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THE NEW PERUVIAN EXPERIMENT: PRIVATE CONSERVATION, TOURISM AND MINING IN THE CORDILLERA HUAYHUASH

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Timothy B. Norris

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The Dissertation of Timothy B. Norris is approved:

_____
Associate Professor Jeffrey Bury, chair

_____
Professor Margaret Fitzsimmons

_____
Professor Emeritus Stephen Gliessman

_____
Tyrus Miller
Vice Provost and Dean of Graduate Studies

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ABSTRACT

The New Peruvian Experiment: private conservation, tourism and mining in the Cordillera Huayhuash

Timothy B. Norris

Global efforts to create protected areas dramatically increased in the last several decades. This growth is couched within the context of rising hegemonic neoliberal economic policies that govern natural resource allocation. Research on the creation and management of protected areas shows that conservation efforts are moving from the domain of sovereign governments to that of the private sector and from a principal of preservation to one of conserving biodiversity in productive landscapes. While these shifts appear successful based on the ever increasing terrestrial surface area considered protected, there is little known about how this "third wave" of conservation touches down at local scales across diverse institutional and ecological contexts. This dissertation presents a case study of how private conservation frameworks and practices emerged in the Cordillera Huayhuash, a mineral and biodiversity rich mountain range located in the Andes of Perú. Particular attention was given to how economic activities such as tourism and mining influence outcomes in local human and natural communities. To determine environmental outcomes measures of water quality, pasture productivity and forest cover were made; the results serve as a baseline for future assessments. Institutional and social outcomes were assessed with mixed methods ranging from a broad questionnaire to a

participatory conservation zoning exercise undertaken in partnership with the Peruvian government. The environmental observations show limited measurable impacts and highlight the importance of future assessments. The institutional and social assessment shows that the exogenous influence from the international conservation community and the extractive industry are both powerful factors, and that endogenous influences such as corruption and self-interested local leaders also play important roles in shaping outcomes. The participatory zoning exercise demonstrates a hopeful method to build bridges between the local communities and sympathetic officials in the Peruvian protected areas service. The zoning work also raises important questions about whose property will be better defended by the state, that of the communities or that of the mining companies. These findings show how the shared role of private property in both conservation and extraction needs careful consideration when implementing market-based conservation efforts on communal territory in extractive zones.

DEDICATON:

This work is dedicated to Barney Nietschmann (1941-2000).

This dissertation never could have been dreamed without him.

ACKNOWLEDGEMENTS:

I am grateful to the people of the communities and the local governments in the Cordillera Huayhuash who allowed me into their world so that we can explore and interpret the reality there together. My informal advisors in Perú to whom I am indebted include Martin Scurrah of the *Centro Peruano de Estudios Sociales*, Dr. Richard Smith of the *Instituto de Bien Común*, Luis Alfaro Lozano of the *Servicio Nacional de Meteorología e Hidrología del Perú*, Marco Arenas of the *Servicio Nacional de Áreas Naturales Protegidas,* and many others. Special thanks go to Gustavo Escobar la Cruz and Romel Segura Jimenez who shared their rich professional research experience in the Peruvian Andes as immeasurably valuable co-workers. Without the help of my principal adviser, Dr. Jeffrey Bury, who contributed countless hours to improve my thinking and writing skills this dissertation would be in much poorer shape. I also want to thank the other members of my advisory committees, Margaret Fitzsimmons, Stephen Gliessman and Kent Eaton whose experience and knowledge are reflected in the following pages. Indeed, without these four committee members this dissertation project would not have affected the change in both myself and the human and natural communities of the Cordillera Huayhuash in the way it has. There are many others without whom none of this would have happened, but of course the most important are my family who have supported me through the good, the bad, and the ugly of the PhD process. I love you all. Financial support for this work was generously provided by the National Science Foundation, National Geographic Society, UC Santa Cruz Environmental Studies, Global Greengrants, *Servicio Nacional de Áreas Naturales Protegidas* (SERNANP), Antamina, the Anderson Foundation and several private donors.

CHAPTER 1

The New Peruvian Experiment: private conservation, tourism, and mining in the Cordillera Huayhuash of the central Andes of Perú

> "More indigenous territory has been claimed by maps than by guns. This assertion has its corollary: more indigenous territory can be reclaimed and defended by maps than by guns." (Nietschmann 1995 p 35)

1.1 Introduction

While Nietschmann likely overstated the power of maps in his work with indigenous peoples, this dissertation is in essence an exploration of the above assertion. The research for this doctoral project was inspired by my previous work experience in Belize, Borneo, Nevada, and Virginia that used a "legal-cartographic" (Wainwright and Bryan 2009) approach to defending indigenous or first-nations rights to territory as a form of "counter-mapping" (Peluso 1995). The lessons learned from these experiences were applied to a resource governance problem in the Cordillera Huayhuash of the Central Andes of Perú where powerful interests seek to extract minerals from the Earth's crust. The rural 'indigenous' communities that have inhabited the flanks of the mountain range for centuries have responded with forms of resistance that span from violent protest to organized forms of "private" conservation. Following general participatory action research methodologies that included mapping, environmental assessment, and ethnography, the dissertation traces the emergence of "private conservation" as a strategy of resistance and adaptation to the

extractive industry and a burgeoning tourism industry.[1] All of the research was conducted as a participating observer with a strong normative stance: while mining in itself is a necessary human activity, it has a long history of negative environmental and social outcomes. There remains much room for improvement in the practices of the extractive industry and the policies that govern extractive activity.

1.2 Extraction, resistance and resilience

There is evidence that humans have been using metals to make useful objects, jewelry and tools for more than 7,500 years; initially copper and iron according to the archaeological record (Rothenberg 1990). It is likely that the use of metal stretches much further back into our evolutionary history. The importance of metal in human history is enshrined in the named historical epochs based upon societal use of metals. The collapse of civilizations has been attributed to cultural and regional differences in metallurgical weapons technology (Diamond 1997). Ultimately the causal role of metals in determining historical outcomes remains heatedly debated, yet there is no doubt that the search for, the extraction of, and the uses of metal shape the human relationship with the natural environment. At our present juncture the use of metal is so ubiquitous that often we are not aware of the history behind the simple act of cutting a tomato in half with a stainless steel knife. We have no knowledge of where the different minerals necessary to make the steel originate from, we do not know who performed the work of extracting the rock ore from the earth, and we could not

[1] Note that the four relationships outlined are not all equal. While there is resistance to both mining and tourism, the resistance to mining is much greater. Adaptation to both mining and tourism also takes place, but as very different processes.

say anything with respect to who originally owned the earth from which the ore was taken or how the rights of access to the ore were acquired. We could also, of course, make similar arguments about the production and harvest of the tomato.

While generally this lack of knowledge is not a problem that we *need* to address in our daily lives, the actual object that we hold in our hand, the knife, may hide social and environmental costs that some other person or place has paid for without compensation; the so called "externality" in environmental economics. This is not to suggest that we need to normatively judge the use of metal as bad, but instead to invite consideration of the negative externalities involved in the extraction of the metal from the earth, particularly in terms of environmental justice. Through careful analysis of the externalities involved, and with special attention given to issues of environmental justice, there is ample room to improve the governance of natural resource extraction.

This dissertation is broadly motivated by questions of environmental justice that arise as a consequence of extracting natural resources from the earth's biosphere, be they renewable resources 'produced' by nature such as trees (or tomatoes), or non-renewable resources that are locked in the earth's crust such as hydrocarbons and minerals. Recent history gives us several cases where extractive activity leads to environmental damages at scales hard to imagine. Examples can be found in the oil extraction in the Ecuadorian Amazon over the past several decades or the Deepwater Horizon oil spill in the Gulf of Mexico in 2010. In the first case human suffering and death are direct consequences of the extraction. Perhaps one of the best examples is

the Conquest of the New World by the Spanish Crown in the 16th century and the subsequent generation of immense mineral wealth based on the mining of silver in Mexico and Perú (Galeano and Belfrage 1973).

Indeed, this "event" in history still lays claim to negative environmental and social legacies in the contemporary world. It is generally accepted that the 136,000 metric tons of silver that was physically moved from the New World to Europe between 1550 and 1800 (Expedientes Coloniales housed in the Archivos y Bibliotecas Nacionales de Bolivia, 1757, 135, 3 cited in Robins 2011) was a financial driver of the industrial revolution and played a significant role in the evolution and rise of capitalism (Blaut 1992). The role of local 'indigenous' labor and the subsequent human suffering incurred in the mines is well documented (de las Casas 1992 [1552]) and it is known that the Spanish conquest resulted in a massive depopulation of both Mexico and Perú (Denevan 1992 [1976]). We can only speculate about the environmental consequences of these historical relations of production. Evidence of soil contamination from the silver refining process known as mercury amalgamation is still present in Potosi Bolivia (Robins 2011).[2]

This dissertation is driven in part by broad geographical questions such as where, by whom, and with what environmental and social outcomes contemporary forms of extraction take place. While the answers to these questions remain important points of departure, interrogating resistance and resilience shown by local cultures throughout history and in contemporary struggles is at the center of the analysis. My work is

[2] The practice of mercury amalgamation was introduced in the mid-16th century and is still used.

driven by the questions of how 'indigenous' people resist the penetration of foreign interests and extractive enterprises and how they strive to adapt their institutions to maintain a resilient cultural identity. In Perú early answers to these questions can be found in Guaman Poma's map of *Tahuantinsuyo* (the Inca empire) drafted less than one hundred years after the conquest in the early 17th century (Guaman Poma 1615; Turnball 1993). The map, combined with lengthy textual accounts, is an elaborate claim which suggests that the Spanish were invaders in Inca territory. The format of the publication attempts to match that of the Spanish chroniclers. In this way Guaman Poma sought to gain legitimacy for his text. The King of Spain likely never saw the work and as history has shown, the effort failed completely. Nevertheless, this map and accompanying text was both an attempt to resist the Spanish invasion and at the same time a complex adaptation of the Inca world view to dominant Spanish institutions of mapping and documentation (see Figure 1.1). In Peluso's (1995) terms Guaman Poma's work is in effect an early "counter map" created to defend an indigenous territorial claim.

1.3 The Cordillera Huayhuash

I first travelled to the Cordillera Huayhuash in 2001 as a tourist; indeed I backpacked the eastern route from Chiquian to Cajatambo (see Figure 1.2). The landscape is beautiful and unforgiving. As I walked for several days my attention was drawn more to the magnificent 6,000 meter glacier covered peaks and their extraordinary topography than the few local people that I met along the way. In any case, through several conversations I became aware of a tension between the local

Figure 1.1: Guaman Poma's map of the Tahuantinsuyo (the Inca Empire) drafted less than one hundred years after the conquest in the early 17th century. Note the monsters and mythical creatures in the margins that mimic then contemporary Spanish cartography as well as the East-West orientation with Cusco at the center of the map reflecting an Inca world view. (Guaman Poma 1615) (p 1001).

communities, a mine owned by the giant Japanese conglomerate Mitsui Kinzonku seeking zinc and lead in an exploratory phase, and the agencies in the Peruvian government that oversee mining and conservation. This emerging conflict captured my attention and a few months later I returned to the mountain range to find out more about how my previous experience with issues of environmental justice might apply to this particular case.

In general the residents of the range were very concerned about the threat posed by the mine that was in its final stages of exploration and would soon transition to the extractive phase of its operations. A survey administered ten years later in 2011 as a part of this research shows that the majority of respondents still see mining and contamination as the principal threat to their communities. Generally livelihoods in the region are based on rearing cattle and sheep to produce cheese and wool, which is augmented by small scale agriculture. In recent years the presence of tourists and miners has offered limited opportunities to expand commercial activities and provide services to the people originating from outside of the mountain range. Some local residents also gain work as manual laborers in the infrastructure development necessary for both activities, particularly mining. While most residents welcome these economic opportunities, there is recognition that new cash-based activities might undermine traditional subsistence livelihoods that rely upon close connections to the functioning ecosystem and fresh water resources. While the cash is tempting, the possible loss of subsistence livelihoods due to ecosystem damage may be devastating to local families.

Figure 1.2: The Cordillera Huayhuash.

Later in 2001 the mine quickly held a requisite public hearing on environmental impacts which was, despite a large public outcry and questionable political tactics, approved rapidly with support from the ministry of energy and mines (GOP 2002). In 2003 members from several communities in the region, with help from my person and several other external actors, created the *Centro Desarrollo Huayhuash* (CDH – Huayhuash Development Center). The CDH is a grass-roots non-government

organization (NGO) with a mission to "support regional development and community participation in the process to manage natural resources in the Cordillera Huayhuash" (CDH 2003).[3] Specific objectives of the CDH included making a map and inventory of the natural and cultural resources present in the communities, realizing an environmental monitoring program in the watersheds of the range, and creating a base for sustainable development in the region. Grant proposals for larger projects were prepared in 2004 and earnest work began in 2005 as the several of the initial proposals were funded. At the same time several communities began their individual projects to create private conservation areas (PCAs). The funded work organized by the CDH included a regional "private conservation" workshop in 2005, a preliminary participatory mapping project that spanned 2006-2007, and a reforestation and environmental education workshop in 2007. I also provided assistance to two communities with the development of their individual PCAs in 2007 and 2008 as a consultant. This dissertation is an extension of this work.

1.4 The political ecology of mining and conservation

As leaders of the *Centro Desarrollo Huayhuash*—the community leaders, an agronomist, and myself—we had no idea that we were "doing" political ecology. Only when I became a graduate student and was exposed to the academic literature did I come to realize our work could be labeled as such. Our work was motivated by a broad concern about how the historical and contemporary political economic context

[3] This moment of creation was made possible with the support of a seed grant from the Global Greengrants Fund coordinated in Perú by Denise Bebbington. Martin Scurrah of OXFAM also played a key networking role in the coordination of this grant.

within which a place—the Cordillera Huayhuash—is embedded might affect social and environmental outcomes that can be observed at the community scale, be the community human or ecological. Amongst others, Blaikie and Brookfield (1987) proposed that by starting with the local socio-ecological setting and expanding a critical vision across ever increasing scales, chains of explanation can be constructed that describe how both ecological and political-economic forces shape the relationship between humans and the natural world. While the CDH was not so concerned with chains of explanation, it was itself deeply embedded within these socio-natural structures and by design played a role in shaping the outcomes.

According to the literature I encountered in my first years as a graduate student, the political ecological approach was originally motivated by what were considered inadequate explanations of 'bad' decisions made by agricultural land managers that were exacerbating soil erosion problems in Africa. The consensus at the time suggested that desertification and erosion (in Africa) was due to ignorant and poverty-stricken people trying to eke a living from the land. This was a blame the poor thesis based on Malthusian ideas that served the interests of big "D" Development. This dominant discourse drew from climax theories of ecology, the enlightenment idea that the environment is external to the human experience, that there is one form of value that informs economic decisions, and most importantly by the (in)famous "tragedy of the commons" thesis that posits that human population dynamics are similar to those of populations of bacteria growing in a Petri dish (Hardin 1968). Thinkers critical of this discourse also noted the role that natural science, particularly biology and

ecology, can play in reinforcing these ideas through monopolistic claims on what constitutes acceptable knowledge and evidence of environmental degradation. Blind spots from such privileged studies of environmental change can be introduced by not considering historical, economic, and political factors and assuming that short-term studies can be generalized (Leach and Mearns 1996; Peet and Watts 1996; Forsyth 2003; Zimmerer and Bassett 2003).

As an alternative, political ecology incorporated an increasingly Marxist based explanation that considered the social relations of production as contingent factors of environmental degradation. In its simplest form, instead of poverty causing degradation, a degraded resource base can cause poverty and the degraded resource base may be an outcome of larger political and economic factors. Class based institutions that govern access to, or control of, natural resources can limit the environmental 'entitlements' necessary for the maintenance of a dignified livelihood (Sen 1981; Leach, Mearns et al. 1997). In a nutshell, the institutions that govern the access to and control of resources (i.e. property rights) can be used as a starting point for an analysis of both social and environmental outcomes of various human activities. Indeed, political ecology research has a long history of investigating how institutions of access and exclusion that govern conservation efforts affect environmental and social change (for examples see Robbins 2004; Brosius, Tsing et al. 2005; Zimmerer 2006), and more recently is engaging with inquiry into how the institutions that govern natural resources in the extractive industries might do the same (Watts 2004; Emel and Huber 2008; Watts 2009; Bury and Bebbington 2013).

This dissertation attempts to bring these two theoretically linked but often practically separate conversations together; whether it is successful or not only the reader can decide.

Two themes from political ecology and allied disciplines will be used for this project. First, political ecology has a long engagement with the role of social movements and resistance tactics employed by communities and indigenous peoples in their struggle to resist capital accumulation and as bids for autonomous control over their territory and the natural resources found within (for example Hecht and Cockburn 1990; Bebbington, Humphreys Bebbington et al. 2008). The adopting and adapting of legal private conservation frameworks by the communities in the Cordillera Huayhuash can be partially understood as a coordinated effort to resist outside interests that include extraction and conservation. The private conservation effort is a direct bid for autonomous local control over natural resource governance while maneuvering within neoliberal institutions (see chapter 2).[4] Second, a broad theoretical conversation about the commodification of nature has emerged as a lens that can be used to understand how neoliberal reform that began in the 1980s and continues in varied forms today has altered the relationships between the state, the market and civil society (Katz 1998; McAfee 1999; Prudham 2003; Liverman 2004; Harvey 2005; Mansfield 2007; Smith 2007; Castree 2008). In the Cordillera Huayhuash the expansion of mining operations, the influx of international tourists, the adoption of legal private conservation frameworks, the CDH mapping project, and

[4] This is necessarily simplified and abstracted. The actual process, as noted earlier, is both resistance and adaptation to exogenous pressures from mining and conservation.

even this dissertation research can be understood as forms of commodification of the natural terrain, both above and below ground, that continue to take place in the context of neoliberal reforms adopted in Perú throughout the 1990s and 2000s (see chapter 4).[5]

Both resistance to capital accumulation and the commodification of nature are articulated in Nietschmann's words. By its very nature the practice of counter mapping is a form of resistance that can be adopted by people who wish to assert territorial claims that "counter" official state policy. At the same time many mapping projects are a tools of the state and lend to legibility, governability, the creation and disciplining of (neoliberal) subjects, and the promotion of private property and the rule of law. This tension between resistance and discipline is a part of any participatory research undertaken under the banner of natural or social science, be it mapping, evaluation of water quality, or simply exploring the emergence of private conservation in a neoliberal economic context. This tension can be constructive and hopeful and at the same time destructive and even violent. I contend that with a mindful approach this dialectic in political ecology research can be transcended and lead to a more just and sustainable future.

