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PLUREL

PHOTO: THOMAS SICK NIELSEN

Sustainable urbanisation: new tool for impact analysis

One of the new decision-support tools developed in PLUREL is its Integrated Impact Analysis Tool (iIAT in brief). It compiles results from quantitative modelling of urbanisation and expected impacts on sustainable development at the European scale and for regional case studies.

With iIAT, users can conduct an integrated analysis of the situation in 2000, and of different scenarios of future development under global change trends. The tool's main purpose is to create awareness on how sustainability is affected at different scales for different types of regions. Moreover, iIAT helps identify where policy action might be necessary, both thematically and spatially.

The iIAT has two modules that cover two different spatial levels. The iIAT-EU covers 543 so-called NUTSX regions of the EU-27. The user can choose between 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 some 30 indicators with relevance for urban-rural functions. The iIAT-Region displays results from regional case studies.

Behind the surface: modelling in PLUREL

Impact analysis of urbanisation trends is a key research objective of PLUREL. Research questions addressed include: What can we learn about future urbanisation trends and their impacts in different parts of Europe? What is the specific role of the peri-urban sphere in the process of urban growth? How can we understand the relationships between urbanisation and its functional impacts in their spatial dimension? Does the governmental and planning framework affect urban growth or its impacts? Is it possible to identify and enhance understanding of the specifics of functional changes due to urbanisation within and between regions?

To answer these questions, PLUREL research applies models. Quantitative models, represented by mathematical algorithms, capture underlying causal pressure-state-impacts relationships, based on European and regional statistical and spatial data. Under the conditions of a scenario framework, development trajectories of global driving forces are explored for the years 2015 and 2025. Based on this, results from a land use change model (RUG) and Response Functions, regression models for impact indicators are integrated at the European level. Modelling at the regional level is carried out by means of the MOLAND model, which generates future land use distribution maps for planning scenarios on the basis of Corine Land Cover and statistical data. Generic models are rule and knowledge based, implying that they generalise a series of good practice examples following defined scientific procedures. Meta models, finally, integrate quantitative and qualitative information derived from different models. The iIAT compiles model results in two databases. Based on these, it carries out user-determined queries based on data aggregation procedures applying typologies.

The surface: a tool that meets user demands

PLUREL iIAT is accessible through the internet. The tool displays results in the form of so-called spidergrams, diagrams which facilitate understanding of multi-level information. The tool is interactive, offering the possibility for an in-depth view into different thematic and regional scopes and different scales, according to individual user interest. It accesses the impact assessment result database, and generates the demanded outputs in the graphical user interface. Through the latter it is possible to explore sustainable development trajectories, the effects of the regional framework, and planning policies and local governance. By its two different-level spatial modules, iIAT facilitates discussions of heterogeneous end user groups, ranging from an EU policy assistant to a local planner. Joint working with the tool promotes learning processes concerning different views on land use development.

The iIAT indicators

Users can choose between an aggregated sustainability analysis carried out for a predefined list of indicators, or a free combination of 3-12 indicators out of those included (specific indicators ana-

Table 1. Aggregated Sustainability Analysis.

Sustainability issue	iIAT-EU (NUTSX) Indicators	iIAT-Region (case studies) Indicators
Social	Single person household ratio Ageing Employment ratio	 Quality of life Housing
Environmental	Biodiversity Emissions Recreation	Climate adaptation and mitigation Ecologic regulation and biodiversity Living environment
Economic	Economic performance Educational level Agricultural production	Economic performance Resource provision Transportation

Table 2. Specific Indicators Analysis.

Sustainability issue	iIAT-EU (NUTSX) Indicators	iIAT-Region (case studies) Indicators
Social	1 person households 2 person households 3 person households 4 person households Educational level 1 Educational level 2 Educational level 3 Educational level 4 Population < 15 years Population > 60 years	Quality of life - overall measure Quality of life - noise pollution Quality of life - access to green space Quality of life - public transport Quality of life - shops in vicinity Quality of life - air quality Availability of recreational green space Energy provision
Environmental	No of Endangered Bird Species per 100 km^2 Interspersion and Juxtaposition Index Landscape Shape Index Effective Mesh Size Green Background Index Heavy Metal and other Emissions NOx Emissions CO Emissions HC Emissions	Breeding bird community Water supply Food production Land surface emissivity Carbon stock in vegetation and soil ETP (EvapoTransPiration)
Economic	GDP Total Employment Employment Sector I Employment Sector II Employment Sector III Employment Sector IV Artificial Area Agricultural Area Part-time farm holders	GDP External costs green space Costs Carbon stock Costs Air pollution

lysis). Both options are summarised in their respective table.

