Mountainous Regions: Spiral of Threats and Human Security Challenges

Colonel Yogesh Nair, VSM, PhD@

Introduction

Amountainous region with high peaks, deep valleys and difficult terrain is extremely significant as it forms one of the most essential bio-geographical assets of the nation state. About 80 per cent of the planet's fresh surface water comes from the mountain watersheds.1 In fact, most countries depend on mountain regions for a wide range of goods and services viz., water, food, hydro-electricity, timber, and mineral resources, besides providing opportunity for tourism and maintaining ecological balance. However, mountainous regions are characterised by unstable landscape, fragile ecosystem and geomorphological attributes. Weather in mountain areas is often severe which coupled with diverse anthropogenic dynamics operating in the ecosystem makes them highly vulnerable to natural hazards and disasters affecting human security in a big way. This paper attempts to analyse ecological threats and human security challenges emanating from mountains and suggest measures to combat them and evolve sustainable development approaches for mountainous regions.

Ecological Threats and Environmental Insecurities

Fragile Geology and Unstable Formations. The mountainous regions are weak, unsteady and geo-dynamically very active and are prone to landslides, rock fall etc. Caving in of land masses results in slippages of soil and rocks due to naturally occurring vibrations, water seepage, increase in soil load, weathering or human activities. Landslide results in blockade of roads/cutting off communication links, loss of productivity of agricultural/forest lands, flooding, destruction of property, injury to persons or even loss of life causing great human, economic and environmental disasters. In snow bound areas avalanches pose the greatest challenge for the locals and troops deployed in such areas.

Extreme Weather Conditions. Due to high altitude terrain, funnelling effect causing wind chill factor, heavy rains and snowfall in certain areas; cold climate perpetually prevails in the mountain regions. This has adverse effect on vegetation and geomorphologic features of mountains, leading to physiological stresses and deterioration of the region. Cloudburst and flash floods are other natural vulnerabilities that can cause landslides, debris flow etc. Their intensity and sudden occurrence in restricted time and space can create large scale devastation and havoc downstream.

Earthquakes. Mountains in India fall in the zone of high seismic activity and are therefore vulnerable to earthquakes which pose one of the greatest threats in the mountainous regions. Earthquakes can trigger landslides and flash floods, water contamination, debris accumulation, run down ecosystem and threaten livelihood. Earthquakes are one of the most destructive natural hazards which can dismantle buildings / infrastructure in seconds, causing sustainable injury or death of the inhabitants.

Human Induced Insecurities. Human activities such as deforestation, unorganised tourism, unsustainable agriculture, unplanned infrastructure development, excessive mining, species hunting, overfishing etc are some of the reasons for depletion of ecosystem. Similarly, construction of dams, unregulated population rise and climatic degradation due to human actions also contribute towards mountains' vulnerability and catastrophic hazards.

Peculiarities and Challenges of Mountainous Region

Mountain people are among the worlds poorest and most underprivileged. They suffer political, social and economic backwardness and lack access to basic services such as health and education. Mountain regions are easily subject to cascade of changes, due to high fragility of their environment with numerous natural thresholds. Some of the peculiarities and challenges of mountain regions have been analysed in the succeeding paragraphs.

Marginalisation. Mountain regions due to their remoteness and poor population density are mostly marginalised in comparison to plain areas. The people generally have little or no voice in national affairs, even on issues that affect their own resources or community directly. The development of infrastructure and services, especially in education, health and agricultural extension are slow and far from satisfactory due to inaccessibility of mountain areas. Lack of understanding of mountain regions results in poor policy formulation on the line of lowland systems which further aggravate the issues rather than creating a positive growth model.

Unplanned Development and Tourism. Unprecedented economic, environmental and cultural changes have been brought about by different agricultural, commercial and developmental activities. In their haste to catch up with their compatriots in the plains, mountain people are unhesitatingly embracing all-round changes, sometimes even jeopardising their unique environment and cultural heritage, creating new problems of pollution and degradation of natural resources. Besides the ills of unplanned development activities, the beautiful hill stations attract millions of visitors as tourists which results in further deterioration of the distinctive character of the mountains.

