

# Report 2006 to 2008

Climate & Environmental Change



Sustainable Land Use



Food, Environment & Health



Natural Resources



Natural Hazards & Risks



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Competence Center  
Environment and Sustainability

# Report 2006 to 2008

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CCES, December 2008

## Welcome to the CCES Report 2006 to 2008

The Competence Center Environment and Sustainability of the ETH Domain was established on January 1, 2006. We are pleased to present the achievements of CCES during the first three years of activities in this report.

Following a two-year preparation phase of scientific discussions and planning, leading to the establishment of CCES, the main focus of the 2006 to 2008 initial phase has been the establishment of multidisciplinary inter-institutional research projects in the fields of environment and sustainability: a synergistic portfolio of 17 research projects and two research platforms has been initiated; overall, more than 600 scientists and engineers from the schools and research institutions of the ETH Domain are participating in large research consortia, bringing together the multidisciplinary expertise required to tackle scientific issues of crucial societal relevance; the CCES support is being used to successfully leverage matching in-kind and third-party contributions, with an overall volume of over CHF 100 million of research and development activities; CCES projects have a high presence in SNF-funded activities and in the 7th Framework Programme of the EU; the various involved partners acquired the experience in developing, writing, and evaluating complex large-scale multidisciplinary projects; CCES established the appropriate administrative structures and procedures to ensure the managerial and quality control of the Competence Center and its activities.

This report describes the current status and achievement of CCES in its 2006 to 2008 implementation period. In the first section, an introduction to CCES is given – its origins, strategic orientation, organization, main activities and achievements, and outlook. The second, main section of the report describes the program and results of the research projects in the five thematic areas of CCES. In Appendix we inform on CCES publications, presentations and on research proposals submitted to the Swiss National Science foundation and to the 7th EU Framework Programme.

CCES achieved all the aims and milestones planned for the initial period. The consolidation of CCES beyond the research projects and towards a more direct knowledge and information exchange with society and stakeholder groups will be one of the challenges of the coming years. On the basis of the successful implementation and of the excellent portfolio of research activities initiated in 2006 to 2008, we are confident that the synergistic potential of CCES will be fully realized in the next phase.

Domenico Giardini  
Director CCES

Nikolaus Gotsch  
CCES Executive Manager

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# PART I

## CONTEXT AND OVERVIEW

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## CONTEXT AND OVERVIEW

In 2000, the United Nations Millennium Development Goals stated that the principles of sustainable development should be integrated by 2015 into country policies and programs. To meet these goals, a new thinking and priority setting needs to be established, based on sound scientific and engineering knowledge. With CCES, the ETH Domain aims at providing the scientific basis for this integration in Switzerland and more generally as a global player.

The mission of CCES is to identify the relevant questions and the appropriate answers to foster the sustainable development of our future society while minimizing the impact on the

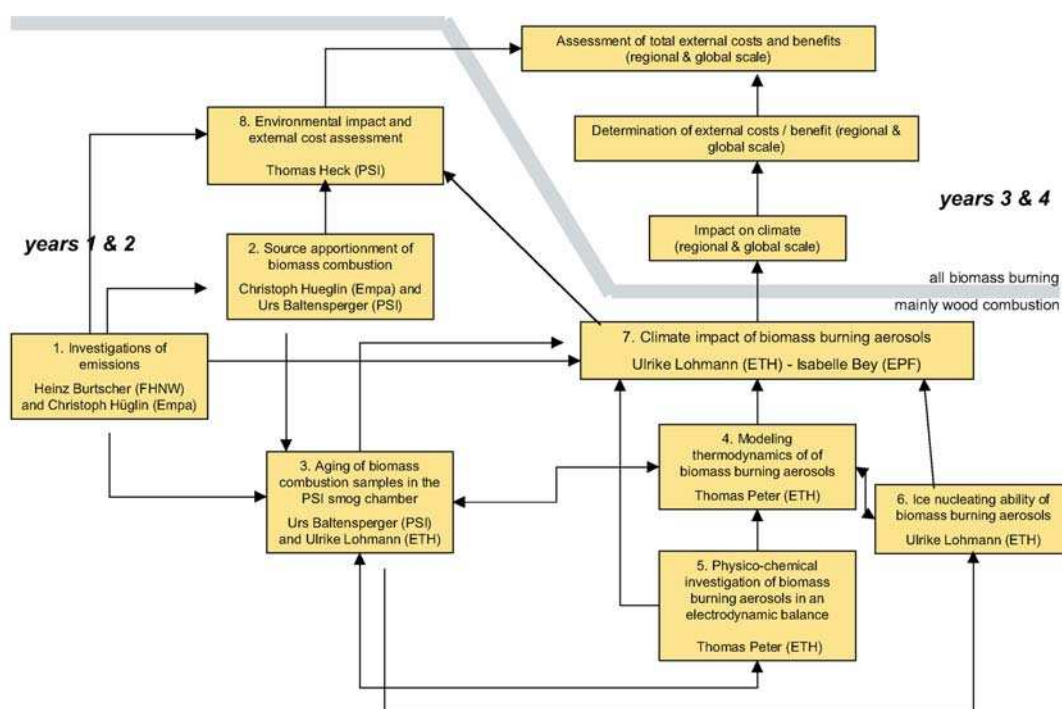
environment. In line with this mission, the overall strategic goals of CCES are to foster major advancements in scientific and engineering research, to establish CCES partners as international and national focal points for environment and sustainability as well as to achieve a visible societal impact with a focus on socio-economic implementation. CCES activities focus on research and applications on themes crucial for our future, ranging from climate and environmental changes to food safety, sustainable land use, natural resources and the management of natural risks.

## Retrospect

The origins of the Competence Centers of the ETH Domain go back to the approval by the Swiss National Assembly in 2001 of a postulate by National Councilor B. Haering requesting the evaluation of the Research Institutes of the ETH Domain. The ensuing strategic discussions lead to the approval of four Competence Centers by the Board of the ETH Domain in December 2004, among them the Competence Center Environment and Sustainability (CCES) under the lead of ETH Zurich; aim of the Competence Centers is to strengthen the cooperation between the four Research Institutions and the two Polytechnical Schools of the ETH Domain, and to improve the overall position of the ETH Domain in areas of key societal and economic

relevance. In 2005, a project organization group chaired by Prof. H. Flühler of ETH Zurich developed the business plan and identified the first thematic research areas of CCES. In December 2005, the business plan was approved by the Board of the ETH Domain and CCES started on January 1, 2006.

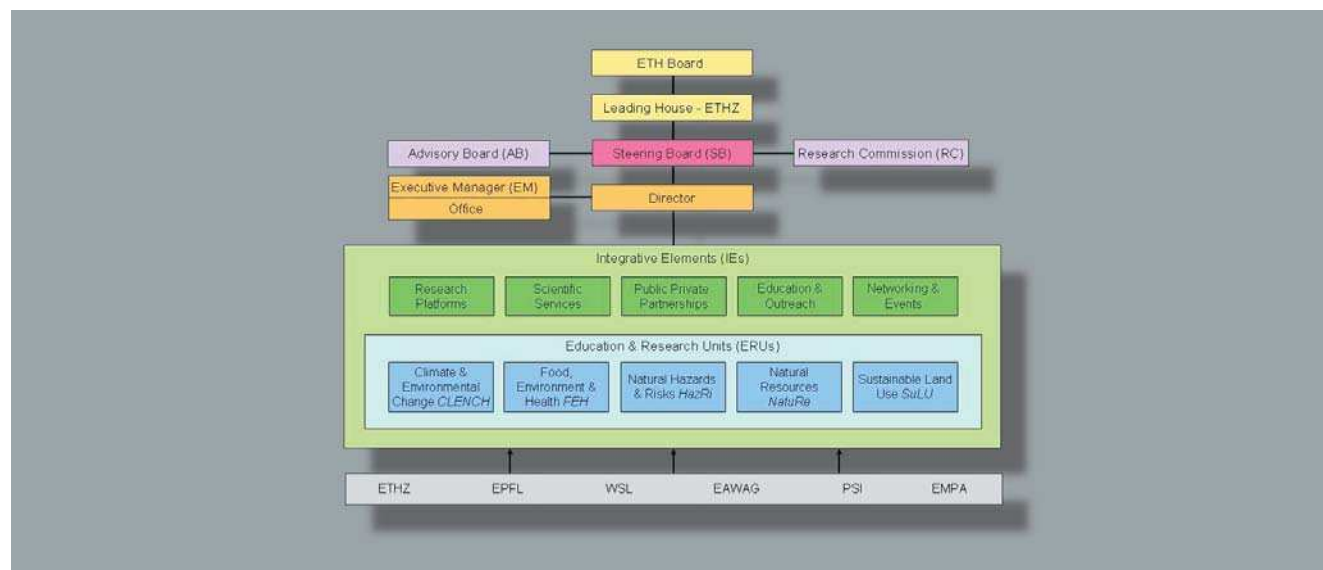
Following the funding schedule of the ETH Domain, CCES was supported for an initial two-year installation phase (2006 to 2007) and then approved for a four-year operational phase (2008 to 2011). In January 2009, CCES will be evaluated by its Advisory Board. The results of the evaluation will form the basis for a decision on the future strategic orientation of CCES by the ETH Board.



Project IMBALANCE as an example for bringing together the multidisciplinary scientific expertise available in the CCES institutions



## Partnership and Organization



### Partner Institutions and ETH Board

ETH Zurich, EPF Lausanne and the four research institutions Eawag, WSL, PSI and EMPA form the ETH Domain under the strategic leadership of the ETH Board as the supervisory body. Partners from all Domain institutions participate in CCES, with ETH Zurich as the Leading House. Within the scope of the CCES-funded projects, partners from the universities of applied sciences, from the private industry as well as from federal and cantonal authorities and communities are also involved.

### Steering Board

The Steering Board is the strategic forum responsible for the overall strategy and planning, the allocation of resources, and the scientific and institutional profile of the CCES. It is composed of the Presidents of the Leading House ETH Zurich and of the ETH Lausanne (as guest), one additional representative of ETH Zurich and EPF Lausanne each, the directors of WSL and Eawag, and three external members from politics, international science, and industry.

### Advisory Board

The Advisory Board is responsible for the overall review of CCES and its activities. It advises the Steering Board on the strategic priorities, fields of activities, and overall objectives to be pursued. It is composed of leading international scientists with recognized expertise in one or more of the CCES' focal topics. For the 2006 to 2010 period, the members of the Advisory Board are: Prof. Sierd A.P.L. Cloetingh, Institute of Earth Sciences, Free University Amsterdam; Prof. Rita R. Colwell, Center for Bioinformatics & Computational Biology, University of Maryland; Prof. Charles Godfray, Department of Zoology, University of

Oxford; Prof. Ignacio Rodriguez-Iturbe, Civil and Environmental Engineering, Princeton University; Prof. Marcel Tanner, Swiss Tropical Institute, University of Basle; Prof. Heinz Wanner, Institute of Geography, University of Berne.

### Research Commission

The Research Commission of ETH Zurich (augmented by members from other CCES partner institutions) is in charge of evaluating the individual CCES research projects based on the results of high-standard international peer reviews, and of making recommendations for funding to the Steering Board.

### Director and Executive Manager

The Director is responsible on the operational level for the planning, design, and implementation of CCES; Prof. D. Giardini of ETH Zurich is the CCES Director for the period of 2006 to 2008. The Executive Manager, Dr. N. Gotsch, is responsible for the organizational, financial, and administrative functioning of CCES as a whole.

### Program Committee

A Program Committee supported CCES in the planning and initial implementation phase. It was composed of two to three leading scientists and engineers for each of the thematic areas, of representatives from social sciences and economics, as well as of the Director of the ETH Zurich North-South Center, and chaired by the CCES Director. The Program Committee ensured cohesion across the whole program and promoted the bottom-up definition of the thematic areas and research projects. The Program Committee was discontinued in spring 2008, once the CCES research portfolio had been defined and approved.

## Research Projects

Following the two-year preparation phase of scientific discussions and planning, leading to the establishment of CCES, the main focus of the 2006 to 2008 initial phase has been the establishment of large-scale multidisciplinary inter-institutional research projects in the field of environment and sustainability: a synergistic portfolio of 17 research projects and two research platforms has been initiated (a full description of the CCES projects is given in Part II).

The definition of thematic areas, project ideas, and the elaboration of project proposals have been the result of bottom-up initiatives from the respective scientific communities. Projects are selected by the CCES Steering Board after passing a rigorous international peer-review. By participating in CCES, the involved partners acquired the experience in developing, writing, and evaluating complex large-scale multidisciplinary projects. Characteristically four to twelve partners from two to five ETH Domain institutions are participating in a CCES project, lasting normally four years. Overall, more than 600 scientists and en-

gineers from the schools and research institutions of the ETH Domain are participating in large research consortia bringing together the multidisciplinary expertise required to tackle scientific issues of crucial societal relevance.

The focus of CCES is on research collaborations which cannot be supported through traditional channels and which can demonstrate a clear added value by bringing together the project consortium. The overall CCES funding allocated to the approved CCES projects and research platforms is of CHF 30.4 million; following the established funding principles, the CCES support is being used to successfully leverage matching in-kind and third-party contributions, with an overall volume of over CHF 100 million of research and development activities. As a result, a significant focusing and re-direction of the research priorities has taken place in many institutes and groups, and CCES projects have a strong presence in SNF-funded activities and in the 7th Framework Programme of the EU.

## Integrative Elements

In addition to the research projects, synergies among CCES partners as well as among ERUs and CCES projects are enabled through the establishment of Integrative Elements, including:

- Research Platforms
- Scientific Services
- Public Private Partnerships
- Education and Outreach
- Networking and Events

### Research Platforms

In the environmental science domain, drawing accurate scientific conclusions, forecasting or validating models requires widespread temporal and spatial environmental monitoring. The overhead in collecting these observations is large and very often duplicated between projects and institutions, whereas the collected data would be more effectively used if shared between projects. Using these synergies also helps us to understand the links between interdisciplinary processes. The widespread use of advanced technology characterizes the entire CCES, ranging from advanced computing to analytical labs to research stations and visualization platforms. There is a need to coordinate, integrate, and improve the methodological tools and specialized equipment operated by experts in several fields, through the development of research platforms. Two platforms have been supported so far by CCES: the research platform Swiss Experiment brings together field measurements with cyber-infrastructure, and the Center for Genetic Diversity supports research on all aspects of genetic diversity (full description is provided in Part II).

### Scientific Services

Important services activities are offered by the partner institutions of CCES, covering crucial sectors in the surveillance and alerting of natural hazards and environmental processes and habitats. These service activities are often regulated at federal or cantonal level, and financed through a variety of internal and external funding sources. They include: earthquake surveillance and hazard assessment (Swiss Seismological Service, ETH Zurich), avalanche warning (SLF/WSL), species and habitat management (BAFU/WSL), forest inventory (BAFU/WSL), virgin forest reservations (Urwaldreservate, ETH Zurich), water quality assessment (BAFU/Eawag). Additional modeling capabilities in the ETH Domain are concentrated in fields such as the modeling of groundwater and surface water processes, flood prediction, erosion control and nutrient export from cultivated land.

To maintain the services at the highest quality standards, a continuous link between science and developments in the interpretation of observations and modeled results is required. These activities are important for ETH because they constitute the key service activity of ETH toward other federal offices, they attract substantial external funding, have a clear societal relevance and public recognition, receive consistent press coverage and contribute to build the ETH profile as an important component of the Swiss society. From a scientific point of view, they offer the unique possibility and important advantage of controlling the whole chain of specific environmental processes, from the monitoring and data collection, to modeling and forecasting.

Through its projects and platforms, CCES aims at supporting the development of the tools for future monitoring strategies. A recent example is the on-going revision of the federal law on public alert (Alarmierungsverordnung, SR 520.12), which now lists SLF/WSL and the Swiss Seismological Service (SED/ETH Zurich) together with MeteoSchweiz and BAFU as the single official voice for natural risks. The new decree of the Federal Council (Bundesratsbeschluss) is expected at the end of 2008. CCES is helping in developing common methodologies for data collection, distribution, and assimilation (TRAMM, APUNCH, COGEAR, SwissEx).

### Public Private Partnership on Natural Hazards

Swiss and international property insurers as well as providers of financial services have an increasing demand for sound methods and instruments to identify, handle, and assess the natural hazards they cover in their portfolio, whereas the partners in the ETH Domain institutions have the thematic «state of the art» know-how to develop and advance knowledge on natural hazards and risk-management methodologies. This know-how is scattered over several institutions of the ETH Domain and needs to be gathered and coordinated on specific projects. The ongoing pilot project for a Public Private Partnership (PPP) in the field of natural hazards aims at addressing issues ranging from the vulnerability in the context of floods, windstorms and earthquakes, to the influence of protection measures on vulnerability, the valorization of hazard maps for property insurers and the increase of risk awareness in general. The pilot project started with a kick off meeting in October 2007, and has since constituted a steering committee and selected the first applications.

### Education and Outreach

In the strategic plan of CCES, Education and Outreach are identified as key elements of the CCES implementation. CCES may help by complementing existing education and outreach activities in a subsidiary way, using the competences and expertise accrued in its activities. In autumn 2006, a working group with participants from all CCES partner institutions was formed to address of the current activities of the CCES institutions, the potential to establish a comprehensive joint education and outreach strategy based on the mission as well as the strategic goals of CCES, and the definition of further work and a financial plan for the establishment of such a program.

The working group concluded that a comprehensive education and outreach program should include the following elements:

- Graduate Program on Environment and Sustainability
- Continuing Education Program on Environment and Sustainability
- Common Communication Strategy
- Primary and Secondary Education

The report «CCES Business Plan for Education and Outreach» was evaluated by the Steering Board in spring 2007; the Board supported in principle the elements of the report and as-

signed to the individual CCES institution the mandate to improve and integrate their Education and Outreach activities. ETH Zurich since then established a new position for the coordination of Sustainability activities under the office of the President, and formed the North-South Center, devoted to research, education and technology transfer toward developing countries.

### Networking and Events

In addition to the scientific cooperation enabled by the individual research projects, CCES also pursues wider networking goals in order to enable the participation of CCES researchers in other research programs and frameworks.

As an example, CCES led the preparation and negotiation for the Environmental Monitoring & Modeling (EM&M) program, the first program approved within the Singapore-ETH Center for Global Environmental Sustainability (SEC). EM&M will focus on areas of crucial relevance for environmental sustainability, including climate and environmental change, natural resources, natural hazards and risks, and economics of environmental sustainability and policy making. Analog to CCES, the EM&M portfolio of R&D activities has been planned as a suite of integrated large-scale joint collaborative projects, technology platforms, and experimental facilities. While EM&M has been approved by the Singapore authorities, the overall approval of SEC is pending.

A second example is given by the report «High-Performance Computing at ETH Zurich: Applications in economic risks, natural hazards and climate change. Strategic Framework, Research Challenges, Technical Requirements». The report was commissioned by the Vice President Research of ETH Zurich and prepared under the editorial lead of the CCES Director. The report, delivered in May of 2006, provides a detailed analysis of the needs and requirements for the selected fields of application, and develops the elements of a common strategy to enhance numerical modeling capacity at the ETH Domain scale.

A key component of the networking strategy of CCES is achieved through meetings and workshops, to effectively bring together the research and engineering communities on specific themes. A series of open nation-wide ERU workshops was held to initiate activities in each thematic area, and approved CCES projects and platforms organize kick-off meetings, yearly project meetings, PhD meetings and focused workshops.

In addition, a first important public activity of CCES was the organization of the Latsis Symposium 2007 «Research Frontiers in Environment and Sustainability», held at ETH Zurich in September 2007, organized by CCES in cooperation with its partner institutions ETH Zurich, EPF Lausanne, Eawag, and WSL. The Symposium included presentations of renowned international experts as well as poster sessions (<http://www.cces.ethz.ch/latsis2007>).

In January 2009, CCES will support the Alliance for Global Sustainability in organising the AGS annual meeting «Urban futures: the challenge of sustainability» at ETH Zurich from January 26 to 29, 2009 (<http://www.cces.ethz.ch/agsam2009>).

## Outlook

### Present to 2011

Since its inception in January 2006, the Competence Center Environment and Sustainability (CCES) has focused on creating an outstanding portfolio of large, interdisciplinary projects that leverages the capacities of the ETH Domain by building collaborative partnerships among the six ETH Domain institutions. This has also required the development of a structure and processes by which such large, complex, and innovative projects can be conceived and realized. Through the end of the current CCES funding period (December 2011), CCES funds have been fully committed, primarily to support the research projects and technology platforms. Therefore, the efforts of the CCES leadership during this period will be directed toward ensuring the successful outcome and visibility of the running projects.

Outreach is an important component of CCES and its projects, but in the initiation phase of CCES, it was necessarily subordinate to the development of the CCES project portfolio. Now that the projects are running and beginning to generate exciting results, outreach for the individual projects and sub-projects will generate more visibility for CCES (as was achieved through the presentation of results from the CCES project Record at the Eawag Infotag in September 2008). In addition, visibility for CCES as a program has been achieved through research-focused events such as the Latsis symposium in September 2007.

A critical activity for the near term is a self-assessment of the success of CCES as a mechanism to foster inter- and transdisciplinary research that addresses the important challenges facing society in the area of environment and sustainability. This assessment should identify the strengths of CCES to be fostered and the weaknesses to be remedied, evaluate the value placed on CCES by its scientific participants, and include a recommendation to the ETH Board regarding the continuation of CCES for the period 2011-2015. It should identify the emerging challenges and new scientific priorities that would be the basis for setting the future direction of CCES.

### Prospects beyond 2011

The investment made by the ETH Board in CCES has resulted in the development of collaborative partnerships among the ETH Domain institutions and in the initiation of large, complex interdisciplinary projects. With such complex endeavors, however, support is needed not only for their initiation but also for their consolidation. Realization of the full potential of CCES would require further investment by the ETH Domain to consolidate the current activities and to develop aspects of CCES that were envisioned at its inception but were not implemented in its initial phase (i.e., up to 2011).

The CCES would be expected to serve as a magnet for enhanced collaborations across and beyond the ETH Domain. Greater cooperation with the Competence Center Energy and Mobility (CEEM) offers the opportunity of leveraging efforts within both Competence Centers. Additional partnerships, particularly with the Swiss Agricultural Research Stations (Agroscope) of the Federal Office for Agriculture, could be developed. CCES also offers a platform for engagement in large-scale research frameworks sponsored by the SNF and EU.

With its portfolio of research projects and technology platforms as a base, the CCES could strengthen the coherence among individual projects and develop the Center's identity and visibility through joint public events and outreach. The CCES could serve as a venue for knowledge and information exchange with external stakeholders, thus increasing the societal understanding of sustainability and the ability of stakeholders to implement sustainability solutions. Strong engagement with the Swiss Federal Offices would be a key component of sustainability implementation.





# PART II

## EDUCATION AND RESEARCH UNITS / RESEARCH PLATFORMS

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### NatuRe

Natural Resources ..... 40

### HazRi

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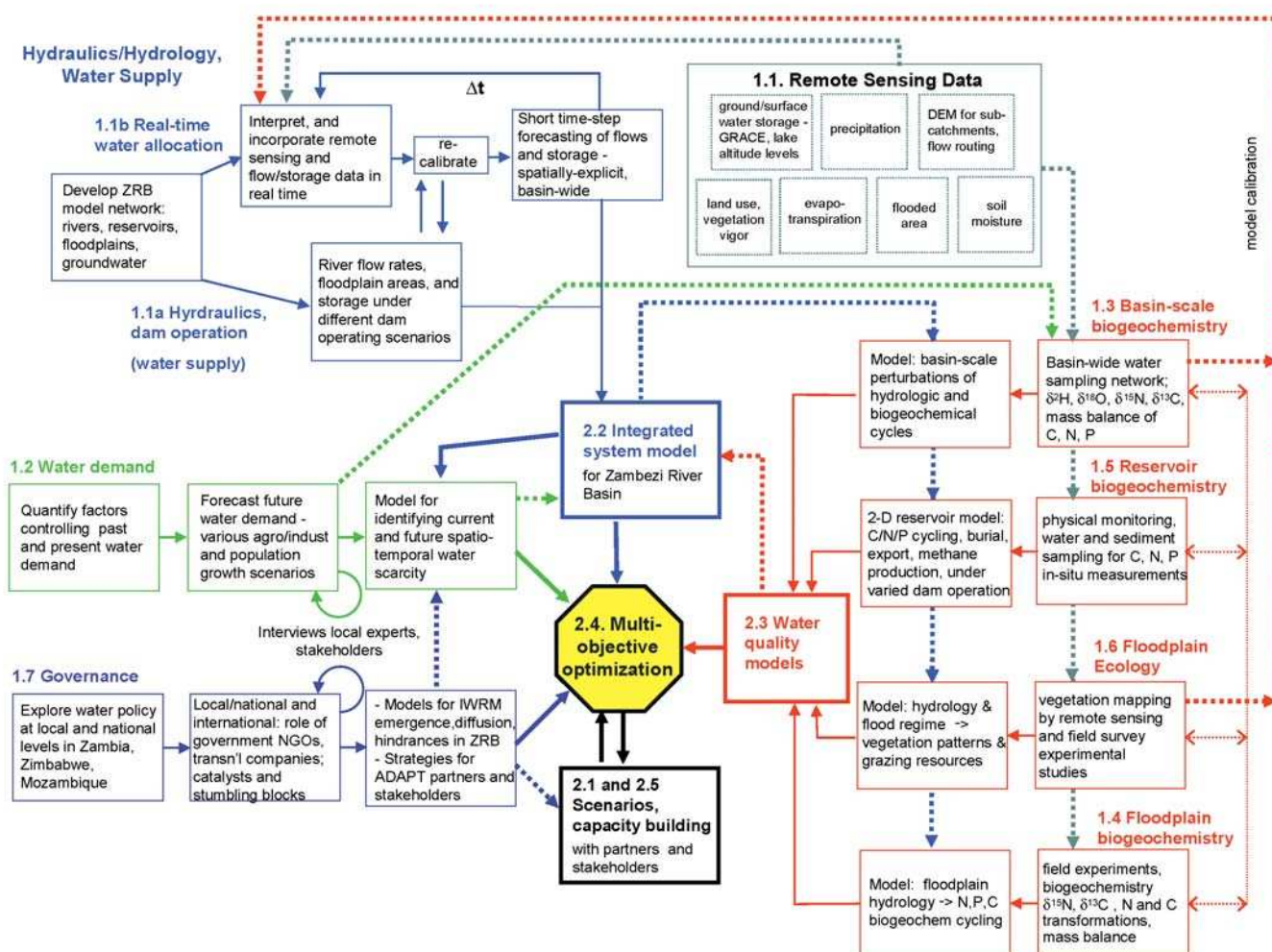
Research Platforms ..... 60

## EDUCATION AND RESEARCH UNITS / RESEARCH PLATFORMS

The overarching strategic priorities and research activities of CCES are implemented in thematic, wide-ranging Education and Research Units (ERUs). In the 2006 to 2008 implementation phase, efforts have been initiated in the following five ERUs:

- **CLENCH**: Climate and Environmental Change
- **SuLU**: Sustainable Land Use
- **FEH**: Food, Environment and Health
- **NatuRe**: Natural Resources
- **HazRi**: Natural Hazards and Risks

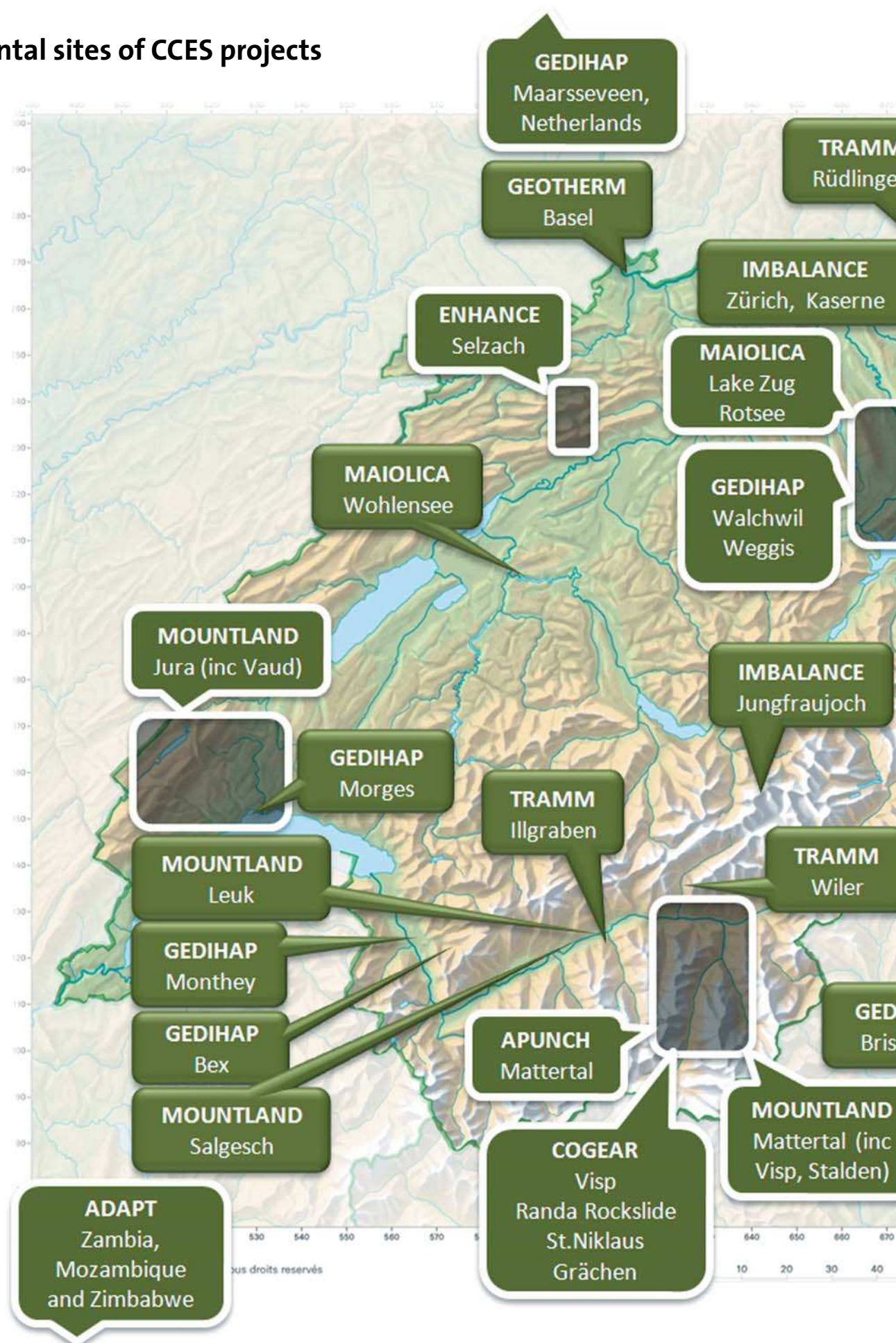
Research projects, experimental facilities and test areas have been established within each ERU, with the goal of fostering world-class research bringing together the expertise available in the CCES institutions. These activities involve several institutes and professorships, in order to reach the required critical mass in the identified themes. Each ERU includes several large-scale collaborative research projects identifying research themes of high relevance for sustainability and high scientific excellence.