1.5 The new Peruvian Experiment

In the historical context of the Spanish Conquest of Perú it is easy to understand the *encomienda* system, whereby land and resident local people were 'granted' to

[5] The commodification of nature is broadly understood to mean the creation of new capital flows through nature in order to create products for market exchange and the accumulation surplus. This dissertation allows for investment to flow through the social and natural landscapes to produce data as a saleable item. In this sense my work can be understood as the commodification of nature.

conquistadores as property, as a form of "enclosure" or even "so-called primitive accumulation" (Marx and Engels 1967 [1867]; Smith 2005 [1776]). In this case, the enclosure not only limited the access of local people to the land through privileged forms of private property based on violence, but also included appropriation of their labor time in the package. This strategy of accumulation was quickly changed to a system that benefitted the state mines rather than individual conquistadores through the *reducciones* initiated by Toledo in the late 16th century whereby local 'autonomous' communities were 'registered' and forced to pay annual labor tributes to the colonial state. Toledo's reform provided the state with labor at virtually no cost. These labor arrangements were principal moments in the formation of a race and class based 'functional dualism' so characteristic of many Latin American economies (de Janvry 1981).

In Perú these original conquest relationships settled into the *hacienda* system in which vested landowners controlled both agricultural and extractive enterprises that utilized various forms of cheap local labor to produce surplus. Resistance, reprisals, and rebellions to these labor relations were common in colonial times and remained prominent throughout the first century and one half of Perú's sovereign and independent rule as a nation which stretched from 1811 to the mid-20th century. While it is generally accepted that the *hacienda* system began to crumble in the early 20th century, general Juan Velasco and his leftist military 'revolution' in 1968 followed by a sweeping agrarian reform in 1969 is credited with toppling the legacy of colonial land ownership and labor relations (Bustamente Olivares 2008; CEPES

2009). Through this reform, labeled "the Peruvian Experiment" (Lowenthal 1975; Lowenthal and McClintock 1983), *hacienda* property was expropriated from the owners and turned over to peasant cooperatives. Additionally an American petroleum company, several banks, and industries in several key sectors that included mining were nationalized. While both the expropriation of property and the nationalization of industry were popular with the general Peruvian population, what many failed to see was that Velasco's government made this politically possible through generous remuneration for the reform of ownership. This was the only way reprisals from powerful actors, including other countries such as the United States, were avoided

For several years the 'revolution' embodied extraordinary hope as Velasco's regime stumbled through the administrative and political details of these sweeping changes. While certain immediate indicators suggested that the reform might be working, within about five years signs of a failed 'revolution' were becoming visible. The cooperatives were falling apart and being taken over by their original owners or others with sufficient financial resources and in other cases and they failed completely. The government debt from the remunerations to property owners and foreign owned industry had not been recuperated and hindered national fiscal budgets for social programs. Amongst many other contingent factors which include policies of import substitution industrialization in the 1950s and 1960s, the 1980 Latin American debt crisis, and Alan Garcia's populist and short-term solution to the onset of economic failure in the mid-1980s, the failed revolution and experimental agrarian reform helped set the stage for high levels of rural unrest, a terrible civil war, and

economic instability that included inflation rates that peaked at nearly 10,000% in 1990 (Thorp and Bertram 1978; Eguren 2006; Bustamente Olivares 2008; CEPES 2009; Mayer 2009; BRCP 2013) (see Figure 1.3).

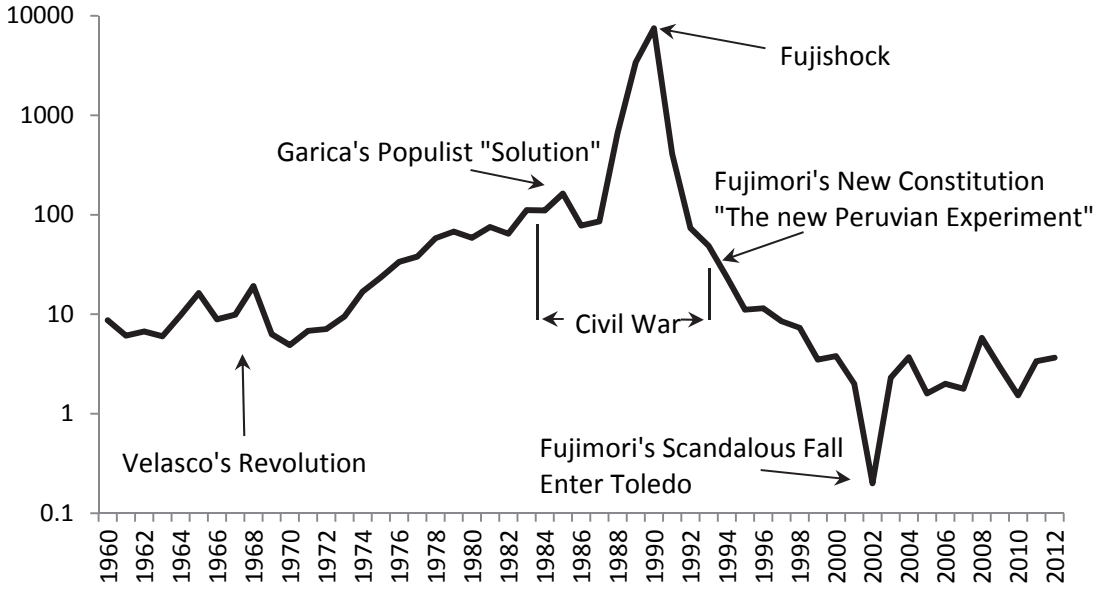

Figure 1.3: The average annual inflation rate in Perú from 1960-2012 (BRCP 2013).

In a remarkable turn of events a politically unknown agricultural extension adviser, Alberto Fujimori, was democratically elected to the Peruvian presidency in 1990. Throughout the first years of his term he implemented neoliberal reform—termed *Fujishock*—that reversed the ideals of social property found in the original Peruvian Experiment. These reforms, in conjunction with brutal military force and an *autogolpe* (self-coup) in 1992 brought the civil war to an end. Fujimori subsequently rewrote the constitution of Perú and in 1993 it was made law wherein neoliberal

ideals of private property became enshrined. A host of legislation that protects foreign investment led up to and followed this constitutional right turn and by the year 2001 Perú had been declared as one of the most open liberal economies not only in Latin America but in the world (IMF 2001). The idea that private property was *the* solution to economic and social woes in Perú (de Soto 1989; de Soto 2000) had been given *carte blanche* political backing and was revered as a 'successful' implementation of this aspect of neoliberal reform. I choose to call it the "New (and improved?) Peruvian Experiment."

The results of this experiment that we can now observe are nearly as remarkable as the turn of events in the 1990s. As planned, foreign direct investment (FDI) in the hydrocarbon and mineral extractive industries began to flow freely. The economy has steadily been growing and in the period of 2002-2013 the average annual economic growth rate has been 6.4% eclipsing that of most developed countries (CIA 2013). While other countries in Latin America have experienced similar patterns of economic restructuring followed by increasing FDI inflows (Bury and Bebbington 2013), Perú has been recognized as an investment "hotspot" due to both large mineral reserves and favorable institutional arrangements for extraction of not only the mineral commodities but the profits as well (Bridge 2004). A rising per capita GDP in the first decade of the 21st century leads to further proclamations of the success of the neoliberal reforms, yet the 2008 financial crisis and a fluctuating GINI coefficient are sober reminders that these gains may not be sustainable. While Perú weathered the

events leading up to and following 2008 well, yet there is growing evidence that the extractive boom may be coming to an end (Neumann 2013).

Accompanying the macro level institutional changes that encouraged investment in the extractive sectors at a national scale, the institutions of individual and communal property ownership were also altered significantly and redefined the relationship between the citizen and the state. As a consequence of both the 1969 agrarian reform and the civil war that spanned the 1980s, the records of legal titles to individual and community property to land were in a shambles. In 1994 the Inter-American Development Bank funded the *Proyecto Especial de Titulación de Tierras* (Special Project for Rural Land Titles or PETT) as an initial attempt to re-organize the national cadaster for rural property. PETT was funded for over a decade through three project cycles and was then dismantled in 2008 by the then President Alan Garcia. While it is known that approximately 1,900,000 titles were given to individuals over the course of project (IADB 2007), it is nearly impossible to find national statistics of how many communal titles were registered through this program. Estimates of just over 1,000 communal titles granted to both Andean and coastal communities are generally agreed upon. However, more than 4,000 communities are still struggling to gain title to their territory (CTSCP 2013). In addition, work from the year 2000 shows that of the known 5,680 communities that exist in Perú, 3,326 have territory that overlap with mining concessions (de Echave, Hoetmer et al. 2009 p 17). With the observed difficulties to gain community titles and the apparent ease to purchase sub-surface mineral rights, it is clear that PETT was not a program created

to strengthen community right. Indeed the outcomes were quite the contrary and in fact weakened the validity communal titles to the benefit of the sub-surface concessions.

As the institutions governing sub-surface and surface ownership were re-arranged the governance of natural protected areas necessarily also went through a period of significant change. Once again, the legislative shifts in protected area frameworks that took place in Perú over the last several decades are part of a broader "third wave" of conservation efforts which have moved away from enclosing spaces and restricting access to resources to working within productive or functional landscapes to conserve biodiversity (Zimmerer 2006). In Perú two shifts are particularly worthy of mention. First, as an apparent move by the Fujimori regime to respect indigenous rights and uphold the ILO 169 adopted in 1994, no protected area can be created without a consensus approval of all people who own territory within the proposed area (if only this were true for extractive operations as well!). And second, an array of new legal conservation frameworks, including private conservation, native reserves, municipal and regional conservation, management concessions for protected areas, and so on, have been incorporated into national policy. This second shift has allowed for the privatization and decentralization of what was previously under the administration of the central state.

As a broader aspect of decentralization two further reforms merit mention. First, in 2001 a redistributive mechanism known as the *canon minero* (mining canon) was created to channel rents and royalties received from extractive industries to regional

and local governments in whose jurisdictions extractive activities are located (GOP 2001). Then in 2002 a broad decentralization law was legislated which devolved what had been centralized decision making in Lima back to regional and local governments. This included reinstating the democratic election of officials in local governments which prior to the law were appointments made by the president elect of Perú (GOP 2002). These decentralization reforms can be understood as the final plank in the creation of what the World Bank and the IMF label "good governance." This term broadly refers to systems of governance conceptualized as an abstract set of relations between the state, market and civil society that include guaranteeing the rule of law in the defense of private property, promoting democratic citizen participation through decentralization of fiscal and political decisions, and accountability in the public sector. Outcomes from these reforms can be visualized at a national level through the series of maps in Figure 1.4 which show the distribution of mining concessions, rural registered titles, and the *canon minero* across regional political jurisdictions. While there is no way to causally connect the patterns in these three maps they are insightful when trying to understand the context within which this dissertation is situated (see Figure 1.4).

1.6 Research questions and methodologies

This dissertation is investigates the emergence of private conservation in the Cordillera Huayhuash of the central Andes. The research design takes advantage of the natural experiment found in the institutional reform outlined above. The work seeks to explain how private conservation has emerged in Perú, what outcomes can be

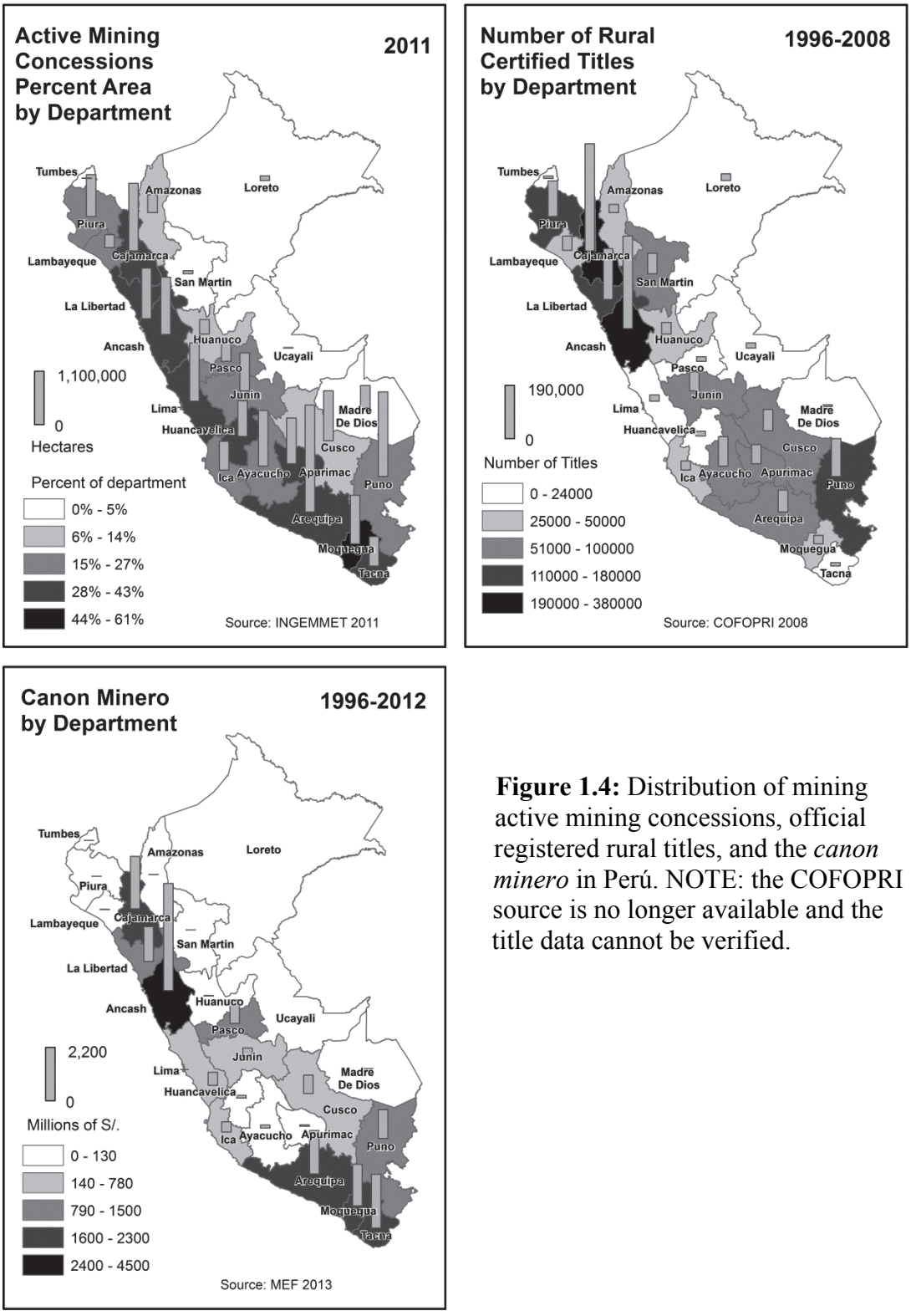

Figure 1.4: Distribution of mining active mining concessions, official registered rural titles, and the *canon minero* in Perú. NOTE: the COFOPRI source is no longer available and the title data cannot be verified.

observed as a result of this novel conservation approach, and what lessons can we draw from the experience. The specific questions addressed are as follows:

1) How have private conservation areas emerged as a strategy of territorial defense and autonomous local control over natural resources in the Cordillera Huayhuash (chapter two)?
2) What baseline environmental conditions can be observed in the Cordillera Huayhuash in terms of water quality, pasture productivity, and forest cover (chapter three)?
3) How might the commodification of the underground (mining) effect the commodification of the surface (conservation and tourism) and vice-versa (chapter four)?

To answer these questions mixed methods were used that span disciplines in the social and natural sciences. Following a political ecology approach to examining the human-environment relationship close attention is given to the current and historical political and economic contexts across various scales. Explanations draw from the observations at local scale at the actual research site in the Cordillera Huayhuash, from the regional and national scales in Perú, and also from a global perspective. Using this method to understand how local contexts are linked to broader political and economic trends through "chains of explanation" (Blaikie and Brookfield 1987) is fundamental to understanding the research questions outlined above. Following traditions in cultural ecology and applied anthropology, long term field work was conducted for the purposes of this dissertation that spanned two preliminary three-

month research periods in 2009 and 2010 followed by a full year of research in 2011. Additional "research" was conducted in the region from 2001 to 2008 as an activist and organizer for the NGO the Huayhuash Development Center. Through this long term engagement my research role was that of a "participating observer." Sections of this dissertation are intended as a "thick description" that blends personal experience and perception with factual events and known phenomena to interpret the cultural, political, and economic contexts of the research (Geertz 1973). This interpretive method seeks to remove the subject—object dichotomy of causal explanation and instead approach the world with a dialectical subject—subject approach (Sayer 2010 [1984]).

Also drawn from a political ecology approach that purports to (re) combine social and natural sciences, and placed firmly in the inter-disciplinary tradition of the environmental studies department at UC Santa Cruz, the collection of empirical evidence in this dissertation used a relatively broad set of tools drawn from across several disciplines. Water quality at over 32 monitoring stations was measured across the two years of 2010-2011. For each sample taken laboratory services were contracted for the evaluation of heavy metal concentrations, field instruments were used to measure several parameters *in situ,* and a field incubation technique was used to measure fecal coliform counts (chapter 3). Pasture condition in terms of productivity was evaluated at 19 different sites across the two years of 2010-2011 by using a step transect technique (chapter 3). A participatory conservation zoning exercise was undertaken in which ten communities demarcated a preliminary set of

land use zones for their respective territories. And finally, a survey instrument was designed, tested, and then administered to 176 respondents using a convenience sample across the same ten communities that participated in the zoning exercise (chapter 2).

Very broadly the entire research endeavor was designed as a participatory action research program. The work undertaken was designed not only to generate new knowledge and interpretations of reality, but also to make change that *should* take place in society. The participatory research design was chosen as a technique to first and foremost produce information useful to all of the actors involved, second to strengthen conservation efforts at the community, municipal, and regional levels in the region, and third to inform academic and practitioner debates regarding the new forms of conservation emerging in the Andes.

It engaged different groups of actors with varying degrees of responsibility ranging from selecting project goals and research design to paid field research and logistical support. Several government officials at the *Servicio Nacional de Áreas Naturales Protegidas* (SERNANP – the National Service from Natural Protected Areas) were direct collaborators at the project goal and design level. This included the director of the service and several of his staff. All of these actors engaged as participants who exercised power both over the research project and beyond. The sections of the research dedicated to understanding environmental conditions and the separate conservation zoning exercise engaged actors in SERNANP, actors in local municipalities, and actors in individual communities (mostly male community

leaders). The actors in the local municipalities participated mostly as advisers and as collaborators who provided logistical support. The actors from the local communities participated through a variety of roles that included labor, hosts, informants, evaluators, collaborators, and partners. Indeed, the research question addressing water quality and the evaluation of pasture productivity were prioritized by these participants as partners. For the conservation zoning exercise and survey these actors gave input to the research design as collaborators and evaluators.[6]

The results from all of the research were summarized in reports (Spanish) that were published as gray literature and given to all of the participating actors in 2010 and 2011 (Escobar and Norris 2010; Norris and Escobar 2010; Escobar and Norris 2011; Norris 2011; Norris and Escobar 2011; Norris, Escobar et al. 2011; Norris, Escobar et al. 2011). In this way the research has already served its first two goals of providing useful information to local actors and to strengthen local conservation efforts. The chapters that follow will be published in academic journals as indicated to serve the third purpose of the research by informing broader conservation debates.

