

Land-system science for analyzing dynamic landscapes: data, tools and models

Summer School July 7 to 12, 2019

Venue: Seminarhotel Lihn (www.lihn.ch) Filzbach Glarus-Nord, Switzerland
Organizers: Swiss Federal Research Institute WSL, WSL Landscape Research Center; University of Bern, Center of Development and Environment CDE



View on the study region: Linth plain Switzerland (photo: S. Tobias)

You will develop an integrated understanding of land system science and landscape assessment. You learn to use state-of-the-art data, tools, and models for spatial analyses as well improve your ability to build strong connections between scientific understanding and the communities of practice and policy that govern and manage the use of land.

The summer school is structured according to the following main topics:

- Complexity of land-systems
- Assessing land-system change: data, models
- Implications of land-system change: land multifunctionality and ecosystem services, scenarios
- Steering land-system change: stakeholder involvement, visualization
- Summarizing the lessons learned

The teaching units include a field trip to the study region, lectures and practical exercises, students' group work, and a role-play of an expert panel reviewing the students' group work.

Lectures and practical exercises

Assessing land-system change: data

The students will learn data processing for **land cover mapping** and tackling the **scaling problem**. They will work on the study region using multiple sources of 2D and 3D remote sensing data from different time periods. The teachers will present different ways to map land cover using remote sensing methods and discuss the challenges and trade-offs. During the practicals, the students will work on specific examples for the study area. The students will also be taught in advanced modelling techniques, e.g. ensemble modelling, for land cover mapping both as a lecture and as a short practical.

Assessing land-system change: models

The students will learn about quantitative and qualitative techniques to develop and use scenarios to understand plausible future land system dynamics. Lectures and hands-on exercises focus on quantitative approaches of modelling land system dynamics for scenarios. Both existing simulations will be analysed and new scenarios created with a model application for an exemplary area.

Implications of land-system change: land multifunctionality and ecosystem services

The topics of ecosystem service, ecosystem mapping and conflict assessment between ecosystem services are introduced in the lectures. The lecture also presents approaches how the framework of ecosystem services could be conceptually enlarged to accommodate the notion "landscape", touching upon the concept of landscape services. Finally, it is shown how the ecosystem service concept can be embedded in landscape monitoring. The exercises focus on use and limitations of ecosystem-service mapping at different spatial scales. The students will work on examples considering conflicts with renewable energies or urban sprawl, applying INVEST software to map ecosystem services.

Implications of land-system change: scenarios

The students will be provided background information on the concepts and methodologies of scenario development focusing on combining qualitative and quantitative products. This is followed by hands-on exercises on narrative scenario development and how to translate this qualitative information obtained during stakeholder interaction to model input.

Steering land-system change: stakeholder involvement

The students will be introduced to qualitative and quantitative social science methods to investigate stakeholder preferences and opinions. In the hands-on practical, they will learn the basic principles of designing surveys and questionnaires.

In addition, the students will be taught the principles of stakeholder involvement for participatory research and planning processes. They will learn and train methods of workshop organisation and their range of application.

Steering land-system change: 3D visualization for collaborative planning

The students will be introduced to GIS-based 3D landscape visualization techniques. Based on examples of two different visualization types the use and applicability of such tools for collaborative planning will be demonstrated. The first example shows a web-based 3D Decision Support System (3D DSS) that helps discussing and negotiating heterogeneous landscape values in the process of power line planning. The second example is about point cloud-based 3D simulations of renewable energy scenarios in different landscape types for systematically studying the public perception of and preferences for these landscape changes. Finally, there will be an outlook on emerging new visualization technologies.

