

QUALITY OF THE ENVIRONMENT IN MOUNTAIN AREAS AND SUSTAINABLE USE OF MOUNTAIN RESOURCES

DOI: <http://dx.doi.org/10.18509/GBP.2015.25>

UDC: 502.131.1(23)

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ABSTRACT

People living in mountain areas are generally much more aware of the limitations of their environment due to the limited space for the settlements set up and the economic activity and that is related to the configuration of the terrain. In this paper, it will be analyzed the problems concerning the quality of the environment that most mountain areas are facing, such as natural disasters, mining, water management, soil loss, endangered species, plant and forest cover, land use and climate change. It will be analyzed the problems that are facing some of the mountainous areas such as transportation, human settlements and tourism, which mostly have local character. The guidelines for the sustainable use and management of limited mountain resources will be given at the end of the paper.

Keywords: mountain areas, environment, sustainable use, mountain resources.

INTRODUCTION

Mountains occupy 24 per cent of the global land surface and host 12 per cent of the global population [1]. The mountain areas with its morphological structure and striking height character, constitute a factor or a modifier of numerous natural (geology, climate, hydrography, pedology, flora, fauna) and socioeconomic (settlements, population, economy, culture) characteristics of the Geo-space [2]. The mountains represent an important source of water, energy and biological diversity. Furthermore, they represent a source of such key resources as minerals, forest products and agricultural products and of recreation. Mountain ecosystems are, however, rapidly changing. They are susceptible to accelerated soil erosion, landslides and rapid loss of habitat and genetic diversity. On the human side, there is widespread poverty among mountain inhabitants and loss of indigenous knowledge. As a result, most global mountain areas are experiencing environmental degradation. Hence, the proper management of mountain resources and socioeconomic development of the people deserves immediate action. Just over a decade ago, the world's mountains had been a topic of interest to a relatively small number of scientists, development experts and decision makers, as well as mountaineers. The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, presented a unique opportunity to move mountains onto the global stage, through the inclusion of a specific chapter in Agenda 21. [1]. Chapter 13 of Agenda 21 is entitled "Managing fragile ecosystems: sustainable mountain development," and includes two "program areas": A. Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems; and B. Promoting integrated watershed development and alternative livelihood opportunities. [3]. In 1998, the UN General

Assembly re-emphasized the importance of the world's mountains by declaring the year 2002 as the International Year of Mountains [1]. A significant number of countries have realized the importance of mountain resources for sustainable development. They have formulated policies and laws in specific sectors such as watershed management, forestry, tourism, energy, transport and infrastructure development. However, most of these policies were elaborated from a downstream perspective. They perceive mountains as "hinterlands" that supply specific resources needed by the national economy and society. For these reasons, it requires appropriate initiatives and tools for sustainable use and management of mountain resources [4].

PROBLEMS CONCERNING THE QUALITY OF THE ENVIRONMENT

Natural hazards

Mountains are greatly affected by destructive natural processes. Shifting tectonic plates cause earthquakes and volcanic eruptions, while heavy rains and snow on steep slopes produce avalanches, landslides, debris and mud flows and floods. [2]. When combined with human interventions, particularly the construction of infrastructure and settlements in hazardous areas, such events turn into disasters causing damage, destruction, injuries and death.

Mining

Mining can bring large benefits, but it can also be devastating to fragile mountain ecosystems and local cultures, destroying the livelihood base of mountain communities. The mining of metals and minerals represents a large range of activities, which include primary (extraction) and secondary (milling, processing, refining, and waste disposal) phases [5]. Massive quantities of waste, surface dumps and slag heaps are only the most visible consequences. Mining leads to atmospheric pollution, the loss of biodiversity and vegetative cover and the water pollution. Short-term investments and the presence of immigrant workers can lead to social disintegration and disruption. The challenge is to balance mining opportunities with environmental and social responsibility, and to ensure that traditional mountain cultures are protected. While new mines today are generally subject to strict environmental controls, older mines and areas abandoned after earlier mining continue to present serious environmental problems.

Water Management

Mountains are often the major water sources for surrounding continental areas. The European mountains, for example, provide about 50 percent of the water for the river systems [6]. An accumulating snow pack in the winter melts in the spring and summer, helping to even out the runoff through the year. Dams are often built in mountain areas to generate hydroelectric power and for flood control. Mountain lakes and streams are naturally poor in nutrients and are particularly susceptible to pollution. The water that comes from the mountains connects the mountains and plain communities where it provides water for irrigation, food production and home use.