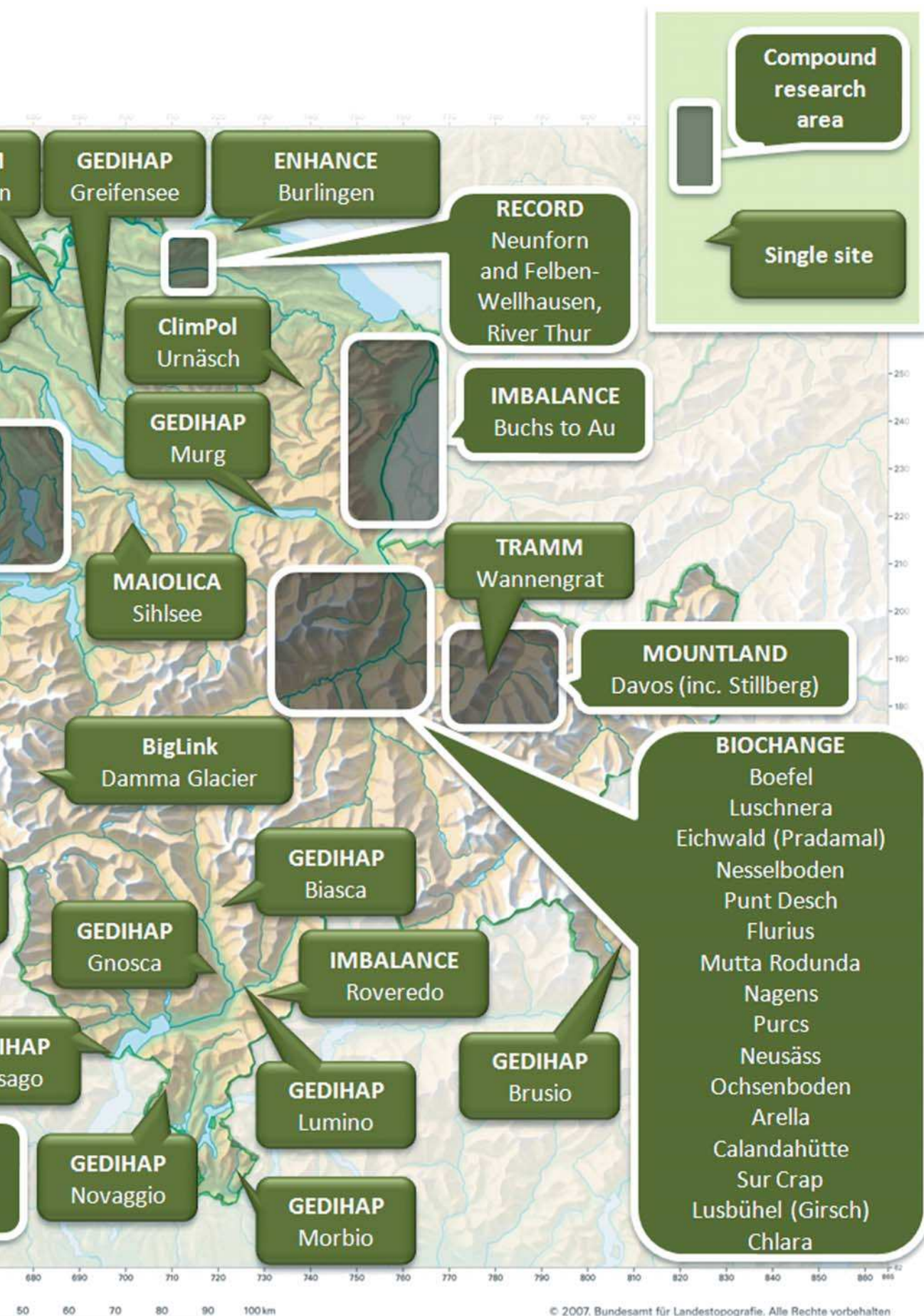
Organization of the project ADAPT as an example for large-scale collaborative research of high relevance for sustainability.



## Experimental sites of CCES projects











# CLIMATE & ENVIRONMENTAL CHANGE CLENCH

## Projects

### BigLink

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### BioChange

Genetic diversity, contemporary evolution and the maintenance of biodiversity in changing alpine environments .... 20

### ClimPol

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### IMBALANCE

Impact of Biomass Burning Aerosol on Air Quality and Climate .... 24

### MAIOLICA

Modelling and experiments on land-surface interactions with atmospheric chemistry and climate .... 26

## CLIMATE & ENVIRONMENTAL CHANGE CLENCH

CLENCH's vision is to contribute significantly to master the intellectual, technological and political challenges of finding innovative solutions to sustain a growing human population under changing climatic and environmental conditions. These challenges include developing solutions to use natural resources sustainably, to reverse the dramatic loss of biodiversity, and to reduce the atmospheric greenhouse gas (GHG) concentrations, which are effectively higher than at any other time within the past 500'000 years. Therefore, CLENCH performs Earth System Science with a special focus on land-atmosphere interactions. CLENCH treats the global aspects of land-atmosphere-interactions and gives special attention to mountainous regions with their particular climate sensitivity and associated concentration of biodiversity. CLENCH's program sets a perspective for at least the next ten years, which will later also encompass marine aspects.

CLENCH's mission is to make significant progress in characterizing physical, chemical, and biological aspects of land-atmosphere interactions as required for improved understanding of climate change, loss of biodiversity, and land use change-related problems. Technically, CLENCH will achieve this scientific mission by state-of-the-art laboratory studies and field work; integrating in a unique fashion climate, bio-geochemistry and biodiversity research, with an emphasis on the Swiss Alps, a strong modeling initiative encompassing data sources worldwide and allowing to scale between regional and global levels, as well as by technological and socio-economic and societal components, dealing with the implementation and consequences of political measures.



## BigLink

# Biosphere geosphere interactions: linking climate change, weathering, soil formation and ecosystem evolution

Soils are the product of a complex suite of chemical, biological and physical processes. In spite of the importance of soils for human society and for sustaining life on earth, our knowledge of soil formation rates, of how biological activity controls mineral weathering, and how these biosphere-geosphere interactions are influenced by (and themselves influence) climate and environmental change is limited.

BigLink is a multidisciplinary study aiming at developing a novel integrated approach to characterize these complex processes at the Earth's surface. We are combining field, laboratory and modeling studies and developing new geochemical tools to understand weathering and soil formation processes. Our initial focus is on initial weathering and ecosystem evolution. The long-term perspective is to improve our understanding of basic processes controlling the creation, evolution and distribution of soils, and improve our ability of up-scaling observations to large watersheds and to forecast changes in the hydrology and element fluxes of whole watersheds with changing climate.

## Achievements and Highlights

### Field activities

The field site has been instrumented with automated runoff and meteorological stations and a discharge-proportional water sampler. Continuous measurements of meteorological, soil, and surface-water parameters are available online. Additional discharge measurements were taken at several locations within the braided river network and the connections between the surface and the subsurface water were established. Water samples were collected biweekly for analysis of elemental and isotopic composition, dissolved organic carbon, and nutrients. Daily photographs of the glacier and the forefield were taken to determine the progress of snow melt and water flow. Ice thickness, total snow accumulation, and net mass balance were determined for the glacier.

23 common sampling plots were defined along the soil chronosequence of 150 years to investigate soil evolution along the time gradient. Samples from these plots were distributed to the partners for analysis of soil chemistry, mineralogy, and texture, microbiology, nutrients, enzymatic activity, soil solution chemistry, root exudates, carbon and nitrogen contents and isotopes. Soil respiration, above- and below-ground biomass, mycorrhiza, plant and microorganism species

distribution and diversity have been determined.

### Development of new methodologies and analytical techniques

New extraction and column chemistry protocols and mass spectrometric techniques for Ca, Mg, Li and Fe isotopes have been developed. These isotopes are being used as tracers for weathering processes by analyzing rocks, soils, individual minerals, plant material, and waters. Large lithium isotope gradients, related to incipient weathering processes, were found in water and soil samples from the glacier forefield.

For detailed analysis of soil organic matter, an automated solvent extraction system, an HPLC-MS and a GC with fraction collector have been installed. These allow not only characterization but also purification of individual organic compounds for radiocarbon dating to determine carbon turnover rates at the molecular level. Recalcitrant carbon fractions, important for long-term soil development, have been quantified and isolated for further radiocarbon analysis and NMR. Methods for the collection and characterization of dissolved organic carbon in river and soils are being developed.

A new optimized sample preparation method for oxygen isotope analysis of phosphate has been developed. First analyses of soils have been carried out.

A large culture collection of approximately 550 (cyano)-bacterial isolates has been created from barren rock material in the vicinity of the glacier tongue. Full-length 16S rRNA gene sequences of 82 isolates have been obtained and revealed that many isolates are closely related to the  $\beta$ -proteobacteria from the order Burkholderiales. Metabolic and biochemical characterization of the microorganisms can now be performed.

### Laboratory experiments

Eight selected isolated bacterial strains were tested for their weathering potential in vitro with dissolution experiments on the granite bedrock and the mechanisms that could explain their weathering abilities were investigated. Several strains efficiently weather Fe from granite and among the isolates two cyanide producers from the genus *Pseudomonas* sp were found.

Batch- and flow-cell dissolution experiments are in progress to evaluate the isotope fractionation factors for Li, Fe, Mg and Ca associated with mineral dissolution.



Laboratory incubations of soils from the plots have been used to measure the loss of fungi-specific biomarkers. Plants are being grown in rhizoboxes with different phosphorus sources to study their adaptation with respect to the type of root exudates they produce. *Salix helvetica* is grown under controlled conditions to isolate its mycorrhizal symbionts into cultures.

## Outlook

The research activities in the coming months will concentrate on the application of the numerous new analytical techniques that have been developed in the first year. A second major goal is the integration of the large amount of data obtained from the common sites and from the waters into a coherent picture,

aided by a numerical hydrological watershed model. Regular workshops will be organized to stimulate the integration of the results across the various disciplines towards a better understanding of the effects of biological activities on weathering and element cycling in young soils. Additional master students will be involved in the research activities.



**Start date:** May 1, 2007

**Project duration:** 4 years

**CCES funding:** CHF 1.6 million

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projects/clench/BigLink](http://www.cces.ethz.ch/projects/clench/BigLink)



## BioChange

### Genetic diversity, contemporary evolution and the maintenance of biodiversity in changing alpine environments

Alpine biodiversity is threatened by climate change, habitat fragmentation, and invasive species. To manage the biodiversity crisis and maintain vital ecosystem functions we need to understand the processes promoting and eroding genetic diversity and adaptive potential at the local and global levels of populations and species. The goal of BioChange is to use evolutionary and ecological parameters estimated in natural populations (genetic diversity, genetic constraints, adaptive capacity) and data on environmental change to build predictive models of biodiversity change. BioChange is a collaborative project involving multiple groups from ETH Zurich, Eawag, and WSL.

### Achievements and Highlights

#### Study species: *Arabidopsis thaliana*

1. Transplant experiments along altitudinal gradient in progress.
2. Phenotyping of natural populations in the greenhouse completed.
3. F1 crosses performed and lines of single seed descent generated in the greenhouse.
4. Candidate traits for experimental crosses for summer 2009 identified and analysis of variation in candidate genes for flowering time and freezing tolerance in progress.
5. Germination of 1168 plants and establishment of field trials of 640 individuals at 600 and 1200m altitude and measurements of eight quantitative genetic traits from all plants completed.
6. Execution of a climate chamber experiment with a total of 528 plants grown under 3 different temperature regimes and measurement of nine quantitative genetic traits during establishment and growth of plants.

#### Study species *Eritrichum*

5. DNA isolation and genotyping of 90 open-pollinated half-sib families completed, and paternity analysis, analysis of paternal contributions, seed set and seed weight in progress.
6. Evaluation and publication of tetra-somic nSSRs completed.

#### Study species: *Arabis*

7. Analysis of existing AFLP data to locate outlier markers started.
8. Landscape-scale gene flow study of >600 adult individuals and >400 open pollinated progenies started.

#### Study species: *Scabiosa columbaria*

9. Selection, establishment, and maintenance of four experimental field plots in the Chur region at 600m and 1200m altitude completed. All field sites are equipped with tem-

perature loggers.

10. Germination of 1168 plants and establishment of field trials of 640 individuals at 600 and 1200m altitude and measurements of eight quantitative genetic traits from all plants completed.
11. Execution of a climate chamber experiment with a total of 528 plants grown under 3 different temperature regimes and measurement of nine quantitative genetic traits during establishment and growth of plants.

#### Study species: *Briza media*, *Ranunculus bulbosus* & *Trifolium montanum*

12. Selection, establishment and maintenance of nine experimental field plots at 600m, 1200m and 1800m altitude. 10 pairs of populations of the three study species are surveyed at 1200m and 1800m altitude.
13. Completion of seed collection from all population pairs at each altitude.
14. Collection of 1800 leaf samples from the ten paired populations for subsequent genetic analyses (AFLP).
15. Identification, survey and negotiation with land owners for three quadruplet (12) populations of each of *R. bulbosus* and *T. montanum*, for collection of plants for establishment of experimental populations.
16. Collection of 2400 living plants of *R.*

*bulbosus* (n=1200) and *T. montanum* (n=1200) from 24 populations, potting and overwintering of plants at 1500m elevation.

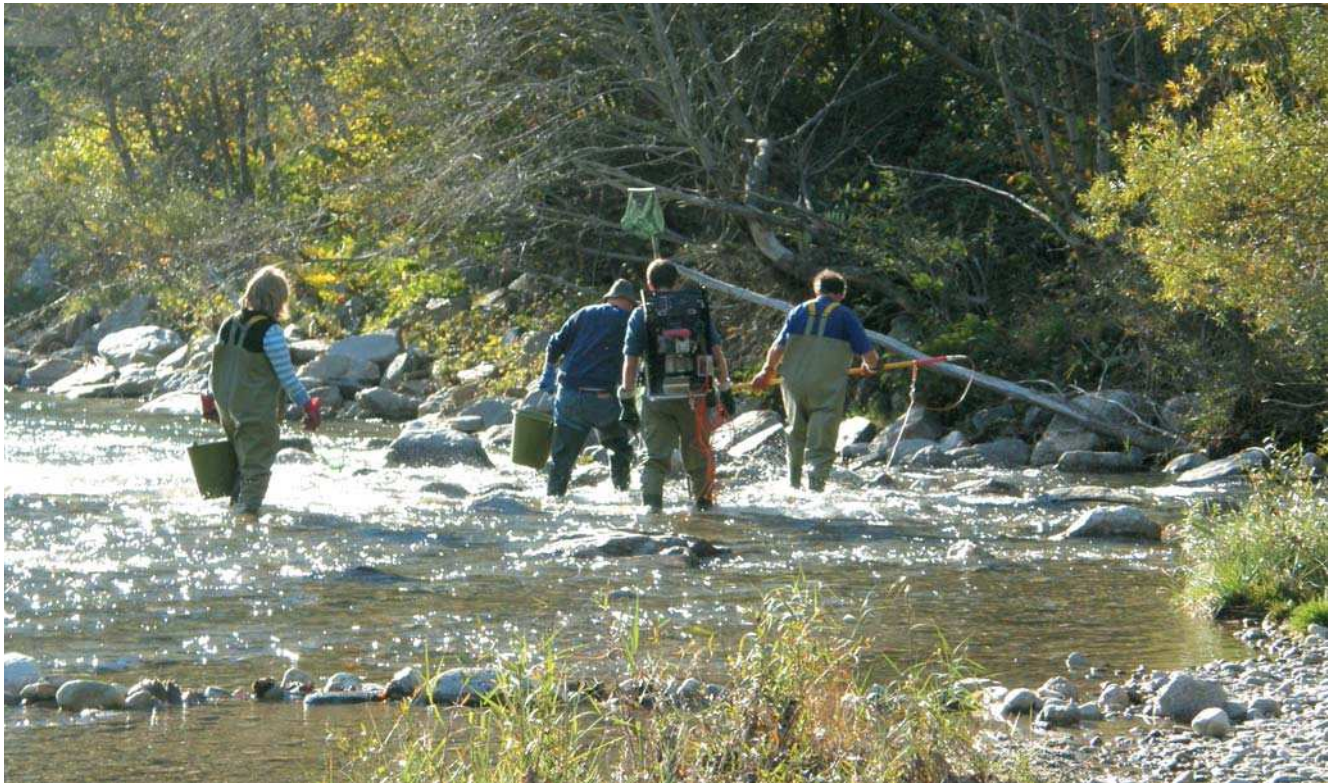
17. Phenological and pollinator observation of natural populations of *R. bulbosus* & *T. montanum*.

#### Study species: Large Pollinators (bumblebees)

18. Design of a sampling scheme collection of samples from 12 sites.
19. Development of additional genetic markers (microsatellites) for *Bombus* spp.
20. Optimization of PCR conditions for markers in several host species and screening of samples for parasites and diseases.
21. Planning of expansion of sampling scheme to comparative areas.
22. Interaction with GEDIHAP project on genetic basis for resistance.
23. Review paper on genetic architecture of resistance in plants and animals as conceptual basis of study.
24. Establishing link between immune genes and genetic markers in *Bombus* spp.

#### Study species: Amphipod (*Gammarus fossarum*) and mayflies (*Baetis rhodani* and *B. alpinus*)

25. Collection of samples from about 50 sites and survey of several habitat parameters at these sites.



26. Determination of the Gammarus species composition and the frequency of Acanthocephalan parasites in all samples.
27. Establishment of a molecular assay to distinguish cryptic species within the Gammarus and Acanthocephala species complexes. Survey of the cryptic species frequencies in 44 populations of G. fossarum.
28. Identification of 11 polymorphic microsatellite markers for G. fossarum and 7 for Baetis rhodani.
29. Optimization of a cage system to perform reciprocal transplant experiments.
30. Completion of a reciprocal transplant experiments to investigate the extent of local adaptation between Acanthocephalan parasites and Gammarus hosts.
31. Completion of the Master thesis of Caroline Baumgartner (ETH Zurich).

#### **Study species: Brown trouts and bullheads**

32. Design of a sampling scheme with altitudinal transects replicated in eight different drainage systems in Switzerland. Collection of trout samples from 18 sites and bullhead samples from 12 sites.
33. Identification of 8 microsatellite loci putatively linked to genes involved in temperature tolerance, reproductive timing and immune defense in salmonids; optimization of PCR conditions for these markers in brown trout.
34. Optimization of 3 PCR multiplex reactions in trouts containing the 8 candidate loci and 10 neutral microsatellite markers.
35. Optimization of 2 PCR multiplex reactions containing 12 neutral microsatellite markers for bullheads.
36. Sequencing of the mitochondrial control region in 136 brown trouts collected in 2007.

## **Outlook**

Development of genetic markers for studies of genetic diversity will be completed for most study species. Intensive field and experimental work continues, now with the aim of characterizing the genetic properties of the study populations. Several master projects will be started and a number of publications from the results of the first year will be published.

A SINERGIA proposal building on the first results obtained in BioChange will be submitted to SNF in spring 2009.

**Start date:** April 1, 2007

**Project duration:** 4 years

**CCES funding:** CHF 1.6 million

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## ClimPol

# Climate Policy Design for Enhanced Technological Innovation

A wide range of technological innovations exist today which can enable the reduction of future CO<sub>2</sub> emissions as well as the reduction of climate change induced societal damages. Furthermore, several policy instruments and institutional innovations are being discussed. However, most of these technological and institutional innovations are far from achieving the likelihood of being implemented.

The ClimPol project strives to bridge the gap between the availability and the implementation of technologies and institutions which could reduce or mitigate climate change problems. We assess the implementation barriers and suggest the design of climate policies that are sustainable in spite of huge uncertainties and irreversibility. The interplay between different groups of actors, as well as between the individual behavioral level and the policy-making level will be taken into account. Hereby, the role of divergent time frames and substantive uncertainties in decision-making will be examined. Based on a synthesis of the different results, we will be able to formulate very explicit recommendations on how to foster a quicker and more convincing transformation of technological and institutional innovations into practical application.

## Achievements and Highlights

In October 2008, ClimPol had its official kick-off meeting with all PhD students on board. The group met for a whole day that ended with a networking dinner. Following two previous meetings, each of the eleven modules presented its progress made so far.

A number of bachelor and master students have started writing or already finished their thesis in the context of ClimPol: A MSc thesis was successfully completed by Yulia Belyaeva on the private sector demand for forestry carbon offsets in October; a second MSc thesis is about to be completed by Stephanie Keller on proposals for the implementation of Reducing Emissions from Deforestation and Degradation (REDD) schemes; a third MSc thesis by Mathias Sacher on the structure of forestry carbon contracts started in October 2008; a related semester thesis by Tilmann Silber on poverty-carbon trade-offs in Mozambique was accepted for presentation at the 2008 Tropentag conference; a fourth MSc thesis by Paolo Moreira will analyze present and past energy demand and supply at a regional/community level.

As a starting point, all modules began with a literature review and if necessary with the preparation of experiments or

field work. Module B2, for example, established several contacts with stakeholders from their first case study region – Urnäsch in the canton of Appenzell Ausserrhoden (AR). Module D1 already conducted 10 case studies within the German electricity industry that complement research ongoing within this module.

On the publication side, first steps have been made: Stefanie Engel (C2) co-edited a special issue of Ecological Economics on the design of payments for environmental services. Its introductory chapter was ranked no. 12 on Science Direct's List of Most Read Articles in Economics, Econometrics and Finance, April-June 2008. From an outreach perspective, the interdisciplinary lecture «Business and Politics of Climate Change» hosted by Renate Schubert (A1) and Volker Hoffmann (D1) can be labelled a success. This lecture, also open to the public, involved several of ClimPol PIs and around 60-70 students every week in the fall term 2008.

## Outlook

In the following months various experiments, interviews, and case studies will be conducted by the different modules. Module B1, for example, will finish before the end of 2008 an experiment on consumers' choice of sustainable food. An interview study investigating how laypeople perceive climate change will be conducted and its results will be reported in a Bachelor thesis by the end of 2008. In November 2008, climate change experts will be interviewed about the status quo of climate change research. These interviews will be finished in the first quarter of 2009. In the second quarter, focus group interviews with Swiss laypeople will be conducted about their knowledge, beliefs, and opinions on climate change. During the spring semester, B1 will conduct a so-called case study: students will design and carry out a study about how policy makers and laypeople perceive uncertainties related to climate change.

Various papers are in preparation and are expected to be presented or published within the next months.

Module A2, for example, will present the paper «Is Space really more than Geography? Using Economic, Political and Cultural Space to Explain Participation





in Voluntary Climate Change Initiatives in the U.S.» at the Jahreskongress 2009 der Schweizerischen Vereinigung für Politische Wissenschaft in St. Gallen. Module A1 and C2 are currently preparing a paper on forestry carbon contracts with a focus on the permanence of sequestered carbon benefits. It has been submitted for the International Association of Research Universities (IARU) International Scientific Congress on Climate Change, 10 - 12 March 2009, in Copenhagen.



On an integrative level, two things have been set up for the future: One is the Transdisciplinary Case Study. Hosted by module B2, three further modules will participate in this lecture which is part of a master course in Environmental Sciences (10 credit points) in the spring term 2009. Groups of students will work empirically in the study region(s) between February and June 2009. The main idea is to develop energy production portfolios and to have them

assessed by various stakeholder groups reflecting the specific interest of the participating modules.

The second integrative part is the set up of working-groups concentrating on sensitive ClimPol issues. Topics for these working-groups have been envisioned and discussed during the kick-off meeting in cluster-wise working groups. The first workshops on uncertainties in decision making will take place in December 2008.

**Start date:** January 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 1.17 million

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## IMBALANCE

### Impact of Biomass Burning Aerosol on Air Quality and Climate

Wood and other biomass combustion represent renewable energy sources, and means to reduce global CO<sub>2</sub> emissions if the biomass stems from sustainable agriculture and forestry. On the other hand, biomass combustion inherently produces high emissions of particulate matter. These aerosol particles exert a climate forcing and have adverse health effects. The strengths of both, climate and health effects, vary during the lifetime of the aerosol due to physicochemical aging processes in the atmosphere.

In this project, physical and chemical properties of emissions caused by intended burning of biomass for the purpose of cooking and heating will be characterized comprehensively. The aerosol's aging processes in the atmosphere and their effects on hygroscopic growth, on concomitant mobility, scattering and absorptivity, and on cloud formation will be studied by field measurements, laboratory investigations, and modeling studies. These results will allow an assessment of their impact on air quality and climate. External costs of biomass burning emissions versus those of other sources of energy production will be assessed by means of an economic model.

## Achievements and Highlights

### Investigation of emissions

1. A first campaign for the quantification of emissions from a pellet burner and two modern burners was performed.
  2. The emissions from the pellet burner were dominated by organics during the start, where the mass concentrations are high. During stable burning the non-refractory particulate emissions are dominated by sulfate.
  3. On the contrary, organics dominate the chemical composition during the whole burning cycle of the log wood burner.
- (BC) contributing between 17 and 27 % to PM<sub>1</sub> mass.
3. The three main sources of organic matter were: Wood burning (WB) for domestic heating purposes, traffic (emitting hydrocarbon-like organic aerosol, HOA), and oxygenated organic aerosol (OOA, related to secondary or aged aerosol), the latter making up the biggest organic fraction throughout the investigated region.

### Aging of biomass combustion samples in the PSI smog chamber

1. A smog chamber campaign was performed at the PSI smog chamber

from February to March 2008 in order to study the aging of wood smoke emissions under atmospheric conditions.

2. Aerosol formation started within five minutes after turning on the lights indicating that the semi-volatile material emitted by wood combustion needs only very little oxidation to partition to the aerosol. This secondary organic aerosol formation potential increases the aerosol load from wood combustion considerably.

### Source apportionment of biomass combustion

1. Two forerunning field campaigns were performed: one in Zurich in December 2007 and one in the Rhine valley in January to February 2008.
2. The relative chemical composition of PM<sub>1</sub> was found to be similar for the whole Rhine valley region (divided into an Austrian part, a northern part including Switzerland and Liechtenstein, and a Swiss southern part), with nitrate dominating the inorganic fraction and black carbon



## Outlook

### Modelling thermodynamics of biomass burning aerosols

1. Gas/particle partitioning of internally mixed organic-inorganic aerosols like biomass burning and wood combustion aerosols will be calculated with a thermodynamic model.
2. Different datasets of ternary alcohol-water-salt solutions where used to validate the liquid-liquid equilibria predictions.
3. Gas/particle partitioning of semi-volatile organics can be significantly influenced by the existence of a liquid-liquid equilibrium in the aerosol particle and will be included in the gas/particle partitioning modeling.

### Ice nucleating ability of biomass burning aerosols

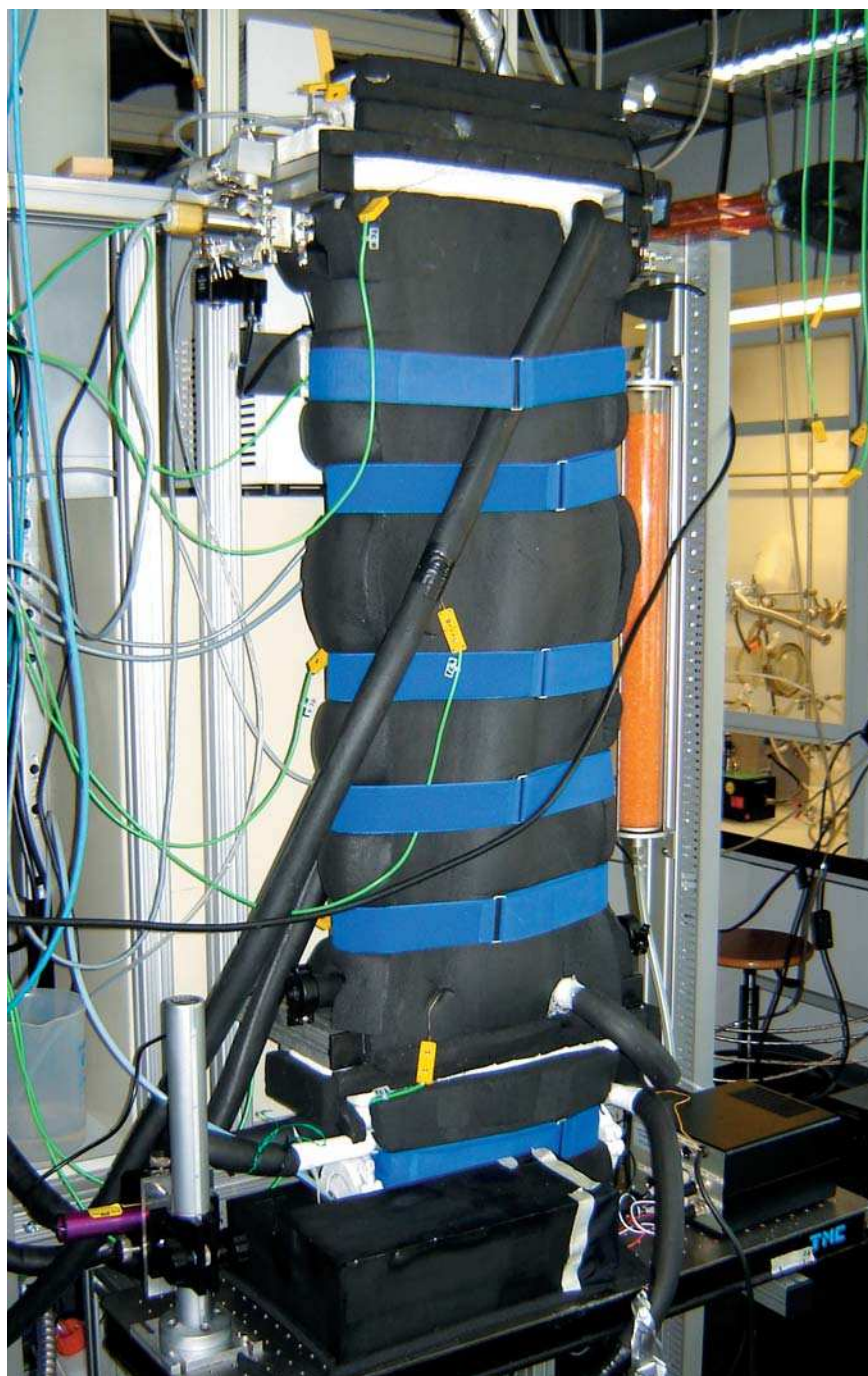
1. The aerosols from the smog chamber will be introduced into the ice nucleation chamber ZINC in order to investigate their effectiveness as ice nuclei as a function of temperature and aging times.

### Climate impact of biomass burning aerosols

1. A global climate model with aerosol-trace gas interactions will be used to investigate the global impact of both trace gases and aerosols from biomass burning emissions.

### Environmental impact and external cost assessment

1. Estimate the external costs of wood and biomass burning.
2. Compare the external costs of wood and other biomass systems to external costs of other energy systems in particular to fossil systems.



