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Social Monitoring in Mountain Biosphere Reserves
Conclusions from the EU GLOCHAMORE Project

The recently concluded GLOCHAMORE (GLObal CHAnge in MOuntain REgions) project, funded under the European Union's Sixth Framework program 'Sustainable Development, Global Change and Ecosystems' had 3 aims: 1) to develop an integrative research strategy for detecting signals of global environmental change (GEC) in mountain environments; 2) to define the impacts of these changes on mountain regions as well as lowland areas dependent on mountain resources; and 3) to facilitate the development of sustainable resource management regimes for mountain regions. A primary focus of the project was on mountain biosphere reserves (MBRs) designated under UNESCO's Man and the Biosphere (MAB) Programme (Reasoner et al 2004).

The 2-year project comprised 5 workshops (Greenwood et al 2005) and an Open Science Conference (Price 2006). While many aspects of GEC fall within the domain of the natural sciences—which were the primary focus of the majority of the workshops (Lee and Schaaf 2004a, 2004b; UNESCO 2005)—comprehensive understanding of the human dimension of GEC was essential to achieve the project's second and third aims. Hence, the first GLOCHAMORE project workshop included a breakout group on sustainable development in MBRs (Lee and Schaaf 2004a), the second included a working group on social monitoring (Price 2004), and the fourth was largely devoted to this subject (UNESCO 2005). The present article introduces the principles and process of social monitoring and presents the conclusions resulting from these activities. It complements the article on long-term environmental observations in MBRs which resulted from the second GLOCHAMORE workshop (Grabherr et al 2005), and thereby contributes to the implementation of the GLOCHAMORE Research Strategy (Björnsen Gurung 2005).

Social monitoring in biosphere reserves

Social monitoring may be defined as "the production and provision of socially relevant information including its presentation" (Habich and Noll 1994). Such information may relate to the "economic, political, cultural, and socio-psychological aspects of human actors and systems" (Lass and Reusswig 2002, p 5). These statements are taken from the report of the first international workshop on social monitoring in biosphere reserves (Biosphere Reserve Integrated Monitoring [BRIM] workshop), which provides a detailed discussion on many aspects of this topic (Lass and Reusswig 2002).

There are compelling reasons why social monitoring is a key activity to be undertaken in connection with the development of sustainable resource management regimes in general, and in biosphere reserves (BRs) in particular. Article 3 of the Statutory Framework of the World Network of Biosphere Reserves states that "biosphere reserves should strive to be sites of excellence to explore and demonstrate approaches to conservation and sustainable development at the regional scale." Along with the conservation function there are 2 others: "development—fostering economic and human development which is socio-culturally and ecologically sustainable" and "logistic support," including "research and monitoring related to local, regional, national and global issues of conservation and sustainable development" (UNESCO 1996, p 16). While the Statutory Framework does not mention GEC, this provides part of the rationale behind the complementary Seville Strategy for Biosphere Reserves, which notes that they "will also contribute to the needs of society as a whole by showing the way to a more sustainable future" (UNESCO 1996, p 5), and that they should contribute to the implementation of various international agreements, including those on climate change. The Seville Strategy proposes a large number of implementation indicators, of which a number relate to monitoring, eg implementation of a coordinated research and monitoring plan, use of the BR for developing and testing monitoring methods and indicators of sustainability relevant to local populations, and inclusion of local stakeholders in these activities (UNESCO 1996, p 15).

Reasons for doing social monitoring include (UNESCO 1996; Lass and Reusswig 2002):

- Assessing the main trends and driving forces of human–nature interactions;
- Contributing data for hypothesis testing and modeling;
- Informing the evaluation of the contribution of BRs to sustainable development;
- Providing input to the policy cycle, more generally as part of the feedback process of policy analysis, and specifically, eg by providing mechanisms for early warning and information for the development of scenarios.

