

Paths to sustainable development in the Andes

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Introduction

The continental mountain range of the Andes represents one of the most heterogeneous, varied and interesting orogenic belts of the entire planet. With a length of over 7 500 km (the range extends from 11° N to 56° S), the Andes host an immense biological, climatic and human diversity. These magnificent heights with an average elevation of 4 000 m and, in cases like the Aconcagua and the Nevado Ojos del Salado, reaching beyond 6 800 m, have justly earned the name of “*la Cordillera de los Superlativos*” (Borsdorf 1997). These mountains not only include many capital cities but also the navigable Lake Titicaca in Bolivia at 3 810 m above sea level and the highest railroute in the world (Peru Callao – Huancayo Railways) reaching more than 4 700 m.

In terms of biodiversity, the Andes are the perfect stage for a great variety of ecosystems with high levels of endemism (Price 2007). This diversity is represented, in the case of wetland ecosystems, by the plains of Venezuela, Colombia, Ecuador and parts of northern Peru. This type of high-mountain ecosystem and its climatic characteristics, such as cold temperatures, cloudiness and mean annual precipitations of 1 000 mm, where evaporation is very low, promote a positive hydric balance that makes them vital for storing and regulating water.

Desert ecosystems, such as the Altiplano in the western part of Bolivia, northern Chile and Argentina as well as in southern Peru, are characterized by rich mineral fields of sodium nitrate, lithium, borax, sodium

chloride, copper, lead, and to a lesser extent, silver and gold. Moreover, this area of South America is one of the regions with great potential for generating photovoltaic, solar and geothermal energy. These different kinds of ecosystems have given birth to a variety of landscapes that have encouraged the emergence of assorted human establishments, forms of land use and the exploitation of natural resources (Cepeda & Oyarzún 2006).

From a cultural point of view, the Andes still are home to most native South-American tribes. Since before the Spanish conquest, these mountains have been home to diverse ethnic groups, such as the Aymara, Quechua and Mapuche. According to the statistics of the Census Bureau, Quechua speakers are the biggest ethnic group. In Bolivia, they make up 15.5% of the population, in Peru they reach 11.9% and in Ecuador 22%. In Chile and Argentina, these groups represent shrinking minorities. The tribes have a clearly set worldview, that is, how they see the world and how they interpret their natural and cultural surroundings. For most natives, humans and Mother Earth (Pachamama) are part of a permanently connected whole.

The Andean region and globalization – the current situation

According to Romero (2002), the Andes are facing two phenomena that have a considerable impact on societies settled in the Latin-American mountains. On the one hand, we see the globalization of the economy, which in most Andean regions is strongly oriented towards the exploitation of natural resources of global interest, such as copper and gold, extracted by multinationals. The impact generated in the mountain systems of these regions creates conflicts among enterprises, native ethnic groups and the residents of the lowlands who mostly depend on the resources of the highlands, given that for the extraction of these minerals many natural resources are needed, including water. The use of these resources increases the number of environmental conflicts currently affecting most Andean countries (Tab. 2) and at

Table 1: Main Andean cities in Latin America. Source: UN DESA 2008.

Country	Capital	Area (km ²)	Inhabitants (2010)	Altitude (m)
Bolivia	La Paz	470	1 692 000	3 600
Chile	Santiago	2 273.6	5 599 000	567
Ecuador	Quito	360	1 846 000	2 850
Colombia	Santa Fe de Bogotá	518	8 375 000	2 600
Perú	Lima	2 664.6	7 605 742	110

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the same time the vulnerability of these areas and their native residents, heightening social and economic disparities.

