Making connections for our changing mountains: future directions for the mountain research initiative (MRI)

Making Connections for Our Changing Mountains: Future Directions for the Mountain Research Initiative (MRI)

Authors: Adler, Carolina, Shahgedanova, Maria, Balsiger, Jörg, Grêt-Regamey, Adrienne, Shrestha, Mandira Singh, et al.

Source: Mountain Research and Development, 40(3)

Published By: International Mountain Society

URL: https://doi.org/10.1659/MRD-JOURNAL-D-20-00045.1

Mountain Research and Development (MRD)
An international, peer-reviewed open access journal
published by the International Mountain Society (IMS)
www.mrd-journal.org

MountainPlatform

Making Connections for Our Changing Mountains: Future Directions for the Mountain Research Initiative (MRI)

Carolina Adler[1]*, Jörg Balsiger[2], Adrienne Grêt-Regamey[3], Andreas Heinimann[4], Christian Huggel[5], Rolf Weingartner[6], Irasema Alcántara-Ayala[7], Aster Gebrekirstos[8], Ricardo Grau[9], Elizabeth Jimenez[10], Robert Marchant[11], Bryan Mark[12], Shawn Marshall[13], Samuel Morin[14], Maria Shahgedanova[15], Mandira Singh Shrestha[16], and Jianchu Xu[17]

** Corresponding author: carolina.adler@unibe.ch*

[1] *Mountain Research Initiative, c/o Centre for Development and Environment (CDE), University of Bern, Mittlestrasse 43, 3012 Bern, Switzerland*
[2] *Institute for Environmental Governance and Territorial Development, University of Geneva, Uni Carl Vogt, 66 Bd Carl-Vogt, 1205 Geneva, Switzerland*
[3] *PLUS, Planning of Landscape and Urban Systems, ETH Zurich, Stefano-Franscini-Platz 5, 8093 Zürich, Switzerland*
[4] *Centre for Development and Environment (CDE), University of Bern, Mittelstrasse 43, 3012 Bern, Switzerland*
[5] *Climate and Environment: Impacts, Risks and Adaptation (Eclim), Department of Geography, University of Zurich, Winterthurerstrasse 190, 8057 Zürich, Switzerland*
[6] *Hydrology, Institute of Geography, University of Bern, Hallerstrasse 12, 3012 Bern, Switzerland*
[7] *Institute of Geography, National Autonomous University of Mexico (UNAM), Av. Universidad 3000, Coyoacán, 04510, Mexico City, Mexico*
[8] *World Agroforestry (ICRAF), United Nations Avenue, Gigiri, PO Box 30677, Nairobi, 00100, Kenya*
[9] *Instituto de Ecología Regional, (CONICET-Universidad Nacional de Tucumán), CC 34, Código Postal 34–4107, Yerba Buena, Tucumán, Argentina*
[10] *CIDES - UMSA Graduate Program on Interdisciplinary Social Sciences of the Universidad Mayor de San Andres, Calle Rosasani No. 55, Obrajes, La Paz, Bolivia*
[11] *York Institute for Tropical Ecosystems, Department of Environment and Geography, University of York, Heslington, York YO10 5DD, United Kingdom*
[12] *Department of Geography, Ohio State University, 1036 Derby Hall, 154 North Oval Mall, Columbus, OH 43210, USA*
[13] *Department of Geography, University of Calgary, 2500 University Dr. NW, Calgary, Alberta, Canada*
[14] *Université Grenoble Alpes, Université de Toulouse, Météo-France, CNRS, CNRM, Centre d'Etudes de la Neige, 38000 Grenoble, France*
[15] *Geography and Environmental Science, University of Reading, Whiteknights PO Box 217, Reading, Berkshire RG6 6AH, United Kingdom*
[16] *International Centre for Integrated Mountain Development (ICIMOD), Khumaltar, Lalitpur, Kathmandu, Nepal*
[17] *Kunming Institute of Botany, Chinese Academy of Sciences, 132 Lanhei Road, Heilongtan, Kunming 650201, Yunnan, China*

The Mountain Research Initiative (MRI) promotes basic and applied research to understand how drivers and processes of global change present challenges and opportunities in mountain social-ecological systems. It convenes a global network that collectively generates and synthesizes knowledge on global change in mountains that also supports decisions and actions to enable sustainable development. Building on the considerable social and intellectual wealth fostered by the MRI over its past 20-plus years of existence, we outline future directions aimed at supporting and further developing the network as well as our flagship and community-led activities aimed at linking and scaling interdisciplinary and transdisciplinary research efforts within and across mountain regions worldwide.