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Social monitoring in mountain biosphere reserves (MBRs)

Given the general focus on the drivers of GEC in mountains, such as climate change and pollution, research and monitoring have typically emphasized natural science activities; the development of appropriate protocols and methodologies in these spheres is well advanced (eg Grabherr et al 2005). However, when considering the subsequent effects of altered mountain ecosystem goods and services on regional economies, human health, and institutional arrangements to mitigate and adapt to GEC, it becomes clear that the inclusion of the social dimension is crucial in the discussion of GEC. Unlike environmental monitoring, social monitoring in MBRs has received relatively little attention to date.

Basic issues and principles

During the GLOCHAMORE project and the BRIM workshop (Lass and Reusswig 2002) it became clear that the availability of both biophysical and socioeconomic monitoring data, and the resources required to obtain them, vary from site to site. To ensure that all MBRs, independent of their human and financial resources and infrastructure, can participate in a wider monitoring program, different levels of indicators need to be defined: ie, *essential*, *improved*, and *optimum* (see also Grabherr et al 2005).

One key issue is that, in principle, all MBRs, like other BRs, include 3 zones: 1) *core area or areas* devoted to long-term protection according to the conservation objectives of the biosphere reserve; 2) *one or more buffer zones* surrounding or contiguous to the core area or areas, where only activities compatible with the conservation objectives can take place; 3) *an outer transition area* where sustainable resource management practices are promoted and developed (UNESCO 1996, p 17). Notably, the outer boundary of the transition zone is flexible. In practice, not all MBRs contain buffer and transition areas, though the periodic review process included in the Statutory Framework is intended to ensure that all BRs contain the 3 types of zones and generally strive to achieve the goal stated in its Article 3 (Price 2002).

In choosing appropriate socioeconomic indicators, the spatial and temporal resolution of data should be considered. With regard to spatial resolution, the choice and extent of the area under examination as well as the spatial resolution of data collection determine the quality of data. This leads to 2 questions: how far into the transition area do data need to be collected; and to what extent are existing data or information from administrative or reporting districts coherent with BR realities?

As has often been noted for mountain areas (eg Royal Swedish Academy of Sciences 2002), census districts tend to include both areas that would be defined as 'mountain' and others that would not. For MBRs, the fact that the outer boundary of the transition area is flexible presents particular challenges. Once the area for monitoring has been agreed, and the suitability of existing sources evaluated, what spatial scale is appropriate for the measurement of data and the collection of information? Similarly, what spatial scale is appropriate for the storage of these data and information? Certain types of information have to be aggregated to ensure the privacy of respondents. A further question is: when data and information are collected at different spatial scales, what is the best level of aggregation for storage and analysis using a geographic information system (GIS), if this is the appropriate means for these purposes? With regard to temporal resolution, what frequency is appropriate? This depends on the issue under consideration and the resources available, and strongly influences the potential uses and users.

In addition to these technical considerations, a third set of issues relating to the choice of indicators derives from the key principle that local people and other stakeholders, as well as MBR coordinators/managers and scientists, should be involved in monitoring in MBRs.

Indicators for social monitoring related to global environmental change

While the conclusions of the BRIM workshop (Lass and Reusswig 2002) were fundamental for the discussion of social monitoring within the GLOCHAMORE project, the former workshop did not focus on indicators for social monitoring specifically in relation to either mountains or GEC. The working group at the second GLOCHAMORE workshop identified 2 main types of indicators within the human–nature systems influenced by GEC:

- Indicators of vulnerability, measuring people's responses to GEC;
- Indicators of adaptation (or resilience), measuring people's adaptive capacity to GEC.