Using the iIAT-EU

To carry out comparisons, users can choose either specific or groups of regions, e.g. the entire EU-27 or all predominantly peri-urban regions of Europe. Each NUTSX region is characterised by an urban structure, and a bio-physical, socio-economic and regulatory profile, resulting from attributes that are derived from the 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. The data themselves will be transformed into standardised values in order to unify the scale of output data values between indicators.

The first figure offers an example of how iIAT-EU can be used for answering a specific comparative question. Assuming an oil crisis scenario, results show that peri-urban regions with different types of accessibility will differ in their artificial surface growth, as well as in related increase of employment, and related negative impacts on bird habitats. However, there are hardly any impacts on emissions (cf. Fig. 1).

Using the iIAT-Region

The iIAT-Region approach allows selecting or adapting the indicators listed in the tables. It also allows for using thresholds or for determining target values for single indicators. Based on these, the system will display the reciprocate effect on other indicators, as calculated by PLUREL's Multi-Criteria Analysis tool. Inputs to iIAT include land use change data and impact assessment models. As output, 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.

An example is shown in the screenshot of the iIAT-Region prototype (cf. Fig. 2).

The interactivity of the tool is similar as for iIAT-EU, allowing for comparison of existing results. Results are directly depicted as spidergrams, without any of the steps (in the form of tables) in between. The tool offers a methodology to include new MOLAND light model or other data, for example when a specific rural-urban-region wants to compare different planning options with its own indicators. The iIAT-Region identifies key questions of policy relevance. However, it does not assess impacts as sustainable or non-sustainable. Its purpose is to allow for stakeholders to interpret changes of impact issues, and to discuss interdependencies and their changes. In its present form, the tool does not (yet) deliver results for scenarios, specific regions, or indicators that were not computed by the PLUREL team. Neither does iIAT-Region currently plots maps. Even though it is not participatory in nature, the tool does facilitate participatory decision processes involving practitioners and/or policy makers.

The iIAT has been developed by a number of PLUREL partner institutions. It will be online accessible by the end of 2010.

Annette Piorr, Ingo Zasada, Regine Berges, Dirk Pohle, Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg
Dagmar Haase, Nina Schwarze, Helmholtz Centre foor Environmental Research – UFZ, Leipzig (Haase also Humboldt University Berlin)

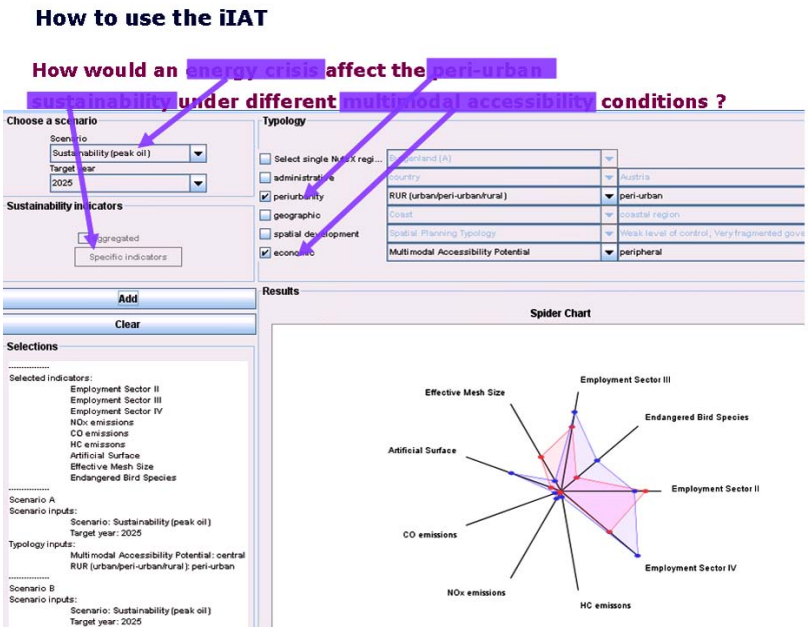


Fig. 1. Example of how to use the iIAT-EU.

