Integrated climate impact assessment in mountains

Impacts

Effects on natural and human systems. Impacts refer to the effects on natural and human systems of extreme weather and climate events, and of climate change.

Hazard

The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Vulnerability

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity, or susceptibility to harm, lack of capacity to cope and adapt.

Vulnerability index

A metric characterizing the vulnerability of a system to a change in climate. A vulnerability index is typically derived by combining, with or without weighting, several indicators assumed to represent hazards or physical impacts, exposure, sensitivity, resilience, or adaptive capacity.

Risk

The potential for consequences where something of human value (including humans themselves) is at stake and where the outcome is uncertain. Risk is often represented as probability of occurrence of a hazardous event(s) multiplied by the consequences if the event(s) occurs.

Exposure

Physical exposure of a system to character, frequency, magnitude and rate of climate effect, climate change and variability.

Sensitivity

Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise).

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.

By definition, integrated assessments seek to understand the linkages or interactions and feedbacks among complex systems. An example of the interaction between the economy and climate systems. IA Models have become recognized instruments for policy makers providing useful information and scientific insights for climate policy. These models can be classified in a number of ways. For example, (i) policy evaluation models and (ii) policy optimization models. The first group is formed by simulation models that take user-defined assumptions about a course of future policy and calculate the implications of the specified policy for all modelled variables of interest of the policy-maker (e.g. temperature change, ecosystem and agricultural yield changes, sea-level rise). Policy optimization models summarize the relevant boundary conditions in a set of defined parameters in a scenario, separate key policy variables that control the evolution of the climate change problem (e.g. GHG emissions, carbon taxes) and determine the value of these policy variables in an optimization procedure. Stanton et al. (2008) separate IAMs into (i) welfare optimization models – models that maximise net present value of utility of consumption subject to climate change damages and abatement strategies; (ii) general equilibrium models – models that represent the economy as a set of linked demand and supply functions for each economy sector; (iii) simulation models – those based on exogenous scenarios about future emissions and climate conditions; and (iv) cost minimization models – models that identify the most cost-effective to a climate-economics model.

Climate change impact assessments are traditionally based on projected scenarios of future climate change and presented as changes in temperature, precipitation, rise in sea level and others. Using available information and data, it is possible to analyze the changes and trends in climate parameters. When analyzing the impacts of climate change, it is important to go beyond the direct impacts and economic consequences of climate change, and consider the role of ecosystem services and the social dimension of climate change impacts. For example, changes in precipitation and temperature could impact the environment by changing species distribution and phenology, changing water availability including both floods and droughts, contributing to soil degradation and forest fires. These impacts could further lead to mentioned economic impacts (i.e.,deterioration of infrastructure, changes that include lost revenues in agricultural and timber production, industrial processes and employment), impacts on ecosystem services (i.e., availability of freshwater, fuel and food; flood and disease protection and cultural values) and social impacts(diseases, mortality, reduced labour productivity, conflicts over resources, migration and changes in social networks etc.).The integrated climate impact assessment is aimed at assessing the consequences of climate change along with other cascading consequences.