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The Concept of Multifunctionality in Sustainable Land Development

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Abstract

The identification of sustainable pathways for proper land use development will play a crucial role in future management of rural landscapes. While in the past, agriculture and forestry have been the predominant types of land use in most arable areas, an increasing number of further demands on land use and landscape functions have to be integrated today. One important step towards sustainable land use is therefore the identification of the multiple environmental, social and economic functions of land use and the subsequent analysis of how well specific landscapes perform with regard to those functions.

The identification of landscape functions for a specific region has to be accomplished by relevant groups within a participative process. In this process, sophisticated and complex methods are necessary (i) to reveal the impacts of prospective multifunctional land use on sustainability aspects and (ii) to achieve consensus among stakeholders about most suitable land use combinations. Landscape science involving inter- and transdisciplinary research is one important instrument to support this process.

In this paper the idea of multifunctionality to implement sustainable land use of rural areas is discussed and related research requirements are delineated.

Rationale

Pressures to Land Use

The member and accession states of the European Union experience rapidly changing economic framework conditions and immense structural transformations within the business of land use (agriculture, forestry, in-land fish production etc.). Four categories of change can be delineated:

- a) The diminishing importance of agricultural and forestry production within the production industry as well as economic globalisation leads to changing

land use politics both on the national and European scale (FAO 2000a, FAO 2000b).

- b) The growing verbalisation of ecological goals related to land use and land use planning.
- c) Climate change along with increasing probabilities of extreme weather events (floods, droughts, storms) might require adaptations through the modification of land use combinations and patterns.
- d) The changing public perception of land use give rise to modifications in subsidy policies within the Common Agricultural Policy (CAP) (MUELLER 1999). Farmers as the main land users have lost their categorical confidence due to various scandals like BSE, foot and mouth disease etc. Environmental, health and ethical aspects of agricultural and forestry production processes as well as the quality of products is increasingly under discussion. The society demands for healthy products of land use and for production processes where negative environmental and social side-effects are minimized.

The changes will induce adaptations of the framework conditions of CAP leading to changes within land use and related impacts on rural areas (economy, social aspects) and the environment (abiotic and biotic sources) (OECD 2000). To find proper solutions for future land use policy and management concepts, the impact of land use combinations on socio-economic, cultural and environmental characteristics of landscapes has to be analysed. This attempt requires the simultaneous and integrative consideration of all intended functions of landscapes and rural areas (COM 2000).

The significance of land use for rural areas

Most rural areas are dominated by agricultural land use, especially when looking at vegetated areas. Therefore, the impact of agricultural land use systems on the environment can be as substantial as its impact on social and economic characteristics of the rural population. Assessing the impact of agriculture on the environment on the one hand and on regional socio-economic conditions on the other hand is crucial for sustainable rural development (OECD 2001).

The recent past has experienced an increase in the intensity of land use with respect to almost all kinds of utilisation, as well as an increase in multiple and overlapping uses. The latter do by far exceed the production purposes and include those of recreation, education, environmental conservation, infrastructure development, storage, buffering and mitigation. Thus, there is an increasing awareness of the importance of rural areas which counterbalance cities and agglomeration areas. Parallel to those expanding land use demands, agricultural production experiences a dwindling share of food expenditures in total consumption expenditures, a high rate of technical progress, and an increasing reallocation of agricultural functions to specialised industrial enterprises. As a consequence, increasing shares of agricultural land cease to be cultivated and agricultural activities are concentrated in few favourable locations.

Furthermore, the demands placed on rural areas by society are often at odds with the wants and needs of the people who live in those areas. Herein lies a decisive reason for land use conflicts between cities and rural areas and for the failure of public and private decision makers to take the functions of rural areas sufficiently into account (SRU 1996).

Those changing conditions for agricultural production together with the emerging demands on land use in rural areas placed by an increasing number of interest groups call for an integrated conceptual framework in which the decision making process of land use can be embedded. On the one hand, this framework needs to involve all relevant interest groups including policy makers and the science. On the other hand, it has to consider the entire set of social, economic and environmental aspects of land use and rural development (MÜLLER et al. 2002).

The concept of sustainability

General Approach

Since the UN Conference on Environment and Development in 1992, sustainable development has been raised to a comprehensive conceptual approach and become a pioneering programme for politics to cope with the common future of humankind. This also implies relevancy to the future shaping of rural areas and the development of future land use systems.

