

Overgrazing and Range Degradation in the Peruvian Andes

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Mountain environments around the world are characterized by their ecological fragility. Many of them are under the threat of serious degradation due to the development of human settlements that have broken, by one reason or another, the harmony between the environment and its inhabitants. This is true in the Peruvian Andes.

The Environment

Peru is crossed by the Andes from north to south between 5 and 18 degrees South latitude. Approximately 484,000 sq. km (one third of the country) are above 2,000 m in altitude (6,560 ft). In spite of the tropical location, average temperatures range from below 0° C in the high mountains to 20° C in the interandean valleys. There are no big seasonal temperature variations, but diurnal changes



are large. Frosts are likely to occur almost all the year round at elevations above 3,800 m. This limits agriculture and leaves livestock grazing as the main activity above that altitude. Rainfall increases as one goes from the Pacific Ocean to the Amazon basin and from South to North. Roughly, precipitation averages from 550 mm in the South to 900 mm (35 inches) in the North, distributed mostly between November and April.

The main tenure institutions in the region are the peasant community and the SAIS ("Sociedad Agrícola de Interés Social"). Peasant communities are a broad gener-

alization of a traditional Indian institution that has existed with territorial autonomy since colonial times. Originally they exerted communal ownership of the land and practiced collective production systems. SAISs are the product of the land reform carried out in the 1970's. They were built out of ex-haciendas land, incorporating workers and tenants of the ex-hacienda in this cooperative-type institution.

Cultivated land represents only 5% of the total area above 2,000 m elevation (the "Sierra" region) and it is 80% rainfed. Regularly grazed rangelands cover 14,300,000 ha (35 million acres), of which SAISs have 4,900,000 ha and about 7,300,000 ha are owned by communities. The rest, approximately 2,100,000 ha, are in small and medium size private holdings. By 1979, the SAISs had about 4.5 million sheep unit equivalents as sheep, alpaca, cattle and horses, inherited endowments from the expropriated haciendas (Matos and Mejia, 1980). Those animals represented about 12% of the Sierra's livestock population, at a time when the communities owned 63%. Since SAISs and communities control 34% and 51% of the rangelands, respectively, it implies that the average stocking rate in community ranges was 3.5 times greater than that practiced in SAIS ranges.

Evidences of Overgrazing and Range Degradation

There is little detailed information about the extent and intensity of overgrazing and range degradation in the Peruvian Sierra. Based on site studies, the Program of Forages of the National Agrarian University of Peru estimated the condition of the Sierra's rangelands in terms of their suitability for the grazing of sheep, alpaca and cattle. They found that approximately 0.1% of the pastures were in excellent condition, 28% in good condition, 50% in fair condition, 15% in poor condition, and 7% in very poor condition. It was estimated that livestock numbers exceeded the maximum supportability of the range in those conditions by 17% (Flores and Bryant 1989). Florez and Malpartida (1987) found that 88% of the Sierra's rangelands were in less than fair condition, and concluded that there was serious range degradation. These results must be taken cautiously because of the limited reliability of the methods of estimation used (very few range sites were actually evaluated), but they reflect the generalized impression of local technicians. Zamora and Luyo, leading Peruvian soil scientists, have estimated that an equivalent soil layer of 200 to 300 thousand hectares, 20 cm deep, erodes annually from the Peruvian Sierra, leaving a sterile bedrock surface (Caballero 1981). The USAID mission in Bolivia reported that 80% of the Bolivian highlands (which are quite similar to the Peruvian ones) are badly eroded and overgrazed (USAID 1980). The Peruvian National

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Office for the Evaluation of Natural Resources (ONERN) concluded that only 10,576,000 ha are suitable for grazing in the Sierra (ONERN 1982). This implies that more than 25% of the presently grazed rangelands should be taken out of production just to stop the degradative process.

Overgrazing, the absence of soil conservation practices, and the inherent fragility of the Andean ecosystems, may easily lead to a severe rangeland degradation in the Sierra. This fragility is caused by the marked seasonality in the rainfall pattern and the great altitudinal variation that exists within the relatively narrow mountain range. Heavy rains fall over dry vegetation that, if overgrazed, offers little cover to a steep topography. In a transversal section, the Peruvian Andes go from the Pacific Ocean up to more than 5,000 m and down again to 200 m in the Amazon jungle, in just about 300 km.

Range Management in the Andean Highlands

Overgrazing and range degradation, as well as erosion, appear to be much more accentuated in the communities than in the SAISs. This is no surprise considering that the peasant communities have a much greater population density—human as well as animal—and that the SAISs own better lands. Another factor that leads to the present state of affairs rests on the very management of grazing animals. Most SAISs use fencing and practice rotational grazing, while the communities do not have fences and practice complex grazing systems that are closer to the continuous type.

