often demanded experience: socialising with family and friends. Which peri-urban areas are especially well suited for family outings? A deficient local supply for certain recreational experiences may have serious negative consequences. For example, Bruckner et al (1999) suggest that it can lead to more affluent groups moving out of such residential areas, leading to segregation of the urban population (see also De Vries, 2005).

## **Further reading:**

- [Paper on basic AVANAR model \(pdf\)](#) by Sjerp de Vries & Johan van Zoest
- [Tranquillity map of the Netherlands \(map\)](#) by Sjerp de Vries
- PLUREL deliverable report: [GIS Peri-urban Landscape Services: Attractiveness and Recreation](#)

## 8.3 ABMLand

*What is ABMLand?*

### FS 61 ABMLand

*By Mark Rounsevell - Edinburgh*

#### What is the issue?

A growing interest in non-rational behaviour in human decision-making reflects a paradigm shift away from other forms of land use models in favour of Agent Based Models (ABM). ABM offers new analytical methods for developing land use change scenarios by combining the intuitive appeal of social verbal theories with the rigour of mathematical models to understand social dynamics and decision making. Residents, planners and developers seek to achieve their goals, but they also interact with one another at the local level. Individual behaviour and local interactions can lead to aggregate patterns of land use of surprising complexity and ABM can help to understand how these processes unfold. ABMLand is such a land use simulation model.

ABM represents the next generation of land use change models. The novelty of ABM lies in its ability to capture the heterogeneity of agents, the dynamics of their interactions and their behaviour in response to the geography of physical space. Thus, ABM is useful in exploring scenarios of land use, where decisions of land users are influenced not only by changes in economic and physical environments, but also by their social and cultural values.

#### Methodology and Materials:

ABMLand is a simulation model developed using the REPAST software. The model describes a range of key decision agents in terms of their behavioural rules and their interactions with other agents. A generic model has been developed for testing purposes with hypothetical agents, and a calibrated version of the model implemented for the Koper case study. Simulations allow the evolution of peri-urban land use to be visualised with maps and the progression of agent satisfaction to be monitored.

Spatial inputs include: Population profile per unit area (census), current land use and land cover, road and rail networks, public transport, water courses, soil quality, DTM (slope and aspect), future land use (planner defined).

Non-spatial inputs include: resident location preferences (from conjoint survey), development plans decisions, noise and air pollution, criminal offences per police unit, rate of residential, commercial, industrial growth, and development densities.

Calibration of the individual agent rule base depends on the availability of information about agent behaviour. Such behavioural information can be derived from the literature, from social survey or from planning guidelines, but the quality of the model is strongly dependent on uncertainties within this information and how rules are interpreted from these data. The model would also benefit from having behavioural rule that are updated as agents learn in response to changing circumstances.

## **Results and Conclusion:**

Spatial outputs include: land use/land cover, including landscape metrics (e.g. mean-patch size, edge-to-area ratio, number of patches, largest patch size, etc...), location of features of interest, population per grid cell, urban sprawl metrics, utility of resident population - partial utilities (i.e. to evaluate specific components of utility affected by different scenarios), noise map (dB). Non-spatial outputs include: population and demographics for the region, remaining high-quality farmland, proportion of different land use types, survey analysis and agent types.

Resident households evaluate their expected quality of life obtained at a future location based on their preferences for the availability of social, economic, and ecological services available at a given location. Because defining the quality of life for any one individual or household is subjective we develop quality of life evaluation using utility theory and a series of normalised utility functions. Because the neighbourhoods social, economic, and ecological characteristics change over time, residents iteratively evaluate their utility.

When a resident's utility drops below a specified threshold it may choose to reside in other locations. Because there is a transaction cost associated with relocation this cost is included in the utility threshold necessary to trigger relocation. Relocation may occur when either: the social or natural environment changes and renders the agent utility for that location below a predefined threshold, or the agent changes (e.g. household stage change) and has the means to relocate.

The preferences of residential household agents are established empirically from their location-based utility using an adaptive conjoint analysis conducted in the Slovenian case study Koper in May 2010. Conjoint analysis comprises: estimating respondent value systems, collecting trade-offs, and making choice predictions. To accommodate different relative perceptions of factor values, the analysis sets forth a value system that is analogous to small, medium, large, or poor, good, best for each location attribute evaluated by respondents.

An attempt was made to classify the conjoint survey respondents based on preferences for eight factors (i.e. access to green space, shops, public transport; level of noise and air pollution; quality of waste collection; safety; and house condition). Results showed a lack of structure in the preference data and further attempts to predict preferences based on respondent attribute data (e.g. marital status, age, income, etc.) using regression trees, also resulted in poor R values (0.49 and 0.26 for the Manchester and Koper case studies, respectively). These results provide further evidence for use of agent-based approaches to represent variability among actors and decision-makers in land-use systems since mathematical and statistical models that represent the average household would not be able to accurately generalise acquired preference data.