Fascinating is, that the model of sustainability promises solutions to economic, social and ecological problems, thus opening up new perspectives. However, it is still unclear how to develop realisable concepts of sustainability and to achieve its implementations (CONRAD 2000; GÜNTHER and SCHUH 2000). The basic idea of sustainability, to orientate economic action and social balancing endeavours towards the conservation of functions of ecological systems, should be irrefutable. Therefore, politics have to be able to determine a development strategy, which does equal justice to reciprocal dependences of economic, social, and environmental development components (WIGGERING et al. 2002). In this context, sciences must show and politics must realise, that, in contrast to the solution of social problems, other strategies are required in order to cope with environmental problems. Consequently, the separation of the economic development of resources consumption and the impairment of environmental functions could be necessary. However, a drastic reduction in consumption of natural resources within economic activities can only be realised and counteracted out of the overall context (HÜTHER and WIGGERING 1999). In this context, the obedience to so called management rules of a sustainable development is of fundamental importance:

- a. the use of renewable resources may not exceed their regeneration rate
- b. the use of renewable resources may not exceed the substitution rate
- c. the release of harmful substances may not exceed the capability of natural systems to absorb and compensate

With regard to land uses, the limited capabilities of natural systems to respond to changes, to adapt to civilisation systems and to balance anthropogenic impacts are herewith taken into account. The time scale is an important factor in this context of adaptation, buffering and balancing. The speed of civilisation developments with exponential growth curves can dramatically exceed the self organisation and adaptation capabilities of natural systems. The introduction of measures to balance the impact of developing civilisations on natural systems is, if at all, effective only with delay (DALY 1999; MUELLER et al. 2000). Due to a so called creeping worsening of the ecological situation, a political picking out of this question as a central theme is particularly difficult. The matter hardly exerts any suffering pressure to be experienced. Landscapes are changing constantly and it is difficult to identify its origin, be it natural or anthropogenic.

The orientation of the economic and social development towards the capability of natural systems to self-organise and adapt requires a change in the widely existing understanding of economic progress and economic rationality. Essential aspects of modern environmental planning can finally lead to this goal. Namely, participation and learning by experience must be connected towards a collaboration between policy makers and all interest groups relevant for the subject of planning. Particular with regard to land use demands, which often are conflictive, a strengthening of participative elements in the relevant planning can be an essential step to implement the idea of sustainability. In order to accelerate the planning process towards a sustainable development, scientists have to contribute to the political discussion, to conduct relevant research and information work, and to monitor the implementation achievements of political decisions (MÜLLER et al. 2002). Problem orientated landscape research is one instrument to provide high quality knowledge input into the planning process (ITTERSUM et al. 1998)

Sustainable land development

Sustainable land development has to be based on existing concepts of site adapted land use refined in the domains of environmental protection and regional planning. Uniform and revisable standards of the sustainability of land use management need to be identified and made legally binding. The standards must include those of (i) long-term conservation of biotic, abiotic and cultural resources, (ii) economic welfare of the land users, (iii) social perspectives for the rural population, and (iv) maintenance of technical and cultural infrastructure in rural areas (Wiggering, 1997).

The complex diversity of natural conditions and cultural systems in landscapes and regions prohibit the development of universally valid socio-economic principles of land use and development. Regionally specific objectives of land use and land development must be defined that respond to the specific environmental and socio-economic situation of the respective region. As a result, priority designations set up by sectoral policies should be used in compliance with

the above mentioned standards to complement a concept of sustainable land development for the specifically desired uses.

Multifunctionality – a demand oriented approach

With the concept of multifunctionality, an attempt is provided at carrying out and implementing the concept of sustainable development in the specific case of land use and landscape development. However, the concept of multifunctionality often is – if at all – only insignificantly more concrete than the concept of sustainable development and is moreover often used, to sell old ideas by making them look new. This is particularly true, when multifunctional agriculture is equated with multifunctional land use and when the avoidance of negative externalities of agriculture, forestry and fisheries is already interpreted as an honourable achievement of society within the frameworks of multifunctional land use.

Multifunctionality is internationally discussed by three major organisations, the Food and Agriculture Organisation (FAO), the Organisation for Economic Co-operation and Development (OECD) and the European Union (EU). This is done equally intensive, though with differing objectives. Generally, the main emphasis is put on multifunctional agriculture instead of multifunctional land use. The FAO assumes an attempt, which orientates strongly towards regional development to support the integration of agricultural land use into the concept of sustainable development (FAO 2000a, FAO 2000b). The analysis of multifunctional land use types contributes to a better understanding of potential interrelations, synergetic effects and trade-offs of the different functions. To the FAO, complex interactions between regional and development politics are of importance. However, it is noticed, that, when describing multifunctionality, present results are of temporary character and require further investigation (FAO 2000b).

