

Policy Advice  
Knowledge Networks  
Capacity Building

# impact

Knowledge Transfer

Advisory Boards  
Expert Panels  
Regulatory Agencies

outcome  
Technology Transfer

About the UFZ

# Helmholtz Center for Environmental Research GmbH

## Our Vision

The UFZ is one of the world's leading research centers in the field of environmental research and enjoys high social recognition. It offers ways for a sustainable use of natural resources for the benefit of humans and nature.

## Our Mission

Biodiversity, functioning ecosystems, clean water and intact soils are our natural bases of life. In light of global change, all staff at UFZ share the objective to demonstrate and promote ways in which excellent research can reconcile social development with a healthy environment. The UFZ is a reliable partner for politics, economy and civil society in the process of understanding the impacts of human activities on the environment and to develop options for social decision-making processes. Therefore, the UFZ addresses societal challenges and creates knowledge and technologies which help to identify potential conflicts between environmental and societal demands at an early stage and to develop precautionary measures.

## Our Structure

The UFZ was founded in 1991 and employs 1,100 people at its locations in Leipzig, Halle (Saale) and Magdeburg. The UFZ is a member of the Helmholtz Association of German Research Centers.



Dear reader,

The UFZ carries out excellent research within a wide range of topics related to the environment. It generates sound knowledge and technological solutions for managing our natural resources in a sustainable way which will ultimately benefit society and environment. The transfer of knowledge and technologies to society and business is an integral part of the UFZ mission and activities.

Knowledge Transfer at the UFZ aims to provide options for citizens and decision-makers from the economy, politics and civil societies to address recent or future challenges in the relationship between societies and their environment. On the one hand, UFZ scientists provide scientific analysis and advice on specific problems of environmental politics and administration. On the other hand we are closely involved in the practical processes of environmental politics and administration and well informed about the real-life problems and complex issues to which applied research needs to be tailored.

The selected examples in this brochure will serve as a first insight into our broad range of knowledge transfer activities which include the following topics:

- UFZ Knowledge Transfer Award 2017
- UFZ Communication Award 2017
- Experts at the UFZ
- Transfer activities
- Offers and contacts

These examples clarify how the UFZ interacts with its different stakeholders and meets their various needs. They demonstrate the capability of the UFZ to support decisions in societal, economic and political domains and to implement the knowledge needed for sustainable development.

Last but not least, the examples reveal how the UFZ proceeds with regard to its transfer role as stated in the center's mission.

Interested in further activities or want to join our knowledge network? My colleagues and I will be delighted to hear from you.

Yours sincerely,

Dr. Joachim Nöller  
 Head of Department  
 Knowledge and Technology Transfer

P.S.: We are also looking for partners from the private sector for developing technical solutions. Would you like to join forces with us and develop our innovative approaches further into products and production processes – based on your processes and market know-how? Just read our brochure “outcome” or visit our homepage to get a first impression.

You can find further information on our website:  
[www.ufz.de/knowledgetransfer](http://www.ufz.de/knowledgetransfer)

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Knowledge Transfer Award 2017

## Dr. Heidi Wittmer



... was honored for outstanding achievements in the initiation and support of sustainability transformations in developing countries.

Heidi Wittmer is Head of the UFZ Department of Environmental Politics. She has a PhD in Socio-Economics of Agriculture from the Georg-August-University Göttingen. Her research interests include science policy interfaces, multi-level governance, design and implementation of policy instruments, and biodiversity and ecosystem services. She is part of the [EKLIPSE](#) Expert Group on Knowledge Synthesis Methods.

The importance of protecting ecosystems and their services to humanity is generally accepted. In recent years, Heidi Wittmer has supported a large number of developing countries in initiating environmental policy processes on the basis of scientific concepts and findings, with the help of which sustainable development and protection of ecosystems can be achieved. The [TEEB](#) (The Economics of Ecosystems and Biodiversity) report she edited for local and regional decision-makers and the 6-step approach to mapping and valorizing ecosystem services developed therein have had a significant impact on international development cooperation and a wide range of practice-oriented approaches and context-specific implementations in developing countries.

