



## Workshop Report

### **GEO-GNOME Workshop “Identifying Essential Biodiversity Variables (EBVs) and Essential Societal Variables (ESVs) in Mountain Environments”**

ETH Zürich, Tannenstrasse 3, Room CLA J1, Zürich, Switzerland | 20-21 February 2020



Hosted by:



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## Summary

The Global Network on Observations and Information in Mountain Environments (GEO-GNOME) convened the **GEO-GNOME Workshop “Identifying Essential Biodiversity Variables (EBVs) and Essential Societal Variables (ESVs) in Mountain Environments”**, on 20-21 February 2020, in Zürich, Switzerland. The workshop was a key activity identified and prioritized at the GEO-GNOME Status and Scoping Workshop held in Bern in May 2018<sup>1,2</sup>, and listed as part of GEO-GNOME’s Implementation Plan under the Group on Earth Observations (GEO) Work Programme for 2020-2022<sup>3</sup>. The workshop was led and coordinated by the GEO-GNOME co-leads Mountain Research Initiative (MRI) and the Institute of Atmospheric Sciences and Climate, National Research Council (ISAC-CNR) with support from the Swiss Agency for Development and Cooperation (SDC) and the MRI. GEO-GNOME contributing organizations, including the Global Mountain Biodiversity Assessment (GMBA) and the US Geological Survey (USGS), contributed to the design and preparation of this workshop.

The GEO-GNOME workshop aimed to identify and select processes that account for and improve understanding of key ecological and social-ecological changes in mountain systems and to identify EBVs and ESVs needed to monitor and report on these changes in biodiversity and society in mountains. The workshop was structured around invited inputs from experts, followed by a series of activities in which participants had the opportunity to discuss, elaborate and provide additional feedback and share their expertise and perspectives in the identification of key processes of change and relevant EVs for selection.

The key outcome of the workshop is a preliminary selection of EBVs and ESVs required to observe, monitor and inform on changes in mountain biodiversity and mountain social-ecological systems. The final results will be presented in a peer-reviewed publication. Based on the outcomes of the discussions at this workshop, GEO-GNOME will start a process towards building an integrative framework around mountain specific Essential Variables addressing Mountain Social-Ecological Systems.

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<sup>1</sup> See <http://www.mountainresearchinitiative.org/index.php/news-page-all/350-geo-gnome-status-and-scoping-workshop-bridging-datagaps-in-mountain-environments>

<sup>2</sup> See Adler et al (2018) - <https://doi.org/10.1659/MRD-JOURNAL-D-8-00065.1>

<sup>3</sup> See [https://www.earthobservations.org/documents/gwp20\\_22/GEO-GNOME.pdf](https://www.earthobservations.org/documents/gwp20_22/GEO-GNOME.pdf)

## Key objectives of the workshop

- 1) Identify and select processes that account for and improve understanding of key ecological and social-ecological changes in mountain systems;
- 2) Following from Objective 1, identify EBVs and ESVs needed to monitor and report on change in biodiversity and society in mountains (selection from existing essential variables and identification of new ones);
- 3) Identify existing data sources, data gaps, and data needs (including field observations, remote sensing and modelling approaches) for the selected EBVs and ESVs, and define criteria and protocols for data collection.

## Part 1: Introduction to global change processes in mountains and essential variable frameworks

To set the context for the goals of the workshop, the first workshop morning provided an opportunity to reflect on processes specific for mountain environmental systems and on the concept of Essential Variables. Invited talk of Sonja Wipf (Swiss National Park) highlighted the most important global change processes affecting mountain biodiversity, such as climate change (temperature, precipitation, snow), land use, natural disturbances, invasive species and Nitrogen deposition and the responses these drivers have in mountain biodiversity. In the GEO BON presentation by Walter Jetz (Yale University), the framework for Essential Biodiversity Variables was addressed, stressing the need to utilise the framework and data sets that are already available as a starting point to discuss what is relevant in mountain contexts. The invited talk by Tuyeni Mwampamba (National Autonomous University of Mexico) highlighted the inherent diversity within mountain social-ecological systems and how they mirror the diversity of ecosystems, driven by combinations and interactions of global mega processes and local scale conditions and drivers, and how the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) framework has been applied to build a system for the identification of relevant Essential Ecosystem Service Variables.

To decide what should be prioritized to “improve monitoring and understanding of mountain processes” (as stated in Objective 3 of the current GEO-GNOME Work Plan), it was agreed that mountain specific global change processes should guide the selection of relevant Essential Variables. It was agreed that the GEO BON Candidate Essential Biodiversity Variables (EBVs)<sup>4</sup> serve the optimal basis as a pool from which the identification and selection of relevant EBVs for mountains could be conducted. Given that the public discussion on Essential Societal Variables (ESVs) so far considers only two key candidate ESVs<sup>5</sup>, with a possibility to include others, it was agreed that a dedicated future workshop would provide the appropriate space and opportunity to consider these in more detail. The resulting list of processes and candidate ESVs of this workshop would therefore be a basis to identify desirable data that would be needed to monitor and account for current changes in mountain social-ecological systems, and therefore improve our understanding of them.

