The Himalayas as the Providers of Essential Ecosystem Services – Opportunities and Challenges

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Mountains occupy 24% of the global land surface area and are home to 12% of the world's population (GTOS 2008). Mountains have significant ecological, aesthetic, and socioeconomic importance not only for those living there but also for people living beyond. About 10% of the world's population depends directly on the use of mountain resources for their livelihoods and well-being, and an estimated 40% depends indirectly on them for water, hydroelectricity, timber, biodiversity and niche products, mineral resources, recreation, and flood control (Schild 2008). Despite their important contribution, mountains are still marginalised in the development agenda. Although the importance of ecosystem services arising from mountains is recognised, approaches to economic valuation of services and payment mechanisms in mountain areas, which are needed to comprehend and realise the benefits, have yet much not been developed (Rasul *et al.* 2011).

The Hindu Kush Himalayas (HKH) range spans over 4.3 million sq km with varied geographical terrain and has many unparalleled characteristics. It is often referred to as the 'Third Pole' and 'Water Tower of Asia' regulating the flow of ten major river systems. The region is home to many diverse ethnic communities speaking about 1000 languages and dialects with enormous socioeconomic and cultural diversities. It is endowed with diverse farming practices and rich natural resources including global biodiversity hotspots that form the source of ecosystem services directly to more than 200 million people living in HKH and indirectly to 1.3 billion people living in the down-streams with the countries benefiting from food and energy produced in the river basins totaling to 3 billion people (Schild 2008).

Ecosystems are capital assets that provide a wide range of services. These include supporting services that maintain the conditions for life; provisioning services that provide direct inputs to livelihoods and the economy; regulating services such as those that provide flood and disease control; cultural services that provide opportunities for recreation, spiritual or historical sites; and supporting services that sustain and fulfil human life (MA 2005). Increasing demands on ecosystem goods and services are now putting pressure on the natural resources that they contain. On the one hand mountains are gaining in importance as a result of recognition of their ecosystem services, while on the other there is a need to develop sound methodologies in valuing them in order to realising the benefits (Rasul *et al.* 2011).

Climate change has emerged as most prominent force of global change however it is embedded in the matrix of drivers including globalization, population growth and local land-use cover change. While climate change is the product of globalization and mitigation implies global norms and measures, mountain systems prove highly fragile and particularly sensitive to the climate change. Despite the fact that mountains generally contribute virtually nothing to the output of carbon and other polluting gases they are a central climate regulatory system and at the same

time are particularly affected. Responding to climate change calls for very specific tailor-made solutions (Schild 2008).

There is need for mountain systems to be viewed in the frame of climate change and enhanced ecosystems services. This paper highlights and analyses the impacts of global summits and conferences in relation to the mountain agenda, marginalization of mountain systems, climate change and biodiversity, mitigation and adaptation, the scientific uncertainty and knowledge gap, and finally on the opportunities arising from the Rio+20 process and conference in 2012.

1. The 1992 Rio Conference and its Impacts

The global community recognised the importance of mountains at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, which led to the inclusion of Agenda 21 in Chapter 13, which relates to sustainable mountain development. Chapter 13 Agenda 21 sets the scene by stating the role of mountains within the global ecosystem and expresses serious concerns about the decline in the general environmental quality of many mountains (UNEP 1992).

The Rio Conference delivered in its agenda 21 a framework for the future orientation of policy makers and planners. The mountains received for the first time an official recognition as ecosystems deserving a special recognition. What will the situation be in 2012? Will the mountain systems appear as deserving a special chapter?

What has been the special focus of chapter 13? Basically the focus has been largely on natural science. The conference proceeded by recognizing “Mountains of the World” and their importance for global goods and services. It highlighted the most important ecosystem services especially dealing with forests, watershed development, soil conservation etc. The initiative of the government of Switzerland subsequently converted to the champion of the mountain agenda. In this initiative there was an eminent role of the Professors Bruno Messerli and Jack D. Ives especially in the preparation and documentation. Initiative was based on a scientific analysis carried out by industrialized countries but with clearly a global vision. The summit resulted into many UN Conventions such as climate change (UNFCCC), biodiversity (CBD) and combating desertification.