Concluding, ABMland represents our departure from previous approaches to model peri-urban land use change at the regional scale. Its principle advantages are the capacity to reflect the behaviour of individual land users and their interactions across a range of different land use and land cover types. Early agent-based models were explicitly devised to have the simplest possible rules necessary to produce the desired behaviour. ABM has undergone an evolution towards increasingly complex and empirically grounded models, used to produce results of increasing specificity. ABMland has contributed to the evolution of such models by considering a wide range of agents involved in the process of urban growth. Periurban models have tended in the past to focus on the decisions of residential agents. For the first time, ABMland has modelled residents, developers, planners and other agent groups and their interactions in a consistent modelling framework.

## **Further reading:**

- PLUREL deliverable report: [Conceptual description of agent-based models to incorporate the decision making process regarding land use change in rural-urban regions](#)
- PLUREL deliverable report: [Conceptual and implemented agent-based model for a generic Rural-Urban Region to analyse the influence of communication patterns on urban land use change](#)
- PLUREL deliverable report: [Report on location patterns of business agents in the rural-urban system](#)

## 8.4 PLUREL integrated impact analysis tool (iIAT)

*How can the sustainability of the peri-urbanisation effects be analysed at European scale?*

### FS 91 iIAT principle

By Annette Piorr, Dagmar Haase - Müncheberg, Berlin

#### What is the issue?

The integrated Impact Analysis Tool (iIAT) synthesises the modelling results from the impact analysis of land use changes of the EU project PLUREL on peri-urban land use relationships into one tool. It is a tool for an integrated result presentation of a broad impact analysis and multipurpose and interactive in nature. It allows for integration of manifold aspects of problems of land use and its functions and services related to urbanisation and considers conflicts of interest of different stakeholders within a planning process. It covers all dimensions of sustainability, namely the economic, the social and the environmental.

The iIAT supports decision-making and scoping processes of sustainable land (use) management at two scales: the EU27 and the regional. As it integrates all three dimensions of sustainability into one spidergram it facilitates integrated planning.

[Start the iIAT application](#)

#### Methodology and Materials:

Physically, the PLUREL iIAT is an internet accessible tool that displays results in form of spidergrams, which provide a surface that enables an easy and holistic perception of multilevel information. The iIAT provides an in-depth view into different thematic scopes and different scales, chosen according to individual user interest. The tool accesses the impact assessment result database of the PLUREL, and generates the demanded outputs in the graphical user interface (GUI).

Uncertainties in developing and using the iIAT occur due to the following reasons:

1. uncertainties in input data
2. uncertainties in indicator and response function calculation
3. uncertainties in aggregation of values and in standardisation.

#### Results and Conclusion:

- [Start the iIAT application](#)

#### Further reading:

- [UGEC Newsletter: iIAT \(pdf\)](#) by Dagmar Haase et al. (2009)

## **8.4.1 Application: iIAT Europe**

*Integrated impact analysis tool for Europe*

### **FS 92 iIAT Europe application**

By Annette Piorr - Müncheberg

#### **What is the issue?**

The European integrated Impact Analysis Tool (iIAT-EU) is a new decision-support tool based on the European Urbanisation Impact Model (EUI Model). It compiles results from quantitative modelling of urbanisation and expected impacts on sustainable development, both at the European scale and for European regions. The iIAT-EU covers 543 NUTSX regions of the EU-27. Users can conduct an integrated analysis of the situation in 2000, and of the four PLUREL scenarios. Indicator choice offers two options: an aggregated sustainability analysis which considers a predefined set of indicators covering the economic, environmental and social dimension, and a free selection of 3-12 out of 25 indicators with relevance for urban-rural functions. Selection and output presentation is possible via map viewer, or for integrated results as spidergrams.

The iIAT-EU's main purpose is to transfer knowledge generated in PLUREL about the impacts of urbanisation on the most relevant urban rural functions at different spatial scales. Furthermore, the objective is to create awareness on how sustainability is affected at different scales for different types of regions. Moreover, iIAT-EU helps identify where policy action might be necessary, both thematically and spatially.

[Start the iIAT application](#)

#### **Methodology and Materials:**

Based on quantitative modelling utilising European data at NUTS2 and NUTS3 level, impacts of urbanisation are calculated with the EUI Model as response functions between social, economic or environmental indicators and the share of artificial surface growth, GDP or population dynamics per region. Results for 25 indicators, baseline situation, 4 scenarios and two time slots are transformed into standardised values in order to unify the scale of output data values between indicators.

