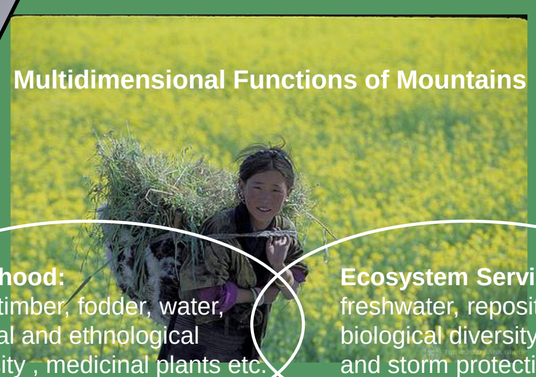
A View From the Top: Vulnerability and Adaptation in Mountain Systems

Mountain ecosystems are among the most vulnerable to climate change and in the frontline of adaptation to extreme warming scenarios. These extreme increases are projected to have major repercussions for regional hydrological systems through advanced glacial melting and also transform mountain livelihoods. These livelihoods are already among the most marginal and stressed, and the prospects of large-scale warming are likely to overwhelm existing coping mechanisms of local populations. This poster proposes a vulnerability assessment tool for these mountain livelihoods, building on the IPCC components of vulnerability: exposure, sensitivity, and adaptive capacity. The tool will identify and apply a mountain-specific set of vulnerability dimensions and criteria, based on Jodha's framework on mountain specificities. The latter highlights the particular conditions and constraints for sustainable development in mountain regions, and calls for tailored development interventions. In a similar vein, we make a case that successful adaptation in these high-risk environments will depend on a sound assessment of mountain-specific climate vulnerabilities.

Mountains are fragile ecosystem that cover 1/3 of the earth's surface and are a home to 500 million people. These people are historically marginalized and exposed to variety of social and natural vulnerabilities.

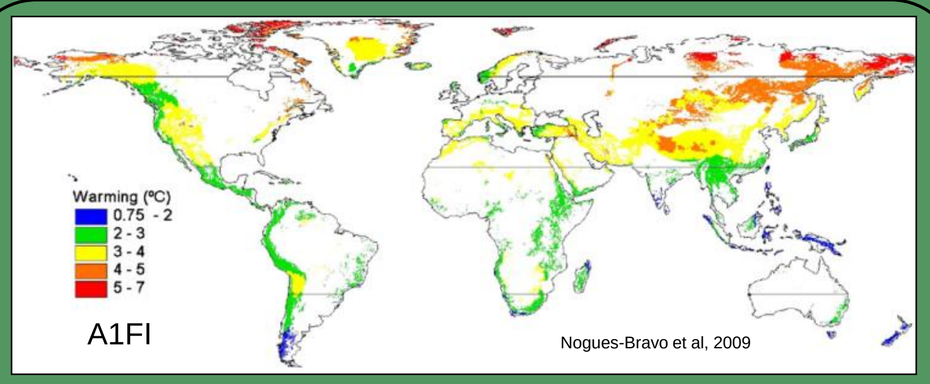
Multidimensional Functions of Mountains



Livelihood: food, timber, fodder, water, cultural and ethnological diversity , medicinal plants etc.

Ecosystem Services: freshwater, repositories of biological diversity, flood and storm protection, etc.

Global Mountain Systems Exposed to Climate Change







The Vulnerability Assessment Tool : Mountain Specific

IPCC defines:

Vulnerability The degree to which a system is susceptible to, or unable to cope with, adverse effects of *climate change, including climate variability and extremes. Vulnerability is a function of the* character, magnitude, and rate of climate variation to which a system is exposed, its *sensitivity, and its adaptive capacity.*

Vulnerability = (Exposure - Adaptive capacity) Sensitivity

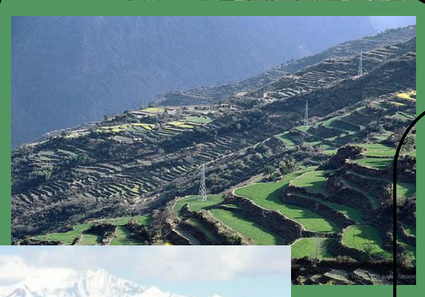
Exposure The nature and degree to which a system is exposed to significant climatic variations.

Adaptive capacity The ability of a system to adjust to *climate change (including climate variability and extremes) to moderate potential damages, to take* advantage of opportunities, or to cope with the consequences.

Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related *stimuli. The effect* may be direct or indirect.

Jodha's Framework of Vulnerability to Mountainous regions

Vulnerability is a function of Mountain 'specificities'	
Negative Features	**Accessibility, Marginality, Fragility**
Positive Features	**Diversity, Niche and Human adaptive capacity**









Exposure

Temperature | **Precipitation**

Magnitude, frequency and type of exposure, such as Seismicity, Cloud bursts, Hail storms, Droughts, Landslides, Soil Erosion ,Glacial Lake outburst floods, etc.

Sensitivity

Marginality		Fragility	
Spatial Marginality / **Social Marginality (Poverty)**		**Ecological Fragility/ Resilience** / **Social fragility/ Physical Weakness**	
•Agriculture productivity per unit of land • Land use and land cover classification	•Number of days and seasonality of food security per household in a year. • % of poor in the population	•Time to recover to the production stage for agriculture field after storms/landslide • Change in Number of household availing safe drinking water after storm/floods etc	•Household indebtness •Type, frequency and incidence of disease per family

Adaptive Capacity

Diversity/Niche		Accessibility	
Biodiversity / **Ethnic/ Livelihood**		**Spatial Accessibility** / **Social/ Political Accessibility**	
•Plant/crop diversity index •Area of pastureland/number of cattle	•Proportion of household income from Non-farming sector •Average number of livelihood options per household	• Road length/ population ratio •Time/ distance from settlement/production site to market	• % of Literate people •Frequency of Government official visit to the village.



The World Bank

SOCIAL DIMENSIONS OF CLIMATE CHANGE

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