These 2 categories are not necessarily exclusive; vulnerability and adaptive capacity (resilience) often overlap. In addition, to a large extent, the adaptive capacity of the society and institutions in a BR is based on exogenous (outside) influences as well as endogenous (inside BR) factors. It may therefore also be necessary to monitor some exogenous factors. Furthermore, people and societies should not be defined only as *re*actors (eg, to exogenous factors) but also as *actors* within their BR making use of their potential to innovate. With specific regard to

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TABLE 1 Indicators for social monitoring in mountain biosphere reserves proposed at the second GLOCHAMORE workshop. The numbers refer to the six categories of indicators (see text). Indicators on similar themes have been grouped horizontally.

Essential set	Improved set		Optimum set (measured)	Optimum set (analytical)	
1: Population				1: Reasons for migration	
	3: Sources of livelihood	3: External reinvestment	3: Tourism		
			2: Values of ecosystem goods and services		
1: Literacy	1: Education and skills			5: Ecological / sustainability knowledge	
1: Food security	1: Net assets				
1: Health					
2: Land use / land cover change	2: Agricultural and forest productivity	2: Livestock	2: Land tenure	2: Dependence on local resources	
2: Safe water	2: Hazards				
4: Participation in BR management	4: Structure & function of participation in BR management		1: Number of community-based organizations	2: Tensions & conflicts	
				5: Values & attitudes	6: Visions and goals
				5: Trust in BR / institutions	4: External influence of BR manager / coordinator

social variables, these exogenous factors may be:

- Quantitative (objective) or qualitative (subjective);
- Collected using either scientific methods or methods derived from traditional ecological knowledge.

Most important, these methods must be transparent and repeatable over a long period of time.

For the purposes of brainstorming, the categories of indicators for social monitoring in BRs proposed by Lass and Reusswig (2002) were slightly restructured into the following categories:

1. Demographics and well-being;
2. Uses of ecosystem goods and services;
3. Dynamics of socioeconomic systems;
4. Management and governance;
5. Values, attitudes, and knowledge;
6. Perceptions of the future.

For each category, the workshop participants initially considered lists of potential indicators from the reports of the BRIM workshop and the first GLOCHAMORE workshop. Starting from (but not limited to) these, they were asked to write down 5 possible indicators within each category, bearing in mind whether these primarily measured *vulnerability* or *adaptive capacity*, and how feasible it might be to develop and implement consistent methodologies for data collection over long periods.

The proposed indicators were then manually clustered to identify *common themes* and reduce the total number of indicators. Indicators with few other 'votes' had, if justified, an equal chance to be included in the final set (Table 1). The table shows that, as participants worked through the different categories from the more objective (demographics) to the more subjective (perception), the definition of specific indicators generally became more difficult. Table 1 also orders the indicators according to their relevance and feasibility, ie within an *essential*, *improved*, and *optimum* set of indicators. The optimum set of indicators was further divided into *measurable indicators*, which could be compared across all sites; and *analytical indicators*, which would be site-specific. A preliminary discussion of the various indicators, and reasons for including them, is

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TABLE 2 Indicators for social monitoring in western European Mountain Biosphere Reserves. (Source: GLOCHAMORE workshop)

Category	Essential set	Improved set	Optimum set
Land	Land cover Land ownership / tenure	Land use change Hazards	Productivity
Water	Water quantity	Water quality	
Population	Census (number, gender) Permanent residents Migration	Numbers of medical centers and doctors	Mortality, diseases
Livelihoods	Sectoral employment	Farming (including livestock numbers)	
Economic dimensions	Income (total tax income)	Compensation for restrictions Value of property	
Tourism	Tourist beds Visitors to BR facilities	Number of tourists at specific locations	Frequencies, seasonality, types of tourists
Policy support	Amount/source of public funds		Infrastructure
Problem-solving	Functioning BR–society mechanisms		Chronology of interactions
Adaptive management		Hazard management	Incorporation of new knowledge in BR management
BR human resources	Number of staff Training		Visions, goals
Sustainability	Environmental actions (BR+public)		Values, attitudes Public knowledge

presented by Price (2004). The number before each indicator represents the category to which it (primarily) belongs.