One case that has had an enormous impact upon public opinion is that of the open pit mining project Pascua Lama, across the border of both Argentina and Chile (in the 3rd region of Atacama, in the municipality of Alto del Carmen and in northern Argentina, 300 km from the city of San Juan). This project belongs to the Canadian-based Barrick Gold Corporation. Their aim is to extract gold, silver and copper with an estimated investment of USD 950 million over 20 years. In environmental terms, the negative impact of this project is substantial, given that the original idea was to remove and “transplant” three glaciers. This would have directly affected the water supply reservoirs dependent on these glaciers, calculated at 370 litres per second. It should be mentioned that the company has bought the water rights and is at liberty to use this natural resource.

The location of the project includes, on the Argentinean side, the Reserva de la Biósfera San Guillermo (San Guillermo National Park and Biosphere Reserve), and, on the Chilean side, the territory that belongs to the Diaguita, another native ethnic group. The required infrastructure for the operations of the Barrick Gold Corporation (tunnels and new roads) implies an enormous environmental impact, risking the natural and cultural balance of this region and contaminating water supplies and soil with toxic and heavy materials, leading to an eventual loss of the biodiversity of these areas.



Fig. 1: Putre, Chile, 3500 m, a good example of an Altiplano landscape. Photograph by Martin Mergilli.

It has been calculated that, on the Chilean side alone, the number of residents directly affected by this mining project amounts to 70 000 individuals. This has led to the mobilization of various social organizations in order to reject the Pascua Lama activities but these actions have not had much success.

The second factor that Romero (2009) takes into account relates to the accelerated effects of climate change, especially those that are highly noticeable in mountain areas (Price & Neville 2003; Huber et al. 2005; Debarbieux & Price 2008). Rising temperatures have caused a visible decrease in the surface area of the permafrost

Table 2: Environmental conflicts related to mining activities. Source: Observatorio de Conflictos Mineros de América Latina (OCMAL) & Observatorio Latinoamericano de Conflictos Ambientales (OLCA), 2010. *One company could be involved in more than one project.

Country	Number of current conflicts until 2010	Number of projects	Number of companies involved*	Number of affected communities
Argentina	19	25	34	27
Bolivia	6	5	5	19
Chile	16	17	26	15
Colombia	13	30	19	18
Ecuador	3	3	2	2
Perú	17	16	33	18
Venezuela	no data	-	-	-

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and snow in the Andean mountains. A drastic example of the speed of this process can be found in the tropical glaciers of the Cordillera Blanca (White Range) in the Ancash region of Peru, which have lost more than 20% of their surface area within the last four decades. If this trend continues, these glaciers will have disappeared entirely by 2030. This not only threatens the water supply for cities but also for most native tribes who largely depend on agricultural activities in these areas. Also, according to the results of this investigation, the melting of these glaciers has already caused a 12% decrease in water supply on the desert coast of Peru, where 60% of the total population live.

In terms of risk factors, climate change also implies more natural disasters originating in mountain areas, such as floods, avalanches and volcanic eruptions, causing increased costs for the Andean regions. A study carried out in 2008 by the Comision Andina de Naciones (Andean Community of Nations, formed by Bolivia, Colombia, Ecuador and Peru) found that climate change could cost the Andean countries USD 30 000 million per year, which is the equivalent of 4.5% of the GDP of these four countries. It has already been forecast that by 2025, 70% of the residents of the Andes will have severe difficulties in accessing drinking water sources. As of 2020, approximately 40 million people will be at risk of losing their drinking water supplies as well as some crops due to melting glaciers and increasing desertification in the Andean mountains.

This scenario raises questions about the future of the world's mountains, especially the Andes, and what we can do to ensure the sustainability of these areas and their residents.

Sustainability and sustainable development of mountain areas: towards a definition

First attempts at establishing a concept of sustainability date back to the early 18th century, in the context of a crisis in German forestry (von Carlowitz 1713). However, interest in this area and recognition of its importance at

international level did not come until several centuries later. In 1984, the first meeting of the World Commission on Environment and Development (WCED) was held. It represents a milestone in awareness of the principles of sustainable development on the international public agenda. In this context, the well-known Brundtland Commission and the publication in 1987 of its report *Our Common Future* emphasized the “environmental crisis” that the planet was about to face and identified the key factors that were going to generate it. It was noted that both the poverty in the countries of the South and the excessive consumerism of the North would contribute to making global development unsustainable.