There are three basic facts about the range management in the communities. First, all livestock and its products are individually owned by the members of the communities. The average household owns between 35 and 50 sheep equivalent units (Caballero 1981). Second, the herds are individually tended on following fields or communal grassland. The average community has 9% of its territory in agricultural rainfed land and 65% in rangelands (Florez and Malpartida 1987). The third and most controversial aspect is the interaction among households, and between each household and the community, in the management of the herds and the rangeland.

Some authors believe that communities do not apply any kind of range management, that every family proceeds according to their individual interests in exploiting the rangelands and that, following the fate illustrated by the "tragedy of the commons", the system leads inevitably to the destruction of the resource (Florez and Malpartida 1987). On the other extreme there are people that claim that the peasant communities, through a number of customary mechanisms, do regulate the use of the rangeland. However, oftentimes the short-term necessities prevail or peasants do not perceive the damaging effect that some of their practices can bring about to the range in the long run (Tapia and Florez 1984, Le Baron et al. 1979).

The Roots of the Problem

How old can the degradative process be? How can the Peruvian Andes have been supporting a rapidly increas-

ing population with shrinking resources? Pre-Spanish societies had developed a complex agricultural system that enabled them to feed a population at least as large as the one existing today. They practiced intense agropastoral systems that minimized the degradative effects of erosion. Main features of those systems were the vertical integration of multiple altitudinal niches, irrigation works, cultivation on terraces, and sectoral following (the cultivation and subsequent following of a number of "sectors" in a cyclical manner).

The Spanish conquest (XVI century) had "catastrophic impact upon both the environment and the native population of the Andes" (Millones 1982). The whole social and agricultural system was disrupted. In less than a century, the native population was reduced to about one fourth its original size (Eckholm 1976). The Andean forests, that once covered much of the mountains, were devastated to provide wood for the mines.

The conquerors established the "Encomiendas", large estates over the best lands that were granted to Spanish lords and local chiefs. At the same time, they also created the "Reducciones de Indios", an institution intended to concentrate the scattered native population. "Encomiendas" and "Reducciones de Indios" were the predecessors of haciendas and peasant communities, respectively. Both institutions developed a history of confrontation over the control of resources that was characterized by the appropriation of communal lands by the haciendas (Caballero 1981). In the process, much of the vertical integration and terrace cultivation was abandoned.

Because of the drastic population drop, the loss of some agricultural practices that prevented erosion were not a big threat to the capacity of the region to feed its inhabitants, at least until recently. During this century Peruvian population increased from 4 million to more than 20 million in 1982. The population growth in the Andean highlands had two main responses: agropastoral intensification and out-migration. In spite of the migration, rural populations still grew 32% between 1940 and 1972, and cattle and sheep populations also went up by 135% and 77%, respectively, between 1929 and 1972 (Caballero 1981). Cropped and grazed areas expanded, and following periods were shortened to allow for increased food demand.

The progressive modernization of the society, with the introduction of capitalist economic relations, debilitated the traditional communal bounds that allowed for a strong communal authority, capable of enforcing communal works and other collective decisions. The increased demand for resources, together with the structural changes just mentioned, left most peasant communities unable to effectively control the exploitation of the rangelands.

Improving the Range Management in the Andean Highlands

General guidelines for the regeneration of damaged rangelands are pretty well known (reduction of stocking rates, improvement of grazing systems, terrace agricul-

ture, reforestation). The expected benefits from these measures are very valuable: increased agricultural production, prevention of land slides, better water supply for the fertile coastal lands, wildlife preservation. However, the institutional and demographic determinants of the region pose formidable challenges to rebuilding the natural resource.

Some areas presently grazed must be reserved as seed banks and others should be put out of production just because they are too steep to support any grazing without erosion. This implies drastic reduction of stocking rates, which can be accomplished either by disposing of animals or by providing alternative feeding sources. The first possibility would be too costly for the poorest. It is difficult to imagine alternative sources of income for peasants that are already very close to the subsistence level. Augmenting the availability of feed has some possibilities but at high costs. Irrigation, fertilization, and reseeding have proven very effective but an expensive means to boost forage production (Flores and Bryant 1989).

A common answer to rationalize the exploitation of natural resources has been their privatization. However, this solution faces several economic and cultural constraints. The rangelands in the Peruvian Sierra are generally poor, show great variability (in quality and accessibility), and would have to be divided among too many people. The result would probably be unprofitable tiny units. Peasants with long tradition of communal organization would also resist the reform on cultural grounds. Direct state intervention has failed in almost every country where it has been tried. It seems that the most reasonable solution would be to work with the communities.

Two policy tools intended to encourage the economic optimization of stocking rates are the imposition of taxes and quotas. Jarvis (1984) points out that the reduction in pastoralists' income as a result of taxation, the complexity in determining the optimum tax (it must vary for different ranges and years), and the difficulty of implementing the measure, makes taxation impractical and inefficient. There is the possibility, however, that the drawbacks could be not so serious if the communities themselves administered the tax. The outlook for using quotas might be better. Communities have used animal quotas for a long time (Caballero 1981, Godoy 1984) and therefore peasants would be more willing to accept them.