What has been the impact? How far has chapter 13 managed to influence the action and the national and international agenda? We observe an impressive number of follow up initiatives for example that the UN General Assembly every two years votes a declaration in favour of the mountains. The World Summit on Sustainable Development (WSSD) in Johannesburg especially considered on ‘How to operationalize the Chapter 13?’ The International Year of Mountains in 2002 observed events like WSSD, Adelboden Conference and finally culminated by The Global Mountain Conference held in Bishkek of Kyrgyzstan. These efforts of 2002 helped in the creation of Mountain Forum, and later Mountain Partnership emerged which is hosted by FAO.

What was the consequence on the development agenda? These initiatives hardly influenced the international development agenda. This was dominated by globalization and macroeconomic stability with related topics of structural adjustments, human rights, debt crisis, Millennium Development Goals (MDGs). The policy instruments (example PRSPs) were strengthened in country wide approaches without differentiating the changing regional needs. Industrialized countries became growingly concerned with the consequences of growth and environmental hazards due to industrialization. There now prevailing global concerns focus on economic growth, macroeconomic stability, trade liberalization, communication, privatization, deregulation, and structural reform.

Mountain agenda experienced the fate of increased isolation, marginalization and fragility. In the development programme basically the same recipes were applied for mountain and non mountain areas which largely ignored the mountain specificity consequently impact on development was nominal. Therefore the 'Sustainable Mountain Development (SMD)' remained largely marginal limited to the concern of a small group of professionals, mainly the scientific community. The politicians and the development agenda did not follow development in science!

2. **Climate Change and Biodiversity in Global Agendas**

After the Rio UN Conference in 1992 the 'Sustainable Mountain Development' remained marginal and never reached the desired impetus in the global agendas. However, the three UN conventions on climate change (UNFCCC), biodiversity (CBD) and **combating** desertification have substantially moved forward. The UNFCCC became gradually more prominent with the established and importance given to its secretariat designated as the Intergovernmental Panel on Climate Change (IPCC). The IPCC fourth assessment report for the first time brought in limelight a common view of the scientific community (IPCC 2007). The Kyoto Protocol put forward the internationally agreed framework for the reduction of green house gases. The follow up conferences of Parties in Bali, Copenhagen and Cancun did not achieve any international breakthroughs, but they created financial instruments for the promotion of mitigation and funding of adaptation to climate change.

In the assessment reports and above mentioned conferences mountain systems are mentioned only randomly, if at all. The HKH region in spite of its importance in providing global goods and services is not getting anything more than journalistic coverage. The fact is that very little and only scarce research is done in the Himalayas. The post colonial period continued to consider mountain with benign neglect, as part of a military defense bulwark or as the home of none integrated hill tribes. The unavailability or inaccessibility of reliable data has its consequences till the present day. The lack of scientific data certainty lead to the controversy on glaciers in 2009 for example the AR 4 mentions of 500,000 sq km of glaciated surface in the HKH region (IPCC 2007). However the most published area coverage is about 110,000 sq km. A detailed study by ICIMOD shows glaciated area coverage of 60,000 sq km (ICIMOD 2011 unpublished).

The Convention on Biological Diversity (CBD) has been more discreet on developing a 'Programme of Work on Mountain Biodiversity (PoWMB) in 2004. The PoWMB invites the Parties to the CBD to adopt outcome-oriented targets for mountain biodiversity, taking into account the Strategic Plan of the CBD, the Global Strategy for Plant Conservation, the Plan of Implementation of the WSSD, and the MDGs. In the process, many international legal instruments relevant to conservation, benefit sharing, and the protection of the rights of indigenous local communities have evolved. Although there are still unresolved issues associated with rights and responsibilities, the CBD has made it difficult to ignore the enormous challenge of biodiversity conservation and the crucial role of local knowledge and local custodians in maintaining and managing natural resources. An analysis of ICIMOD on the paradigm shift in the policy on biodiversity management and convergence of policy with practice of the HKH provides an understanding to guide biodiversity agenda in the future (Sharma *et al.* 2010)

The concept of biodiversity corridors got prominence in the 10th Conference of Parties in 2010 at Nagoya, Japan. During this conference mountain biodiversity including the use of natural resources received that attention of global players who led to declarations on making use of environmental goods part of the national accounting. In addition the idea if creating an international CBD panel will give a new impetus to biodiversity related global agendas.

The debate on the consequences of climate change has created a new awareness for the role and importance of mountain systems. However, science has not followed the political agenda!