**Start date:** May 1, 2007

**Project duration:** 4 years

**CCES funding:** CHF 1.6 million

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## MAIOLICA

### Modelling and experiments on land-surface interactions with atmospheric chemistry and climate

The project «**Modelling And experIments On Land-surface Interactions with atmospheric Chemistry and climAte**» (MAIOLICA) (i) will improve our understanding of fundamental processes that contribute to greenhouse gas (GHG) emissions, including CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>, and H<sub>2</sub>O, from temperate, mid-latitude terrestrial and lake ecosystems and (ii) investigate the interactions and feedbacks among the terrestrial biosphere, atmospheric composition, and climate. These issues will be addressed using various experimental and modeling approaches at local, regional, and global scales. In addition to continuous stationary measurements, an aircraft campaign will provide an integrated assessment of CO<sub>2</sub> and non-CO<sub>2</sub> GHG emissions over heterogeneous landscapes typical for the temperate latitudes. A central feature of the MAIOLICA project is the close cooperation between field experimentalists and modelers, which will promote rapid, efficient communication and integration of experimental results into models for subsequent evaluation and feedback studies.

### Achievements and Highlights

#### Terrestrial and aquatic ecosystem flux measurements

- A roving eddy tower flux has been set up to measure CH<sub>4</sub> fluxes.
- A Los Gatos CH<sub>4</sub> analyzer has been purchased, intensively tested, and installed in the field.
- First measurements of CH<sub>4</sub> fluxes took place with the newly purchased Los Gatos methane instrument at Wohlensee near Bern (see figure 1) and at Lindenstock landfill site near Liestal. A large variability in CH<sub>4</sub> fluxes was observed over one week of measurements.
- First flux measurements took place over grassland at the ETH Research Station Chamau (continuous measurements since the end of August 2008).
- Continuous CO<sub>2</sub>, water, and energy flux measurements have been operated at the stations within the Swiss-Fluxnet (forest, grassland, cropland).

#### Planning of the aircraft campaign (as part of the regional integration experiment)

- A first meeting was held in spring 2008 to refine the planning of the regional integration experiment including the aircraft campaigns. A group of people (including W. Eugster (ETH

Zurich), B. Neininger (Met-Air), and D. Brunner (EMPA)) will be responsible for decision making concerning the day-to-day timing and design of the aircraft flights.

- Intense discussions took place with the subcontractor MetAir, Bruno Neininger, on planned modifications of the CH<sub>4</sub> analyser for aircraft campaigns. The recently hired Ph.D. student Rebecca Hiller has inspected the aircraft and discussed next steps in the project.
- Contacts have been established with other groups in Europe (e.g., Ch. Gerbig, MPI Jena) measuring CO<sub>2</sub> and CH<sub>4</sub> concentrations employing a Picarro cavity ringdown system.

#### Development of a long open-path system for methane measurements

- The optomechanical part of the measuring system has been designed and built.
- First detection of the absorption spectrum of atmospheric methane was possible.
- A reference cell for calibration is currently being designed and will be incorporated into the system.
- The development of an acquisition system and data treatment software is ongoing.

#### Biogeochemistry modeling and regional/global chemistry-climate modeling

- The modeling activities are scheduled to start at a later stage than most of the observational activities. However, a first meeting was held in summer 2008 to ensure a close collaboration between the experimental and modeling groups in one hand, and between the different modeling groups in another hand.
- A post-doctoral fellow has been hired by ETH Zurich (starting May 15, 2008) to initiate the coupling of the regional climate model with the community land model (Activity 3a).
- A post-doctoral fellow has been hired (starting October 1, 2008) by WSL who will work on the development of inventories and scenarios of global land use and land cover change (Activity 2).





## Outlook

Terrestrial and aquatic ecosystem flux measurements

- Continuous CO<sub>2</sub>, water, and energy flux measurements will be performed continuously at grassland, forest, and cropland sites.
- CH<sub>4</sub> fluxes will be measured in campaign-mode over relevant ecosystems in Switzerland.

### Integrated regional experiment

- First flights are planned in spring 2009 with an initial test flight aiming at exploring the CH<sub>4</sub> gradient over Switzerland. In-depth analysis of the data is planned using a variety of tools.
- Additional aircraft campaigns will be performed at various seasons in close collaboration with the group in charge of ground-based measurements of terrestrial and aquatic ecosystems, including the long open-path system that is currently being developed.

### Biogeochemistry modeling and regional/global chemistry-climate modeling

- The development, testing, and application of the improved regional climate model will be continued.
- The development of the improved biogeochemical module to be implemented in the regional and global



chemistry-climate models will be initiated.

- The development of inventories and scenarios of global land use and land cover change will be performed and will be further implemented in the global chemistry-climate models.

**Start date:** February 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 2 million

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# SUSTAINABLE LAND USE

## SuLU

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## SUSTAINABLE LAND USE

### SuLu

Global, regional, and local degradation of land resources as well as segregation of land use, e.g. intensification on favorable land and marginalization in remote areas bears a world-wide conflict potential. The latter can be significantly reduced with new technologies, sound modeling approaches and knowledge-based decision support tools that reconcile economic growth and technological progress with ecosystem integrity. SuLu tackles this challenge and proposes innovations in the following fields:

- (1) early detection and modeling of long and short-term, spatially explicit landscape and ecosystem quality changes based on temporally, non-continuous data sources;
- (2) modeling and forecasting land use change as a function of demographic, economic, technological, and climatic driving forces; implementing the models into frameworks of adapted decision support tools that foster transparent negotiations among various actors;
- (3) developing technologies and land management schemes that enhance ecosystem functions, goods and services of 1) highly diverse non-degraded but vulnerable mountain landscapes, 2) degraded environments of the lowlands, and 3) urban and peri-urban systems. This know-how will be propagated in a restoring and a preventive mode;
- (4) evaluating the influence of linear landscape elements (e.g. rivers) on the connectivity of ecosystems.

The current generation of land-use modeling and negotiating tools has been a valuable means for exploring the implications of environmental, social and economic change, but they are limited because they focus on system states that are assumed to represent some kind of equilibrium under current and future conditions, respectively. These limitations are increasingly removed due to computational power and remote sensing tools at different spatial scales as well as advances in the research on the human-landscape interface. The ERU SuLu is exploiting this momentum.

There is a direct benefit for economic development in Switzerland in the sense that landscapes are the basic resource for tourism, well-being of the people, and cultural identification. State-of the art planning tools enable land managers to base their decision on transparent and scientifically based management approaches.

## ENHANCE

### Enhancing ecosystem connectivity – a benefit for nature and society?

ENHANCE is challenged by the premise that appropriate management interventions may reverse negative effects of fragmentation, thus improve ecosystem functions of ecologically deteriorated environments for the benefit of society. ENHANCE quantifies biotic responses at the gene, species, population, and community level prior and after structural connectivity is enhanced with management interventions (local and landscape-scale experiments). We study aquatic (river) and terrestrial (urban, agriculture) habitats to link structural connectivity measures with biotic responses. Based on these links, quantitative models will scale local empirical findings to the regional scale. Enhancing ecosystem connectivity is a high priority issue for nature conservation and management. Therefore, ENHANCE provides societal and economic assessments of recently performed and future interventions which aim at increasing structural connectivity (e.g., river restoration, agricultural compensation areas). The interdisciplinary ENHANCE project relies on the expertise of WSL, ETH Zurich, Eawag and EPF Lausanne teams. Key methods include molecular genetics, dispersal experiments, spatial modeling, and socio-economic techniques.

### Achievements and Highlights

**Starting the science:** The experimental period has started in spring 2008 for two research teams working in agricultural and riparian habitats. Main achievements of connectivity experiments in agricultural habitats refer to the quantification of foraging distances flown by a bee species between its two key resources, its nest and its specific pollen plant, with special consideration of landscape barriers. Main achievements for riparian habitats are related to longitudinal connectivity studies in riparian habitats, comprise a biodiversity study on macrovertebrates, and effects of landscape barriers for fish in rivers (funded by 3rd party money).

**Optimizing synergies:** Main achievements of the preparatory work for urban habitats are based on synergies with ongoing work, leading to an intensified focus on mobility of the target species. Mobility should be limited in view of the fine granularity of green-spaces in urban landscapes. For agricultural habitats, synergies between ART Reckenholz, private planning offices involved in large-scale connectivity projects, and ENHANCE are identified.

**Successfully finished third party projects:** Several third party projects associated with ENHANCE have come to a

successful close in 2008. One project, «Natural rejuvenation of Black Poplar in » (Daniela Csencsics), focused on applied conservation genetics and analyzed the data to receive estimates of functional connectivity by seed dispersal along riparian corridors. Another project quantified the costs of nature conservation in Switzerland (Sascha Ismail). Three projects referring to river landscapes were finished by Berit Junker: «Revitalization of river landscapes, Sounds of riverscapes, and Social-friendly river reevaluation».

**Hiring researchers:** By spring 2009, all ENHANCE personnel will have started their projects and experiments. To date, the majority of PhD students and post-docs are selected.

#### Important activities of the coming months

**Identifying common study sites:** To guarantee that we are investigating aspects of de-fragmentation and to maximize the interactions and scientific output between and among ENHANCE modules, the exact locations of the study areas for the experiments starting in 2009 will be selected in a concerted action. Researchers of each habitat and scientific background deliver criteria to an intern (Lau-

ra Langeloh) who will maximize the spatial overlap of the sites and coordinate the ENHANCE requirements with ongoing large-scale de-fragmentation experiments by cantons and private planning offices

**Landscape genetics platform:** the genetic and landscape modelling groups will establish a landscape genetics platform at WSL in 2009. Goal of this platform is to develop new quantitative approaches for population genetic data within a landscape-scale context.

**All ENHANCE experiments start:** The remaining ENHANCE experiments for urban, riparian, and agricultural habitats will all begin in spring 2009.

**Publications:** During 2009, first submission of manuscripts can be expected by PhD projects which have already started in spring 2008.

**Outreach:** Goals and expectations of ENHANCE researchers regarding outreach needs and activities will be identified by the end of 2008. First appropriate outreach activities will be initiated during 2009 (e.g., writing articles for internal use of WSL and ETH Zurich). In 2009, we will write a «Merkblatt für die Praxis» on the topic of how to establish natural Black Poplar forests in river restoration areas of Switzerland.



### Projects and project participants

- PhD project «Fragmentation and de-fragmentation effects on brown trout populations». Laura Langeloh will start her thesis in January 2009 at EAWAG.
- PhD project «Foraging ranges of native bee species in agricultural habitats». Antonia Zurbuchen has started her work on this ENHANCE project at ETH Zurich in April 2008
- 2 PhD projects «Genetic connectivity of plants and animals in agricultural landscapes: a landscape genetic approach» are currently advertised. Both PhD students are scheduled to start in early 2009 at WSL and ETH Zurich.
- PhD project «Connectivity in urban habitats». Sonia Baaker will start her thesis in January 2009 at WSL.
- PhD project «Ecological modeling and landscape genetics». Maarten Van Strien will start his thesis in February 2009 at WSL.
- Postdoc project «Ecological modeling and landscape genetics». Gwenaëlle Le Lay will start her 18 month postdoc in March 2009 at WSL. Her research field of experience is spatially explicit landscape modeling.
- PhD project «Societal perception of biodiversity in cities». Robert Home. Project completed spring 2009.
- PhD project «Biodiversity assessment of natural areas in cities». Thomas Sattler. Project completed autumn 2009.
- Postdoc project «Attitudes towards de-fragmentation measures». Robert Home. Start of the project spring 2009.
- Postdoc project «Evaluation of the effect of participation regarding de-fragmentation measures.» Susanne Menzel. Start of the project January 2009.
- Internship on «Costs and benefits of de-fragmentation measures». Roxana Tesileanu. Literature review started October 2008, to be completed spring 2009.
- Internship «ENHANCE site selection». Laura Langeloh. October to December 2008.

**Start date:** April 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 1.6 million

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## MOUNTLAND

### Sustainable land-use practices in mountain regions: integrative analysis of ecosystem dynamics under climate change, socio-economic impacts, and policy implications

MOUNTLAND aims to contribute to the development of adapted land-use practices and innovative policy solutions for mountain regions under climate change in order to warrant life-supporting ecosystem services. The key focus of the project lies in the effect of climate change on forestry and alternative agricultural use of land, in the valuation of ecosystem goods and services, and in cross-sectoral policy solutions which are economically and ecologically efficient as well as socially and institutionally feasible.

The project combines a wide range of methodological and disciplinary backgrounds. Task 1 includes plot-based observational and experimental evidence on ecosystem response to climate change and spatially explicit ecosystem modeling at the landscape scale. Task 2 addresses socio-economic questions, namely the valuation of ecosystem services and the issue of land management decisions based on spatially explicit economic optimization modeling. Task 3 concentrates on the political aspects with the analysis of relevant political networks, the formulation of policy options, and the evaluation of policy changes.

The three case study regions of the Jura Vaudois, Visp Region and Davos cover a range of specific sensitivities to climate and land use change, i.e. the temperature-sensitive high mountain ecosystems of Davos, drought-sensitive inner-alpine ecosystems of the Visp Region and management sensitive pasture-woodland ecosystems of the Jura Vaudois.

In accordance with its overall focus on feasible adaptation solutions, it aims for a close collaboration with stakeholders in the three case study regions and at different administrative levels.

## Achievements and Highlights

### Experiments and field study

1. Elaboration of different options to optimize the comparability of experimental finding between case study regions.
2. Start and official opening of the rain shelter experiment in Leuk in May 2008.
3. Definite prolongation of the irrigation experiment in Pfynwald until December 2009.
4. Selection of the field sites for the investigation of management measures to reduce competition between tree species in Pfynwald and Salgesch in close collaboration with the local forest service.
5. The experimental warming and CO<sub>2</sub>-enrichments experiments on the Stillberg research area have successfully proceeded through summer 2008 and studies on ecosystem development, and forest-avalanche interactions within the study region have been intensified and focused towards the Mountland objectives.

6. Choice of the field sites and the design of transplantation and warming experiments in the Jura Vaudois will be made until the end of 2008.

### Modeling

7. Specification of the outputs of the three ecosystem models involved (WOODPAM, TREEMIG, LANDCLIM) and their meaning for the assessment of Ecosystem Services.
8. Clarification of input data to run first low-resolution simulation of ecosystem responses to climate change until the end of 2008.
9. Further development of the optimization-based land management model S\_INTAGRAL and discussions about its central role within the project.
10. Establishment of a FAO database on Global Agro-Ecological Zones to estimate the potential for agricultural production under climate change scenarios.
11. Development of a holistic concep-

tual model capturing all information flows within the project.

12. First assessment of feasible methodological solutions to model the overall system on the basis of the holistic conceptual model.

### Scenarios

13. Distinction between exogenous and endogenous scenarios depending on their origin as outputs of a previous simulation or as purely external assumptions.
14. Differentiation of multiple exogenous scenarios and where they feed into the information flow.
15. Decision to focus on medium to extreme climate change scenarios.

### Stakeholder process

16. Compilation of stakeholder list for the case study regions and at higher administrative level as a basis for conceptually designing and practically coordinating the stakeholder process.



17. Definition of first applied products of interest to be discussed with the stakeholders.
18. Gathering of stakeholder who will be addressed by any project partner during the course of the project and of information on how and when they will be involved.
19. First introduction of the project to stakeholders of the case study region Jura Vaudois at the Interreg project meeting, August 29, 2008, Morteau, France.

#### Assessment

20. Identification of a priority set of Ecosystem Services that will be taken into account, and recognition of further Ecosystem Services which might possibly be added to this set.
  21. Compilation of a suitable set of criteria and indicators for policy assessment.
- Other achievements**
22. Invited presentation and organization of the discussion group «Demand and evaluation of ecosystem services» at the COST Strategic Workshop, April 7 to 9, 2008, Innsbruck, Austria.
  23. Invited presentation at the ICAS convention Gebirgsforschung Schweiz/ Recherche alpine en Suisse in Brig, September 9 to 12, 2008, Brig.

**Start date:** April 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 1.8 million

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# FOOD, ENVIRONMENT & HEALTH

## FEH

### Projects

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## FOOD, ENVIRONMENT & HEALTH FEH

The rapidly increasing size of the human population requires the development of innovative strategies for the sustainable exploitation of natural resources, but at the same time generates major challenges in supplying water and food and in combating diseases.

The vision of the ERU FEH is to become an internationally recognized key player, through understanding of the agri-food chain, ecosystems processes and their management, for strategies to achieve simultaneously progress in the UN Millennium Development Goals (1) eradicate extreme poverty and hunger, and (7) ensure environment sustainability. It will give the

basis to implement ways to improve public health by special foods and measures against diseases related to food and environmental changes.

The mission of the ERU FEH is to develop and integrate new ways of environmentally-friendly food production and efficient water reuse in the South and innovative products and sustainable manufacturing technologies in the North while addressing consumer expectations for high quality and safe food, minimized environmental impact as well as improved public health.

## BactFlow – Impact of environmental «stealth» pathogens on food safety and human health

The BactFlow project aims to unravel the transmission routes and strategies that environmental pathogens pursue to enter the human host via food or water. Within the scope of this multidisciplinary approach is the investigation of the environmental reservoirs of food-borne pathogens with particular emphasis on the strategies that the bacteria pursue to become 'stealth pathogens', thereby allowing hidden transfer from environment to food and human host. Additional important aspects are the impact of the 'stealth character' on the interaction with the host immune system and the impact of horizontal gene transfer on pathogenicity. The project will focus on *Listeria monocytogenes* as a prototype of a food-borne pathogen capable of transforming from a harmless environmental saprophyte into a hazardous, opportunistic human pathogen.

The long-term goal of the project is the discovery of the environmental reservoirs of this important food-borne pathogen and the improvement of our knowledge about the strategies and mechanisms that the bacteria pursue to survive within their environmental niche and to switch to 'stealth pathogens', which is of utmost importance for food safety and human health.

### Achievements and Highlights

#### ***Listeria monocytogenes* as environmental organism and a food-borne pathogen**

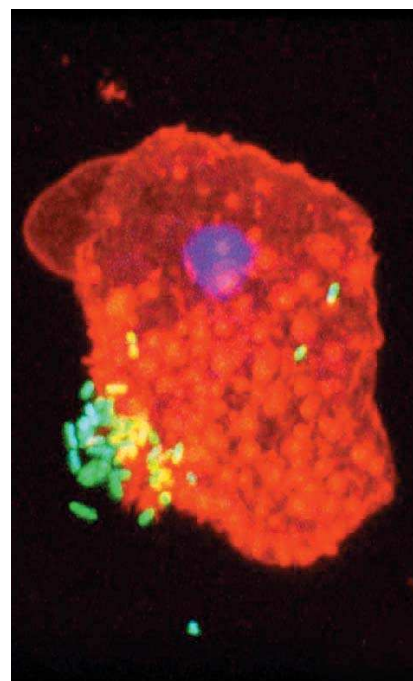
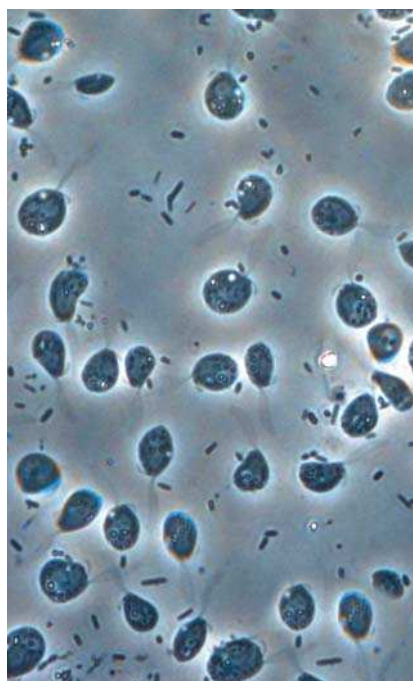
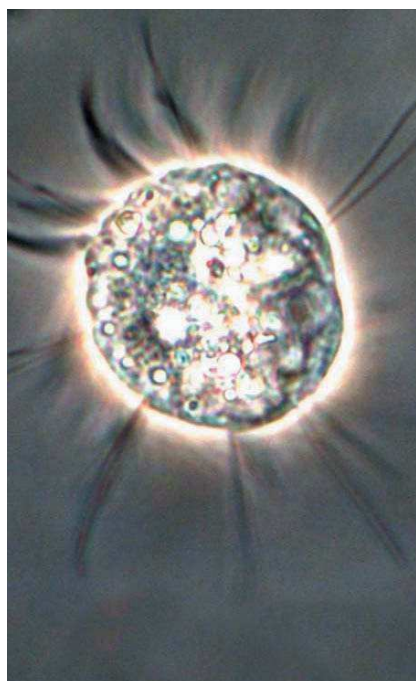
1. Engineering, expression, and purification of highly specific cell-wall binding domain (CBD) proteins derived from *Listeria* bacteriophages, for the specific detection and identification of *Listeria* cells.
2. Setup of a strain library of *Listeria* spp. isolated in 2008 from Swiss food samples that were previously exposed to antibiotics (e.g. cheese surface, mastitis milk samples).
3. Quantitative susceptibility testing of *Listeria* spp. against 18 different antibiotics revealed low prevalence of antibiotic resistant *Listeria* (<5% among 79 *Listeria* spp. isolates).
4. Phenotypic resistance of several isolates to tetracycline and clindamycin has been found.

#### **Interaction of *Listeria monocytogenes* with environmental protozoa**

1. Establishment of methodology for isolation, in vitro culture, and identification of environmental protozoa.
2. Successful isolation and identification of various protozoa from environmental sources like small natural and artificial ponds.
3. Genetic engineering of fluorescent strains of *Listeria monocytogenes* by insertion of the gene for green fluorescent protein (GFP).
4. Implementation and optimization of the methodology necessary for protozoa / *Listeria* co-culture assays.
5. *Listeria* / *Acanthamoeba* co-culture assays point to a specific interaction of *Listeria monocytogenes* and *Acanthamoeba* with a certain benefit for *Listeria*.
6. *Listeria* attach to the uroid of *Acanthamoeba* and form large aggregations («backpacks»).
7. Motility (flagellation and/or chemotaxis) is an essential factor needed for uroid attachment.
8. *Listeria* involved in formation of aggregations is connected to *Acanthamoeba* by a net of amoebal filaments.

#### **Impact of «stealth» L-forms of *Listeria monocytogenes***

1. Establishment and maintenance of cell-wall deficient (L-form) lines from different *Listeria monocytogenes* strains.
2. Generation of GFP-tagged *Listeria monocytogenes* L-forms from a previously genetically engineered *L. monocytogenes* strain carrying the gene for green fluorescent protein (GFP).
3. The *Listeria monocytogenes* L-forms are viable, and show growth and cell division.
4. *Listeria monocytogenes* L-forms can survive in food (e.g. milk).
5. *Listeria monocytogenes* L-forms seem to survive and persist intracellular within macrophages.



## Outlook

1. Development of a rapid detection and identification system for *L. monocytogenes* in environmental samples based on the use of specific CBDs in combination with flow cytometry.
2. Further elucidation of the AB resistance situation of *Listeria* spp. isolated from Swiss food will be of high impact for epidemiology, future listeriosis case analysis, and clinical treatment.
3. Co-culture experiments of *Listeria* and protozoa will provide further evidence and details on the specific interaction of *L. monocytogenes* with *Acanthamoeba* and other protozoa.
4. Co-culture of *L. monocytogenes* L-forms and protozoa will answer the important question whether *Listeria* L-forms have the potential to survive and persist intracellularly in protozoa.

**Start date:** July 1, 2008

**Project duration:** 5 years

**CCES funding:** CHF 0.9 million

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## GEDIHAP

### The role of genetic diversity in host-pathogen interactions in dynamic environments

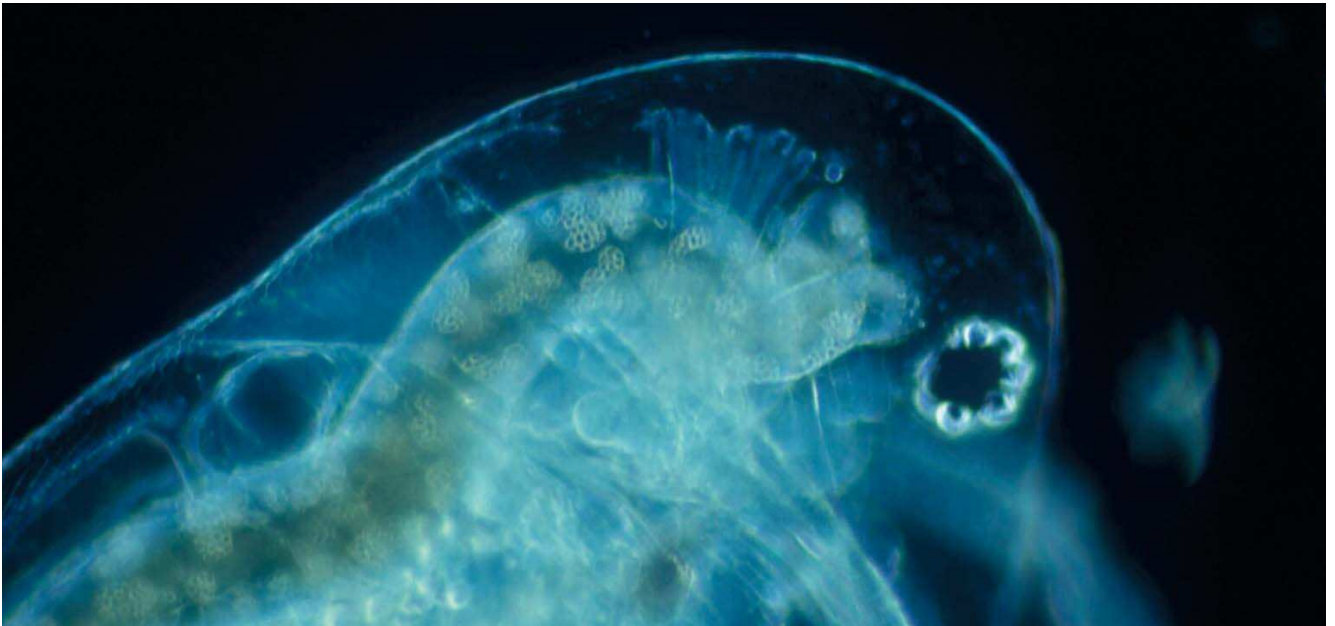
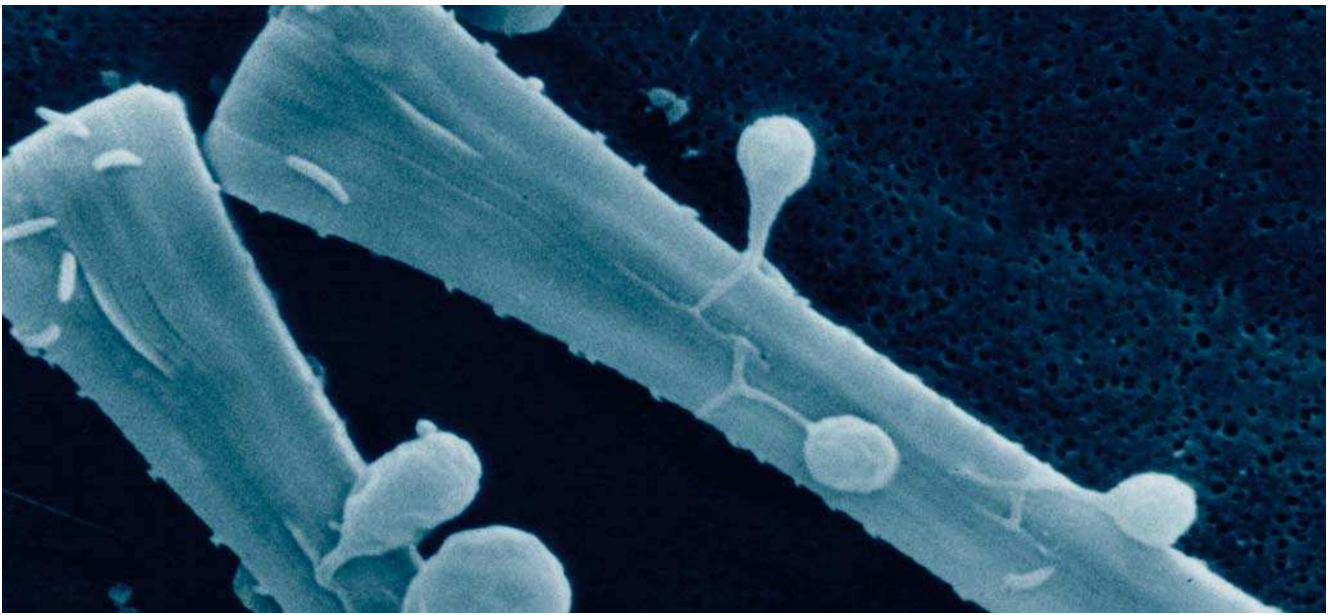
The project GEDIHAP (GEnetic Diversity Host And Parasite) lies at the interface between food production, environmental health, and human societies. Healthy societies are the key to sustainability. Healthy societies are based on healthy people, existing in healthy environments, and with access to a healthy food supply. Infectious diseases have major adverse effects on the environment, food supplies, and human and societal health. Genetic diversity of populations affects the impact of infectious diseases, and in turn infectious diseases add to the evolution and maintenance of genetic diversity. Several internationally-recognized research groups within the ETH/Eawag/WSL domains work on the interplay between genetic diversity and infectious diseases on the one hand, and between genetic diversity and the influence of dynamic environments on the other. This project aims to be the binding agent between those groups that could lead to the development of a world leading competence center in the arena of ecology and evolution of infectious diseases.

#### Achievements and Highlights

1. On Friday, September 5, we had our kick off meeting in Zurich in the CHN building. Around 60 people attended this meeting in which research from all participating groups was presented. From the meeting it became clear that there is a immense need for GEDIHAP. Many questions on the role of genetic diversity in host pathogen interactions in dynamic environments need to be answered.
2. Within several groups, successful searches were carried out for PhD positions. In the group of Bas Ibelings, Silke van den Wyngaert started a project on host parasite association between *Asterionella formosa* and *Zygohizidium planktonicum*.
3. In the group of Piet Spaak, Claudia Buser was hired as PhD student. She will work within the project environmental stress and infectious disease in aquatic ecosystems on host parasite association *Daphnia galeata* and *Caullerya mesnili*.
4. In the group of Ottmar Holdenrieder, Vanessa Reininger was hired as PhD student. She will work on the influence of genetic diversity and temperature on DSE-woody plant pathosystems.
5. In the group of Paul Schmid Hempel, a technician, Undine Zippler, was hired. She will work on the EST (expressed sequence tags) library of the host *Bombus*.
6. An important step in the group of Paul Schmid Hempel is the further development of genomic tools for the study of host-parasite interactions in pollinators. The now first draft of the EST-library will be further developed. A list of candidate immune genes is currently being under test for intra- and interspecific variation. At the time being, this project has worked well but the amount of polymorphism discovered so far is rather limited. We expect to take this project ahead by the construction of a subtractive library for the infection by trypanosomes.

