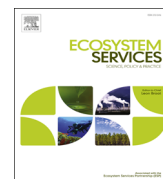




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# Ecosystem governance in a highland village in Peru: Facing the challenges of globalization and climate change



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## ABSTRACT

The agricultural systems of the Peruvian Andes have been created and maintained over many generations using locally adapted management practices that help to maintain agrobiodiversity while providing for local populations. Despite their longstanding history, many of these ecosystems and the services they provide are currently threatened by a number of economic and environmental factors. We use findings from behavioral science to examine the opportunities and conflicts at different governance levels—individual, community, and global. Market pressures to produce for distant markets have resulted in reduced diversity of crops in the Andes region. Another major threat to ecosystem services in the region is climate change, which is already being observed in the form of rising temperatures, extreme temperature fluctuation, changing rainfall patterns, and increasing glacial melt. To explore the effects of, and the responses to, these pressures we used semi-structured interviews to gain insight into agricultural practices and challenges and the various levels of governance present in the agriculture of Langui, Peru. We find that low staple crop prices combined with increasing climate variability has led to a reduced production of traditional crops such as pseudocereals and tubers in favor of production of improved grasses for livestock. The growth of the livestock economy is being driven by the presence of a transnational dairy corporation in the region, plus increased migration leading to a reduced local labor force. We conclude that loss of traditional crops and community based agricultural management techniques will make it difficult for smallholders to maintain food self-sufficiency and agrobiodiversity in the face of a changing climate and global economy.

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## 1. Introduction

## 1.1. Behavior, incentives, and the management of environmental services

The people of the Peruvian highlands have successfully managed their ecosystem resources for centuries in ways that insured sustainability and shared governance. Economic decisions were made in ways that reconciled individual priorities and communal responsibilities. Peasant societies vary tremendously of course, but the most successful ones have evolved similar strategies that can be generalized, as in Elinor Ostrom's (Wilson et al., 2013) design principles.

In this paper we use a behavioral and evolutionary framework to examine the conflicting pressures on the use of ecosystem services in the district of Langui, Peru at the individual, community, and global levels. Because of its fragile environment and limited resource base life was difficult even before the current

challenges of climate change and globalization, but members of the community had a variety of strategies to minimize the risks of agriculture in the high Andes. Today it is an open question as to whether or not traditional institution can cope with the new reality.

Human behavior is much richer, more flexible, more cooperative, and more adaptive than the standard economic model allows. The standard economic model of behavior focuses on individuals as self-regarding, rational consumers. With the assumption that people use all the information available to them to make informed decisions about allocating scarce resources, the economic problem is reduced to making sure that market signals in the form of relative prices are “correct”. When property rights are complete, correct prices insure the rational allocation of ecosystem services by individual market players. In recent decades findings from behavioral science have challenged the economic model of human behavior. First of all, *individuals* exhibit a variety of “irrational” behavioral regularities including loss aversion, anchoring, the endowment effect, and reference dependent preferences (Camerer, 2008). Secondly, human *social* behavior is highly culture dependent. “Rational” behavior in one culture may be completely unacceptable in another (Henrich et al., 2010; Sahlins, 1996). Furthermore, the

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individual-at-a-point-in-time perspective of standard theory may be inappropriate for evaluating policies involving long-lived ecosystem services with public good characteristics (non-rival and non-exclusive). For these kinds of resources, communal governance may be the most effective way to manage them (Wilson et al., 2013). Finally, the global economy in many ways operates as an *ultrasocial* system with rules of its own that frequently conflict with individual and community well-being (Gowdy, 2014; Gowdy and Krall, 2013). This paper examines the conflicts and opportunities for ecosystem management taking into consideration recent findings from behavioral science, community governance, and ultrasocial systems.

### 1.2. The uniqueness of ecosystem Services

In the case of environmental services, it is clear that many of the benefits received from them are not recognized by the market economy. These benefits have been classified by the Millennium Ecosystem Assessment (MEA) as provisioning (food, water, fuel), regulating (climate, flood control, filtering), and cultural (aesthetic, spiritual, recreational). This conceptual framework captures the multi-level layers of value provided by biodiversity and ecosystems, economic, cultural, and ecological (Gowdy, 1997; Kumar et al., 2013). “Values” at each level may be in conflict. For example, it is perfectly reasonable for an individual to discount the future. To an individual, having something today is preferred to having that same thing in 10 years. But is this true for an entire community or for the human species as a whole? For ecosystems, unlike the market economy, “maximization” is not the goal. Rather, biological systems tend to operate on the principle of homeostasis (self-regulation to maintain stability). Living systems generally evolve to ensure balance and resilience in the face of change. Discounting in the economic sense of heavily favoring the present over the future does not come into play at the systems level.