Students' group work

During the week, the students will accomplish draft project proposals in groups of two students. The products will be research/project proposals to tackle certain problems in the study region. The students can select their group work out of the following topics:

- **Nearby recreation:** Students will read 1-2 key papers in recreation research and design their own model. The latter aims at identifying attractive locations for near-by recreation and will be based on empirical preference patterns of various user groups. Spatially explicit GIS data of the region will be provided together with typical Swiss preference patterns. However, students are encouraged to perform a cross-cultural comparison of dominant recreation patterns in their home country.
- **Landscape connectivity:** This exercise will deal with connectivity of organisms in human-dominated landscapes. Increasingly, wetlands and small 3D structures (e.g. rock piles) have become scarce in the intensely used landscape. Therefore, conservation management is interested in assessing the permeability of the landscape to species, also for changing landscapes in the future. Students will also evaluate different methodological approaches to quantify connectivity and assess use and limitations of the methods as well as their suitability to present the expected results to land managers and stakeholders.
- **Land cover and land use (change):** The students will sketch a project using satellite Earth Observation data to identify land cover and land use in the study area. They will assess data from different Earth Observation platforms and ascertain land use intensity.
- **Sustainable development goals:** The students will develop and discuss alternative options for the study region to contribute to the sustainable development goals for 2050 by modifying the land use of the region.
- **Sustainable urban development:** The students will outline a proposal for a research project involving local stakeholders to develop a road map towards SDG 11 "sustainable cities and communities" in the study region.

The presentations on Friday will be organized as a role-play of a review panel. Each student group will present their research proposal and the audience, i.e. the other students and the lecturers, will ask questions similar to a review panel.



Program

Sunday,

July 7, 2019

12:00–16:00	Individual arrival	
16:45–17:00	Welcome address	J. Bolliger
17:00–18:15	Icebreaker: Group work experiencing interdisciplinarity; Plenary presentation with welcome drink	S. Tobias
18:30–19:30	Dinner	S. Tobias
19:45–20:30	Lecture: introduction to the study region	

Monday,

July 8, 2019

9:00–9:20	Objectives and concept of the summer school	J. Bolliger
9:20–9:50	Opportunities for land-system science	P. Verburg
9:50–10:20	Presentation of GLP	A. Ehrensperger
10:20–10:40	Break	
10:40–11:00	Organizational information	J. Bolliger, S. Tobias
11:00–11:45	Selection of group work	
11:45–12:45	Lunch	
13:00–18:30	Field trip	S. Tobias
19:00–20:00	Dinner	

Tuesday,

July 9, 2019

8:30–9:10	Lecture: Data for land-system research: remote sensing	C. Ginzler
9:10–10:10	Practical: Scale and land-cover/land-use mapping using RS	C. Ginzler, A. Psomas
10:10–10:30	Break	
10:30–11:15	Lecture: Earth observation in the cloud	A. Psomas
11:15–12:00	Lecture: Classification of RS data for LU/LC maps	B. Price
12:00–13:00	Lunch	
13:00–13:40	Lecture: Why model? Land change models and their applications	P. Verburg
13:40–14:40	Practical: Modeling the driving factors of land use change	P. Verburg
14:40–15:00	Break	
15:00–16:00	Lecture/Practical: Dynamic models	P. Verburg
16:00–19:00	Group work/sports, etc.	
19:00–20:00	Dinner	

Wednesday,

July 10, 2019

8:30–9:15	Lecture: Land multifunctionality and ecosystem services	F. Kienast
9:15–10:10	Lecture: Connectivity in multifunctional landscapes	J. Bolliger
10:10–10:30	Break	
10:30–12:00	Practical: Land multifunctionality; land-use conflicts	J. Bolliger, F. Kienast
12:00–13:00	Lunch	
13:00–13:40	Lecture: Scenarios: definitions, concepts, and use; qualitative participatory scenarios	K. Kok
13:40–14:40	Practical: Qualitative scenario development	K. Kok
14:40–15:00	Break	
15:00–16:30	Practical: Qualitative scenario development	K. Kok
16:30–19:30	Group work sports etc.	
19:30–20:30	Dinner/BBQ outside of hotel	