#### **Results and Conclusion:**

Each NUTSX region is characterised by an urban structure, and a bio-physical, socio-economic and regulatory profile, represented by the attributes of different typologies. The latter include, for example, rural-urban-region-type, spatial planning type or level of vulnerability, innovation and accessibility. In the functionality of iIAT-EU, these act as filter for the generation of grouped average indicator values ([Tab.2](#)). The user can select a fixed list of sustainability indicators or choose up to 12 indicators out of 25 ([Tab.1](#)). Integrated result presentation is displayed in spidergrams, while for single indicators also maps can be produced. The option for comparisons by making use different spatial scales, different typologies, scenarios or times exists.

The iIAT-EU is an internet tool that allows for result presentation from the EU modelling algorithm of PLUREL. The user can choose the (1) spatial aggregation level: single NUTS regions, predominantly urban, peri-urban or rural regions, other groups regions of similar characteristics (making use of 11 different typologies), national and EU-27 scale ([Tab.2](#)). (2) the scenario; (3) different times and (4) different indicators. A map viewer facilitates guided choices. Click here to visit the PLUREL iIAT-EU

#### Further reading:

- PLUREL deliverable report: [Description of methodology of iIAT at pan-European level](#)
- [How to use the iIAT \(image\)](#)

### 8.4.2 Application: iIAT case study regions

*Integrated impact analysis tool for case study regions*

#### FS 99 iIAT case study regions application

By Dagmar Haase, Nina Schwarz - Leipzig

#### What is the issue?

The integrated Impact Analysis Tool (iIAT) synthesises the modelling results from the impact analysis of land use changes into one tool. It is a tool for an integrated result presentation of a broad impact analysis (IA) and multi-purpose and interactive in nature. It allows for integration of manifold aspects of problems of land use and its functions and services related to urbanisation and considers conflicts of interest of different stakeholders (e.g. residents, planners, developers) within a planning processes. It covers all dimensions of sustainability, namely the economic, the social and the environmental.

The iIAT-Region approach allows for selecting or adapting the above mentioned comparisons to create a visualisation of impact analysis results for the case study regions. This visualisation provides a quick scan of different future land use scenarios and their impacts on ecological, social and economic indicators.

#### Methodology and Materials:

Physically, the PLUREL iIAT is an internet accessible tool that displays results in form of spidergrams, which provide a surface that enables an easy and holistic perception of multilevel information. Here, a variety of [indicators](#) is used. Although it not a participatory model, the iIAT-Region facilitates participatory decision processes of practitioners or policy makers.

## **Results and Conclusion:**

As output the iIAT computes interactively composed integrated spidergrams for a) different land use scenarios per urban region, b) a range of indicators comparing different urban regions and c) a single indicator displayed for different urban regions and scenarios.

Results are displayed as changes compared to land cover in the year 2000 rather than as absolute values. This enables comparisons across case studies.

## **Further reading:**

- PLUREL deliverable report: [Interactive Impact Analysis Tool based on Multi Criteria-Assessment for key indicators at case study level](#)
- [UGEC Newsletter: iIAT](#) (pdf) by Dagmar Haase et al. (2009)
- [Indicator list iIAT EU27 and Region](#) (pdf) by Annette Piorr, Dagmar Haase

## 8.5 Quality of Life Simulator - pan EU level

*How to use the Quality of Life Simulator (QoLSim) application?*

### FS 207 Quality of Life Simulator (QoLSim) - pan EU level

By Affonso Zuin, Simon Bell - Edinburgh

#### What is the issue?

While it is relatively simple to understand the impact of individual issues related to the environment in the context people's process of choosing where to live or whether they wish to stay where they are, the impact of multiple factors, each of which vary in their effect, is harder to determine. When populations rather than individuals are involved then the complexities increase further. Moreover, not all people are the same and what is a suitable place to live depends on many factors. However, understanding this for purposes of land use policy-making is fundamental since the feedbacks between development, land use change and quality of life can have major impacts on people.

Quality of life is becoming a more important aspect to be taken into account in all aspects of the development of sustainable cities. Many indicators exist but they are frequently crude and simplistic. The approach used here aims to raise the level of sophistication of the application of the concept in relation to land use change. In this way it gives policy makers a better grip on one of the important but often hard to measure variables as part of the sustainability triangle.

#### Methodology and Materials:

Data from a conjoint study of residents located in rural urban regions across Europe and on a gradient from urban core to rural hinterland across the peri-urban zone was used to create a so-called "market simulator". Such a simulator, based on the anticipated behaviour of people derived from the conjoint study is able to be used to predict how people would behave given certain changes to land use as a result of urbanisation. The "Quality of life Simulator" or **QoLSim** is the result.