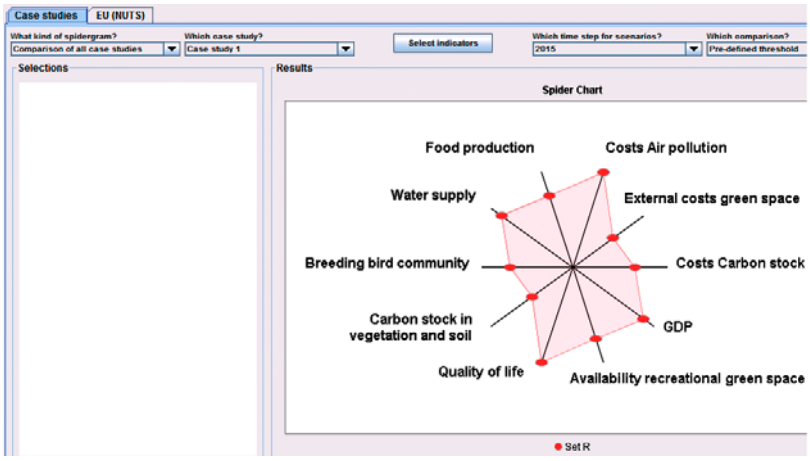


Fig. 2. Screenshot of the iIAT-Region prototype.

Planning instruments to control urban growth

It is challenging to plan and control urban development in peri-urban areas. But if no planning is done, the result will often be unsustainable, including widespread, dispersed and uncoordinated urban growth. Spatial planning based on zoning remains the most important planning instrument and its success depends on regional coordination. Incentive based instruments may contribute to growth management, but only few examples are available and their effects on urban growth patterns yet to be seen.

PLUREL has investigated the potential of different government structures, policies and instruments to deal with the problem of sprawl based on European cases, while also looking at China (Hangzhou) and the United States (Portland and Seattle).

Legal system and planning authority

Some planning instruments are defined nationally as frameworks within which regional and local levels have to operate. A legal system which empowers both planning and regulating urban development, and protects agricultural and natural areas, is of course of vital importance. Moreover, there is need for a planning system which ensures that local and municipal planning adheres to national policies and regional plans. Also essential is the existence of a regional planning authority with sufficient legal power, and with good professional competencies and negotiation skills to ensure a broad acceptance among local authorities. Regional co-ordination is that important because peri-urban municipalities often have less professional resources for spatial planning. Moreover, they often have a strong »individual« interest in a regionally dispersed urbanisation.

Visions and economic instruments

To support broad acceptance, a strong and clear »easy-to-grasp« vision for regional development can potentially guide all planning efforts in the region. Good, well-known examples accepted by professionals, politicians and the wider public alike, include visions such a »The Green Heart« of the Dutch Randstad, the »Urban Growth Boundary« of Portland (which is even mentioned in poetry and art), and the »Fingerplan« of Copenhagen.

Economic incentives and taxation developed for other purposes have long had – sometimes unintended – influence on spatial patterns. Differentiated taxation for different municipalities of a region is a well known »instrument« to disperse urban development. Other examples are various types of public support for commuters. Government support of agriculture tends to preserve agricultural areas, while support of urban regeneration encourages densification of urban development. In some cases, targeted economic incentives have been applied for directing urban development towards existing urban areas or for supporting farmers at the urban fringes. These include transfer of development rights in Seattle and support for »Blue-Green services« in The Hague, Netherlands. The efficiency of these policies in the long run remains to be seen.

Coordination and the prevalence of zoning

While there is evidence of mobility impacts on urban dispersion, there is little direct evidence of the contribution of infrastructure investments to the prevention of sprawl and containing of urban

development. However there is evidence that lack of coordination with other policies, especially infrastructure investments and housing policies, undermines regional planning, and that transit-driven urban development does lead to less dependence on cars.

In summary, spatial planning based on zoning is the most important planning instrument in most European cases. There are variations in the power of the planning authority as well as in the degree or commitment to regional cooperation. Planning of urban development at regional level is complicated by a number of factors, among which a fragmented regional government structure and lack of powers for planning at the regional level seem to be the most important. Spatially targeted investments may be in place as an important part of urban policies or urban development programmes. These also have a role to play in growth management.