Regional evaluation of indicators for social monitoring

The fourth GLOCHAMORE workshop focused primarily on refining the indicators presented in Table 1. Recognizing that the key issues vary from one part of the world to another, and building on experience from organizing previous scientific meetings (Price et al 1999; Ramakrishnan et al 2003), the indicators were evaluated by 3 groups, each consisting of scientists and MBR managers or coordinators from a specific region: the mountains of western Europe; the Himalaya and the mountains of Central Asia; and the mountains of Latin America. Following initial evaluation, each working group aimed to:

1. Refine and further develop these indicators with reference to the regional context;
2. Consider which indicators MBR managers/coordinators would find useful to monitor GEC and to assess the adaptive capacity of mountain people, taking into account their relevance and feasibility;
3. Identify which indicators would improve understanding of the driving forces and impacts of GEC.

Western Europe

The western Europe working group re-categorized the indicators proposed (Table 2). While some were omitted because of their limited relevance (literacy, food security, health), others were added (policy support, sustainability) or attributed higher priority (tourism, values and attitudes, ecological/sustainability knowledge). For details on the indicators, see UNESCO (2005). It was proposed that the new categories and many of the new indicators may also be appropriate for other regions.

Himalaya and Central Asia

The working group from the Himalaya and Central Asia emphasized the need for active participation of local communities in BR-related research and management activities. Such activities should take into account:

1. Natural resources or environment, including the assessment of indicators related to biomass, biodiversity, soil fertility, agricultural and forest productivity, and water. Traditional knowl-

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edge and monitoring of the adaptive changes of local populations over time and space should be given appropriate attention.

2. Socio-cultural and economic systems. The group strongly proposed working with a 'livelihood-centered approach', beginning with an assessment of current livelihood conditions (DFID 1999; Baumgartner and Högger 2004) and livelihood strategies as a reference base for future changes. Key elements such as the role of livestock and its linkages with the other elements of the productive system will thus become more evident. The definition of such key elements is crucial to eventually anticipate possible reactions or actions to GEC by local actors that are relevant for BR management.

Starting from the indicators in Table 1, the following key elements for a socioeconomic, cultural and political assessment were considered relevant for MBRs:

- Food security: an issue in many BRs where rural food production does not cover subsistence needs.
- Land use and land cover change: critical indicators, since they reveal rapid adaptations of livelihood strategies and are likely to have immediate and direct impacts on MBR management. Particular attention has eventually to be paid to upland–lowland interactions.
- Land tenure: a very sensitive indicator for rapid changes or adaptations from a livelihood perspective.
- Dependence on local resources: monitoring of the type and degree of dependence on local resources can help to assess changes in, and vulnerability to, these, and eventually anticipate possible negative or positive impacts of GEC.

MBR managers in the region are increasingly concerned with unforeseen short-term stresses, leaving communities with insufficient time to adapt and threatening local knowledge. Forced changes to adapt livelihood strategies are likely as a result of either stresses and pressures or new opportunities. Consequently, tensions and/or conflicts due to conflicting interests can appear or intensify. Likely changes and possible indicators for local conditions in the region's MBRs include:

- Land use changes:
  – shift from rainfed to irrigated land or to cultivation of non-timber forest products on community or private land; possible reduction of pressure on pastureland;
  – decrease of water availability and/or quality or increase of water use leading to increased water stress;
  – introduction or expansion of tourist activities;
  – changes in land tenure.
- Insufficient or decreasing economic income:
  – migration of populations to and/or out of the region;
  – role of remittances: type, contribution to livelihood, use of remittances, gender aspects;
  – changes in gender and age pyramid/composition.
- Changes in services:
  – availability and/or type of health services;
  – availability of education services.

In a next step, the expected impacts from these anticipated changes should be described or assessed in order to develop mitigation strategies or measures where necessary. This should also include the assessment of the values of ecosystem goods and services to have a reference base.

