



**Summer Field School [Online] on
MOUNTAIN ECOSYSTEMS AND
RESOURCE MANAGEMENT
19-28 September, 2021**

Technical Sessions 2.2



Climate Change and Mountain Ecosystems & Communities

Climate Change Impacts on Mountain Livelihoods



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Outline



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- Climate Change Impacts in Mountains
- Livelihoods and Mountain Livelihoods
- Livelihood Analysis
- Mountain Ecosystem Services and Livelihoods
- Livelihood affected by Climate Change
- Major Constraints to Sustainable Livelihood
- Prospects of Sustainable Livelihoods



Background

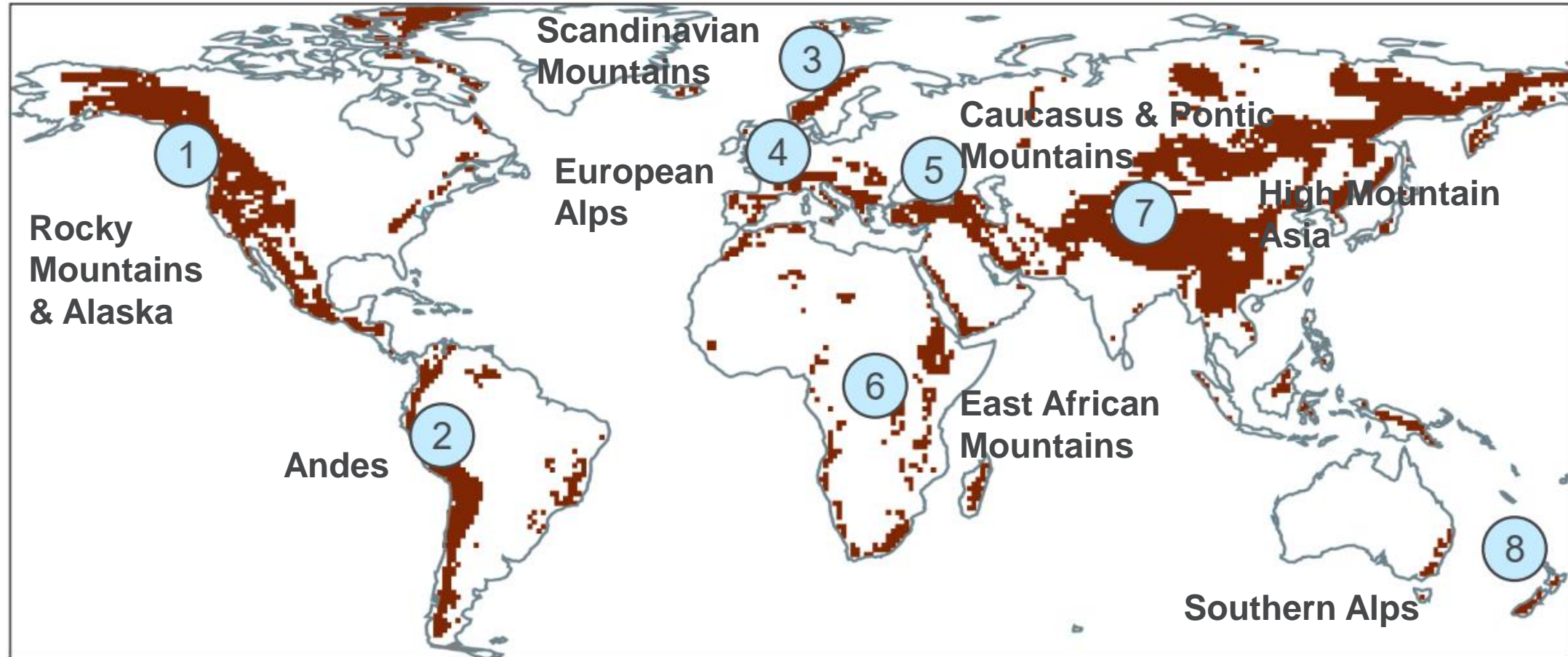
- Mountains are among the most sensitive ecosystems to climate change, occupying 24% of Earth's surface.
- Mountains provide numerous and diverse sources of ecosystem services, with water supply one of the most critical.
- 10 % of the world population's livelihoods and well-beings rely directly on mountainous resources.
- About 40% of the world population depends indirectly on mountain resources for water supply, agriculture, hydroelectricity, and biodiversity.
- Climate impacts form an essential threat to mountain ecosystem services and the populations depending on them.

SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

ipcc

INTERGOVERNMENTAL PANEL ON climate change



Regional fact sheet - Mountains


- The freezing level height in mountain areas is **projected** to rise and **will alter** snow and ice conditions (*high confidence*).
- Warming **has occurred** in the Himalayas, the Swiss Alps, and the central Andes and has increased with altitude. Such elevation-dependent warming **could lead** to faster changes in the snowline, the glacier equilibrium-line altitude and the snow/rain transition height (*high confidence*).
- The global warming-induced earlier onset of spring snowmelt and increased melting of glaciers **have already contributed** to seasonal changes in streamflow in low-elevation mountain catchments (*high confidence*).

Regional fact sheet - Mountains

- It is *virtually certain* that snow cover **will decline** over most land regions during the 21st century, in terms of water equivalent, extent and annual duration.
- Extreme precipitation **is projected** to increase in major mountainous regions (*medium to high confidence*, depending on location), with potential cascading consequences of floods, landslides and lake outbursts in all scenarios (*medium confidence*).
- **Projected** runoff is typically decreased by contributions from small glaciers because of glacier mass loss, while runoff from larger glaciers **will generally increase** with increasing global warming levels until their mass becomes depleted (*high confidence*).




Climate Change Impacts in Mountains

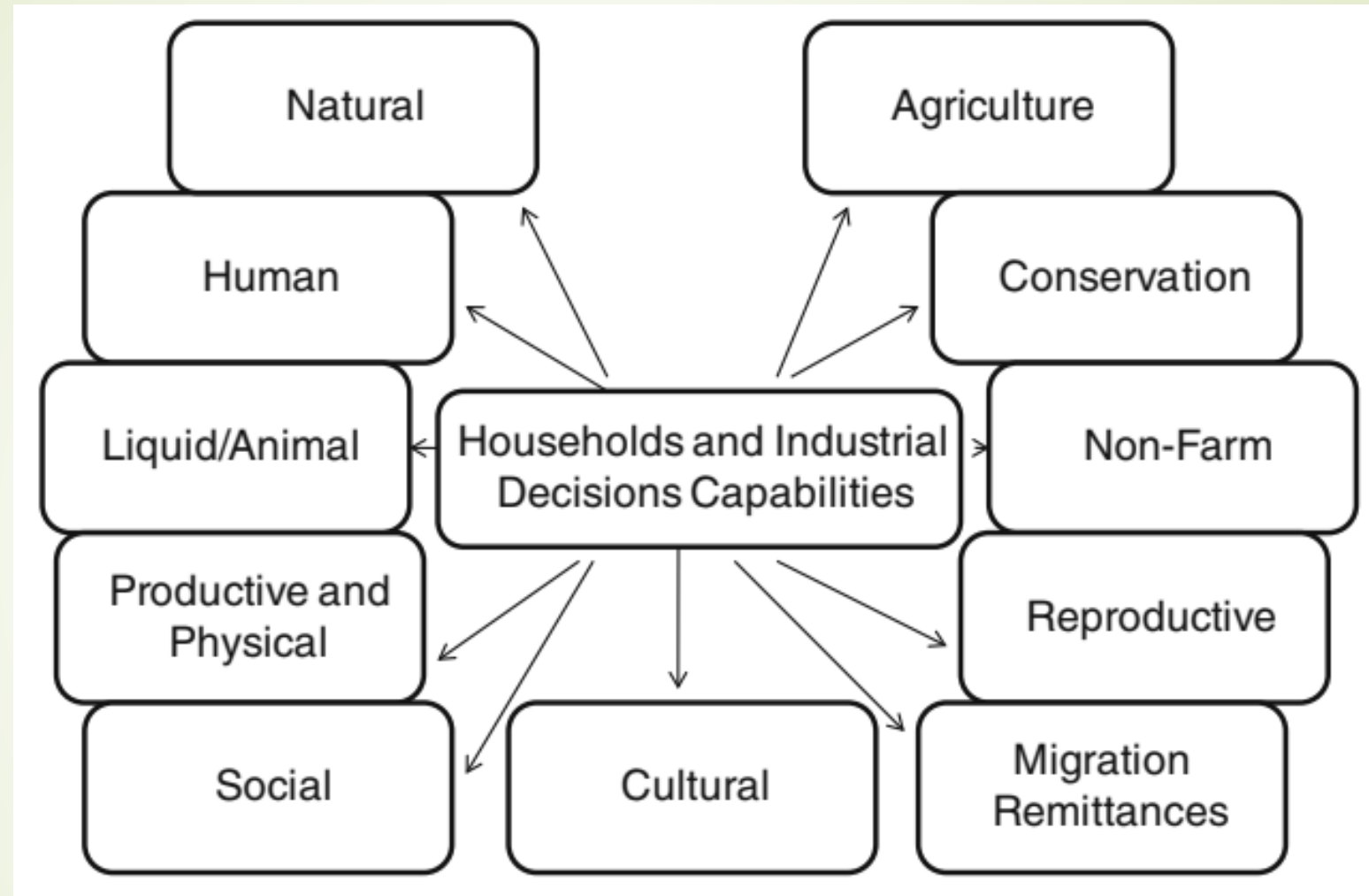
- ▶ Apple cultivation belt has been shifted greatly to higher elevations, same as, citrus, nut-stone fruits and other agricultural crops.
 - ▶ Due to continuous changes in climatic conditions and as the temperature is increasing in the valleys and mid-altitudes, the pine forests have been shifted towards higher elevation and they have already invaded the areas where oak forests were grown.
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Livelihoods and Mountain Livelihoods