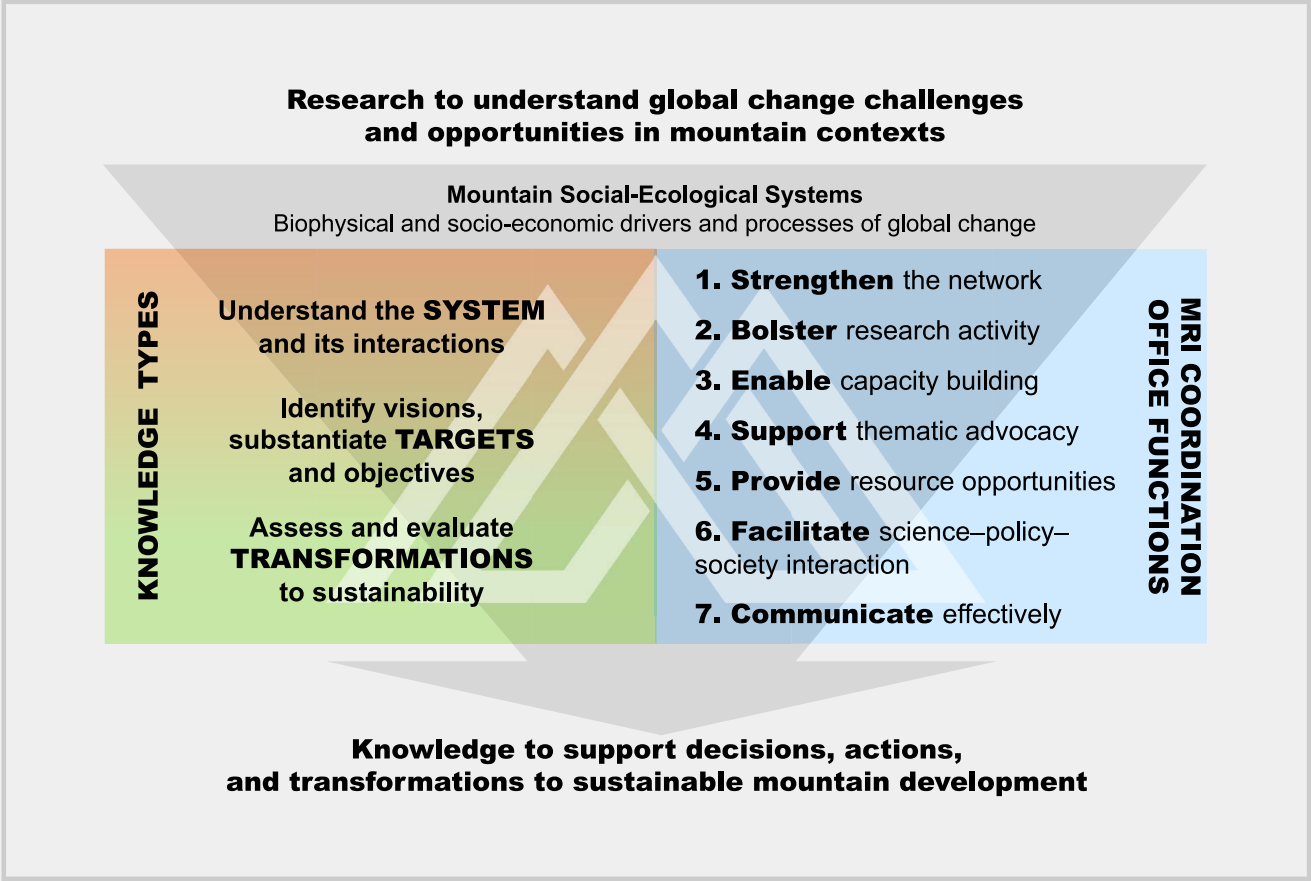
Introduction

Since the 1990s, and with the founding of its coordination office (MRI-CO) in 2001, now hosted at the Centre for Development and Environment at the University of Bern, the Mountain Research Initiative (MRI) has striven to encourage a vision in which research to identify and understand drivers and processes of global change in mountains is promoted and linked across disciplines and mountain regions worldwide (Becker and Bugmann 2001). Via the convening role of the MRI-CO, the MRI has initiated numerous collaborations and networks of researchers, implementing actions that enhance the profile and value of global change research in mountains, whilst also integrating and synthesizing the results of this research and thereby informing stakeholders about the implications of these results for policy (Weingartner and Greenwood 2011; Greenwood 2013).