The OECD prefers a rather environmental economic attempt. Its analytic framework presents a comprehensive theoretical basis, which outlines the most important problems of multifunctionality (OECD 2000, OECD 2001). In this context, the concept of multifunctional agriculture is based on the assumption, that every economic action fulfill several functions besides its main function. Accordingly, agriculture has always fulfilled various social, environmental and economic functions besides the production of food, fibre and commodities. The OECD subsumes those functions of agriculture to the term “non-commodity-outputs”. As the term multifunctionality is defined in many different ways, the OECD has developed a draft definition, which combines the varying demands on multifunctionality. Key elements of multifunctionality are (i) the existence of several ‘commodity and non-commodity outputs’ being produced by agriculture and (ii) the fact, that some of those ‘non-commodity outputs’ show features of externalisations and public goods with the result, that markets for these goods do not exist or function unsatisfactorily (BOISVERT 2001a, BOISVERT 2001b).

Within the EU, the term multifunctionality is discussed against the background of changing frame conditions for agricultural production. As a result, agriculture is less put into the context of the production of food (commodity-outputs), but rather into the context of resources protection, leisure and recovering space as well as cultural landscape (non-commodity-outputs). This differentiation of use demands and perceptions coincides with a different understanding of agriculture and forestry being responsible for the management of rural area and thus presenting an aspect of multifunctional land use. To the EU, this concept of multifunctionality presents a powerful opportunity to continue the financial support of farmers, not any longer through subsidies but as remuneration of the production of non-commodity-outputs, i.e. for environmental or other services demanded by the society (COM 2000). Considering the reduction of subsidies for commodity-outputs the publicly financed demand for specific non-commodity-outputs plays thus a decisive role in the existential security of agricultural farms. Within the EU, the concept of multifunctionality has consequently experienced an increasing relevancy with regard to diversification strategies. In this context, the term multifunctionality describes the various private and public use potentials of land for farmers, for rural areas and for society in general (MAIER and SHOBAYASHI 2001).

Multifunctionality and Sustainability

Above the attempts of FAO, OECD and EU, the concept of multifunctionality is given further importance to sustainable land development. Opposing the reduction in the interpretation of the concept of multifunctionality through the equation of multifunctional agriculture with multifunctional land use by pressure groups, a problem oriented approach of implementing the multifunctionality concept is considered to support sustainable land use and development respectively. This presupposes, that (i) all demands on landscapes are considered simultaneously and (ii) all demands are seen as legitimate. Inevitably, land use conflicts result from different demands. Therefore, the demands on the use of landscapes resulting from the different sectoral contemplation have to be combined to a regional contemplation, which is only effective, when the regional negotiation process is of participative nature. A successful participation requires the provision of all necessary information in a user friendly way.

Demands on land use in a specific region can also derive from other regions. Best examples are urban-rural-relations. If *all* demands on land use are to be considered within a consensus finding process in a specific rural area, demands of the urban areas on the respective rural area need to be included. The same is valid for larger scale, national, international and even global demands on the rural area, which derive from external effects in the context of land use. Corresponding large scale demands must also be considered in the development of local land use concepts in order to follow the idea of the sustainability principle (RUDLOFF and URFEI 2000, URFEI and BUDDE 2002).

This consideration of global demands in regional land use decision making does only apparently contradict with the increasingly occurring competition between single regions, the latter being a result of globalisation. Efficient incentive structures are relevant for the performance of a single region in this global competition, which need to combine the regional responsibility taking with regional decision competence. Another prerequisite is the clear definition of property rights with regard to the use of landscapes. In this context, the principle of subsidiarity demands a far reaching decentralisation of decision competence, while the limits of decentralisation are determined through the spatial expansion of the environmental and socio-economic impacts of the decisions (EWERS and HENRICHSMeyer 2000). Only if those rules following the subsidiarity principle are implemented, the regions have the necessary degrees of freedom to develop and implement their regional specific concept of sustainable land use in spite of globalisation and increasing competition between regions.

Consequences for integrated rural development

Regarding the implementation of new concepts of sustainable land use, it is still unclear, whether the available instruments to do so are actually suitable. Possibly, completely new instruments are required (HODGE 2000). The latter would be true, if the available instruments turn out to be resistant to adaptation because they are still only orientated towards sectoral aspects instead of regional aspects or because new goals just require new instruments.

The sustainability of a certain land use combination can only be defined for a given time span during which the demands on landscape as well as the property rights with regard to land use are valid. New knowledge and information can constantly change the assessment frame for sustainability. Against this background, the planning of sustainable land development must be regarded as a continual process, where iteratively new information on demands, property rights, technologies and expected land use impacts are taken up in order to optimise sustainable land use in the long term.

