

Introduction: Mountains of Our Future Earth— Perth 2015

Dear Readers,

From 5 to 8 October 2015, 400 people from 52 countries on 6 continents attended the international conference “Mountains of Our Future Earth” in Perth, Scotland. The event was organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Chair in sustainable development at the Centre for Mountain Studies (CMS) at Perth College, University of the Highlands and Islands, together with 2 global organizations: the Mountain Research Initiative (MRI) and the Global Mountain Biodiversity Assessment (GMBA). This editorial introduces the conference and the papers in this special issue, which are based on presentations given during the conference. The present issue of MRD concludes with an evaluation of the conference and consequent recommendations for future research.

The Perth mountain conferences

“Mountains of Our Future Earth,” referred to as Perth III, was the third international conference on mountains and global change held in Perth, following 2 previous international conferences. Perth I, in 2005, was the Open Science conference that concluded the 2-year Global Change and Mountain Regions (GLOCHAMORE) project, primarily funded by the European Commission’s Sixth Framework Programme for Research and Development. Through 5 product-oriented workshops and this final conference, the project aimed to achieve further understanding of the causes and impacts of global change in mountain regions. The conference attracted 310 abstracts and was attended by 210 people from 41 countries on 6 continents. The principal products of the conference were a book of 197 accepted abstracts (Price 2006) and the GLOCHAMORE Research Strategy (Bjørnsen Guring 2006), which was used as the basis for UNESCO’s Global and Climate Change in Mountain Sites (GLOCHAMOST) initiative (<http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/specific-ecosystems/mountains/glochamost/>) as well as to inform the development of the MRI.

Perth II, co-organized by CMS and MRI in 2010, was titled “Global Change and the World’s Mountains.” It attracted 610 abstracts and was probably the largest international mountain science conference to date, with 450 participants from 60 countries on 6 continents. It provided an unparalleled opportunity for mountain scientists from a very wide range of natural and social science disciplines to present and discuss their research. The key published outcome was a special issue of Mountain Research and Development (MRD 32[S], March 2012), including plenary papers, a synthesis of all papers presented, and 2 prospective policy papers. The conference also provided opportunities for presentation and further development of activities within various global and regional programs or initiatives focusing specifically on mountain themes or featuring a mountain component: a 3-day pre-meeting brought together 80 scientists from 5 continents for a meeting of the Global Observation Research Initiative in Alpine Environments (GLORIA); other initiatives (eg the South Eastern European Mountain Research Network [SEEMORE] and the Mountain Invasive Research Network [MIREN]) organized lunchtime sessions; and the conference was followed by a 1-day strategy session organized by MRI, which focused on future research activities and on the means to ensure a high profile for mountain issues in the Rio+20 process and other global assessment and policy processes.

The mountain context and the Future Earth Agenda

The context of all 3 conferences has been similar. Mountain areas occupy 22% of the Earth’s land surface; they are home to 13% of the global population, and another 14% live in their immediate proximity. Globally, these areas are vital sources of water for agricultural, industrial, and domestic use. They include major centers of biodiversity, often coinciding with centers of cultural diversity where traditional ecological knowledge is maintained. In an urbanizing world, mountain areas are key locations for tourism and recreation; some include major urban areas.

Mountain systems are particularly fragile and subject to both natural and anthropogenic drivers of change. These range from volcanic and seismic events and flooding to global climate change and the loss of vegetation and soils because of inappropriate agricultural and forestry practices and extractive industries. Thus, many mountain ecosystems are moving along trajectories that couple high rates of environmental change with strong economic changes. The collective effect of these changes may be to alter the ability of mountain ecosystems to provide critical goods and services to both mountain and lowland populations. The vital linkages between mountain and lowland systems are increasingly recognized in global and regional policy debates and action, most recently in the Sustainable Development Goals.

Within this broad context, the title “Mountains of Our Future Earth” was chosen to underline the intention for the conference to contribute to the global Future Earth program, a 10-year international research initiative that will develop the knowledge for responding effectively to the risks and opportunities of global environmental change and supporting transformation toward global sustainability in the coming decades. GMBA is a Core Project of Future Earth and MRI is a Sustaining Partner. As described later, the conference as a whole was structured around the 3 Research Themes of Future Earth. The connection to Future Earth was further ensured by the participation of Dennis Ojima, director of the Colorado Hub of Future Earth, and the topic of the final plenary panel discussion: “Future Earth—An agenda for R&D from a mountain perspective.”