The results of this report were vital for defining the actions taken by the UN at the United Nations Conference on Environment and Development (UNCED), also known as the “Earth Summit”, held in 1992 in Rio de Janeiro. As a consequence of this summit, the Agenda 21, also known as “Plan of Action”, was drawn up. It lists the challenges that have to be dealt with by the participants of the summit at international, national and especially at local level (Heinelt 2000). A strategic area of action of Agenda 21 in this context is its Chapter 13, called Managing Fragile Ecosystems: Sustainable Mountain Development.

In this chapter, some concrete objectives could be established in order to advance towards sustainable development in mountain areas. Coordinating the fulfilment of all these objectives is the task of the FAO (Food and Agriculture Organization) which supervises the progress towards these targets by means of two programmes based on what is known as “integrated ecosystem approach for the sustainable development of mountain areas” (FAO 1997). The first objective was to strengthen the knowledge about the ecology and the sustainability of these ecosystems, and the second sought to promote integrated watershed management and offer opportunities for better living conditions for mountain villagers.

Since the Rio Summit, there has been progress in many aspects related to the promotion and dissemination of sustainability of mountain areas. Improvements include:

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- a global, regional and national perspective of the importance of the sustainability in mountain regions; better protection conditions of natural resources and improved technical and institutional means to reduce natural disasters;
- a stronger global network of information for organizations, governments and other individuals involved in this field;
- improved capacities of the countries for better planning, implementation and monitoring of programs and activities related to sustainable development;
- the fight against poverty, support for the generation of infrastructure and social services aimed at the protection of mountain livelihoods and native ethnic populations;
- the formulation and negotiation of regional or sub-regional mountain conventions, and the formulation of a global charter for mountain areas.

The actions already taken by the UN are global in scope and, as a result, mountains now enjoy a higher degree of attention by both politicians and scientists. They have improved the living conditions of the residents of different mountain ranges in the world, ensuring food security by improving production techniques and by providing tools to stimulate these local economies. Nevertheless it must be emphasized that the sustainability of these diverse and dynamic mountain systems requires strategies relevant to the individual regions.

Authors such as Price and Messerli (2002) are of the opinion that it is not possible to establish a one-size-fits-all definition of sustainable development in mountain areas. Such a definition would be restrictive and not representative enough of the diversity present in these regions. What is more, this concept should be defined taking into account the various regional scales (national, regional and local) and should relate to region-specific processes of development relevant to the cultural characteristics of the populations that live in and depend on these spaces.

However, despite the heterogeneity of mountain areas, key elements can be identified and will have to be

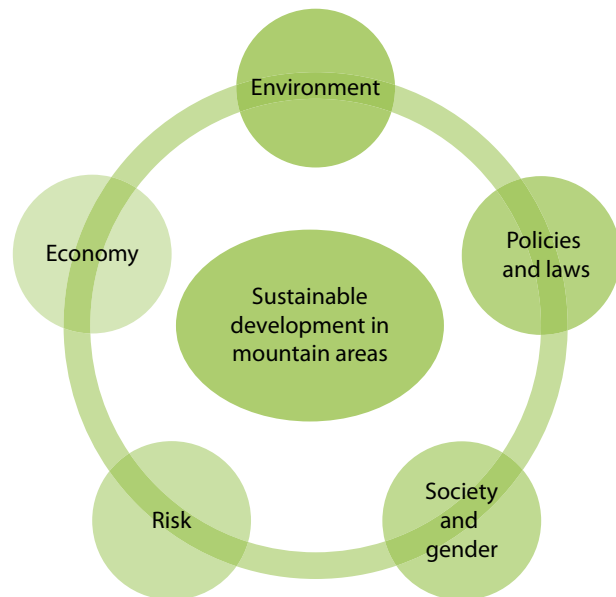


Fig. 2: Key elements of sustainable development in mountain areas.

considered when creating policies and plans for sustainable development (Fig. 2).