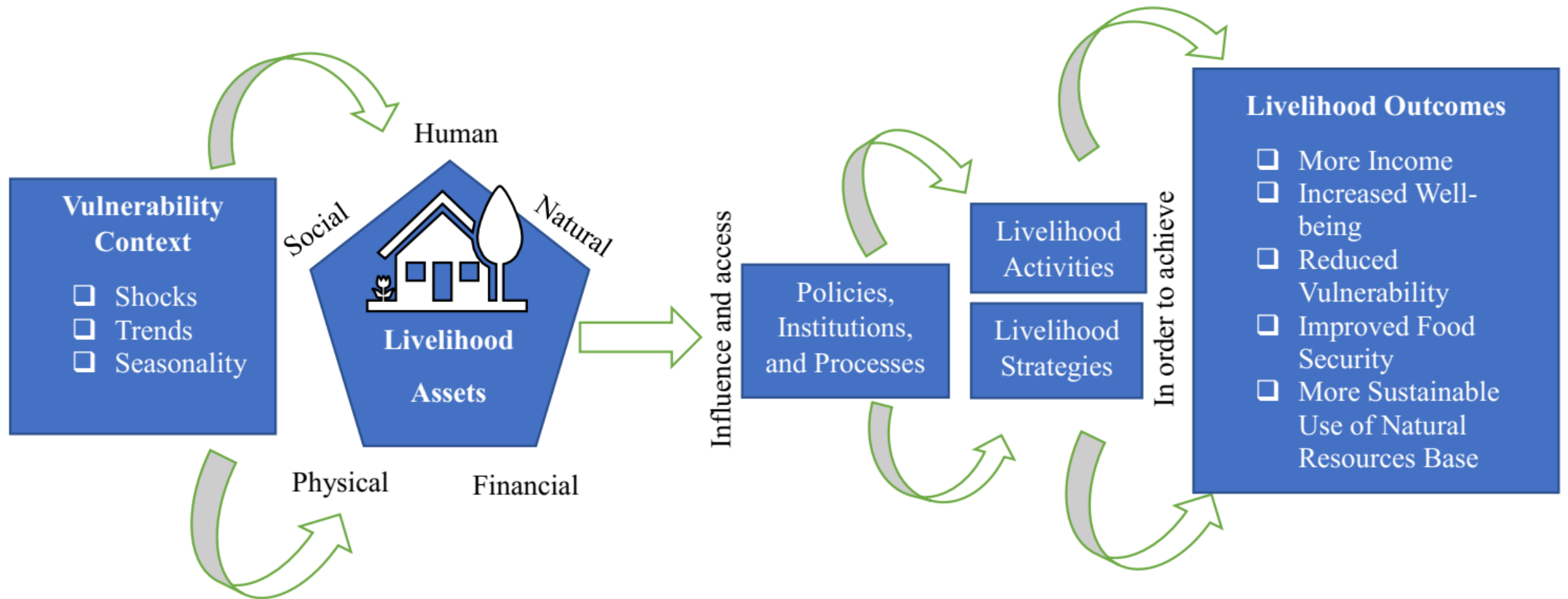
- Most of the people living in mountain regions are economically vulnerable and socially backward.
- Among the mountain communities cultural and traditional diversity is high.
- Mountains have ecological, aesthetic and socio-economic significance both as natural ecosystems and as people's living place.
- Mountain people depend on subsistence agriculture, wage labour, circulatory labour migration, tourism, and mountaineering services for survival.
- Most households survive on a combination of livelihoods.