#### Outlook

After hiring the necessary personnel, all groups started their work as described in the work plan. We are confident that the deliverables and milestones as formulated in the work plan will be reached.



**Start date:** April 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 1.4 million

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# NATURAL RESOURCES

## NATuRE

### Projects

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## NATURAL RESOURCES

### NatuRe

The vision of the ERU NatuRe is to provide the scientific and technological basis for equitable and sustainable use of natural resources of water, air, soil (including underground) and renewable energy in a world whose population is expected to exceed eight billion. One of the crucial challenges in coming decades is the development and maintenance of the sustainable delivery of water/ecosystem-derived goods and services with ongoing global change. In NatuRe, consistent with legislation, planning, and integrated problem solving, the catchment scale will be the intrinsic management unit for water, forest, and soil resources. Furthermore, with the decline of inexpensive oil, the innovative use of «renewable» energy sources – wood, solar, wind, geothermal and hydropower – calls for substantial product- and process-oriented research. Given the existing trends of global change, NatuRe's vision for the next 25 years shall focus also on the improvement, maintenance and sustainable use of natural resources in transitional countries.

NatuRe's mission is to build an internationally recognized Center for Natural Resources and Technology, focusing on

- (1) development of concepts and technology for the sustainable use of water and soil re-sources and the maintenance of ecological integrity and biodiversity;
- (2) optimization of non-urban land resource utilization under ecological constraints;
- (3) renewable energy, especially wood, hydropower and geothermal heat;
- (4) build-up of competences for handling large environmental data sets (GIS/remote sensing);
- (5) build-up of a large scale (some 100 km<sup>2</sup>) experimental site in Switzerland for interdisciplinary research and education on different levels;
- (6) creation of a Centre of Competence for Water and Agriculture in Sub-Saharan Africa, emphasizing food security, drinking water, sanitation, hydropower and ecological integrity.

## ADAPT

# The African dams project: adapt planning and operation of large dams to social needs and environmental constraints – an integrated water resource management study in the Zambezi Basin

This interdisciplinary project aims at developing new models for integrated water resource management (IWRM) that can be used to improve the operation of large reservoirs and to design new schemes at the basin-scale. These models will incorporate new concepts of multi-objective optimization and real-time control. The approach will be calibrated with novel data resources and used to investigate the large reservoirs and wetlands in the Zambezi River Basin.

During a pilot phase, the ADAPT project team has established working relationships with academic and governmental partners in Zambia, Mozambique, and Zimbabwe. Together with these partners, the ADAPT team is strengthening the interdisciplinary science of IWRM through new remote sensing technologies, biogeochemical characterizations, policy analysis, numerical models, and quantitative optimization. The team engages in a capacity building effort involving joint training and research activities in African partner countries.

## Achievements and Highlights

### Staffing and finances

1. During most of 2008, the ADAPT project team was built up with third-party funding and in-kind resources. CCES finances will help completing the staffing process and bringing the project into full operation.
2. Project partners Bernauer and Kinzelbach successfully applied for 2 PhD positions for their joint project «Cooperative Management of International Freshwater Resources», which allowed funding the work of the two ADAPT PhD students Phillipp Meier and Lucas Beck.
3. Partners Wüest and Wehrli obtained matching funds from Eawag to fund field work in Zambia and used in-kind resources to fund the two students Manuel Kunz and Roland Zurbrugg during their first year.
4. Dr. David Send (formerly at the Harvard School of Public Health) moved to ETH Zurich to work on the ADAPT project.
5. With Wilma Blaser, Théodora Cohen, and Claudia Casarotto three PhD students with excellent qualifications could be hired for the project of the partners Edwards, Schleiss, and Bernauer/Kappel, respectively.

### African partnerships

6. Project partner Alfred Wüest is spending his sabbatical in Lusaka (September 1, 2008 to March 2009) in order to strengthen the research partnership with the University of Lusaka and different stakeholders in Zambia.
7. Two African master students have so far been recruited and additional funding has been secured via the Eawag Partnership Program for training in Switzerland.
8. A formal agreement of collaboration has been signed with Prof. Imasiku Nyambe of the Integrated Water Resource Management Center of the University of Zambia; an additional MoU is in preparation with the Zambian Wildlife Authority.
9. Several joint sampling campaigns were successfully conducted on Lake Kariba together with the Zambezi River Authority (ZRA) and on the Itzhi-Tezhi reservoir with the ZESCO power company.
10. Agreements were reached with partners from the Danish Technical University (Prof. P. Bauer and F. Larsen) who are performing a capacity building program funded by Danida to joint forces and offer intensive courses for African students.

11. A first short-course on integrated water resource management in the Zambezi Basin was tested by David Senn, Manuel Kunz, and Bernhard Wehrli on September 3, 2008 in a DEZA-sponsored program at the University of Applied Sciences in Biel.

### Data, analysis, and modeling

12. Intensive collaboration with the power company ZESCO and the use of new remote-sensing data allowed PhD student Philip Meier to develop and calibrate a spatially explicit flood model for the Kafue Flats. The model will allow a detailed analysis of the hydrological and ecological consequences of different operation rules of the Itzhi-Tezhi hydropower reservoir.
13. With extensive expert interviews in the region and a cooperation with the project partners within ADAPT and at Columbia University, PhD student Lucas Beck developed a prototype water demand model for the Zambezi River basin. In his pilot studies, he identified hydropower, irrigation, and domestic water uses as the most important drivers for water allocation.

14. In her semester internship, master student Wilma Blaser compiled a detailed survey of previous studies on plant ecology and invasive species in the Kafue wetlands.
15. With several field campaigns, PhD student Manuel Kunz constructed preliminary nutrient and particle mass balances for the large reservoirs in Zambia. His first sediment analyses showed promise for the reconstruction of time-series for the biogeochemical effects of wet and dry years.
16. A first survey of wetland biogeochemistry by David Senn and PhD student Roland Zurbrugg in the Kafue flats showed drastic changes in redox parameters along the river stretch. The data will help constraining the complex hydrology and future water quality models.



Photo: Richard Belfuss



Photo: Richard Belfuss

## Outlook

The group of ADAPT researchers and students is working towards defining the interfaces between the different types of models in order to define the detailed goals of the project synthesis. A next meeting of the project group will be held in January 2009 in order to discuss important focal points of the project integration:

- Merging basin-wide hydrological models with water demand modeling;
- Integrating spatially explicit models for wetland hydrology with catchment-scale biogeochemical models and nutrient requirements of aquatic/terrestrial ecosystems;
- Expanding the discussion of water allocation goals with stakeholders in the river basin. For this end, ADAPT will be present at the next meeting on Zambezi River Basin Management to be held in November in Malawi.

Starting three new PhD projects in Switzerland and expanding the capacity building effort in Africa by the end of 2008 will balance the project's activities and start the main phase of the ADAPT project.

**Start date:** September 1, 2006 (pre-phase)  
January 1, 2008 (full project)

**Project duration:** 4 years

**CCES funding:** CHF 1.77 million

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## CARMA

### Carbon Dioxide Management in power generation

Carbon dioxide (CO<sub>2</sub>) capture and storage (CCS) is a set of technologies for the capture of CO<sub>2</sub> from its anthropogenic point sources, its transport to a storage location or treatment plant, and its isolation from the atmosphere. With reference to this, the aim of the CARMA project is twofold. On the one hand we intend to explore the potential for and the feasibility of the deployment of CCS in Switzerland and in a few other countries within the framework of future energy scenarios. On the other hand we aim at exploiting available expertise to develop new CCS technologies and know-how, which might be applied in Switzerland and worldwide. The CARMA project will occupy a team of scientists and students from ETH Zurich, EPF Lausanne, the Paul Scherrer Institute, University of Applied Sciences North-western Switzerland, University of Bern, and GeoForm. CARMA is the first project that will be jointly funded by CCES-CH together with the Competence Center for Energy and Mobility (CCEM-CH). Carbon dioxide capture and storage has such an interdisciplinary scope that makes it an ideal subject to establish a formal co-operation between the two competence centers of the ETH Domain.

## Highlights

CCS is only one, though very important, option in a portfolio of actions to fight the increase of atmospheric CO<sub>2</sub> concentration and to mitigate climate change, while at the same time allowing for the continued use of fossil fuels. Deployment of CCS technologies is expected to be limited in the next 5 to 10 years, but to provide a significant CO<sub>2</sub> sink in at best 20 years from now. Capture of CO<sub>2</sub> using existing separation techniques can be applied to large point sources, i.e. power plants or industrial plants; CO<sub>2</sub> can be easily transported over large distances using pipelines and ships; CO<sub>2</sub> storage can be in geological formations, or by fixing it as mineral carbonates.

There are at least three reasons why we should consider CCS. First, fossil fuel based power generation is one of the candidate options in the Swiss energy roadmap. Secondly, reduction of CO<sub>2</sub> emissions is a global issue and requires concerted international action; new technology and know-how developed within this project would have a global value and could be commercialized and implemented worldwide. Finally, we argue that even though significant additional cost and energy penalties are associated with the implementation of CCS, this technological option will be

needed to bridge the gap until CO<sub>2</sub>-free/neutral energy technologies are able to become the most prominent primary energy source.

Based on this analysis, CARMA's main objectives are as follows:

- To assess the potential role of CCS, by a life cycle analysis of material and energy fluxes and an economical evaluation of the different options for new (fossil fuel) power plants with the associated fuel cycles. Various alternatives for reducing emissions will be ultimately examined through a multi-criteria decision analysis covering a broad range of environmental, economic, and social criteria. Apart from Switzerland, one more European country having a different i.e. fossil-dominated electricity supply will be addressed.
- To study new concepts for zero emission fossil fuel power plants based on the pre-combustion CO<sub>2</sub> capture scheme, i.e. with a focus on the combustion of hydrogen-rich fuel gases. The experimental study will be complemented by a thermo-economical analysis of pre-combustion capture systems.
- To assess the applicability of geological storage of CO<sub>2</sub> in Switzerland, either in saline aquifers or in coal

seams, including risk analysis and induced seismicity hazard. Ultimate goal as a follow-up of this project will be a CO<sub>2</sub> injection field test.

- To develop a new mineral carbonation process that would lead to a drastically different approach to CO<sub>2</sub> storage worldwide, with higher cost and energy penalty but also a better promise of permanent storage than geological storage.
- To explore the societal issues associated with capture, transport and storage of CO<sub>2</sub>, including accounting aspects, the public and institutional understanding, and the acceptance of CCS in Switzerland and in neighboring countries.

## Achievements

1. An integrated inter-disciplinary methodology for energy systems analysis has been developed and implemented at PSI to compare current and future fossil, nuclear, and renewable energy technologies with associated fuel cycles. This methodological framework integrates a wide variety of bottom-up, process-oriented approaches including Life Cycle Assessment, environmental impact and external cost assessment, risk assessment, and integrated evaluation addressing also social aspects, based on Multi-Criteria Decision Analysis (MCDA).
2. The Combustion Research Laboratory at PSI is engaged in fundamental and applied heterogeneous (catalytic) and homogeneous (gas-phase) combustion, using experimental, numerical, and theoretical approaches. In the framework of this project, focus will be addressed to the experimental and numerical evaluation of hetero-/homogeneous combustion of hydrogen at industrially relevant pressures. Applying thermo-economic models and process integration techniques, the pre-combustion capture system will be further investigated in terms of optimal process design configuration.
3. In the framework of the geologic assessment of CO<sub>2</sub> storage in Switzerland, a wide expertise has been developed among the project partners. This covers the characterization of the behavior of rocks in water, oil and gas reservoirs, basin modeling, and geochemical modeling to simulate the long-term coupled effects of chemical reactions and fluid flow in the target rock-water systems. Moreover, with focus on CO<sub>2</sub> storage in coal seams, the surface adsorption phenomena and dynamics of CO<sub>2</sub> injection into coal have been extensively studied in a co-operation between the Separation Processes Laboratory and the



Structural Geology and Tectonics Group at ETH Zurich over the past few years.

4. Detailed work on the study of mineral carbonation has been carried out both theoretically and experimentally for several years at the Separation Processes Laboratory at ETH Zurich. Main efforts had been directed at studying the dissolution of silicate minerals, namely olivine at elevated temperature both with and without the presence of CO<sub>2</sub> and the precipitation of carbonates.
5. The group of Consumer Behavior at ETH Zurich has widely examined how laypeople perceive the risks associated with new technologies. In the past few years, work had been directed towards perception of climate change and this knowledge will be used to study public's opinion about CCS.

**Start date:** January 1, 2009

**Project duration:** 3 years

**CCES funding:** CHF 526'000

**CCEM funding:** CHF 520'000

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## GEOTHERM

### Geothermal reservoir processes: research towards the creation and sustainable use of enhanced geothermal systems

GEOTHERM aims to contribute to the quest for a sustainable energy strategy free of CO<sub>2</sub> emissions by conducting multidisciplinary basic research towards the development of Enhanced Geothermal Systems (EGS), a technology which will tap the deep geothermal resources that underlie most continental regions. State-of-the-art and novel techniques for the analysis of hydraulic, borehole geophysical, seismological and geochemical data will provide detailed insight into the in situ reservoir conditions and processes in Basel and other EGS sites. Computer simulation techniques will be developed that are expected to aid in 'engineering' the hydraulic flow paths and to predict the long-term behaviour of Enhanced Geothermal Systems. In the broader context of sustainable development, GEOTHERM will also investigate how usage of these geothermal resources in urban areas can be optimized.

### Achievements and Highlights

The rising cost of energy coupled with the desire to reduce CO<sub>2</sub> emissions has fuelled increased interest in geothermal energy. Shallow geothermal resources are now routinely exploited in Switzerland with more than 80% of new homes being fitted with geothermal heat pumps. However, the greatest potential lies at greater depths in crystalline rocks where temperatures are more favorable for electricity production. The technology intended to exploit such deep geothermal resources has been under development since the 1970s and is now referred to as Enhanced Geothermal Systems (EGSs). In essence, heat is extracted from a low-porosity rock mass by pumping water through natural fractures of enhanced permeability that link two or more boreholes (see Illustration). The engineering of the linkage constitutes the primary challenge of EGS system development. GEOTHERM will contribute basic research towards understanding the processes that underpin permeability creation and enhancement within crystalline rocks, the impact of fluid-rock interactions during the long-term operation of such systems, and the optimization of geothermal po-

wer generation in an urban environment. GEOTHERM has a close association with the project to develop a 5 km deep EGS at Basel and a collaborative agreement with the consortium that leads the project has been signed that gives GEOTHERM researchers preferential access to the data. However, other EGS datasets will also be included in the study.

The GEOTHERM project consists of five interlinked research modules.

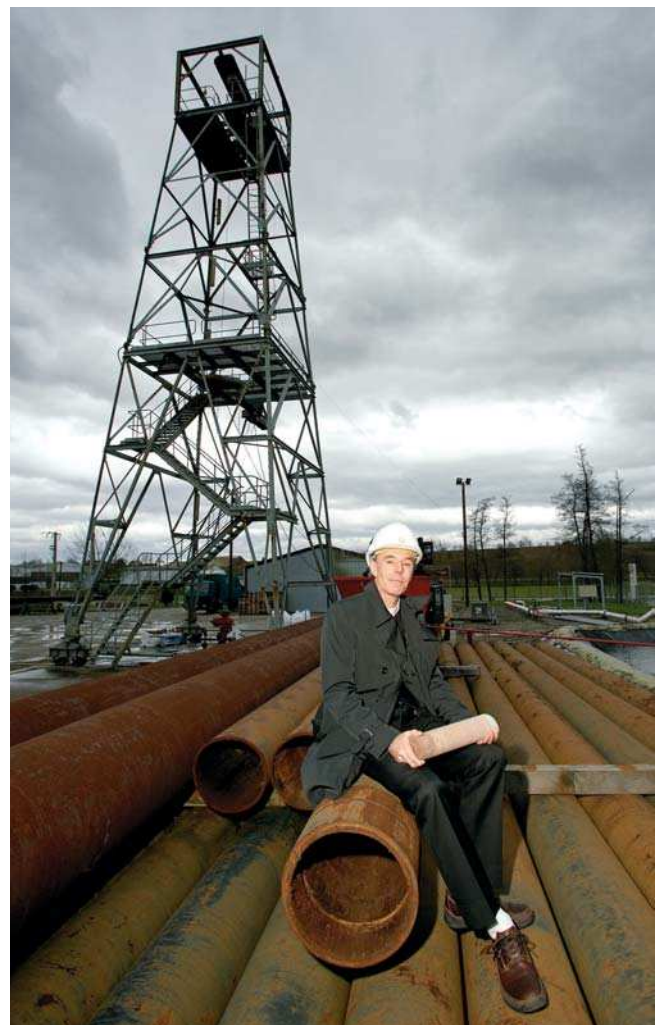
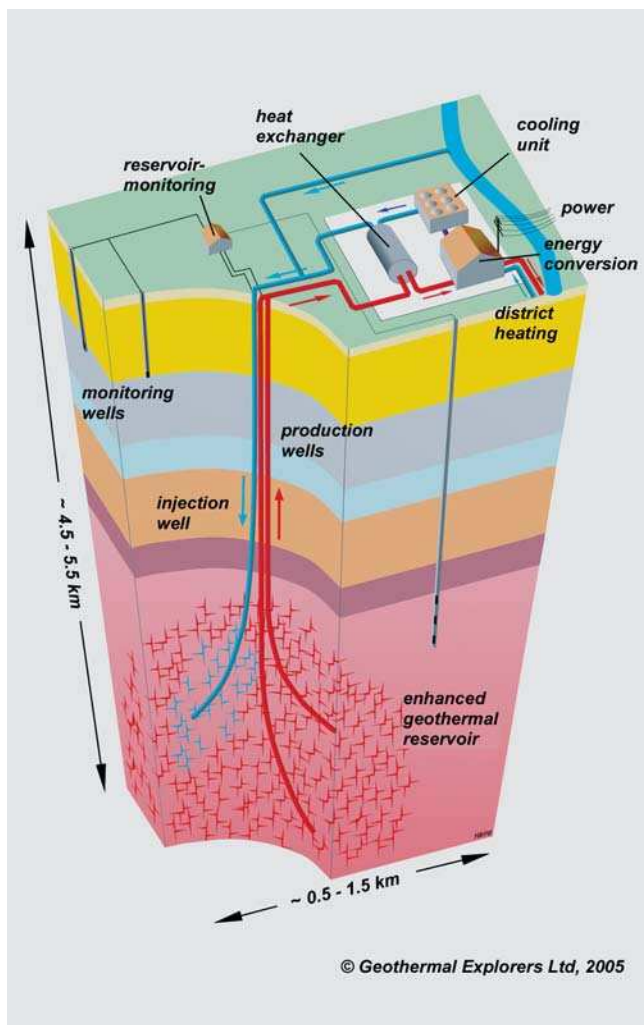
**Module 1** is concerned with the integrated analysis of hydraulic and borehole logging data largely for the Basel reservoir, and has two primary objectives: firstly geological and stress characterization of the reservoir, and secondly, to identify the changes that take place on the fracture populations within the reservoir as a consequence of the stimulation injections.

**Module 2** will analyze waveforms from microseismic events induced during the stimulation of the Basel and other EGS reservoirs and extract information pertaining to the process of shear failure, which is believed to be the mechanism

underpinning permeability creation and enhancement. One element of this work will focus on the nature and propagation of the failure process within fracture zones, whilst another will examine the spatial and temporal variations within the reservoir of the b-value of the Gutenberg-Richter magnitude frequency relations.

**Module 3** will develop a hydro-thermo-mechanical modeling platform for the simulation of permeability creation processes conditioned by the wellbore and microseismic observations of Modules 1 and 2. The simulator will be fully-modular in structure, implement modern approaches to the representation of fractured reservoirs, and include a geo-mechanics module that allows the consequences of the 'fresh-fracture' of rock bridges within a brittle fracture zone to be simulated. The model will ultimately be extended to a full reservoir size and serve as a platform for simulating the impact of the fluid-rock interactions identified in Module 4 on the long-term behavior of the reservoir during circulation.





**Module 4** will apply state-of-the-art thermodynamic and hydrodynamic simulation methods to describe fluid-rock interactions and mineral scale formation that could occur during long-term circulation. Predictions will be tested against existing datasets collected during the long-term circulation of EGSs.

**Module 5** is broadly concerned with investigating the relationships between the deep and shallow geothermal resources in urban areas from the perspective of sustainable development. The work has two aspects. The first is the assessment of the shallow geother-

mal potential in urban areas. The second is the modeling and optimization of energy conversion systems.

The project began on July 1, 2008. Activity since then has concentrated on recruiting staff, setting up a website, and activating the administrative bodies such as the Steering Committee. A total of four postdocs and five doctoral students will be employed on GEOTHERM. At the time of writing, all but two have been recruited. The kick-off meeting was held on October 6, and the first meeting of the project Steering Committee will take place in December.

**Start date:** July 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 1.7 million

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## RECORD

### Assessment and modeling of coupled ecological and hydrological dynamics in the restored corridor of a river

River restoration is an essential tool to achieve «good ecological status» of water courses as required by European and Swiss legislation. Although the number of restoration projects has increased in recent years, scientific understanding of the underlying principles determining how hydromorphological variability in restored corridors of rivers relates to ecosystem functioning, to biodiversity, and to water quality is still limited. Our objective is to increase mechanistic understanding of coupled hydrological and ecological processes in near-river corridors.

For this purpose, we are

- instrumenting a restored and a channelized section of the Swiss river Thur as large-scale field experimental sites, where we will quantify how the relevant variables influence (ground)water quality, ecosystem functioning, and biodiversity;
- performing controlled experiments at the field sites and in the lab;
- developing process-based models of coupled hydrological, biogeochemical, and ecological processes, facilitating transfer to other river systems undergoing restoration.

### Achievements and Highlights

1. We instrumented and characterized two research sites at the river Thur (restored river site in Niederneunforn/Altikon and canalized-river site in Felben-Wellhausen) (M.Sc. thesis Samuel Diem, ETH Zurich).
2. Four gauging stations were installed at Niederneunforn/Altikon.
3. Two observation towers (15 m high) equipped with 4 high-resolution digital cameras have been built to monitor river morphodynamic changes ([www.record.ethz.ch](http://www.record.ethz.ch)).
4. A complete meteo-station, a pluviometer, and two Sensorscope stations have been installed.
5. Vegetation plots (36) have been installed which started to grow and interact with floods.
6. 15 soil moisture sensors have been installed on five locations to measure vertical soil moisture distribution and temperature (Project Jonas Knöpfel, ETH Zurich).
7. A computer workstation has been set up and two PCs were installed with permanent internet connection for data submission and remote control of sensors.
8. A numerical code has been written to integrate river cross-section data and correct Digital Terrain Models (DTM) for river bathymetry (M.Sc. thesis Bettina Schächli, ETH Zurich 2008).
9. We acquired a Geoprobe direct-push machine for soil sampling, installation of wells, and aquifer probing within the R'Equip program of SNF.
10. An algorithm has been developed for experimental design of static crosshole electrical resistivity tomography (ERT).
11. Self-potential monitoring was performed to investigate the hyporheic exchange (M.Sc. thesis Oliver Genoni, ETH Zurich, 2008).
12. 3D ground penetrating radar and ERT data have been acquired.
13. An algorithm for joint 3D inversion of geophysical data has been extended to three data types. It has been coupled with a zonation algorithm.
14. We developed a forward model which directly links measurements of electrical potential differences during salt tracer experiments to the hydraulic conductivity distribution.
15. We designed and constructed a 2D sandbox to carry out salt tracer experiments monitored by ERT.
16. We tested optical fibers for distributed-temperature sensing (DTS) in the field and developed a high-resolution vertical temperature profiling technique.
17. We performed extensive surveys on 1) groundwater organisms (M.Sc. thesis Fabia Moret and Patrick della Croce, ETH Zurich) and 2) soil properties (M.Sc. thesis Karine Grin, EPF Lausanne, 2007).
18. The relationships between vegetation and soil organisms were studied (M.Sc. thesis Bertrand Fournier, University of Lausanne). In addition, bacterial community profiles and activities were analyzed.
19. Strong emissions of greenhouse gases are observed mainly from the Phalaris grass zone and the riparian willow forest, while the climax forest seems to act as a sink.
20. We established collaboration with Prof. Moritz Lehmann (University of Basel) to measure denitrification rates using the dual stable isotope approach ( $^{15}\text{N}$ ,  $^{18}\text{O}$ ).
21. We developed a fully coupled spati-



## Outlook

- ally distributed hydrological model of the river Thur catchment (M.Sc. thesis Alanna Minogue, EPF Lausanne, 2007).
- 22. A variably-saturated flow, reactive-transport model has been developed coupling existing codes with a splitting operator approach.
- 23. We screened more than 200 organic micropollutants and found 47 of them in the groundwater and 46 in the river Thur and the side channels.
- 24. A wiki was installed and implemented as meta-data documentation and communication platform for the project team.
- 25. We organized and performed
  - a. a public kick-off meeting,
  - b. information seminars and excursions for the cantons of Thurgau and Zurich, the Federal Office for the Environment (FOEN), the municipalities, adjacent owners, and members of the river-maintenance team,
  - c. a two-day (February 2008) and a five day (September 2008) seminar retreat for Ph.D. students and supervisors.

- 1. We will perform tracer tests along piezometer transects.
- 2. We will analyze aerial images including those obtained by a Drone flying machine.
- 3. A formulation for three-dimensional inversion of ERT data for time-varying models and data acquisition will be finalized, implemented, and tested.
- 4. The fully coupled inverse model of geoelectrical signals will be implemented and applied to several salt-tracer experiments in the lab.
- 5. The numerical flow and transport model will be applied to investigate the complex, non-linear interactions between nutrient and carbon cycling and physical factors.
- 6. Rhizobox experiments in the laboratory will be set up to quantify N uptake by key plants.
- 7. The isotopic N and O signature of nitrate in soil solution and groundwater samples will be assessed.
- 8. A field study will be performed with focus on several indicator micropollutants with different behaviour.
- 9. An analytical field technique will be developed for the in-situ determi-

nation of the oxygen consumption in groundwater.

- 10. The floodplain site will be used as a study site for the «Praktikum Aquatische Systeme», spring semester 2009» (Bachelor ETH Zurich).
- 11. We will organize a PhD retreat in spring 2009 including a half-day with partners from the cantons and FOEN.

**Start date:** April 1, 2007

**Project duration:** 4 years

**CCES funding:** CHF 1.8 million

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# NATURAL HAZARDS & RISKS

## HazRi

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## NATURAL HAZARDS & RISKS

### HazRi

The overall vision is to improve the predictability of natural hazards (including torrents and floods, debris flows, rock fall, landslides, snow and rock avalanches). Improvements in the predictability of hazards will concurrently advance our understanding of natural risks since the current state of the art to represent the hazard cycle is considered to be largely inaccurate. The ERU HazRi is focusing on major cross institutional research advances in the general domain of natural hazards that would (and could) not be addressed without the formation of this cooperative team. This ERU interacts closely with the other ERUs and many of our plans (especially the intensive field site and study SWISS EXPERIMENT) lead to broader collaboration in the ETH Domain (in particular, other ETH organizations concerned with natural hazards and risks). The ERU HazRi intends to develop close interactions with Swiss universities concerned specifically with the social, economic, and political aspects in this domain (e.g. Universities of Lausanne, Zurich and Bern), as well as government agencies (e.g. BAFU), cantons, engineers, and consultants, and the Mountain Research Initiative.

The main mission of the ERU HazRi is the improved understanding of the formation of hazards (initialization), the transport of water, snow, rocks, and debris (transformation) and ultimately the reduction of the risks associated with natural hazards. We develop community models that can be used by engineers and planners in practice for the study of scenarios and to develop risk response strategies. The 'formation' part of natural hazards is an area with massive experimental information and theoretical knowledge gaps and it is considered the aspect of the hazard cycle where we can achieve something

truly unique and outstanding in the context of this particular ERU. Given the poor understanding of initiation of natural hazards, rudimentary and incorrect decisions concerning initialization are often made in practice.

To improve the predictability of natural hazards, and hence achieve our overall goal, there are two initial lines of research that are pursued for maximum return for the ETH Domain and society at large that would not be achieved in an integrated fashion without the formation and leadership of this ERU. A natural outcome will be the development of community models – the third module. Finally, the improved coordination of Risk research broadly defined in the ETH Domain could be coordinated through HazRi, though it is currently not viewed as a primary mission of this ERU. The specific work modules for the first three years are:

1. design and implementation of an unprecedented intensive field experimental campaign SWISS EXPERIMENT that can address multi-scale issues in natural resources formation including: avalanches, floods, debris flows, land slides and rock falls;
2. implementation, development, and application of instrumentation, monitoring technology, and wireless observation systems for field observation along with scientific computing and data assimilation systems for real time predictions;
3. development of Community Models for Alpine Processes and their Application to Climate Change and Natural Hazards Prediction. Coordinate to develop a RiskCH program to assimilate the disparate data sources available to the broad hazard and risk community.

## APUNCH

### Advanced process understanding and prediction of hydrological extremes and complex hazards

A number of recent natural hazards have revealed severe shortcomings of models used in Alpine regions to predict storm rainfall driven hazards and to plan relevant mitigation strategies. The APUNCH project aims at improving the know-how necessary to implement more efficient models that can be used to generate risk maps and for real-time prediction. Specifically, the objective of the APUNCH project is to gain a comprehensive and process chain based insight into the response of Alpine watersheds hit by storm rainfall events. These trigger, in turn, flood runoff and diffused hillslope erosion, mobilize and accumulate sediment in channels up to building temporary dams. The collapse of these is followed by hyperconcentrated flows, which finally cause the failure of natural and engineered embankments in the channels of the upper watershed, and dyke ruptures with associated flooding in the lower river reaches. Among others, major challenges of the project are: (i) the investigation of the space-time structure of rainfall in mountainous regions; (ii) the laboratory and field experiments on initiation and evolution of sediment transport in steep channels and under rapidly varying flow conditions; (iii) the combination of physical modeling, field testing and numerical simulations to analyze and predict the conditions that lead to failure of dykes; (iv) the across-scales monitoring and modeling effort.

### Achievements and Highlights

The project started on June 1, 2008, and its achievements are at this time therefore still very limited. Most of them concern field installations or measurement devices that have already been put in place in the Vispa Valley (Valais, Switzerland) river basin, which will be used as prototype area for most of the experimental investigations.

#### Experimental investigations

An X-Band local weather radar has been installed on the Kl. Matterhorn at an elevation of 3888.88 m a.s.l. The radar is now being tested for robustness and reliability before it can deliver images on a regular pace to the project partners. Together with a dense network of rain-gauges to be installed in the coming months, it will contribute to high resolution observations of space-time variability of precipitation in mountainous regions. Such observations will be used to advance the understanding of the connection between space-time rainfall and natural hazard occurrence, to investigate the small scale spatial structure of rain fields, and to support the development of ensemble radar estimation

techniques in orographically complex regions.

Ground Positioning System (GPS) stations are also being installed, profiting additionally from synergies with the CCES project COGEAR to investigate the potential of atmospheric water vapour estimation by GPS tomography for assimilation into numerical weather prediction (NWP) models.