Latin America

The Latin America working group identified 3 sets of indicators (Table 3). Comments on these indicators with regard to their relevance and measurement, as well as in relation to previously proposed indicators are included in UNESCO (2005). The working group found that the remaining indicators in Table 1 (tensions and conflicts, values and attitudes, trust in the BR/institutions, visions and goals, external influence of the BR manager/coordinator) would provide very important information, but are not easily measurable. They suggested that there should be a minimum set of indicators for global and regional comparison, and that a multi-scale approach within and between BRs is necessary to deal with scale differences and to avoid overgeneralization (particularly of indicators).

Conclusions

The 3 presented evaluations and proposals reflect the great diversity of situations, both within and between these regions. This differentiated approach showed that few indicators are probably applicable at the global level; the regional—and even local—context must always be taken into account if indicators are to be meaningful for informing the development and implementation of both management actions and policy. In particular, even though the western Europe working group suggested that the indicators they proposed would be appropriate in other regions, this may not necessarily be true, depending on both different contexts (economic, social, political, environmental, etc) and the existing and likely availability of relevant data and information. One important point to be made is that, in western Europe, agriculture and/or forestry are no longer the primary sources of livelihoods, and populations are rarely growing significantly; the converse is generally true in MBRs in developing and transition countries. However, certain themes do appear to be of general relevance in all 3 regions:

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TABLE 3 Indicators for social monitoring for Latin American Mountain Biosphere Reserves. (Source: GLOCHAMORE workshop)

Essential set	Improved set	Optimum set
Vegetation cover	Sources of livelihood	Reasons for migration
Land use	Level of poverty	Dependence on local resources
Quantity of water	Investments in the BR	Value of ecosystem goods and services
Quality of water	Vulnerability	Ecological sustainability knowledge
Population		Number of community-based organizations (CBOs)
Health		
Employment		
Literacy		
Food security (or malnutrition)		
Agricultural productivity		
Forest productivity		
Livestock		
Tourism		
Participation of different actors in BR management		
Human pressures and possible impacts		

1. Water quality and quantity;
2. Land cover and land use change;
3. Land tenure/ownership;
4. Population and age structure, and migration (and reasons for this);
5. Tourism facilities and numbers of tourists;
6. Livelihoods and income—though what should be monitored depends on the region; tourism is increasingly important; remittances are important in MBRs in many developing and transition countries;
7. Food security in MBRs in developing and some transition countries; however, knowledge of livestock numbers appears to be of general relevance for both livelihood and conservation reasons.

The first 2 sets of indicators are contextual and largely natural science-based, and link to specific elements of the GLOCHAMORE Research Strategy (water systems, land use change). Others link to the strategy elements on mountain economies (employment and income, tourism and recreation economies) and on society and global change (governance institutions, development trajectory, and vulnerability). Overall, these 7 themes (though not all the detailed indicators proposed within them) echo the first 6 categories proposed by the western Europe working group; most of the other issues identified for possible high-priority indicators by this group were not identified as such in the other 2 working groups.

The workshop showed the need for considerable additional work to identify and then implement effective indicators for social monitoring in MBRs and other mountain regions. In contrast to many of the indicators proposed in previous GLOCHAMORE workshops—which focused on biogeophysical systems (Lee and Schaaf 2004a and 2004b; Grabherr et al 2005; UNESCO 2005)—for socioeconomic systems, there may be a greater need to distinguish between the situations and needs in different parts of the world.

Participatory action research, management, and monitoring in specific mountain areas are likely to underline such differences. At the same time, there is a need to develop protocols for social monitoring that enable MBR managers and scientists, together with local communities, to generate comparable data sets. Promoting shared ownership of such activities is a challenging aspect of such an approach; however, it will ultimately enable mutual learning within a partnership (KFPE 1998; Baumgartner et al 2004, p 331). Such data of reliable origin are required, in particular, for modeling purposes. In this context, attention should also be given to existing structures and themes for monitoring, both within individual countries and internation-

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ally—such as UNESCO's BRIM and the Global Terrestrial Observing System (GTOS).