*“A livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable which is capable to cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide the next generation with sustainable livelihoods; and which offers net livelihood benefits at local and global levels and in short and long-terms.”
(Chambers & Conway, 1992, p.7)*



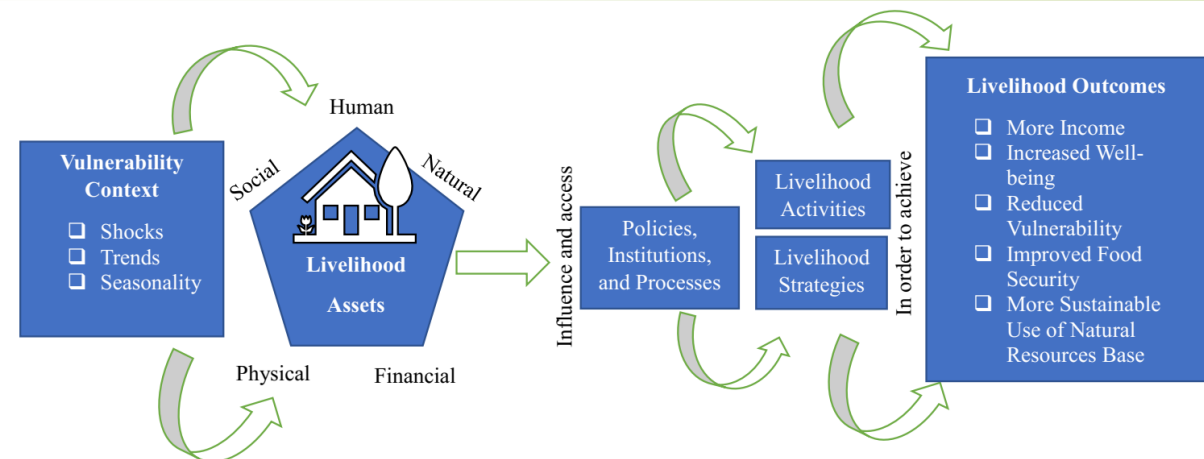
Livelihood strategies: assets, decision and activity portfolios



Sustainable livelihood framework (DFID, 2001)

Sustainable Livelihood Framework: Key Components

- (1) livelihood assets
- (2) vulnerability
- (3) transforming structures and processes
- (4) livelihood activities and strategies, and
- (5) livelihood outcomes