At existing dyke sections along the Rhone river, full scale experiments have already started in order to measure dyke response to transient flood loading and to investigate the temporal dynamics of changes in the internal wetting and drying along with their effect of soil state on potential breach development. New in situ instrumentation at additional critical dyke cross sections will be installed to expand the range of experiments and real world cases considered in the project.

Additional experimental activities are planned to support the development of advanced models. Specifically, centrifuge model tests are foreseen to complement the geotechnical field investi-

gations. Field and laboratory experiments are planned to investigate the development of a dam-break flood wave down a mountain stream, which, for instance, occurs as release of water and sediment following the collapse of temporary dams upstream of bridges and other obstacles or restrictions.

Flow conditions with intense sediment transport with emphasis on dune formation along steep channels with step-pool morphology will be also investigated. These often lead to sudden self-generated instabilities and high wave formation as well as initiation of sediment motion in steep channels with irregular bed morphology. The development of a new embedded sensor technology will allow Lagrangian observations and thus a better understanding of the space-time variability of these complex phenomena and of the development of channel debris-flows.





## Model developments

The experimental activities will generate in each of the tackled fields mathematical models that are able to simulate the investigated process at the scale of observation and that can be scaled-up to model them at the river basin scale. Accordingly, models will be developed for the advanced stochastic simulation of precipitation fields, for their disaggregation into high resolution fields, and for the integration of multisensoral precipitation measurements. Storm hazard indexes will also be derived from high resolution composite rainfall data. Process oriented computational methods will be developed to simulate and predict the consequences of a dam-break flood wave down a mountain stream; to simulate the transient response of dykes in terms of soil state and slope stability to river level variations and precipitation prior to breach formation, thus providing the base conditions for the evaluation of breach development; to model lateral erosion of natural river banks and engineered dykes by extending existing numerical tools with incorporation of hydromechanical laws;

focussing on the spatio-temporal growth of the breach and the corresponding flow rate; the rate of eroded material being released as sediment transport; and to improve 2D modeling of sediment transport. Improvements of the ability of 2D flooding models are also envisaged, to account for propagation of extreme dynamic flooding events evolving over complex topography of urbanized areas and of floodplains, the natural topography of which is strongly modified by settlements, urbanization, and infrastructures.

The process-oriented models developed for each of the research themes will flow into an integrated fully distributed and process-oriented hydrological model. This will enable a spatially and temporally explicit prediction of the main processes of storm rainfall driven hazards in mountain river basins, thereby including improved predictions of flood peaks, volumes and duration, but also sediment erosion and delivery to channels, as well as their transport throughout the river network, as well as the local erosion of

embankments and engineered dykes. The river basin scale distributed model will enable more reliable and spatially explicit simulations of the scenarios necessary to develop risk maps, as well as the implementation in realtime prediction systems necessary for mitigation actions.

**Start date:** June 1, 2008

**Project duration:** 3 years

**CCES funding:** CHF 1.88 million

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## COGEAR

### Coupled seismogenic geohazards in alpine regions

This interdisciplinary natural hazard project is investigating the hazard chain induced by earthquakes. It started in February 2008, and addresses tectonic processes and the related variability of seismicity in space and time, earthquake forecasting and short-term precursors, as well as strong ground motion as a result of source and complex path effects. We study non-linear wave propagation phenomena, liquefaction, and the triggering of landslides in soils and rocks as well as the potential of earthquake-induced snow avalanches. Our focus is on the physics of non-linear processes in relation to topography, geological disposition and slope stability. The Valais, and parts of the Rhone, Visper and Matter valleys specifically have been selected as study areas. The tasks include detailed field investigations, development and application of numerical modeling techniques, assessment of the susceptibility to seismically induced effects and installation of different monitoring systems to test and validate our models. These systems are for long-term operation and include a continuous GPS and seismic network, a test installation for observing earthquake precursors, and a system to study site-effects and non-linear phenomena in two test areas (Visp, St. Niklaus-Randa). Our project is to prepare a risk-related study of impacts on buildings, infrastructure, and society.

## Achievements and Highlights

### Common database and monitoring system

- A first version of the database prototype and interface has been established, and support to the project partners and tutoring for the preparation of data started. Some datasets are already visualized in test-beds.
- Screening of the buildings in Visp, including structural parameters of the buildings and ambient vibration measurements of some typical buildings together with a preliminary analysis of their vulnerability.
- A concept for a photogrammetric data viewer tool has been developed together with a conceptual model of the photogrammetric data.
- A historical overview of the effects of the largest earthquakes in the Valais has been achieved including a homogeneous macroseismic assessment.

### Earthquake preparation

- PhD students have started work for revising the seismo-tectonic framework of the Valais and for improving earthquake location techniques to better characterize faults in the study area.
- The PhD work on scaling relations of earthquakes in Switzerland established a relation between local magnitudes  $M_L$  and moment magnitude  $M_w$ .
- First results from GPS analysis show that movements are very small and that the detection needs sophisticated methods.
- Potential sites for the different seismic sensors and GPS stations as well as for co-located installations are investigated. A close coordination with Swiss-topo is established.
- A working group has been established with institutions interested in electromagnetic and geo-chemical signals that are related to earthquakes and deformations. Possible instruments and sites have been evaluated.

### Earthquake effects and impact

- Field mapping for the engineering geological characterization, extensive geophysical measurements for the soil characterization including passive (ambient vibration using single stations and arrays) as well as active measurements (combined surface wave/refraction analysis), and deformation measurements on different slopes.
- Preparation work for the design of boreholes in Visp and the Matter valley, including instrument evaluation and data collection related to potential sites for the boreholes.

Different monitoring systems were installed including temporary seismic networks in Visp and the Matter valley, and different devices at the Randa in-situ laboratory (fiber optic strain sensors in a borehole, temporary high resolution geodetic network, meteorological stations, arrays of temperature sensors, standard precipitation and atmospheric measurement devices).





**Start date:** February 1, 2008

**Project duration:** 4 years

**CCES funding:** CHF 2.4 million

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projects/hazri/COGEAR](http://www.cces.ethz.ch/projects/hazri/COGEAR)



## EXTREMES

### Spatial extremes and environmental sustainability: statistical methods and applications in geophysics and the environment

Environmental change is expected to have a substantial impact on the timing and sizes of rare but potentially catastrophic events, such as extreme precipitation, avalanches, and heat waves. Although their consequences can be enormous, these and other events such as earthquakes stem from complex circumstances and are very difficult to predict. Statistical thinking and mathematical modeling play an essential role in forecasting, but at present there is a large gap between the needs of stakeholders – such as scientists, public authorities, and insurers – and the quantitative tools that are available for modeling extreme events in time and space. This project will bridge this gap through the development of new statistical methods for rare event modeling, applying these new approaches to major natural hazards in the Alps, determining whether factors influencing rare events are internal or external to the system under study, and assessing limits to the predictability of such processes. Mathematicians, statisticians, and physicists work in close collaboration with environmental engineers, climatologists, and seismologists in interaction that will maximize the value and likely impact of the new data analytic approaches.

### Achievements and Highlights

1. Assembled 'clean' data sets for analysis, including data on snowfall, rainfall, temperatures, seismic activity, stratospheric ozone, avalanches, watersheds (soil, topography, and land-use)
2. Development of novel methods for analysis of extreme events of complex spatial data, based on fitting of max-stable random storm and random process models using composite likelihood estimation and their application to temperature and rainfall data
3. Development of statistical software for fitting the newly-developed models, now freely available for the statistical environment R
4. Application of physically-based watershed model to sub-basins of the Drances watershed using digital elevation model data, and more detailed analysis of related data on stream temperatures, evaporation, and precipitation
5. Introduction of a new definition of extremes of total atmospheric ozone
6. Analysis of ozone data based on peaks over threshold methods, showing that human activity has influenced changes in low-ozone events
7. Retrospective forecast comparison of physical and statistical seismicity models on the 1992 M7.3 Landers aftershock sequence, demonstrating the need for physical models to be augmented by stochastic components to compete with statistical models
8. Evaluation of the first 2.5 years of the 5 year prospective earthquake forecast initiative for Californian earthquakes. Among models based on geodetic, geological, seismic and tectonic data, results so far suggest that smoothed seismicity models are performing best
9. Identification of sequential Monte Carlo methods as methodological framework for data assimilation for earthquake forecasts for renewal process models; demonstration of significant improvement using numerical experiments
10. Study of the impact of magnitude uncertainties on rate estimates in earthquake clustering models, on their forecasts, and on tests of the quality of forecast models
11. Development of an efficient numerical scheme to solve the non-linear integral equations that describe the distribution of inter-event times in a general earthquake model with long memory
12. Development of new methods for the estimation of the tail of earthquake size distributions
13. Development of a new pattern recognition method able to reconstruct the three-dimensional structure of the active part of a fault network using the spatial location of earthquakes
14. Exploratory analysis of average and extreme levels of snowfall data, and assessment of their dependence on altitude and on location within Switzerland
15. Exploratory analysis of borehole data on permafrost at different Alpine locations
16. Analysis of open-site and below-canopy data on average and extreme climatic conditions, with particular reference to the heatwave of 2003, showing that certain types of forest clearly provide a cool shelter during such events



Photo: Hervé Wadier

## Outlook

1. Promotion of new methods to partners outside consortium, including short courses in Brazil and Finland
2. Further development and application of spatio-temporal models of statistical extremes, including refinement of current code libraries
3. Implementation and testing of spatial weather generator for Alpine environments
4. Study of effect of equivalent coordinates on statistical properties of spatial ozone
5. Installation of a next-day earthquake forecast algorithm for California at the CSEP Testing Center at the University of Southern California, for independent and prospective testing against other algorithms
6. Development of a robust parameter estimation technique for models of triggered seismicity
7. Exploratory analysis of seismicity parameters in terms of extremes and plate tectonic zones
8. Stochastic modeling of extreme snowfalls
9. Improved understanding of rare Alpine temperature events



**Start date:** July 1, 2007

**Project duration:** 3.5 years

**CCES funding:** CHF 1.8 million

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## TRAMM

### Triggering of rapid mass movements in steep terrain

This project aims at enhancing understanding of triggering and initiation mechanisms, including the transition from slow to fast mass movement processes, and flow characteristics of shallow landslides, debris flows and snow avalanches. A primary focus is on the roles of heterogeneity and criticality of hydro-mechanical hill-slope processes. Formulation of a framework that capitalizes on similarities between the different hydrologically-driven mass movements will be a key outcome of that project. Three research tasks were determined: (1) spatial characterization of hazard prone slopes; (2) improved understanding of triggering mechanisms; (3) transition to rapid mass movement. The innovative aspects of the project are: (1) synergies within the field of hazardous rapid mass movements are exploited; (2) general theories and models of release and mass flow are further developed for landslides, debris flows and snow avalanches; (3) multi-purpose platform enhancing scientific collaboration among the disciplines involved and promoting practical and academic educational missions related to rapid mass-release hazards.

### Achievements and Highlights

#### Collaboration

- A new collaboration between eight complementary research institutes within the ETH Domain has been established to make a joint effort in studying processes related to rapid mass movements.
- Twice per year, the TRAMM consortium has been meeting for mutual exchange of information about the accomplished and planned work, as well as for scientific presentations by invited speakers. In addition, a specific internal workshop on model concepts related to the triggering of rapid mass movements was held in January 2008.

#### Field experiments

- A previously ongoing hillslope experiment related to the triggering of shallow landslides at Tössegg (canton of Zurich) was completed, being the data basis for one PhD thesis and one master thesis within TRAMM.
- A comprehensive hillslope experiment on hydrologic perturbation of a steep hillslope was set up at Wiler (Lötschental, canton of Valais) in summer 2007. In that context, two intense irrigations of selected hillslope sections were carried out in August 2007 and 2008.
- In the frame of the longterm debris-flow observatory Illgraben (Valais), a

particular study of the entrainment by debris flows has been initiated with the installation of erosion sensor arrays and a first analysis of aerial photographs allowing for mapping of the source area.

- In winter 2007/08, an experiment was carried out at Wannengrat (Davos, Grisons) to test a prototype of an acoustic sensor for registering precursors of a snow avalanche. For winter 2008/09, a new seismic sensor system was tested in the lab and installed in an avalanche slope.
- A further extensive field experiment to observe the onset and propagation of an artificially released shallow landslide was set up at Rüdlingen (canton of Schaffhausen). A one-week irrigation (October 2008) yielded important insights in the hydrological behaviour of this slope.

#### Lab experiments

- A prototype pull-out test to determine root forces in the laboratory was developed.
- A new facility to visualize the flow features of complex mass flows (free surface + velocimetry inside the flow) in the laboratory has been set up.
- Extensive physical and mechanical characterization of the soils from Wiler and Rüdlingen was made.

#### Sensor development

- Prototypes of a sensor to measure acoustic emissions as indicators of an imminent landslide release and of a wireless sensor to measure water content were developed.
- A prototype of an acoustic sensor for registering precursors of a snow avalanche was devised.
- A novel technique to quantify channel bed erosion in the course of a debris flow was developed and successfully tested in the Illgraben.

#### Model and theory developments

- A constitutive hydro-mechanical model for unsaturated soils including double-way coupling between the stress-strain behavior and the water retention was formulated, validated, and implemented into a finite element code. The numerical tool is now ready to be applied to the Rüdlingen experiment.
- A 3-D hillslope hydrological model accounting for preferential lateral water flow was tested and further developed with data from the Tössegg landslide experiment.
- New concepts based on Self-Organized Criticality and Fiber-bundle theory were developed that describe the propagation of a local failure within a hillslope resulting in the release of the whole slope.
- A simple fiber bundle model was de-





veloped that reproduces the strain rate dependent behavior of snow deformation and failure.

- For some classical rheologies (Newtonian and viscoplastic) a theory has been developed elucidating the specific role played by the front of an avalanche mass.

#### Acquisition of third party funding

- A total of six SNF or EC Seventh Framework Programme (FP7) applications for third party funding related to the research carried out in TRAMM have been approved or are under negotiation with a total amount of CHF > 500'000.

#### Dissemination

- A special issue of the FAN Agenda, which is the official bulletin of natural hazard experts in Switzerland (Fachleute Naturgefahren), is devoted to the project TRAMM (Dec. 2008).
- Information on TRAMM was provided to local authorities and natural hazard practitioners through two newsletters, a public event (Wiler) and the WSL Forum für Wissen.

#### Awards

- M. Nuth received an award for the best PhD student presentation at the XXV Rencontres AUGC, Nancy 2008.



## Outlook

- While the first half of the project to a large degree consisted of field work and development of basic modeling concepts (SOC, hydro-mechanical model), the focus of the second half will be on the field and lab data analysis and the associated test and further development of numerical models.
- Two additional field experiments to study the triggering and propagation of shallow landslides are planned for summer 2009.
- An international conference on the Triggering of Rapid Mass Movements is planned for 2010 at the ETH congress hotel Monte Verità (Ascona) to relate the findings of TRAMM to international research projects.
- Possibilities for continuation of the TRAMM project will be explored in autumn 2009.

**Start date:** November 1, 2006

**Project duration:** 4 years

**CCES funding:** CHF 1,566 million

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# RESEARCH PLATFORMS

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## RESEARCH PLATFORMS

The widespread use of advanced technology characterizes the whole CCES, ranging from advanced computing to analytical labs to research stations to visualization platforms. There is a need to coordinate, integrate, and improve the methodological

tools and specialized equipment operated by experts in several fields. The development of advanced research platforms will benefit the whole CCES domain.



## Swiss Experiment – Interdisciplinary Environmental Research

The large-scale Swiss Experiment (SwissEx) project, spearheaded by the SLF for the Competence Centre Environment and Sustainability (CCES), was initiated to foster new wireless communication technologies, simpler and less expensive sensors and, above all, the possibility to capture, transmit, save, and automatically process huge amounts of data in real time.

SensorScope, which is developing a new generation of wireless and inexpensive automatic weather stations, provides a good example of the work being conducted as part of the Swiss Experiment. This compelling concept envisages highly mobile stations, which can be set up and deployed quickly at a location chosen, connect to each other to form a network and transmit in real time to a central server, where they are immediately available for use and processing. SensorScope technology is incorporated in several large-scale CCES projects. The measurements of meteorological data are also to be used for investigating the effects of glacier melt on soil formation, the influence of wind, humidity, and temperature on the landscape, and the origination of rapid mass movements, such as debris flows on slopes and avalanches.

During the successful pilot phase of SwissEx, a basic infrastructure was created which can support the acquisition and storage of streaming data and its metadata. The current infrastructure is described in Figure 1 using four parts to the workflow.

### Achievements and Highlights

#### Infrastructure

- Global Sensor Networks (GSN) software was developed by EPFL-MICS and adapted for Swiss Experiment. GSN is a «database middleware», meaning that it pre-defines the database schema, removing the requirement for scientists to have any prior database knowledge. GSN is at the heart of SwissEx, meaning that all projects can have a secure distributed database infrastructure with a web interface.
- A web based metadata infrastructure was created for easy storage and update of sensor metadata. Metadata is recognized by SwissEx to be an integral part of the data and this infrastructure will be improved and developed into a generalized system based on discussions with the CCES projects.
- Microsoft SensorMap, a geo-spatial visual interface for data retrieval, was created under the guidance of Swiss Experiment. This tool will form one of the main portals for data retrieval within SwissEx.
- Infrastructure workshops were run for all CCES projects. These workshops are to be held regularly to update projects on the latest technology available.
- In-stream processing was added to GSN, both in SQL and R programming languages. This area will be expanded to incorporate in-stream processing of models.
- The envisaged long distance WiFi link from Wannengrat to Davos has now been implemented. The system will be put into service as soon as the contracts with Swisscom have been settled. This will be a key technology, retrieving data from remote locations in the Alps.
- SwissEx has successfully served as an integration platform for several non-CCES projects. These projects provide services CCES partners may take advantage of, whilst also storing their data within the Swiss Experiment infrastructure, hence making them available to CCES partners. These projects are PermaSense (permafrost monitoring), Hydromon (water quality monitoring), SensorScope (climate monitoring) and Hydrosys (augmented reality). PermaSense have recently successfully implemented a new generation robust sensor network on the Matter-

horn and Hydromon have recently developed a real time water quality network in Chiasso. Hydrosys is a new EU project which will push the boundaries of SwissEx technology.

#### Data

- Sensor data from various CCES projects (BigLink, TRAMM, RECORD) were integrated into the SwissEx infrastructure. Much more data will follow as the infrastructure grows.
- 18 SensorScope first generation stations were created and deployed in a dense network on Wannengrat to monitor wind meteorological parameters over a harsh winter period.

#### Environmental education

- Two field campaigns have been successfully completed under the ClimAtscope program, using SensorScope stations to do climate education with schools in the Valais. This program enables children to acquire their own data and compare it with other schools.
- A pedagogical notebook was produced for the educational program above.



## Outlook

### Infrastructure

Now that a basic infrastructure is in place, user requirements are being collected to define more advanced features in the infrastructure:

- GSN is currently being upgraded to provide an entirely web interface-driven tool, allowing scientists to register their own sensors into the system with minimal prior IT knowledge.
- SensorMap is to be upgraded to take advantage of the tool's geospatial interface. These new functions include advanced download interfaces, querying and GIS based functionality to show metadata surrounding the sensor's position.
- A user requirements process is currently underway to define the infrastructure for entering and storing manually sampled data. This will eventually be integrated into the rest of the SwissEx infrastructure. RECORD and BigLink manually sampled data will be leading the way in the manually sampled data interface.
- User requirements are being gathered from individual projects separately to define exactly where and when SwissEx can assist, and where synergies exist between projects. The other CCES projects are now keen to see

where SwissEx can assist in minimizing costs, so that funding within the projects can be directed towards the science.

- After some successful field campaigns, EPFL's SensorScope team finished deployments in May 2008 to concentrate on the development of their 2nd generation station. Manufacturing of the new generation of stations will start with an industrial partner in December 2008. A pool of 100 stations should be available for Swiss Experiment use by March and a harsh conditions test deployment will take place at Wannengrat over the winter 2008/09.

### Data

The IMIS data, planned for integration over the summer of 2008, has been delayed by the development of a simpler and more stable web-based GSN interface. The integration of these stations will occur as soon as the new version is complete. The addition of all SLF data will significantly expand the database and SLF will use this as their primary point of data access. BigLink streaming data is already implemented within the SwissEx infrastructure. Mountland have formed close contact within SwissEx and are currently looking at how they

can use the infrastructure further as they define their experimental measurements. APUNCH remains one of the closest CCES collaborators within SwissEx and will use the infrastructure as soon as they implement their measurement system. Data from the radar is already available and will be incorporated soon. Negotiations with COGEAR on access to their data have not yet begun. MAIOLICA and GEDIHAP remain on the verges of SwissEx and it will be clearer what SwissEx can do for them once the manually sampled infrastructure is properly defined.

**Start date:** September 1, 2006 (pilot phase)  
September 1, 2008 (full proposal)

**Project duration:** 4 years

**CCES funding:** CHF 2.85 million

**Principal investigator:**

Michael Lehning  
michael.lehning@wsl.ch

**Partner institutions:**

WSL, ETH Zurich, EPF Lausanne, Eawag

**Website:**

[http://www.cces.ethz.ch/integrative\\_elements/research\\_platforms/swiss\\_experiment](http://www.cces.ethz.ch/integrative_elements/research_platforms/swiss_experiment)

## The Genetic Diversity Centre

### A research platform for the analysis of genetic diversity in natural populations and ecosystems

Genetic diversity is the most fundamental component of biological diversity. Its analysis is a key element for the study of biodiversity, ecosystem functioning, and the consequences of anthropogenic changes in natural systems that are due to climate change, habitat fragmentation, or biological invasions. At the same time, genetic diversity is central for understanding the spread and impact of diseases on natural and managed populations. Understanding genetic diversity is therefore essential for predicting the consequences of environmental change for natural populations, for developing sustainable agriculture and land management strategies, and for improving food production and human health.

The goal of GDC is to serve as leading technology and research platform in the ETH Domain for the analysis of genetic diversity at the level of populations, species, communities, and ecosystems. GDC aims to provide academic support for data acquisition, management and analysis, and access to state-of-the-art genotyping technologies to ensure that the ETH Domain continues to play a leading role in the analysis and understanding of genetic diversity.

## Achievements and Highlights

### Setting up GDC

1. GDC has officially opened its doors for users in January 2008 and is located centrally in the CHN building.
2. A homepage has been established at [www.gdc.ethz.ch](http://www.gdc.ethz.ch) to inform scientists about GDC and its possibilities.
3. Dr. Aria Minder was recruited as Technical Manager.
4. The organizational structure was put in place for GDC and consists of the Executive Board, the Panel and the Users.
5. The first Director and Vice Director of GDC are Prof. Dr. Paul Schmid-Hempel (D-UWIS) and Prof. Dr. Bruce McDonald (D-AGRL), respectively.
6. Regulations have been formulated for GDC and duties and responsibilities defined.

### Equipment and workflows at GDC

7. Major equipment items available at GDC include an ABI 3730xl Genetic Analyzer, a PyroMark ID pyrosequencing machine, an ABI 3700 RealTime PCR system, and two robots for liquid handling. Further equipment is made available by the participating labs.
8. Workflows for the different equip-

ment items have been developed and prices defined for members and non-members.

9. More than 50'000 samples have been processed with the ABI 3730xl Genetic Analyzer between January and July 2008.

### Projects at GDC

10. GDC is used by members of CCES projects BioChange, BigLink, Enhance and GEDIHAP for genetic diversity analyses.
11. In addition to CCES, projects funded by SNF, ETH, BAFU, BWL, Roche, WSL and EU use GDC.
12. Eight professorships and research groups from ETH Zurich, WSL and Eawag have become regular users of GDC within 6 months of its establishment.
13. The total budget of projects running at GDC in 2008 is over CHF 10 million.

### Organisms

14. Within the first six months of operation, genetic diversity analyses have been performed on 13 plant, six fungal, three animal and one bacterial and lichen species each.
15. The majority of these organisms are

non-model organisms for which little or no information on genetic diversity were previously available. They have been chosen based on their importance for natural systems.

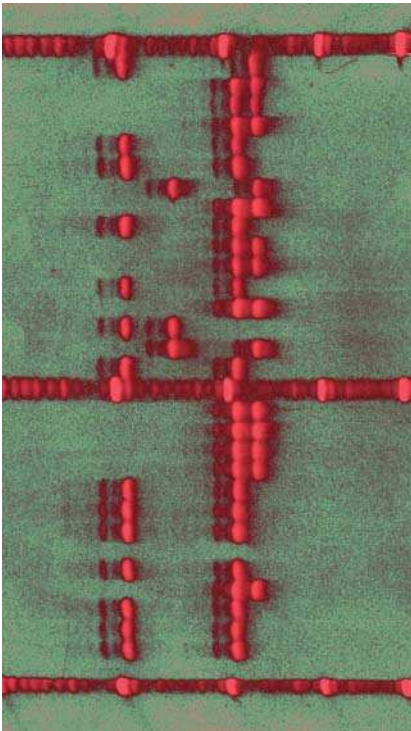
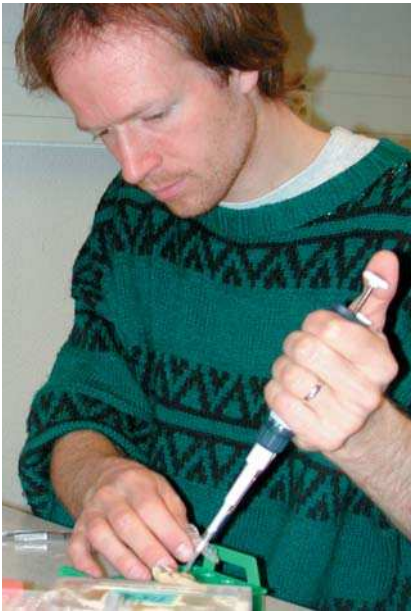
### Methods used at GDC

16. The most widely used molecular markers at GDC are Simple Sequence Repeats (SSRs), Amplified Fragment Length Polymorphisms (AFLPs), and Single Nucleotide Polymorphisms (SNPs).
17. Sequencing analyses have been carried out on nuclear, chloroplast, and mitochondrial genomes of animals, plants, fungi, bacteria, and a lichen species.

## Outlook

18. GDC is evaluating platforms for high-throughput genotyping of SNPs for large sample sizes typically used in population genetic analyses.
19. As a direct result of its success, GDC will move to larger laboratories within CHN in 2009.





**Start date:** January 1, 2008

**Project duration:** 1 year

**CCES funding:** CHF 0.1 million

**Principal investigator:**

Alexander Widmer

[alex.widmer@env.ethz.ch](mailto:alex.widmer@env.ethz.ch)

**Partner institutions:**

ETH Zurich, Eawag, WSL

**Website:**

[http://www.cces.ethz.ch/  
integrative\\_elements/  
research\\_platforms/gdc](http://www.cces.ethz.ch/integrative_elements/research_platforms/gdc)



# APPENDIX

Publications, Presentations, Research Proposals submittet to SNF (Sinergia) or EC FP7 .....	67
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## BigLink

### a) Publications

#### Peer reviewed publications

- Bernasconi S.M. and BigLink Project Members (2008) Weathering, soil formation and initial ecosystem evolution on a glacier forefield: a case study from the Damma glacier, Switzerland. *Mineralogical Magazine*, 72, 19-22.
- Bünemann, E.K., H. Göransson, E. Kandeler, J. Jansa, E. Frossard, F. Tamburini, R.H. Smittenberg, H. Olde Venterink, and S.M. Bernasconi (2008). Vegetation, soil nutrient availability and enzyme activities along a chronosequence of soil development in the forefield of the Damma glacier. *Berichte des naturwissenschaftlich-medizinischen Vereins Innsbruck, Supplementum* 18:9.
- Dessureault-Rompré, J.; Nowack, B.; Schulin, R.; Luster, J. 2007. Spatial and temporal variation in organic acid anion exudation and nutrient anion uptake in the rhizosphere of *Lupinus albus* L.. *Plant and Soil*, 301: 123-134.
- Dessureault-Rompré, J.; Nowack, B.; Schulin, R.; Tercier-Waeber, M.-L.; Luster, J. 2008b. Mobilization and complexation of Zn and Cd in the rhizosphere of *Thlaspi caerulescens*. - *Environ. Poll.*, submitted
- Dessureault-Rompré, J.; Nowack, B.; Schulin, R.; Tercier-Waeber, M.-L.; Luster, J. 2008a. Metal solubility and speciation in the rhizosphere of *Lupinus albus*. *Environ. Sci. Technol.*, submitted
- Edwards, I.P., Bürgmann, H., Miniaci, C. and Zeyer, J., 2006. Variation in microbial community composition and culturability in the rhizosphere of *Leucanthomopsis alpina* (L.) Heywood and adjacent bare soil along an alpine chronosequence. *Microbial Ecology*, 52: 679-692.
- Farinotti, D., M. Huss, A. Bauder, M. Funk, M. Truffer (in press). A method to estimate ice volume and ice thickness distribution of alpine glaciers. *Journal of Glaciology*.
- Heger TJ, Mitchell EAD, Ledeganck P, Vincke S, Van De Vijver B, Beyens L. (2009) The curse of taxonomic uncertainty in biogeographical studies of free-living terrestrial protists: A case study of testate amoebae from Amsterdam Island *Journal of Biogeography* (accepted pending minor revisions)
- Hämmerli, A., Waldhuber, S., Miniaci, C., Zeyer, J. and Bunge, M., 2007. Local expansion and selection of soil bacteria in a glacier forefield. *European Journal of Soil Science*, 58(6): 1437-1445.
- Luster, J.; Finlay, R. (eds.). 2007. *Handbook of Methods used in Rhizosphere Research*, online Edition. <http://www.rhizo.at/handbook>
- Luster, J.; Göttlein, A.; Sarret, G.; Nowack, B. 2008b. Strategies and methods - the soil science toolbox. In: Dessaux, Y.; Hinsinger, P.; Lemanceau, P. (eds.) *Rhizosphere: Achievements and Challenges*. Springer; Plant Soil, submitted (Invited)
- Magnusson J, Jonas T, López-Moreno I, Lehning M. (2008) Potential impact on climate change on the snow pack in a partly-glaciated basin in central Switzerland. Submitted to *Nordic Hydrology*.
- Miniaci, C., Bunge, M., Duc, L., Edwards, I., Bürgmann, H., Zeyer, J., 2007. Effects of pioneering plants on microbial structures and functions in a glacier forefield. *Biology and Fertility of Soils*, 44(2): 289-297.
- Payne R, Mitchell EAD. How many is enough? (2008) Determining optimal count totals for ecological and palaeoecological studies of testate amoebae. *Journal of Paleolimnology* (accepted pending minor revisions)
- Mitchell EAD, Charman DJ, Warner BG. 2008. Testate amoebae analysis in ecological and paleoecological studies of wetlands: past, present and future. *Biodiversity and Conservation*, In Press. doi: 10.1007/s10531-007-9221-3
- Richter, A.K.; Hirano, Y.; Luster, J.; Frossard, E.; Brunner, I. 2008. Root growth and physiology of European beech (*Fagus sylvatica* L.) seedlings are affected by very low base saturation. *Plant Soil*, submitted
- Wiederhold J. G., Teutsch N., Kraemer S. M., Halliday A. N. and Kretzschmar R. (2007) Iron isotope fractionation during pedogenesis in redoximorphic soils. *Soil Sci. Soc. Am. J.*, Volume 71, Number 6, pages 1840-1850.
- Wiederhold J. G., Teutsch N., Kraemer S. M., Halliday A. N. and Kretzschmar R. (2007) Iron isotope fractionation in oxic soils by mineral weathering and podzolization. *Geochim. Cosmochim. Acta*, Volume 71, Issue 23, pages 5822-5834.
- Wiederhold J. G., Teutsch N., Kraemer S. M., Halliday A. N. and Kretzschmar R. (2007) Iron isotope fractionation during pedogenesis in redoximorphic soils. *Soil Sci. Soc. Am. J.*, Volume 71, Number 6, pages 1840-1850.
- Wiederhold J. G., Teutsch N., Kraemer S. M., Halliday A. N. and Kretzschmar R. (2007) Iron isotope fractionation in oxic soils by mineral weathering and podzolization. *Geochim. Cosmochim. Acta*, Volume 71, Issue 23, pages 5822-5834.

