



## BOOK OF ABSTRACT

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### I. SESSION DESCRIPTION

**ID: B8**

Scoping with global changes in mountain and arctic socio-ecological systems

	Title	Name	Organisation	E-mail
<b>Host(s):</b>		Uta Schirpke	Institute for Alpine Environment, Eurac Research, Bozen/Bolzano, Italy	uta.schirpke@eurac.edu
	Prof.	Vera Helene Hausner	UiT-the Arctic University of Norway	Vera.hausner@uit.no
<b>Co-host:</b>		Ulrike Tappeiner	Department of Ecology, University of Innsbruck, Austria	Ulrike.Tappeiner@uibk.ac.at

#### Abstract:

Mountain socio-ecological systems have developed over centuries and provide crucial ecosystem services such as fresh water, raw materials, climate regulation and recreation. Most of these ecosystem services are important to local people, but a growing population in the lowlands depends increasingly from ecosystem services provided by mountain ecosystems due to massive land transformations and an increasing demand for ecosystem services. However, mountain ecosystems are highly vulnerable to environmental and socio-economic changes, including climate variations and landscape changes due to a shifting focus of the use of ecosystems. While in the past agricultural use played a dominating role, nowadays a touristic use often has become more important due to an increased demand for outdoor recreation. These current developments have huge implications for the functioning of ecosystems and the provision of related goods and services often with undesired consequences, especially for beneficiaries in lowland areas. The pace and the complexities of these changes, combined with the deficient knowledge about the ecological and societal impacts of global warming, makes adaptation to climate change challenging. Therefore, decision-making and policy-making is in need of information on underlying mechanisms, potential impacts to effectively support a sustainable use of natural resources and to face the changing demand for ecosystem services.



### Goals and objectives of the session:

This symposium aims at addressing important knowledge gaps related to the assessment of ecosystem services in mountain regions, the understanding of mountain socio-ecological systems and important drivers of change, the analysis of spatial relationships resulting from supply-demand mismatches. Societal trends in and outside mountain regions and their implications for mountain regions will be in the center of the discussions, and the exchange of experiences from mountain regions worldwide will foster the development of strategies to achieve a sustainable use of the natural resources. We therefore invite contributions presenting methods and tools that assess the services and benefits from mountain ecosystems, understand the functioning of mountain socio-ecological systems and assess the influence of drivers of change. The session welcomes in particular contributions that highlight ecological societal trends and tendencies through time and space in mountain areas as well as experiences and examples of sustainable strategies to stimulate the discussion for a sustainable use of the natural resources. Moreover, the workshop seeks to identify the key priorities and challenges for understanding, assessing and adapting to the rapidly disappearing cryosphere. We will:

1. Identify the key research priorities and barriers for research in the BWG8 relating to a changing cryosphere.
2. To discuss how to organize BWG8 to provide policy-relevant science to understand and assess socioecological impacts and support adaptation.
3. To plan for a publication co-authored with participants in the workshop, and to discuss submission of papers to a special issue in Ecosystem Services or other journals.

### Planned output / Deliverables:

- A publication on key priorities and challenges co-authored with participants;
- Revision of lead group, description and organisation of the BWG8;
- Establishment of subgroups to address research priorities and challenges.

This session will furthermore support the interaction of different the research groups on ecosystem services in mountain as well as arctic regions worldwide. The contributions to the session may be included in an upcoming Special Issue "Ecosystem services in mountain regions" in Ecosystem Services.

### Related to ESP Working Group/National Network:

[Biome working group: BWG 8 – Polar regions & High mountains](#)