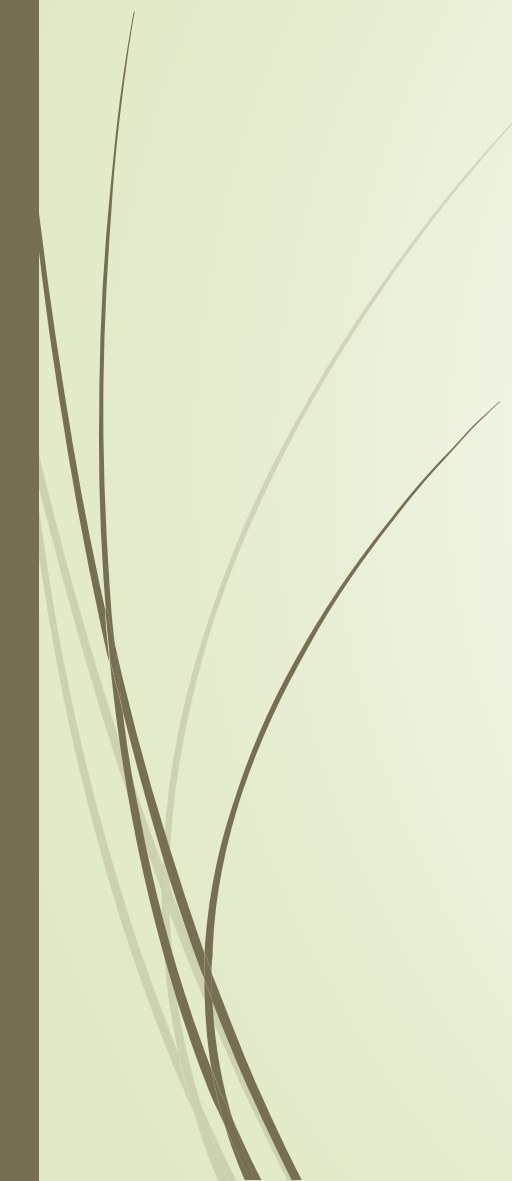



Livelihood Analysis

- Livelihood analysis refers to finding out the degree to which the pattern of life differs from one social class to another social class in terms of size of the family, type of house, technology adoption pattern, size of land holding, annual income, sources of income, food habits, expenditure pattern, indebtedness, type of animals owned, migrants in the household, seasonality of variation, crisis management pattern etc.
- In reality, livelihood analysis analyses multiple activities (Chambers, 1992).



Variables for Livelihood Analysis

- Household size and composition
 - Number of labour migrants in the household
 - Livestock and land ownership
 - Proportion of income by source
 - Expenditures
 - Seasonality
 - Relative income
 - Credit and debt
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$$\begin{aligned}\text{Livelihood Sustainability Index (LSI)} &= X(x^1 + x^2 + x^3 + x^4) \\ &\quad - Y(y^1 + y^2 + y^3 + y^4 + y^5) \\ &= XY\end{aligned}$$

where X stands for household income that includes $x^1 =$ income from farming, $x^2 =$ income from business, $x^3 =$ income from government service and $x^4 =$ income from labour. Further, Y stands for household expenditure, $y^1 =$ for food, $y^2 =$ for shelter, $y^3 =$ for cloth, $y^4 =$ for education and $y^5 =$ for others. $X - Y$ is equal to XY , i.e. saving. The objective towards formulation of this index was to understand the level of sustainability in livelihood.



Household Income (X) & Household Expenditure (Y)

- The major sources of livelihoods comprise agriculture, daily wage labour, jobs, artisanry, pensions, animal husbandry and NTFP collection.
- Nearly a quarter of the income is spent on the purchase of food grains. Household supplies in the form of sugar, spices, edible oil, salt and cooking gas rank second in household expenditure.