Against this clear perspective, we have to ask ourselves, what is the state of sustainability in the Andes? What alternative ways and examples already put into practice in other mountain ranges of the world have led to improved levels of environmental sustainability and can be successfully applied in this particular mountain range?

In search of sustainability in the Andes

To advance in this regard, it is necessary to identify priority issues and problems that should be considered in the environmental agenda of the Andean nations. Only in this way will it be possible to ensure ways of sustainability for these mountain areas by developing appropriate plans and public policies.

From the perspective of policies and laws, these plans should be integrated in an articulated manner among the different Andean countries, taking as example successful instances of already implemented measures in other parts of the world. A feasible way to achieve this is

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to adapt and recondition to our Latin-American reality those models already put into practice in Europe, such as the Alpine Convention or the Carpathian Convention.

In the economic dimension, we have to progress further in promoting and fostering those activities that are beneficial for the commercial integration among Andean countries (that is, to establish fairer tax policies, to protect free competition, to control safeguards, etc). The Andean Community of Nations (CAN) is a body that has achieved dynamic free trade among member countries and partners and has also facilitated foreign investment into this block of countries. Future challenges in this area lie in consolidating and strengthening a Latin-American group as a platform for regional exchange to negotiate better conditions, free-trade agreements (FTAs) with other global trading groups, such as the European Union. It is necessary to strengthen the conditions of economic and political stability in the Andean countries to create proper environments that permit such flows of investment.

In the environmental dimension, the main actions suggested aim at creating both an agenda and a plan of action to face climate change which is generating indisputable negative effects on the natural resources of the region. The retreat of glaciers, for instance, has a huge impact on energy generation (approximately 60% of the electricity consumed by the Andean countries is currently being generated by hydropower stations using the water from the glaciers). It is also vital to develop integrated strategies to manage water resources and plans to protect biodiversity as well as establishing payment mechanisms for environmental services.

In a related aspect, the dimension of risk, the Andes is a region with frequent instances of natural disasters resulting in major social and economic losses. Between 1900 and 1999, in Latin America and the Caribbean alone, 1 309 natural disasters were reported. This corresponds to 19% of all natural disasters reported worldwide. Latin America is thus the second most disaster-prone region in the world, after Asia (44%), where most catastrophic events happen. Given this perspective, we

must first reduce the vulnerability of the Andean countries to risks and dangers (i. e. establish regional maps of risks and vulnerability) and secondly, we should aim at a better public management of these events together with more effective plans of prevention and mitigation.

To conclude, I want to stress the need to promote the development of multidisciplinary mountain-oriented research approaches inside the Latin-American context as only these are able to address fully the diversity and complexity of these spaces. A valid option to achieve this would be to follow models that have already been successful in other mountains in the world, such as can be found in the DIAMONT project (Data Infrastructure of the Alps – Mountain Orientated Network Technology) and in mountain.TRIP (Mountain Sustainability: Transforming Research Into Practice) in the Alps and Europe (Borsdorf & Braun 2008).

Finally, both the spread of scientific knowledge generated by research groups and NGOs and the dissemination of successful practices are relevant as they allow the establishment of exchange networks between the international scientific community and local people. Following this line and some antecedents seen in the Foro de las Montañas (Mountain Forum), an international network responsible for contacting and divulging news related to the sustainable development achieved in the various mountain areas across the world, Latin America is seen as a region where participation and research are actively pursued. The work done by these networks is highly valuable, especially for the mountain region of the Andes. We can therefore claim that even though we still have a long way to go, we have nevertheless progressed in terms of the current sustainability of the Andes.

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