## II. SESSION PROGRAM

**Date of session:** Monday, 21 October 2019

**Time of session:** 15:30 – 18:00

### Timetable speakers

Time	First name	Surname	Organization	Title of presentation
15:30–15:45	Davnah	Payne	Global Mountain Biodiversity Assessment	On nature and people in mountains worldwide: a global comparison
15:45–16:00	Juan Camilo	Villegas	Universidad de Antioquia	Evaluating ecosystem function and potential tradeoffs among ecosystem services in the tropical mountains of the Andes in the context of global-change-type climate variability
16:00–16:15	Jie	Gong	Lanzhou University	Tradeoffs–synergies analysis among typical ecosystem services of a mountain–basin area in western China: a case study of Bailongjiang Watershed of Gansu
16:15–16:30	Ana	Stritih	ETH Zürich	Understanding uncertainties in mountain ecosystem services
16:30–16:45	Aletta	Bonn	IRSTEA	Cascading down the ecosystem service chain: supply and use of cultural services in mountain National Parks
16:45–17:00	Helen	Wheeler	Anglia Ruskin University	Broadening our perspective on needs for arctic monitoring, research and synthesis to meet human needs and support nature
17:00–17:15	Vera Helene	Hausner	UiT–the Arctic University of Norway	Ecosystem services research in a rapidly disappearing cryosphere & workgroup discussion
17:15–17:30				Discussion



### III. ABSTRACTS

*The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.*

#### 1. Type of submission: **Abstract**

#### B. Biome Working Group sessions B8 Scoping with global changes in mountain and arctic socio-ecological systems

### Cascading down the ecosystem service chain: supply and use of cultural services in mountain National Parks

*First author:* Emilie Crouzat

*Other author(s):* Volker Grescho, Jan Watzema, Angel de Frutos, Aletta Bonn

*Presenting author:* Aletta Bonn

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Drivers of visitors' frequentation and benefits obtained from outdoor activities remain poorly assessed over most European mountain protected areas. Cultural ecosystem services (CES) can be seized as a relevant tool to better understand these drivers, as they represent the (im)material benefits provided by ecosystems to people for instance in terms of recreation outdoor activities, inspiration or sense of belonging. Our works makes use both of biophysical modelled data describing six landscapes indicators related to CES potential supply and in-situ survey data, gathered in the context of the ECO-POTENTIAL H2020 project. In summer 2018, we carried out a survey with over 400 visitors of three mountain national parks in Europe (the Swiss National Park, the Austrian Kalkalpen National Park and the Portuguese Peneda-Geres National Park), aiming at understanding which CES they enjoyed, and where they were actually used. We characterized landscape potential attractiveness by mapping several biophysical indicators such as the distance to waterbodies or the absence of man-made structures in the view shed. Comparison between the potential supply and the actual use of services reveals features of management interest for the National Park teams. Further, we identified groups of visitors benefitting from similar bundles of CES, and characterized their socio-demographic profiles. This information is of interest for the National Parks to better anticipate conflicts and synergies around CES as well as to design more efficient visitors' management strategies.



*Keywords:* Cultural ecosystem services, Mountain national park, Landscape indicators, Use and potential supply, Visitors' profiles

2. *Type of submission: Abstract*

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## **Tradeoffs-synergies analysis among typical ecosystem services of a mountain-basin area in western China: a case study of Bailongjiang Watershed of Gansu**

*First author:* Jie Gong

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Mountain areas in western China, hosted rich biodiversity and millions of people and inhabitant with vital ecosystem services, had experienced the most serious biodiversity loss with fragile ecological problems. Bailongjiang Watershed of Gansu, a typical ecotone between Tibet Plateau, Qinba Mountain Area and Loess Plateau, is not only an important water conservation area and ecological barrier in the upper reaches of Yangtze River, but also a concentrated area of the national-level poverty-stricken counties. It is of great significance to clarify the tradeoff relationship of ecosystem services (ES) for realizing the "win-win" between the ecological environment and social economy in the mountainous areas. Based on the InVEST model, the typical ESs including food supply (FS), soil conservation (SC), water conservation (WC) and habitat quality (HQ) were assessed, then the multi-scale tradeoff of ES and its impact causes were analyzed by the correlation analysis and RMSD methods. The results showed that: (1) There was a significant synergy among soil conservation, water conservation and habitat quality, and a significant tradeoff between food production and habitat quality, soil conservation, water conservation, respectively. (2) The areas of the high value of the ESs tradeoff intensity between the SC-WC, SC-HQ, WC-HQ, and FS-HQ were mainly located in the forest area in the middle-high mountains with steep valley in Wenxian, Diebu and Zhouqu. The areas with the high intensity of tradeoff between SC-FS, WC-FS were mainly concentrated in the farming and pastoral areas in the middle-low mountain in Tanchang and Wudu. (3) The spatial difference of land use/cover pattern driven by human activities was an important factor affecting the degree of ES tradeoff and its scale effect, and also restricted the balance development of comprehensive ecological benefits of the watershed.