Soil Loss

Accelerated soil erosion is a common and environmentally destructive consequence of development, especially in mountain regions. Soil erosion is of special concern in agricultural lands, but agriculture is only one of many development activities that greatly accelerates soil erosion processes. Road building, trail use, excavation, extractive

activities, and construction also can cause severe soil erosion [7]. Steep mountain slopes are particularly susceptible to soil loss through erosion if the vegetation cover is damaged or removed. The soil is very slow to regenerate in mountain areas, so eroded areas may be permanently degraded. The productive soil is not only lost from the mountain slopes, but it pollutes streams, reducing habitat for fish, and fills lakes and reservoirs. Many dams have lost their usefulness prematurely because the lake behind the dam is filled with sediment from upstream, and that way it is reducing its capacity. In an extreme case, denuded mountain sides may cause landslides, cutting roads, burying villages and damming rivers, with the possibility of later catastrophic flash floods downstream, when the dams finally break.

Plant and tree cover

The mountains are rich in plant and tree cover. In the past and in some parts today, the area under grass cover is intensively used as for pasture also for livestock grazing by the local population. More recently, the reduction of livestock and reduced agricultural activities are noticeable restoring forest vegetation on abandoned agricultural land through natural regeneration. The forests have environmental (produce oxygen, purify the air, producing biomass, etc.), economics (an irreplaceable natural resource that primarily provides wood and other forest products) and social function (with their beauty and wealth contribute to the development of tourism). Forest fruits and medicinal herbs most commonly used as a food, but some of them as a drug. In terms of economic and other crises such forest fruits can have social significance of income and livelihood of the population in mountain regions [8]. The non-planning activities in the economy can cause change of vegetation through the destruction of certain areas and their conversion into arable land, orchards, vineyards and more. The illegal (non-law) cuttings in the forest and fires also cause major damage on forests as well as on the overall biodiversity. Furthermore, excessive or improper picking of medicinal plants, mushrooms, seeds and forest fruits can cause destruction or endangerment of species.

Endangered Species

The problem of the conservation of nature is particularly critical on mountains where limited populations may be particularly vulnerable to over-exploitation or changing environmental conditions. High altitude species may have been restricted to small mountain areas, and have nowhere to go if their habitat is damaged [9]. While a number of countries have made great efforts in setting aside protected areas, the needs far exceed the means. Visitor impacts need to be managed carefully to avoid degrading the fragile mountain environment and losing the species for which protection was intended.

Climate change

Climate change is one of the most important global challenges affecting mountain ecosystems. Mountains host the most visible and sensitive indicators of climate change – the melting of glaciers – and many scientists believe that the changes occurring in mountain ecosystems may provide an early glimpse of what could happen in lowland environments. Mountains can therefore be considered as early warning systems [2]. Climate change is likely to increase the occurrence and intensity of extreme weather events. Storms, heavy rainfall, heat waves and glacier melt will amplify hazards in mountain areas worldwide, while the melting of glaciers and the upward movement of permafrost will release loose rock and soil, aggravating the risks of rock falls, debris and

mud flows, and glacial lake outburst floods. Prolonged periods of higher temperatures will increase the incidence of droughts and fires, leaving some regions prone to desertification [10].

Human Habitat

The mountain villages are mostly characterized by poor road infrastructure, water supply and sewerage infrastructure. The supply of basic groceries is difficult, and a major problem is the absence of administrative buildings, hospitals and veterinary stations. In these areas the household waste is often dumped into nearby valleys and streams.

Transport

Transportation is always a challenge in the mountains. In rural areas, walking and pack animals may still be the primary form of transport, making it difficult to bring goods into the villages and to take products to market. Roads and railways are expensive and difficult to build up on the steep mountain valleys. Tunnels and bridges are often necessary. Conventional approach of road building with cut and throw practice has caused significant mass wasting and has created a landslide of hill slope. For having the roads, any type of adverse environmental damage was acceptable to the implements. Local people, with innocence and ignorance, wanted roads and accepted all types of evil practice to have a road in their village. They thought, perhaps to have the road, land degradation, landslide, side tipping of ruthless excavation with cut and throw is acceptable and this might be the only way to build a road. Soil loss occurs in various stages of road building, i.e. quantity of excavated mass, shear failure in downhill on the road due to the additional load of tipping soil, landslide due to unstable slope created due to cut the height in the mountainside of the road and soil erosion during operation of roads [11]. Heavy snowfall, avalanches, landslides and floods may block the roads. Communities may be totally isolated. Helicopters may have to be used in emergencies.

Tourism

Mountain areas are second only to the coasts and islands as popular tourism destinations, generating 15-20 percent of annual global tourism. Tourists are attracted to mountain destinations for many reasons, including the climate, clean air, unique landscapes and wildlife, scenic beauty, local culture, history and heritage, and the opportunity to experience snow and participate in snow-based or nature-related activities and sports [12]. Tourism can have a range of impacts on mountain ecosystems, communities and economies. While many of the impacts are negative, tourism can also generate positive impacts as it can serve as a supportive force for peace, foster pride in cultural traditions, help avoid urban relocation by creating local jobs, increase visitor awareness and appreciation of natural, cultural and historical values and assets. In some mountain areas, tourism is now replacing agriculture as the primary economic activity. While summer hiking and mountaineering have limited environmental impacts, winter sports such as skiing require construction of the ski lifts and clearing of slopes which can seriously modify the mountain environment [2]. The concentrations of seasonal populations of tourists can overstretch water supplies and waste disposal facilities, and require construction of hotels and other facilities that may be only seasonally occupied. The employment created for mountain inhabitants may also be only seasonal, but can help to maintain communities that otherwise, might be depopulated.