Mountain Ecosystem Services and Livelihoods

- ▶ Mountain agroecosystems not only provide agricultural commodities such as food and fibre, but also help protect biodiversity, water, carbon storage, and landscape amenity.
- ▶ Global climate change scenarios suggest that there will be considerable impacts on ecosystems and their associated ecosystem services with serious consequences for the livelihoods of communities, particularly in the most economically challenged parts of the world.



Livelihood affected by Climate Change

- ▶ The world's poor lives in mountain regions, particularly in the developing countries. Mountain landforms trigger precipitation, which, coupled with the water-storage capacity of glaciers, give them a vital hydrological role.
- ▶ the climatic conditions have become less predictable, causing major impacts on traditional livelihood activities such as agriculture and animal husbandry

Major Constraints to Sustainable Livelihood


- Lacking in Infrastructural Facilities (both physical and social)
- Scarcity of water
- Poor road networks
- Lacking in Holistic Government Initiatives
- Frequent landslides

Major Constraints to Sustainable Livelihood

- Lack of Proper Marketing
- Lack of Training Programmes
- Absence of livelihood opportunities except tourism(in some areas)
- Limited Understanding of Mountain Environments and
- Climate change




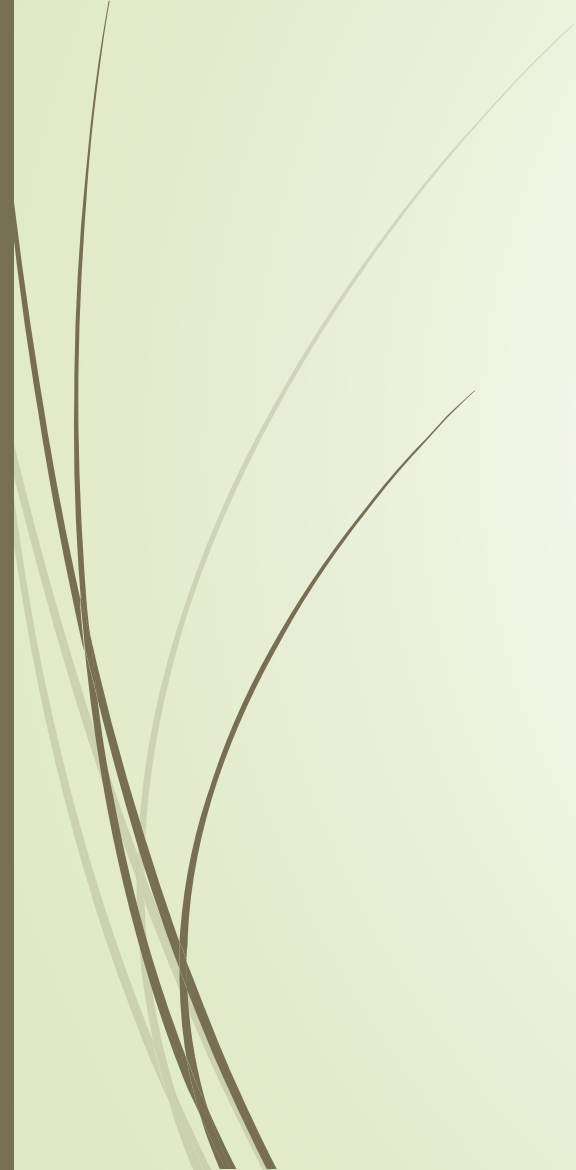
Prospects of Sustainable Livelihoods

- Development of infrastructural facilities such as transportation, hydroelectricity generation, hotels and housing without damaging the ecology of the region.
 - Management of forest resources for the well-being of mountain people should be the priority of the forest department as well as of the local government; for this purpose people's participation should be ensured.
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Prospects of Sustainable Livelihoods

- Sustainable use of natural resources and mountain niche products should be ascertained and natural resources should be properly managed.
 - Efficient and sustainable use of landscape, biospheres/ sanctuaries for the construction of dam, development of tourism and for the use of timber/non-timber forest products/ medicinal plants will ensure sustainable livelihoods and wellbeing of the marginal mountain people.
 - Education for better livelihoods through capacity building to absorb new technology and innovation.
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Thank You