

# DEUTSCHER AKADEMISCHER AUSTAUSCHDIENST

Programm Projektbezogener Personenaustausch

USA

Sachbericht

◆ Der Bericht ist bis spätestens zwei Monate nach Ablauf der Projektförderung vorzulegen ◆

## A) PROJEKTDATEN

<b>Projekttitel:</b>	<b>Analysis and Management of Landscape Transitions in the Urban Rural Gradient</b>
<b>Deutsche Institution:</b>	Umweltforschungszentrum Leipzig-Halle, Department Landschaftsökologie.
<b>Deutscher Projektverantwortlicher:</b>	Prof. Dr. Ralf Seppelt
<b>Amerikanische Institution:</b>	Gund Institute for Ecological Economics, University of Vermont, Burlington
<b>Amerikanischer Projektverantwortlicher:</b>	Prof. Dr. Alexey A. Voinov
<b>Projektlaufzeit:</b>	1.1.2005-31.12.2006
<b>Berichtszeitraum:</b>	1.1.2005-31.12.2005

## B) KURZE BESCHREIBUNG DER IM BERICHTSZEITRAUM DURCHGEFÜHRTEN ARBEITEN (ggfs. auf gesondertem Blatt fortfahren)

Bemerkung: Intern verwenden wir für die Berichterstattung und Ergebnisdarstellung englische Dokumente, daher ist die folgende Zusammenfassung der Ergebnisberichte der drei Gastaufenthalte von Frau Dühmann, Frau Holzkämper und Herrn Dr. Lautenbach ebenfalls in Englisch.

In the first period of the project the aim was to identify appropriate modelling and simulation tools and strategies to describe landscape functioning in the urban-rural fringe. We focused on the identification of appropriate modelling concepts for *intensively used* (see part II) and in terms of the hydrological processes *disturbed systems* (see part I).

**Part I: Eco-hydrological modelling in intensively used and disturbed landscapes, such as the peri urban frindge (Doris Dühmann, Sven Lautenbach).**

The first important question was to investigate the transferability of a grid based eco-hydrology model, the Landscape Modelling Framework (LMF) between different sites in anthropogenic influences regions. The model LMF simulates water, nutrient cycling and vegetation dynamics on a catchment's scale and is used to estimate the effects of changes in land use or land management on water and nutrient dynamics of a watershed. The model consists of modules from the Library of Eco-Hydrologic Modules (LHEM) and the Spatial Modelling Environment (SME), which connects these modules.

Here, LMF was applied to the 320 km<sup>2</sup> Parthe watershed located Southeast of Leipzig (Germany). This has to be seen as a first step, in order to evaluate the transferability of LMF several of such case studies in different watersheds are needed. Within this study the focus

was on hydrology. Applying LMF to the Parthe watershed included the following steps: First the input data were prepared and the model was set up for the Parthe watershed. In order to identify model parameters which could not be derived from measurements or estimations a strategy for model calibration was identified and applied. The model results were evaluated with respect to runoff, groundwater surface, water balance and spatial distribution of evapo-transpiration.

The transfer of LMF to the Parthe watershed showed that the model had several difficulties to simulate the hydrology of the Parthe watershed. A major problem was the spatial distribution of the simulated evapo-transpiration. The calculated hydrograph showed strong seasonality and was over- respectively underestimated and some of the peaks were not simulated. It was concluded that several changes to the model code were needed. This concerned processes which did not play a major role in previous study areas, e. g. runoff from snowmelt, but also process descriptions for evapotranspiration, percolation and backflow.

The results of the application of LMF to the Parthe watershed were made accessible via internet pages, which complement the internet pages of the application to the study areas (<http://www.uvm.edu/giee/IDEAS/parthe/>). A documentation which especially addresses new model users, who want to apply LMF to a specific catchment, was written. Further documentation of the modules especially regarding changes between different versions was added directly within the Stella module files. Some model equations were already changed, but further changes and model tests are necessary.