1.7 Introduction to the Chapters

The three chapters that make up the principal content of this dissertation are linked through the participatory action research design. Parts of chapter two were originally written with Jeff Bury and the remaining chapters were written as individual efforts. A brief outline of each chapter follows.

Chapter two begins with a review of recent conservation research which

[6] The labels used for levels of responsibility in project participation are drawn from Rocheleau (1994).

theoretically situates “private conservation” as a form of emergent neoliberal environmental governance. Then the Peruvian context is outlined with historical details for existing legislative, political-economic, and cultural landscapes within which private conservation in the Cordillera Huayhuash emerges. The chapter then proceeds with a national level institutional analysis of current natural resource governance focused on the extractive and conservation sectors. Then a brief description of the Cordillera Huayhuash, both physical and cultural, introduces the case study. Next the chapter turns to how local institutions contribute to new conservation priorities, how these priorities shape local governance, and what challenges local communities encounter with the novel private conservation frameworks. Finally the chapter considers how outside pressures from the extractive and conservation sectors influence local perceptions and objectives of conservation. The conclusions focus on weaknesses and strengths of private conservation in the Huayhuash and provide some recommendations for future research. This chapter was written with the target journal *Society and Natural Resources* in mind; significant portions will be cut before submission.

Chapter three presents an empirical environmental assessment in terms of forest cover, water quality and pasture productivity as distinct case studies. The water and pasture assessment used participatory approaches while the forest cover evaluation used laboratory based methodologies (remote sensing coupled to geographic information systems). The pasture evaluation confirms the hypothesis that pasture condition close to campsites is poorer than in non-camping areas. The discussion

articulates these results with local concerns for improved pasture management and reduction of tourism impacts (too many pack animals). The findings from the water monitoring confirm the hypothesis that water quality in terms of human contamination is poorer in rivers directly downstream from camping areas. The water quality results in terms of heavy metal concentrations are tentatively linked to mining activities. The findings from the temporal analysis of forest cover drawn from several years of satellite imagery support the hypothesis that forest cover is relatively constant. The forest cover results are articulated to local conservation and governance institutions. The baseline data in this chapter will serve as a reference point for future research and will also serve the local communities in their endeavor to better understand their changing environment. This chapter is written as a journal article with the target journal as *Conservation Biology* in mind.

In chapter four a commodification of nature framework is used to analyze the ways in which mining and conservation activities exist dialectically in the Cordillera Huayhuash. Privatization, property rights and the role of persuasion are used to theoretically link extraction and conservation activities. This is chapter is quite experimental and is an attempt to give Mac Chapin's (2004) polemic about the closing gap between large international conservation organizations and trans-national extractive interests a theoretical base. To achieve this goal it is assumed that the institution of property relies upon persuasion to exist. From this starting point it is argued that both extraction and conservation share the need to persuade property owners to give up certain rights in order for both activities to take place. Conflicts and

congruencies between the two sectors in the Cordillera Huayhuash are used as evidence for how this articulation takes place on the ground. The conclusions focus on ways to think about the convergence of these two traditionally disparate sectors in order to better understand market-based approaches to conservation in extractive zones. The chapter is written as an article with the target journal of *Antipode* in mind.

Chapter five contains concluding remarks in which the theme of participatory action based research is revisited. The research for this dissertation is evaluated based on lessons learned, outcomes observed, and dilemmas that remain problematic. From this evaluation three future research directions are outlined. First, there is an imperative to repeat the empirical evaluations of water quality, pasture productivity and forest cover in the Cordillera Huayhuash. Ideally this work will take place within five years and the same participatory research methods will be used. This work will serve dual goals; to strengthen private conservation in the region and to evaluate longer-term environmental outcomes. Second, the evaluation of the action research process highlights the role of leadership in the emergence of private conservation in the Huayhuash. Future research into how leadership roles factor into observable outcomes will produce useful knowledge. And third, future research programs to further the tentative theory of the conservation–extraction dialectic outlined in chapter four will serve to increase our understanding of the sustainability of current global economic patterns and practices.

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CHAPTER 2

The People's Parks:
Private Community Conservation in the Cordillera Huayhuash, Perú

Abstract: This research examines the recent creation of new community-led and owned private parks in the Cordillera Huayhuash, Perú. The article highlights the ways in which collisions of private conservation and communal land tenure create new conservation models which are emerging from neoliberal economic and political restructuring efforts in developing countries. After tracing the historical genesis of the legal private conservation frameworks in Perú, the article evaluates the ways in which these novel private parks are embedded in local management institutions, how community-led efforts are contributing to shifts in conservation priorities, and the types of challenges that are arising for community-led efforts due to lack of institutional and technical capacity. The article continues with an analysis of the emerging conflicts that new private parks are contributing to across a variety of scales of analysis, including between communities and outside actors, between communities, and within the communities themselves. Finally the article considers how outside pressures from extractive industry and international conservation actors influence local perceptions of conservation and subsequent conservation objectives.

Keywords: conservation, private parks, Latin America, Perú, Cordillera Huayhuash

2.1 Introduction

The number of protected areas on the planet has tripled in the past two decades and now covers more than ten percent of the earth's surface (Naughton-Treves, Holland et al. 2005; WRI 2005). Among the more than 100,000 protected areas that exist there are a host of new types of parks and places that reflect growing changes in conservation goals, institutional frameworks and protection purposes. Generally, the spectrum of new protected areas has shifted from state-led protection to include efforts with a diverse set of managers and actors who pursue goals including biodiversity protection, national development and poverty reduction through private investment. In the developing world recent increases in protected area coverage are also embedded in neoliberal political and economic restructuring efforts that have reorganized the control and management of natural resources over the course of the past two decades. These changes opened many countries to new flows of global resources and to multi-national actors intent on assisting in the development of conservation plans and protected areas. Altogether these shifts transformed the institutions, management systems and decision-making procedures affecting natural resource allocation and use.

Like many other developing countries, Perú's system of protected areas grew rapidly in the recent past. Currently, over 16 percent of the country is covered by nationally protected areas that now include a variety of new forms of management and natural resource use. Most recently, a number of new private conservation areas (PCAs) are emerging which have been influenced by broader global changes taking

place in conservation agendas. Based on decentralized natural resource control and private property, these new "private" parks raise important theoretical and empirical questions for conservation efforts in Latin America and the developing world. This article explores several of these questions related to the management and conservation priorities in several new protected areas in the Central Peruvian Andes. The structure of the article proceeds in the following fashion. The first section establishes a theoretical context which explores private community-led conservation within current conservation research. Subsequent sections then explore the evolution of conservation efforts in Perú, neoliberal change and the emergence of new private parks within the country. Following sections turn to case-study research on private parks in the Cordillera Huayhuash to illustrate the ways in which they are being created and managed.

2.2 Theoretical Context: New Conservation Research Agendas

One important facet of change in global conservation efforts in the past two decades has been a shift in the role that national governments have assumed in creating and managing protected areas; generally the trend is towards less state involvement in conservation efforts. This shift can be attributed to several interrelated factors. First, the adoption of neoliberal political and economic reforms has transformed the institutional context surrounding national natural resource management policy in the past two decades. Recent interdisciplinary research in geography and allied fields examines the ways in which these reforms are decreasing the presence of the state in environmental management and how national

restructuring is affecting environmental and social change (Bates and Rudel 2000; McCarthy and Prudham 2004; Harvey 2005; Perreault and Martin 2005; Liverman and Vilas 2006; Zimmerer 2006). A second factor in the reduction of the state's conservation role is the recognition that "fortress" (Neumann 2005) or "Yellowstone" (Stevens 1997) models of conservation cannot be simply exported from the North to the South without considering the articulations between conservation, poverty and development (Adams and Hutton 2007). Critiques of top-down protected area models have clearly demonstrated the negative impacts that "imposed" parks have had on local peoples in Africa (Neumann 1998; Turner 1999) and Latin America (Zerner 2000; Stonich 2001). These two factors have shifted conservation efforts away from top-down models to models that recognize indigenous rights and include sustainable development objectives. More recently "third wave" conservation efforts have emerged in which private sector actors play a significant role in promoting biodiversity conservation within productive landscapes; this transition is understood as part of the broader process of globalization (Naughton-Treves, Holland et al. 2005; Zimmerer 2006; Adams and Hutton 2007). To show how this third wave of conservation touches down in Perú we consider how decentralization, privatization, and democratic participation, three principal planks of neoliberal reform (Castree 2008; Himley 2008), affect outcomes in a particular institutional setting.

Concurrent to the spread of neoliberal reform, the recognition that conservation must respect indigenous rights was marked by the 1989 International Labor Organization's Indigenous Tribal Peoples Convention (ILO 169) and further work at

the Rio Earth Summit in 1992.[1] These two events led to a focus, particularly in developing countries, on conservation models such as community-based wildlife management (Jones and Murphree 2001), indigenous reserves (Langton 2003), extractive reserves (Fearnside 1989), integrated conservation and development (ICD), community based conservation (CBC) (Berkes 2004), Joint Forest Management (Rangan and Lane 2001) and community-based natural resources management (CBNRM) (Hulme and Murphree 2001; Brosius, Tsing et al. 2005). In varying degrees these models all reflect certain aspects of decentralized resource governance with more inclusive policies for non-government participation tied together with new institutional configurations that define rights of access and control over natural resources. On the one hand, this shift towards local level management is complemented as an advancement in social justice and political effectiveness (Stevens 1997), yet, on the other hand, it is also criticized because it exacerbates social inequalities and struggles over access to resources within these local spaces (Ribot 1999; Peluso and Watts 2001; Young 2001; Agrawal and Gupta 2005), local institutions are often poorly equipped to effectively manage conservation areas (Barrett, Brandon et al. 2001), and local efforts may be co-opted by international interests and generate outcomes that are not based on local priorities (Sundberg 1998; Chapin 2004). Our research contributes to this literature as both a critique of

[1] Also born from the Rio Earth Summit was the term 'biodiversity' which reflected new paradigms in ecology that recognized the difficulties of conservation through ecosystem preservation and shifted conservation priorities to preserving species (Worster 1994 [1977]).

decentralized biodiversity conservation models and as a hopeful case of local empowerment through the management of burgeoning tourism flows.

In contexts where indigenous rights are no longer—or are not considered—an issue, and where institutions regulating private property are well developed (for example most of the United States and Europe), the decentralized conservation models described above were not as prominent in practice. Instead strategies were created to promote efforts to conserve biodiversity and open space through voluntarily agreements between two agents (a land owner and a conservation organization) in a free market backed by concrete economic incentives. These strategies are generally termed as "private conservation" (PC) (Wright and Czerniak 2000; Byers, Ponte et al. 2005; Rissman, Lozier et al. 2007). The main instruments of private conservation in the North are land trusts and conservation easements; markets for conservation offsets and/or credits are also becoming important (for example see Robertson 2006; McAfee 2012). While there are claims of enormous success of these instruments (Byers, Ponte et al. 2005), several authors observe that problems with the longevity and the monitoring of the agreements have not been fully addressed (Merenlender, Huntsinger et al. 2004; Rissman, Lozier et al. 2007; Logan and Wekerle 2008; Gallo, Pasquini et al. 2009). Furthermore conservation success appears to hinge on aligning conservation goals with local development goals (Duane 2010) and ensuring that these tools which limit rights on private property must not threaten local property owners (Stacy 2002).

As part of the process of globalization and the third wave of conservation these PC instruments are being exported across the world with varying degrees of success (Cesareo and Daly 2004; Llambí, Smith et al. 2005; Gallo, Pasquini et al. 2009). In Latin America non-government organizations (NGOs) practicing private conservation, such as The Nature Conservancy (TNC), have been operating since the 1980s, yet the instruments used are quite distinct from the North.[2] Several observers note that in addition to the problems of longevity and monitoring, PC in Latin America lacks concrete financial incentives for land owners, is legislatively weak and lacks implementation capacity both in government agencies and the private sector (Langholz and Lassoie 2001; EIL 2003; Swift, Arias et al. 2004; Monteferri and Coll 2009). Furthermore, in places where sub-surface and surface tenure regimes are distinct private conservation may not work at all (Rissman, Lozier et al. 2007) or the perceived financial incentives of extractive industries may trump PC incentives (Schwartzman and Zimmerman 2005). Finally, PC instruments are relatively untested on private lands under communal tenure regimes (Merenlender, Huntsinger et al. 2004). This case study approaches the emergence of private conservation with a particular focus on the experimental nature of implementing private conservation tools on communally owned territory in a resource rich region.

Finally, to compliment this theoretical approach we also consider how conservation has a long history of forceful imposition over, and subsequent resistance from, local people who find themselves as trespassers in territory that they

[2] In fact TNC in Perú does not own any land in trust and holds no conservation easements although they have been operating in Perú since 1983.

traditionally used (Peluso 1993; Neumann 1996). This type of external institutional pressure and subsequent local resistance can lead to outcomes that stray from the original intent, whether solely for conservation (Himley 2009) or as part of broader institutional reform (Yashar 2005). This push and pull can further be understood as a tension between contrasting epistemologies and understandings of the world which may lead to an impasse (Orlove 1991 for example) or contains the hope of a co-production of institutions and democratic governance mechanisms that lead to more just and sustainable outcomes (Ostrom 1996; Ostrom and Nagendra 2006; Bebbington and Bury 2009). Both of these perspectives lend agency to local communities as they strive to accommodate their local institutional practices to the influence of outside pressures such as mines or international conservation organizations; their participation in the process is a factor in the outcomes observed. To untangle this process of accommodation and co-production it is useful to first understand how local perspectives are influenced by external pressures. This deepens the understanding of impasses encountered and the hopeful process of co-production in this particular case of conservation and development.

Overall this research broadens our understanding of these three general developments, decentralized conservation institutions, novel private conservation instruments implemented on communal property, and the co-production of outcomes, and we show how they have come together through a case study in the Cordillera Huayhuash of the central Peruvian Andes. We begin with the assumption that private conservation is inherently neoliberal and must work within neoliberal frameworks

(Logan and Wekerle 2008), but that through the collision of private conservation with communal forms of property in a resource rich environment new models of private conservation are emerging. First the article outlines historical conservation efforts in Perú and their relationship to political and economic change; this section of the research broadens our understanding of how conservation efforts are related to neoliberal economic and political change. Second, article examines how new private parks in the Cordillera Huayhuash have emerged within the Peruvian context. In doing so it examines the ways in which community-led management institutions are being empowered by, and contributing to, changing conservation priorities. Third, this research examines the types of difficulties and dilemmas that these novel conservation efforts are encountering due to lack of institutional capacity, funding and technical training. Finally the article shows how local perceptions of conservation and development are influenced by outside pressure yet simultaneously bring their own agency into the emergence of the parks. This draws out attention to the importance of local participation in the understanding of these novel forms of conservation and development.

2.3 Conservation in Perú

Perú possesses an abundance of natural geographic landscapes that span dry coastal biomes, rugged high-altitude tundra and the tropical Amazon Basin. Because of this substantial climactic variation, the country is one of the ten most bio-diverse countries in the world (SERNANP 2011). It is estimated that 15 percent of the world's biodiversity can be found within Perú's varied life zones. To complement this

biological richness Perú also possesses a well-developed system of national protected areas. Since beginning in the early 1940's national conservation efforts have increased significantly throughout the latter half of the twentieth century to protect the historical, biological and scenic resources of the country. Presently, over 16 percent of the country has been incorporated into the Peruvian system of national protected areas (SINANPE) (see Figure 2.1). SINANPE encompasses 158 different areas that cover more than 22 million hectares (See Table 2.1). The protected areas are categorized according to their use (indirect and direct) and by administrative jurisdiction (national, regional, and private) across eleven different categories.[3] In addition, there are thirteen areas that have been set aside as "reserved zones", which have not been categorized. These reserved zones currently total nearly 3,000,000 ha and offer little actual protection; they are considered as 'paper parks' (Rodríguez and Young 2000).

Historically, the system of national protected areas in the country has evolved and changed in response to the tumultuous national political and economic events in conjunction with burgeoning local and international interest in conservation efforts (Solano 2005; Young and Rodríguez 2006). In 1941, Perú ratified the Washington Convention which provided a nascent legal framework for parks and protected areas in the country (albeit imported). During the following twenty years, successive administrations established the first national reserve, the first national forests and, in 1961, the first national park. The 1968 leftist military revolution and subsequent

[3] Most of these designations draw on the IUCN's suggested categories, but there is no direct mapping between the Peruvian categories and the IUCN categories.

Table 2.1: Protected areas in Perú (SERNANP 2013)

Category	Number of Areas	Use	Administration	Hectares	% of National System
National Parks	13	Indirect	National	8,170,747.54	36.83
National Sanctuaries	9	Indirect	National	317,366.47	1.43
Historical Sanctuaries	4	Indirect	National	41,279.38	0.19
National Reserves	15	Direct	National	4,652,851.63	20.97
Wildlife Reserves	3	Direct	National	20,755.11	0.09
Landscape Reserves	2	Direct	National	711,818.48	3.21
Communal Reserves	10	Direct	National	2,166,588.44	9.77
Protected Forests	6	Direct	National	389,986.99	1.76
Game Preserves	2	Direct	National	124,735.00	0.56
Reserve Zones	13	N/A	National	2,924,455.79	13.18
Regional Conservation Areas	15	Direct	Department	2,405,588.82	10.84
Private Conservation Areas	65	Direct	Private	259,333.51	1.17
Total	**158**			**22,185,507.16**	**100**

agrarian reform in 1969 marked the end of the crumbling hacienda system and opened up territory to conservation initiatives. Large private land holdings were dissolved and reformed as communal property that was granted to community organizations and new legislation permitted the legal expropriation of private property for the creation of national parks. Throughout the 1970s successive military governments, seeking to assert sovereign control, enhance national pride, centralize control of the country's resources and re-orient national resource extraction activities towards national economic development, created 14 new protected areas that encompassed more than 3 million hectares (including the celebrated Manu and Huascaran National Parks). This marked the beginning of the first conservation boom in Perú (see Figure 2.2). As a part of this emerging conservation and development strategy, Perú ratified the CITES convention in 1975 and incorporated IUCN zoning practices into the system of protected areas in the same year. All of these initial

efforts were guided by the Washington Convention and the then popular "Yellowstone model" for conservation (Stevens 1997); these top-down efforts gave little importance to indigenous rights.