Aims, process, and structure of Perth III

“Mountains of Our Future Earth” had 3 aims:

1. To present, evaluate, and synthesize progress in our understanding of global change in mountain regions, and share examples of innovative approaches, particularly in terms of progress toward addressing the gaps in global research in mountain regions noted in 2010 (Björnsen Gurung et al 2012);
2. To refine and agree on agendas for collaborative research and action relating to global change and mountain regions and to significantly increase the use of applied research findings on the ground in mountain regions;
3. To foster effective interdisciplinary and international interactions between participants—researchers, practitioners, and policy makers—including specific opportunities to strengthen ongoing research activities and to foster new collaborations—thematic and/or regional.

As in 2010, a key to the success of the conference was that 18 months before the conference, experts working on a wide range of themes within both the social and natural sciences were requested to organize a session related to their interests. These experts included people who had chaired sessions at Perth II as well as other experts in the MRI database. All proposals were accepted, some with modifications, usually to widen the scope of the session. It is notable that only 10 chairs from Perth II proposed sessions, so that the range of session topics at Perth III was quite different.

Each session organizer was asked to identify the Research Theme(s) of Future Earth (2014) to which their session would contribute:

1. **Dynamic Planet:** Observing, explaining, understanding, projecting Earth, environmental, and societal system trends, drivers, and processes and their interactions; anticipating global thresholds and risks.
2. **Global Sustainable Development:** Knowledge for sustainable, secure, and fair stewardship of biodiversity, food, water, health, energy, materials, and other ecosystem services.
3. **Transformation Toward Sustainability:** Understanding transformation processes and options; assessing how these relate to human values, emerging technologies, and social and economic development pathways; and evaluating strategies for governing and managing the global environment across sectors and scales.

This structure enabled the global change research community working in mountain areas to align itself more easily with the broader global change research framework established by Future Earth.

Prospective participants could submit their abstracts for oral or poster presentations to 35 research presentation sessions and 15 roundtables. In total, 624 abstracts were submitted. Of these submissions, 292 were accepted for presentation in 46 parallel sessions, 35 for presentation in 7 parallel roundtables, and 81 for the poster session.

Perth III included 7 plenary presentations, compared with 10 in 2010, in order to maximize opportunities for participants to present and discuss their own research. Although the numbers of participants and countries represented were slightly less than in 2010, the conference was truly international, with more participants from Switzerland (51) than the host country (48); there were also 48 participants from the United States. The conference was also highly interdisciplinary, with a larger proportion of participants from social science disciplines than in 2010, as discussed in the final article of this Special Issue. Beyond the sessions themselves, the aim of fostering opportunities for interdisciplinary interactions was achieved particularly through field trips to different parts of the Highlands on the day before the conference, which were attended by more than half of the participants; a long poster session; and many social events.

As in 2010, the conference organizers used a structured process to capture the insights of participants throughout the meeting. These insights provided the basis for a draft synthesis and recommendations presented during the final plenary as well as for the article by Gleeson et al, the final article in this Special Issue (Gleeson et al 2016). The keynote presentations and the final plenary session and roundtable may be viewed at <http://mri.scnatweb.ch/en/events/2015-01-29-07-56-51>; blogs about the parallel sessions can be found at <https://perthmountains2015.wordpress.com/>. The abstracts of all the presentations at the conference are available from the CMS.

Contributions to this Special Issue

All of the articles in the first 3 sections—MountainDevelopment, MountainResearch, and MountainAgenda—derive from presentations at Perth III and have been peer-reviewed. They give a flavor of the diversity of presentations at the conference; all align with one or more of the Research Themes of Future Earth.

In the MountainDevelopment section, the first article presents an innovative approach developed by Sanseverino et al for use in Canada's Mountain West to explore changes in mountain environments using archival and recent images; the software tool is now geared to accept comparison of photos from other mountain regions in the world. In the next article, Mathez-Stiefel et al outline a 4-step approach, using a combination of participatory tools and ethnographical and botanical methods, to identify and analyze suitable agroforestry gender-sensitive options in the Peruvian Andes. The third article, by Imperiale and Vanclay, focuses on how to strengthen community resilience using social impact assessment. Their case study is the Tratturo Magno path in the Italian Apennines, an area that suffered severe damage during the 2009 earthquake. While each of these articles focuses on a specific mountain area, the methods they present all have far wider applicability.