She has paid particular attention to various challenges

of knowledge transfer on this topic:

- The conflict between complexity in matter and pragmatism in the practical recommendation
- The complementary role of knowledge and incentives as a prerequisite for sustainable activities
- The consideration of environmental (un)justice in political decisions
- The interpretation and adaptation of academic concepts for different political and “administrative cultures”.

Heidi Wittmer has made a name for herself in the field of so-called “science-policy interfaces“ in Germany as well as at European and international level.

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Communication Award 2017

## Dr. Mark Auliya



... was honored for his outstanding popular scientific communication on his research.

Dr. Mark Auliya has received the UFZ Communication Prize 2017 for the outstanding popular scientific communication of his research on deficits and challenges of international species protection using the example of the reptile trade.

In addition to advising on [IUCN](#) (International Union for Conservation of Nature) and international participation in discussions on the [CITES](#) (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and advising the contracting industry, Mark Auliya has provided extensive publicity (UFZ Newsletter March 2016: Making Reptile Trade Transparent, Long Night of Science) and media work.

In summary, Mark Auliya works both in applied science and at the interface of science and politics. He is using special methods to reduce scientific uncertainties for political decisions and is the point of contact for trade questions on wildlife, not only for international scientific authorities. Also, when it comes to identifying seized reptiles or products, the UFZ regularly receives requests from customs, government and other relevant stakeholders.

With these extensive communication activities, Mark Auliya has made a significant contribution to the nati-

onal and international visibility of the UFZ, not only to global state and non-state conservation organizations such as IUCN and CITES, but also to the general public.

As an international expert, he is member of many IUCN Specialist Groups:

- IUCN SSC Crocodile Specialist Group (CSG)
- IUCN SSC CSG - Tomistoma Task Force (working group on the Tomistoma crocodile)
- IUCN SSC Tortoise and Freshwater Turtle Specialist Group
- IUCN SSC Sea Snake Specialist Group
- IUCN SSC Boa & Python Specialist Group - Red List Authority Coordinator
- IUCN SSC Monitor Lizard Specialist Group - Co-Chair

Further advisory functions comprise for example:

- Consultant for reptile species conservation for authorities in Germany, Indonesia and Malaysia
- Contributor to the IUCN Red List
- Authority for the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety ([BMU](#)) – subject area: amphibians and reptiles

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**Our Experts**

**Dr. Heidi Wittmer**

Department of Environmental Politics

Heidi Wittmer is Head of the UFZ Department of Environmental Politics. Moreover, she personally contributes to the developing countries the integrative potential of the ecosystem service concept and the practical orientation aids for the selection and design of solution approaches. She has accompanied local stakeholder processes in various project contexts (e.g. in Thailand, the South Pacific, Mexico, Peru), held numerous lectures as a recognized expert both at political events worldwide (e.g. in Nepal, Norway, Ecuador) and international processes such as the Convention on Biological Diversity (CBD) and the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES). In addition to her scientific expertise, Heidi Wittmer has a remarkable ability to bring together different perspectives and opinions of stakeholders, to promote their productive exchange and to effectively support joint solution finding.

“My main aim is to make UFZ research relevant to policy and society by better understanding policy needs and concerns and to frame results in such a way that they become actionable for policy and other decision-makers. Working at a large interdisciplinary center with a high proportion of colleagues beyond their PhD greatly facilitates such work as inter- and transdisciplinary work greatly benefits from established relationships building on trust and easy understanding across different backgrounds.”

Personal website of [Dr. Heidi Wittmer](#)



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**Dr. Mark Auliya**

Department of Conservation Biology

Mark Auliya is postdoctoral researcher at the Department of Conservation Biology and wrote his thesis on “Taxonomy, Life History and Conservation of Giant Reptiles in West Kalimantan (Indonesian Borneo)”. From April 2010 to December 2017, his two major projects were based on the science-policy interface, “Risk Assessment of Chytridiomycosis to European amphibian diversity” and “Population genetics and their forensic applications to the reticulated python (Malayopython reticulatus spp.) for regulation of the commercial skin trade in Southeast Asia”. His research focus is to tackle the manifold existing scientific uncertainties that reflect species involved in the international trade and therein to improve the scientific basis for decision-making processes and to implement a sustainable and legal trade. Mark Auliya has created a huge network over the last two decades with international stakeholders, from numerous non-governmental organizations to scientific/management authorities and academics. Over the last 10 years, he has increased his presence in the international media, and in 2017, he was awarded the communication prize through the UFZ for his outstanding popular-scientific communication of his research on the deficits and challenges of international species conservation using the example of the reptile trade.