SUSTAINABLE USE OF MOUNTAIN RESOURCES

The above mentioned problems, one way or another, all contribute to the most critical environmental issue facing mountains: the sustainable use and management of their limited resources. All the stakeholders involved – people living in the mountain, the private sector, politicians and other decision-makers – are responsible for using natural resources wisely and considering the particular characteristics of upland ecosystems [2]. The crucial role of mountains in the global water cycle results in careful management of water resources. Management of water resources needs to be adjusted accordance with the different climate zones. Where abundant, water resources should be used to the maximum that besides meeting the basic needs of the population, it should be used to make electricity for example.

In areas where water resources have less capacity, it is necessary to build reservoirs for the accumulation of water. In many regions are constructed modern irrigation systems, in order to overcome the difficult terrain and the distance between the source of water and the user. As water becomes increasingly scarce in many parts of the world, equitable distribution systems and improved water-use efficiency is indispensable.

The reduction of erosion and nutrient loss is an important priority in mountain areas. Good protection provides adequate coverage and trees with dense foliage and expanded root system. Other measures for preventing degradation and increasing the fertility of mountain soils includes reducing slope lengths and angles through different forms of terracing; controlled grazing; diversified cropping systems; intercropping; zero-tillage; and the planting of nitrogen-fixing plants along contour lines [4].

Deforestation of large areas or construction of access roads can lead to destabilization of entire mountain hillsides and erosion. Mountain forests it is necessary to be managed by ecosystem approach, taking into account the different functions of forests.

The sustainable management of natural resources in mountain areas requires significant effort and investment and imposes a heavy workload on local people. People living in the mountain should therefore participate in the search for sustainable solutions, to ensure that they will be economically viable and socially acceptable. Indigenous communities' knowledge and experience have to be fully considered and recognized, and the causes and impacts of unsustainable natural resource management carefully assessed [2]. The ecological consequences of unsustainable natural resource management and land-use practices often have underlying causes of a social, political or economic character and have to be considered.

REFERENCES

- [1] Price F.M. Key issues for mountain areas, Edited by Martin F. Price, Libor F. Jansky, and Andrei A. Iatsenia a United Nations University Press, 2004, p.p. 11-17.
(<http://archive.unu.edu/unupress/sample-chapters/MountainAreas.pdf>)
- [2] Food and Agriculture Organization of the UN – (FAO). Why invest in sustainable mountain development, Rome, 2011, p. p. 1-84.
(<http://www.fao.org/docrep/015/i2370e/i2370e.pdf>)
- [3] United Nations Environment Programme – (UNEP). Agenda 21, 2013
(<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52>)
- [4] Mountain Agenda. Sustainable Development in Mountain Areas, The Need for Adequate Policies and Instruments, 2002.
(http://www.cde.unibe.ch/CDE/pdf/Mountains%20of%20the%20World-all_2002.pdf)

- [5] Cooke J.A. and Johnson, M.S. Ecological restoration of land with particular reference to the mining of metals and industrial minerals: A review of theory and practice, *Environ. Rev.* Vol. 10, 2002. p. p. 41-71
- [6] Iyngararasan M., Tianchi L. & Shrestha S. The challenges of mountain environments: Water, natural resources, hazards, desertification and the implications of climate change, Mountain Forum e-consultation, Mountain Tourism and the Conservation and Maintenance of Biological and Cultural Diversity, Bishkek Global Mountain Summit, UNEP, 23-28 April 2002.
- [7] Harden C.P. Soil Erosion and Sustainable Mountain Development, *Mountain Research and Development*, 2001, 21 (1): 77-83
- [8] Duguma Alemayehu L., Gratzner G., and Price F. M. Values of biodiversity, Mountain Forests in a Changing World - Realizing Values, addressing challenges. Published by FAO/MPS and SDC, Rome, 2011, p. p. 28-35 (<http://www.mountainpartnership.org/>).
- [9] Hamilton, L. S. Protected areas in mountains, *Pirineos*, 2006, 161. (<http://proyectos.ipe.csic.es>)
- [10] Beniston M. Climatic change in mountain regions: A review of possible impacts, *Climatic Change* 59, 2003, p. p. 5–31.
- [11] Shrestha H. R. Harmonizing Rural Road Development with Mountain Environment: Green Roads in Nepal, SCAEF Nepal. 2009.
- [12] UNEP. Tourism and Mountains, A Practical Guide to Managing the Environmental and Social Impacts of Mountain Tours, 2007.