With a change in the MRI leadership in 2017, there came a transition period in which a strategy for the future of the MRI took shape, designed to build on past successes, such as the considerable social and intellectual wealth fostered via the network over the years. A new proposal to the Swiss Academy of Sciences (SCNAT) was prepared for continued support of the MRI-CO and the MRI network, presenting a strategy and work-plan structure that was successfully funded in 2019 for the next 4-year period (October 2019 to September 2023).

We, as members of the MRI Governing Body—the MRI Board (chair and co-principal investigators), members of the MRI Science Leadership Council (SLC), and the MRI executive director—outline the objectives of the network

FIGURE 1 Long-term and interconnected knowledge needs central to the MRI for supporting transformations to sustainable mountain development: new knowledge on mountain social-ecological systems is enabled by the 7 functions of the MRI-CO that support the network and its actors to maximize outcomes and outputs.



and the features that define the functions of the MRI-CO to support it, as well as flagship and community-led activities that will support the mountain research community in realizing their potential and the MRI vision in future years.

Objectives for the MRI in 2019–2023

Consistent with the founding vision for the MRI (Becker and Bugmann 2001), we defined the MRI's objectives to reflect 3 long-term and interconnected knowledge needs to which the MRI network can respond:

1. to identify and understand mountain social-ecological SYSTEMS (elements, interactions, and trends) via long-term empirical observations and modelling;
2. to identify visions and substantiate TARGETS that reflect and sustain vibrant mountain social-ecological systems, where sustainability outcomes are aspired to and their trade-offs are defined in context;
3. to enable pathways and TRANSFORMATIONS to sustainability by identifying, assessing, and supporting decisions, policies, and actions, as well as their fitness-for-purpose in closing the problem–solution gap, specific to diverse mountain contexts, from the observed changes (systems knowledge) to the desired outcomes (target knowledge).

To meet these objectives and respond to the corresponding knowledge needs, the MRI-CO enables the MRI network to generate, integrate, and synthesize knowledge in order to not only advance scholarship but also support decisions, actions, and transformations to sustainable development in mountain regions. The MRI-CO supports the network through 7 key functions (see Figure 1, adapted from Schneider et al in review; Waddell 2009).

Seven functions of the MRI Coordination Office

1. Strengthen the network

The MRI-CO organizes and connects the network, primarily via the MRI Experts Database. Part of SCNAT's ProClim InfoSystem, the database is a registry with 11,478 entries that details experts' thematic expertise and regional distribution and enables automatic subscription to the MRI Global Newsletter. The database is an important tool and resource for connecting and communicating with the network, identifying relevant expertise, and promoting the visibility of professionals in more than 160 countries and disciplines spanning the natural and social sciences and humanities, including practitioners. However, due to internal technical changes at SCNAT, and to better serve the needs of a growing MRI community, a new system is currently under development that will offer multiple functionalities and reporting options. For instance, the ability to identify panels of regional and thematic expertise will allow us to broker better links between scientists and policy- and decision-makers at the science–policy interface. The new database,

expected later in 2020, will be managed by the MRI-CO, ensuring consistency with the European General Data Protection Regulation. The new database will help the MRI-CO strengthen the network considerably, supporting all its activities. An annual survey will ensure that users' needs are identified and taken up by the MRI-CO, adapting and updating the database as needed.

