OpenGeoEdu Exercise: Basic

Estimation of the land use share for settlement and transport purpose (SuV)

Spatial level
National (but possible up to the district)

Introduction
The proportion of settlement and transport areas (SuV) is an important parameter for monitoring land use development, but also for achieving the sustainability objectives of spatial planning. Therefore, the major task should be included on data collection, evaluation, visualization and interpretation in different administrative and spatial contexts.

Problem definition
This exercise serves to evaluate, visualize and understand the settlement and traffic area (SuV) share at national level. This is an example for the nationwide share of settlement and traffic areas (SuV) on the administrative level of the federal states. Depending on your interests and the available computing power, you can also choose any other spatial unit (spatial planning region, district, municipal district).

After completing this exercise, you will have acquired basic knowledge of the following questions:

- How can you obtain and prepare land use information from a WebGIS service?
- How can you export these data records to a GIS environment and adapt them to the desired requirements?

For this example, we will work with the QGIS desktop application. However, the exercise can also be performed in any other GIS environment that is compatible with vector data formats.

Data research and preparation

Working with the WebGIS service
In these exercise units we work with the interactive WebGIS service of the IOER Monitor. There you have the possibility to determine the settlement and traffic area (SuV) share for different levels and time periods.

- With the help of the IOER Monitor map viewer you can select a settlement indicator, e.g. the proportion of settlement and traffic areas (SuV) in an area on the level of the federal states.
- Then, you can adjust the "default" map display, e.g. the visibility of the indicator, the colour scheme, the classifications, the class occupation, the type of display and the background.
- Up to now you have only used the "Default" time setting 2017. You can set this to 2016 and export the SuV card for the year 2016 as PDF/PNG. The time setting and the export must be repeated for the year 2006.

Note: After the indicator selection, please read the identification sheet (Method, Data, Comment). It might help you to better understand the data basis and its interpretation. An adjusted map can also be saved permanently as a map link on the IOER server.

You have seen with the web-based GIS service how a desired land use information can be exported as a map representation (also with the desired setting). The question is how to integrate this extensive data set into a GIS software and thus have even more settings available or the possibility to link other data sets (SuV2006 + SuV2016).

For this possibility we can use the services WMS, WCS or WFS in the "Export" menu. In this BASIC - example you only work with the WFS service. More basic information about WMS, WCS, WFS and your data structure and usage can be found in the tutorial on OGC web services (https://learn.opengeoedu.de/en/tutorials/OGE-Tutorial_OGC_WxS-en.pdf).

Data preparation with the GIS environment

In the QGIS Desktop, WFS sources can be used directly for mapping, as geoprocessing inputs and for conversion between these and other GIS data formats. We need the QGIS feature "Add WFS layer". Use the "Add Server WFS Layer" window to create a new connection. In the "Create New WFS Connection" window you can assign any name for the WFS service, so that you can easily connect the desired WFS service later. Here you insert the link displayed by the IÖR-Monitor into the field "URL" and then connect to the WFS service in the remaining window. Here you also have the possibility to create complex queries if necessary; you can also use a "Create Query" window. For this example, we will work with the "Default" settings. After selecting the desired layers, they appear in the layer overview. Please choose the correct name of the desired layer (e.g. bld_2016).

For further help: IÖR-Monitor as WFS (Tutorial)

Note: Depending on the territorial unit, it may take some time until the selected layer appears. Once the WFS service has been set up, it can be reconnected and added to the desired feature layer at any time.

Modelling and evaluation

Now we have 2 feature layers already on QGIS desktop: Share of settlement and traffic areas (SuV) in an area in 2006 (bld_2006) and the share of settlement and traffic areas (SuV) in an area in 2016 (bld_2016). The question arises how the desired classification method for the SuV share can be selected ? What preparations are necessary for this? How can the decrease/increase of the SIA share be calculated? For this purpose you create a data modelling diagram, a so-called UML or ERM flowchart (See https://learn.opengeoedu.de/en/tutorials/OGE-Tutorial_UML_Vorlesung-en.pdf). Here the required attribute fields, types, methods etc. should be selected. At this point you can use draw.io or ERD-Plus (Webtool - open, free to use), but other tools are also available.

Help: Data Modeling

Selection of the classification method

With the interactive IÖR-Monitor WebGIS - Service you can select only two classification methods. The finished map (Ready-to-Get) can be exported as PDF/PNG. But there are more classification methods (e.g. Standard Deviation, Natural Interruptions etc.) and further evaluation and visualization possibilities. For this example, you will display the SuV portion with graded classification using the standard deviation as a map.

After selecting a classification method you will receive an error message that no column (field) can be selected. After checking the attribute types - all are "String" - the field type must be changed. To do this, we have to convert the WFS layer (e.g. bld_2006) into an ESRI shape file: to do this, you work with the attribute table, in which a new field is created in which the SuV proportions can be calculated. Repeat this procedure for the SuV part 2016, too, to get the new edition as ESRI shape file.

Decrease/increase of the SuV share

In the previous steps you have prepared the SuV values for 2006 and 2016. This enables you to calculate the decrease/increase of the SuV values within 10 years. For this, the SuV shares are linked as ESRI Shape file of the two points in time (e.g. 2006 and 2016). Now we calculate the change in land use (decrease/increase in SuV values) for the years 2006 and 2016 as a new field with any name. After linking the results this can be saved as a new ERSI Shapefile (e.g. bld_suv_2006_2016).

Visualization

Now you have the share of settlement and traffic areas (SuV) in the area for the period 2006, 2016 and its change. Try to visualize the following results:

1. categorized/graded classified land use map (2006, 2016)
2. graph based on the map with the SuV changes in 10 years (2006 to 2016)
3. basic statistics (table, diagram)

Help for QGIS environment: Setting a map with QGIS Desktop (classification); Setting a graphic and map with QGIS Desktop (graphic creation), Tutorial for Statist/QGIS Plugin (basic statistics), https://learn.opengeoedu.de/en/tutorials/OGE-Tutorial_Kartengestaltung-en.pdf.

Note: Think about your analysis goals for the selection of the significant classification methods, graphs, or statistics. The average basic timeliness is also a very important aspect of the indicator values. You can also examine these with the IÖR-WebGIS service for the SuV share.

Interpretation

In this exercise unit we discussed the most important aspects of connecting and using a WebGIS service. It was also shown how to export these data sets into a GIS environment and adapt them to the user requirements. This should now also enable you to display and interpret the information on the proportion of settlement and transport areas (SuV) at the federal state level as a map, diagram or table. Try to derive as much information as possible from this. The following sample questions are intended to stimulate further thinking:

- Which federal states have higher/lower SuV percentages in 2006 and 2016?
- Where is there an increase/decrease in the SuV share in the 10 years (2006 to 2016)?

- What influence do the classification methods (monitor vs. own presentation) have?
- In your experience, what form of use is recommended for the IÖR Monitor WebGIS service and WFS in QGIS?

If you are further interested, please follow the ADVANCED part of this exercise.