## Part 2: Identifying key processes for mountain biodiversity and social-ecological systems

Discussion and selection of mountain specific and relevant processes was conducted as a group exercise in three thematic groups: 1) Ecological processes at species level; 2) Ecological processes at community and ecosystem level; and 3) Societal processes and ecosystem services. The first two groups were later merged to one group considering all the levels of biodiversity as indicated in the GEO BON EBV classes.

The biodiversity group identified 12 key processes that were deemed necessary to account for and monitor changes in biodiversity all the way from the species level, to community and ecosystem levels, such as Species range shifts<sup>6</sup>. The society group identified six key societal processes, such as Demographic changes, that would require monitoring, and therefore identify the required data and information relevant to monitor their changes in mountain environments.

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<sup>4</sup> See full list of GEO BON Candidate EBVs: <https://geobon.org/ebvs/what-are-ebvs/>

<sup>5</sup> See Ehrlich et al. 2018: <https://www.sciencedirect.com/science/article/pii/S1462901117305695>

<sup>6</sup> Full list of selected processes and Essential Variables will be published in the peer-reviewed article (in preparation).



Picture 1. Left: Biodiversity group filling the processes and candidate Essential Biodiversity Variables in the poster template. Right: Society group discussing the processes.

### Part 3: Selecting Candidate Essential Biodiversity Variables and Candidate Essential Societal Variables for mountains

Identifying candidate Essential Variables for mountains was conducted as an exercise where the participants continued working in the two break-out groups, one on biodiversity variables and one on societal variables. The groups reviewed the nominated processes and listed candidate EBVs and ESVs that are needed for monitoring changes in these processes. GEO BON list of candidate EBVs<sup>7</sup> as well as ESVs presented in literature<sup>8</sup> were used as a starting point for the selection and discussion, but groups were encouraged to come up with further variables where needed. The final step was to discuss how well each selected EV informs about these processes and rating its importance for a process.

Fifteen candidate EBVs, were identified. Eleven out of the 15 identified EBVs are also listed as GEO BON candidate EBVs<sup>9</sup>. Four additional candidate EBVs, not listed by GEO BON, were identified as having specific importance in and relevance for monitoring processes of change in mountain systems.

A total of 34 candidate ESVs for mountains were identified that would correspond the nominated processes. All the 34 candidates were rated either very important or at least somewhat important across all six processes. The group also identified further important variables that could inform about change, but already exist as EBVs or ECVs. The group concluded that the exercise offered a good opportunity to start the discussion but further activities would be needed to finalise the selection for mountain ESVs.

It was concluded that a more comprehensive, integrative framework presenting EMVs for mountain social-ecological systems that address different sets of EVs (across climate, biodiversity, and society) is needed to better account for how both the dynamics and the drivers of social-ecological processes manifest in the mountain context. The outcomes of this workshop, and the previous GEO-GNOME ECV workshop<sup>10</sup>, provide a good basis for this work, however additional and complementary follow-up activities, such as workshops, are needed to accomplish this work. Related to this integrated system, a data-layer combining mountain delineation with required social-ecological data layers (so called K4 layer) would be welcomed for analyses and visualisations.

### Key outcomes and outputs of the workshop

The key outcome of the workshop is a preliminary selection of EBVs and ESVs required to observe, monitor and inform on changes in mountain biodiversity and mountain social-ecological systems. The final results will be

<sup>7</sup> See list of GEO BON candidate EBVs: <https://geobon.org/ebvs/what-are-ebvs/>

<sup>8</sup> See Ehrlich et al. 2018: <https://www.sciencedirect.com/science/article/pii/S1462901117305695>

<sup>9</sup> See list of GEO BON candidate EBVs: <https://geobon.org/ebvs/what-are-ebvs/>

<sup>10</sup> See more on the GEO-GNOME ECV workshop here: <https://mountainresearchinitiative.org/news-page-all/129-mri-news/2399-selecting-essential-climate-variables-for-mountain-observations>

presented in a peer-reviewed publication. Objective 3: Identify existing data sources, data gaps, and data needs for the selected EBVs and ESVs was not accomplished but will be addressed in further GEO-GNOME activities.

### Planned actions

1. A peer-reviewed publication presenting the selection of mountain specific EBVs with a literature review;
2. Based on the outcomes of the discussions at this workshop, GEO-GNOME will start a process towards building an integrative framework around mountain specific Essential Variables addressing Mountain Social-Ecological Systems;
3. Inventory of existing data sources, data gaps and data needs will be completed in a gap analysis by GEO-GNOME Project Officer; and
4. To engage with wider public and GEO community, preliminary results of the GEO GNOME EV workshops will be presented at the GEO Symposium 2020, GEO BON Open Science Conference and GEO Week 2020.