*Keywords:* ecosystem services; tradeoffs/synergies; correlation analysis; root-mean-square deviation (RMSD); Mountain-basin area

3. *Type of submission: Invited speaker abstract*

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## Ecosystem services research in a rapidly disappearing cryosphere

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Global warming and the rapid disappearance of the cryosphere are affecting a range of ecosystem services in the arctic and high mountain regions. The pace and the complexities of these changes, combined with the deficient knowledge about the ecological and societal impacts of global warming, makes adaptation to climate change challenging. To address some of the shortcomings of current research and to better inform policy and decision makers, the BWG8 on polar and high altitude will invite participants to discuss opportunities to reflect on research priorities using the nominal group technique, and thereafter we will discuss how the BWG8 can organize and create new initiatives to fill the pressing knowledge gaps and to support adaptation to the upcoming changes. On the basis of this exercise we will plan for a publication co-authored with participants in the workshop, and to discuss submission of papers to a special issue in Ecosystem Services or other journals.

*Keywords:* Climate change, ecosystem services, adaptation



#### 4. Type of submission: **Abstract**

#### B. Biome Working Group sessions B8 Scoping with global changes in mountain and arctic socio-ecological systems

### On nature and people in mountains worldwide: a global comparison

*First author:* Davnah Payne

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Urgent calls for action in sustainable development come from the mountain research and development community as it acknowledges the effects of global change on the essential capacity of mountain ecosystems and their biodiversity to support human populations locally and globally. Effective policies and management approaches are needed to safeguard the natural assets that are underpinning human wellbeing in mountains and beyond and ultimately “ensure the conservation of mountain ecosystems” (SDG 15.4). However, the formulation and implementation of contextually relevant approaches requires a thorough understanding of the relationship between people and nature in mountains and of the impact of different drivers on the trajectory of mountain social-ecological systems.

Our project aimed at producing a first comparative assessment of the status of, trends in, and relations between biodiversity, ecosystem services, human wellbeing, and drivers of change across mountains worldwide. Data acquisition broadly followed the conceptual framework of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, and combined an online questionnaire with a literature review.

Many of the reported trends and patterns in biodiversity and ecosystem services follow recently reported global trends, with a deterioration in ecosystem condition and trends towards a decrease in the delivery of ecosystem services, which affects the wellbeing of mountain populations. However, analyses of expert perceptions and of the literature also revealed interesting nuances, including differences in the importance of various drivers and their interactions along the elevational gradient; trade-offs and synergies between nature conservation and the amelioration of human livelihoods locally; and context-specific differences in the upstream processes elicited by socio-economic development in the lowlands.



This comparative assessment highlights context-specific interactions between people and nature in mountain social-ecological systems exposed to multiple drivers of change. It thereby contributes to a better understanding of the specific challenges associated with the sustainable management and conservation of mountain biodiversity.

*Keywords:* mountain biodiversity and ecosystems, comparative assessment, conservation, management, sustainable development

5. *Type of submission: Abstract*

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## Understanding uncertainties in mountain ecosystem services

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Mountain ecosystems provide a wide range of ecosystem services (ES), and the provision of these services is sensitive to changes in land use and climate. At the same time, the demand for ES varies over space and time, driven by different management regimes and changing social preferences. Information on ES is available from a variety of sources, from Earth Observation data, social media and in-situ data, existing process-based models, to local expert knowledge. We use Bayesian Networks (BNs) to integrate these different types of information into models of a set of ES (protection from natural hazards, carbon sequestration, recreation, habitats) in two case study areas in the Swiss Alps, the strictly protected Swiss National Park and the more tourism-oriented region of Davos. Although the two areas are similar in terms of biophysical conditions, they differ in the level and spatial distribution of demand for ES.