3. Economic Development and Relevance to Mountains

What are the frame conditions which have brought about changes? The last twenty years have been characterized by economic growth, which has implications in increasing demand and pressure on ecosystems and resources. Growth has not been evenly shared among the countries or within a country. A number of national economies particularly in Asia have brought a new dimension to the equation north-south equaling to rich-poor. Particularly India and China have emerged as new global economic power houses.

Mountain systems have benefitted only marginally from this situation. The policies also in the mountain countries were focusing growth. Yet, with the growing awareness of the scarcity of resources (freshwater) the effects of climate and the relevance of the ecosystem services of mountain systems became a focus of attention. However, the approaches of economic valuation of ecosystem services and payment mechanisms in mountain areas are needed to comprehend and realize the benefits (Rasul *et al.* 2011).

Recently, it is realized that the development has brought a stronger differentiation relevant and required for mountain areas. While change in the mountain systems in the subtropical zones (namely in Asia, Africa and Latin America) have a direct influence on the livelihoods and food security of the millions of people, mountains in industrialized countries are much more perceived as an areas of tourism and recreation. Mountain systems in subtropical zones brought new

criteria for the relevance of the mountains that increases vulnerabilities and reduces food security in the downstream areas if they are not managed sustainably which consequently has impacts on the livelihoods of more than billion people in the case of the HKH.

4. Mountain Systems - Challenges and Opportunities

The mountain systems of the world have not been receiving the deserved attention which has increased their marginalization. The enormous economic growth, the dynamic development of communication and transport with the globalization of international relations, the evolution of the mountains has taken place in function of the dynamics in urban centers. Rapid urbanization, a rural- urban continuum and migration lead an increased marginalization.

At the same time the relevance of the availability of freshwater, the importance of biodiversity and also 'in a world of globalization' - the relevance of identification with local values have given the mountains a focus and attention which the mountains never had in modern times. Melting glaciers, intensification of floods and extended droughts are the most visible and alarming signs. Compared to the situation during the Rio Conference in1992, now the mountain systems are seen as the providers of strategic ecosystem services, which are a prerequisite for food security and poverty reduction and a central argument for sustainable development. At the same time there is a shift observed, while the weakening of the mountain ecosystem services in moderate climate areas is creating inconvenience on the other strengthened in the case of Scandinavia whereas in subtropical areas changes are reducing food security and can even be threatening to sustain life.

The growing awareness of the importance of mountain systems particularly of the Andean and HKH ranges gives new significance to the upstream- downstream relations. The question is how services from the mountains provided to the downstream are compensated or in other words 'what are the policies and strategies which make the services sustainable in the interest of the regional development?' The river systems having their origin in the HKH have their footprint in the food security of 1.5 billion people, and for energy security up to three billion people!

5. Climate Change Mitigation and Adaptation

Climate change is in recent times an additional driver of change particularly for mountain systems. On one hand mountains are particularly fragile and the vulnerabilities of particular importance for the mountain population. The increased awareness creates on the other hand also new opportunities. Of particular importance are the consequences and the instruments which are being discussed in order to reduce global warming and the impact on climate change.

Mitigation: Simplifying the discussion associated with the mitigation we often exclusively focus green house gases, whereas adaptation is associated with water. The reduction of green house gases require a long-term effort of global dimensions. Optimal measures will not hinder global temperature to increase during the coming fifty years. Mountain systems can be largely seen as suffering from factors generated elsewhere. The glaciers serve as an excellent indicator for the

measures reducing climate change. Glaciological research in the Himalayas is therefore not only in the interest of the regional countries but it also has a global concern!

Adaptation on the other hand has to start now with greater attention. While mitigation needs global agreements, adaptation calls for tailor made ecosystem specific measures. While the development agenda has been globalizing since the last thirty years, adaptation calls for mountain specific measures. For the first time there is political and diplomatic support for specific programs for mountain systems in the interest of a sustainable mountain development and in the interest of sustainable ecosystem services for the downstream populations.