Traditionally, successful peasant agricultural systems balanced the needs of individuals with those of the community. It was possible to do this so long as peasant communities were more or less autonomous. Peasant economies are by definition part of larger economic entities but in the past they could still be self-sufficient. Globalization is changing this by bringing every corner of the planet under its domination. There is a large literature on the effects of group size on social structure. Effective group size is limited by the maximum number of individuals with whom a person (or animal) can maintain social relationships by personal contact (Dunbar, 1993). This maximum number is somewhere around 150–200 individuals. Traditionally, Langui was what scientists call an “individual recognition” society where economic transactions and other social interactions were face-to-face-to-face (Moffett, 2012). A market economy, on the other hand, is a kind of “anonymous” society whose proper functioning depends on more non-personal shared values and common ways of doing things compatible with market transaction. It is not an easy transition from traditional cultures to a market economy. Analysis of peasant agricultural systems today must also take into account the fact that the world’s ecosystems are human dominated (Vitousek et al., 1997). Worldwide, over 80 percent of the global terrestrial biosphere is under direct human influence (Sanderson et al., 2002). Astonishingly, the total dry weight human biomass is over 12 times the weight of all other vertebrates combined (Smil, 2013). Even remote ecosystems in the Peruvian Andes are affected by distant markets and the human-caused disruption of global environmental changes.

### 1.3. Individual behavior and the use of environmental services

Behavioral economics research has supported those who question the uncritical application of the neoclassical economic model to peasant economies. A decades-long controversy among scholars

of peasant societies is the “structuralist” versus “formalist” debate. Formalists such as Schultz (1983) adopt neoclassical economic theory to proclaim that peasant farmers are strictly rational in that they efficiently allocate land, water, and ecosystem services no differently than farmers in developed countries. There is no need to appeal to cultural values to explain their behavior. Structuralists, on the other hand, stress the importance of uncertainty, gender roles and the vulnerability of peasant agriculture (Adams, 1986; Nair, 1979). Peasant behavior exhibits reluctance to change, an avoidance of risk, and a reliance on emulation of respected community leaders. Policies that acknowledge these insights can be used to “nudge” behavior in directions that benefit individuals as well as the community as a whole.

### 1.4. Community governance

A striking characteristic of the human species is the ability to cooperate. For most of our existence humans lived in small groups within the confines of local ecosystems and cooperation evolved because those groups that worked together survived while those that did not perished. Scott (1976), pp. 2–3 writes of peasant economies: “Patterns of reciprocity, forced generosity, communal land, and work sharing help to even out the inevitable troughs in a family’s farm resources which might otherwise have thrown them below subsistence”. Peasant communities are tight-knit groups that have evolved behavioral patterns that are aggregations of past decisions that have worked in similar circumstances in the past (Adams, 1986).

Andean households are organized into communities that serve to manage the commons for their members; including creating and enforcing land use, governing natural resource use, maintaining infrastructure, and defending territory from outside encroachment (Mayer, 2002). Within communities complex systems of reciprocity have been created and evolved over time to allow households to use communal labor in order to carry out labor intensive agricultural tasks (Mayer, 2002). Barter markets are another important feature of Andean communities; allow households to mitigate the risks of competing against industrial scale farmers, and sustainably cultivate their crops while maintaining their cultural identity (Argumedo and Pimbert, 2010). Barter between communities of different climate zones and elevations also provides households with protection from harvest failure (Mayer, 2002).

The question for communities such as Langui is whether these evolved institutions can cope with the new forces of globalization and climate change or whether these changes are so outside the bounds of past experience that new approaches to governance are needed.

### 1.5. Local governance and the global economy

The global economy is evolving into a unified single entity that is bringing all of the world’s cultures and ecosystems under its control (Gowdy and Krall, 2013). It has become what biologists call an ultrasocial system that dominates the planet (Wilson, 2012). Ultrasocial systems are characterized by “downward causation”, meaning that the imperative of growth is reinforced by top-down institutions, belief systems, and regulations. Although globalization has brought advances in agricultural technology that have greatly expanded the world’s capacity to feed a growing population, this has come with environmental and social consequences. Climate change is but one unintended consequence of global economic growth. The new reality is that the reach of the global economy is shaping even remote small peasant communities. Can the human propensity for cooperation and community-building be harnessed sufficiently to scale up and challenge a global system

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