Gertrud Jørgensen and Thomas Sick Nielsen, Danish Centre of Forest, Landscape and Planning, University of Copenhagen

Monetary valuation of peri-urban changes in The Hague and Warsaw

Study of citizens' preferences and willingness to pay provides important information to decision-makers about alternative possible options. PLUREL investigates the importance of this type of research. Examples from the project's case studies in The Hague and Warsaw illustrate this.

Most public policies affecting land use decisions entail a cost to society, in terms of higher taxes, higher prices, or reduction in the provision of other public goods and services. When considering new land use policies, it is therefore useful to gain insight in the public's preferences on the effects of those policies, as well to assess how much citizens are willing to pay to implement those changes.

Studying effects of land use policies

Within PLUREL, public preferences on the effects of hypothetical but realistic policies affecting land use at the urban and peri-urban level were studied. This was done by using Choice Experiments, a survey-based technique. Here we report the results from the cities of Warsaw, Poland, and The Hague, Netherlands.

After initial analysis and discussion with stakeholders about the most important effects related to land use policies, we focused on four selected effects that appeared to be relevant to the case studies chosen. These effects are

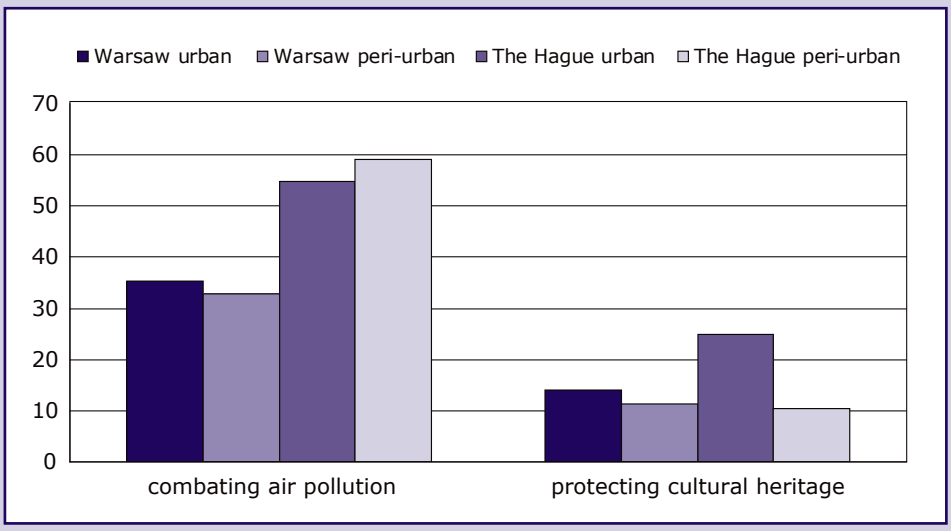
(i) improvement in air pollution caused by transportation;
(ii) protection of cultural heritage monuments;
(iii) development of new housing in green open spaces; and
(iv) development of new housing by refurbishing abandoned buildings, hence protecting green open spaces.

We investigated citizens' preferences and Willingness To Pay (WTP), expressed as a one-off tax, for the four effects. This was done by administering a choice experiment internet-based questionnaire to a sample of 500 respondents in every city.

Results from Warsaw and The Hague

The results from the choice experiments data show that respondents in both cities are strongly against developing new houses in green open spaces. In Warsaw,

Willingness to pay in euros for selected effects of land use policies.



respondents consider housing an important problem that should be solved by refurbishing abandoned buildings mostly in the urban area. Respondents favour policies that reduce air pollution from transport and protect cultural heritage. On average, citizens living in urban (peri-urban) areas are willing to pay €35 (€32) to decrease air pollution. With regards to cultural heritage, urban residents are willing to pay €14, and peri-urban residents €11, to protect cultural heritage monuments.

In The Hague, respondents favour combating air pollution and protecting cultural heritage monuments over solving housing problems. Respondents living in urban areas are willing to pay €55 to improve air quality and €25 to protect cultural heritage monuments. Respondents living in peri-urban areas consider air pollution more important than their urban counterparts, but they are less concerned about the protection of cultural heritage monuments than urban residents. Indeed, peri-urban residents' WTP for decreasing air pollution from transport and for protecting cultural heritage is €60 and €10 respectively.