#### Diploma and masters thesis

- Ziegler H. "Messkonzept für hydro-meteorologisches Monitoring optimiert auf ein Gletschervorfeld". Diploma Thesis, ETH Zurich, D-BAUG. Juli 2007. Co-advisors Manfred Stähli, WSL, and Tobias Jonas, SLF.
- Gärtner D.: "Initiale Bodenbildung im Gletschervorfeld". Diploma Thesis, ETH Zurich, D-BAUG. August 2007. Co-advisor Michael Plötze.
- Frick, S.: Hydrochemistry of the Damma glacier forefield - Influence of weathering processes on pore water chemistry. Diploma thesis ETH Zurich, 2007.
- Tresch, E.: Hydrochemistry of the Damma glacier forefield - temporal and spatial variability. Diploma thesis ETH Zurich, 2007.
- Matthias Rudolf von Rohr: "Biologische Verwitterung von Mineralien durch cyanogene Bakterien (*Pseudomonas* sp.)". Master Thesis, ETH Zurich, D-UWIS. April 2008. Co-advisor Helmut Brandl, Uni ZH.
- Merle Gierga: Characterization of organic matter associated with different mineral size fractions at the Damma Glacier



Forefield: Masters Thesis ETH Zürich/Uni Braunschweig, D:ERDW. May-nov 2008. Advisors S. Bernasconi and R. Smittenberg.

## b) Presentations

### Invited presentations

Bernasconi S.M. Weathering and soil formation in glacial forefields in the Alps, Conference "Geochemistry of The earth surface 8" (GES8), London, 18-22 August 2008, Invited Key-note presentation.

Bernasconi S.M. Weathering and soil formation in glacial forefields in the Alps, Third SoilCritZone workshop. Chania Greece. 5-9 Sept 2008.

Bourdon, B., R. Kretzschmar, M. Kiczka, J. Wiederhold, B.C. Reynolds, G. de Souza, Weathering processes traced with isotopes in a glacial soil chronosequence, AGU Fall Meeting 2007, San Francisco.

Kiczka, Mirjam: Iron isotope fractionation by biotic and abiotic weathering in an alpine glacier forefield. University of Karlsruhe, Germany, Karlsruhe, June 12, 2007, Invited Seminar

Mitchell EAD, Meisterfeld R. (2008) Cercozoan testate amoebae. Tree of Life Web Project Workshop Halifax July 19-20, 2008 (invited lecture)

Wiederhold, Jan: Iron isotopes - a new tracer for the biogeochemical iron cycle in soils. Austria, Vienna, February 26, 2007, Department of Environmental Geosciences Seminar.

### Contributed presentations and abstracts

Bünemann, E. Vegetation, soil nutrient availability and enzyme activities along a chronosequence of soil development in the forefield of the Damma glacier. Glacier foreland workshop, University Centre Obergurgl, Austria, 28 April 2008.

Bünemann, E. (2008) Development of soil as a living space: the case of the Damma glacier. Eurosoil 2008, 25-29 August, Vienna, Austria.

de Souza, G.F., B.C. Reynolds and B. Bourdon Evidence for stable strontium isotope fractionation during chemical weathering, *Geochimica et Cosmochimica Acta* 2007, Supplement S.

D. Farinotti, M. Huss, A. Bauder and M. Funk, "A new method to estimate ice volume and ice thickness distribution of alpine glaciers". 12th Alpine Glaciology Meeting, Chamonix, France, 6-7.Mar.2008.

Flagstad, L.A., Mitchell, E.A.D., Carlson, M.L. How tightly are aboveground and belowground communities linked? A comparison of primary successional patterns along a proglacial chronosequence in Kenai Fjords. 2007 Arctic Science Conference Partnering for Northern Futures: Science o Policy o Education o Legacy In the International Polar Year. Alaska American Association for the Advancement of Science, Arctic Division, Anchorage, Alaska, 24-26 September 2007.

Göransson, H. Nutrient uptake strategies of plants along a glacier forefield. Annual Research Conference of the former Geobotanical Institute, ETH, 27 February 2008.

Heger TJ, Derungs N, Theurillat JP, Mitchell EAD. Testate amoebae (Protista) communities in *Calluna vulgaris* litter differ with increasing altitude. V European Congress of Protistology and XI European Conference on Ciliate Biology. St.-Petersburg, Russia. July 23-27, 2007.

Hindshaw, R.S., Reynolds, B.C., Bourdon, B., Wiederhold, J.G., Kretzschmar, R.: Calcium isotope variations at the Damma glacier, Switzerland. Goldschmidt Conference, Vancouver, Canada, 13-18 July, 2008

Kiczka M., Frommer J., Voegelin A., Kretzschmar R.: Changes in Fe Speciation during Early Soil Formation in an Alpine Glacier Forefield, HASYLAB Annual Report.

Kiczka M., Wiederhold J.G., Kraemer S., Bourdon B., Kretzschmar R.: The impact of Fe isotope fractionation by plants on the isotopic signature of soils, Goldschmidt Conference, Cologne, Germany August 2007.

Kiczka M., Wiederhold J.G., Kraemer S., Bourdon B., Kretzschmar R.: Eisen-Isotopenfraktionierung während der initialen Pedogenese auf Granit, DBG Jahrestagung, Dresden, Germany, September 2007.

Magnusson, J. Jonas, T. López-Moreno, I. Lehning, M. Potential impact of climate change on the snowpack in a partly-glaciated basin in central Switzerland. 2008. Confernece Proceeding to the Nordic Hydrology Conference from 11 to 13 August, Reykjavik, Iceland

Mikutta, C., Wiederhold, J., Hofstetter, T., Cirpka, O.A., Bourdon, B., Von Gunten, U.: Iron isotope fractionation during Fe(II) sorption to mineral surfaces Goldschmidt Conference, Vancouver, Canada, 13-18 July, 2008

Olde Venterink, H. Ecological interactions between plants and micro-organisms in the acquisition of the growth limiting nutrients N, P, and K. Biglink Opening Symposium, ETH-Zürich, Zürich, 14 May 2007.

Scharfy, D., H. Eggenschwiler, H. Olde Venterink & S. Güsewell. 2007 *Solidago gigantea* – an invader resembling native species. Colonization versus invasion: do the same traits matter? Proceedings of an International Workshop, February 2007, University of Zürich / ETH Zürich pp. 39

Smittenberg R.H. et al. Early evolution of the soil organic matter pool as measured on a high alpine chronosequence. Eurosoil Congress, Vienna, August 2008.

Smitttenberg R.H., I.Hajdas, S.M. Bernasconi. Early evolution of the soil organic matter pool as measured on a high alpine chronosequence using organic geochemical and (radio)isotopic techniques. Meeting - Mountain soils under a changing climate and land-use, Zürich, March 2008.

Smitttenberg R.H., I.Hajdas, S.M. Bernasconi. Early evolution of the soil organic matter pool as measured on a high alpine chronosequence using organic geochemical and (radio)isotopic techniques. European Geophysical Union General Assembly, Vienna, April 2008.

Smittenberg R., Birkholz A., Gierga M., hajdas I, Hagedorn F. guelland K., Christl I. and Bernasconi S.M. (2008) Soil carbon dynamics on annual to millennial timescales – the experi-

mental approach. Swiss Geoscience Meeting 2008, Lugano, Nov 21-23

Streit, K., Thonar, C., Fließbach, A., Frossard, E., Jansa, J. A quest for mycorrhizal biomass quantification – fatty acids revisited. Plant Science Center Symposium: Plant reproductive systems, October 26 2007.

Thonar, C., Fischer, R., Frossard, E., Jansa, J. Molecular genetics of roots endosymbioses. A conference of the 3ème Cycle Romand en Sciences Biologiques. Cartigny 1-2 June 2007.

Welc, M., Jansa, J., Frossard, E.: Mycorrhizal status of plants along a soil chronosequence of the Damma glacier forefield (Switzerland, Canton Uri). Glacier foreland workshop. 28-29.04.2008. University Centre Obergurgl, Austria.

Welc, M., Smittenberg, R., Goransson, H., Bunemann, E., Tamburini, F., Frossard, E., Jansa, J.: Mycorrhizal associations at the Damma glacier forefield. Mountain soils under a changing climate and land-use. Conference and workshop. 06-08.03.2008, Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland.

Welc M., Bünemann E., Smittenberg R., Frossard E., Jansa J (2008) Soil fungi and nutrient cycling along a gradient of soil formation at the Damma glacier forefield (Switzerland, Canton Uri). Plants and People, PhD Symposium of the Zürich–Basel Plant Science Center, 6 June 2008.

Welc M., Bünemann E., Frossard E., Jansa J (2008) Soil fungi and nutrient cycling along a gradient of soil formation at the forefield of the Damma glacier (Switzerland, Canton Uri). SoilCritZone Workshop, Technical University of Crete, Chania, Crete, 5 September 2008

Wiederhold, J., Bourdon, B., Kretzschmar, R.: Hg isotopes in contaminated soils. Goldschmidt Conference, Vancouver, Canada, 13-18 July, 2008

Wiederhold, J., Bourdon, B., Kretzschmar, R.: How can we trace Fe isotope fractionation by weathering in soils? Goldschmidt Conference, Cologne, Germany, 23. 8. 2007.

Wiederhold, J., Kiczka, M., Kretzschmar, R., Bourdon, B.: Fractionation of stable iron isotopes - a new tracer for the biogeochemical iron cycle in nature. Workshop "Stable Isotope Tools for the Assessment of Chemical and Microbial Transformation Reactions in Complex Natural and Contaminated Environments", Ascona, Switzerland, 22. 11. 2007

Wiederhold, J., Teutsch, N., Kraemer, S., Halliday, A., Kretzschmar, R.: Fraktionierung von Eisen-Isotopen durch pedogene Prozesse in Podsolon und redoximorphen Böden. Jahrestagung der Deutschen Bodenkundlichen Gesellschaft, Dresden, Germany, 7.9. 2007

### c) Submitted proposals

Proposal for FP7 (will be submitted January 7th 2009) Soil transformation in European Catchments: "SoilTrec" (Working title) P.I: Prof. Steve Banwart, University of Sheffield, UK, Co- PI S. Bernasconi and BigLink Members, (Total 7 Mg).

## BioChange

### a) Publications

Vonlanthen, P., Roy, D., Hudson, A.G., Largiadere, C.R., Bittner, D., Seehausen, O. In Press. Divergence along a steep ecological gradient in Lake whitefish (*Coregonus* spp.). *Journal of Evolutionary Biology*

Pauchard, A., Küffer, C., Dietz, H., Daehler, C. C., Alexander, J., Edwards, P.J., Arévalo, J. R., Cavieres, L., Guisan, A., Haider, S. (2008) Ain't no mountain high enough: Plant invasions reaching new elevations. *Frontiers in Ecology and the Environment* in press

Küffer, C., Alexander, J., Daehler, C., McDougall, K., Pauchard, A., MIREN Consortium (2008) The Mountain Invasion Research Network (MIREN). *Mountain Research Initiative Newsletter* 1, 12–14

Lively, C. M., Delph, L. F., Dybdahl, M. F. and Jokela, J. 2008. Experimental test for a coevolutionary hotspot in a host-parasite interaction. *Evolutionary Ecology Research*, 10: 95-103.

Seehausen, O., Takimoto, G., Roy, D. and Jokela, J. 2008. Speciation reversal and biodiversity dynamics with hybridization in changing environments. *Molecular Ecology* 17:30-44.

### b) Presentations to conferences and congresses

Anja Westram: Talk at 14th European Meeting of PhD students in Evolutionary Biology, Einsiedeln, September 2008

Peter Edwards: Evolutionary processes along steep altitudinal gradients. Invited lecture at NCCR Plant Survival International Conference, Neuchâtel, 1st February 2008.

Jake Alexander: Going up in the world: has *Lactuca serriola* broadened its ecological horizons? Talk. 4th Annual meeting of the MIREN network, 1st-5th December 2008

Esther Frei, Philippe Matter, Thomas Hahn: Plant populations in a changing climate – pre-adaptation or plastic response? Poster. *Plant Population Biology* 2008, Luxembourg

Esther Frei, Philippe Matter, Thomas Hahn: Population genetics in different contexts: Impacts of altitude & landscape structure. Poster. *Plants and People Conference*, ETH Zurich

Thomas Hahn: Can gene flow disrupt local adaptation in the face of climate change? Poster. *GfÖ-Jahrestagung* 2008, Leipzig

Jake Alexander: Genetic diversity, contemporary evolution and the maintenance of biodiversity in changing alpine environments ("BioChange"). Poster presentation at the GfÖ, section Population Biology meeting, 1st-3rd May 2008

Jake Alexander: Genetic diversity, contemporary evolution and the maintenance of biodiversity in changing alpine environments ("BioChange"). poster presentation at the ETH Latsis Symposium, 17th-19th September 2007.

**c) Research proposals submitted to SNF and FP7: Title, PI and amount requested of large proposals submitted to SNF (only Sinergia) or EC FP7 (all actions).**

SNF interdisciplinary projects: Climate change impacts on Alpine aquatic biodiversity: integrating landscape processes and evolutionary ecology to predict macroinvertebrate responses. Applicants: Katja Räsänen (PI), Christopher Robinson, Peter Reichert and Irene Keller. Amount requested: 495'448 CHF

SNF: The influence of climate change and extreme weather events on plant invasions. Regula Billeter. NF-Project 174725.- (funded)

## ClimPol

### a) Publications

Allenspach, Urs. Parity and the Chaining Argument. (submitted)

Brun, Georg & Hirsch Hadorn Gertrude 2008. Ranking Policy Options for Sustainable Development. *Poiesis & Praxis*, 5, 15–30. (DOI 10.1007/s10202-007-0034-y).

Engel, S., Bretschger, L., and R. Schubert. 2008. "Die andere Seite der Stern Debatte". *Schweizerische Zeitschrift für Forstwesen* 159, 7: 209–213

Engel, S., and C. Palmer. 2008. "Payments for Environmental Services as an Alternative to Logging under Weak Property rights: The Case of Indonesia". *Ecological Economics* 65:799–809.

Engel, S., Pagiola, S., and S. Wunder. 2008. "Designing Payments for Environmental Services in Theory and Practice – An Overview of the Issues." *Ecological Economics* 65:663–674.

Engel, S., and C. Palmer. 2008. "Designing Payments for Environmental Services with Weak Property rights and External Interests." In: Zilberman, D., R. Stringer, L. Lipper, and T. Sakuyama (eds.), *Managing Environmental Services in Agricultural Landscapes: Policies and Incentives for Poverty Reduction in Developing Countries*, Food and Agriculture Organization of the United Nations (FAO) and Springer Press.

Engel, S., and C. Palmer. "Painting the forest REDD"? Prospects for mitigating climate change through reducing emissions from deforestation and degradation. IED Working Paper, Institute for Environmental Decisions, ETH Zürich.

Engel, S. 2008. "Zahlungen für Umweltleistungen – Potentiale und Grenzen". *Böll.Thema*. Available at <http://www.boell.de/weltweit/lateinamerika/lateinamerika-1785.html>

Furrer B., Swoboda, M., Hoffmann V.H. (2008), *Stumbling into Momentum? An analysis of climate strategies in more than 100 banks worldwide*, Project Report in preparation, SAM, Zurich

Hirsch Hadorn, Gertrude & Brun, Georg 2007. Ethische Probleme Nachhaltiger Entwicklung. In: *Schweizerische Akademie der Geistes- und Sozialwissenschaften SAGW* (Hrsg.). 2007. *Nachhaltigkeitsforschung – Perspektiven der Sozial- und Geisteswissenschaften*, Bern: SAGW, 235–253.

Hirsch Hadorn, Gertrude; Pohl, Christian & Bammer, Gabriele 2009. Problem Solving through Transdisciplinary Research and Integration. In: Frodeman, Robert, Thompson Klein, Julie & Mitcham, Carl (eds.). *Oxford Handbook on Interdisciplinarity*. Oxford: Oxford University Press, forthcoming

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Hirsch Hadorn, Gertrude; Hoffmann-Riem, Holger; Biber-Klemm, Susette; Grossenbacher-Mansuy, Walter; Joye, Dominique; Pohl, Christian; Wiesmann, Urs; Zemp, Elisabeth (eds.). 2008. *Handbook of Transdisciplinary Research*. Heidelberg: Springer

Hirsch Hadorn, Gertrude & Pohl, Christian 2007. Realexperimente als Lernprozesse. *Erwägen, Wissen, Ethik (Deliberation, Knowledge, Ethics)* 18, 3, 379–380.

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Hoffmann V.H., Busch T. (2008): "Corporate Carbon Performance Indicators: Carbon Intensity, Dependency, Exposure, and Risk", *Journal of Industrial Ecology* (forthcoming)

Hoffmann V.H., Schneider M., Schmidt T.S.: "Is the Carbon Price the Magic Bullet - A systematic performance assessment of renewable energy technologies under the CDM", *Climate Policy* (under review)

Hoffmann, V.H., Trautmann, T., Schneider, M. (2008): "A taxonomy for regulatory uncertainty - Application to the European Emission Trading Scheme", *Environmental Science & Policy* 11(8): 712–22

Kolk A., Hoffmann V. (2007): "Business, Climate Change and Emissions Trading: Taking Stock and Looking Ahead", *European Management Journal* 25(6): 411–414

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Palmer, C., and S. Engel (eds.). In press for Spring 2009. *Avoided Deforestation: Prospects for Mitigating Climate Change*. *Routledge Explorations in Environmental Economics*, Routledge, Oxford.

Pohl, Christian; Wülser, Gabriela & Hirsch Hadorn, Gertrude 2008. Nachhaltigkeitsforschung: Kompromittiert die Orientierung an der gesellschaftlichen Leitidee einer nachhaltigen Entwicklung den Anspruch als Forschungsform? In: Bogner, A., Kastenhofer, K. & Torgersen, H., (Eds.) *Inter- und Transdisziplinarität revisited. Potenziale und Dilemmata gesellschaftsrelevanter Wissenschaft*. Berlin: nomos, forthcoming.



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- Pohl, Christian & Hirsch Hadorn, Gertrude 2008. Methodological challenges of transdisciplinary research. *Nature, Science, Société*, 16, 111-121.
- Pohl, Christian & Hirsch Hadorn, Gertrude 2008. Gestaltung transdisziplinärer Forschung. *Sozialwissenschaften und Berufspraxis*, 31, 5-22.
- Schneider M., Hendrichs H., Hoffmann V.H.: "Navigating the Global Carbon Market - An analysis of the CDM's value chain and prevalent business models", *Energy Policy* (under review)
- Schneider M., Hoffmann V.H., Gurjar B.R.: "Corporate Responses to the Clean Development Mechanism - the Indian Pulp and Paper Industry", *Climate Policy* (forthcoming)
- Schneider M., Holzer A., Hoffmann V.H. (2008): "Understanding the CDM's contribution to technology transfer", *Energy Policy* 36(8): 2920-2928
- Schubert, R. 2008. "Unternehmen tun etwas für die Umwelt, wenn es sich für sie lohnt. Ein Gespräch zur Rolle von Firmen im Klimaschutz, zu den "richtigen" Massnahmen und zum sozialen Druck auf die Mitarbeiter. *Neue Zürcher Zeitung* vom 22.08.2008
- Weinhofer G., Hoffmann V.H. (2008): "Mitigating Climate Change: How do Corporate Strategies Differ?", *Business Strategy and the Environment*, (forthcoming)
- Wunder, S., Engel, S., and S. Pagiola. 2008. "Taking Stock: Lessons Learnt for the Design of Payments for Environmental Services Programs". *Ecological Economics* 65: 834-852
- Wunder, S., Engel, S., and S. Pagiola, S. (eds.). 2008. Designing Payments for Environmental Services in Developing and Developed Countries. Special Issue. *Ecological Economics* 65.
- Wünscher, T., Engel, S., and S. Wunder. 2008. "Spatial Targeting of Payments for Environmental Services: A Tool for Boosting Conservation Benefits." *Ecological Economics* 65: 822-833.
- Wünscher, T., Engel, S., and S. Wunder. 2008. "Payments for Environmental Services – a Report from Costa Rica". *ZEF News* 20, May 2008. Center for Development Research, Bonn.
- b) Presentations to conferences and congresses**
- Allenspach, Urs. Evaluative Comparison & Complex Comparative Concepts, XXI. Deutscher Kongress für Philosophie, 2008, Essen
- Allenspach, Urs. Expanding the Conceptual Space of Comparison, ECAP 6, 2008, Krakau
- Allenspach, Urs. Expanding the Conceptual Space of Evaluative Comparison in Practical Reasoning, Symposium 2008, Swiss Philosophy Society, Bern
- Brun, Georg. Wer hat ein Problem mit irrationalen Präferenzen? Entscheidungstheorie und Überlegungsgleichgewicht, Symposium 2008, Swiss Philosophy Society, Bern
- Furrer, Bettina and V. Hoffmann) August 21-22, 2008: "Stakeholder management as a determinant for banks' climate change strategies", 2nd International Sustainability Conference 2008, Basel/Switzerland,
- Markard, J./van Lente, H.: On the relationship between expectations and technological innovation systems, Paper presented at the 4S/EASST conference, August 20-23, Rotterdam.
- K. Rogge, V. Hoffmann September 11-13: "EU Emission trading and the sectoral innovation system for power generation technologies - Findings for Germany and Europe", DIME International Conference on "Innovation, sustainability and policy", Bordeaux, France
- Schaffer, Lena M. (2008) "Explaining the Diffusion of Environmental Policy in the U.S.", paper presented at the Midwest Political Science Association (MPSA) Annual National Conference in Chicago, USA 03.-06. April 2008
- Schaffer, Lena M. (2008) "Voluntary Climate Change Initiatives in the U.S.: Testing Spatial Dependence in Participation", paper presented at the American Political Science Associations Annual Conference in Boston, USA, 28.-31. August 2008
- Schaffer, Lena M. (2008) "Now or later? Testing a model of the timing and design of climate change policies". Presentation at the Conference of the International Political Economy Society (IPES) in Philadelphia, 14.-15. November 2008.
- Schmidt, Tobias and M. Schneider, V. Hoffmann) September 8-10: "Emission Reduction Projects in Developing Countries - Assessing the performance of renewable energy technologies under the CDM", Poster Presentation, Smart Energy Strategies Conference 2008, Zurich/Switzerland
- Schubert, R. et al. 2008. How to make private households' energy demand less myopic – The role of discounting, information and incentives. Poster Presentation, Smart Energy Strategies Conference 2008, Zurich/Switzerland
- Schubert, R. et al. 2008. Climate policy making for enhanced technological and institutional innovations (ClimPol). Poster Presentation, Smart Energy Strategies Conference 2008, Zurich/Switzerland
- Silber, T., Palmer, C. 2008. 'What Role Can Carbon Payments Play in Poverty Alleviation? Analysis of a Forestry Carbon Project in Mozambique', *Tropentag* 2008: 'Competition for Resources in a Changing World: New Drive for Rural Development', University of Hohenheim October 7 - 9, 2008 in Stuttgart-Hohenheim.
- Wünscher, T., Engel, S., Wunder, S. 2008. "Targeting International Payments for Environmental Services (IPES): General criteria, existing global approaches, real world examples and special challenges to IPES". Presentation at UNEP side event to the Annual Conference of the International Society of Ecological Economics in Nairobi, August 2008.

## IMBALANCE

### a) Publications

- Lanz, V. A., M. R. Alfarra, U. Baltensperger, B. Buchmann, C. Hueglin, S. Szidat, M. N. Wehrli, L. Wacker, S. Weimer, A. Caseiro, H. Puxbaum and A. S. H. Prevot (2008). Source attribution of submicron organic aerosols during wintertime inversions by advanced factor analysis of aerosol mass spectra. *Environmental Science & Technology* 42(1): 214-220.
- Sandradewi, J., A. S. H. Prevot, S. Szidat, N. Perron, M. R. Alfarra, V. A. Lanz, E. Weingartner and U. Baltensperger (2008). Using aerosol light absorption measurements for the quantitative determination of wood burning and traffic emission contributions to particulate matter. *Environmental Science & Technology* 42(9): 3316-3323.
- Viana, M., T. A. J. Kuhlbusch, X. Querol, A. Alastuey, R. M. Harrison, P. K. Hopke, W. Winiwarter, M. Vallius, S. Szidat, A. S. H. Prevot, C. Hueglin, H. Bloemen, P. Wahlin, R. Vecchi, A. I. Miranda, A. Kasper-Giebl, W. Maenhaut and R. Hitzenberger (2008). Source apportionment of particulate matter in Europe: A review of methods and results. *J. Aerosol Sci.* 39(10): 827-849.
- Weimer, S., C. Mohr, C. Good, V. Lanz, P. DeCarlo, R. Richter, M. Mohr, A. S. H. Prevot, U. Baltensperger, Organic aerosol source apportionment using mass spectra of mobile laboratory data, to be submitted to *Environ. Sci. Technol.*

### b) Presentations to conferences and congresses

- Baltensperger U., New frontiers on organic aerosols, Invited plenary lecture, European Aerosol Conference, Thessaloniki, August 24-29, 2008.
- Baltensperger, U., Nucleation, growth, and aging of secondary organic aerosol, talk, Workshop on Organic Aerosols, Telluride, CO, August 4-8, 2008.
- Baltensperger, U., Primary and secondary organic aerosol from diesel engines, Keynote lecture, 12th ETH-Conference on Combustion Generated Nanoparticles, Zurich, June 23-25, 2008.
- Heringa, M.F., R. Chirico, P.F. DeCarlo, A.C.J. Richard, M.R. Alfarra, N. K. Meyer, H. Burtscher, M.A. Sattler, C.K. Gaegauf, A.S.H. Prévôt, U. Baltensperger, Investigation of primary and secondary aerosols from wood combustion with online aerosol mass spectrometry, poster, European Aerosol Conference, Thessaloniki, August 24-29, 2008.
- Mohr, C., S. Weimer, R. Richter, P.F. DeCarlo, A.S.H. Prevot, U. Baltensperger, Source apportionment of ambient aerosol applying PMF on AMS mobile and stationary data, talk, European Aerosol Conference, Thessaloniki, August 24-29, 2008.
- Mohr, C., S. Weimer, R. Richter, A.S.H. Prévôt, U. Baltensperger, Partikelzusammensetzung im Rheintal und in der Stadt Zürich, Talk, Ostluft Vollversammlung, Birmensdorf, 27 May 2008.
- Tritscher, T., M. Heringa, R. Chirico, M. Steiger, J. Duplissy, M. Gysel, P. DeCarlo, J. Dommen, E. Weingartner, U. Baltensperger,

Properties of aged combustion aerosols, first results from smog chamber experiments, poster, 12th ETH-Conference on Combustion Generated Nanoparticles, Zurich, June 23-25, 2008.

## MAIOLICA

A EU-project is currently being planned to measure greenhouse gas budgets across Europe (Steering committee: N. Buchmann). A SNF grant is pending (PI: W. Eugster)

## ENHANCE

### a) Publications

- Angelone S., Holderegger R. Population genetics suggests effectiveness of habitat connectivity measures for the European tree frog in Switzerland. Submitted to *Journal of Applied Ecology*
- Csencsics D., Holderegger R. In press. Le peuplier noir bénéficie des revitalisations de cours d'eau. *La Forêt*
- Csencsics D., Holderegger R. In press. Genetische Tests im Auenwald. *Wald und Holz*
- Daouda Kouakou, Thomas Sattler, Martin K. Obrist, Peter Duelli, Marco Moretti. submitted Recent Swiss records of rare bee species (Hymenoptera, Apidae) with two species new to Switzerland. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*.
- Holderegger R. and DiGuilio M. submitted. The genetic effects of roads: a review of empirical evidence. *Ecology and Society*.
- Home, R., Bauer, N. & Hunziker, M., Cultural and Biological Determinants in the Evaluation of Urban Green Spaces. Accepted. *Environment and Behavior*
- Home, R., Keller, C., Bauer, N. & Hunziker, M., Selection criteria for species as representatives of conservation organizations. in review. *Biological Conservation*.
- Jaeger JAG, Bertiller R, Schwick C, et al., 2008. Implementing landscape fragmentation as an indicator in the Swiss Monitoring System of Sustainable Development (MONET). *Journal of Environmental Management* 88, 4: 737-751.
- Junker, B. und Buchecker, M., 2008. Sozialverträgliche Flussrevitalisierungen. Ein Leitfaden. Birmensdorf, Eidg. Forschungsanstalt für Wald, Schnee und Landschaft WSL. 58 S.
- Junker, B., Buchecker, M., Frick, J. submitted. What Influences Public Attitudes Toward River Restorations? *Society and Natural Resources*.
- Junker, B., Buchecker, M., 2008. Aesthetic preferences versus ecological objectives in river restorations. *Landscape and Urban Planning*, 85 (3-4): 141-154.
- Junker B. and Buchecker M. in press. Zielvorstellungen der Bevölkerung hinsichtlich der Revitalisierungen von Fließgewässern. In Buchecker M., Frick J. and Tobias S. (eds.), *Gesellschaftliche Ansprüche an den Lebens- und Erholungsraum*.

Eine praxisorientierte Synthese der Erkenntnisse aus zwei Forschungsprogrammen, pp. 32-25. Eidg. Forschungsanstalt WSL, Birmensdorf.

Germann C., Sattler T., Obrist M., K., Moretti M. accepted. Weevils in the Swiss cities of Lucerne, Lugano, and Zurich (Coleoptera, Curculionidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft.

Peter, A., Schager, E. & Weber, C. 2008. Fischökologische Anforderungen an den Wasserbau. Internat. Symposium ETH Zürich. VAW Mitteilungen 208, Band 2: 811-821.

Sarvary, M.A., Bloem, K.A., Bloem, S., Carpentier, J.E., Hight, S.D. and Dorn, S. 2008. Diel flight pattern and flight performance of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) measured on a flight mill: Influence of age, gender, mating status, and body size. *Journal of Economic Entomology* 101:314-324.