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New Community-led Conservation Efforts in the Cordillera Huayhuash, Peru

In late 2002 a new national conservation zone was created in the Cordillera Huayhuash mountain chain in the Peruvian Andes. After many years of studies, dialogue, and local, national and international support for conservation efforts in the area, the Peruvian Ministry of Agriculture temporarily designated approximately 67,000 hectares of land in the region as the "Reserved Zone of the Cordillera Huayhuash." Following this decree, a technical commission was created by the national Institute for Natural Resources (INRENA) to determine the level of protection that would be granted to the new conservation unit. After delays lasting several years, the preliminary technical report has just been completed.

While the national-level study was being conducted over the past 4 years, however, local communities protested the creation of the new national conservation zone and have initiated new management plans that would create a series of community-led private conservation areas in the region. These 2 conservation plans present conflicting visions and goals for the future of land management in the region and also highlight a series of new and important issues concerning conservation efforts and resource management, local grassroots empowerment, and

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the future of ecotourism activities in the country.

The Cordillera Huayhuash is located in the Central Peruvian Andes south of Huascarán National Park. The range has Peru's second tallest mountain peak, Yerupajá (6634 meters), as well as 15 major peaks (6 of these above 6000 meters) and is the second highest point of the Amazon Basin drainage system. The mountainous area is also one of the few tropical mountain chains in the world and is the location of important high mountain ecosystems. Studies have identified more than 1000 plant species, 62 bird species, and more than a dozen mammal species in the region, including the threatened *quenal* (*Polylepis racemosa*) plant and the rare Andean condor *(Vultur gryphus)*. In addition, the area is also an important source of water resources, as it contains more than 40 lakes and 115 glaciers.

Because the region is fairly remote and was inaccessible during Peru's recent civil war due to the fact that it was a base for Shining Path rebels, it has only recently become a major destination for tourists. Beginning in the late 1990s, international and national tourism in the region began to increase rapidly. In 2001, approximately 2000 international tourists visited the region to engage in trekking, wildlife observation and climbing activities. In addition, the region has recently become an important destination for transnational and national mining operations. In the mid-1990s Mitsui Mining and Smelting Peru began operations in the area adjoining the new conservation reserve, and a host of new mineral rights claims and exploration activities have just begun both within and surrounding the zone.

The communities surrounding the Cordillera Huayhuash have historically been isolated from the rest of the country due to lack of transportation networks and support from the Peruvian state. The reserve encompasses land belonging to at least 8 communities that belong to 3 different national administrative units (Ancash, Huanuco, Lima). In 1993, roughly 23,000 people lived in the area, mostly at lower elevations and in widely dispersed communities. Livelihoods in the region have been dedicated primarily to agricultural and livestock production, but new opportunities to support ecotourism in the region have begun to integrate local communities into larger economic processes.

As the Cordillera Huayhuash has begun to be recognized as an important location for new conservation and resource management activities, a new debate has been ignited concerning the ways in which the region will be integrated into national protection activities. On one hand, the technical study process begun in 2000 would integrate the zone into the Peruvian system of national protected areas and, depending on the level of protection given to the area, would alter access to and use of resources in the region for local communities, tourists, and mining interests. In addition, the new zone would be managed in a traditional resource conservation model that is directed at the national level by institutions and personnel largely located outside the region. On the other hand, local communities are proposing new private conservation areas that would allow them to control conservation and management goals and activities. These contrasting approaches raise important questions about the future of conservation in the region, particularly about how it will be managed, by whom, and through what types of institutions.

Another important and related issue that new conservation efforts in the region have raised is related to local grassroots empowerment. The Peruvian system of national protected areas has perennially been plagued by inefficiency, lack of funding and personnel, and centralized management from Lima that is ill-prepared or unconcerned with addressing local concerns. This has led, in many cases, to "paper" parks that are either mismanaged or unmanaged and have historically neglected to resolve longstanding disputes over access to the areas by local communities.