2. Bolster research activity

The MRI-CO bolsters research through implementing MRI activities that support a vibrant mountains-oriented scholarship, as well as through actively communicating and coordinating support in responding to, funding opportunities, publication calls, research collaborations, conferences, and other outreach opportunities. The MRI-CO and members of the Governing Body also regularly guest-edit special issues in mountain and non-mountain scientific journals, thereby bringing thematic collections of mountain research to the fore and connecting to the research work of individuals in the MRI network. Through the MRI's various partnerships, the MRI-CO facilitates links to international research networks and provides channels for the network to engage in and further resource their own activities. Another way in which we bolster research is by continuously scanning the horizon to identify relevant knowledge needs at the science–policy interface that provide opportunities for new research activities.

3. Enable capacity building

The MRI-CO currently convenes and contributes to several activities aimed at raising the capacity of early-career researchers (ECRs, typically up to 5 years beyond master's or PhD) to participate in the current Intergovernmental Panel on Climate Change (IPCC) sixth assessment (AR6). In view of these positive experiences, the MRI-CO, with the support of the MRI Governing Body, will invest additional efforts in capacity building and enhance diverse participation via its activities. ECRs, women, and researchers from the Global South, underrepresented disciplines, and non-mountain target audiences, are, and will continue to be, encouraged to pursue and apply their expertise within the MRI community. The MRI-CO will coordinate the establishment of a new ECRs group, seeking external funding to provide for fellowships, internships, and scientific exchanges. Through targeted publication projects, the MRI will seek to retain and make knowledge gains available as research and teaching resources.

4. Support thematic advocacy

With support from the MRI Governing Body, the MRI-CO has considerably strengthened mountain research's visibility and relevance in local, regional, and international scientific and policy forums with promising prospects to continue this trend in the future. Outside of academia, the MRI supports advocacy efforts to raise the profile of mountain research for international policymaking, for instance as a current member of the Mountain Partnership and by participating in the Mountain Partnership Steering Committee 2018–2022. The MRI-CO connects with and coordinates inputs based on scientific evidence to substantiate these advocacy efforts, for example, at the High-level Political Forum on Sustainable Development, the United Nations (UN) Secretary-General's Report on Sustainable Mountain Development, and the Integrated High-mountain Observation, Prediction and Services Initiative, led by the World Meteorological Organization (Adler et al 2020), to name a few. The MRI-CO also shares and makes available the research outputs of its community with elected officials, legislators, public administration, civil society, and the private sector via its website, newsletters, and blogs.

A notable example in supporting thematic advocacy is the MRI-CO's role in backing its members in strengthening visibility for mountains in the IPCC AR6, with prominent participation from the community as lead and contributing authors and reviewers in the IPCC Special Report on the Ocean and Cryosphere (see Hock et al in press) as well as the IPCC Working Group II contribution to AR6, including its Cross-Chapter Paper on Mountains, expected in 2021. These efforts also support and link to relevant advocacy efforts at the science–policy interface to address critical global change issues in mountains, such as climate change, via the UN Framework Convention on Climate Change.

