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Desarrollo y Perspectivas de los Sistemas de Andenerías en los Andes Centrales del Perú (Development and Perspectives of Irrigated Terrace Systems in the Peruvian Central Andes)

By Ann Kendall and Abelardo Rodríguez. Cuzco, Peru: Institut Français d'Études Andines (IFEA) and Centro Bartolomé de Las Casas (CBC), 2009. 312 pp. Hardcover: PEN 50.00, US\$ 17.50, plus handling and shipping. ISBN 978-9972-691-93-5.

Terraces in the Peruvian Andes have been the focus of studies analyzing crop and livestock production systems under different land management practices (Rodríguez and Nickalls 2002; Posthumus and De Graaff 2005; Antle et al 2007). Irrigated terrace systems have supported Andean livelihoods for 2200 years, ensuring food security under different sources of risk.

Kendall and Rodríguez's book addresses these issues from an innovative perspective based on the authors' broad field experience and the synthesis of a rich literature. The authors contribute on several fronts. First, they provide a long-term perspective explaining how Andean rural economies have sustained themselves thanks to these irrigated terrace systems and other less sophisticated systems to conserve soil and water. Second, they propose several explanations for the decline of these systems, including environmental disturbances, the arrival of the Spaniards in the 16th century, and today's modern economies, which attract rural dwellers to the urban centers. Finally, they demonstrate the importance of the rehabilitation of terraces without limiting themselves to the economic worth of cultivating terraces. Instead, they

include cultural values, ecosystem services to society, and sources of income generated by tourists seeking landscape amenities. The authors elaborate on the ways in which policy makers and development practitioners may justify their technical and financial intervention through subsidies.

The first chapter sets the prehistorical and ethno-historical context of the Andean culture, covering a 17,000 year period, from the Andean Paleolithic (15,000 BC) when hunting prevailed, to the Inca Empire and the Spanish conquest. Andean agriculturalists and their terrace systems adapted to climatic change, drought, flooding, cold and dry spells, as well as seismic events leading to migrations. Changes in political and military structures, religious beliefs, and environmental factors caused the expansion and contraction of settlements and their associated agricultural systems. In the second chapter, the authors shed light on the underutilization and abandonment of terraces after the arrival of the Spaniards. Under Spanish domination, the labor force decreased due both to a high mortality caused by epidemics and to the transfer of labor from agriculture to mining. The authors point out that, with rising temperatures due to climate change, terrace productivity and land under cultivation could increase, as long as water is not a limiting factor.

The third chapter presents the irrigated terrace construction techniques that still apply today. The authors assess the rehabilitation requirements of terrace systems depending on the area, the level of conservation or abandonment, the availability of labor, and the level of social organization. For example, less fragmented communities show better irrigation and maintenance management, fostering production. In the fourth chapter, the authors discuss this adaptive capacity and conclude that irrigated terraces form an "authentic agro-ecological system" based on a rich diversity of local cropped

plants, which fosters food security when the system is fully in use. The authors highlight the importance of reviving these systems in order to cope with climate change.

The fifth chapter elaborates on the impact of colonial and postcolonial livestock production. The Spaniards were more concerned with exports of precious metals than with sustainable agriculture, and favored extensive livestock systems over cropping. As a result, the Old World livestock species (cattle, horses, sheep, and goats) still exist and interact with the Andean livestock species (South American camelids such as alpacas, llamas, and vicuñas). The authors explore the negative and positive effects of extensive cattle production on nearby irrigated terrace systems and conclude that irrigated terraces and livestock production can be complementary, provided that property rights and communal organization in different altitudinal niches are reinforced.

The sixth chapter analyzes rural development projects in Andean irrigated terraces and discusses forms of subsidized soil and water conservation works. The authors argue that subsidy payments should reflect the ecosystem services provided when terrace systems are in use and maintained by farmers. Regional specificities need to be debated locally with stakeholders in order to find local solutions to specific biophysical and socioeconomic conditions. The last chapter argues that the rehabilitation of irrigated terraces is a straightforward solution to enhance people's livelihoods in the rural Andes. Adequate land tenure, land-use intensification, and conditions that reduce out-migration are prerequisites. The authors' emphasis on development interventions is justified because it enhances the conservation of soil, water, and biodiversity. Governmental intervention may extend to fostering markets that would permit the sustainable provision of environmental and cultural services, in addition to ecological production of

crops and livestock, and other value-added products. In addition to increasing people's incomes, it is important to address human social dimensions such as empowerment, gender, education, and health as part of the terrace rehabilitation.

The authors' recommendations are conducive to broadening the knowledge of irrigated terrace systems as suppliers of environmental and cultural services and food security while proposing innovative approaches for commercialization and Andean rural development in general. The book seems to be more applicable for rural development practitioners in the Bolivian, Ecuadorian, and Peruvian Andes than for practitioners in higher-income Andean countries, and it is an interesting reference for

natural resource management in mountainous areas of the developing world; it also has broad policy relevance in various other regions, notably in Central and South Asia. We foresee an important research potential in better understanding mountain terrace agricultural systems and their rehabilitation to sustain local livelihoods and foster adaptation capacity to a number of stressors.

The book was written in Spanish for wide dissemination among mountain rural development practitioners in Hispanic America. An English version will be published in the near future, and will be very welcome.

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