The country's turn to neo-liberal political and economic reforms as well as new legislation reforming natural protected areas have given rise to new efforts to address the historical lack of community participation in management of protected areas as well as to privatize and decentralize the management and use of natural resources. These new developments have generated openings for novel local and private conservation areas that would delegate power and decision-making to local communities. Beginning in 2001, several new private conservation areas were created in the country, with many more under consideration.

In the Cordillera Huayhuash, several communities have been granted preliminary approval for private conservation areas, and nearly all of the communities affected by the new conservation zone are in the process of developing their own management plans. These new efforts by local communities may indeed represent new examples of grassroots empowerment and local resource management conservation, but it is important to note that this does not suggest that these efforts will be unified and devoid of conflicts over how and in what ways conservation will take place. This has certainly been the case in the Cordillera Huayhuash, as both the national classification process and the development of private conservation areas have heightened historical patterns of conflict over access to and use of resources in the region, and have created new conflicts within and between communities over who will manage the new areas.

Finally, the creation of the new national conservation zone and new private conservation areas in the

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Cordillera Huayhuash have also raised important issues surrounding the future of increasing ecotourism activities in the region. Tourists utilize the trails that pass by or through many of the local communities in the region and across land held by households and communities. In addition, many tourists contract local people to provide mules and guides for their journeys, which represents an important source of income for households in the region. However, there is little infrastructure in the region to support tourism, including an almost complete absence of sanitary facilities, organized camping locations, and emergency support. Furthermore, providing for security within the zone is another important consideration. In 2003, several tourists were killed and several dozen were robbed at gunpoint in the region. In response, local communities have begun to patrol the region, in some cases armed with rifles.

Under either national protection or local private conservation efforts, these new flows of tourists represent important new economic opportunities for local communities, but also important challenges due to the environmental impacts of their activities. Unresolved questions for either conservation strategy include how security will be maintained in the region, how and in what ways tourists will be asked to pay for visiting the region (in 2004 local communities began to charge tourists) and how and what types of services will be provided for tourists. Presently, local communities and guides are pursuing cooperative strategies to manage security and some waste problems, but disputes have occurred over the provision of services and charges for passage. The ways in which these new conservation plans address these issues will almost certainly affect the quantity of tourists visiting the region.

While the form of recent conservation efforts in the Cordillera Huayhuash region has yet to be fully developed and agreed upon, these efforts will affect the nature of future ecotourist activities in the region. They represent an important new instance of grassroots empowerment intent on maintaining local control of natural resource conservation, and illustrate the ways in which national and local conservation frameworks in Peru have been changing. Current research and efforts on the part of academics, policy-makers and organizations could both further refine the form and content of conservation activities and broaden our understanding of changes taking place in the Cordillera Huayhuash.

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Broadband for Mountain Development

In an economic and social system dominated by urban, industrial capitalism, mountain areas have been seen as peripheral to the process of growth and development. But today, as the service sector and the global economy are becoming increasingly more important than the industrial sector, a new world of opportunity is opening up for mountain areas. Today's global economy is increasingly focused on broadly diversified products and services. In this context, knowledge and skills are the winning element in global competition, just as brute force once was in agricultural society, and money in industrial society. And where knowledge or skills are concerned, there is no difference between mountain and lowland areas.

Mountain development projects should therefore aim primarily at enabling mountain areas to maximize their capacities and resources and apply them to different settings. This would foster the ideal climate in which to network with productive sectors located elsewhere, a *sine qua non* for bringing mountain communities into the mainstream. And what better tool than broadband Internet connections to hook up mountain economies with other production systems and bring them into the global economy?