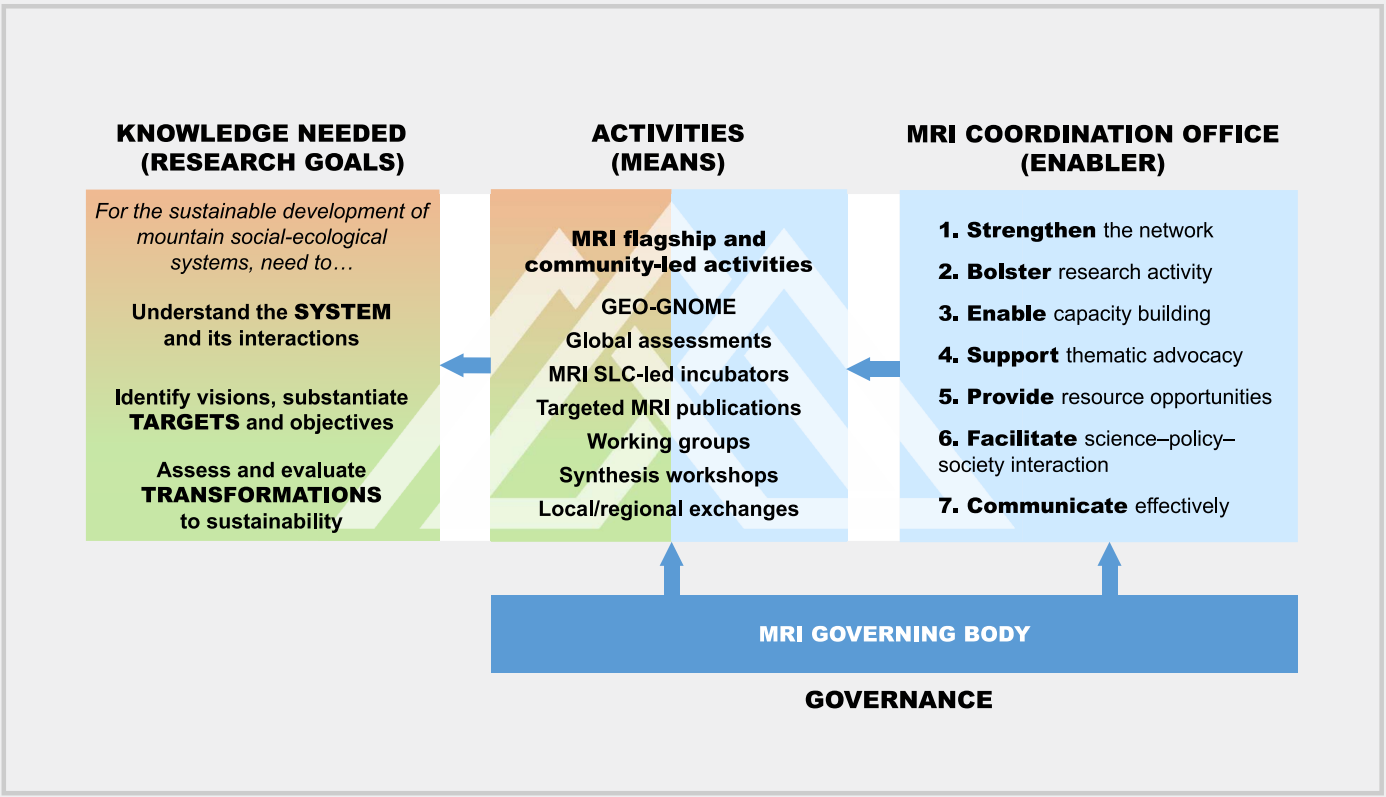
5. Provide resource opportunities

The MRI-CO allocates and makes available seed funding via open calls (eg synthesis workshops), which are available to the network to support collaborations and syntheses. Additionally, it strives to provide timely information on funding opportunities for members to pursue for their research activities or professional development and training. The MRI-CO also procures external sources of funding to resource activities for the MRI community. Prospects include funding calls in European Commission programs, among others. Furthermore, MRI SLC members are strategic links to the regions, providing advice on funding prospects and research opportunities where the MRI-CO could facilitate links with and for its international community. Attracting additional funding for MRI-led activities will be an important focus in this 4-year period.

6. Facilitate science–policy–society interaction

The many thematic advocacy activities that the MRI-CO has promoted for the network over the years have largely focused on facilitating linkages and exchange at the science–policy interface, and this will continue to be an important area of focus. However, knowledge that supports transformations to sustainability (see Figure 1) demands inclusive engagement that also goes beyond interdisciplinary research collaborations, through codesign and coproduction of knowledge with policymakers, practitioners, and broader society (Shrivastava et al 2020). Engaging practitioners and nonscientists in MRI activities is, and will be, increasingly and actively encouraged, bringing evidence, data, experiences, and information that complements scientific inquiry. The MRI-CO regularly scans for training and capacity-building opportunities from inside and outside the network, including prospects to enhance skills and familiarity with coproduction. The MRI Working Group on Education for Sustainable Mountain Development is also expected to support this function.

FIGURE 2 The MRI Governing Body, as well as MRI flagship and community-led activities all support the network in fostering research, linking scholarly communities of practice, and generating knowledge to address the knowledge needs of policy and society.



7. Communicate effectively

Communication is a key priority for the MRI-CO as a service to the community, positioning the MRI as an informative, authoritative, and active voice for mountains, both within research communities and among policymakers and media outlets internationally. Improved communication and streamlined newsletter and social media engagement were part of the communication strategy overhaul, yielding considerable positive results in a short period. Work on this strategy began in early 2018, simplifying the MRI's core texts (vision, principles, goals) and updating its brand identity.