For successful rural planning, all relevant activities have to be adapted to the three identified major characteristics of the sustainability and multifunctionality concept, namely (i) the demand and goal oriented identification of land use functions, (ii) the participative character of negotiations on possible land use combinations involving all relevant groups including science, and (iii) the iterative character of the decision making process, which allows tolerating uncertainties on the one hand and adapting to emerging information and knowledge on the other hand.

The implementation of these three characteristics within the methodology of rural development would also bring about a new situation to planning organisations, public administration and politics. The consideration of all actual and intended functions of landscape use in the planning process requires a cross-sectoral approach. Especially the definition of relevant problems and the solu-

tions to solve them should be elaborated co-operatively. A feasible way to handle environment protection goals could be explored in organising regional co-operatives for the environment (GLASBERGEN 2000, MÜLLER et al. 2002). Those groups should include farmers, communities, the public administration and any other group interested in the development of rural areas. They should first determine the achievable regional goals, define the sensitive areas within the region and then develop a set of possible management solutions. Public funds intended for environmental protection and ecological services could be distributed through such co-operatives more efficiently than through any general programme (BAHNER 1996). Those institutions could increasingly consider further goals of rural development and become a base for public *sustainability developers* in their region.

The public administration, which is responsible for planning and managing the rural areas will play an important role in this process. All relevant sub-organisations currently working separately (farming, forest, environment, rural planning, etc.) have to be included in these activities. This new approach of achieving development concepts for rural areas results in new tasks and specific demands concerning skills and knowledge for most of the administrative units (WERNER et al. 1997)

Implications for Landscape Research

In order to enhance the understanding and to scan scientific methods of analysing and developing relevant aspects of multifunctionality within landscape use in Europe three levels of investigation can be identified and important requirements for landscape research formulated: (i) inventory of landscape functions and demands, (ii) analysis of the interdependences of land uses and landscape functions, and (iii) methodologies to achieve consensus between conflicting demands

Inventory of landscape functions and demands

One basis for further steps concerning the analysis of multifunctionality is the inventory of the various functions of and demands on landscape use. However, multifunctional agriculture, forestry and fishery is just touching on some functions of landscapes like production and environmental issues (e.g. soil protection, water conservation, biodiversity). A sustainable use and development of landscapes have to integrate those aspects and meet further demands such as providing sites for development, traffic, industry, raw material processing and waste disposal. Further important, though not yet completely understood landscape functions include buffering capacities for matter and energy as well as mitigation abilities to extreme weather events (floods, drought) which might become of increasing importance with evolving climate change effects.

In addition, the use of landscapes has to be regarded as an element of urban-rural-interconnection, by which recreational and educational demands of urban residents as well as issues of cultural heritage are to be included.

A total inventory of multiple landscape functions and of demands addressed by various interest groups concerning the utilisation of landscape requires a joint approach of socio-economic sciences as well as of natural sciences, since people, companies, public structures as well as natural functions and production systems have to be addressed.

The research requirements include the development of methods for the identification of landscape functions as well as current and potential demands concerning the use of landscapes. In general, available methods are based on information of individual views of persons or groups and thus too expensive or not appropriate to identify all demands in a region.

Generally, every distinct landscape within the European regions has its specific set of functions and land use demands. This characteristic set is by itself a characteristic property of the respective landscape. The problem is to properly characterise and delineate landscapes and to derive information of all groups which express demands on the use of landscapes.

One crucial step towards the full inventory is to check whether the various demands on landscapes are synonymous with relevant landscape functions. Some landscape functions might not be addressed by interest groups since their importance is (i) relevant only in the long term (i.e. buffering capacities, genetic pools), (ii) not completely understood (cooling and mitigation functions) or (iii) of relevance only to extreme events (floods, droughts) and will not be publicly anticipated in the near future. Those functions are summarised as *option values* and *bequest values* in the economic terminology but need to be addressed explicitly when sustainable land use is concerned.

The entire process of inventing landscape functions and demands can be structured into the following research topics:

- Adequate delineation of the studied landscapes (e.g. administrative vs. natural, rural vs. urban) considering those problems which arise from inexact or overlapping jurisdiction and those which concern the handling of trans-boundary landscapes.
- Identification of adequate instruments and procedures to derive information from interest groups about their demands on landscape use. This procedure has to consider culturally distinct means of communication, guarantee the completeness of demand collections, be cost efficient and oriented towards implementable solutions. Research has to answer, whether already existing instruments and facilities can be used or whether new solutions for specific cases are required.
- Development of a procedure to identify and deal with landscape functions not being addressed to by interest groups, but the importance of which might be formulated by the society through a better understanding and/or through a longer period of time (option and bequest values).