Since January 2018, he has been a guest scientist at the UFZ and working part-time for the Zoological Research Institute Alexander Koenig in Bonn.

Personal website of [Dr. Mark Auliya](#)



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**Our Experts**

**Prof. Dr.-Ing. Daniela Thrän**

Department of Bioenergy

Daniela Thrän is an engineer and Head of the Department of Bioenergy at the UFZ in Leipzig and also Head of the Bioenergy Systems Department at the German Biomass Research Centre (DBFZ) in Leipzig. She holds the chair of Bioenergy Systems at the University of Leipzig and is co-spokesperson for the “EnergyLandUse” Integrated Project in the Helmholtz “Terrestrial Environment” research program. Daniela Thrän has been a member of the Bioeconomy Council since September 2012. She represents Germany in the ISO Committee “Biogenic Solid Fuels”, is a member of the Energy Council for Saxony, coordinator of accompanying research for the “Biomass Energy Use” funding program of the Federal Ministry for Economic Affairs and Energy (BMWi) and was Head of Scientific Accompanying Research in the “BioEconomy Cluster” (2012–2017).

Personal website of [Prof. Daniela Thrän](#)



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**Prof. Dr. Erik Gawel**

Department of Economics

Prof. Dr. Erik Gawel is Head of the Department of Economics, Head of the Institute for Infrastructure and Resources Management at the University of Leipzig and Publicly Certified Expert (Chamber of Commerce and Industry Frankfurt am Main) for Cost Accounting of Public Enterprises. He has a PhD in Economics from the University of Cologne. He is a member of the European Academy of Sciences and Arts.

His areas of expertise are environmental and energy economics, infrastructure economics, new institutional economics and public finance.

He conducts research in the areas of economic key issues of climate change, environmental impacts of energy transition, the economics of biomass and bioenergy and water resources management, especially water-related prices and charges.

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Transfer Activities

## Partition Coefficients – an Important Parameter for Regulation

### From a Single Descriptor...

The partitioning behavior of chemicals in solvents and biomaterials plays an important role for analytical tasks, distribution scenarios for environmental pollutants, risk assessment for the accumulation of a chemical in the body, pharmacokinetic modelling and for technical processes in chemical engineering. Dr. Nadin Ulrich and her colleagues from the Department of Analytical Environmental Chemistry have developed a free online database of descriptors and system parameters for the prediction of partition coefficients of neutral organic chemicals based on LSER (Linear Solvation Energy Relationship) equations.

The database started with compound descriptors of about 3,000 compounds in 2013, an integration of the Absolv database by Prof. Dr. Michael Abraham (emeritus from University College London), and led to around 21,000 sets of descriptors available in the LSER-database (LSERD) for about 8,600 chemicals today. Furthermore, there are about 450 different system equations stored in the database, which describe more than 200 partition systems. The datasets included in the database are checked and validated by different plausibility tests.

### ... to Prediction of Regulators for Authorities.

LSERD is unique due to its usability and subsequent user-optimized developments, such as an “extraction tool”, and was mainly developed for planning experimental setups and method development for analytical chemistry.

It enables the user to select the most efficient solvent for an extraction procedure of a chemical from the water phase. The fraction of the chemical, which is extracted by the selected solvent, is automatically calculated for each solvent selected in the tool. It allows for comparing different solvents in extraction efficiency within less than a minute. Compared to a classical experimental approach, where different solvents are tested for the extraction procedure during weeks or months, the tool saves a lot of time for experimental workers.

The second tool, which was developed for LSERD, the “Bio-partitioning Tool” enables the user to calculate the partitioning behavior of a chemical in the different compartments of a defined organism (for example membrane lipids or serum albumin). This tool is of high impact for toxicologists, biologists and regulatory organizations such as the Federal Environment Agency and Federal Institute for Risk Assessment. It was implemented in November 2016.

