



## BOOK OF ABSTRACT

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### I. SESSION DESCRIPTION

**ID: B8**

Gaining height: mountain social–ecological systems as sentinels of change

#### Hosts:

	Title	Name	Organisation
<b>Host:</b>	Dr.	EmilieCrouzat	Helmholtz–Center for Environmental Research – UFZ / German Centre for Integrative Biodiversity Research (iDiv) Halle–Jena–Leipzig
<b>Co–host(s):</b>	Dr. Dr.	Ignacio Palomo, Sandra Lavorel	

#### Abstract:

Mountains worldwide critically contribute to the well-being of humankind by supplying a diverse range of ecosystem services to people living both within and outside their ranges. As relatively well-preserved social–ecological systems, mountains also host a particularly rich and specific biodiversity. Mountains supply critical provisioning services such as fodder production for livestock or timber products, and a variety of regulating services including water purification or protection against natural hazards. Their cultural services, based on the attractiveness of landscapes, on the specificities of outdoor activities or on the spiritual and mental benefits people enjoy in these restorative environments, are highly valued locally and globally.

Mountains face multiple drivers of change at global (e.g., climate change) and local (e.g., evolution of agro–pastoral practises) scales. Their combined impacts modify species interactions, affect human well-being and in some cases trigger societal adaptations.

Charactering the evolving ability of mountains to supply a bundle of ecosystem services as well as exploring the multiple value dimensions society attach to them appear both a critical necessity for human well-being and a scientific opportunity for developing novel assessment



methods and tools. In this context, complementary data, from field experiments, earth-observation sources or modelled outputs, are needed to understand social and ecological patterns in mountains throughout space and time. Further, integrated assessments that combine diverse sources of knowledge and disciplines hold a high potential to integrate the interests of the diverse stakeholder groups that use, impact and benefit from mountain ecosystem services. Such assessments often include a significant participation of non-academic partners, up to fully collaborative research-action processes, and feedbacks from recent or on-going projects will favourably contribute to optimizing scientific contributions to real-life governance and problem solving. In addition, scenarios can be seized as a tool to describe possible futures of the mountain system, ultimately fostering the identification of socially desirable trajectories of change and of their determinants. How to design such scenarios and what to expect from them remain open areas for improvements that need to be further discussed.

#### Goals and objectives of the session:

This session invites academic and non-academic participants with diverse backgrounds (ecology, remote-sensing, geography, social sciences ...) interested in coupled human-nature mountain systems. Talks will present methods and tools to assess mountain ecosystems, their services and beneficiaries, as well as associated institutional and policy settings. Contributions building on participatory work (e.g., participatory mapping, scenario making, citizen science...) are welcome to explore the potential of transdisciplinarity in the understanding and steering of mountain systems. Additionally, we encourage participants to present evidences of the influence of drivers of change on social and ecological patterns through time and space in mountain areas. Insights gained through the use of specific technologies, such as earth-observation data, and of community web-based data, are particularly welcome.

We aim at discussing challenges associated to the characterisation and/or the steering of transforming mountain systems towards sustainability, based on actual results from case-studies and assessments worldwide. Novel methodological developments and assessment frameworks are welcome and should demonstrate their relevance and transferability to other settings. There will also be space for participants to share the technical and analytical issues they face, in order to foster the emergence of collaborative answers.

#### Planned output / Deliverables:

This session will strengthen the community of practice working on ecosystem services in mountain landscapes. Feedbacks from past and on-going research will stimulate the dissemination of assessment methods and tools and can foster future interactions among participants.



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

[Biome Working Groups: B8 – Polar regions & High mountains](#)

## II. SESSION PROGRAM

**Date of session:** Wednesday, 17 October 2018

**Time of session:** 10:45 – 13:00

Time	First name	Surname	Organization	Title of presentation
10:45–11:00	Ana	Stritih	ETH Zürich	Supply and demand of mountain ecosystem services within and outside protected areas
11:00–11:15	Emilie	Crouzat	UFZ – iDiv	A multi-layered approach to cultural ecosystem services in mountain national parks
11:15–11:30	Sandra	Lavorel	LECA – CNRS	Assessing ecosystems and ecosystem services in French high mountains
11:30–11:45	Ignacio	Palomo	Basque Centre for Climate Change	A Review of Climate Change Impacts on Ecosystem Services in High Mountain Areas
11:45–12:00	Enora	Bruley	LECA – CNRS	A participatory approach for linking visions of a desirable future with ecosystem services demand for mountain social-ecological system adaptation to global change.
12:00–12:15	Joint discussion			
12:15–12:30	Networking and science for mountain systems in a context of global and local changes			
12:30–12:45				
12:45–13:00	ESP Mountain Biome Group			