The probabilistic BN approach allows us to account for uncertainties in the ES models. A major source of uncertainty for future ES in the region is the increasing frequency of forest disturbances due to climate change. Windthrows, bark beetle outbreaks, forest fires, and other extreme events have a strong impact on landscape structure and the potential of mountain ecosystems to provide ES, particularly carbon sequestration and protection from natural





hazards. Using a combination of expert knowledge and Earth Observation data in a BN, we aim to improve our understanding of the drivers of disturbances (including different management regimes, such as within and outside protected areas), and their effects on ES.

*Keywords:* Uncertainty, protected areas, Bayesian Networks, disturbance

6. *Type of submission: Abstract*

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## **Evaluating ecosystem function and potential tradeoffs among ecosystem services in the tropical mountains of the Andes in the context of global-change-type climate variability**

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Tropical montane ecosystems are pressured by multiple environmental and socio-economic factors. A suite of competing services is demanded from these ecosystems, leading to uncertainties around their sustainability. Along with human demands, environmental changes associated with climate variability affect the ecological stability of tropical montane ecosystems and ultimately, their potential to maintain the processes (function) that support their capacity to provide services to society. One of the most demanded services from these systems are those associated with ecohydrological processes (hydrologic regulation, erosion control, among others). The interactions between climate variability and land use change in the region alter the natural ecohydrological dynamics, producing responses that vary in extent and intensity. In particular, natural forests have been extensively converted into agricultural and pasturelands with little consideration to potential restrictions in this conversion, such as edaphic and geomorphological restrictions, that can affect socio-ecosystems capacity to maintain functions that support ecosystem services. We monitored a suite of ecohydrological and biogeochemical processes in a gradient of human intervention that includes native vegetation in different degrees of conservation, agricultural and pasturelands in the central Andes of Colombia. Our results highlight an explicit effect of transforming native vegetation



into other land uses on the capacity of ecosystems to maintain hydrologic regulation and biogeochemical processes that support nutrient availability and soil fertility, including soil and nutrient loss both dissolved and suspended in runoff. Notably, these effects respond to climate seasonality and variability, suggesting higher vulnerability of ecohydrological function to climate change as native vegetation is transformed. More generally, our results highlight a potential tradeoff between functions that support regulation vs. provision services as native Andean vegetation is transformed into other land cover types. However, long-term sustainability of these productive uses might be affected by global-change processes, highlighting the importance of ecosystem restoration and conservation in the region.

*Keywords:* Ecosystem service tradeoffs, Environmental change, ENSO/ socio-ecological systems, Tropical Andes

7. *Type of submission: Abstract*

[B. Biome Working Group sessions B8 Scoping with global changes in mountain and arctic socio-ecological systems](#)

## **Broadening our perspective on needs for arctic monitoring, research and synthesis to meet human needs and support nature**

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Global environmental change is creating some of the highest likelihood and most impactful risks to humans, and the many species upon which we depend. These risks are intensified in arctic and northern mountain environments, where rapid warming is driving biophysical and socio-ecological transformation. As the north transforms, we see a rapid expansion of stakeholders, the emergence of novel drivers of change and an increased likelihood of new synergies and antagonisms between impacts of drivers of change.

Where concurrent rapid changes in the environment and the stakeholder community occur, conflicts over resource use and conservation can be severe. Accordingly, there is a critical need



for accurate and reliable information to inform decision-making, which provides just outcomes for stakeholders. The current separation between ecological and social science paradigms for research and synthesis creates knowledge gaps at their interface and can have consequences for the information generated by research and its synthesis. Biases in the foci of our research typically leads to poor scientific understanding, poorly designed policy, stakeholder discontent and badly managed environments.

First, I will present the results of an interview-based study of stakeholder needs for arctic wildlife monitoring. Our interviews with representatives of Indigenous organisations and NGOs and scientists and decision-makers from across the Arctic highlight the need to broaden perspectives in research and monitoring beyond purely scientific objectives to consider how both the process and outcomes of monitoring and research can better support a broader range of benefits to ecosystems and society. I will then discuss how different paradigms for knowledge generation could affect the information and knowledge that is recorded and used in research, monitoring and synthesis, and how this might affect our perceptions of systems, of decision-making outcomes and ultimately provision of ecosystem services. This will help identify research gaps within the polar regions and high mountains.

*Keywords:* Arctic, Monitoring, Research gaps, Wildlife