The latest developments include the “Freundlich Koc Tool” that calculates concentration dependent partition coefficient between soil organic carbon and water, which is of high interest for environmental chemists. Besides the technical maintenance of server infrastructure and updating the database, the UFZ is responsible for building up a network, both in the scientific community and with stakeholders, just like the regulatory organizations mentioned above. Therefore, workshops for external users have been organized to exchange knowledge and ideas, but also user’s background and needs. So far, the LSERD website has had about 175,000 page views by users and since 2016 it has been used by 2,600 different users from 30 countries all over the world.

[UFZ-LSER database](#)



Participants of the first user workshop of the LSER database

Transfer Activities

## Policy Advice for Animal Diseases in Europe

### A Disease is Spreading ...

The African Swine Fever Virus (ASFV) is a disease which is transmitted by a virus invading Europe from the Baltic Countries. It is affecting wild boars and domestic pigs causing substantial economic damage. Therefore, the European Food Safety Authority (EFSA) of the European Commission as an authority responsible for food security formulated the necessity to develop a European Intervention Plan to prevent the spread of ASFV and effectively respond to reported outbreaks. Recently, even regional authorities strongly demanded decision support as ASFV and its risks are right now recognized by the public and intensively discussed in the media. Hence, tools for predicting and mitigating the ASFV risk across scales were required as a basis.

### A Predictive Simulation Model for Decision-Makers in Europe...

The UFZ scientist Dr. Hans-Hermann Thulke from the Department of Ecological Modelling has developed a predictive spatially explicit Eco-Epidemiological Simulation Model (EcoEpi), which has been tailored especially to the needs of risk assessment, decision-making and management support. It combines information of land-use pattern, the ecology of wild boars and the ASFV virus. Innovative core was a method for rapid parameterization of the EcoEpi-Model on the basis of empirical data of wild boar carcasses.

The delivered model-based products for decision-making-support are European Maps predicting the likelihood of occurrence of ASFV for different time zones and assessments of the cost-effectiveness for alternative intervention strategies. Since the developer of the EcoEpi-Model belongs to the Expert Panel advising EFSA, the outcomes were used as a basis for the EFSA Intervention Plan approved in October 2017. Additionally, members of the EcoEpi-team were involved in an expert hearing of the Saxonian Parliament on ASFV control in December 2017.

[Project group Ecological Epidemiology](#)



Species endangered by the African Swine Fever Virus

Transfer Activities

## Strategies for Alleviating Temperature Disruption in the Downstream River

### Operating Drinking Water Reservoirs...

Reservoirs dramatically disrupt the temperature continuum of rivers as usually cold water from the bottom outlet is supplied for the downstream connection. Withdrawing warmer water closer to the lake surface, however, would isolate the deep water from any renewal and hence oxygen depletion and subsequent effects of water quality and deterioration can be the consequence. In addition, other requirements, such as flood protection, minimum outflow and leisure use, must be taken into account and balanced against each other.

### Deriving New Reservoir Operation Strategies ...

Dr. Michael Weber and PD Dr. Bertram Boehrer from the UFZ Department of Lake Research have developed a reservoir operation model that is able to predict optimal withdrawal strategies for drinking water reservoirs. This model realizes prescribed downstream water temperatures and water fluxes by mixing waters from various accessible outlets, while simulating reservoir stratification and hypolimnetic oxygen concentration (to be above 4 mg/l). The proposed new reservoir operation strategy alleviates one of the major negative effects of dams on downstream river communities of fish and invertebrates. It increases the sustainable operation of dams without harming the prioritized function of the dam (such as the drinking water supply).

The scientists have produced an operational reservoir model based on a one-dimensional coupled hydro-physical biogeochemical model.

- The model is available for free as an Open Source (General Lake Model [GLM](#)).
- The results were published in Weber *et al*, Journal of Environmental Management, 197 (2017), p.96-105.
- The new reservoir operation strategy is implemented in the Great Dhünn Reservoir. This drinking water reservoir supplies water to about one million people and is operated by the Wuppertverband.