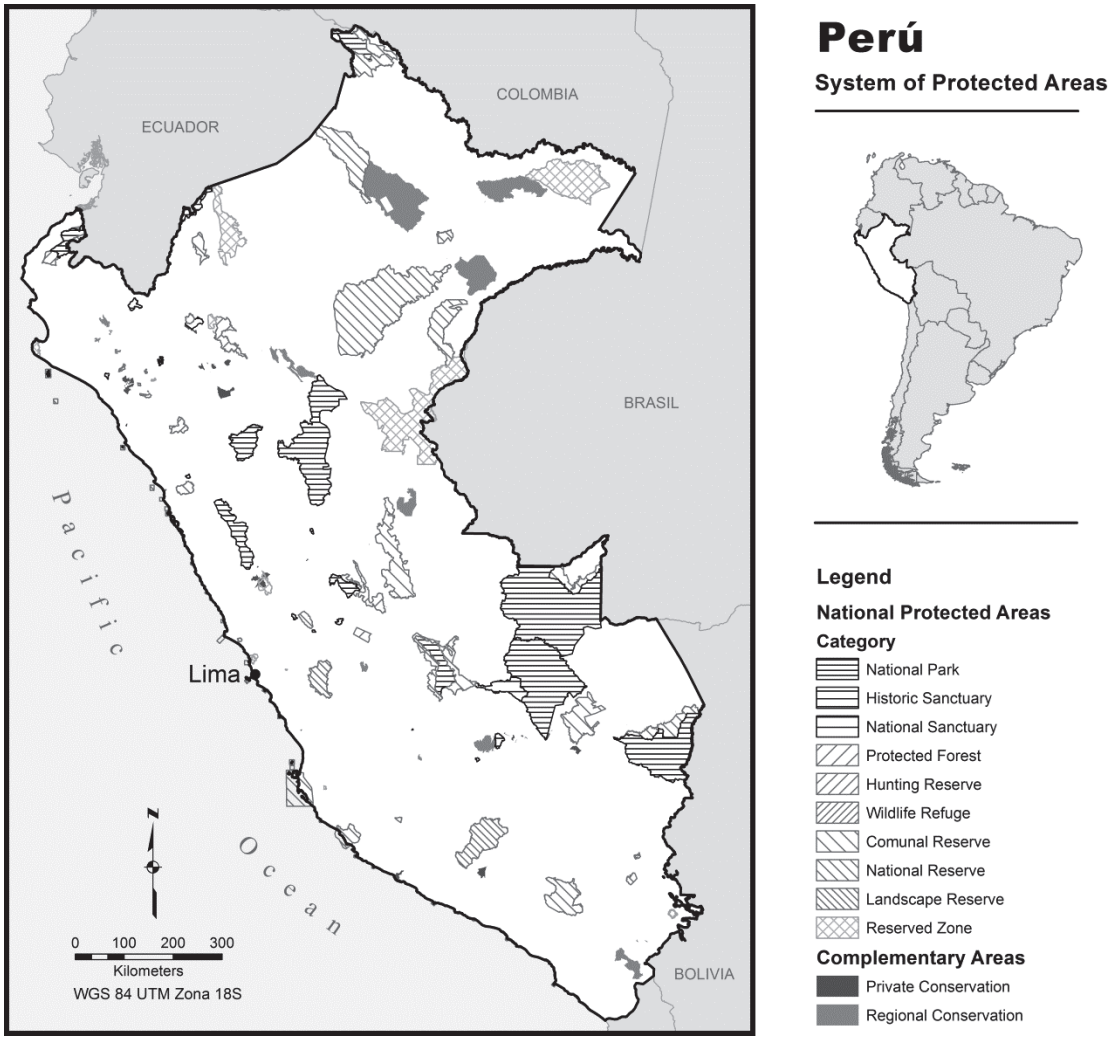

Figure 2.1: Protected Areas in Perú (SERNANP 2013)

Up until 1988 the protected areas system continued to grow, but economic upheaval and an ongoing and increasingly violent civil war that peaked in 1992

negatively affected the creation, management and control of many protected areas. Insurgent guerilla groups, particularly the Shining Path and the Tupac Amaru Revolutionary Militia, controlled large sections of the rural territory in Perú making administration of natural protected areas difficult. Additionally, government resources were dedicated to quelling the violence and not to conserving biodiversity. Subsequently no new national protected areas were created between the years of 1988-1996 (see Figure 2.2).

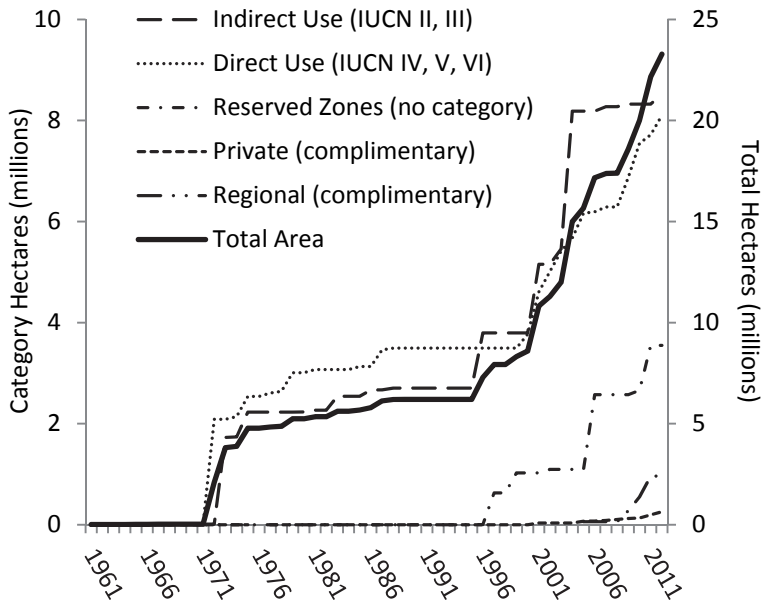

Figure 2.2: The growth of SINANPE (SERNANP 2013)

2.4 Neoliberalization of Conservation in Perú

In 1990, the surprise election of President Alberto Fujimori set the stage to dramatically alter Perú's political and economic climate. Fujimori's regime affected

two important shifts that re-configured conservation in Perú. First, in the early 1990's Fujimori's government began an intense military and police campaign that led to the end of the civil war that plagued the country, particularly in remote areas where many of the country's protected areas were located. By 1993 Abimael Guzman, the leader of the Shining Path, was captured and the war was declared over. This led to substantial increases in the governability of territory under protection and increased the central government's ability to manage protected areas. Second, beneath dramatic and broad neoliberal reform, a new institutional framework was created for the country's protected areas. In 1992 the Natural Resources Management Institute (INRENA) was created within the Ministry of Agriculture (MINAG) to oversee the country's protected areas system.[4] This moved park administration from its previous shared home in the forest service (also under MINAG) to its first ever administration dedicated solely to protected areas. After this move, when Fujimori's (in) famously implemented 'Fujishock' through an auto-coup in 1993, a host of new laws and a new national constitution further transformed the institutional context for managing protected areas. The constitutional reform replaced the ideals of social property from the 1968 agrarian reform with constitutionally defined ideals of private property. Also within the 1993 constitution was national mandate to protect and conserve biodiversity; this closely followed the adoption of the Biodiversity Convention a few

[4] As an institution INRENA survived the fall of Fujimori's regime in 2001, but in 2008, under Alan Garcia's (second) presidency, INRENA was moved to the newly created Ministry of the Environment (MINAM) and renamed SERNANP (the National Protected Area Service). We will use both acronyms INRENA and SERNANP, depending on what period is being discussed, to refer to the national agency that oversees conservation efforts in Perú.

months earlier in 1993. Shortly thereafter in 1994 Perú ratified the ILO 169 convention on Indigenous rights. The incorporation of these perhaps contradictory ideals into conservation legislation began in 1997 and continues to this day (GOP 1997; GOP 2001). The new conservation laws drafted in 1997 have their genesis in then contemporary currents of political and economic change in Perú that are largely linked to much broader neoliberal economic and political restructuring and reform programs.

Beginning in the early 1990's, the Fujimori administration sought to integrate the country into the rapidly globalizing international economy, reduce the presence of the state in national economic and social affairs and establish a system of self-regulating and more efficient supply-demand pricing mechanisms. Principally these reforms were directed at revitalizing Perú's extractive industry and to attract flows of foreign capital into the hydrocarbon and mineral primary production sectors in Perú. The constitutional and legislative restructuring efforts made under Fujimori's rule have been hailed as very effective in terms of implementing neoliberal ideology and the economy is now dominated by the private sector, regulated by market forces and intricately linked to the global economy. Rents collected from trans-national corporations which operate in the extractive sector are the most important source of revenue for the Peruvian government. Comparatively, while neoliberal reforms have swept through Latin America in the past two decades (Gwynne and Kay, 1999; Klak, 1998), Perú has become one of the most open and liberal economies not only in Latin America, but in the world (IMF 2001).

Several key elements of Perú's neoliberal transformation have influenced conservation activities in the country. First, privatization programs have broadened the range of actors involved in conservation efforts beyond the state such as local communities, individuals, businesses, private institutions and NGOs. For example, the 1992 creation of the parastatal organization PROFONANPE (the Peruvian Trust Fund for National Parks and Protected Areas) allowed for foreign donors to indirectly finance state-led conservation efforts in Perú. By 2009 56.8% of SERNANP's budget was provided through "international cooperation" which largely flows through PROFONANPE (SERNANP 2009). This created a legal mechanism for INRENA (and later SERNANP) to access private international investment for conservation purposes; it also makes conservation funding semi-transparent at best. Often this international support is specifically destined to certain geographical regions according to the desires of the donor, not the Peruvian government or the Peruvian people. An observable preference for support for Amazonian conservation is reflected in the fact that over 83% of the land coverage protected in Perú is in the Amazon region (cf. Rodríguez and Young 2000).

Second, decentralization of state activities and control of protected areas led to the creation of a variety of new management institutions that include both private and state organizations working across complex and diverse scales of influence. As part of a renewed emphasis on the empowerment of civil society state institutions were re-designed to encourage the participation of civil society in natural resource decisions and management. Local conservation initiatives can be undertaken by individuals,

communities or municipal governments and they are then reviewed and sanctioned by the central government. Not only did this take place with regards to conservation. In the 2002 laws of "decentralization" and "territorial demarcation and ordering," local participation in public financial decision making is promoted through new *presupuesto participativo* (participatory budget) and *zonificación ecológica y económica* (ecological and economic zoning) processes that are designed to be facilitated annually at the provincial (similar to United States counties) level (GOP 2002; GOP 2002).

Third, the incorporation of ILO 169 into conservation legislation reversed the state's right to expropriate territory considered 'property' of any group of people generally considered as 'indigenous' for conservation purposes. To create a national protected area under current laws, SERNANP must first elaborate an *expediente técnico* (technical dossier) that outlines the conservation priorities address by the proposed area and demarcates the territory that the new area will encompass. A technical commission must then be convened and given the charge to categorize the proposed area as one of the 11 types of national protected areas in Perú. The categorization process requires a 100% consensus from all owners of property within the proposed area, be they local communities, individual owners, or commercial enterprises. Only once this consensus is gained can the proposed area gain official recognition within the system of national protected areas. When the categorization is complete, the commission has the final task of writing the *plan maestro* (master plan) for the new area. This process is also consensus driven and includes a zoning

component in which land use designations within the area are agreed upon and demarcated.

2.5 Private Conservation in Perú: the emergence of private parks

One new type of conservation framework that these shifts have allowed for is the private conservation area (PCA). The legal framework for PCAs in Perú is explicated in the 1997 Law of National Protected Areas and the 2001 implementation of this law (GOP 1997; GOP 2001). This legislation's genesis lies in imported frameworks for private conservation that have been adapted to the historical contexts of property, conservation, and extraction in Perú. Essentially, PCAs in Perú are legally recognized spaces that encompass private property and have conservation potential. Officially PCAs are understood as "spaces set aside voluntarily by the owner to strengthen [national] strategies for conservation and sustainable development." (SERNANP 2009 p. 41, translation ours). Specific stated strategies include conservation of biodiversity, scenic landscapes and environmental services in conjunction with habitat restoration, environmental education and scientific investigation. PCAs must demonstrate some form of conservation potential that meet these objectives (Wust and Solano 2005) and are granted legal status by the Ministry of the Environment and form what is referred to as a "complimentary" conservation system to state protected areas (Capella, Cerdán et al. 2005; SERNANP 2009).

Although the legal framework for PCAs in Perú is based on the idea of allowing conservation through private investment, these PCAs should not be confused with private conservation as practiced in the United States or elsewhere. Although PCAs

are entirely private property, in the Peruvian context this designation is not as clear as it might first appear. There are six different kinds of title to surface lands that range from statements issued by local judges to fully registered titles in the national cadastre (World Bank 2004), yet only registered titles can be used for PCAs. In Perú it can take 728 steps and up to six years to secure the needed registered title (de Soto 2000). Furthermore communal forms of private property exist that extend titles to a legal "natural person" that could be a corporation, an NGO, an 'indigenous' Amazonian community, an Andean 'peasant' community, or a coastal agricultural cooperative.[5] In the latter cases the 'private' property is communally held by a registered association (the community) that is structured and defined by the 1987 *Ley General de Comunidades Campesinas* (General Law of Peasant Communities)(GOP 1987). To gain recognition as PCA, property owners must demonstrate a registered title to the land, but there is no mechanism to provide direct financial incentives for property owners to voluntarily declare their land as a PCA (EIL 2003; Benzaquén, Monteferri et al. 2009). This distinction further differentiates PCAs in Perú from PC initiatives in the global North in which direct economic benefits from the sale of either property, or easements on property titles, can be captured by property owners.

The legal process to gain recognition as a PCA involves several stages and begins with a short written request certifying title to the property and stipulating that the land has conservation potential. Applicants are then required to elaborate how the intended use of the land is compatible with national conservation goals in a document

[5] Andean communities in Perú have been referred to as indian, indigenous, and peasant, depending on specific periods in Perú's history.

known as the *expediente técnico* (technical dossier). The *expediente técnico* for PCAs follows the same format for national protected areas and often requires the input of environmental professionals. After the *expediente técnico* is approved by INRENA a Ministerial Resolution from MINAG grants initial recognition of the area. As the second step the owner is required to develop a *plan maestro* for the area that creates and defines land-use zones (which must meet certain requirements defined by INRENA), elaborates on the conservation potential of the area, and defines future management plans and the length of time the area will be protected (at least 10 years). Finally, when the *plan maestro* is approved, several restrictions are placed on the property title and registered in Perú's cadastral system that limit use-rights for certain land-use activities such as the harvest of wood, the harvest of certain animals, traditional land management practices such as annual pasture management that uses fire as a tool, and large development projects (roads, large scale hydro-electric, mines, etc). These restrictions are negotiated between INRENA and the owner and codified through a signed contract known as *carta de entendimiento* (letter of understanding). This model for the development of PCAs, that includes the *expediente técnico*, subsequent *plan maestro* and registered *carta de entendimiento*, closely follows the model for the development of a national protected area (see above). Some commentators have observed that unlike PC in the North, PCAs in Perú are "mini-parks" (EIL 2003).

In 2001 INRENA granted recognition to the first two "private parks" in the country, *Chaparri* (funded by various international donors and largely motivated by

an internationally renowned wildlife photographer) and *Cañoncillo* (for the most part funded by the United Nations Small Grants Program and coordinated by a Lima trained technocrat). These PCAs fit well with the nascent private conservation model that was emerging; a technical process had allowed for flows of international capital to move through private property and conservation goals were reached. A short decade later there is a now veritable private conservation (mini) boom underway in Perú (see Figure 2). 51 PCAs are now officially recognized that encompass over 250,000 hectares and requests continue to be filed with SERNANP every month. Worthy of note is that the average PCA size is nearly 4000 ha, yet the median size is approximately 250 ha, which indicates a skewed size distribution; most PCAs are small with a few exceptionally large ones.

Due to the popularity of these PC instruments a series of legislative decrees and resolutions have further codified and refined the legal framework for PCAs. Various omissions in the original 2001 legislation have been identified and rectified, and then as INRENA moved to SERNANP in 2008, a whole series of further modifications were made (see DS-008-2009, DS-012-2009, DS-016-2009, RP-144-2010, RP-155-2010). One modification gives the owner the option to submit both the *expediente técnico* and *plan maestro* as one document, which subsequently only passes through one approval process. This lowers transaction costs to both the land owner and to SERNANP and addressed the excessive dual cost of generating both an *expediente técnico* and *plan maestro*. Another modification grants the property owner a legal channel to report 'biodiversity crimes' directly to SERNANP which can then be

formalized into citations and punishments. This is the first legal regulatory framework for enforcing PCA rules, but notable is that SERNANP is the administrative authority, not the property owner.

While there is little doubt that the PCA framework in Perú is increasingly popular, it is as yet unknown how effective these novel legal market-based instruments will be for the conservation of biodiversity. On one hand the creation and refinement of these institutions gives reason to hope that private conservation models in Perú will be useful for this purpose. On the other hand, while the private conservation model purports to create restrictions on development such as mines and large-scale hydroelectric projects, the property owner can simply give up their recognition as a PCA and all restrictions can be removed from the property title. The owner can also choose to negotiate with external actors interested in restricted development projects and simply not tell SERNANP. The worst consequence for the landowner would be to lose the PCA recognition, but it also possible that SERNANP will do nothing.

The following sections examine several of these new private conservation areas through a case study of new private parks that are being created in the Cordillera Huayhuash, a mountain chain located in the Central Peruvian Andes. Since 2002 at least seven communities have expressed interest in creating PCAs and the four communities who hold the requisite registered title have gained recognition by the Peruvian state as PCAs.

2.6 Methods

The authors of this article have been engaged with research in the Huayhuash since 2002 with intense periods of research that span the periods of 2005-2006 and 2010-2011.The methods utilized during the field research include a mix of qualitative techniques such as archival research, household questionnaires/surveys, key informant interviews, participant observation, observing participation, and participatory mapping exercises. Archival research was conducted using governmental resources such as INRENA/SERNANP and Ministry of Agriculture materials and a variety of civil society and NGO resources focusing upon conservation efforts in the mountain chain. Key informant interviews were conducted with community representatives (elected leaders and civil servants), civil society and NGO representatives, governmental agencies personnel, mining company representatives, and tourists visiting the region; over 60 interviews in total across all of these categories. These interviews provide important context and historical depth to the research as well as insights into cooperation and conflicts taking place within communities and between communities and outside actors in the region. Participant observation was used which included attendance at community and regional meetings and trekking as a tourist/researcher as well as research conducted as a participating observer by combining leadership roles in conservation outreach with research objectives as action-oriented research.

