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Authors: Fischer, Andrea, Bender, Oliver, Braun, Valerie, Pauli, Harald,
and Rutzinger, Martin

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The Institute for Interdisciplinary Mountain Research: Connecting Minds Across Borders in Science and Societies



Andrea Fischer*, Oliver Bender, Valerie Braun, Harald Pauli, and Martin Rutzinger

* Corresponding author: Andrea.Fischer@oeaw.ac.at

Institute for Interdisciplinary Mountain Research of the Austrian Academy of Sciences, Technikerstrasse 21 a, 6020 Innsbruck, Austria

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The European Alps: peaks, glaciers, ski resorts, Ötzi the iceman, crowded heritage sites, plants conquering high altitudes, abandoned areas, natural disasters—this is how they come across in the media. In everyday usage, the Alps often just mean mountains: on Instagram, #Alpen returns 1.5 million hits, #Berge 2.2 million; of the 7 million entries for #Mountains, 10% are for #Alps. The Alps are also an object of intense research. In Innsbruck, the heart of the Alps, the Institute for Interdisciplinary Mountain Research was created to bridge disciplines in international mountain science.

Science for a sustainable future, based on a long history of mountain research

The Institute for Interdisciplinary Mountain Research (IGF) was founded as an institute of the Austrian Academy of Sciences (ÖAW) to investigate processes of global change in mountain environments at both regional and international levels. About 30 scientists from different disciplines explore the effects of global change on mountain landscapes, populations, and communities. The trans- and interdisciplinary research agenda arises from the United Nations Agenda 2030 for Sustainable Development, and the institute's scientific activities are integrated into international networks and policy strategies.

Local activities, as well as international programs, benefit from the wealth of historical and recent data available to us, the infrastructure built up over the years, and our experience and knowledge of Alpine research. We study phenomena like urbanization, migration, and multilocality in terms of their impact on the physical and cultural features of landscapes and how these are perceived. We integrate natural and social sciences by using state-of-the-art techniques and methods in geoinformatics and remote sensing, and diachronic analysis and by developing and validating strategies of observation and monitoring.

Mountains as sentinels of global change

Mountain systems present strong topographic and climatic gradients and a great variety of ecosystems and human livelihoods. Therefore, they offer excellent opportunities for

studying multiple effects of global change. The inter- and multidisciplinary setting of the IGF and the involvement of policymakers and other stakeholders allow us to apply a transdisciplinary understanding of complex open systems, current challenges, and potential solutions. We engage in outreach activities with communities and local organizations, museums, and schools, such as in the Jamtal Environmental Education Centre, set up by IGF researchers. The transformative potential of knowledge can only unfold when it is a part of societal discourse. Therefore, the IGF research strategy includes cooperation on a wider scale and dissemination within the scientific community and beyond.

Spotlight on our research within the last 3 years

IGF researchers have successfully contributed to the development of a new method of dating glacier ice that offers the possibility of investigating ice core records directly with instrumental data, closing a methodological gap in Holocene climate research (Feng et al 2019). Close-range remote-sensing techniques complement satellite remote sensing for process studies on smaller scales, for example, analyzing forest conditions and mass movements (Zieher et al 2019; Kollert et al 2020). The question of when glaciers will be gone is one of the most publicly discussed topics to which the IGF team contributes scientific background information (eg Fischer et al 2019; Zemp et al 2019). Changes in plant diversity on Alpine summits have been found to accelerate in synchrony with warming trends across Europe (Steinbauer et al 2018), and actual changes turned out to be stronger than observation errors even within timespans of one or two decades (eg Futschik et al 2020). The multiple interactions of ecosystems with human activities and various types of cultural systems are an essential part of the institute's research agenda (eg Bender and Haller 2017; Haller and Bender 2018).

Act locally, think globally: connections with the global research community

In the natural sciences, local research allows a high degree of continuity and a greater repeat frequency of measurements. In the social sciences, local research means an approach at

eye level and greater cooperation. But the results of such research do not remain local: we integrate them with global scientific efforts in relevant networks to arrive at a bigger picture. The IGF, together with the Department of Integrative Biology and Biodiversity Research of the University for Natural Resources and Life Sciences Vienna, operates the international monitoring and research headquarters of the Global Observation Research Initiative in Alpine Environments (GLORIA). Founded in 2000, GLORIA uses a worldwide-standardized approach for the long-term measurement of changes in alpine plant diversity because of global warming and other anthropogenic effects and has study sites run by local researchers in about 130 mountain regions on 6 continents.

The IGF is a member of the International Scientific Committee on Research in the Alps (ISCAR), which was recognized as an observer of the Alpine Convention in 2000, and of the working group on Alpine Protected Area Research (ISCAR-P). Following an initiative of the Network of Alpine Protected Areas, ISCAR, ÖAW, and the University of Innsbruck, *eco.mont (Journal on Protected Mountain Area Research and Management)* was created to act as an international hub of knowledge exchange on protected areas among their managers, scientists, and practitioners. Networking activities include participating in the Permanent European Conference for the Study of the Rural Landscape and leading the Horizon 2020 Marie Skłodowska-Curie Research and Innovation Staff Exchange Evaluations project Highlands 3. The Highlands 3 project involves 42 institutions and brings together academic and nonacademic partners for capacity building, sharing of knowledge and experience, and developing tools for inclusive sustainable development in highlands.

IGF hosts three sites of the Long-Term Socio-Ecological Research platform: Tyrolean Alps Jamtalfener, Kesselwandfener, and Schrankogel (GLORIA master site). The Jamtalfener site contributes to the Global Cryosphere Watch program of the World Meteorological Organization. It provides information not only on essential climate variables, and thus on the state of climate change and its effects on the environment, but also on the efficacy of mitigation measures. The glaciological data collected at the IGF contribute to the World Glacier Monitoring Service, which is part of the United Nations Global Terrestrial Network–Glaciers. Long-term monitoring, which is essential for detecting changes, developing future strategies, and validating results and model projection, is one of the core fields of the IGF.

In recent years, the IGF joined the International Mountain Society, as well as Rete Montagna and the International Partnership for the Satoyama Initiative. We

are happy to have a nominee in the reestablished mountain research section of the International Geographical Union. IGF contributes the following:

- Substantial baselines and time series for comparative studies;
- A sandbox for scientific development and validation of models and methods; and
- A knowledge hub for a lively and constructive scientific debate that points out potential pathways of sustainable development in mountain regions.

To do so, the institute is closely integrated into the global mountain research community. The IGF fosters scientific exchange by hosting guest scientists, offers training for young researchers, and collaborates with the international community in joint projects, publications, and discussions.

WEBSITES

Institute for Interdisciplinary Mountain Research (IGF): <https://www.mountainresearch.at>

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