

Mountain and global change research programmes in Austria

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The Austrian Academy of Sciences as a partner of international research programmes

The international research programmes of the Austrian Academy of Sciences (ÖAW) play a significant role in the Austrian basic and applied earth system sciences research efforts. In total, seven international research programmes are established at the Austrian Academy of Sciences: *Alpine Research*, *Global Change*, *Man and the Biosphere (MAB)*, *International Strategy for Disaster Reduction (ISDR)*, *Hydrology of Austria (the Austrian contribution to UNESCO's International Hydrological Programme)*, *International Geoscience Programme (IGCP)* and *Geophysics of the Earth's Crust (GdE)*. These programmes, administered by national committees established at the ÖAW, are financed by the Federal Ministry of Science and Research (BMWF). The national committees, made up of renowned scientists and representatives of several ministries and federal organizations, see their main task as facing global change proactively by establishing timely strategic research foci. Other tasks of the national committees include:

- coordination of the research activities in the research sector of their expertise
- formulating programme-based research strategies
- quality assurance of the funded research projects
- development of new research foci
- stimulation und funding of new research projects and scientific cooperation

The research proposals submitted after specific project calls are granted by the national committee after an external peer review. In addition, the scientific quality of both the results and project reports is also reviewed by the national committee.

The programmes

All ÖAW research programmes are either part of international scientific programmes (e. g. UNESCO, UNO, ICSU) or linked to international research programmes through contracts and scientific co-operations. The ÖAW research programmes are represented in many international scientific conferences and in UNESCO bodies by national committee members and the head of the ÖAW international research programmes unit.

While the programmes *Alpine Research* and *Global Change* are definitely focused on mountain, environmental and global change research issues, all other programmes are regularly (co)funding some projects in these fields of research. For example, since 2007, the programmes *Alpine Research* and *ISDR* have been co-financing the new interdisciplinary research focus "Permafrost in the Austrian Alps". According to statistics provided by the BMWF, the ÖAW research programmes in the period of 2002–2006 were the most significant source of funding for climate-related research in Austria (BMWF 2008).

The programme *Alpine Research*, established in 1999, is part of the research cooperation International Scientific Committee on Alpine Research (ISCAR). The research programme serves to promote pan-alpine and interdisciplinary cooperation in the field of the alpine research. Main research topics include global change, water, traffic, natural disasters, biodiversity, social economy and geoscience.

The *Global Change* programme, established in 1990, covers three international research networks including the International Geosphere Biosphere Programme (IGBP), the World Climate Research Programme (WCRP) and the International Human Dimension Programme (IHDP). The programme aims to promote high-quality research in the field of global environmen-

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tal changes (e.g. climate, biodiversity) and the transfer of scientific results into practice and to the public. The programme provides funding for targeted research and activities that will contribute to a better understanding of impacts on and vulnerabilities of terrestrial and aquatic ecosystems to global change and provide information necessary for the development of adaptation and mitigation strategies. Current research topics are: effects of climate warming on alpine permafrost; global change impacts on species composition of mountain biota; the impact of neobiota; and global change effects in alpine and arctic areas.

A selection of typical projects

In the period from 2005 to 2010, these two programmes have financed numerous research projects with a total budget of approx. 3.0 million euros to work on a wide range of basic and applied research topics. A good part of these projects were and/or are carried out at research institutes in Innsbruck, underlining the position of this university town as the leading European centre for alpine research. Let me highlight just a few studies within these high-quality projects:

A set of three projects studying the effects of climate change on Alpine permafrost upgrades the University of Innsbruck as the centre of Austrian permafrost research:

Permafrost in Austria – PART 1 (led by K. Krainer, Institute of Geology and Palaeontology), *The impact of melting permafrost and rock glaciers on alpine lakes* (carried out by K. Koinig, Institute of Ecology, Innsbruck) and *Austrian Permafrost Research Initiative* (coordinated by M. Monreal, IGF). These projects are aimed at increasing our understanding of the effect of climate change on permafrost and the consequences of permafrost thawing and investigate the phenomenon from different angles including hydrology, geomorphology, limnology and ecology.

A series of studies dealing with biodiversity aspects of alpine research are carried out by the institutes of the Faculty of Biology at the University of Innsbruck, which



Karl Krainer (University of Innsbruck) on his way to the permafrost monitoring sites on the rock glacier in the Krummgampental, Tyrol. Photograph by Lois Lammerhuber.

provides expertise in a wide range of research topics (e.g. limnology, animal ecology, microbial ecology, river ecology, landscape ecology, mountain agriculture).

The project *Biodiversity in alpine ecosystems* (coordinated by R. Psenner, Institute of Ecology), carried out in the UNESCO-MAB biosphere reserve Gossenköllesee, is not a typical project with a duration of two or three years, but a long-term research programme to study high-altitude ecosystems under the auspices of the ÖAW since 1977. In the course of numerous dissertations and projects also sponsored by the Austrian Science Fund and the EU, researchers and students contributed to the understanding of problems most of which had a global background, such as acid rain, deposition of pollutants, changes in biodiversity and the consequences of climate change, but also the characteristics of extreme habitats and communities. A project in a similar context is *Climate-driven alterations in biodiversity and functioning of high-alpine lakes in the Tyrolean Alps over the past millennium (CLIMBIOFUN)* led by E. Ilyashuk (Institute of Ecology). The general objective of this very recent project is to reconstruct changes in chironomid and diatom biodiversity along with alterations in the functioning and limnological conditions of two high-alpine lakes from North Tyrol (Austria) and

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Brigitta Erschbaumer with a grid for counting plant species on meadows at the BR Gurgler Kamm, Tyrol. Photograph by Lois Lammerhuber.