A new logo and tagline—"Making Connections for Our Changing Mountains"—were introduced to reflect the MRI's mission, with the MRI website, social media channels, and MRI Global Newsletter modernized in line with this brand identity. Our strategy over the next 4 years is to continue implementing several improvements started in 2017. In tandem, we continue our content offering, publishing news, events, and opportunities relevant to the mountain research community and increasing our MRI-led content (news and feature articles, thematic newsletters, print publications, and videos that raise the profile of researchers, scientific activities, and issues affecting mountains). Social media provide a valuable platform for engaging an interactive global online community of mountain researchers and the general public.

MRI Activities in 2019–2023

Three principles guide how we implement our activities: (1) mountains are unique social-ecological systems; (2) diversity is valued in terms of knowledge, disciplines, cultural, generational, and gender aspects; and (3) knowledge is shared to fulfill an important social role. Proposed flagship and community-led activities connect researchers in mountain-related fields in natural and social sciences and humanities, as well as practitioners and broader society, helping to address shared research goals and knowledge needs. Enabling coproduction of knowledge, empowering the next generation of researchers, and facilitating diverse participation will be key considerations for all these activities.

We structure and distinguish between flagship and community-led activities: flagship activities are mainly led by and coordinated at the MRI-CO, with network participation, whereas community-led activities are primarily led by researchers, with the MRI-CO supporting administration and communications (Figure 2). The MRI Governing Body oversees and provides strategic direction and advice to support the implementation and development of both flagship and community-led activities, of which a few main ones are mentioned and featured in this article.

MRI flagship activities

Group on Earth Observations—Global Network for Observations and Information in Mountain Environments (GEO-GNOME): GEO-GNOME continues to galvanize key activities to enhance mountain observations. A coordination workshop (Adler et al 2018), and other activities held throughout 2019 and early 2020, have continued this momentum. In its current implementation plan, GEO-GNOME aims to identify and facilitate access to relevant observation data and

information on drivers, conditions, and trends in biophysical and socioeconomic processes in mountains, with the MRI-CO inviting inputs from across the network to support these objectives.

The GEO-GNOME will focus on cataloging data and information already available from various sources and networks, based on long-term monitoring and analysis of indicators of environmental and social change in mountain regions, including the cryosphere, terrestrial and freshwater ecosystems, watershed hydrology, and integrated model-based studies of environmental change in different mountain regions. The MRI Elevation Dependent Climate Change and Mountain Observatories Working Groups support GEO-GNOME with research and other synthesis activities to guide a scientific basis for this work.

As a Group on Earth Observations initiative, GEO-GNOME works to support 3 global priority engagement areas: the UN 2030 Agenda for Sustainable Development, the UN Framework Convention on Climate Change Paris Agreement, and the UN Sendai Framework for Disaster Risk Reduction. It will respond to these priority areas by connecting with relevant data and information to support monitoring and reporting, foster capacity building, and connect key stakeholders from academia, policy, practice, and society working in these areas in mountain contexts.

Global assessments: Actively contributing to global assessments is a means of connecting relevant research findings with policy knowledge needs and, conversely, also helping orient future research and synthesis activities to better address these needs. For instance, the high visibility for mountains in the IPCC AR6 has stimulated calls for assessment-relevant reviews and syntheses, with plans underway at the MRI-CO to support and further develop and sustain these efforts beyond AR6. Similar efforts to provide scientific inputs, and thereby identify prospects for relevant synthesis work, are currently ongoing in support of the post-2020 process for the Convention on Biological Diversity in collaboration with the UN Environment Programme and the Global Mountain Biodiversity Assessment. Similar efforts are also ongoing in support of the next UNDRR Global Assessment Report, expected in 2022. Additional synthesis efforts also serve regional and local assessments, with local partners and the ambassadorial role that members of the MRI SLC have in linking back from the global scale to regional and local contexts. The MRI, via GEO-GNOME, is also expected to support activities designed to enhance and bring assessment-relevant data and information to support global policy, for instance Adaptation at Altitude, a newly formed collaborative global program aimed at boosting the resilience and adaptation of mountain communities to climate change.