Analysis of interdependences of land uses and landscape functions

Approaching sustainability by looking at multifunctional land use requires the consideration of mutual effects of the different types of land use, since particular actions, processes or conditions of land use influence each other specifically. Within a certain setting of land use systems, the spatial patterns of land uses as well as land use modifications can determine specific performances of landscapes with respect to certain functions to a greater extent than the mere type or intensity of its use. By this, modifications of regional patterns in land use systems and their characteristics may require more attention than just local changes in the intensity of land use or its management.

A proper understanding of the interrelations of various land uses and landscape functions is thus indicative in order to develop tools for sustainability impact assessment of land use strategies. Moreover, it can open new opportunities for intelligent solutions in terms of land use modification or pattern adjustments that result in win-win situations of apparently conflicting land use demands. A problem oriented indicator system for land use effects is an important tool to make interdependences of land use transparent and help to derive consensual decision making.

The considerable lack of information (identification, quantification, assessment) concerning mutual effects of land use, the knowledge of which would be an indispensable prerequisite to balance different interests in land use, can only be filled by interdisciplinary cooperation. There are conflicting interdependences as well as neutral or just complementary interdependences. Especially the knowledge and methods of landscape ecology and new landscape sciences have to be used in a cooperation with socio-economic sciences to identify the interrelations. It should be checked carefully, if new knowledge has to be acquired or if already available knowledge just has to be reworked and newly communicated within an interdisciplinary approach. Resultant research requirements may be grouped into:

- Development of new approaches in landscape research that explicitly considers the effects of land use modifications and land use patterns on landscape functions with the aim to generate intelligent solutions for apparently conflicting land use demands. Issues of temporal and spatial scaling have to be considered in those analyses.
- Utilisation of interdisciplinary methodologies to analyse site related effects and interactions of processes and states in land use and its development. Analyses carried out by natural sciences have to be supported by socio-economic competence when land use situations are studied, and people and their actions are involved.
- Translation and proper management of available disciplinary derived knowledge to generate new understanding in a wider and interdisciplinary context.

- Problem oriented definition and implementation of functionally based landscape indicator systems to make interdependences of land use management transparent and generate a basis for multi-objective and sustainable decision making.

Methodologies to achieve consensus between conflicting demands

Sustainable land use and landscape development can only be achieved if knowledge about the multiple landscape functions and its interdependences is transferred to decision makers. Decision makers have to be assisted in balancing interests and achieving consensus between conflicting demands in order to develop sustainable land use strategies. A consensual balance of interests at the local or regional level (oriented at the principle of subsidiarity) can be achieved, when information about these interdependences is prepared and transferred adequately to the users. Precondition for a successful balance of power is, however, a precise definition of the property rights of the various user groups.

Achieving consensual balance of interests requires an institutionalised moderation of the process and sufficient provision of information preceding the discussion. All information has to be prepared and effectively communicated to all groups being involved in finding a consensus in land use decision making. The utilisation of modelling tools and scenario techniques may help to facilitate decision making in a transparent way (KEITH et al. 1999). Those tools have to be further developed according to the specific needs of user groups. To provide highest potential for the successful implementation of the transfer concepts, the specific demands of the administration have to be considered at the earliest possible stage. Research requirements may be formulated as:

- Methods to adequately prepare and communicate knowledge to all groups being involved in decision making considering cultural particularities and demands of specific social groups.
- Development and utilisation of scenario techniques linked to a proper indicator system as a mean to generate transparency of the multiple and interrelated effects of alternative land use options. This tool might facilitate decision making in a comprehensible way.
- Identification of means that motivate the administration to implement innovative solutions and to define, which institutional solutions are appropriate to achieve consensus. In this context, the role of the principle of subsidiarity needs clarification.

Conclusions

The utilisation of the concept of multifunctionality seems to be a powerful tool for the process of sustainable land development. Three important steps could be delineated for this process. The first step towards sustainable land use is the

comprehensive identification of land use functions and demands in a specific region involving the environmental, social and economic aspects of land use. The second step concerns the analysis of the mutual interrelations of land use functions and the identification of land use conflicts. The third step addresses the process of decision making and achieving consensus on land use combinations involving a participative co-operation of all interest groups. Interdisciplinary landscape research is an important instrument to scientifically support this process of sustainable land development.

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