Degradation of Land and Natural Resources. With integration of economy and commercialisation of mountain culture, there has been an unabated exploitation of natural resources. The exposure of intricate ecosystem of mountains to heavy population influx, unplanned growth and resource mismanagement has adversely deteriorated the health of mountain ecology. Similarly, detrimental land use practices, poor irrigation and overgrazing have led to rapid degradation of valuable land of mountain regions. Mining in the mountain regions is largely unorganised and unscientific and is known to cause land degradation.

Deforestation and Loss in Biodiversity. Industrialisation, agricultural expansion and over dependence on forest products for meeting the energy needs have resulted in large-scale deforestation in most of the mountainous regions. In an effort to increase agricultural production farmers have encroached upon forests and other environmentally fragile areas. Deforestation has also resulted in the loss in biodiversity due to trade in forest products, uncontrolled tourism and over exploitation of mountain regions for short term economic gains.

Mountains and Human Security Contributions

Mountains play a very important role for socio-economic future and well-being of mankind and for maintenance of ecological balance. Mountain areas are important source of cultural diversity, keepers of traditions, languages and customs that could represent key factors for sustainable economic development. Some of the security contributions of mountain regions have been analysed in the succeeding paragraphs.

Water Security. Mountain ecosystems play a significant role in regulating water quantity and quality. Almost all of the world's major rivers, originate in mountainous regions, and support the entire globe.2 The high-altitude cryosphere that stores huge amounts of water as snow and ice are unique reservoirs of fresh water and flow as perennial rivers, serving as a lifeline for billions of people downstream.3 For this reason mountains are often referred to as the 'water towers of the world'.4 Mountain hydrological services are also essential for groundwater recharge and related functions that maintain hydrological balance in downstream areas.

Energy Security. Hydropower and other forms of clean energy, such as wind and solar are becoming increasingly important all over the world to meet ever growing energy needs. Clean energy is needed to maintain economic growth in a sustainable way and to improve the living standards of the vast number of people who still depend on fossil fuels. Swift flowing mountain rivers are cost-effective sources of hydropower and need to be fully exploited. The Himalayan region, for example, has the potential to generate over 300,000 MW of hydropower and only nine per cent of this potential has been developed.5

Climate Security. Mountain ecosystems contribute in regulating global climate through biogeochemical and biophysical processes that mediate the carbon, energy, and water balance on the land surface.6 Because of the great depth, area and altitude of large glacier masses, mountains also assist in modifying the air circulation and regulating temperature of the region. The Himalayas influence the climate of the Indian subcontinent by sheltering it from the cold air mass of Central Asia and also exert a major influence on monsoon and rainfall patterns. They serve as a barrier for the moisture laden monsoon winds, preventing them from travelling northwards, thus facilitating timely and heavy precipitation in the southern part of the region.7 Mountain ecosystems also have a significant role in carbon storage and carbon sequestration.8

Environmental Security. Mountains are a repository of biodiversity, water, and other ecosystem services and their influence extends far beyond their geographical limits including the surrounding lowlands. Mountains support about 25 per cent of the planet's ecology, 50 per cent world's biodiversity hotspots and 32 per cent of global protected areas.9 Mountain forests cover account for 28 per cent of the world's closed forest areas encompassing significant assemblage of unique flora including some precious variety having usage in rare pharmaceutical products in the world market.10 Remote mountain regions serve as the last sanctuaries of many exceptional species of wild life and play an important role in safeguarding the endangered species. Thus, a mountain region plays a vital role towards development of green economy and human survival.

Cultural Security. Mountains provide a setting for cultural, religious and traditional living in the nature's ambiance harbouring a high degree of ethnic and linguistic diversity. For instance, more than 500 languages are spoken in the Himalayas, over 400 of which are spoken by less than 100,000 people, and most are in danger of extinction.11 Mountain populations also conserve vast indigenous knowledge about such subjects as agriculture, botany, medicine, and ecology. Mountain people are caretakers of natural resources, driven by the beliefs and behaviours of human communities, strengthened by their intimate connections to the natural environment that sustains them. They consider the mountains as sacred and the spiritual values of mountain cultures contribute towards continuing stewardship of watersheds and other mountain ecosystems.