MRI community-led activities

MRI SLC-led incubators: These provide seed funding to groups of SLC members to lead research synthesis activities and publications, providing incentives and support for SLC members to lead and generate ideas that inspire research agendas or to create MRI working groups. The MRI SLC consists of a cohort of leading senior researchers in diverse fields, appointed to 2-year terms with the possibility of extending their term. They convene at annual meetings with the MRI Governing Body to discuss strategic interests, create synergies, and coordinate activities, facilitated by the MRI-CO. At the most recent meeting, which took place in early March 2020 near Geneva, Switzerland, we welcomed the MRI SLC cohort for 2020–2021, who also defined 2 new SLC-led incubator activities.

These activities target, respectively, mountain-specific syntheses of telecoupling and paleoscience in mountain social-ecological systems. *Telecoupling* refers to the socioeconomic and environmental interactions and flows between distant yet coupled human and natural systems, such as natural resources, people, or financial capital (Hull and Liu 2018). This SLC-led activity links to and exchanges with similar thematic initiatives in other networks, such as the Global Land Program. Findings are also expected to complement and support the work of the MRI Governance Working Group.

The second SLC-led incubator looks at paleoscience and the identification of data and information proxies of past changes in mountain social-ecological systems worldwide. This activity looks to revisit and revive efforts already started as part of the MRI's earlier proposals on building and integrating paleoscience in mountain observations (see Messerli 2001), envisaging close exchange and interactions with members in the Past Global Changes network. This also complements the activities of the MRI Elevation Dependent Climate Change and Mountain Observatories Working Groups and provides a valuable contribution to the 2020–2022 objectives of GEO-GNOME.

Working groups: These are groups of individual researchers that self-organize to address research questions and synthesize activities aligned with the MRI's mission. Working groups provide a platform for discussion, exchange, and research, with 2-year work plans (with possible extensions) specifying planned peer-reviewed publications, conference presentations, or compilation of data sets. To date, the MRI has 5 working groups, which are also encouraged to cross-fertilize ideas and create synergies among them. These are: (1) Elevation Dependent Climate Change; (2) Mountain Observatories; (3) Education for Sustainable Mountain Development; (4) Mountain Governance; and (5) Mountain Resilience. These working groups are open to the community, and we encourage MRI network members to actively participate in their activities—especially ECRs.

Synthesis workshops: These bring researchers together to address specific topics of interest to the mountain research community, supporting community-led ideas and generating outputs that respond to knowledge needs in their research and for policy. Seed funding is provided by the MRI-CO to support these activities after annual calls for proposals. The active participation of ECRs and other underrepresented groups is encouraged and is part of the funding conditions for supporting these workshops in future.

Local/regional exchanges: The effects of global environmental change are felt differently in local and regional contexts. Accordingly, aggregating data, information, and knowledge based on experiences and observations at these scales can pose methodological challenges when synthesizing and combining information for global assessments. This is key to consider, given how important it is to account for the local sociocultural contexts and conditions in each unique mountain region. Partnerships with local and regional and/

or thematic mountain networks are therefore crucial and will continue to be supported, not only to address global data and information needs but also to help enhance local capacity building and provide an exchange opportunity for researchers between different mountain regions, including South–South collaborations. The MRI has ongoing collaborations and partnerships with relevant networks and institutions in the Andes, Hindu-Kush-Himalaya, Caucasus, North America, Japan, Africa, and Europe, fostering exchange and dialogue that also link MRI members in these regions with global-scale activities. GEO-GNOME will also provide a tangible and nodal role through which to further support these collaborations in future.

Outlook

Our scientific work in mountains continues to advance scholarship and strengthen the value of global change research, considerably improving our knowledge base and understanding of mountains as social-ecological systems. However, it also plays a key role in identifying the diverse human values and goals that underpin desired outcomes for sustaining mountain ecosystems and people, and support transformative actions and pathways to sustainability through coproduction of knowledge. These 3 types of knowledge collectively represent the objectives by which we see the MRI connect, synthesize, and contribute research findings, enabled by the supporting functions of the MRI-CO and the activities that are offered to the network.