There are clear differences in the results from the two cities. However, it appears that in both cities, among the effects considered by this study, respondents consider improving air pollution caused by transport as the most important effect to be considered by a land use policy.

Alberto Longo, Marco Boeri, Queen's University Belfast, and Tim Taylor, University of Bath

Manchester city-region – post-industrial peri-urban in search of a future

Manchester was one of the world's first industrialized and global trading cities, creating notorious levels of pollution and industrial sprawl. 150 years later the peri-urban is divided in many ways, with beautiful green infrastructure side by side with post-industrial waste. In each case there are local agendas struggling with global forces, re-inventing a future role and identity in a complex metropolitan landscape or »metro-scape«.

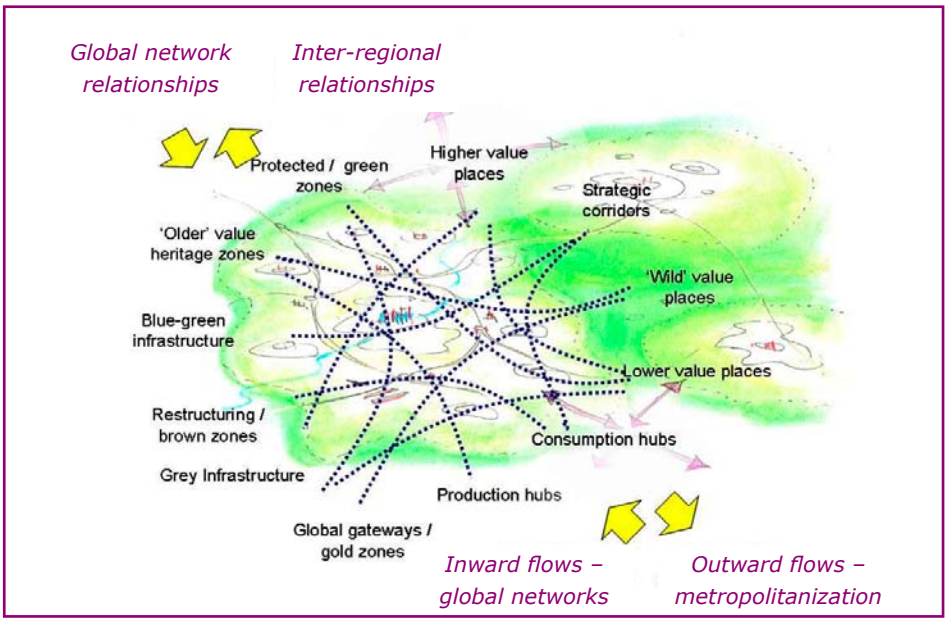
Greater Manchester (GM) in England is a conurbation of 2.5 million people, in 10 municipalities, with an area of 1280 km². A larger »rural-urban-region«, roughly a 1 hour commuting distance, has a population of nearly 4 million. At its core, the city of Manchester was one of the world's first industrialized and global trading cities. Its population grew rapidly from 1750 – 1900, and then declined from 1950 due to industrial restructuring. Since 1990 the population has returned to the city centre and some regeneration areas, many inner city neighbourhoods have stabilized, but some continue to be fragmented and chaotic.

Peri-urban landscape transitions

In the wider peri-urban area, there is a complex family of satellites – larger towns, smaller towns, new commuting settlements, peripheral public housing, and scattered settlements. In the upland landscapes of the South Pennines, most farming has declined, former industrial pollution has been cleaned up, natural areas have been conserved, and much countryside is accessible to the public. In the Mersey Belt area between Manchester and Liverpool, there are post-industrial landscapes still damaged by urban infrastructure and commercial development. And in the lowland farming areas of Cheshire, many settlements are dominated by wealthy commuters.

The PLUREL research approach aimed to look beyond the surface to explore three main peri-urban transitions:

- Metropolization: an urban transition, networked across wider peri-urban and rural areas;
- Cultural capitalism: a global transition – new patterns of globalizing economic / social structures and activities;



ARTWORK BY JOE RAVETZ

- Spatial ecology: a green infrastructure transition, with trends of localization and new identities of place.