In the MountainResearch section, the first article considers seedling regeneration in the alpine treeline ecotone of the Pacific Northwest of the United States. Johnson and Yeakley conclude that seedlings benefit from wood microsites, as they have a greater water content—a finding that may be of relevance in many other mountain areas as climates become warmer and drier. This is followed by 2 articles on ecosystem services (ES). The first, by Sil et al, considers how ESs in the mountains of northern Portugal changed from 1990 to 2006. They find that changes in these landscapes over this period increased the total supply of ESs, with regulating and provisioning services increasing in value—and that such trends are likely until 2020. The second, by Schmidt et al, focuses on the sociocultural value of ESs in the Pentland Hills, comparing them with the perception of ESs in urban green spaces in nearby Edinburgh, Scotland. Notably, visitors to

the Pentland Hills prefer nature-oriented management; in urban areas, leisure-oriented management is valued highest. The next article addresses another aspect of visiting mountain areas: visitors' use of energy. Using the example of Alpbach in the Austrian Alps, Unger et al apply a geographic information system-based tool to provide an in-depth view of the energy consumption and greenhouse gas emissions of tourism-related traffic. Tourism is closely related to amenity migration, and the next article, by Löffler et al, investigates this phenomenon using case studies from the Italian Alps. They apply 2 models that address both the dynamics of in-migration and its diverse impacts. Migration is also the theme of the next article, by Jaquet et al. Their focus is the Harpan watershed in the Middle Hills of Nepal, which has experienced substantial outmigration, both internationally and to lower altitudes. This has led to changes in land cover at higher altitudes as well as to increased exposure to flooding at lower altitudes. The final article in this section also comes from Asia, where Zhumanova et al explore the decision-making of farmers in Kyrgyzstan with regard to herd size and land use. They find complex interactions between these issues and also note that the infrastructure provided by pasture committees is somewhat ineffective and can even worsen pasture condition. This leads to recommendations for improving the situation.

Each of the 3 articles in the MountainAgenda section has a global focus. Strachan et al outline the challenges of developing mountain climate observatories and how to address these using a combination of gradient monitoring, uniform observational standards, and modern technology. On a related theme, Flint highlights the challenges of integrating social science paradigms into the Global Network of Mountain Observatories (GNOMO). She proposes a multiparadigmatic, multimethod approach to ensure that this network fully represents the social-ecological dimensions of dynamic mountain systems. Finally, Gleeson et al present an analysis of the presentations and participants at the Perth III conference, and outline a proposal for future mountain research. This links to the first article of the MountainPlatform section, on the MRI, which is followed by an overview of the activities of the CMS.

Other publications emerging from Perth III

In addition to this Special Issue of MRD, Mountain Research and Development 37(2), May 2017—guest edited by Georg Gratzler and Willian Keeton—will include papers presented at Perth III on “Mountain Forests and the SDGs: Challenges and Potentials for Fulfilling the 2030 Agenda for Sustainable Development.”

A number of other publications based on presentations at Perth III are also in preparation or have already appeared:

- *Mountain Ice and Water: Investigations of the Hydrologic Cycle in Alpine Environments* (Schroder and Greenwood 2017);
- *Climate Change Adaptation Strategies—An Upstream–Downstream Perspective* (Salzmann et al 2016);
- A special issue of *Regional Environmental Change*, with the tentative title “Past legacies and future challenges for land use and land cover change (LULCC) in mountainous regions,” edited by Janine Bolliger, Urs Gimmi, Thomas Houet, and Jacek Kozak;
- An issue of the *Scottish Geographical Journal* on biocultural diversity, edited by Will Tuladhar-Douglas.

Two further publications associated with Perth III were the Autumn 2015 issues of, first, *The Geographer*, the newsletter of the Royal Scottish Geographical Society, on Scottish mountains (<http://rsgs.org/exploring-geography/publications/geographer-archives/>); and, second, *Mountain Views* Vol 9, Issue 2, the newsletter of the Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT), with reflections on the conference from many participants (<http://www.fs.fed.us/psw/cirmount/publications/mtnviews.shtml>).

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