### 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 Gaining height mountain social–ecological systems as sentinels of change

##### **A multi-layered approach to cultural ecosystem services in mountain national parks**

*First author:* Emilie Crouzat

*Other author(s):* Grescho Volker, Watzema Jan, Kraemer Rolland, Bonn Aletta

*Affiliation, Country:* UFZ / iDiv, Germany

National parks are challenged by the two-fold objective of sustaining habitats and species of high conservation interest on the one hand, and of attracting and managing visitors on the other. Drivers of visitors' frequentation and benefits obtained from outdoor activities remain poorly assessed over most European mountain protected areas. Cultural ecosystem services can be seized as a relevant tool to better understand these factors, 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. In the context of the ECO-POTENTIAL H2020 project, we assessed the potential capacity of landscapes to supply cultural ecosystem services as well as their actual use by visitors. Results have been obtained for three mountain National Parks: the Swiss National Park, the Austrian Kalkalpen National Park and the Portuguese Peneda-Geres National Park. 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. Collecting visitors' perspectives through surveys and participatory mapping enabled us identifying hotspots where cultural ecosystem services are actually enjoyed. Comparison between the potential supply and the actual use of services reveals features of management interest that we currently discuss with the National Park teams.

**Keywords:** ecosystem service, mountain national park, supply and use



**2. Type of submission: Abstract**

**B. Biome Working Group sessions: B8 Gaining height mountain social–ecological systems as sentinels of change**

**A participatory approach for linking visions of a desirable future with ecosystem services demand for mountain social–ecological system adaptation to global change.**

*First author:* Enora Bruley

*Other author(s):* Sandra Lavorel

*Affiliation, Country:* Laboratoire d'Ecologie Alpine – CNRS, France

Mountain social–ecological systems (SES) require future societal adaptations to maintain the material and immaterial ecosystem services they provide to people. The MountainPaths project implements a three–step participatory process involving a wide range of local and regional stakeholders in the Pays de la Meije (French Alps). By this it aims to inform the potential contribution of ecosystems to this adaptation. In this process, we analyse the past, present and future trajectories of local ecosystem services demand, and how changes in the SES impact the decision context for activating these services for benefits to people. Past and current trajectories will inform us about the SES's capacity to respond to adaptation goals. For co–designing adaptation pathways, it is necessary to first determine with stakeholders a vision of a desirable future for the area. During workshops, we used a normative scenario approach for questioning stakeholders about their visions for Pays de la Meije in 2040. Visions were structured as desirable values, quality of life and a range of economic activities under climate change constraints. Stage two workshops and follow–up interviews consolidated proposed activities into a coherent scenario, and allocated activities across the landscape. We synthesized the resulting vision as a storyline and a map of land use and activities. We demonstrate how such a participatory approach can be used to identify future ecosystem services demand, and thus the desired bundles of ES, as well as the associated socio–economic and human context. This vision will be the starting point for the co–construction of adaptation pathways for the Pays de la Meije by identifying the social–ecological system's capacity to co–produce ecosystem services towards adaptation.

**Keywords:** Social–ecological system, ecosystem services, normative scenario, climate change, adaptation pathways



**3. Type of submission: Abstract**

**B. Biome Working Group sessions: B8 Gaining height mountain social–ecological systems as sentinels of change**

**Assessing ecosystems and ecosystem services in French high mountains**

*First author:* Sandra Lavorel, Emilie Crouzat

*Other author(s):* Mégane Zawada

*Affiliation, Country:* Laboratoire d'Ecologie Alpine, CNRS, Grenoble, France, Laboratoire d'Ecologie Alpine, CNRS, Grenoble, France & iDiv, Leipzig, Germany, French Southern Territories