The SAISs have maintained the fairly good condition of the range they got from the haciendas. Nevertheless, they have completely failed in transferring wealth and technology to the communities, which was one of the main objectives stated at their creation, back in the early 1970's. Their estates constitute relatively wealthy islands in a sea of poverty and the struggle of peasants to get those lands is understandable. The present government has given mild steps towards redistributing some lands to communities in the poorest areas. The liquidation of the SAIS in favor of the communities could be a good opportunity to implement an integral program aimed at reversing the degradative trend of the highland ranges. If not

carefully monitored, it could also signify in a few years the generalization of the Andean ecosystem degradation.

Final Thoughts

The range degradation in the Peruvian Andes and the role that overgrazing plays in that process represent a very complex problem. There is no easy nor single solution, but a strategy needs to be elaborated, carefully planned, and strongly implemented. Much needed information is not available at the moment. Range research takes much effort and long periods of time. Peruvian institutions and foreign agencies have seldom had the commitment and resources to do it (Gilles and Jamtgaard 1988). The last effective attempt to build up the so needed knowledge on range management in the Peruvian Andes was the "Small Ruminant Collaborative Research Support Program" (funded by the U.S. government). Unfortunately, it has been discontinued after ten fruitful years of work because of the violent environment that reigns in the area and that has already taken the life of two researchers of the program.

The research aimed at overcoming overgrazing and range degradation should be carried out by a multidisciplinary team work. Range scientists should work on mapping and classifying the rangelands, analyzing grazing systems and working out experiments to determine the optimum carrying capacity for different sites and conditions of range. Economists should follow up animal and human populations in sample areas in order to evaluate production systems. With this information they could identify the role of livestock in peasant economies and determine, through simulations, the impact of alternative policies. Finally, sociologists and anthropologists should help the team understand peasants' expectations and the feasibility of alternative institutional arrangements. Although this is not an exhaustive list of the research needed, it would produce invaluable information for the design and implementation of any strategy intended to alleviate overgrazing and range degradation in the Andean highlands.

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Analyzing Subsaharan Livestock Rangeland Development

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Charles Scifres (1987) reminded us in a *Journal of Range Management* article that approaches to research on U.S. range resource issues have not been sufficiently interdisciplinary in the past, where our "overall task requires focusing of the coordinated expertise of representatives from appropriate plant, animal, and social-economic sciences." Interdisciplinary approaches to livestock rangeland issues in Subsaharan Africa are also sorely needed. This paper outlines one such approach. A framework for analyzing government-sponsored livestock and range activities is described and justified for the Subsaharan livestock rangeland sector and its implications for development interventions are drawn. The framework focuses on the unpredictable fluctuations in funding that have become a key factor in government projects, policies, and administration. The analysis's major implication is that those involved in these interventions have to better understand and adapt to these instabilities than has happened in the past.

The Analytic Framework

The framework identifies the primary sources and responses to govern-

ment funding instabilities. Instabilities are unpredictable and frequent fluctuations occur in preparing, allocating and spending government funds. Their causes can be conceived as external or internal. For example, the cost of livestock watering equipment may suddenly rise due to factors outside the country, while cost increases in water pumping may be the result of changes in local aquifer levels.

The resulting government funding fluctuations are macrobudgetary (government-wide) or microbudgetary (specific to ministries or departments): Macrobudgetary instabilities typically arise because of high-level government decisions affecting the livestock rangeland sector at the national level, while microbudgetary funding fluctuations affect decision-making in lower-level government departments, field projects, and line items for sector activities at the local or regional levels (LeLoup 1988). What is increasingly observed in the Subsaharan livestock rangeland sector is that these funding fluctuations have become cycles of over- and underregulation at the microbudgetary level and cycles of boom and bust budgeting at the macrobudgetary level.

Cycles of overregulation and underregulation occur this way: A government proceeds to adopt more

and more regulations that are increasingly restrictive with regard to the rapidly growing problems of concern. As the number of regulations increase, the regulatory process becomes more time-consuming and the pace of implementing regulations slows down. The slower the implementation and faster the growth in the problems, the more the problems appear underregulated. The more underregulation, the greater the pressure on government to micromanage problems by adopting newer and tougher restrictions. But more numerous and stringent regulations slow even further the pace of implementation, and the cycle begins anew. Funding fluctuations often arise in this micromanagement cycle because the slower pace of implementation leads to schedule slippage and spiraling production and regulatory costs beyond those originally estimated. External micromanagement in the form of a donor's highly bureaucratized project and purchasing cycle, along with internal micromanagement in the form of a local government's red tape, have long been familiar to U.S. livestock rangeland specialists working in the Third World generally and in Africa specifically.

Boom and bust budgeting has become the dominant cycle driving

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