Household questionnaires/surveys were administered across three communities in both research periods in 2005 and 2006 and once again across ten communities in

2011 (see Figure 2.3). All of the surveys and questionnaires administered were based on a convenience sample, but households representing a variety of livelihood activities and locations were selected. The 2011 survey responses were entered into an Excel© spreadsheet and all answers to open-ended questions were coded/classified first using terms from the answers themselves (open coding) and then coded into broader analytical groups (selective coding).[6] The entire database was imported into the open-source 'R' statistical package for analysis. Descriptive statistics were used for general analysis. Two explanatory dummy variables that use the community as the unit of analysis, mine presence and recognition as a PCA, were chosen to tease apart how mining and private conservation influence community perceptions and respective contributions to the emergence of PC in the Huayhuash. The survey instrument was designed to be useful to SERNANP decision makers, local municipal governments and the communities themselves who were all involved in a process to categorize the CHRZ in 2011. The instrument was field tested once in a regional workshop where community leaders were present and a second time with several community members in the communities of Llamac and Pacllon. Please see Appendix A for the final version of the survey instrument and Appendix B for summary descriptive statistics of the survey sample.

2.7 Research Context

The Cordillera Huayhuash (pronounced "why wash" – this is debated to be either the Quechua word for 'weasel' or 'place of icy winds') is located along the

[6] Please see the supplementary materials for a copy of the spreadsheet in Microsoft Excel format.

continental divide of the Central Peruvian Andes 200 kilometers north of Lima (See Figure 2.3). The range has the country's second tallest mountain peak, Yerupajá (6634 meters), as well as 15 major peaks (six of these above 6000 meters) which form a 30 kilometer north to south trending ridge of ice and snow clad summits. There are 115 glaciers that cover more than 8000 hectares, which have been in recession since at least the early 1930's (Coney, 1964; Hidrandina S.A., 1988; Kolff and Bartle, 1998), and feed more than 50 lakes that drain into both the Amazon and Pacific Basins. The relief of the range, from below 3000 meters up to 6634 meters, in less

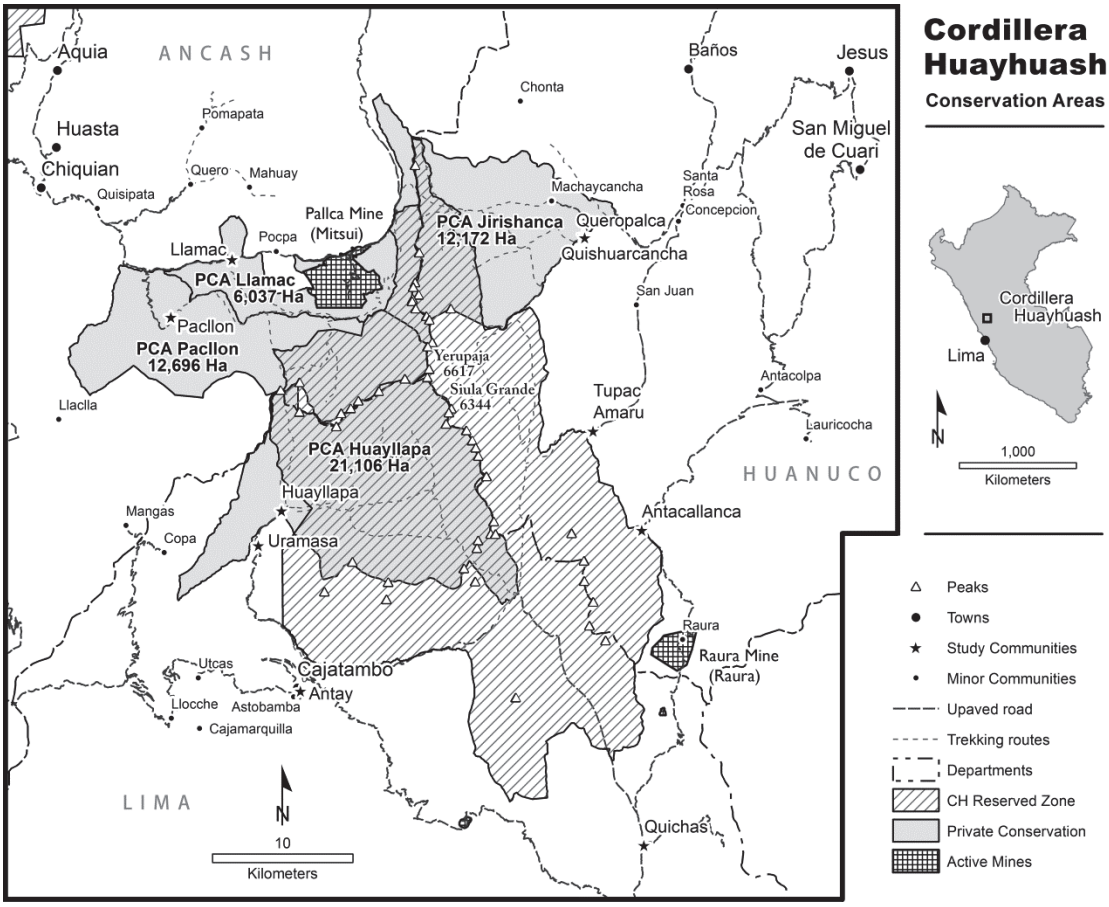

Figure 2.3: Conservation areas in the Cordillera Huayhuash (SERNANP 2013)

than 20 kilometers, has created conditions for a wide variety of climates and ecosystems. The climate of the region is punctuated by a dry season between April and September and a rainy period between October and March. The high valleys and peaks are dominated by a cold and dry climate, but along the flanks of the range climatic and biological conditions allow for at least six distinct life zones that include montane forests, *paramo* and tundra (Kolff and Bartle 1998; TMI 2001). Studies across the region have identified more than 1,000 plant species including the "vulnerable" and endemic to the Andes Quenal trees (*Polylepis spp*), 62 bird species including the rare and "near threatened" Andean Condor *(Vultur gryphus),* and more than a dozen mammal species (Weberbauer 1945; Cerrate de Ferreyra 1979; Fjeldsa and Krabbe 1990; Oxford University 1996; IUCN 2013).

Human populations have utilized the resources of the Cordillera Huayhuash since at least the early 1500's (Bodenlos and Ericksen 1955; Robles Mendoza 2006; Huaranga 2008). Historically, the communities surrounding the Cordillera Huayhuash have pursued rural-based livelihoods that have vacillated between being well-connected (in the era of *haciendas*) and isolated (recently) from the rest of the country due to shifting transportation networks and varying interest from the Peruvian state. Livelihoods in the region were historically dedicated to agricultural and livestock with a constant presence of artisanal mining. Agricultural pursuits include the cultivation of wheat, barley, a variety of potatoes and other tuber crops and corn at lower elevations for subsistence needs (TMI 1998; TMI 1998). Households also graze herds of sheep, cattle and mules for both subsistence and market activities; cheese,

wool and transportation respectively. Finally, households have historically relied upon migration to the coast and other areas of the country for part-time work and the marketing of cheese and some artisanal products which are sold in Chiquian, Cajatambo, Huanuco and Huaraz. More recently, new opportunities to support adventure based tourism in the region and the development of mining activities have begun to integrate local communities into larger economic processes.

In 2000 an estimated 18,100 people lived in the area (TMI 2001). Communities are dispersed along the lower flanks of the range and small settlements extend throughout the high valleys up to 5000 meters. More distant from the range are the larger towns of Cajatambo and Chiquian, which are also the major access points to the range and where most of the population is concentrated. The range belongs to three different sub-national administrative units (the departments of Ancash, Huanuco and Lima). Local community governments are corporate structures based on the *Law of Campesino Communities* which was legislated in 1987 under the first presidency of Alan Garcia. According to this law, communities are governed by a *junta directiva* (executive officers) who are elected every two years by the *asamblea general* (the constituent body of the community). There are strong stipulations regarding membership in the *asamblea* and how community territories are claimed and defined.

Most of the land below the glaciers corresponds to communities adjacent to the range and is held under collective tenure regimes, but there are several contested boundary zones where the state is the legal owner while in practice informal agreements govern tenure. Llamac, Pacllon, Huayllapa and Queropalca hold formal

property titles registered in the national cadaster while Uramasa, Pocpa, Jesus, and San Miguel de Cauri do not. All of the communities divide their territory into *posesionario* plots (individual family rights to land near the settlement) and communal grazing areas (usufruct rights for the entire community at higher altitudes). In recent decades there has been some privatization that resulted in the fracturing of community held lands in Uramasa and Pocpa. Historically several conflicts between communities have existed and tensions remain evident to this today. Local municipalities exist separate from the *junta directiva* and *asamblea* that serve as links to the central state (although weak).

Because the region is fairly remote and was inaccessible during Perú's recent civil war due to the fact that the southwestern part of the range was a base for Shining Path rebels (AAC 1997), it has only recently become a major destination for tourists. Prior to the 1990's, the area had been visited sporadically by expeditions and climbing parties seeking to map the region and climb the high peaks of the range (Miller 1929; Kinzl and Schnieder 1954; Sack 1954; Matthews 1959; Bartle 1981; Simpson 1988; Neate 1994; Frimer 2005). Beginning in the late 1990's, however, as the region became safer for travel, international and national climbing and trekking tourism in the region began to increase rapidly (Bury 2008). In 2001, approximately 2000 international tourists visited the region to engage in trekking, wildlife observation and climbing activities (TMI, 2001). By 2010 this number is estimated to have increased to 3000 and has remained at approximately this level for the last several years.

Although there are historical records of small-scale mining that date to pre-conquest and post-conquest eras (Bodenlos and Ericksen 1955; Raimondi 2006), the region has only recently become an important destination for medium-scale transnational and national mining operations. In the mid-1990's Mitsui Mining and Smelting Perú began operations in the area and constructed a series of new roads that now link several communities to larger transportation networks. This mining project began production in 2003 and ten years later is constructing a small-scale hydroelectric project in the territory of the community of Pocpa in order to expand. In 2002 a Norwegian hydroelectric firm, SN Power, proposed the construction of a hydroelectric facility that would result in the construction of 57 kilometers of pipelines in the territories of Huayllapa and Uramasa. This medium-scale hydroelectric project is linked to the *Diablo Mudo* mining exploration project under development by The Raura Mining Company and is situated in the territories of Pacllon and Huayllapa. These development projects have lead to new roads and ecological disturbances in canyons above the communities. In addition to these activities, a host of new mineral rights claims have been initiated both within and surrounding the range in recent years (Bury and Norris 2013).

2.8 Private Conservation Areas in the Cordillera Huayhuash

As the Cordillera Huayhuash is (re)integrated into wider political, economic and social processes, debates over the form and content of conservation priorities in the range emerged. By the mid-1990's, members from several communities surrounding the range, in conjunction with two congressmen and national and international

conservation groups, began to express concerns about the impacts of new mining exploration efforts on the environment and the increasing influx of tourists visiting the 165 kilometer trekking and climbing circuit. In the late 1990s the Mountain Institute (TMI), a US-based NGO intent on protecting high mountain environments, began efforts to study the possibility of gaining national protection for the area (Kolff and Bartle, 1998; Kolff and Tohan, 1998; TMI, 1998a; 1998b). Community concerns were broadly motivated by the perceived impacts of mining in the region, particularly on water and land resources, but the national effort was, by design, focused on biodiversity conservation. The unaddressed local concerns were heightened significantly after Mitsui punctured an aquifer in the Rio Llamac watershed near the Pallca mine site in 1999 and water quality in the river that both the communities of Pocpa and Llamac rely upon was significantly reduced (Kolff, 2000). This led to violent protests at the Pallca mine site which resulted in several injuries. Although this intensified local concerns of impacts related to further mineral exploitation, the issue was resolved behind closed doors in Lima through what has been termed "forced negotiation" by several respondents from Llamac.

In 2001, under the direction of TMI, a broadly "participatory" study intended to provide the foundation for a new conservation zone in the region was concluded (TMI, 2001). Shortly thereafter, in late 2002, and by act of congress, a new national conservation reserved zone was created in the Cordillera Huayhuash. MINAG designated approximately 67,000 hectares of land in the region as the *Zona Reservada Cordillera Huayhuash* (the Cordillera Huayhuash Reserved Zone –

CHRZ) and a technical commission was created by INRENA to categorize the new conservation unit as a national Landscape Reserve (See Figure 2.3). The declaration of the CHRZ mandated the immediate cessation of the granting new mining concessions within the area, but guaranteed exploration rights to companies already holding concessions (MINAG 2002). The proposed categorization prioritized the conservation of freshwater resources (glaciers) and biodiversity and also noted the growth of adventure-based tourism in the area. The national landscape reserve would have disallowed further mining exploration in the CHRZ as well as place several restrictions on local livelihood activities, particularly wood harvest and annual pasture burns. Although the limitations on future mining activity spoke to local concerns, the boundary for the CHRZ conspicuously circumnavigated the existing mine at the Pallca site. This demarcation prompted complaints from local and international actors and created doubts about the Peruvian state's real intentions in the Cordillera Huayhuash.

Since these initial steps taken by INRENA, there has been a remarkable shift in conservation efforts in the region and local communities who have registered land titles now oppose efforts to create the national protected area. One reason for this fairly abrupt reversal of sentiment is that communities feared that a national protected area would restrict access to and use of land resources, especially pastures, forests and tourist entry fees, which would adversely affect household livelihoods and production strategies. Local communities expressed discontent that the proposed protected area would be managed by Lima-based INRENA personnel and that few

resources and benefits would flow to local communities, especially tourist entrance fees. This is particularly important as access to tourism related resources was one of the key community concerns in the 2001 scoping study. The communities also resented the top-down approach which was dictated to them by TMI and INRENA and felt that their autonomy was being threatened. In 2011 these community concerns were still central and nearly 20% of the survey respondents still believe that the principal intention of the state in the Cordillera Huayhuash is the capture and control of tourism resources (see below).

As the state proposed the categorization of the CHRZ in 2003, politically and financially motivated local actors, resentful of the influence of outside conservation organizations and the national government in the region, fueled fears in local communities that the new protected area would lead to a variety of undesirable economic and social consequences; particularly a loss of autonomy and control over the burgeoning tourism industry. These actors promoted the nascent PCA framework as an alternative mechanism to keep the mines out and as a means to territorial sovereignty through which the central government would not be allowed to meddle in local affairs. While both of these rallying points spoke to local concerns of 'indigenous' rights and autonomous development, they were largely incorrect. Similar restrictions on economic activity, as noted above, are imposed through the development PCAs and there is no legal mechanism to prevent mining activity within a PCA. Nevertheless, as of 2011, 50 out of 84 respondents (60%) from communities recognized as PCAs still believe that their PCA either provides, or may provide, a

legal mechanism to prevent mines from entering the community's territory and 17% believe that the principal reason to have a PCA is for defense of community territory (be it from the mines or the state) (see Table 2.2). These findings show that the level of misinformation among community members is high which exasperated the historical disconnect and lack of trust between the communities and the state.[7] As a result of the top down approach and subsequent opposition, TMI has left the region and other actors and conservation organizations supporting the proposed national protected area have not been warmly welcomed by local communities.

Table 2.2: Responses from the 2011 survey to the question: Why have a private conservation area in your community?

responses	count	percent
tourism	14	17%
tourism resources (work, fees, business)	6	7%
improve tourism services	4	5%
improve order	4	5%
defense	14	17%
defend from the mine	7	8%
defend from the state	4	5%
defend in general	3	4%
conservation	26	31%
conserve the environment	10	12%
manage the environment	10	12%
protect the environment	6	7%
don't know or blank	29	35%
TOTAL	**83**	**100%**

[7] The long history of a state dominated by colonial landowners followed by the failed military revolution and land reform in the late 1960s has created a lack of trust between Andean communities and the Peruvian state.

Indeed, rather than support the consensus driven process to create a national landscape reserve in the range, local communities that held the required registered land title initiated the development of community-owned PCAs. In 2005, the contest between national and local conservation models in the region peaked. INRENA was concluding several years of effort to gain the required consensus and categorize the ZRCH. In addition to the difficulties caused by "well-placed" misinformation as outlined above, this process was further mired by a substantial donation from KfW Bankengruppe (of Germany) to fund the categorization process. PROFONANPE received the donation and, in what can be classified as a semi-transparent funding process, channeled the funds to INRENA. INRENA personnel used these funds to conduct extensive workshops in the communities of the area and draft the *expediente técnico*. The only economic benefits received by the communities in this process were very occasional commercial opportunities to cook food and provide beds to INRENA officials. At the same time, local communities were holding workshops facilitated by local actors, several local grassroots NGOs, and hired environmental professionals and submitting letters of request for recognition as PCAs to INRENA. All of the local efforts were financed with entrance fees collected from tourists (see below) and there was competition between professionals, NGOs, and local actors to capture these fees through the development of the PCAs (see below).

On December 8th of 2005, INRENA released their *expediente técnico* which recommended that the CHRZ should not be considered a national conservation priority, that the bio-geographic features of the area are represented in other national

protected areas, that the area should be dropped from the national system, and that local conservation initiatives should be given room to grow (INRENA 2005).[8] Shortly after this decision, on December 13, 2005, the Ministry of Agriculture simultaneously emitted two resolutions (0908-2005-AG and 0909-2005-AG) granting Pacllon and Huayllapa recognition as PCAs (MINAG 2005). Since then, Queropalca and Llamac, the two remaining communities in the range that hold the required title, submitted requests for private conservation areas, developed *expedientes técnicos* and *planes maestros*, and received recognition as PCAs in 2007 and 2009 respectively (MINAG 2007; MINAM 2009).

There are now four recognized PCAs in the Cordillera Huayhuash that total approximately 55,000 hectares in the communities of Pacllon, Huayllapa, Llamac and Queropalca (see Figure 2.3). The Huayllapa PCA is the third largest in Perú and the in 2013 the total coverage of the four PCAs in the Huayhuash—out of a total of 53 PCAs in Perú—accounts for over 20% of land recognized as private conservation areas in Perú. All of the four areas have PCA status for a period of ten years since the date of their respective recognition (see Table 2.4). In addition, the Ministerial resolution that recognizes Huayllapa's PCA indicates that 17,691.62 hectares of the Huayllapa PCA is superimposed over the national CHRZ. Indeed, all of the PCAs in the Huayhuash overlap with the CHRZ compromising approximately 27,437 hectares of lands under two legal designations which suggests that future legal and

[8] The CHRZ still exists within the national system of protected areas, nevertheless. Indeed, since the recognition of the PCAs SERANP has undertaken one more categorization attempt in 2011 and is planning another.

administrative activities will have to resolve this apparent contradiction in land classification.[9] The remaining three communities that occupy territory beneath the mountain range are also seriously considering PC efforts, but they must first navigate the complexities of gaining registered land titles before approaching SERNANP.