**Thursday,
July 11, 2019**

8:30–9:00	Lecture: Introduction in social-science approach (main principles and theories), including intervention-research	M. Hunziker
9:00–9:30	Lecture: Overview social-science methods with examples from empirical studies	F. Wartmann
9:30–10:45	Practical (including 30' break): Research design and sampling	M. Hunziker, F. Wartmann, B. Salak
10:45–11:15	Lecture: Overview quantitative methods in (landscape related) social science, operationalisation of latent concepts, insight into discrete-choice modelling and factor analysis, insight into results of an experimental approach	B. Salak
11:15–12:00	Practical: (a) operationalising latent concepts for a questionnaire (b) design of a interview guide line for qualitative interviews	M. Hunziker, F. Wartmann, B. Salak
12:00–13:00	Lunch	
13:00–14:30	Practical: Combining qualitative scenario development with scenario modeling	K. Kok
14:30–15:00	Break	
15:00–15:30	Lecture: 3D visualization for landscape and environmental planning	U. Wissen Hayek
15:30–16:15	Demo and practical: 3D DSS for power line planning	U. Wissen Hayek
16:15–16:35	Break	
16:35–17:30	Lecture and demo: 3D point cloud visualizations for landscape perception studies	U. Wissen Hayek
17:30–19:30	Group work/sports, etc.	
19:30–20:30	Dinner	

**Friday,
July 12, 2019**

8:30–10:00	Mock review panel	all
10:00–10:20	Break	
10:20–12:15	Mock review panel	all
12:15–12:30	Closing	S. Tobias
12:30–13:45	Lunch	
14:00–17:00	Individual departure	

Lecturers



Janine Bolliger has conducted several modelling studies on impacts of land change in Switzerland. Her research particularly focuses on connectivity in a spatial context.



Silvia Tobias has led several inter- and transdisciplinary research programs on urban and landscape development. She is a specialist in research at the science-practice interface and in outreach activities.



Felix Kienast is Professor for Landscape Ecology at ETH Zurich and a specialist in landscape studies that link physical and socio-economic properties of landscapes. He was involved in several recreation studies, urban sprawl and landscape service modelling and is responsible for the Swiss landscape-monitoring program.



Christian Ginzler has a long year experience in remote sensing and photogrammetry. He works on high-resolution spatial data generation for environmental monitoring programs like the National Forest Inventory and the national Biotope monitoring.



Achilleas Psomas is a remote sensing and GIS expert with a background in forestry. He works with time-series of satellite data for modelling vegetation processes and has experience with optimizing sampling design and sampling design methods.



Bronwyn Price works on spatially explicit modeling of land use patterns and processes with particular focus on the use of remote sensing data including satellite imagery, stereo aerial photography and aerial laser scanning (LiDAR). The modeling of 3D landscape connectivity and dynamics of land use intensity and change as well as scenarios of future land use change are also key foci of her research.



Peter Verburg is professor in Environmental Geography at VU University Amsterdam and a visiting professor at WSL, Switzerland. Peter is an expert in land system science working from local case studies to global scale assessments. He is a specialist in dynamic, spatial models of land system change.



Marcel Hunziker is head of the research group "Social Sciences in Landscape Research" at WSL. He has led several national and international research projects on landscape preferences, human-nature relationship, acceptance of nature conservation, and the effect of interventions measures on (recreation) behaviour. Marcel holds a teaching position at ETH Zurich.



Ulrike Wissen Hayek is an expert in developing and implementing GIS-based 3D landscape visualizations and visual-acoustic simulations for participatory landscape and environmental planning.



Albrecht Ehrensperger is Head of Land Resources at the Centre for Development and Environment (CDE) at the University of Berne. He studied geography and anthropology at the University of Bern and received his doctorate in geoinformation systems for sustainable development. He worked for Caritas in Kenya and Somalia before joining the CDE as a research associate. Since 2016 he has also worked for the Global Land Programme on Agenda 2030 and related land issues.



Kasper Kok is Assistant Professor at Wageningen University and holds a PhD in land use modelling. He develops integrated, multi-scale scenarios, both by linking participatory and model-based knowledge and by combining socio-economic and biophysical factors. He uses scenarios and participatory methods to integrate knowledge systems and discuss trade-offs between social, economic, and environmental issues with a large range of stakeholders.



Flurina Wartmann is a Postdoc in the 'Social Sciences in Landscape' research group at WSL. She investigates how we can assess landscape perception and cultural landscape values using interdisciplinary approaches including public surveys, participatory mapping and social media data analysis.



Boris Salak is a Postdoc in the 'Social Sciences in Landscape' research group at WSL. He was involved in several renewable energy, recreation and regional development studies. His work at WSL focusses on the research of the perceived change of landscape quality through renewable energy infrastructures. This can help to identify and understand social patterns of preference (acceptance/non-acceptance) of ongoing landscape developments and can potentially contribute to sustainable developments.