For further information please contact [Dr. Bertram Boehrer](#).



The Rappbodetalsperre System

Transfer Activities

## Scenarios for a Global Sustainable Land Management

### From Transdisciplinary Regional Projects...

Climate and demographic change as well as competition between alimentation and energy supply require innovative solutions for the future use of natural resources and land. Therefore, the German Ministry of Education and Research launched the international research program "Sustainable Land Management" in 2009. Within this funding measure, twelve regional collaborative projects (RPs) have researched the impacts of climate and socio-economic changes and a corresponding optimization of the use of land and natural resources. The projects were spread over four continents and analyzed the complex interaction between the different topics.

### ...to Global Scenarios on Climate and Land-Use Change

The RPs dealt with changes and resulting problems in biodiversity, ecosystem services, food security, water management, science and policy interface, as well as climate change and their interactions. Researchers from the UFZ Department of Computational Landscape Ecology scientifically coordinated the RPs between 2009 and 2017 within the framework of the [GLUES](#) (Global Assessment of Land Use Dynamics, Greenhouse Gas Emissions and Ecosystem Services) project. The researchers developed target group specific communication strategies for an effective communication and outreach between partners and regional stakeholders. The second pillar of GLUES was the synthesis of the RP results achieved by identifying patterns from regional solutions from a reduced number of differing regional conditions and by creating global scenarios and a common data pool.

The online portal Geodata Infrastructure ([GDI-DE](#)) developed by the Department of Geosciences at the TU Dresden ([applications](#)) facilitated publishing, sharing, and maintaining global and regional data sets, as well as model results on land-use scenarios, climate change, and economic development. The GLUES GDI supported a technical collaboration of the GLUES partners and the RPs and provides a technical basis for further outreach activities.

GLUES successfully demonstrated that research

results on a regional level are also relevant in a global context and that local case studies can be transferred to other geographic regions. Further it was shown, how the case studies can impact decision processes for a sustainable land use in complex, socio-ecologic systems and how ecosystem services can be evaluated to integrate them in recommendations and make them relevant for policy.

A prominent example for publications within the project is the e-book "Making sense of research for sustainable land management" jointly published with [WOCAT](#) (World Overview of Conservation Approaches and Technologies) - a global network on Sustainable Land Management.



[Here you can read in the e-book.](#)

Transfer Activities

## “Energiewende” – Map in Germany

### The implementation of the energy transition...

The transition to a decarbonized power system in Germany, also known as the “Energiewende”, is rapidly progressing. The German energy transition is an internationally renowned transformation project.

Hydropower, wind, sun and biomass supplied already 29 per cent of Germany’s electricity in 2016 (BMWi, 2016). The ambitious goal to change to climate-friendly energy supply is taking place in all federal states. However, regional differences are immense.

These discrepancies have been investigated by Sebastian Rauner and the UFZ scientists Dr. Marcus Eichhorn and Prof. Dr.-Ing. Daniela Thrän from the Department of Bioenergy.

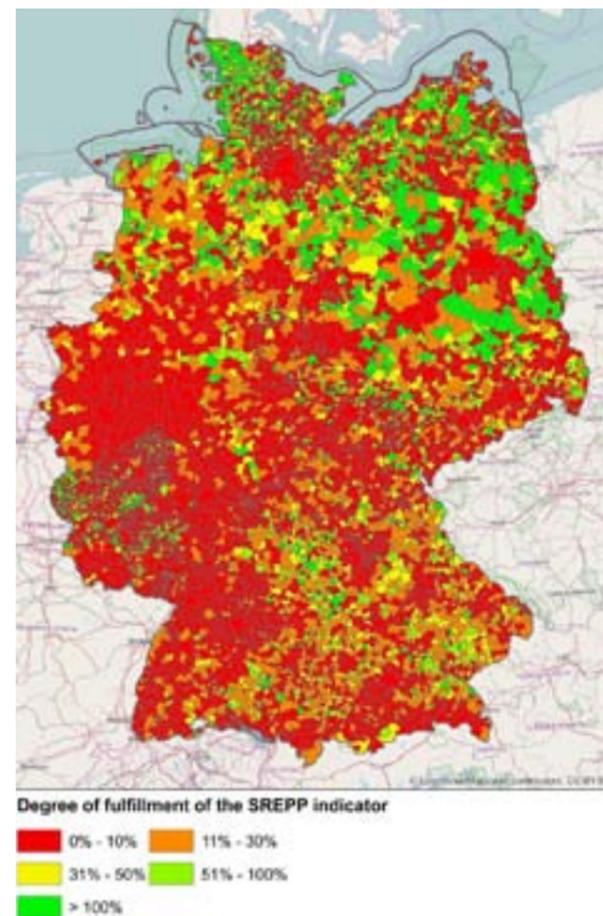
### ... strong at the coast, weak in the cities