Economic Security. Mountain ecosystem services make both direct and indirect contribution to mountain and downstream livelihoods and the economy. In terms of direct contribution, mountains provide a large share of the world's resources for mining, forestry, water for drinking and irrigation, and energy in terms of hydropower and wind. Mountain products and services form the basis for many economic sectors viz.; food, pharmaceuticals, agriculture, forestry, hydropower generation, tourism and other range of products and services. Mountain range land and forests provide economic benefits to local people and global communities through medicinal plants, timber, firewood, and minerals. Indirect contributions to national, regional, and global economies include the support and regulation of ecological functions and processes, such as carbon control, soil conservation, flood control, climate moderation, and wind and monsoon regulation.

Food Security. By 2050, the global population is expected to increase to nine billion and the challenge of feeding a growing population is daunting.12 While all economic sectors depend to some degree on ecosystem services, agriculture has the most intimate relationship with nature. The unique diversity to include water sources, ground water recharge capabilities, climate regulation, wetland ecosystems etc., preserved in mountain ecosystems, helps to ensure the world's future food security. Thus, a sustained flow of mountain ecosystem services is critical for feeding the growing world population.

The Way Ahead

Due to increased deterioration of ecosystems and isolation of mountain regions; the native population has become poorer and has progressively lost control over their subsistence base of resources. Therefore, mountains merit special consideration for building sustainability and equity across affected sectors. Sustainable mountain development requires a long-term vision and holistic approach that integrates political, economic and environmental aspects, multistakeholder cooperation and forward-looking institutions. Some of the measures deliberated upon during United Nations Conference on Sustainable Development (UNCSD or Rio+20) and other forums have been analysed in the succeeding paragraphs.

Poverty Reduction. For long lasting and effective resolution, it needs to be ensured that mountain populations receive

full compensation for the ecosystem goods and services they provide to enhance their livelihoods and reduce poverty in mountain areas and to prevent migration. This will also ensure sustained flow of these goods and services for the benefit of all. Policies need to be formulated to factor in the role of mountain people in decision-making processes for the development of mountainous areas.

Balancing Conservation and Development. Mountain ecosystems are often fragile. Protecting their integrity is key to securing the provision of critical goods and services. However, the development of most of the mountain areas frequently lags behind that of other regions. Mountain areas are often the site of unsustainable investments and damaging extractive industries. There is a need to maintain balance between conservation policy and development programme. This can be achieved by combining the use of high end environmental friendly technologies and products, local material/practice and targeted investments.

Integrated Resource Management Strategies. Given mountains' key role in providing water for domestic and commercial use, ensuring food security and supporting green energy, national and regional bodies must develop integrated water resource management strategies. These strategies should be based on a multidisciplinary approach that embeds mountain centric policies and action within the overall goal of sustainable development.

Environmental Governance to Institutionalise Green Economy. A green economy in the region has to rely on a strong natural resource base to include water, biodiversity, forests and clean energy sources. These resources need to be managed as public goods, in line with the principles of good governance and social equity and involving local communities in accounting for the full value of ecosystem goods and services. This includes reorganising marginal mountain communities' role in environmental stewardship. The private sector can play an important role in the development of mountainous region. Incentives should be provided for green initiatives and other innovative financing ventures that follow principles of corporate social responsibility.

Climate Change Adaptation. Climate change is already affecting mountain ecosystems, production systems and related livelihoods. The need for coordinated efforts to support measures of adaptation to the expected impacts at the local, national and regional scales is widely recognised. Hence implementation of national adaptation programmes with appropriate strategies of land-uses addressing the social and environmental effects of climate change in mountains and other areas need to be effective. These measures needs to include new technologies, encourage the exchange of mountain-specific traditional and innovative information and systems for sound decision-making, and establish appropriate information baselines and monitoring systems.