Transitions in governance and social structures
Hanging over each of these are transitions in governance and social structures. Greater Manchester itself has a fragmented governance, split between ten independent municipalities. However there are experiments in progress with new forms of partnerships and consortiums.

The UK government has set up a City-Region Pilot programme, with a set of Commissions on environment, economy, housing etc, and a novel Low Carbon Economic Area Initiative. There is a relatively strong spatial planning system, and long experience of urban fringe policies and programmes.

While physical development is limited by the Green Belt and similar policies, social / economic / cultural change in the peri-urban area is rapid (depending on how it is measured). So the agenda is how to respond to new types of problems and opportunities in the peri-urban – not just physical sprawl, but the social / economic / cultural fallout from a large and messy urban system.

Overall the Manchester city-region shows a possible future path, with lessons for other parts of the EU. With a (more or less) effective spatial planning system, there is much experience in partnership agencies and multi-functional land-use. However there are also powerful forces, of globalization and privatization, social exclusion and fragmentation, and governance systems in continuous flux, which increase the challenge of the peri-urban agenda and the uncertainty of its future.

Joe Ravetz, Centre for Urban & Regional Ecology, University of Manchester

PLUREL People

Interview with Dagmar Haase, Humboldt University Berlin and Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany.

What is your role in PLUREL?
I coordinate regional-scale land use and impact modelling work and coordinate the Leipzig-Halle case study. Through involvement in the land use change modelling activities with MOLAND, in a region struggling in close vicinity of peri-urban growth and urban decline, one of my research priorities in PLUREL is to »place« shrinkage into land use modelling and impact assessment.

How will PLUREL benefit from your specific expertise?
I am a trained geographer and landscape ecologist and have quite some experience with interdisciplinary work. In an EU-funded project on adaptive management, I learnt working together with stakeholders and conducting participatory modelling work, an experience of benefit to the work in PLUREL. Moreover, the expertise of our entire UFZ-group in terms of quantitative analysis of land use changes is important for the project. Additionally, I am one of the contributors to agent-based modelling in PLUREL.

What will be PLUREL's most important results?
PLUREL develops methods and tools for assessing the impacts of land use change in peri-urban Europe. We compiled an up-to-date pan-European database on where either land consumption or abandonment is taking place in European rural-to-urban regions. Our scenarios then show where this will happen in the future. Based on locally adapted, participative scenario workshops, PLUREL developed spatially explicit land use change maps for selected rural-to-urban regions in Europe. These help evaluate the impact of planning and governance strategies on land use. The »light« version of MOLAND was specifically developed for screening processes at the regional level. PLUREL developed an integrated Impact Assessment Tool (iIAT) that summarises the manifold impacts of peri-urban land use change in easily comprehensible »spidergrams«.

Which challenges can stand in the way of PLUREL's success?
After three years of intensive research work, PLUREL has entered its final phase. All groups are working on the final products that will integrate our work, something requiring a lot of communication in order to fine tune the tools and their application by practitioners. In the case studies, considerable effort will be directed towards national and regional dissemination activities.

Why should policy-makers be interested in PLUREL?
PLUREL is among the largest land-use related EU-projects, bringing together vast experience in land use modelling and planning. It develops pan-European and regionally specific tools for assessing the impacts of urban growth and shrinkage, and for evaluating current land use planning and management strategies. The rich expertise and tools developed during four years of research will be offered in an easy-access format through the Xplorer platform. I think that every European and regional policy analyst, planner and policy maker should have a close look at this excellent instrument.

Upcoming events

PLURELS's International conference:
Managing the Urban Rural Interface – Strategies and Tools for Urban Development and Sustainable Peri-urban Land Use Relationships

19-22 October, 2010, Copenhagen, Denmark

Now open for registration at www.plurel.net/conference

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- Leibniz Centre for Agricultural Landscape Research, Germany
- Wageningen UR / Alterra, The Netherlands
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- Austrian Institute of Technology, Austria
- Institute for Local Government Studies, Denmark
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- Research Institute for Knowledge Systems, The Netherlands
- Technische Universität München, Germany

Peri-urban Land Use Relationships

Strategies and Sustainability Assesment Tools for Urban-Rural Linkages

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