2.9 Local Agency in Defining Private Conservation

These private community-led conservation efforts mark the first PCAs in Perú funded from local income and not national or international interests. While this has created a strong sense of ownership locally regarding the conservation efforts, the PCA model that emerged in the Huayhuash strayed from the initial vision promoted by INRENA. The community of Huayllapa invested approximately $30,000 for the development of their PCA while the community of Queropalca invested approximately $6,000 during their process. Llamac and Pacllon's investments fell between these two outlying numbers. The large discrepancy between the investments is due to how each community approached the development of their conservation area. Huayllapa hired a team of 13 professionals to write a lengthy *expediente técnico* as well as a detailed *plan maestro*,[10] while in Queropalca both the *expediente técnico* and *plan maestro* were written by the then current president of the community (by hand). In Pacllon and Llamac different groups of professionals were hired (including one of the authors in Llamac) and varying levels of "participatory" approaches were

[9] It is the informal policy of SERNANP to let this slide for the moment and allow the private conservation experiment to run its course (personal communication from *Licenciado* Luis Alfaro 2009).

[10] It should be noted that at the end of the process in Huayllapa, the community believed that it had been unfairly charged and ended up suing the person who had organized the group of professionals to complete this work.

used. With the exception of Queropalca, all of the PCA development efforts can be understood on one level as a means of transferring the tourist entrance fees from a local informal economy to an extra-local formal economy (cf. de Janvry 1981). The Ministerial Resolutions that recognize the four PCAs formally codify the extension of a complementary national system of private conservation into the Cordillera Huayhuash and the purpose and function of these new zones is clearly articulated. According to MINAG resolutions, which draw directly from the respective *expediente técnico* for each PCA, the conservation areas possess sufficient technical reasons for protection, including threatened species, valuable biodiversity and scenic landscapes. The formal objectives of the new PCAs, in general, are to protect biodiversity, promote natural resource conservation and promote sustainable development in local communities through the improvement of local livelihood activities and tourism. The objectives appear to align well with national conservation priorities in the region; biodiversity, water, and tourism. These codified objectives also align closely to the 2011 survey responses to an open question of what people think the principal objective of conservation is. These findings show that the protection of water resources and the conservation of biodiversity are the top two conservation objectives identified by community members in the mountain range. Pastures and tourism come in third and fourth place respectively (see Table 2.3). Yet these findings beg the question as to which came first, the national discourse on biodiversity conservation or locally formed opinions about conservation objectives? This may be difficult to answer in retrospect.

Table 2.3: Responses from the 2011 survey to the question: What is the principal objective of conservation?

responses	count	percent
Tourism	46	22%
Cleanliness	2	1%
Fee Income	6	3%
Landscape	10	5%
Tourism	23	11%
Order	5	2%
Conservation	66	32%
Preservation	13	6%
Conservation	22	11%
Biodiversity	31	15%
Livelihoods	80	38%
Agriculture	4	2%
Pasture	29	14%
Forests	3	1%
Water	44	21%
Prevent Contamination	17	8%
Total *	211	100%

* Several respondents indicated more than one principal objective

Table 2.4: Private conservation areas: recognition dates and objectives as stated in the *planes maestros* (Huayllapa 2006; Pacllon 2006; Queropalca 2008; Llamac 2010).

		Huayllapa	Pacllon	Llamac	Queropalca
Specific PCA objectives	**Year Recognized**	2005	2005	2009	2007
maintain ecosystem services		X		X	X
conserve ecological diversity		X			X
maintain genetic diversity		X		X	
promote alternative education		X			
promote environmental education			X	X	
environmental monitoring		X			
maintain freshwater resources		X		X	
develop tourism resources		X	X	X	X
train local people in tourism related activities					X
protect cultural landmarks		X			
restore populations of vulnerable species					X
improve livelihoods through sustainable development		X	X	X	X
rescue and defend inalienable cultural heritage		X		X	

This broad brush analysis suggests that there is agreement, not only between the state and the communities but also within the communities themselves, about conservation priorities, yet upon closer examination particular objectives vary between each PCA. While the variance across all of the communities, whether or not they are recognized as an PCA, can be attributed to factors such as mining presence and the actual recognition as an PCA (see below), the actual objectives in the master plans show a combination of local and external conservation objectives (see Table 2.4). The objectives observed in survey responses, broadly categorized as either tourism or livelihood based, articulate well with the written conservation objectives in the master plans, but the linkages between objectives broadly classified as conservation do not show so clearly (compare Table 2.3 and Table 2.4). In the cases of Huayllapa, Pacllon, and Llamac their objectives were developed in participatory workshops facilitated by groups of environmental specialists and conservation professionals. In the case of Queropalca the workshop was facilitated by the president of the community under advice from conservation lawyers in Lima. In all cases the facilitators needed to meet national conservation objectives outlined in the SERNANP guidelines for the creation of a PCA as well as address community concerns; a difficult proposition at best where national biodiversity conservation objectives were given priority in order to gain the PCA recognition. This mix of local and external objectives presents challenges and dilemmas for the implementation of community led conservation through local institutions (see below; also see Norris in press).

Also problematic is connecting the legal frameworks for PCAs with the written conservation objectives. The key legal element of the PCA framework is the resource use restrictions defined in the *carta de entendimiento* that are registered on the property title; these restrictions provide the only legal instrument to enforce the conservation objectives. In the case of Huayllapa, a new *junta directiva* was elected during the process for the development of the PCA. As a result the restrictions were never registered on the property title and there is no legal mechanism to enforce conservation objectives. Thus, although the PCA is officially recognized by SERNANP, there is no restriction on development projects such as mining operations and large scale hydro-electric projects. The new *junta directiva* in Huayllapa negotiated and signed agreements with a mining company and a hydroelectric company respectively. In the case of Queropalca, due to misunderstandings of the legal details of how to implement these restrictions, instead of having the land-use restrictions from the *carta de entendimiento* registered, the general objectives of the PCA from the *plan maestro* were registered on the title (Benzaquén, Monteferri et al. 2009). These general conservation objectives will most likely not provide an enforceable mechanism to prevent development projects in the Peruvian court system. In the cases of Llamac and Pacllon the restrictions were never registered on the respective land titles. This is most likely due to one of two causes: first, the lack of understanding on the part of the community leaders and hired professionals on the legal details of creating the PCAs, and second, the conflicts within the communities

related to implementing the restrictions negotiated with SERNANP would make local elected leaders hesitant to register and enforce the restrictions.

The written conservation objectives of the new PCAs in the Cordillera Huayhuash constitute a spectrum of management challenges related to both conservation priorities and the ways in which local governance structures are developing to meet these needs. Under the established guidelines for creating PCAs, communities are entitled to some technical assistance from SERNANP, but the task of managing and maintaining specific conservation goals is the responsibility of each community. To maintain PCA status each community must demonstrate its compliance with its own stated objectives in the *plan maestro* through regular monitoring by SERNANP (every five years for the perpetuity of the PCA). To date no *in situ* technical assistance has been offered by SERNANP, but community leaders do receive limited advice when they visit the Lima offices of SERNANP. Limited efforts to monitor the four areas have been undertaken by SERNANP as brief visits to community meetings, but these efforts were made in conjunction with the most recent attempt to categorize the CHRZ in 2011.

2.10 Conservation Management and Community Empowerment

Distinct from written conservation objectives outlined in the PCA *planes maestros*, nearly all of the communities in the region engaged in some form of tourism management during the past decade. Since the CHRZ was created in 2002, local communities have taken the initiative to manage flows of tourists and entrance fees, provide tourist protection services and engage in preliminary wildlife

management, waste management and trail maintenance activities. Indeed, since 2003 the eight communities which occupy territory adjacent to the glaciated portion of the range, whether or not recognized as a PCA, unilaterally adopted entrance fees for tourists passing through communal lands. This initiative was largely in response to several incidents in 2003 when several dozen tourists were robbed and several people were killed by bandits. In 2004 the fees were used to organize armed patrols in all of the communities during the high tourist season to safeguard the passage of tourists.[11] Since this noble beginning only three communities continue to organize patrols and the fees have become a focal point for local autonomous development. The fees vary between communities and across years, but have steadily increased since they were adopted. In 2013, total fees levied by all eight communities for each tourist were over US$70, with additional fees levied for animal passage and camping in some places.

The protection of this income became a rallying point for the creation of the PCAs and provided the investment necessary for this undertaking (as noted above). The fees were the economic incentive to voluntarily develop communal lands as PCAs; further explanation is warranted. The communities have the right to charge tourist entrance fees with or without the recognition of their territory as a PCA. It is a constitutionally guaranteed right of property owners to charge fees for the right of transit for purposes other than accessing contiguous private property. Nevertheless, nearly 50% of the 2011 survey respondents indicated that without a PCA the tourist

[11] These armed patrols were formed under the legal mechanism to create local "police forces' under the framework for the *Rondas Campesinas*; originally a legal means for communities to police cattle rustling in areas where there is no police presence (Starn 1999).

entrance fees were not legal. The community members do not know their rights. Once again, this finding suggests a high level of misinformation amongst community members in the Huayhuash.

Yet if the CHRZ had been categorized it is likely that SERNANP would have also enacted and charged entrance fees to insure that the national reserve would provide income not only to support itself, but also to support the entire park system, SINANPE. The nearby Huascaran National Park has served in this manner as a cash cow for SERNANP for many years. There was a well-publicized conflict between the community of Catac and INRENA regarding who has the rights to collect entrance fees. The final resolution of the Catac conflict allows for both the community and the park to collect entrance fees. The story of this conflict is well known in the Huayhuash and was a contingent factor in the locally perceived economic incentive to create PCAs. The communities do not want the state to capture entrance fees.

The procedures that communities have recently established in the Huayhuash to manage tourism and the entry fees represent important new and paradoxical opportunities that both strengthen and expand certain community governance institutions while at the same time weaken and erase other institutions. The community *asambleas* established the new rules and procedures for charging fees, providing the limited protection services to tourists, and enforcing new conservation regulations. Communities raised tens of thousands of dollars from tourist fees and have enacted several new measures that are providing some environmental protections. For example, almost all communities whether PCA or not, enacted

prohibitions on fishing with nets to stem a rapid decline in observed fish populations. In addition some communities organized trash pickup and disposal efforts, and without exception all communities constructed several latrines in established camping areas. These new conservation regulations and activities force shifts in status quo access to and control over natural resources such as pasture and fish; this proves to be contentious and generates divisions within the communities over the perceived benefits of tourism.

Tourism in the region relies on donkeys as pack animals for the groups of tourists who complete the 8-10 day trek around the range. This activity places pressure on traditional grazing practices and patterns in several important ways. First, families from any community who have herds of pack animals can gain access to pasture resources near the camping areas; local families who traditionally graze these pastures are losing access. Second, the intensive grazing during the high tourist season (from June through September) disrupts seasonal movements of cattle and sheep traditionally managed at a community level. And third, the herds of pack animals sometimes originate from outside the range brought by trekking agencies that operate from regional centers. Not only do these changes generated immediate conflict, both inter-community and intra-community, but they provide an incentive to raise large herds of pack animals that are only economically productive during the trekking season. This relatively new practice places additional pressures on traditionally grazing patterns and local economic systems which function across the entire year. Similar situations in the Huascaran National Park led to pasture

degradation (Farriss 2007) and uneven distribution of tourism benefits (Auer and Norris 2001).

The fishing net prohibitions are proving difficult to enforce. The declining fish population is likely due to tourist consumption of fish as they complete the 5-8 day trek. While these prohibitions are enforced when people external to the community use a net—whether a tourist, a guide, or a member from a neighboring community—they tend not to be enforced for local community members. In one observed case nets were used by a community elder, the captured fish were distributed amongst local children, and the community president watched with no comment. In another case, armed men on horseback escorted non-local fishermen out of the community's territory. These prohibitions are clearly an attempt to prevent outsiders from using a precious community resource without permission and not a mechanism to conserve biodiversity.

The amount, distribution and use of tourist fees, also determined through the community *asambleas*, is a source of fierce debate. The collected monies are hard to account for and in several communities the money apparently goes directly into the pockets of those who collect the fees (either officially or unofficially). In two communities the *asambleas* authorized the distribution of monies collected to all registered community members. This (re)distribution is not based on providing services, but instead can be interpreted as a mechanism to resolve conflicts over unequal distribution of tourism benefits within the community (see chapter 4).

The provision of tourist services and charging of fees is also a source of conflict across communities. Each community charges different fee amounts to individual tourists. In 2010, Huayllapa charged each tourist nearly US$13 while Llamac only charged US$5.50, yet neither community provides tourist services outside of a few latrines and access to the trails. Interviews in both communities revealed that the prices are more related to competitive conflicts between the communities rather than actual services provided. While Huayllapa has legitimate reasons for charging higher fees, including the fact that their PCA is the largest and has three campsites as opposed to only two in Llamac (or one as in most other communities), the higher fee can also be interpreted as their attempt to balance access to monies generated from tourism. Nearly 80 percent of households in Llamac—perhaps the community most extensively integrated into tourist networks at present—are involved in the provision of tourist services, while Huayllapa—one of the least integrated—has only a few guides and very limited services for tourists.

While there are important indications that community governance structures are being altered through the adoption of the new management activities, it is important to note that these activities re-prioritize stated conservation objectives in the region. While there have been limited advances in conservation management activities, communities have focused primarily on management activities related to generating new tourist related monies. Within the PCAs there are few if any activities related to biodiversity conservation, ecosystem services and other stated goals in the conservation plans. As one NGO representative observed, “the master plan is just

that, nothing more than a plan."[12] Thus the private conservation areas appear to be most concerned with tourism management with a special focus on managing entrance fees rather than biodiversity or ecological protection. This finding is confirmed by the fact that over 20% of the respondents in 2011 identified some form of tourism management as the principal conservation objective (see Table 2.3) and 62 out of 132 respondents indicate that the principal benefit of tourism is the entrance fees. This highlights the economic incentive to manage tourism and the lack of incentives to manage biodiversity related conservation. This also suggests that the biodiversity components of the master plans were written more to gain legal recognition as a PCA and were not principal priorities within the communities themselves. In the 2011 survey biodiversity conservation was identified by only one respondent as a reason for PCA development and over one third of the respondents did not know why the community was recognized as a PCA (see Table 2.2).

The presence of only very limited management activities related to environmental protection and maintenance highlights an important emerging dilemma for community-led conservation management. The *planes maestros* that both Pacllon and Huayllapa organized specify a host of very technical and time-intensive conservation objectives, but there is little institutional or technical capacity within the communities to accomplish these written goals. This is not to conclude that community members have no knowledge or interest in maintaining biodiversity in their grazing ecosystems, but instead that community members have limited access to

[12] July 17th 2013: Personal communication from a representative of the NGO ECOAN which was contracted to re-develop Pacllon's master plan in 2012.

the lengthy *planes maestros* elaborated by environmental professionals. It is daunting for a trained professional to pick up a 300 page *plan maestro* and consider how a community might implement the proposed projects within. For a community member to comment critically on the plan, it is likely to be more intimidating. They must first ask permission to have the document and then not only read it, but make comments and suggestions in front of their peer group. Furthermore the plans were written in technical language that is difficult to understand, particularly if Spanish is not your mother tongue as is the case for many community members. While the *planes maestros* for Llamac and Queropalca are shorter and perhaps more realistic, they were also elaborated by (necessarily) a few community members in conjunction with technical assistance. They are also relatively inaccessible to the entire community. The findings from the 2011 survey confirm this problem and show that only 38% of the respondents from the communities recognized as PCAs have knowledge of their PCA *plan maestro* (Table 2.5). It is likely that this number is high; people are proud of their PCAs and do not want to admit to outsiders that they do not *know*.

These findings suggest that community *asambleas* and auxiliary organizations that were only cursorily included in the creation of the *planes maestros* are poorly equipped to manage, for example, genetic or archeological resources and to provide the necessary personnel or skills. In this sense, the paradox of community empowerment mentioned previously is relevant as it seems unlikely that communities will be able to effectively manage for these imported conservation objectives without additional outside incentives and/or help. The technological/scientific approach to

biodiversity conservation imposes this dilemma and suggests that biodiversity conservation will not be sustainable in this context, yet at the same time there are indications that the local management of tourism is improving and that the communities will be innovative in their adaptations to effectively manage the burgeoning tourism industry.

Table 2.5: Responses from the 2011 surveys to the question: Are you familiar with the master plan for your PCA?

	responses: count (percent)		
Community (n)	**yes**	**no**	**blank**
Huayllapa (43)	15 (35%)	17 (40%)	11 (26%)
Llamac (17)	10 (59%)	5 (29%)	2 (12%)
Pacllon (12)	2 (17%)	9 (75%)	1 (8%)
Queropalca (12)	5 (42%)	6 (52%)	1 (8%)
Total (84)	32 (38%)	37 (44%)	15 (18%)

2.11 Confounded Perceptions of Conservation

There is little doubt that a gap between community and state conservation objectives exists. This is largely because the historical development of conservation objectives and discourse at international and national levels does not include local livelihood concerns (see above). The gap can be better understood by examining outside pressures on the communities such as the presence of mining operations and the development of PCAs as contingent factors in the formation of local conservation objectives. The results in Table 2.3, the 2011 survey respondents' principal objective

of conservation, can be categorized broadly into tourism, conservation, livelihoods and the prevention of contamination (through selective coding). These results indicate that across all communities conserving resources related to livelihoods are the most important objectives for the largest group of respondents. Indeed, if tourism is counted as a livelihood activity, then it is a majority of respondents that consider maintaining livelihood activities as the most important conservation objective.

When these results are analyzed with mining presence or absence across the community level, a more nuanced story emerges. For the communities with mining presence, the largest group of respondents still indicates that maintaining livelihood activities is the most important objective (water and pasture as categorized in Table 2.3), but for communities with no mine presence, biodiversity and conservation (generally mentioned) become the most important objectives (Figure 2.4). It is likely

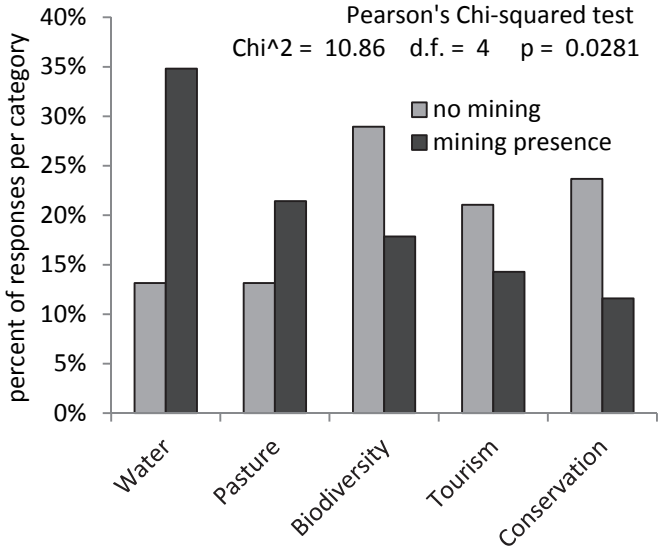

Figure 2.4: 2011 survey responses to the open question: what is the principal objective of conservation? The responses are analyzed at the community level for mining activity.

that these results are due to, on the one hand, the fear of contamination from mining activities and the subsequent perceived impacts of the contamination on livelihood activities in communities with mining presence, and on the other hand, the increased interest in developing tourism in communities with no mining presence.