The simulator is based on data collected using a conjoint study. This is a type of choice experiment which simulates the real-life complexities of decision-making, in this case for residential choice. The output variables are a range of preference distributions according to different factors and attributes of the sampled population.

The generic, Europe-wide simulator, based on mixed data from several countries, is likely to produce less sensitive results than one based on data obtained from a specific city region under discussion. It would be possible to collect data from any city region specially and to construct a tailor-made version of the **QoLSim** specifically for that area, with much greater reliability of results. This service is available by contacting [openspace@eca.ac.uk](mailto:openspace@eca.ac.uk)

## **Results and Conclusion:**

The results from using the generic **QoLSim** tool at a European level permit a policy maker to experiment with the potential effects of proposed land use changes on a discrete set of quality of life indicators

1. quality of residence,
2. air quality,
3. noise pollution,
4. access to public transport,
5. access to shops,
6. access to green space,
7. waste collection service and
8. safety and security of the area

The results can be compared against a baseline condition which is set by the operator and several scenarios of change effect can be used for comparison. The simulator then predicts which of the options would be preferred by the residents. The results, coming from several city regions across Europe are generic so that they may not entirely reflect the preferences of residents in a specific city, but they are still valuable. As well as a general population response it is possible to segment the population in several ways: age, social class, location on the urban-rural spectrum and to which lifestyle group they belong. Each of these variables gives a different or more sophisticated picture. The concept of environmental affordances lies behind this approach - different people gain different positive aspects from different environments. For example, some people prefer to live in inner city areas which are full of cultural activities, night life opportunities and are walkable, while willing to tolerate increased risk of crime, noise and air pollution and less green space. Other people, perhaps with young families, may prefer to live in a leafy suburb close to public transport and with greater feeling of safety and clean air. People when they are young single adults may prefer the former location but in later life may prefer the latter. If the proposed land use change affects the environment, perhaps by making it feel less safe, less green or more noisy, people may decide to move somewhere better. This illustrates the value of a simulator which allows the population to be segmented and their preferences to be modelled before final decisions are made.

A working version of **QoLSim** and more results from this study can be accessed [here](#).

Market simulators have become popular tools for predicting the behaviour of people in different circumstances. While such approaches started in the world of product marketing, where they proved their worth, they have become of great interest to researchers looking at environment-behaviour relationships. The reaction of people to land use change and on choosing a place to live is very similar to other market situations, while the complexities of multiple variables are much more realistic than simple dichotomous choice experiments. The weightings given to the different variables through the data collection process is what provides the sophistication of the approach and the applicability of the tool when using it and comparing different sub-groups within the sampled population. The data-economy of the product is also an attractive feature.

## 8.6 System dynamics model

*A system dynamics model for peri-urbanisation*

### FS 28 A system dynamics model for peri-urbanisation

By Dagmar Haase - Berlin

#### What is the issue?

This system dynamics model for peri-urbanisation demonstrates dynamics and feedbacks between demography, housing preferences and supply of residential land use.

The model approach aims at being a helpful tool for understanding complex housing demand-supply processes based on household location preferences, choices and feedbacks of this decision-making.

Demographic change, suburban growth and inner-city shrinkage are challenges for urban planners and policy-makers in post-industrial, modern societies. Simulation models can help to understand complex dynamics and to derive scenarios for the future. The shrinkage of urban regions is a trend in numerous parts of Europe but is not included very well in urban simulation models so far.

#### Methodology and Materials:

The system dynamics model presented uses population and household dynamics to compute a household-preference driven demand for eight types of urban structural residential areas. The respective supply in turn influences this demand. Housing stock is based on the demand-supply ratio, residential vacancy and demolition.

There are a range of uncertainties in the model which are typical for every model. Most uncertainties are related to

1. input data
2. model functions
3. representativeness of the calibration cases.

#### Results and Conclusion:

The results of the population development simulations show that current shrinking cities and urban regions can expect very different futures: further decline is only one of them. In accordance with recent findings on re-urbanisation trends in urban regions formerly faced with population decline both baseline and growth scenarios indicate that urban regions might grow again following a phase of decline.

We observe an increase of single households, young and elderly. This leads to an increase in the total housing demand. In contrast, the shrinkage scenario does not show an increase in the number of single households or housing demand in the long-term.

The simulations show that residential vacancies will remain regardless of population growth. At the same time, our model shows that regardless population shrinkage and oversupply of flats, there is a negative net-demand on living space in affordable prefabricated housing estates as the percentage of low-income households will increase. These findings help planners to modify or adapt their views on desired or undesired urban futures.

**Further reading:**

- PLUREL deliverable report: [Conceptual and quantitative system dynamics integrated framework to analyse rural-urban land use relationships including growth and shrinkage in a generic way](#)