By combining a variety of socioeconomic and geographical data with a hot spot analysis, the scientists identified statistically relevant hot and cold spots of renewable power provision and visualized them in a map. In such a way, “pioneers” and “laggers” among all 12,066 German municipalities were identified. For instance, the map indicates that municipalities on the west coast of Schleswig-Holstein are relatively active with numerous wind parks and biogas plants. Moreover, Brandenburg and Saxony-Anhalt are forerunners with regard to renewable energy generation from wind, sun and biomass. However, backlog becomes visible in large cities such as Berlin or industrial conurbations in Hesse and Baden-Wuerttemberg.

One major result of the study is the spatial discrepancy between supply and demand of renewable energy. The few identified hot spots of renewable energy production are mainly located in areas with less energy demand (e.g. rural areas with space for wind and solar parks but at the same time low population). The scientists suggest two main strategies to cope with this issue. The first one proposes a significant increase in transmission capacity so that demand centers can be supplied. The second strategy suggests a spatially organized deployment of renewable energy capacities according to the local demand. This can be

achieved by regionally explicit political support schemes or tailor-made market frameworks, e.g. locational pricing. With the provided approach, energy strategies can be formulated at local level. Such a decentralized strategy would not only have the advantage of reducing transmission expansion but could also promote social acceptance through local prosumer structures.

For further information please contact [Dr. Daniela Thrän](#).



“Energiewende” map of German municipalities

Transfer Activities

## Where to Put the Wind Turbines?

### German Energy Transition

Europe, and especially Germany, has begun to shift from fossil to renewable energy sources. So far, wind power has taken and probably will continue to take the lion’s share of gross electricity production from renewable energy onshore. This is mainly due to the high technology readiness level and energy efficiency of wind power. However, especially in densely populated regions, such as Central Europe, sites are limited by physical, legal and political factors. At the moment, suitable areas for onshore wind turbines are usually determined by a Geographic Information System (GIS), but this does not allow conclusions about optimal positioning and energy efficiency of the planned wind turbines. In practice, planning is therefore realized manually, with the help of highly complex (and expensive) specialized software, or a combination of both. Moreover, in the planning stage, it is important to maximize the possible energy yield of a given area taking into account other sites close by, which may be affected by the new area. The resources required for planning multiple sites are also an issue on a regional or even higher planning level.

### “MaxPlace” - Software for the Area-Efficient Allocation of Onshore Wind Turbines

The UFZ scientist Dr. Frank Masurowski developed in the Department of Ecological Modelling a GIS-based software solution (MaxPlace) for the area-efficient allocation of onshore wind turbines on multiple potential sites. MaxPlace integrates various alternative allocation algorithms which account for special site conditions such as wind intensity and selects the algorithm with the highest energy yield in an automatized way.

In a nutshell, MaxPlace calculations maximize the energy potential of a given area. It can be used as stand-alone software to plan any number of areas in one single computation, making it the first choice for very scattered locations or large areas. Different algorithms will calculate, compare and assess the distribution of wind turbines in an area which maximizes energy yields.

Parameters such as the main wind direction, wind

speed and frequency, minimal distances between turbines and houses, effects of nearby parks, protected areas and other limitations, form the basic data for possible turbine locations. The turbine type(s) to be used can be chosen freely, and existing ones are also taken into consideration.