MRI, as a network, has much to look forward to in the coming 4-year period—and beyond—helped enormously by the sustained investments and support afforded to it over the years, not least thanks to the many thousand community members who continue to be a part of this journey. The members of the MRI Governing Body and the MRI-CO, look forward to continuing to support you all in making meaningful and fulfilling connections for our changing mountains, and safeguarding them as social-ecological treasures for ecosystems and people worldwide.

WEBSITES

Mountain Research Initiative (MRI):
www.mountainresearchinitiative.org

ACKNOWLEDGMENTS

We thank Martin Grosjean, MRI co-principal investigator up to 2019, whose inputs helped shape the MRI proposal to SCNAT, the MRI SLC cohort of 2016–2019, whose collective contributions strengthened that proposal, and MRI-CO staff Aino Kulonen and Grace Goss-Durant, who assisted in its development. We also thank the Swiss Academy of Sciences for its continued support to the MRI, as well as the contributions to MRI projects by the Swiss Agency for Development and Cooperation, swissuniversities Development and Cooperation Network, the Office of Foreign Affairs of the Principality of Liechtenstein, and Future Earth.

REFERENCES

Adler C, Palazzi E, Kulonen A, Balsiger J, Colangeli G, Cripe D, Forsythe N, Goss-Durant G, Guigoz Y, Krauer J, et al. 2018. Monitoring mountains in a changing world: New horizons for the global network for observations and information on mountain environments (GEO-GNOME). *Mountain Research and Development* 38(3):265–269. https://doi.org/10.1659/MRD-JOURNAL-D-8-00065.1.

Adler C, Pomeroy J, Nitu R. 2020. High mountain summit: Outcomes and outlook. *WMO Bulletin* 69(10):34–37. https://public.wmo.int/en/resources/bulletin/articles-by-themes?tid-type-bulletin=589.

Becker A, Bugmann H, editors. 2001. *Global Change and Mountain Regions: The Mountain Research Initiative*. International Geosphere-Biosphere Programme (IGBP) Report Series 49. Global Terrestrial Observing System Report Series 28. International Human Dimensions Programme Report Series 13. Stockholm, Sweden: IGBP.

Greenwood G. 2013. Mountain research initiative seeks to break new ground in second decade. *Mountain Research and Development* 33(4):473–476. https://doi.org/10.1659/MRD-JOURNAL-D-13-00094.1.

Hock R, Rasul G, Adler C, Cáceres B, Gruber S, Hirabayashi Y, Jackson M, Kääb A, Kang S, Kutuzov S, et al. In press. High mountain areas. *In:* Pörtner H-O, Roberts DC, Masson-Delmotte V, Zhai P, Tignor M, Poloczanska E, Mintenbeck K, Alegría A, Nicolai M, Okem A, Petzold et al, editors. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Available at https://www.ipcc.ch/srocc/chapter/chapter-2/; accessed on 16 July 2020.

Hull V, Liu J. 2018. Telecoupling: A new frontier for global sustainability. *Ecology and Society* 23(4):41. https://doi.org/10.5751/ES-10494-230441.

Messerli B. 2001. The International Year of Mountains, the Mountain Research Initiative and PAGES [Editorial]. *Past Global Changes (PAGES) Newsletter* 9(3):2. http://www.pages-igbp.org/download/docs/newsletter/2001-3/announcements/editorial_2001-3(2).pdf; accessed on 16 July 2020.

Schneider F, Tribaldos T, Adler C, Biggs O, de Bremond A, Buser T, Krug C, Loutre M-F, Moore S, Norström A, et al. In review. Co-production of Knowledge and Sustainability Transformations: a Strategic Compass for Global Research Networks. *Current Opinion in Environmental Sustainability*. Available from Flurina Schneider, flurina.schneider@unibe.ch.

Shrivastava P, Stafford Smith M, O'Brien K, Zsolnai L. 2020. Transforming sustainability science to generate positive social and environmental change globally. *One Earth* 2(4):329–340. https://doi.org/10.1016/j.oneear.2020.04.010.

Waddell S. 2009. *Strategies & Structures of Global Networks: Learning for GKP3.0*. Cambridge, MA: Global Action Network.

Weingartner R, Greenwood G. 2011. The Mountain Research Initiative reaches outward and climbs upward. *Mountain Research and Development* 31(1):58–60. https://doi.org/10.1659/MRD-JOURNAL-D-11-00002.1.