Based on these findings the aim the following discussion focused at the further development of grid based hydrological model for the Parthe and the Weiße Elster catchments in Germany. Since the transfer of the LHEM/SME model to the Parthe catchment. We concluded what the new model developed at the GUND Institute by Erica Gaddis could not be used for the purposes of an integrated landscape model in the German catchments. The model of Erica Gaddis focuses on phosphorus transport resulting in a detailed process description of surface flow and erosion processes. On the other hand groundwater transport is not relevant for the aim of the model, so related process descriptions in the model are not very detailed. Given the fact that groundwater is of some relevance for the hydrology of the Parthe and the Weiße Elster catchments we decided to develop a different model using the SME framework. A spatial explicit version of the semi- distributed hydrological model HBV-D will be used to cover the hydrologic processes for the integrated landscape ecology model for the two German catchments. A cross catchment application of the model is intended. Further discussions covered the selection of the algorithm for the lateral flows in the spatial explicit model and uncertainty aspects. A presentation of the model results in 2006 in Burlington is planned. Additionally extensions of the model system towards additional ecosystem services are considered. Future collaborations about the further development of the integrated landscape ecology model are intended (related publications: master thesis by Doris DÜthmann, in prep für 2006 by Sven Lautenbach).

## **Part II: Optimization of landscape functions within in antropogenic influenced regions.**

During the visit we developed a concept for incorporating an economic component into the optimization model to make optimization results more realistic by taking into account site specific earning capacities for different land use types. The incorporation of an economic component is especially interesting when linear changes like the introduction of hedges are modelled, as these changes can be directly coupled to costs for cultivating hedges. Thus it would be possible to estimate costs for improving certain landscape functions.

The presentation about my work that was held at the Gund Institute for Ecological Economics

on the 15<sup>th</sup> of September was followed by a fruitful discussion that lead to many new ideas. Some of the attendants (Alexey Voinov (Gund Institute of Ecological Economics), Theresa Donovan, Brian Mitchell (Rubenstein School of Environment and Natural Resources)) are involved in a project that aims at building habitat occupancy models for different species in Vermont. They plan to use these habitat models to evaluate different scenarios of land use change (UrbanSim) and to use them in an optimization model to enhance a landscape for these species. Future collaboration could therefore be based on adjusting my optimization model for land use patterns for the new study area in Vermont and transforming the routines for evaluation habitat suitabilities into SME (Spatial Modeling Environment) modules. (Resulting Publications /1, 2/)

## C) ERGEBNISSE DES GEMEINSAMEN FORSCHUNGSPROJEKTS

**Anzahl** der aus Ihrem Projekt im Berichtszeitraum hervorgegangenen

1. Diplom- bzw. Masterarbeiten	1
2. Dissertationen	0
3. Publikationen	1
davon zur Veröffentlichung angenommen:	0
zur Veröffentlichung eingereicht:	1
4. Konferenzbeiträge/Poster	2
5. Patentanmeldungen	0
davon angemeldet:	
patentiert:	

⇒ Bitte fügen Sie diesem Bericht eine listenmäßige Aufstellung aller o. g. Ergebnisse bei. Die Übersendung von einzelnen Publikationen ist nicht erforderlich.

### Tagungspräsentationen/Poster

1. Holzkämper, A., Lausch, A, Seppelt, R. (2005): How do changes in land use pattern affect species diversity? – An approach for optimizing landscape configuration. – 45th Congress of the European Regional Science Association, 23-27 August 2005, Vrije Universiteit Amsterdam, 13 p.

### Publikationen

2. Holzkämper, A., Lausch, A, Seppelt, R. : Optimizing landscape configuration to enhance habitat suitability for species with contrasting habitat requirements. submitted to Ecological Modelling on August 5th, 2005.

6. Bitte geben Sie an, ob Sie sich im Zusammenhang mit Ihrem Projekt erfolgreich um finanzielle Förderung aus anderen Quellen beworben haben (wenn möglich, bitte Geldgeber und Fördersumme angeben).

Zur Zeit sind Anträge in der Vorbereitung,

- EU-IP „PLUREL“ Peri-urban Land Use Relationships – Strategies and Sustainability Assessment Tools for urban-rural Linkages, Area V.1.1 Strategies for sustainable urban, peri-urban and rural land use relationships, 4<sup>th</sup> call, FP 6. erfolgreich in der zweiten Evaluationsrunde, 22 Europäische Partner
- BMBF Initiative GeoGRID.

7. Betreffen die unter Pkt. 6 genannten Anträge außer Ihrem Partner noch weitere Wissenschaftler/Gruppen? Wenn ja, nennen Sie hier bitte die Institutionen und Projektleiter.

8. Sind an Ihren Forschungsarbeiten auch Partner aus der Industrie beteiligt? Wenn ja, bitte spezifizieren.

nein

9. Bitte kreuzen Sie an, in welchem Maße Ihrer Ansicht nach die Ziele Ihres Projekts erreicht wurden  
(1 = Ziele in vollem Umfang erreicht)

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10. Raum für Ihre Anmerkungen

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Datum und Unterschrift des Projektverantwortlichen