The software is ready to use for planners. Partners of the BMBF Project are Energy EFFAIR (software concept) and Planning Association West Saxony (software testing).

Commissioned calculations are also possible up to a certain capacity.

For further information please contact [Dr. Frank Masurowski](#).



Wind turbines at housing estates, Klepzig in Saxony-Anhalt

Transfer Activities

Our Contacts

# ClimateAdaptationSantiago (CAS) Project

## Mutual Learning

Within the international research project ClimateAdaptationSantiago (CAS), a Regional Learning Network on adaptation to climate change in Latin American megacities was established in strong collaboration with the UN Economic Commission for Latin America (ECLAC). The network was coordinated by Dr. Kerstin Krellenberg from the Department of Urban and Environmental Sociology from the Helmholtz-Center for Environmental Research. The Regional Learning Network includes representatives - scientists, decision-makers and practitioners - from six Latin American megacities: Buenos Aires, Bogotá, Lima, México, Santiago de Chile and São Paulo.

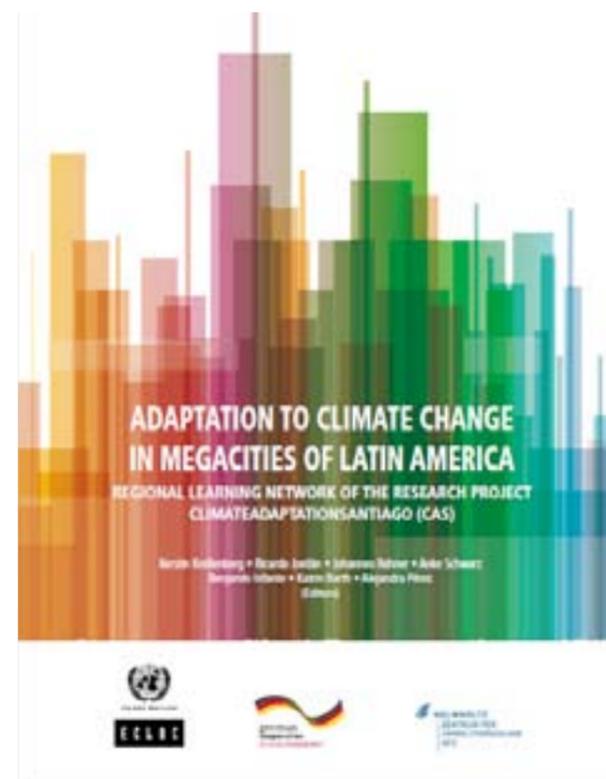
The Regional Learning Network was set up with the aim of illustrating, explaining, discussing and comparing the state of the art of urban adaptation to climate change in the Latin American Region, based on manifestations and impacts of climate change as well as existing policies and measures in Latin America's megacities.

## Approach and Results

The Learning Network was established in three workshops. Whereas the first workshop was devoted to a dialogue between scientists from all six cities; the second sought to strengthen the exchange between decision-makers and practitioners of the cities, including representatives of different administrative levels, and the third brought them all together.

This way, the Regional Learning Network fostered exchange and mutual learning between actors and cities. It helped to promote the technical skills of those responsible for decision-making in Latin America through learning from the experiences of other cities and the discussion on possibilities to transfer approaches and successful experiences. Thereby, the insights of the Regional Learning Network directly supported the development of the Regional Climate Change Adaptation Plan of Santiago de Chile, the main outcome of the CAS project which was delivered to the main entities of the Metropolitan Region of Santiago de Chile for implementation.

The reliability of the Network was underpinned by a follow-up activity that took place within the CLAVE Helmholtz International Research Group on Climate change adaptation options in Santiago de Chile and other Latin American megacities. Exchange between the cities of the Regional Learning Network continued with a focus on urban vulnerability on a local level and led to a joint book publication.



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### Reply coupon

#### Request information on:

- Research contacts at UFZ
- Science-based advice and concepts
- Collaboration

#### Thematic areas at UFZ:

- Environmental Engineering and Biotechnology
- Ecosystems of the Future
- Water Resources and Environment
- Chemicals in the Environment
- Smart Models and Monitoring
- Environment and Society

#### Your contact:

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