In a similar manner the results in Table 2.2, the 2011 survey respondents' principal reason for private conservation (the subset of respondents who live in a community recognized as a PCA), can be broadly categorized into tourism, defense, conservation and either a lack of response or don't know. These categories do not map well to the conservation objectives in Table 2.3. While tourism and conservation still exist as categories, respondents did not relate private conservation to the maintenance of non-tourism livelihoods yet they did relate private conservation with defense from outsiders and the implied importance of autonomous local development. This difference can likely be explained by a lack of information about, and hence a lack of understanding of, what "private conservation" means in legal and everyday terms to members of these communities. Indeed, the level of misinformation and the lack of good information among the communities during the creation and development of conservation networks in the Cordillera Huayhuash is high. As mentioned above, in 2011 a full 37 out of 84 respondents (44%) from communities recognized as PCAs still think that their PCA provides a legal mechanism to prevent mines from entering the community's territory; an additional 13 respondents (15%) think that it the PCA may work for this purpose. Even more striking is that in the 2011 survey, respondents from communities recognized as PCAs are significantly

more likely to erroneously believe in this fictitious legal mechanism (see Figure 2.5). These findings also show that over one third of the respondents did not know whether a legal mechanism existed or not.

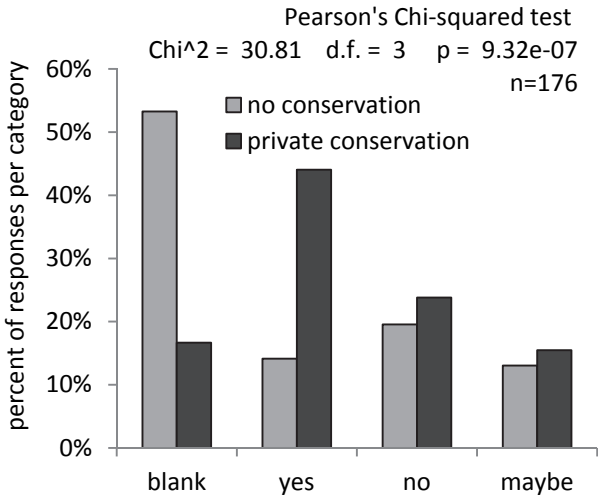

Figure 2.5: 2011 survey responses to the yes/no/maybe question: do you think that private conservation is a legal tool for the communities to slow the granting of mining concessions in the community's territory? The responses are analyzed at the community level for PCA recognition.

The misinformation and lack of information are likely contingent factors in the emergence of conflicts between the communities and mining companies; they are also likely to be factors in SERNANP's difficulties in gaining consensus for the categorization of the CHRZ as a national landscape reserve. The division in opinion between PCA communities and non-PCA communities in their perceptions of the state's initiative to create a national reserve is significant. In non-PCA communities more people think the state's intention is to protect and conserve while in PCA communities more people think the principal objective of the state is to benefit.

Across all communities over 38% of the respondents left the answer blank or admitted that they did not know (see Figure 2.6). In non-PCA communities over 70% of the respondents indicate that they support the initiative to create a national landscape reserve, yet in PCA communities nearly 50% of the respondents indicate that they do not support the national conservation initiative (see Figure 2.7). These findings highlight the long standing lack of trust between the communities and the Peruvian state in this process.

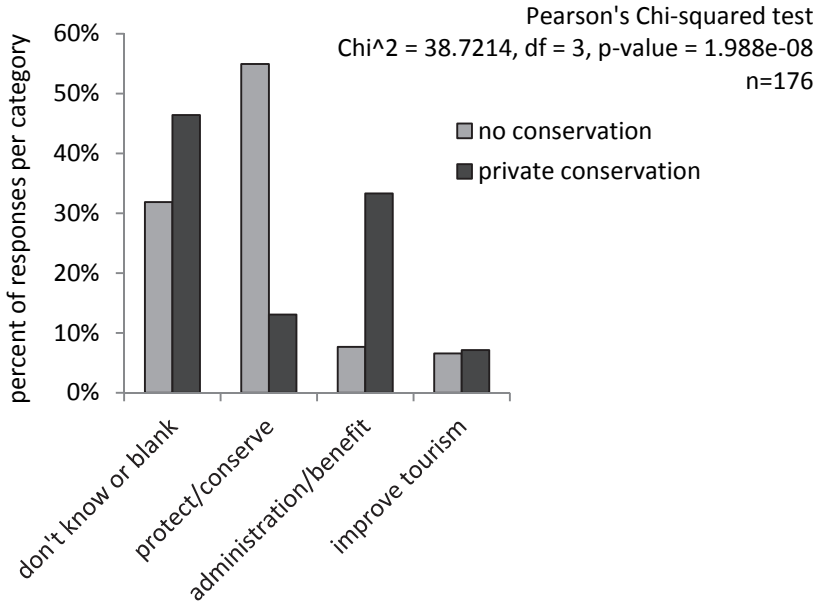

Figure 2.6: 2011 survey responses to the open question: why do you think that the Peruvian state wants to create a protected area in the Cordillera Huayhuash? The responses are analyzed at the community level for PCA recognition.

The problems related to either no information or bad information are generally recognized by the communities themselves who identified "lack of conscience" and "lack of information" as two of the top four problems that impede conservation in the

area (see Figure 8). These results highlight the influence of local actors spreading misinformation with motives based in self-interest and the personal capture of entrance fees (see above).

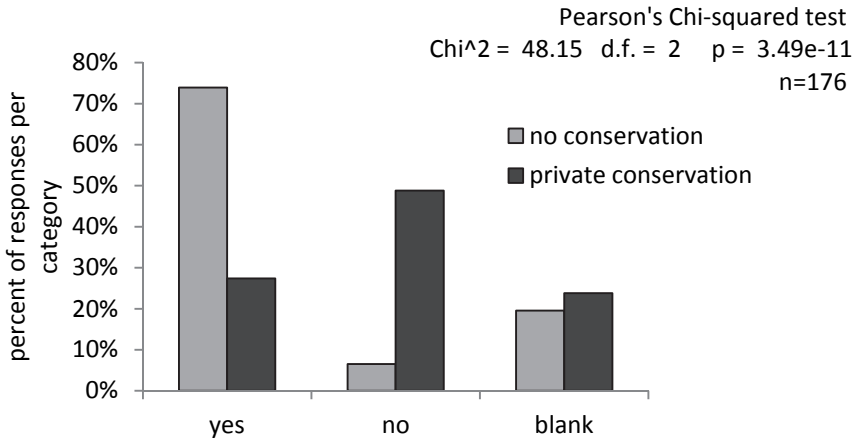

Figure 2.7: 2011 survey responses to the open question: are you in agreement with a national protected area in the Cordillera Huayhuash? The responses are analyzed at the community level for PCA recognition.

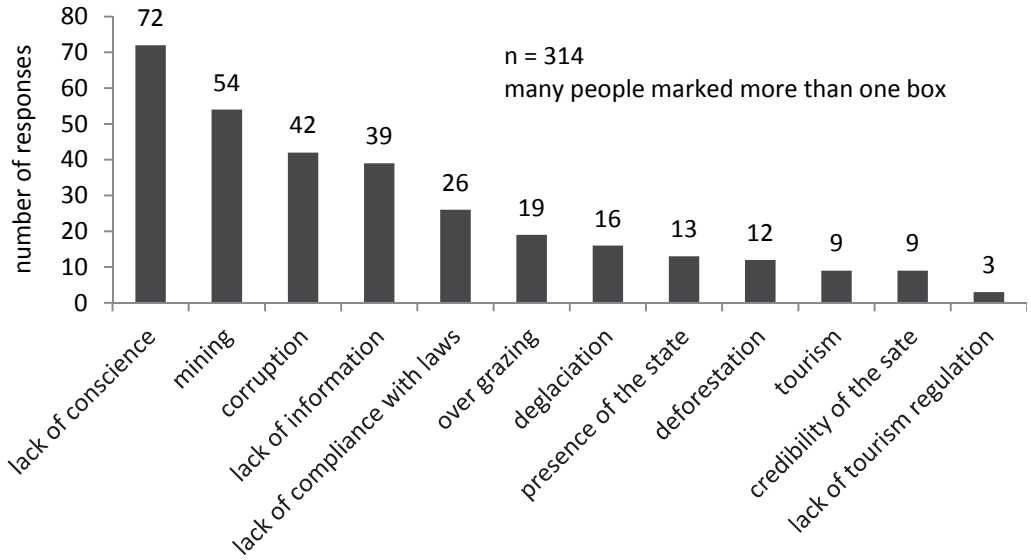

Figure 2.8: 2011 survey responses to the fixed response question: what problems impeded conservation of said resources (reference to previous question about which natural resources are the most important to conserve)?

The presence of mining operations within the communities cannot be understated as a factor in the development of either private community-led or public state-led conservation (see Figures 2.4, 2.8, and 2.9). Across the entire 2011 survey, 85% of the respondents indicated that contamination (both generally and with a particular focus on water) is the principal problem that mining brings to a community. When asked about secondary problems, more nuanced results appear. Across all communities the secondary problems are divided almost evenly across social and environmental ills (see Table 2.6) and when these responses are analyzed for independence based on presence of mining activity in the community, the categories of "disrespect/abuse" and "cheats the community" only appear in communities with mining presence. It is likely that this is because without the experience of negotiating with a mining company, most communities *believe* that the mine's representatives are honest when they claim that the mine will benefit the community. In a similar manner, across the entire 2011 survey, the top perceived threats to the communities were mines and contamination; both answers together account for 44% of all responses. When tested for independence at the community level using mine presence as a dummy variable, the results show that mining presence elevate concerns for quality of water over quantity of water and that even without mining presence mining activity is perceived as a threat (see Figure 9). This result is likely due to a community's actual experience with contamination versus hearsay; although there is also evidence that it may be due to exaggerated fears of contamination when mining activity is present versus actual measured contamination (see chapter 3).

Table 2.6: Responses from the 2011 surveys to the question (subset of the responses that excludes all principal problems): What kind of problems does mining bring to your community (if there is not a mine in your community, what problems would the mine bring)?

Responses	count	percent
Environmental ills	54	50%
contamination	13	12%
sickness	8	7%
damages flora and fauna	27	25%
damages soil	3	3%
deglaciation	3	3%
Social ills	55	50%
divides the community	21	19%
corruption	10	9%
cheats the community	8	7%
disrespect/abuse	11	10%
damages tourism	3	3%
dangerous work	1	1%
violence	1	1%
Total	109	100%

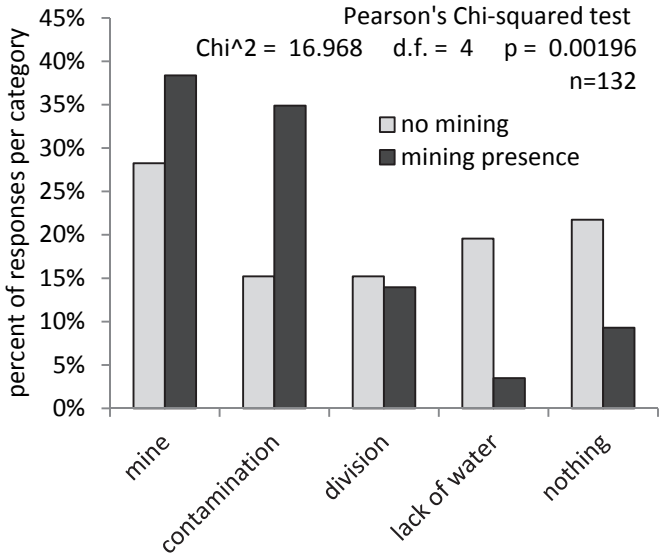

Figure 2.9: 2011 survey responses to the open question: what is the most important threat to the community right now (subset that excludes categories with less than 6 responses)? The responses are analyzed at the community level for mining presence.

Conclusions

The creation of new private conservation areas in the Cordillera Huayhuash illustrates a number of important issues related to contemporary political, economic and environmental change taking place in the Peruvian highlands. First, the creation of new private parks demonstrates how new types of conservation models are being adopted in Perú. Fuelled by decentralization, privatization and neoliberal political and economic restructuring, the management and control of conservation spaces and priorities in Perú is increasingly being turned over to civil society and the private sector. Through these shifts the Peruvian PCA framework allows for flows of international capital through the landscape as a part of the neoliberalization of conservation. In the case of the Huayhuash the capital was generated locally through tourism entrance fees and then 'siphoned' from the informal economy (collected tourist fees) to the formal economy (environmental and development specialists). Whether this trend will continue is hard to predict and the need for further specialist assistance in meeting biodiversity conservation goals (see below) will likely play a role in this. The locally financed PCAs in the Huayhuash are not typical in Perú, this finding shows the difficulty of predicting the results of neoliberalization at small scales (Yashar 2005; Himley 2009).

As previous sections illustrate, the management of new private parks in the Cordillera Huayhuash has been relegated largely to local communities. While these responsibilities generate new openings for community empowerment, they also place difficult burdens on community management institutions. In addition, community-led

management also led to a reconfiguration of conservation priorities towards tourism management. One important conclusion from this research is that it is unlikely that local communities will be able, at least in the near term, to successfully manage for the protection and sustainable use of archeological, genetic and ecological resources, yet they are obligated to do so under their own *planes maestros* (albeit their goals were imported from international models of conservation). This self-imposed "rendering technical" (Li 2007) of conservation creates openings for policymakers and organizations that might be able to provide financial resources and technical training for communities to achieve their objectives. The next few years will be a critical period for these new private parks and will most likely determine their future as conservation models. If provided with enough time and resources, these PCAs may mature into functional conservation instruments (cf. Myers 2002; Fearnside 2003).

As the conservation priorities of the private parks in the Cordillera Huayhuash are primarily concerned with tourism management, the impacts of these management activities in the context of increasing tourism generate important shifts in household and community access to resources. While most of these transformations are positive (i.e. access to markets and new income), they are also distributed unevenly and have ignited a series of conflicts between and within communities. Resolving these conflicts should be a high priority for policymakers concerned with the viability of these new conservation models (Llambí, Smith et al. 2005). In addition, understanding how benefits are distributed unevenly and the ways in which community institutions are adapting to these changes should be an important

objective for future research in the area. These are pressing issues that are poorly understood, yet will also be important determinants affecting the future of private parks in the region.

One of the greatest difficulties with PCAs in Perú is that there is an at best weak legal protective mechanism for conservation. The PCA framework does little or nothing to counter the interests of extractive industries and instead, in places like the Cordillera Huayhuash, may be creating private paper parks. Currently success of the PCAs in the Cordillera Huayhuash rests to a large degree on the elected *junta directiva* in each community and how they resolve the inherent contradiction between their perceived 'valuation' of the landscape (i.e. sell property to a mining operation or develop tourism) and their version of a "land ethic" (Leopold 1949) that values nature in other than monetary ways (cf. Logan and Wekerle 2008). In the Huayhuash the question may simply be: will tourism be perceived as a greater income generator than mining? Unless there are more direct economic incentives for biodiversity conservation it is likely that mining will be perceived to be the greater income generator (cf. Schwartzman and Zimmerman 2005). Future research directed at understanding and creating an array of economic incentives, beyond tourism and tree planting, for conservation *at a local level* will be critical to the future success of private conservation in resource rich regions in the developing world. A focus on the maintenance of fresh water sources as an ecosystem service may be a key in places such as the Cordillera Huayhuash.

While the private parks in the Cordillera Huayhuash currently belong to a relatively small group of similar areas, a host of new private park proposals have been introduced throughout the highlands and across Latin America. This burgeoning trend suggests that conservation research should be increasingly attentive to the ways in which new park models are emerging from national and international political and economic change. Addressing these trends would enable conservation research to explore how these new park models function, how they are being co-produced by conservation visions ranging from local to international, how conservation institutions are being hybridized across local to national administrative jurisdictions, and the ways in which they are situated within local environmental and social contexts.

Supplementary Materials

Filename	Description
2011_Huayhuash_SurveyData.xlsx	A Microsoft Excel file with two sheets, all in Spanish. The first sheet ("Resumen") is a small summary and the second sheet ("Todos Encuestas") is the raw data from all of the surveys.
2011_Huayhuash_SurveyInstrument.docx	A Microsoft Word file that contains the final version of the survey instrument (see Appendix A).

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APPENDIX A – The Survey Instrument

ENCUESTA:
Ordenamiento territorial en la Cordillera Huayhuash y Cordillera Raura

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[TODO DE 00.# ES OPCIONAL, SI QUIEREN CONTESTEN, SI NO, NO IMPORTA]

00.0 Nombre _____
Comunidad/Pueblo_____ Distrito _____
Provincia _____ Región/Departamento _____
[leer] "Esta encuesta es confidencial. En todas maneras quisiéramos pedir tu permiso para usar tu nombre y las contestas que provees en publicaciones futuras. Nos daría este permiso?" ____ (SI, NO)

00.1 DATOS PERSONALES
Edad _____ Genero (M o F) _____ Nivel Educativo (vea abajo) _____
[1-sin nivel; 2-inicial; 3-primaria incompleto; 4-primaria completo.; 5-secundaria incompleto; 6-secundaria completo; 7-superior; 8-otro programa del estado de alfabetización]

00.2 TRABAJO
Principal fuente de ingreso/trabajo _____
Otras fuentes de ingresos/trabajo _____
_____
Trabajan en turismo (SI, NO) _____ Trabajan en la mina (SI, NO) _____

00.2 CASA
Cuantas personase viven en su casa? ____Cuántos de ellos son menores? ____
Cuantos animales tienen?
Ganadero vacuno ____ Ganadero ovino _____ Caballos _____ Burros ____
Llamas _____ Alpacas _____ Vicuñas _____
Tienen forestales/arboles (si o no)?_____ Tipo de árbol _____ HA _____

I. **Conservación**

a. Como se define conservación? [marca uno]

☐ "Es preservar un lugar, su flora, fauna y ecosistema, en su presente condición.

☐ "Es manejar los recursos naturales en manera racional considerando los necesidades de generaciones actuales y futuros."