In addition increasing evidence shows that the clear separation between mitigation and adaptation is not any more possible. Black carbon and tropospheric ozone are hazardous to health and also influencing the agricultural productivity and is contributing substantially to glacier melt. These short living aerosols (contrary to green house gases) can be reduced with appropriate measures. According to the present status of research such measures could contribute substantially to the slowing of earth warming in the coming thirty-to-forty years, i.e. before he global mitigation measures are kicking in. Reduction of the emission of black carbon is a mitigation measure. Contrary to green house gases they are also the product of non-industrial production. They are produced also locally by households through the burning of biomass, wild fires etc. Reducing black carbon therefore calls for action also in the mountain areas. Adaptation to climate changes need well targeted regionalized and localized strategies

6. The Rio+20 an Opportunity for Mountain Agenda

The Rio conference of 2012 will have two main topics: 'Green Economy' and 'Governance' in the frame of sustainable development. Green Economy wants to address the issue of low carbon economy. The addressees are mainly the country with a substantial degree of industrialization and a high output of carbon. This means also that eventually the RIO+20 conferences can be rather rich country focused!

However it will be essential that we do not only consider the high level polluters. What happens to the rural and mountain areas which are largely green? They have a right to grow, but should not increase the carbon output! On the other hand the mountain areas provide a series of essential ecosystem services, essential for the urban downstream areas! We see a high potential for the mountain systems if we manage to argue in a smart way and if we manage to construct the rational in a consistent and convincing way. We see a unique opportunity to put the mountain agenda in the frame of CBD and UNFCCC and in view of the Rio+20 conference.

The slogan is - what does it cost to keep the green economy (in the mountains) green considering the principles of equitable and sustainable development! There are two hurdles to be addressed: Do we have a robust science base and knowledge to make the case? Who is going to defend the mountain agenda?

7. Reducing Scientific Uncertainty: Responsibilities for the Scientists

Some thematic areas that need to receive urgent attention are:

Climate trends: Changing behavior of the monsoon; role of the Westerly's; role of heating of atmosphere (Tibetan Plateau); scaling-down; and customizing global climate change scenario.

Mitigation: Black carbon and tropospheric ozone; REDD+, REDD++

Cryosphere: Mass balancing; hydrological balancing; behavior of glaciers (sweep and debris covered); role of Karakorum glaciers; glacier lakes as risks and potentials; snow melt and monsoon discharge.

Water: Hydrological balance; discharge modeling; water storage; changing discharge pattern due to climate change and consequences for debris flow.

Livelihoods: Vulnerabilities; disaster risks; adaptation (herders, below the tree line); adaptation or SDM; labor migration and remittances; how to build resilience in a changing social fabric; changing gender patterns and role of women; new forms of livelihoods.

Biodiversity: Changes in biodiversity due to climate change (biodiversity corridors versus crowding out); changes in plant sociology and soils stability; invading species and soil stability; management of biodiversity as a source of livelihoods; market driven biodiversity management.

Green Economy: Costs for green to remain green; mechanism to assure sustainability of marginal and fragile areas; valuation of ecosystem services; payment for ecosystem services; use of national resource as part of the national accounts.

8. Need to Bridge the Knowledge Gap

Are we ready to take up the challenge? Deficit of reliable and consistent research has been the main constraint of the HKH region. Example of glaciers is very representative for this situation. Research has been done largely by non-regional researchers. This has hardly enriched regional academia and has lead recently to controversies which are not in the interest of anyone. Here we are talking of research. We have to ask ourselves also are we ready to propose well targeted measures of adaptation? We experience presently a rebranding of development measure as because in practice we do not make the difference between sustainable development and adaptation.

There are no evidence that the 'Earth Sciences' are strong enough to prominently take part in the discussion. We need them for glaciology, hydrology, in understanding the demographic dynamics, and most importantly geographers' role in understanding complicated systems in a systemic approach. These capacities in the region are missing and there is a tremendous and rewarding field of work.

9. Defending Mountain Agenda

Who is going to defend the mountain agenda? We have to assume that the industrialized countries have other priorities. They can be supportive but we have to assume that they will not take a leading role. The question on the combination of defending the mountain agenda in the context of an international debate is dominated by the need of international regulation for mitigation, it is not evident that industrialized countries are ready to push this agenda.
The discussions in such platforms as Mountain partnership continue to be dominated by topics of physical geography. Issues of food security, increasing vulnerability, poverty and migration and the quest for new livelihood strategies, which are the relevant issues in the HKH but also in the Andean countries and Africa need more attention, if sustainable mountain development is to lose its marginality.

We have seen that in the frame of climate change and biodiversity the relevance of mountain systems in the south has increased. This means also that adaptation to climate change and the sustainability of ecosystem services is articulated in the interest of the south especially the mountains. We therefore have to assume that the mountain agenda has to be defended by the riparian countries of the subtropical zones, where these systems are preeminently important.

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