Stäheli, T. 2008. Revitalisierungen an der Bünz: Zusammenhänge zwischen Hydromorphologie und Makrozoobenthos. ETH and Eawag, MSc-thesis: 44 p.

Tesileanu, R. 2008. Valuing non-market environmental goods: a critical analysis of various valuation methods. Diploma thesis, Faculty of forest and environmental sciences, University Freiburg.

#### **b) Presentations**

Bolliger J. Invited keynote, Workshop Series A "Aufbau ökologischer Netzwerke im Alpenraum", ICAS meeting on Gebirgsforschung Schweiz, September 11, 2008

Home, R., Bauer, N., Hunziker, M.: Urban Green Spaces and Quality of Life. International Association of People Environment Studies (IAPS). 28.-31.7.2008, Rome

Moretti M., T. Sattler, R. Home, F. Bontadina, N. Bauer, S. Gloor, P. Duelli, P. Della Bruna, M.K. Obrist, M. Hunziker. 2008. BiodiverCity - Ecological and social value of urban nature. How to maintain and improve biodiversity and its acceptance in urban areas. Urban Biodiversity & Design. International Conference Erfurt, Germany.

Csencsics D., Holderegger R. Nachweis artreiner Schwarzpappelverjüngung. Poster to the meeting "La Biodiversité en Valais". November 6-7, 2008, Musée de la Nature du Valais, Sion.

#### **Research proposals submitted to Sinergia and FP7**

We did not submit large projects in fall 2008. However, we are in the process of acquiring money from the following sources:

#### **SNF project**

Bolliger J., Holderegger R. Landscape defragmentation to enhance functional connectivity: a landscape genetic and modeling experiment at two scales, CHF 240'000 (1 PhD).

#### **BAFU funding**

Positive funding of one project in connection with habitat fragmentation ("Landscape Fragmentation in Europe", BAFU contract approved but pending signature) CHF 200'000.

## **MOUNTLAND**

#### **a) Poster**

Rigling et al. 2008. Sustainable land-use practices in mountain regions: Integrative analysis of ecosystem dynamics under global change, socio-economic impacts and policy implications (MOUNTLAND). COST Strategic Workshop: Global Change and Sustainable Development in Mountain Regions. 7-9 April 2008, Innsbruck, Austria.

#### **b) Presentations**

Rigling A.: CCES MOUNTLAND: Nachhaltige Landnutzung in Gebirgsregionen: Integrative Analyse der Ökosystemdynamik im Klimawandel und ihrer Auswirkungen für Sozio-ökonomie und Ressourcen-Politik. Gebirgsforschung Schweiz, 10-11 Sept. 2008, Brig, Switzerland.

Ingold, K., Barbeçat, V., Gillet, F.: Le projet MOUNTLAND du Centre de Compétence Environnement et Durabilité du Domaine des EPF (CCES). Objectifs et enjeux pour le paysage jurassien. Comité de pilotage, projet Interreg GISP-Arc jurassien, 29 août 2008

## **BactFlow**

#### **Presentations to conferences and congresses**

Doyscher D., Hagggenmüller M., Fieseler L., Schuppler M., Loessner M.J. (2007). Interaction of *Listeria* spp. with environmental protozoa. Latsis Symposium 2007 "Research Frontiers in Environment und Sustainability", 17.-19.09.07, Zurich, Switzerland.

Doyscher D., Fieseler L., Schuppler M., Loessner M.J. (2008). Interactions of *Listeria* and *Acanthamoeba*. D-Biol PhD Summer School "Evolution - From Molecules to Civilization", 20.-22.10.08 Stels, Switzerland.



## GEDIHAP

### a) Publications

#### Submitted

- Wolinska, J. and Spaak, P. The cost of being common: evidence from natural *Daphnia* populations. - *Evolution*.
- Sommerhalder, R.J., McDonald, B.A., Mascher, F., Zhan J.. Sexual recombinants make a significant contribution to epidemics caused by the wheat pathogen *Phaeosphaeria nodorum*. *Phytopathology*
- Linde, C. C., Zala, M. and McDonald, B. A. Molecular evidence for recent founder populations and man-mediated migration in the barley scald pathogen *Rhynchosporium secalis*. *Molecular Ecology*

#### In press

- Torriani, S.F.F., Brunner, P.C., McDonald, B.A., Sierotzki, H. Qol resistance emerged independently at least four times in European populations of *Mycosphaerella graminicola*. *Pesticide Management Science*
- Zaffarano, P.L., McDonald, B.A., Linde, C.C. Phylogeography of *Rhynchosporium secalis*. *Molecular Ecology*
- Torriani, S.F.F., Linde, C.C., McDonald, B.A. Screening for strobilurin resistance in field populations of *Rhynchosporium secalis*. *Australasian Journal of Plant Pathology*
- Wilfert L, Munoz-Torres M, Reber Funk C, et al. Construction and characterization of a BAC-library for a key pollinator, the bumblebee *Bombus terrestris* L. *Insectes Sociaux*
- Jokela, J., Dybdahl, M. F. and Lively, C. M. The maintenance of sex, clonal dynamics and host-parasite coevolution in a mixed population of sexual and asexual snails. *American Naturalist*
- Seppälä, O., Karvonen, A., Valtonen, E. T. and Jokela, J. Asymmetric strain-specific interactions among co-infecting parasite species. *Proc. R. Soc. B, iProceedings of the Royal Society B*
- Dybdahl, M. F., Jokela, J., Delph, L., Koskella, B. and Lively, C. M. Hybrid fitness in a locally adapted parasite. *American Naturalist*, 172(6)

#### 2008

- de Bruin, A., Ibelings, B. W., Kagami, M., Mooij, W. M. and van Donk, E. (2008) Adaptation of the fungal parasite *Zygorhizidium planktonicum* during 200 generations of growth on homogeneous and heterogeneous populations of its host, the diatom *Asterionella formosa*. - *Journal of Eukaryotic Microbiology*. 55(2): 69-74
- Seppälä, O. and Jokela, J.-- 2008. Host manipulation as a parasite transmission strategy when manipulation is exploited by non-host predators. *Biology letters* 4:663–666
- Seppälä, O, Liljeroos, K. Karvonen, A. and Jokela, J. 2008. Host condition as a constraint for parasite reproduction. *Oikos*, 117: 749-753
- Lively, C. M., Delph, L. F., Dybdahl, M. F. and Jokela, J. 2008. Expe-

perimental test for a coevolutionary hotspot in a host-parasite interaction. *Evolutionary Ecology Research*, 10: 95-103.

- Yourth C, Brown MJF, Schmid-Hempel P (2008) Effects of natal and novel *Crithidia bombi* (Trypanosomatidae) infections on *Bombus terrestris* hosts. *Insectes Sociaux* 55, 86-90.
- Wilfert L, Schmid-Hempel P, Gadau J (2008) Bumblebee. In: *Genome Mapping and Genomics in Animals* (eds. Hunter W, Kole C), pp. 17-26. Springer, 122 pp., Berlin.
- Zaffarano, P.L., McDonald, B.A., Linde, C.C. 2008. Rapid speciation followed host specialization in *Rhynchosporium*. Evidence for non-overlapping origins of host and pathogen. *Evolution* 62:1418-1436.

### b) Presentations to conferences and congresses

- The recent emergence of agricultural plant pathogens. Institute of Plant Science, University of Bern, Bern, 7 May 2008.
- The population genetics of *Mycosphaerella graminicola*. 7th International *Mycosphaerella* and *Stagonospora* Symposium, Ascona, Switzerland, 18-22 August 2008.
- The population and evolutionary biology of fungal necrotrophs. British Society of Plant Pathology Presidential meeting. London, UK, 16-17 December 2008.

### c) Research proposals submitted to SNF and FP7

- Invasive species in a changing world: A *Leptosphaeria* Invasion and Evolution Network (ALIEN). Marie Curie Initial Training Networks (ITN). PIs: B.A. McDonald P. Brunner, Requested amount ETH: CHF 600,000..

## ADAPT

### a) Publications

- Saskia Wegmann "A rethink of the Zambezi", *ETH life* 22.7. 2008; [http://www.ethlife.ethz.ch/archive\\_articles/o8o722\\_Revision\\_am\\_Sambesi/index\\_EN](http://www.ethlife.ethz.ch/archive_articles/o8o722_Revision_am_Sambesi/index_EN); reprinted as "Integrales Gewässermanagement in Zambia" in *Geomatik Schweiz* - page 547, 4. Okt 2008
- Jessica Dacey "Zambian river dam issues go under microscope" *SwissInfo.CH* 2. August 2008; <http://www.swissinfo.ch/eng/search/Result.html?siteSect=882&ty=st&sid=94o8o92>

### b) Presentations to conferences, congresses, and stakeholders: Posters

- Senn DB, M Kunz, R Zurbrügg, J Landert, J Wamulume, I Nyambe, A Wüest, B Wehrli Biogeochemical studies for integrated water management of reservoirs and wetlands in the Zambezi Basin. Annual Conference of the ETH-Zürich North-South Centre. June 2008.
- Beck L, T Bernauer, T Siegfried Studying strategic interactions under hydrological uncertainty. A case study in the Kafue Flats, Zambia. Annual Conference of the ETH-Zürich North-South Centre. June 2008.
- Kunz MJ, DB Senn, B Wehrli, A Wüest. The influence of large hy-

dropower schemes on biogeochemistry in the Zambezi River Basin. International Conference on Research for Development (ICRD), Bern, July 2008.

Kunz MJ, DB Senn, B Wehrli, I Nyambe, C Dinkel, P Mwiinga, A Wüest

Reservoirs in the Zambezi River Basin: The biogeochemistry of Lake Kariba. ETH Zurich, IBP PhD congress, April 2008.

Kunz MJ, DB Senn, S Thuring, F Anselmetti, B Wehrli, A Wüest. Particle and nutrient budgets for Kariba Reservoir (Zambia/Zimbabwe). American Geophysical Union Fall Meeting, San Francisco (US), December 2008.

Zürbrugg R, DB Senn, M Lehmann, J Wamulume, I Nyambe, B Wehrli Nutrient and carbon cycling in the Kafue River (Zambia). American Geophysical Union Fall Meeting, San Francisco (US), December 2008.

Senn DB, MJ Kunz, R Zurbrugg, J Wamulume, J Landert, N Blank, I Nyambe, A Wüest, B Wehrli. Exploring the influence of hydropower structures on biogeochemistry in the Zambezi River Basin. International Conference on Implementing Environmental Water Allocations. Port Elizabeth (South Africa), February 2009.

#### c) Presentations

Senn DB. ADAPT: Adapt planning and operation of large dams to social needs and environmental constraints – integrated water resources (IWRM) study in the Zambezi Basin. Department of Water Affairs, Lusaka, Zambia. May 2008

Kunz MJ. Biogeochemical studies in Lake Kariba. Zambezi River Authority, Lusaka, Zambia June 2008.

Landert J, J Wamulume. Biogeochemistry studies in the Kafue River. Department of Water Affairs, Lusaka, Zambia, July 2008.

Landert J, J Wamulume. Biogeochemistry studies in the Kafue River. School of Mines, University of Zambia, Lusaka, July 2008.

Senn DB. ADAPT: An introduction to the CCES African Dam Project in the Zambezi Basin. Institute for Environmental Engineering, ETH-Hönggerberg, 13. August 2008.

#### d) Research proposals submitted to Sinergia and FP7

T. Bernauer and W. Kinzelbach were granted two PhD positions for ADAPT in their SNF project "Cooperative management of international freshwater resources"

## GEOTHERM

The Swiss Department of Energy has indicated a willingness to support activities related to GEOTHERM.

Since GEOTHERM is directed towards EGS reservoir processes, there is significant overlap with induced seismicity studies. Thus, it is planned to collaborate with the recently approved study of the seismic risk posed by EGS development activity at the Basel EGS site, and participate in an FP7 proposal that will

examine the seismic risk posed by EGS development in general. Furthermore, a proposal to examine the seismic risks posed by fluid injection, which forms a component of a broader study of CO<sub>2</sub> sequestration possibilities within Switzerland, has recently been approved by CCEM/CCES.

## RECORD

#### a) Publications:

Acuna, V., Tockner, K. Surface-subsurface water exchange rates along alluvial river reaches control the thermal patterns in an Alpine river network. *Freshwater Biology*. Accepted.

Acuna, V., Wolf, A., Uehlinger, V., Tockner, K. 2008. Temperature dependence of stream benthic respiration in an Alpine river network and its relevance to global warming. *Freshwater Biology*. in press.

Brovelli, A., Barry, D.A. 2007. Evaluation of possible strategies for biogeo-chemical model calibration. *Geophysical Research Abstracts*, European Geo-sciences Union. 9(02610), SRef-ID: 1607-7962/gra/EGU2007-A-02610.

Brovelli, A., Malaguerra F., Barry, D.A. 2008. Bioclogging in porous media: Model development and sensitivity to initial conditions. Accepted for publication by *Environmental Modelling and Software*.

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- b) Presentations to conferences and congresses**
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- Luster, J. Plant-soil-microbe interactions. RECORD Kick-off meeting, Zürich, April 26, 2007 (oral)
- Luster, J. Plant-soil-microbe interactions. RECORD Retreat, Kastanienbaum, February 12, 2008 (oral)
- Mitchell EAD, Meisterfeld R. (2008) Cerczoan testate amoebae. *Tree of Life Web Project Workshop Halifax July 19-20, 2008* (invited lecture)
- Meisterfeld R. Mitchell EAD, (2008) Arcellinida testate amoebae. *Tree of Life Web Project Workshop Halifax July 19-20, 2008* (invited lecture)
- Perona, P. Research tools for a sustainable water resources management. (oral) *Hydrology Seminars*, ETH Zurich, November 2008
- Perona P, Molnar P, Savina M, Burlando P. A probabilistic approach to sediment-vegetation interactions in an Alpine braided river. Part I: the sediment model. (oral) *Sediment Dynamics in Changing Environments Conference*, Christchurch, New Zealand, December 2008



- Peter, S., Durisch-Kaiser, E., Tockner, K., Wehrli, B. 2008. Effect of environmental heterogeneity and hydrological connectivity on biogeochemical transformations of nutrients and organic matter. Zoek Congress, ETHZ, Einsiedeln, September 2008 (oral presentation).
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- Samaritani E, Fournier B, Frey B, Moretti M, Freléchoux F, Luster J, Vuilleumier S, Guenat C, Gillet F, Durisch-Kaiser E, Tockner K, Mitchell EAD (2008) Effect of environmental heterogeneity on above- and below-ground terrestrial biodiversity in a restored river corridor: a combined field and modeling approach. Society of Wetland Scientists Annual Conference 26-30 May 2008 Washington DC, USA. (poster)
- Savina M, Perona P, Molnar P, Burlando P. A probabilistic approach to sediment-vegetation interactions in an Alpine braided river. Part II: the vegetation model. (Poster) Sediment Dynamics in Changing Environments Conference Christchurch, New Zealand, December 2008
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- Shrestha, J. The role of plant-soil-microbe interactions in nitrogen cycling in floodplains. Ph.D. symposium Institute of Plant Sciences, Zürich, August 2008 (poster)
- Vogt T, Cirpka OA, Schneider P. 2008. Temperaturmessungen zur Untersuchung des Austausches zwischen Fluss- und Grundwasser, Jahrestagung der Fachsektion Hydrogeologie in der Deutschen Geologischen Gesellschaft, 21.-25.5.2008, Göttingen.

### c) Research proposals submitted to SNF and FP7

- ADVOCATE - Advancing In Situ Remediation for Contaminated Land and Groundwater, PI Steve Thornton (University of Sheffield), Co-PI Mario Schirmer, Marie Curie Initial Training Networks EC FP7, submitted September 1, 2008. Requested Funds: part EAWAG CHF 600,000.
- River – VEgetation interactions and Reproduction of Island Nuclei formation and Evolution (RIVERINE, www.riverine.ethz.ch), PI Paolo Perona, European Framework Programme HYDRALAB III (funded value: 350,000 CHF)
- ROOT Erosion Dynamics and the Nonlinear Effect of Strengthening of river alluvial Sediments (ROOTEDNESS), PI Paolo Perona, Swiss National Foundation, submitted October 1st 2008. Requested funds: 230,000 CHF

## COGEAR

### a) Publications

- Fäh, D. and the COGEAR Working Group, 2008. Coupled seismogenic Geohazards in Alpine Regions. Proceeding so the The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China. Paper Number 13-0004.
- Schuler, J, 2008a, Joint inversion of surface waves and refracted p- and s-waves. Master thesis, ETH Zurich.

### b) Presentations to conferences and congresses

- Bethmann, F., N. Deichmann, P.M. Mai, Scaling relations of Ms vs MI for families of similar earthquakes in Switzerland. Geophys. Res. Abstracts, EGU2008-A-06467, 2008.
- Eisenbeiss, H., 2008. UAV-Photogrammetry: "Pinchango Alto, Maize field, Randa, Sarnen" UAV-Photogrammetry meeting, Zurich, Switzerland, 19th of February 2008.
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- Moore, J.R., Button, E., Loew, S., Gischig, V. (2008). Rockslide Monitoring With Fiber Optic Strain Sensors: Installation and First Results, EOS Trans. AGU, 89(52), Fall Meet. Suppl., Abstract H43I-01.
- Yugsi, F., Lemy, F., Kos, A., Loew, S. (2008) Characterization of brittle discontinuities in crystalline rocks applied to slope failure analysis in the Matter valley, Switzerland. In. Proc. Slope Tectonics 08, Lausanne 15-16 Feb. 2008.

### c) Projects submitted in 2008

- Coupled seismogenic Geohazards in Alpine Regions – Plus (COGEAR+), D. Fäh, submitted to SNF Sinergia program October 2008.
- Electromagnetic precursors of earthquakes in the Valais region? D. Fäh, submitted to the Sino-Swiss Science and Technology Cooperation (Leadinghouse ETHZ), July 2008
- NLT, Non Linear Threshold for amplification analyse for moderate earthquakes regions. J. Laue, submitted to SNF in October 2008.

### d) Granted in 2008

- Iris Marschall (SED) was granted 2 year-funding from Marie Heim-Voegtlin Programm SNF) for her Ph.D. thesis on the subject of "A new seismotectonic model of the Swiss Alps", which is part of COGEAR.

## EXTREMES

### a) Publications

- Ancey, C., M. Rentschler, R.M. Iverson, and R.P. Denlinger (2008) An exact solution for ideal dam-break floods on steep slopes, *Water Resources Research*, 44, W01430.
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- Blanchet, J., Marty, C., and Lehning, M. (2008) Extreme value statistics of snowfall in the Swiss Alpine region. Submitted to *Journal of Climate*.
- Boldi, M.-O. and Davison, A. C. (2007) A mixture model for multivariate extremes. *Journal of the Royal Statistical Society, series B*, 69, 217-229.
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- Davison, A. C. and Gholamrezaee, M. M. (2008) Geostatistics of extremes. Submitted.
- Fang, J., A. Parriaux, M. Rentschler, and C. Ancey (2008) Enhancing SPH for incompressible viscous flows using a corrected particle approximation within an energy-based framework, *Applied Numerical Mathematics*, in press
- Ouillon, G., C. Ducorbier, and D. Sornette (2008) Automatic reconstruction of fault networks from seismicity catalogs: Three-dimensional optimal anisotropic dynamic clustering, *J. Geophys. Res.*, 113, B01306, doi:10.1029/2007JB005032 (<http://arxiv.org/abs/physics/0703084>)
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- Padoan, S., Sisson, S. and Ribatet, M. (2008) Likelihood inference for max-stable processes. Submitted
- Padoan, S. and M. P. Wand (2008) Mixed model-based additive models for sample extremes. *Statistics and Probability Letters*, in press.
- Pisarenko, V.F., A. Sornette, D. Sornette and M.V. Rodkin (2008a) New Approach to the Characterization of Mmax and of the Tail of the Distribution of Earthquake Magnitudes. *Pure and Applied Geophysics* 165, 1-42 (2008) (<http://arxiv.org/abs/physics/0703010>)
- Pisarenko, V.F., A. Sornette, D. Sornette and M.V. Rodkin (2008b) Characterization of the Tail of the Distribution of Earthquake Magnitudes by combining the GEV and GPD descriptions of Extreme Value Theory, submitted to *Pure and Applied Geophysics* (<http://arxiv.org/abs/0805.1635>)
- Rebetez M., Dupont O., Giroud M., 2008. An analysis of the July 2006 heatwave extent in Europe compared to the record year of 2003. *Theor. Appl. Clim.*, in press.
- Renaud V. and M. Rebetez (2008) Comparison between open-site and below-canopy climatic conditions in Switzerland during summer 2003, submitted.
- Rieder H.E., Holawe F., Simic S., Blumthaler M., Krzyscin J.W., Schmalwieser A.W., Wagner J.E., and Weihs P. (2008): Reconstruction of erythemal UV-doses for two stations in Austria: A comparison between alpine and urban regions, *Atmos. Chem. Phys.*, 8, 6309-6323, 2008.
- Schorlemmer, D., J. D. Zechar, M. J. Werner and T. H. Jordan (2009), First Results of the Regional Earthquake Likelihood Models Experiment, in revision for *Pure and Applied Geophysics*.
- Sornette, D., Utkin, S. and Saichev, A. (2008) Solution of the Non-linear Theory and Tests of Earthquake Recurrence Times, *Physical Review E* 77, 066109
- Sornette, D. and M.J. Werner (2008) Statistical Physics Approaches to Seismicity, in the *Encyclopedia of Complexity and Systems Science*, Springer (<http://arXiv.org/abs/0803.3756>)
- Sornette, D., V.I. Yukalov, E.P. Yukalova, J.-Y. Henry, D. Schwab, and J.P. Cobb (2007) Endogenous versus Exogenous Origins of Diseases, second round of revision to *Journal of Theoretical Biology*. (<http://arxiv.org/abs/0710.3859>)
- Suveges, M. (2007) Likelihood estimation of the extremal index. *Extremes*, 10, 41-55.
- Suveges, M., Rebetez, M., and Davison, A. C. (2008) Nonstationarity of summer temperature extremes and the role of air humidity. Submitted to *International Journal of Climatology*.
- Werner, M. J. and D. Sornette (2008), Magnitude uncertainties impact seismic rate estimates, forecasts, and predictability experiments, *J. Geophys. Res.*, 113, B08302, doi:10.1029/2007JB005427.
- Woessner, J., S. Hainzl, W. Marzocchi, M. J. Werner, A. M. Lombardi, F. Catalli, B. Enescu, M. Cocco, M. C. Gerstenberger and S. Wiemer, Forecasting aftershock seismicity Part III: A retrospective comparative test for the 1992 Landers sequence, submitted to *Journal of Geophysical Research: Solid Earth*.

### b) Conference proceedings

- Faillat, J., D. Sornette, M. Funk (2008) Interplay between frictional sliding and cracking in a block-spring model of large ice masses instabilities, *SHEAR IN GEOLOGICAL MEDIA, "SHEAR 07" SYMPOSIUM* (NANCY, France, 4-7 September, 2007).
- Rieder, H.E., Holawe, F., Simic, S., Blumthaler, M., Krzyscin, J.W., Wagner, J., Schmalwieser, A.W., Weihs, P. (2008): Rekonstruktion der erythemwirksamen UV-Bestrahlungsstärke in Österreich: Ein Vergleich zwischen Hochgebirge und Wiener Ballungsraum In: Bundesministerium für Gesundheit Familie und Jugend, Symposium UV-Strahlung und Gesundheit in Österreich, Medieninhaber und Herausgeber: Bundesministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft Ed. Martin Kriech, Symposium UV-Strahlung

und Gesundheit in Österreich, 22. April 2008, Wien

Rieder, H.E.; Staehelin, J.; Bodeker, G.E.; Stuebi, R.; Maeder, J.; Divis, L.; Weihs, P.; Holawe, F.; Simic, S. (2008): Determination and distribution of extreme events in total ozone using the world's longest total ozone record from Arosa, Switzerland, *Geophysical Research Abstracts*, 10, 6751-6751; ISSN 1029-7006

Rieder, H.E., Holawe, F., Simic, S., Blumthaler, M., Krzyscin, J.W., Wagner, J., Schmalwieser, A., Weihs, P. (2008): Rekonstruktion der erythemwirksamen UV-Bestrahlungsstärke in Österreich: ein Vergleich zwischen Hochgebirge und Wiener Ballungsraum In: Universität für Bodenkultur, Tagungsband des 10. Österreichischen Klimatags "Klima, Klimawandel und Auswirkungen", Klimaforschungsinitiative AustroClim, 10. Österreichischer Klimatag, 13.-14. März 2008, Wien

### c) Presentations

Ancey, C.: Fluid Avalanches on the Laboratory Scale, SIAM symposium, San Diego 4-7 July 2008

Ancey, C.: Avalanche: from lab to snow avalanches, Flow in Glassy systems, Winter School les Houches, February 2007 (invited lecturer).

Blanchet, J.: Extreme snowfall: the effect of altitude. E2C2 (Extreme Events, Causes and Consequences) conference, 26-28 March 2008, Paris (<http://e2c2.ipsl.jussieu.fr>)

Blanchet, J.: Spatial distribution of extreme snowfall in Switzerland. Workshop on Extremes and Data Assimilation, Strasbourg, June 2008 (<http://www-irma.u-strasbg.fr/articles579.html>).

Davison, A. C.: Towards a geostatistics of extremes, CEAUL workshop on Environmental Extremes, Lisbon, February 2007.

Davison, A. C.: Smoothing methods for extremes, Workshop on Environmental Statistics, Edinburgh, March 2007.

Davison, A. C.: Smoothing methods for environmental extremes, Statistics for Innovation, Oslo, Norway, May 2008.

Davison, A. C.: Statistical models for spatial extremes, Extremes in a Changing Climate Workshop, organised by World Climate Research Program, Royal Netherlands Meteorological Institute, de Bilt, May, 2008. (<http://www.clivar.org/organization/etccdi/etccdi3/meeting.php>).

Davison, A. C.: Geostatistics of extremes, UK Extremes meeting, Lancaster, UK, September 2008.

Davison, A. C.: Geostatistics of extremes, International Seminar on Nonparametric Inference, Vigo, Spain, November 2008.

Divis, L., Bodeker, G.E., Brunner, D., Staehelin, J.: Stratospheric ozone trend analysis of the Swiss long-term measurements in relation to global trends focusing on the effect of the Montreal Protocol. Quadrennial Ozone Symposium.

Ferrez J., Davison A.C., Rebetez M. 2008. Extreme temperature analysis under forest cover compared to an open-field. EMS8/ECAC7, Amsterdam, 29 September-3 October 2008

Gholamrezaee, M. M.: Spatial modelling of temperature extre-

mes. Extreme Values and Applications, Bern, July, 2007.

Gholamrezaee, M. M.: Spatial modeling of climate extremes: A composite likelihood approach. Workshop on Extremes and Data Assimilation, Strasbourg, June 2008 (<http://www-irma.u-strasbg.fr/articles579.html>).

Padoan, S.: Mixed Model-based Additive Models for Sample Extremes, The International Environmetrics Society, June 8 - 13, 2008, University of British Columbia, Okanagan, Canada.

Renaud V. and M. Rebetez : Comparison between open-site and below-canopy temperature conditions in Switzerland during summer 2003, El Escorial, Spain, October 4-5, 2007, 7th EMS Annual Meeting/8th European Conference on Applications of Meteorology

Renaud V, Rebetez M, 2008. Extremely hot climatic conditions in the Swiss Alps: Comparison between open-site and below-canopy temperature, Innsbruck, Austria, COST workshop, 7-9 April 2008.

Renaud V, Rebetez M, 2008. Comparison of open-site and below-canopy climatic conditions in Switzerland during summer 2003, 9th Swiss Global Change Day, Bern, 1 April 2008

Renaud V., Rebetez M. 2008. Comparison of open-site and below-canopy climatic conditions in Switzerland during summer 2003, Networking event "Femmes de Sciences", EPFL, Lausanne, 8 April 2008,

Renaud V., Rebetez M. 2008. Comparison of open-site and below-canopy temperature conditions in Switzerland during summer 2003, EPFL Research Day, Lausanne, 15 April 2008.

Renaud V., Rebetez M. 2008. Comparison between open-site and below-canopy climatic conditions in Switzerland from 1998 to 2007, NCCR Climate Summer School 2008, Monte Verità, 1-5 September 2008.

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Rieder H.E., Holawe F., Simic S., Blumthaler M., Krzyscin J., Schmalwieser A., Wagner J., Weihs P.: UV-changes in Austria: A comparison between alpine and urban regions, Quadrennial Ozone Symposium, Tromsø, Norway, 2008.

Rieder, H.E., Staehelin, J., Bodeker, G.E., Stuebi, R., Maeder, J., Divis, L., Weihs, P., Holawe F., Simic, S.: Classical and new approaches using extremal statistics to detect and describe extreme events in total ozone using the world's longest total ozone record from Arosa, Switzerland. Quadrennial Ozone Symposium, Tromsø, Norway, 2008.

Rieder, H.E., Staehelin, J., Vuilleumier, L., Walker, D., Weihs, P., Holawe, F., Simic, S., Blumthaler, M., Lindfors, A., Maeder, J.: Extreme events in total ozone and erythemal UV-radiation in Switzerland and Austria. Quadrennial Ozone Symposium, Tromsø, Norway, 2008.