South Tyrol (Italy) in response to climate variations over the past millennium. The very new project *Proglacial stream ecohydrology and climate change over the Alps* (coordinated by L. Füreder, Institute of Ecology) is the first linked field and numerical modelling study of an alpine glaciology-hydrology-ecology system. The project *Fish from sensitive ecosystems as bioindicators of global climate change (High-Arctic 1997–2010)*, an ongoing multi-year study coordinated by G. Köck (Institute of Zoology, Innsbruck and ÖAW Vienna) and D. Muir (Environment Canada) carried out in cooperation with various Canadian research facilities, is investigating the effects of short-term and long-term climate change on freshwater ecosystems in the Canadian High Arctic and in the Austrian Alps. The study suggests that fish from high latitude and high altitude lakes appear to be sensitive bioindicators of the interactive effects of pollution (e.g. mercury, POPs) and global climate change.

Two projects led by B. Erschbamer (Institute of Botany) investigate *Grazing effects in the alpine environment of the Biosphere Reserve Gurgler Kamm*. In this area where sheep, goat and horse grazing increased in recent decades, this long-term monitoring programme was started in summer 2000 to study the effects of grazing on subalpine and alpine vegetation (e.g. species diver-

sity, seedling recruitment, biomass production) along an altitudinal gradient from 1950 m to 2650 m. The projects have pilot character because in the Alps hardly any enclosure experiments have been carried out within the alpine belt.

Other studies are focused on the effects of climate change on ice masses in the Alps. Two projects *Eurasian glacier recession and environmental warming: a zonal comparison study* and *Quantification of water yield from debris covered glaciers in the Austrian Alps* led by A. Lambrecht (Institute of Meteorology and Geophysics) provide new insights into the influence of climatic conditions on glaciations of the Eurasian mountains from the Alps to Southern Siberia. The multi-disciplinary study *AUSTRO*ICE*CAVES*2100* led by C. Spötl (Institute of Geology and Palaeontology) aimed to gain a better physical understanding of underground ice dynamics, to develop constraints on the fate of alpine ice caves and to assess the unexplored potential of this ice as a paleoclimate archive in the Alps.

Other projects cover aspects of socioeconomy and social science in alpine research. The project *GALPIS – Permanent Actualization of Alpine Database and WebGIS* (led by A. Borsdorf, IGF) is a geo-referenced database with more than 1300 variables and now accessible at a special homepage (<http://www.galpis.at>) as an interactive, web-based Alpine Information System. It is an outcome of the RAUMALP project, aimed at investigating profound changes in alpine cities, which are increasingly subject to processes of post-suburbanization.

The multidisciplinary project *Y-chromosomal history of Tyrol (Austria)*, carried out by a research team of the Institute of Legal Medicine at Innsbruck Medical University, investigated the history of the population in Tyrol by studying the variability of the paternally inherited Y-chromosome in selected regions of the Tyrolean Alps in the context of the effects of topology and demographic history on genetic differentiation.

The project *Future Development Strategies for the Biosphere Reserve Großes Walsertal – A Regional Economic and Perceptual Analysis* (led by M. Coy, Institute of Geography) focused on socio-economic aspects of al-

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pine research. The study analysed the acceptance of the biosphere reserve concept among regional stakeholders, the local population, visitors, etc., as well as looking at the first regional economic effects of concrete projects which were initiated within the framework of the biosphere reserve Großes Walsertal to develop the regional economy in an adequate and sustainable way.

Further information on projects funded by the seven international research programmes can be obtained from the ÖAW website (<http://www.oeaw.ac.at/deutsch/forschung/programme/programme.html>).

Dissemination

The work as well as the scientific expertise of the seven research programmes are communicated to the public by targeted public relation work. The achievements of the research programmes are also presented at national and international conferences as well as in popular-scientific print media.

A recent product of the international research programmes is the book project “Planet Austria – rock, water, life”. The book, officially introduced to the public in May 2009 during a ceremonial meeting of the Austrian Academy of Sciences, presents the seven international research programmes administered at the ÖAW through 33 research topics and 58 research projects. The wide range of these “earth system sciences” serves to highlight the international context of the studies as well as the significance of the individual research projects for scientists and practitioners alike. In line with the aim of the book to get students and non-experts enthusiastic about science, the volume has been delivered to all Austrian secondary schools providing general qualification for university entrance. The book is also available online at <http://www.planet-austria.at/>.

In order to increase both the scientific output and public access to the results of projects financed by the ÖAW research programmes, the option of online publication (including ISBN and DOI) of project reports was introduced in cooperation with Austrian Academy



*Research in Tyrolean high mountain lakes on the Arctic charr's (*Salvelinus alpinus*) reaction to changes in water temperature. Photograph by Lois Lammerhuber.*

of Sciences Press. Currently, 26 project reports (accessible by full-text search with all WWW search engines) can be downloaded from the Austrian Academy of Sciences Press homepage (<http://epub.oeaw.ac.at/forschungsprogramme>).

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

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