Mountain socio–ecosystems support high biodiversity and numerous ecosystem services to local and remote beneficiaries. Their multiple values were assessed for the French metropolitan territory through a transdisciplinary process involving researchers, a panel of scientific experts and representative of institutions (e.g. the national parks network or the Alps and Pyrenees development programs), environmental and mountain sport NGOs and the French Ministry for the Environment. High mountain ecosystems host a disproportionate proportion of France's biodiversity, mostly in good conservation state. They are highly multifunctional, especially species–rich grasslands which provide fodder for geographically–designated animal products, regulate hydrological flows, erosion and natural risks, host multiple outdoor recreation activities and support rich cultural values associated with open landscapes and iconic species. Grassland and wetland soils also hold significant, but poorly known carbon storage. Yet climate and agricultural management change threaten these ecosystems and their services, and risk to enhance trade–offs. High mountain catchments play critical roles for regulating water flows, erosion and natural risks, largely benefiting downstream users. Highly sensitive peat and wetland areas, which are in less good conservation state and highly threatened by climate change, pollution and tourism intensification, are hot spots for these regulating services. High mountains support multiple outdoor recreation activities, especially in more accessible high altitude summits and ranges close to large urban centres. These activities overlap significantly with hot spots for endangered and emblematic species, even within protected areas. But some areas with suitable habitat for multiple species are not attractive for outdoor sports. The multi–dimensional values of high mountain ecosystems are incorporated in national and regional policy and decision–making. They target the mitigation of threats from climate change or tourism development, and favour sustainable economic development. Local participation and deliberation are also essential to mitigate ecosystem service trade–offs.



**Keywords:** French national ecosystem assessment, mountain socio–ecosystems, Alps, Pyrenees

**4. Type of submission: Abstract**

**B. Biome Working Group sessions: B8 Gaining height mountain social–ecological systems as sentinels of change**

**A Review of Climate Change Impacts on Ecosystem Services in High Mountain Areas**

*First author:* Ignacio Palomo

*Affiliation, Country:* Basque Centre for Climate Change, Spain

Climate change is one of the major drivers of global change. It impacts biodiversity, ecosystem services and human well-being at multiple levels. One of the most sensitive ecosystems to climate change are mountains. Mountain ecosystem services are essential for mountain communities, and at the same time, benefit mountain tourists and populations downstream. In this work we present the results of a systematic literature review on how mountain communities and tourists are affected by climate change through changes in the supply of different ecosystem services. We have found that the ecosystem services mostly affected are food and feed, water availability, natural hazards regulation, spirituality and cultural identity, aesthetics and recreation. Moreover, diverse infrastructure that mediates access to these ecosystem services is also affected by climate change. The literature review shows a concentration of studies in the Alps and Himalayas, and a lack of studies in tropical mountain ranges which are one of the most affected by climate change. We conclude that the magnitude of climate change impacts in high mountain regions might be used to increase climate change awareness beyond mountain systems, and that strong measures to adapt to climate change for the beneficiaries of mountain ecosystem services are needed.

**Keywords:** Mountain ecosystem services, climate change, stakeholder groups, literature review.



5. *Type of submission: Abstract*

B. Biome Working Group sessions: B8 Gaining height mountain social–ecological systems as sentinels of change

**Supply and demand of mountain ecosystem services within and outside protected areas**

*First author:* Ana Stritih

*Other author(s):* Peter Bebi, Adrienne Grêt–Regamey

*Affiliation, Country:* ETH Zürich, Switzerland

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. In the Alps, many valuable ecosystems are designated as protected areas, which affects both the provision and the demand for ES. We explore the effect of protected areas by comparing a set of ES in a strictly protected and a non–protected area. The Swiss National Park (SNP) was established in 1914 with the clear objectives of letting natural processes take their course, observing them, and informing visitors. The landscape of Davos has similar biophysical conditions, but is dominated by tourism and traditional agriculture. We model both the provision and demand for ES in both areas, by developing Bayesian Network models of carbon sequestration, timber production, avalanche protection, recreation, and habitats. This approach allows us to combine different types of information, including Earth Observation, social media, process–based models and expert knowledge, while quantifying the associated uncertainties. Although uncertainties in the ES assessments are high, some differences between both areas can be observed, particularly in the level and spatial distribution of demand for ES. For example, the demand for protection from avalanches is one of the most valuable services in the region of Davos, while it is only important in a small part of the SNP. In addition, the social preferences of visitors differ between both areas, with a high demand for wildlife observation in the SNP, and a focus on outdoor sports in Davos. Our results indicate that management regimes and differences in demand should be taken into account in ES assessments.

**Keywords:** Provision, Demand, Protected Area, Bayesian Network, Earth Observation