Rieder H.E., Holawe F., Simic S., Blumthaler M., Krzyscin J., Schmalwieser A., Wagner J., Weihs P.: Reconstruction of past UV-doses in Austria: A comparison between alpine and urban regions, SCOUT Annual Meeting, 21.-24. April, Potsdam,



- Germany.
- Rieder, H.E., Holawe, F., Simic, S., Blumthaler, M., Krzycin, J.W., Wagner, J.E., Schmalwieser, A.W., Weihs, P.: Rekonstruktion der erythemwirksamen UV-Bestrahlungsstärke in Österreich: ein Vergleich zwischen Hochgebirge und Wiener Ballungsraum. Symposium UV-Strahlung und Gesundheit in Österreich, österreichische Akademie der Wissenschaften, 22. April, Wien, Österreich.
- Rieder, H.E.; Staehelin, J.; Bodeker, G.E.; Stuebi, R.; Maeder, J.; Divis, L.; Weihs, P.; Holawe, F.; Simic, S.: Determination and distribution of extreme events in total ozone using the world's longest total ozone record from Arosa, Switzerland, IFGR Climate Seminary, 16. April 2008, Vienna, Austria.
- Rieder, H.E.; Staehelin, J.; Bodeker, G.E.; Stuebi, R.; Maeder, J.; Divis, L.; Weihs, P.; Holawe, F.; Simic, S.: Determination and distribution of extreme events in total ozone using the world's longest total ozone record from Arosa, Switzerland, EGU General Assembly 2008, 13.-18. April 2008, Vienna, Austria.
- Rieder, H.E., Holawe, F., Simic, S., Blumthaler, M., Krzycin, J.W., Wagner, J.E., Schmalwieser, A.W., Weihs, P.: Rekonstruktion der erythemwirksamen UV-Bestrahlungsstärke in Österreich: ein Vergleich zwischen Hochgebirge und Wiener Ballungsraum. 10. Österreichischer Klimatag "Klima, Klimawandel und Auswirkungen", 13.-14. März 2008, Wien, Österreich.
- Sornette, D.: Endogenous versus Exogenous Origins of Crises: catastrophic "kings" and predictability, Seminar Series Hilary Term 2008, Risk in the 21st Century, University of Oxford, Oxford, UK ([http://www.21school.ox.ac.uk/news\\_and\\_events/events/200801\\_Seminars.cfm](http://www.21school.ox.ac.uk/news_and_events/events/200801_Seminars.cfm))
- Sornette, D.: Parallels between earthquakes, financial crashes and epileptic seizures, keynote presentation at the Risk Management Solutions Earthquake symposium 2008 on "Advances in Earthquake Forecasting," (<http://www.rms.com/2008EQsymposium/>) 23rd January, Millenium Broadway Hotel, New York, USA
- Sornette, D.: Parallels between earthquake prediction, financial crash prediction and epileptic seizures, invited speaker at the conference "Extreme events: causes and consequences" (E2-C2), ENS Ulm, Paris, 26-28 March 2008 (<http://e2c2.ipsl.jussieu.fr/>)
- Sornette, D.: Endogenous Versus Exogeneous Origins of Financial Bubbles," invited speaker at the 2nd Workshop "Bridging Mathematics, Natural Sciences, Social Sciences and Finance," organized by the Hedge Funds Research Institute, International University of Monaco, 9-11 April 2008,
- Suveges, M.: Likelihood estimation of the extremal index. CEAUL workshop on Environmental Extremes, Lisbon, February 2007.
- Suveges, M.: More on likelihood estimation of the extremal index. Extreme Values and Applications, Bern, July, 2007.
- Suveges, M.: A Dirichlet mixture approach to the estimation of clusters of extreme events. Workshop on Extremes and Data Assimilation, Strasbourg, June 2008 (<http://www-irma.u-strasbg.fr/article579.html>).
- Suveges, M., M. Rebetez and A. C. Davison, Extremes values and air humidity: A statistical approach. Swiss Global Change Day, Bern, April 2008
- Suveges, M., M. Rebetez and A. C. Davison, Extremes values and air humidity: A statistical approach. Extremes in a changing climate workshop. De Bilt, The Netherlands, May 2008, (<http://www.clivar.org/organization/etccdi/etccdi3/meeting.php>).
- Werner, M. J., Kayo Ide and Sornette, D.: Uncertainties In Earthquake Forecasts: Quantification And Data Assimilation. Evison conference, February 18-22, Wellington, New Zealand (<http://www.gns.cri.nz/evisonsymposium/>)
- Werner, M. J.: Earthquake Forecasting Based on Data Assimilation. Workshop on Extremes and Data Assimilation, Strasbourg, June 2008 (<http://www-irma.u-strasbg.fr/article579.html>).
- Werner, M. J., Extreme Earthquakes, presented at the Seismology Seminar, UCLA, May 2008.
- Werner, M.J., D. D. Jackson and Y. Y. Kagan, Next-Day Earthquake Forecasts for California, presented at the European Seismological Commission, Crete, Greece, September 2008.
- Werner, M.J. and K. Ide and D. Sornette, Earthquake Forecasting Based on Data Assimilation: Sequential Monte Carlo Methods for Renewal Processes, presented at the ESF-Conference on "New Challenges in Earthquake Dynamics: Observing and Modelling a Multi-Scale System", Obergurgl, Austria, October 2008.
- Werner, M.J., Evaluating Earthquake Forecasts: Open Questions, presented at the Workshop of the Collaboratory for the Study of Earthquake Predictability (CSEP) in Italy, Rome, Italy, October 2008.
- Werner, M.J., Next-Day Smoothed Seismicity and ETAS Forecasts for California, presented at the Workshop of the Collaboratory for the Study of Earthquake Predictability (CSEP) in Italy, Rome, Italy, October 2008.
- Wiemer, S. and T. Van Stiphout ; On Precursory Seismic Quiescence . Evison conference, February 18-22, Wellington, New Zealand (<http://www.gns.cri.nz/evisonsymposium/>)
- Zenkhusen Mutter, E., Phillips, M. and Blanchet J., Evidence of warming in disturbed and undisturbed permafrost terrain at Schafberg (Pontresina, Eastern Swiss Alps); 6th Swiss Geoscience Meeting, Lugano, November 2008.

#### d) Submitted research proposals

- Parlange/Lehning EU-FP7, HYDROSYS-224416, 2008-2011, CHF 1.6Mio
- Rebetez M., Dobbertin M.: Elaboration d'une méthode de détermination de seuils pertinents de précipitations et températures pour une espèce à la limite de sa niche écologique face au changement climatique. Cost Action ECHOES 2009-2012: Fr. 170'000

## TRAMM

### a) Publications

#### Published / in press

- Cochard, S., and Ancey, C. Experimental investigation of the spreading of viscoplastic fluids on inclined planes. *Journal of Non-Newtonian Fluid Mechanics*, in press.
- Imre, B., S. Räsänen, S.M. Springman. 2008. A Coefficient of Restitution of Rock Materials. *Computers & Geosciences* 34: 339-350, doi:10.1016/j.cageo.2007.04.004.
- Laloui, L., and Nuth, M. 2008. On the use of the generalised effective stress in the constitutive modelling of unsaturated soils. *Computers and Geotechnics*, DOI 10.1016/j.compgeo.2008.03.002.
- Ng, C.W.W., S.M. Springman & E.E. Alonso: Monitoring the performance of unsaturated soil slopes. *Geotechnical and Geological Engineering, Special Issue on Laboratory and Field Testing of Unsaturated Soils*. In Press.
- Nuth, M., and Laloui, L. 2008. Advances in modelling hysteretic water retention curve in deformable soils. *Computers and Geotechnics*, DOI 10.1016/j.compgeo.2008.08.001.

#### Submitted

- Ancey, C., S. Cochard, and N. Andreini: The dam-break problem for viscous fluids in the high-capillary-number limit. Submitted to *Journal of Fluid Mechanics* (2008).
- Ancey, C., S. Wiederseiner, S. Cochard, and M. Rentschler: Determining the rheological behavior of gravity-driven flow down a flume. Submitted to *Journal of Non-Newtonian Fluid Mechanics* (2008).
- Gray, J.M.N.T. and Ancey, C. Particle size-segregation, recirculation, and deposition at coarse particle rich flow fronts. *Journal of Fluid Mechanics* (submitted).
- Reiweiger, I., Schweizer, J., Dual, J. and Herrmann, H.J. Modeling snow failure with a fiber bundle model. *Geophys. Res. Lett.* (submitted).
- Schwarz M., Preti, F., Giadrossich, F., Lehmann, P., and Or, D. Quantifying the role of vegetation in slope stability: the Vinchina case study (Tuscany, Italy). *Ecological Engineering* (submitted).

#### In Preparation

- Bowman, E.T., B. Imre, J. Laue, and Springman, S.M. Experimental modelling of debris flows using a geotechnical centrifuge. *Canadian Geotechnical Journal* (in preparation).
- Cohen, D., Or, D., and Lehmann, P. The Fiber Bundle Model for multiscale modeling of hydro-mechanical triggering of shallow landslides. *Water Resources Research* (in preparation).
- Kienzler, P., Naef F., and Springman, S.M. Saturation of soils at the hillslope scale and implications for landslide triggering.
- Lehmann, P., and Or, D. Precursor events in Self-Organized Criticality models. *Physical Review E* (in preparation).

Reiweiger, I., Schweizer, J., Dual, J. and Herrmann, H.J. Modeling snow failure with a fiber bundle model, *J. Glaciol.* (in preparation).

Schwarz, M., Cohen, D., Lehmann P., and Or, D. A quantitative framework for modeling lateral root reinforcement in steep slopes. *Hydrological Processes* (in preparation).

Thielen, A., and Springman, S.M. A long term field study for the investigation of rainfall induced landslides. *Geotechnique* (in preparation).

#### Conference proceedings

- Andreini, N., Wiederseiner, S., Rentschler, M. and Ancey, C. 2008. Avalanches of concentrated granular suspensions down an inclined plane. XVth International Congress on Rheology and 80th Annual Meeting of The Society of Rheology, Monterey, California 3–8 August 2008, AIP Conference Proceedings 1027, 1045–1047.
- Bellaire, S. and Schweizer, J. 2008. Deriving spatial stability variations from penetration resistance measurements. In: C. Campbell, S. Conger and P. Haegeli (Editors), *Proceedings ISSW 2008, International Snow Science Workshop*, Whistler, Canada, 21-27 September 2008, pp. 188-298.
- Casini, F., Vassallo, R., Mancuso, C., Desideri, A. 2008. Application to a compacted soil of a Cam Clay model extended to unsaturated conditions. *First European Conference on Unsaturated Soils - E-UNSAT 2008*, Durham, UK, 2.-4.7.2008: 609-615.
- Kienzler, P., Naef, F., and Springman, S.M. 2008 Hillslope hydrology and implications for landslide triggering. *Proceedings of the 3rd International Workshop on Unsaturated Soils*, Trento, Italy, 2008.
- Nuth, M., and Laloui, L. 2008 Advanced hydro-mechanical coupling for unified constitutive modelling of unsaturated soils, *Proc. of the First European Conference on Unsaturated Soils*, Durham, 2nd-4th July 2008.
- Nuth, M., and Laloui, L. 2008 New insight into the unified hydro-mechanical constitutive modelling of unsaturated soils. *Proc. of International Workshop on Unsaturated soils*, Trento, 4th-6th February 2008, in press.
- Schweizer, J. 2008. On the predictability of snow avalanches. In: C. Campbell, S. Conger and P. Haegeli (Editors), *Proceedings ISSW 2008, International Snow Science Workshop*, Whistler, Canada, 21-27 September 2008, pp. 688-692.
- Springman, S.M., Mayor, P.A., Müller, P., and Teyssie, P. 2008. The influence of river floods and rainfall on protection levees in the Valais. 2008. 1st International Conference on Long Time Effects and Seepage Behavior of Dams (LTESBDo8), Nanjing, China, 30.5.-2.6.2008: 155-162.
- van Herwijnen, A., Heierli, J. and Schweizer, J. 2008. Field study on fracture propagation in weak snowpack layers. In: C. Campbell, S. Conger and P. Haegeli (Editors), *Proceedings ISSW 2008, International Snow Science Workshop*, Whistler, Canada, 21-27 September 2008, pp. 1-8.

Wiederseiner, S., and Ancey, C. 2008. Rheophysical investigation in concentrated particle suspensions. XVth International Congress on Rheology and 80th Annual Meeting of The Society of Rheology, Monterey, California 3–8 August 2008, AIP Conference Proceedings 1027, 929–931.

### PhD and master thesis

Gilgen, M. 2008. Hydrological simulations of a hillslope prone to shallow landslides. ETH, Eidgenössische Technische Hochschule Zürich, Department of Environmental Sciences, 76 pp. <http://e-collection.ethbib.ethz.ch/view/eth:30789>

Thielen, A. 2007. Einfluss der Bodensättigung auf die Stabilität von Hängen, ETH-Diss. Nr. 17303. <http://e-collection.ethbib.ethz.ch/view/eth:29862>

### b) Presentations at conferences:

Ancey, C.: Dynamics of rapid surges. Complex Geophysical Gravity Currents Workshop, University of British Columbia, Vancouver, 2–4 March 2007 (invited lecturer).

Ancey, C.: Avalanche: from lab to snow avalanches, Flow in Glassy systems. Winter School les Houches, 5–9 February 2007 (invited lecturer).

Ancey, C. and Wiederseiner, S. Fluid avalanches in the laboratory: from rheometrical experiments to flow-dynamics runs. Swiss Rheology Group, ETH Zürich, 24 October 2008.

Ancey, C. Fluid Avalanches on the Laboratory Scale, SIAM symposium, San Diego 4–7 July 2008.

Andreini, N., and C. Ancey: Avalanches of concentrated granular suspensions down an inclined plane. XVth International Congress on Rheology, Monterey, August 2008.

Bellaire, S., Schweizer, J., Schneebeli, M., Pielmeier, C.: Deriving snow stability from micropenetration resistance. EGU General Assembly 2008, Vienna, 13–18 April 2008.

Bellaire, S. and Schweizer, J. Deriving spatial stability variations from penetration resistance measurements. International Snow Science Workshop, Whistler, Canada, 21–27 September 2008.

Berger, C., B. W. Mcardell, F. Schlunegger: Erosion and deposition in a debris flow torrent channel: Influence of event type and rainfall. Geophysical Research Abstracts, Vol. 10, EGU2008-A-02679, 2008, SRef-ID: 1607-7962/gra/EGU2008-A-02679, EGU General Assembly 2008.

Berger, C., Mcardell, B.W., and Schlunegger, F. Direct measurement of debris flow entrainment at the Illgraben catchment, Switzerland. Annual fall meeting of the American Geophysical Union, December 2008.

Bowman, E.T., B. Imre, J. Laue & S.M. Springman: Geotechnical centrifuge modelling of debris flows. 4th International Conferences on Debris-Flow Hazards Mitigation: Mechanics, Prediction, and Assessment (DFHM Conference), Chengdu, China, 10–13.9.2007.

Cohen, D., Or, D., Lehmann, P., Schwarz, M., and Michlmayr, G.: The Fiber Bundle Model for multiscale modeling of hydro-

mechanical triggering of shallow landslides. AGU fall meeting, San Francisco, December 2008.

Kienzler, P., Naef, F. & Springman, S.M.: Hydrology of landslide triggering. Poster presentation at the EGU General Assembly, Vienna, Austria, 14.04.2008.

Kienzler, P., Naef, F., and Springman, S.M.: Hydrology of landslide triggering. Oral presentation at the International Workshop on Unsaturated Soils, Trento, Italy, 2008.

Lehmann, P., and Or, D.: Concepts of Self-Organized Criticality (SOC) for modeling hydro-mechanical triggering of shallow landslides. AGU fall meeting, San Francisco, December, 2008.

Lehmann, P., and D. Or: Concepts of Self-Organized Criticality for modeling triggering of shallow landslides. EGU General Assembly, Vienna, Austria, April 18, 2008.

Lehmann, P., and D. Or. Concepts of Self-Organized Criticality applied to model landslide triggering. Seminar für Hydrologie der ETH Zürich, Zurich, Switzerland, November 20, 2007.

Lehmann, P., and D. Or, Self-organized criticality concepts for modeling hydromechanical triggering of rapid landslides. EGU General Assembly, Vienna, Austria, April 18, 2007.

Lehmann, P., and D. Or. Self-Organized criticality modeling of the onset of rapid landslides on hillslopes. 4th Swiss Geoscience meeting, Berne, Switzerland, 24th November, 2006.

Locher, D., and L. Tacher: An evapo-transpiration controlled landslide in Switzerland: The Steinernase case. In Geophysical Research Abstracts, volume 10, EGU General Assembly, Wien 14–18 April 2008.

Mayor, P.A., Springman, S.M., and Teyssie, P. In situ field experiment to apply variable high water levels to a river levee. Int. Conf. E-UNSAT, Glasgow, 2008.

Michlmayr, G.K., Or, D., Cohen, D., Schwarz, M., and Lehmann, P.: Acoustic emissions from hydro-mechanical perturbation of natural and artificial slopes. AGU fall meeting, San Francisco, December 2008.

Nuth, M., and Laloui, L. Advanced hydro-mechanical coupling for unified constitutive modelling of unsaturated soils. First European Conference on Unsaturated Soils, Durham, 2nd–4th July 2008.

Nuth, M., and Laloui, L. New insight into the unified hydro-mechanical constitutive modelling of unsaturated soils. International Workshop on Unsaturated soils, Trento, 4th–6th February 2008.

Nuth M., and Laloui L. Un nouveau cadre constitutif couplé pour la modélisation avancée des sols non saturés”. XXV Rencontres AUGC, Nancy 2008.

Or, D., P. Lehmann, M. Güell, M. Schwarz, and D. Cohen: The Fiber Bundle Model for hydrologic triggering of shallow landslides. EGU General Assembly, Vienna, Austria, April 18, 2008.

Reiweger, I., Schweizer, J., Dual, J. and Herrmann, H.J., 2007: Modeling snow failure with a fiber bundle model. International Symposium on Snow Science, Moscow, 2–7 September 2007. International Glaciological Society.



- Rentschler, M., S. Wiederseiner, and C. Ancey: Simulating viscoplastic flows. Schweizer Numerik Kolloquium, Fribourg 25 April 2008.
- Rentschler, M., and C. Ancey: Simulation de fluides viscoplastiques, 18e Congrès français de mécanique, Grenoble, 27–31 August 2007.
- Rentschler, M., and C. Ancey: Numerical simulation of viscoplastic flows. American Geophysical Union, Fall Meeting, December 2006, San Francisco.
- Schwarz, M., D. Or, and P. Lehmann: Modeling effects of lateral root reinforcement on hydro-mechanical behavior of vegetated slopes. Second International Conference on Eco-Engineering, Beijing, July 14 2008.
- Schwarz, M., P. Lehmann, and D. Or: Modelling of root reinforcement in steep and vegetated slopes. EGU General Assembly, Vienna, Austria, April 14, 2008.
- Schwarz, M., D. Or, and P. Lehmann: Process scale and key parameters for hydromechanical triggering of shallow landslides in vegetated slopes. EGU General Assembly, Vienna, Austria, April 18, 2007.
- Schwarz M., and F. Preti: The influence of root reinforcement depending on the shape and the dimension of shallow landslides. EGU General Assembly, Vienna, Austria, April 18, 2007.
- Schweizer, J. On the predictability of snow avalanches. International Snow Science Workshop, Whistler, Canada, 21–27 September 2008.
- Springman, S.M., P.A. Mayor, P. Müller and P. Teyssere: The influence of river floods and rainfall on protection levees in the Valais. 1st International Conference on Long Time Effects and Seepage Behaviour of Dams (LTESBDo8), Nanjing, China, 30.5.-2.6.2008.
- Springman, Sarah M.: Stability of moraine slope due to rainfall infiltration. Presentation, Wallis Field Trip, HazNETH, Visp, Switzerland, 7.-9.9.2007.
- Tacher, L., and C. Bonnard: Hydromechanical modelling of a large landslide considering climate change conditions. Lecture at International conference on 'Landslides and Climate Change - Challenges and Solutions', Ventnor, Isle of Wight, UK, 21–24 May 2007.
- Tacher, L.: Modélisation hydrogéologique du glissement de la Frasse (VD). Journées de rencontre sur les dangers naturels, Université de Lausanne, 31 août–1er septembre 2007.
- Wiederseiner, S., and C. Ancey: Rheophysical investigation in concentrated particle suspensions. XVth International Congress on Rheology, Monterey, August 2008.
- Wiederseiner, S., Ancey, C., Andreini, N. and Rentschler, M.: Rhéophysique des suspensions granulaires très concentrées par vélocimétrie par images de particules fluorescentes, Actes du 11e Congrès Francophone de Techniques Laser, CFTL 2008, Futuroscope, 16–19 septembre 2008.
- van Herwijnen, A., Heierli, J., Schweizer, J., 2008: Field studies of collapse propagation in weak snow layers. EGU General Assembly 2008, Vienna, 13–18 April 2008.
- van Herwijnen, A., Schweizer, J., 2008: Continuous monitoring of acoustic emissions in an avalanche start zone. EGU General Assembly 2008, Vienna, 13–18 April 2008.
- van Herwijnen, A., Heierli, J. and Schweizer, J. Field study on fracture propagation in weak snowpack layers. International Snow Science Workshop, Whistler, Canada, 21–27 September 2008.
- Wiederseiner, S., and Ancey, C. Rheophysical investigation on concentrated noncolloidal particle suspensions in a wide-gap Couette cell. 2nd international workshop on Viscoplasticity, Monte Verità (Switzerland) 14–19 October 2007.

### c) Research proposals submitted to SNF and FP7:

#### SNF

- Hydrologic and geomorphic factors determining landslide patterns: Modeling stochastic, hydrologic and failure processes. P. Lehmann (WSL), A. Papritz (ETHZ), M. Stähli (WSL) and D. Or (EPFL). Approved sum: 164'000 CHF, August 2008.
- Quantification of sediment transfer in an exceptionally active Alpine catchment. B.W. McArdeil (WSL) Awarded sum: 42'632 CHF, May 2008.
- Time-dependent free-surface flows of concentrated suspensions. C. Ancey (EPFL). Accepted in December 2007 (200021-105193/1).
- Requip proposal: Hydro-mechanical monitoring of landslide triggering in steep terrain. M. Stähli (WSL), D. Or (EPFL), M. Schwank (WSL), L. Tacher (EPFL). Approved sum: 114'500 CHF, July 2007.
- Understanding the small scale variability of the mountain snow cover, Michael Lehning/Jürg Schweizer (SLF). Submitted: 1 October 2008

#### EU/ERC

- ERC Seventh Framework Programme (FP7). SafeLand, S. Springman (ETHZ) and L. Laloui (EPFL), under negotiation.
- ERC advanced grant (EU FP7): SlopeFlow (Dynamics of flows on steep slope). Principal Investigator: C. Ancey (EPFL). Submitted in Feb. 2008. Outcome: the project passed the evaluation thresholds, but then was not placed in the top list (decision sent by ERC in Sept. 2008).

## SwissEx

### SwissEx related papers from consortium members in 2007/2008

#### Journal Papers and books

- O. Couach, G. Barrenetxea, B. Le Bocey, M. Krichane, T. Bertholet, V. Luyet, D. Daidie, K. Aberer, J. Medico, M. Vetterli, M. Parlange. Thermal anomaly identification over a rock glacier by a wireless environmental monitoring network. In preparation (2008).
- G. Barrenetxea, O. Couach, F. Ingelrest, M. Krichane, K. Aberer, M. Parlange, M. Vetterli. SensorScope : An Environmental Monitoring Network. To be submitted to Water Resources Research (2008).
- K. Aberer, G. Alonso, G. Barrenetxea, J. Beutel, J. Bovay, H. Dubois-Ferrière, D. Kossmann, M. Parlange, L. Thiele and M. Vetterli, Infrastructures for a Smart Earth - The Swiss NCCR-MICS initiative -, PIK - Praxis der Informationsverarbeitung und Kommunikation, Vol. 30. Jahrgang, Nr. Heft 1, pp. 20-25, 2007.
- K. Aberer, G. Alonso and D. Kossmann, Data Management for a Smart Earth - The Swiss NCCR-MICS initiative -, Sigmod Record, Vol. 34, Nr. 4, 2006.
- M. Woehrle, J. Beutel and L. Thiele, Wireless Sensor Networks Test and Validation, Chapter in Handbook of Networked Embedded Systems, CRC Press/Taylor & Francis. (To appear)

#### Conference Papers

- Y. Zhou, K. Aberer, A. Salehi and K.-L. Tan, Rethinking the Design of Distributed Stream Processing Systems, accepted to Proceedings of the 24th International Conference on Data Engineering Workshops, 2008.
- Dawes N., Kumar K.A., Michel S., Aberer K., Lehning M. Sensor Metadata Management and its Application in Large-Scale Environmental Research; 4th IEEE International Conference on e-Science.
- Karl Aberer, Smart Earth: From Pervasive Observation to Trusted Information. MDM 2007: 3-7
- Anmol V. Singh, Andreas Wombacher, Karl Aberer, Personalized Information Access in a Wiki Using Structured Tagging. OTM Workshops (1) 2007: 427-436
- W. Woehrle, C. Plessl, R. Lim, J. Beutel and L. Thiele, EvAnT: Analysis and Checking of event traces for Wireless Sensor Networks. Proc. IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing (SUTC 2008), June 2008.
- A. Hasler, I. Talzi, J. Beutel, C. Tschudin and S. Gruber, Wireless Sensor Networks in Permafrost Research Concept, Requirements, Implementation and Challenges. Proc. 9th International Conference on Permafrost (NICOP), vol. 1, pages 669-674, June, 2008.
- A. Meier, T. Rein, J. Beutel and L. Thiele: Coping with Unreliable Channels, Efficient Link Estimation for Low-Power Wireless Sensor Networks. Proc. 5th International Conference on Networked Sensing Systems (INSS2008), June, 2008.

A. Meier, M. Weise, J. Beutel, and L. Thiele, NoSE: Neighbor Search and Link Estimation for a Fast and Energy Efficient Initialization of WSNs. Proc. 6th ACM Conf. Embedded Networked Sensor Systems (SenSys 2008), pages to appear, November 2008.

- Michel S., Salehi A., Luo L., Dawes N., Aberer K., Barrenetxea G., Bavay M., Kansal A., Kumar K.A., Nath S., Parlange M., Tansley S., Van Ingen C., Zhao F., Zhou Y. Environmental Monitoring 2.0; ICDE 2009 (demonstration track)
- O. Couach, G. Barrenetxea, V. Luyet, B. Le Bocey, M. Krichane, T. Bertholet, T. Varidel, M. Bystranowski, K. Aberer, J. Medico, M. Parlange, M. Vetterli. SensorScope: a New Environmental Monitoring System. Example of Application in an Alpine Environment. International Congress on Environmental Modelling and Software (IEMSS 2008), Barcelona, Catalonia, 6-10 July 2008.
- G. Barrenetxea, F. Ingelrest, G. Schaefer, M. Vetterli, O. Couach and M. Parlange. SensorScope: Out-of-the-Box Environmental Monitoring. The 7th International Conference on Information Processing in Sensor Networks (IPSN 2008). St. Louis, Missouri, USA, 22-24 April 2008.
- G. Barrenetxea, F. Ingelrest, Y. M. Lu and M. Vetterli. Assessing the Challenges of Environmental Signal Processing through the SensorScope Project. The 33rd IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2008). Las Vegas, Nevada, USA, 30 March - 4 April 2008.
- F. Ingelrest, G. Barrenetxea and M. Vetterli. SensorScope, un système clef en main de surveillance de l'environnement. 13ème Colloque Francophone sur l'Ingénierie des Protocoles (CFIP 2008). Les Arcs, France, 25 - 28 March 2008.
- G. Barrenetxea, F. Ingelrest, G. Schaefer and M. Vetterli, The Hit-chhiker's Guide to Successful Wireless Sensor Network Deployments, accepted to The 6th ACM Conference on Embedded Networked Sensor Systems (SenSys 2008).
- G. Barrenetxea, F. Ingelrest, G. Schaefer and M. Vetterli. Wireless Sensor Networks for Environmental Monitoring: The SensorScope Experience. The 20th IEEE International Zurich Seminar on Communications (IZS 2008). Zurich, Switzerland, 12-14 March 2008.
- M. Woehrle, J. Beutel, R. Lim, M. Yucel and L. Thiele, Power monitoring and testing in Wireless Sensor Network Development, Workshop on Energy in Wireless Sensor Networks (WEWSN 2008), June, 2008.

#### Posters

- Swiss Experiment: a New Environmental Monitoring Platform in Alpine Environment; AGU Conference, San Francisco, California, USA, 10-14 December 2007.
- Swiss Experiment: a New Environmental Monitoring Platform for the Alpine Environment; COST Conference, Innsbruck, Austria, 08 April 2008.

**Press Articles**

MRI Europe Newsletter, April 2008

Dawes N., Aberer K., Lehning M., Parlange M., Swiss Experiment: an e-science platform for interdisciplinary collaboration in environmental research, MRI Europe, Autumn 2008.

Flash, EPFL journal, September 2008,

SwissInfo.ch, 8th April 2008,

China Info, 30th November 2007

ScienceDaily, 26th November 2007

Neuen Zürcher Zeitung, 26th November 2007

SDA/Schweiz, 26th November 2007

Basler Zeitung, 26th November 2007

**Other**

C. Nosedà and E. Charbon, HYDROMON: On-Line Monitoring of Drinking Water Quality within a Supply Network, White Paper

**GDC****a) Publications**

Yourth C, Brown MJF, Schmid-Hempel P (2008) Effects of natal and novel *Crithidia bombi* (Trypanosomatidae) infections on *Bombus terrestris* hosts. *Insectes Sociaux* 55, 86-90.

Wilfert L, Muñoz-Torres M, Reber Funk C, et al. (2008) Construction and characterization of a BAC-library for a key pollinator, the bumblebee *Bombus terrestris* L. *Insectes Sociaux* in press.

Wegner MK, Berenos C, Schmid-Hempel P (2008) Non-additive genetic components in resistance of the Red Flour Beetle against parasitic infection. *Evolution* in press.

Wilfert L, Schmid-Hempel P (2008) The genetic architecture of susceptibility to parasites. *Evolution*, in press

Torriani, S.F.F., Brunner, P.C., McDonald, B.A., Sierotzki, H. 2008. QoI resistance emerged independently at least four times in European populations of *Mycosphaerella graminicola*. *Pesticide Management Science*, in press.

Zaffarano, P.L., McDonald, B.A., Linde. C.C. Phylogeography of *Rhynchosporium secalis*. *Molecular Ecology* (accepted).

Torriani, S.F.F., Linde, C.C., McDonald, B.A. Screening for strobilurin resistance in field populations of *Rhynchosporium secalis*. *Australasian Journal of Plant Pathology* (accepted).

Holderegger R., Hermann D., Poncet B., Gugerli F., Thuiller W., Taberlet P., Gielly L., Rioux D., Bridbeck S., Aubert, S., Manel S. Land ahead: using genome scans to identify molecular markers of adaptive relevance. *Plant Ecology and Diversity*, in press.

Wirth L., Graf R., Brodbeck S., Reber-Funk C., Holderegger R. and Landergott U. Fully informative microsatellite markers for the tetraploid plant *Eritrichium nanum* (Boraginaceae) with polysomic inheritance. *Molecular Ecology Resources*, in press.

**b) Talks**

Holderegger R. 20-23.10.2008. Land ahead. Landscape genetics and adaptation. European Science Foundation Workshop on landscape genetics, Grenoble, France (invited key note).

McDonald B. A comparative genomics approach to identify genes involved in host specialization and sympatric speciation. Plant and Animal Genomics meeting, San Diego, California, 12-16 January 2008.

McDonald B. The recent emergence of agricultural plant pathogens. Institute of Plant Science, University of Bern, Bern, 7 May 2008.

McDonald B. The population genetics of *Mycosphaerella graminicola*. 7th International *Mycosphaerella* and *Stagonospora* Symposium, Ascona, Switzerland, 18-22 August 2008.

McDonald B. The population and evolutionary biology of fungal necrotrophs. British Society of Plant Pathology Presidential meeting. London, UK, 16-17 December 2008.

Widmer A. De novo sequencing of sex chromosome derived BACs in a non-model plant species. Launch Seminar of the Functional Genomics Center Zurich. Zurich, 5 November 2008.

Widmer A. Reproductive isolation, hybridization and introgression in a plant species pair with heteromorphic sex chromosomes. HIT Seminar, University of Heidelberg, Heidelberg, 28 October 2008.

**c) Research Proposals submitted to SNF (Sinergia) or EC FP7 (all actions)**

Invasive species in a changing world: A *Leptosphaeria* Invasion and Evolution Network (ALIEN). Marie Curie Initial Training Networks (ITN). PIs: B.A. McDonald P. Brunner, Requested amount ETH: CHF 600,000.