Disaster Management. Mountains are particularly vulnerable to the effects of natural disasters, such as avalanches, mudflows, floods, landslides and earthquakes, with consequences that often extend far beyond mountain regions. Individual countries need to prepare mountain-specific disaster risk management plans that integrate risk assessment, prevention, response and recovery. These plans could contain elements of a green economy, such as sustainable forestry and hazard-resistant road construction. Further, the plans need to suitably factor in employment of Army or establish institutions capable of successfully dealing with hazards and risk management.

Capacity Building. Lack of mountain-specific knowledge and processes leads to poor decision-making at all levels. Technologies and institutions that work well in lowland areas are often ill suited to mountain realities. There is a need to promote mountain-focussed regional centres of excellence with advance research and green technology development, enhance capacity building and institutional growth and generate policy advice tailor made for mountain areas.

Regional Cooperation. Regional cooperation is the key to developing a green economy and good environmental governance, and also to enhance access to the markets, finance and technology transfer. In order to make full use of this potential in a sustainable way, individual countries need to tap existing national and international finance mechanisms, explore partnerships and design green investment plans for mountain regions.

Conclusion

The mountain regions are unique natural expanse of great beauty and ecological value, and home of the head waters of major rivers. Efforts towards sustainable mountain development should not concentrate exclusively on mountains; they should be designed to benefit the entire river basin. The focus must be on actions that ensure the continued supply of mountain ecosystem goods and services that are critical to promoting a green economy in the all-inclusive area. Natural resource scarcity and inequitable distribution of benefits are emerging as major drivers of social conflicts. Adopting a mountain perspective in addressing national and regional issues thus becomes an issue of paramount importance and countries needs to pursue green development pathways for futuristic solutions.

Endnotes

1. Prince MF (2002); Mountain Waters, Voyager Press.

2. Bandyopadhyay, J; Kraemer, D; Kattelmann, R; Kundzewicz, ZW (1997); 'Highland waters: A resource of global significance'; New York, USA: Parthenon.

3. Barnett, TP; Adam, JC; Lettenmaier, DP (2005); 'Potential impacts of a warming climate on water availability in snow-dominated regions'; Nature 438.

4. Messerli, B; Ives, JD (1997); Mountains of the World: A Global Priority. New York, USA: Parthenon.

5. Tian, H (2011); 'Global mechanisms for compensating mountain ecosystem services; Paper presented at the International Conference on Green Economy and Sustainable Mountain Development, Kathmandu, 5–7 Sep 2011.

6. Woodwell, GM (2004); 'Mountains: Top down'; Ambio Special Report 13.

7. INCCA (2010); Climate change and India, A sectoral and regional analysis for 2030s; Ministry of Environment and Forests, Government of India

8. Piao, SL; Fang, JY; He, JS (2006); 'Variations in vegetation net primary production in the Qinghai-Xizang Plateau, China, from 1982 to 1999.

9. Singh, SP (2011); 'Mountain biodiversity and recreational ecosystem services in the context of green economy'; Paper prepared for the International Conference on Green Economy and Sustainable Mountain Development, 5–7 Sep 2011, Kathmandu, Nepal.

10. Price, MF; Butt, N (2000); Forests in Sustainable Mountain Development. Wallingford, UK: CABI.

11. Turin, M (2007); 'Linguistic diversity and the preservation of endangered languages', Talking Points; Kathmandu, Nepal: ICIMOD.

12. MA (Millennium Ecosystem Assessment) (2005) Ecosystems and Human Well-Being: Synthesis report. Washington, DC, USA: Island Press.

@Colonel Yogesh Nair, VSM, PhD was commissioned into the Corps of Engineers on 10 Dec 1996. He is an M Tech in Civil Engineering and PhD in Political Science. Presently, he is posted as Colonel (Works and Planning) in Bhutan.

Journal of the United Service Institution of India, Vol. CXLV, No. 601, July-September 2015.