### Key follow-up events

- GEO Symposium | 16 – 18 June 2020
- GEO BON Open Science Conference | 6 – 10 July 2020
- GEO Week | Port Elizabeth, South America | 2 – 6 November 2020
- GEO-GNOME Workshop on ESVs and human dimensions on change in mountain social-ecological systems | to be confirmed
- GEO-GNOME Workshop on K4 – Ecosystem Services and social-ecological systems in mountains | to be confirmed

We take this opportunity to thank all participants of this workshop for your active participation and engagement and for sharing your valuable time.

Carolina and Elisa  
27 May 2020

## Annex 1: Workshop Participants

	<b>Name</b>	<b>Institute</b>	<b>Country</b>
1	Carolina Adler	MRI	Switzerland
2	Jake Alexander	ETH Zurich	Switzerland
3	Nasrin Amini Tehrani	University of Lausanne	Switzerland
4	Claudia Capitani	European Commission Joint Research Centre	Italy
5	Wakjira Takala Dibaba	Rostock University	Germany
6	Andreas Heinimann	University of Bern	Switzerland
7	Walter Jetz	Yale University	USA
8	Aino Kulonen	MRI	Switzerland
9	Tuyeni Mwampamba	National Autonomous University of Mexico	Mexico
10	Claudia Notarnicola	EURAC	Italy
11	Marijana Pantić	Institute of Architecture and Urban & Spatial Planning of Serbia	Serbia
12	Harald Pauli	ÖAW; BOKU; GLORIA	Austria
13	Davnah Payne	GMBA	Switzerland
14	Christophe Randin	University of Lausanne	Switzerland
15	Sergey Rosbakh	University of Regensburg	Germany
16	Maria J. Santos	University of Zurich	Switzerland
17	Roger Sayre	U.S. Geological Survey	United States
18	Dirk Schmeller	ENSAT	France
19	Stefan Schneiderbauer	UNU - EHS; GLOMOS, EURAC Research	Italy
20	Ana Stritih	ETH Zurich	Switzerland
21	Tom Walker	ETH Zurich	Switzerland
22	Sonja Wipf	Swiss National Park	Switzerland
23	Susanne Wymann von Dach	University of Bern	Switzerland

## Annex 2: Workshop Program

THURSDAY 20 FEBRUARY	FRIDAY 21 FEBRUARY
<p><b>08:45 Arrival coffee and registration</b></p> <p><b>09:15 Welcome and introduction</b>  <i>GEO-GNOME co-leads</i></p> <p><b>09:20 Introduction to Essential Variables for mountains</b>  <i>Aino Kulonen (MRI)</i></p> <p><b>09:30 Invited talks</b></p> <ol style="list-style-type: none"> <li>1) Key processes changing mountain biodiversity –  <i>Sonja Wipf (Swiss National Park)</i></li> <li>2) Introduction to Essential Biodiversity Variables –  <i>Walter Jetz (Yale University)</i></li> </ol> <p>Invited responses (Dirk Schmeller and Jake Alexander) and comments from participants</p>	<p><b>9:00 Recap Day 1 and plan for Day 2</b></p> <p><b>09:15 Orientation to Exercises 2 and 3 in break-out groups</b></p> <p><b>09:30 Break-out groups</b>            Exercise 2: Discussing and selecting essential variables for each process and evaluating their importance</p>
<b>10:30 COFFEE BREAK (group photo)</b>	<b>10:30 COFFEE BREAK</b>
<p><b>11:00 Invited talks</b></p> <ol style="list-style-type: none"> <li>3) Mountain social-ecological systems and Essential Ecosystem Service Variables –  <i>Tuyeni Mwampamba (Universidad Nacional Autónoma de México)</i></li> </ol> <p>Invited responses (Andreas Heinemann and Roger Sayre) and comments from participants</p> <p><b>11:40 Discussion</b>            Comments and questions from participants</p> <p><b>12:10 Results of the pre-workshop survey</b>  <i>Aino Kulonen (MRI)</i></p>	<p><b>11:00 Break-out groups</b>            Exercise 2 continues</p> <p><b>12:00 Plenary</b>            Groups present their selection of essential variables            Discussion</p>
<b>12:30 LUNCH</b>	<b>12:30 LUNCH</b>
<p><b>13:30 Orientation to Exercise 1 in break-out groups</b></p> <p><b>13:50 Break-out groups</b>            Exercise 1: Discussing and identifying key processes in mountain systems in break-out groups</p> <p><b>15:15 Plenary – short feedback</b></p>	<p><b>13:30 Break-out groups</b>            Exercise 3: Considering data collection possibilities and criteria – mapping existing data sources</p>
<b>15:30 COFFEE BREAK</b>	<b>15:30 COFFEE BREAK</b>
<p><b>16:00 Break-out groups</b>            Exercise 1 continues (possibility to change groups)</p> <p><b>16:30 Plenary</b>            Groups present their selection of processes            Discussion</p> <p><b>17:30 Close Day 1</b></p>	<p><b>16:00 Plenary</b>            Groups present their outcomes - lists of associated protocols for each essential variable            Discussion on results            Final words and next steps</p>
<b>18:30 WORKSHOP DINNER</b>	<b>17:00 END OF WORKSHOP</b>