Reducing the digital divide and connecting mountain people

The first notion of the 'Information Age' can be traced back to the early 1980s, when the advent of increasingly refined technological applications for information processing, alongside social transformation, gave rise to the idea that a completely new world was about to be born. Some authors have introduced the concept of an "interconnected world," to depict a scenario where distances are nullified by the existence of digital technologies. Among the information-based industries, the telecommunications industry is widely recognized as one of the most important in the global economy. The way of doing business in highly developed societies, and our lifestyle in general, would not be the same without digital telecommunication technologies—and in fact, the "Information Society" itself would not exist.

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Broadband, the new communications tool which today makes it possible to send increasingly greater content at ever greater speeds, is fundamental to the development of mountain areas. By contrast with the costs of other infrastructure such as roads and railways, and thanks to the quantum quality leap of broadband Internet navigation, we can now use an increasingly efficient system of communication to narrow the gap between mountain and valley. And there is more. What broadband mainly offers is vast access to new sources of information and knowledge and new forms of economic activity. A whole array of business models has been reshaped by the introduction of digital communication technologies. In fact, access to faster, accurate, and effective communication channels allows sharing of information and knowledge among economic actors, thus easing the development of business activities.

Broadband communication has positive impacts on information-based industries as well as on several other economic sectors. In the agricultural sector, for instance, where typical products are now being heavily promoted, the new information and communication technologies are assuming an increasingly strategic role, thanks to their ability to favor the recovery of costs linked to the on-demand delivery of services. They are also equally important in the promotion of rural areas and the implementation of agricultural policies.

For the tourism sector, broadband telecommunications can play a fundamental role in a context in which there is widespread demand, given the current prestige of unique cultural, historic, and natural settings. Whereas telecommunications technologies have so far focused on doing business more efficiently, they can now be harnessed to create *new* ways of doing business and to provide a diverse and integrated source of supply. Similarly, in the food processing sector, local agricultural products can become global products thanks to broadband communication. The exact opposite occurs in the tourism sector, as the global becomes local with the arrival of tourists on the local scene, bearing in their wallets new economic opportunities for local people.

In the management field, networks are used to depict the provision of a typical service, where many components are required. Given clients' demands for services composed of different components, network elements are complementary. Broadening the spectrum of economic actors that are linked together would enlarge the network and positively alter business dynamics.

Using broadband to strengthen civil society

Reducing the digital divide that has so far excluded mountain areas is therefore an essential step in achieving competitiveness and in social and economic advancement in developed and developing countries alike. Mountain people are clearly aware of the opportunity to catch up that is afforded them by the "Information Society:" their best (and perhaps their last) chance to overcome the social and economic marginalization of their mountain homes.

However, there is more at stake. In the new and increasingly information- and service-oriented global economy, the role of telecommunications is of fundamental and growing importance, especially for mountain people. The evolution of this sector impacts directly and indirectly on much in the productive and social sectors. The many applications that broadband communication has today have made it possible for some mountain people to enjoy health, work, and educational services that were once much harder for them to access. In terms of management of the public domain, and thanks to the availability of on-line government services and programs, both citizens and businesses now have enhanced access to their local and national administrations, with all the relative benefits in terms of administrative efficiency.

Conclusion

The availability of networked information and communication technologies proved to be effective in supporting national development, both from a sociological and from an economic perspective. This seems to be confirmed by the less advanced degree of development in regions where such technologies are not available. In fact, due to morphological and geographical characteristics, rural and mountain regions lag behind in the diffusion of the most advanced technological infrastructure. On the other hand, the European Union has strongly advocated academic research and efforts based on practice to help bridge this divide. As stated in the "eEurope 2005" work program, broadband access among EU regions is considered a priority for the development of the Information Society.

The digital divide therefore confronts local policy-makers with a decisive choice: should they encourage the building of a digital community, supported by public administration and business? As emphasized, broadband is a must-have tool for enabling the transformation of the cultural, economic, social, and productive systems needed to foster the development of areas that have, up to now, been sidelined by economic progress.

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