☐ Otro_____

b. Cuál es el objetivo principal de conservación en la Cordillera Huayhuash (o Raura)?

_____
_____

c. Cuáles son los principales recursos para conservar en la Cordillera Huayhuash (o Raura)?

☐ Agua ☐ Pastos Naturales ☐ Paisaje

☐ Suelos ☐ Bosques ☐ Otro _____

d. Que problemas nos impiden conservar dichos recursos?

☐ La corrupción

☐ Falta de Conciencia (personalismo, individualismo)

☐ Deforestación

☐ Deglaciación

☐ Minería

☐ Turismo

☐ Falta de información

☐ Incumplimiento de las leyes

☐ Sobrepastoreo/demasiado animales

☐ Credibilidad del estado

☐ Presencia del estado

☐ Otra _____

e. Qué organización/institución tiene la mayor responsabilidad en conservar los recursos naturales de la Cordillera Huayhuash (o Raura)?

☐ la comunidad

☐ los gobiernos locales (distrital, provincial)

☐ gobierno regional

☐ SERNANP (Servicio Nacional de las Áreas Naturales Protegidas)

☐ las minas

☐ las ONGs

☐ las universidades

☐ otra _____

f. Que proyectos de conservación consideras más importantes [marca tres]?

☐ forestación o re-forestación

☐ manejo de pastos naturales y cultivados

☐ mejorar la actividad turística (infraestructura, señalización, caminos, reglamento turístico)

☐ mejorar la servicio turística (capacitación en servicios turísticos)

☐ vigilar la actividad minera (cumplimiento con normas legales que regulan la actividad minera)

☐ mejorar el uso del agua

☐ programas de educación ambiental

☐ investigaciones/inventarios sobre el agua, la biodiversidad, los bosques y los pastos naturales.

☐ otros _____

II. Conservación y la Mina

a. Usted cree que la conservación puede existir en conjunto con la minería (SI, NO) _____

b. Que tipo de problemas trae la minería en la comunidad (poner lista 1, 2, 3 .)?
[Si no hay mina en el territorio de la comunidad, que problemas traerá]
_____
_____
_____

c. Por cuantos años vienen dichos problemas? _____

d. Que beneficios trae la minería en la comunidad (poner lista 1, 2, 3….)?
[Si no hay mina en el territorio de la comunidad, que beneficios traerá]
_____
_____

e. Por cuantos años vienen recibiendo dichos beneficios? _____

f. Cual es el beneficio más importante de la minería?

☐ trabajo remunerado en obras de la mina misma

☐ desarrollo local, obras en la comunidad (colegio, puesto de salud, etc.)

☐ construcción de carreteras

☐ aprendizaje sobre temas relacionado a la minería (ambiental, legal, etc.)

☐ el canon minero (desarrollo al nivel de provincia y región)

☐ otro _____

g. Cuál es la amenaza principal de minería?

☐ contaminación del aire, aguas y suelos

☐ quiebra de la comunidad, crea desigualdad, migraciones de jóvenes

☐ la comunidad perderá su reconocimiento como ACP

☐ malogra el circuito turístico de la Huayhuash

☐ perdida de tierras comunales

☐ derrite las glaciares

☐ otro _____

h. Cree usted que la conservación privada es una herramienta legal disponible para las comunidades para frenar el otorgamiento de derechos mineros dentro la territorio de la comunidad. (SI, NO, PUEDE SER) _____

i. Una área de conservación a nivel nacional (administrado a menos por parte de SERNANP) puede frenar la otorgación de derechos mineros dentro la territorio de la comunidad. (SI, NO, PUEDE SER) _____

j. La mina debe priorizar proyectos de conservación igual que proyectos de desarrollo (colegios, puestos de salud, etc.) (SI, NO)? _____

k. Conoce la ley de consulta previa? (SI,NO) _____

l. Usted cree que esta ley servirá a las comunidades mejorar la negociación con las empresas mineras (SI, NO)? _____
Por qué?
_____
_____

III. Conservación y Turismo

a. Usted crean que conservación puede existir en conjunto el turismo? (SI, NO) _____

b. Qué problemas trae el turismo a la comunidad (poner lista 1, 2, 3….)?
_____
_____

c. Por cuantos años hay estos problemas? _____

d. Qué beneficios trae el turismo a la comunidad (poner lista 1, 2, 3….)?
_____
_____

e. Por cuantos años vienen dichos beneficios? _____

f. Es el cobro turístico legal (SI, NO)?_____
Por qué?
_____

g. [si la comunidad ya tiene RUC para los cobros turísticos obviar este pregunta]
La comunidad debe sacar un RUC y formalizar el negocio de los cobros turísticos incluyendo el pago tributario (SI, NO)? _____
Por qué?
_____
_____

h. [si no hay cobros turísticos en la comunidad obvia este pregunta]
La comunidad está invirtiendo los fondos recaudados de los cobros turísticos en proyectos de conservación (SI, NO)? _____

i. Qué porcentaje de los ingresos a la comunidad por los cobros turísticos se debe invertir en proyectos de conservación? _____

IV. Turismo y Minería

a. Piensa que el turismo y la minería pueden existir juntos (SI, NO)?
_____

b. Pienses que las carreteras construido para las minas afectan negativamente el turismo (SI, NO)? _____

c. Si tuviera que elegir entre carreteras y turismo, que es más importante para usted?
_____
Por qué?
_____
_____

V. Conservación Privada

a. Porque tener un Área de Conservación Privada en su comunidad? [si no hay ACP, se puede contestar todavía en contexto del futuro]
_____
_____

b. Tienen usted conocimiento sobre el plan maestro del ACP (SI, NO)?_____
[si no hay ACP obviar]

c. Cuales creen que serían los problemas de tener una ACP?
_____
_____

d. Qué éxitos hay del Área Conservación Privada (poner lista 1, 2, 3….)? [si no hay ACP obviar]
_____
_____
_____

VI. Conservación a Nivel Nacional

a. Estas acuerdo con un área protegida del estado (reserva nacional, reserva paisajística, etc.) en la Cordillera Huayhuash (o Raura) (SI, NO)?
_____
Por qué?
_____
_____

b. Porque cree que el estado peruano quiere poner un área protegida en la Zona Reservada Cordillera Huayhuash (o Raura)?_____
_____
_____

VII. Zonificación/Ordenamiento Territorial

a. Usted cree que la comunidad debe privatizar sus tierras y buscar que cada posesionario tendrá un título registrado en SUNARP de su propiedad (SI, NO)? _____
Porque (razón principal)?
_____
_____
_____

b. Que restricciones del uso de los recursos son problemáticas dentro la comunidad?
☐ prohibido la quema de pastos
☐ prohibido la tala de quenual
☐ prohibido la pesca con red

☐ prohibido la cacería de animales

☐ prohibido los proyectos de construcción grandes

☐ otras _____

Por qué?

_____

_____

VIII. General

a. Cuale es la amenaza actual importante que tiene la comunidad?

_____

_____

b. Cuáles son las prioridades principales para el desarrollo en la comunidad?

_____

_____

c. Usted conoce la experiencia del Parque Nacional Huascaran (si o no)?

d. Según su conocimiento, la experiencia del PNH es positiva o negativa en los siguientes aspectos:

	Positivo	Negativo
Manejo turístico	☐	☐
Controlar la actividad minera	☐	☐
Manejo de pastos	☐	☐
Manejo de basura	☐	☐
Conservar biodiversidad	☐	☐
Desarrollo de la población local	☐	☐
Educación ambiental	☐	☐
Preservar valores culturales	☐	☐
Investigaciones ambientales	☐	☐

APPENDIX B

2011 Huayhuash Survey Summary

Survey responses by community

Community	Distrito Provincia Region	Number of Surveys	Approximate Community Members	Sample percent of the total (community)	Sample percent of the total (total)
Pacllon	Pacllon Bolognesi Ancash	12	120	10%	6.82%
Llamac	Pacllon Bolognesi Ancash	17	72	24%	9.66%
Quichas	Oyon Oyon Lima	21	118	18%	11.93%
Antay	Cajatambo Cajatambo Lima	23	36	64%	13.07%
Huayllapa *	Copa Cajatambo Lima	43	80	54%	24.43%
Uramasa	Cajatambo Cajatambo Lima	13	50	26%	7.39%
Antacallanca *	San Miguel de Cauri Lauricocha Huanuco	17	40	42%	9.66%
Tupac Amaru	Jesus Lauricocha Huanuco	3	80	4%	1.70%
Quishuarcancha	Jesus Lauricocha Huanuco	15	60	25%	8.52%
Queropalca	Queropalca Lauricocha Huanuco	12	120	10%	6.82%
	TOTAL	**176**	**776**		22.68%

Survey responses and explanatory dummy variables:

Region			**Mine Presence**			**Private Conservation**		
Ancash:	29	16.5%	mine	121	68.8%	private conservation	84	47.7%
Huanuco:	47	26.7%	no mine	55	31.2%	no conservation	92	52.3%
Lima:	100	56.8%						
Totals	176	100%		176	100%		176	100%

Survey responses and explanatory dummy variables by community:

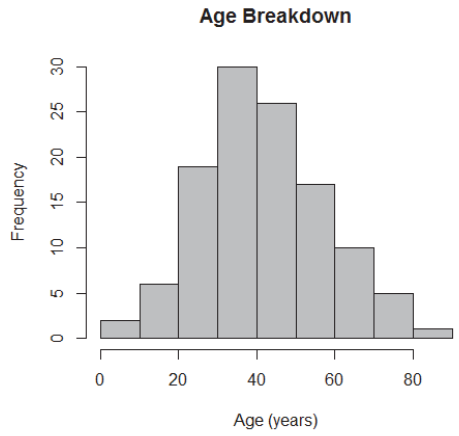
Community	**Region**	**Mine presence**		**Priivate Conservation**	
Pacllon	Ancash			X (12)	14.3%
Llamac	Ancash	X (17)	14.0%	X (17)	20.2%
Quichas	Lima	X (21)	17.4%		
Antay	Lima	X (23)	19.0%		
Huayllapa *	Lima	X (43)	35.6%	X (43)	51.2%
Uramasa	Lima				
Antacallanca *	Huanuco	X (17)	14.0%		
Tupac Amaru	Huanuco				
Quishuarcancha	Huanuco				
Queropalca	Huanuco			X (12)	14.3%
	TOTAL	**5 (121)**	**100%**	**4 (84)**	**100%**

* several school kids (14-18 years old

APPENDIX B
2011 Huayhuash Survey Summary (continued)

Age Breakdown

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
9	33.75	41.50	43.03	53.25	84	60

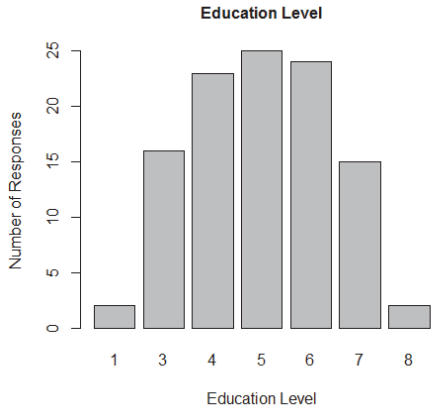


Gender Breakdown

NA's	Female	Male
55	28	93

Education Level Breakdown

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
1	4	5	4.972	6	8	69



1-sin nivel; 2-inicial; 3-primaria incompleto; 4-primaria completo.; 5-secundaria incompleto; 6-secundaria completo; 7-superior; 8-otro programa del estado de alfabetización

Works in Tourism

NA's	no	yes
45	106	25

Works in a Mine

NA's	no	yes
52	99	25

CHAPTER 3

Fire, water, and earth in a mineral rich conservation zone: baseline data for forest cover, water quality, and pasture productivity/biodiversity in the Peruvian Andes.

Abstract: This article presents empirical baseline data collected in the Cordillera Huayhuash of the central Peruvian Andes during 2010 and 2011 for measures of forest cover, water quality, and pasture productivity. The purpose of the studies was twofold. First, baseline data was collected and made available for future studies that evaluate the relative roles of anthropocentric (mining, tourism, and local economic activities) and natural (climate change and geological) influences on environmental change. This is particularly important in the context of the Cordillera Huayhuash where potential negative impacts from expanding mining and tourism activities are perceived as threats. Second, the participatory methods used to collect the pasture and water data strengthened conservation initiatives in the region and facilitated relationships between the local communities and government agencies charged with natural resource and environmental management. The results show that pasture productivity can be considered in the "regular" to "excellent" range with just a few sites showing "poor" productivity. There is evidence that pack-animal based trekking impacts pasture productivity negatively. The water quality results show limited impacts from both mining and tourism with elevated heavy metal concentrations and elevated fecal coliform concentrations respectively. Natural contamination from geological formations and biological contamination from animal sources confound

the results. The forest cover results show little measurable change in the last two decades. The data gathered in this study highlight the need to continue with environmental monitoring in the Cordillera Huayhuash to better understand the dynamics in the natural and human communities.

Keywords: baseline data, water quality, forest cover, pasture productivity, biodiversity, Cordillera Huayhuash, Andes, Perú

3.1 Introduction

On March 11th 2007 leaders from ten communities located in the environs of the Cordillera Huayhuash in the central Andes of Perú came together in Chiquian, the provincial capital of Bolognesi in the department of Ancash. The purpose of the meeting was to discuss a perceived environmental degradation in the vicinity of the mountain range and to identify concrete actions that would reverse the situation. A grassroots non-government organization, the Huayhuash Development Center, had organized the meeting. This organization had initially formed in 2003 around the multiple concerns stemming from the recent influx of both mining operations and adventure tourism and trekking in the region. The attendees at the March 2007 meeting were mostly local authorities from within the community governments and local municipalities that spanned the three departments, three provinces, and six political districts that comprise the Cordillera Huayhuash.

The discussion was heated and opinions varied significantly. The problems that the leaders identified were directly related to the major economic activities in the

region: cattle and sheep ranching, adventure tourism, trekking, and medium-scale mining operations. The underlying causes of the problems were attributed to lack of local organization, lack of local conscience, and corruption (mostly with respect to tourism, but mining also was blamed for corruption), lack of ecological knowledge (with respect to the material outcomes and management of all three activities), and a lack of local influence in the regulation and control of mining activities, either from the centralized control of mining laws or a local lack of knowledge of mining laws. The material manifestations of these problems that motivated the discussion were simple: deforestation, the contamination of water from both mining activities and tourism, and overgrazing that was leading to desertification.

This exercise, to identify problems in the human-environment relationship and then to seek practices to improve our material and spiritual well-being that is derived from this relationship, is something that humans have been doing since the origins of written history, and perhaps even longer (Glacken 1967). Indeed, the three material problems that the leaders in the Huayhuash identified are remarkably similar to three of the four classical elements thought of as the primary constituents of all matter: fire (energy drawn from wood), water, and earth (as the productive capability of the soil for pastures). The only classical element missing in the March 2007 discussion was air, yet on other occasions the problem of air quality due to dust and particulate pollution from mining activity was identified as a concern by members of communities directly impacted by mining activities.

Distinct from a classical understanding of our relationship with the earth, the conversation in Chiquian focused on exogenous forces that affect the local biophysical outcomes as proximate causes, particularly the role of "outsiders" and their economic activities which leave footprints on the local landscape. Although the words "foreign capital" and "capitalist social relations of production" were not directly heard in the discussion, these factors are clearly visible in the final causes attributed to the problems identified. The perception that most, if not all, of the environmental damage was at least in part due to geographically broader political and economic processes was prevalent (cf. Blaikie and Brookfield 1987; Hecht and Cockburn 1990; Leach and Mearns 1996).

The principal result from the meeting was the identified and agreed upon goal to search for funding in order to carry out *capacitaciones* (capacity building workshops) with a focus on pasture productivity and management and water quality issues with relation to mining activities (actual monitoring and how to interpret results within Peruvian law). Other capacity building priorities that were identified included workshops for tourism services, ecological science, mining law in a broad sense, and legal private conservation frameworks recently legislated and incorporated into Perú's system of protected areas. At the time of the meeting one of the twelve communities was recognized as a private conservation area (PCA) and two others were in the process of developing their own areas; the remaining communities paid close attention to these developments (see Bury 2006; Bury 2008; Bury and Norris forthecoming). These priorities to build local capacity were of national conservation

interest as well. In 2001 the national park service had declared the Cordillera Huayhuash a national reserved zone slated to become part of the system of protected areas in Perú (see chapter 2).

In the process of identifying these concrete actions the seven or eight communities spread across several political jurisdictions recognized the need to work together. They also would have to build better relationships with government agencies in charge of natural resource management, and perhaps even work with the government through the ministry of the environment and the national park service. It was suggested (by the author and a local agronomist) that reaching all of the objectives in one effort would be difficult at best. Due to existing expertise in pasture management (the agronomist) and water quality (the author) a decision was made to start the work with pasture assessment and water quality testing. As a possible way to incorporate these broad goals into concrete plans it was suggested (again by the author and the agronomist) that both of the activities could be carried out as participatory research linked to an academic institution. The meeting closed on a hopeful note.

This article presents the results from these two participatory studies in the region in terms of species diversity and abundance for pasture productivity, and heavy metals and fecal coliforms for water quality. Additionally a non-participatory assessment of forest cover change is presented. The purpose of the article is to provide baseline data for the Cordillera Huayhuash for pasture productivity and water quality and to contribute to several past assessments of forest cover (TMI 2001;

ECOAN 2010). The baseline data can be used in future assessments of the relative importance anthropocentric (mining, tourism, and local economic activities) and natural (geology, climate change) influences on water quality, pasture productivity, and forest cover. Additionally the participatory research approach used for the collection of the pasture and water data provided a means to better connect local land managers to government agencies charged with environmental management, to actual methods of environmental assessment, and to the numerical data produced through the studies. This approach may improve governance of natural resources in the area (see chapter 5).

The article is divided into three sections that correspond to the three investigations; forest cover, water quality, and pasture productivity. A brief site description precedes the three main sections. Within each section a small historical and theoretical background is given, the methodology used for each study is described, the results are presented, and a discussion of preliminary results follows. The article concludes with a synthesis/summary of the three sections which highlights the contemporary importance of this work and calls for continued research in this region and further research in other regions using similar approaches.

3.2 Site description

The Cordillera Huayhuash lies in a North-South direction along the continental divide with two prominent spurs that extend to the West and it is situated approximately 200 km north of Lima between the Cordillera Raura to the southeast and the Cordillera Blanca to the north (see Figure 3.1). The range contains six peaks

above 6000 m, approximately 100 km^2 of permanent glaciers, 10 large lakes, and numerous small lakes that drain into the Huayaga which feeds the Amazon and the Pativilca which drains to the Pacific. The range covers over 3000 meters of elevation change within distances of 20 kilometers or less which lends to a high level of biodiversity.

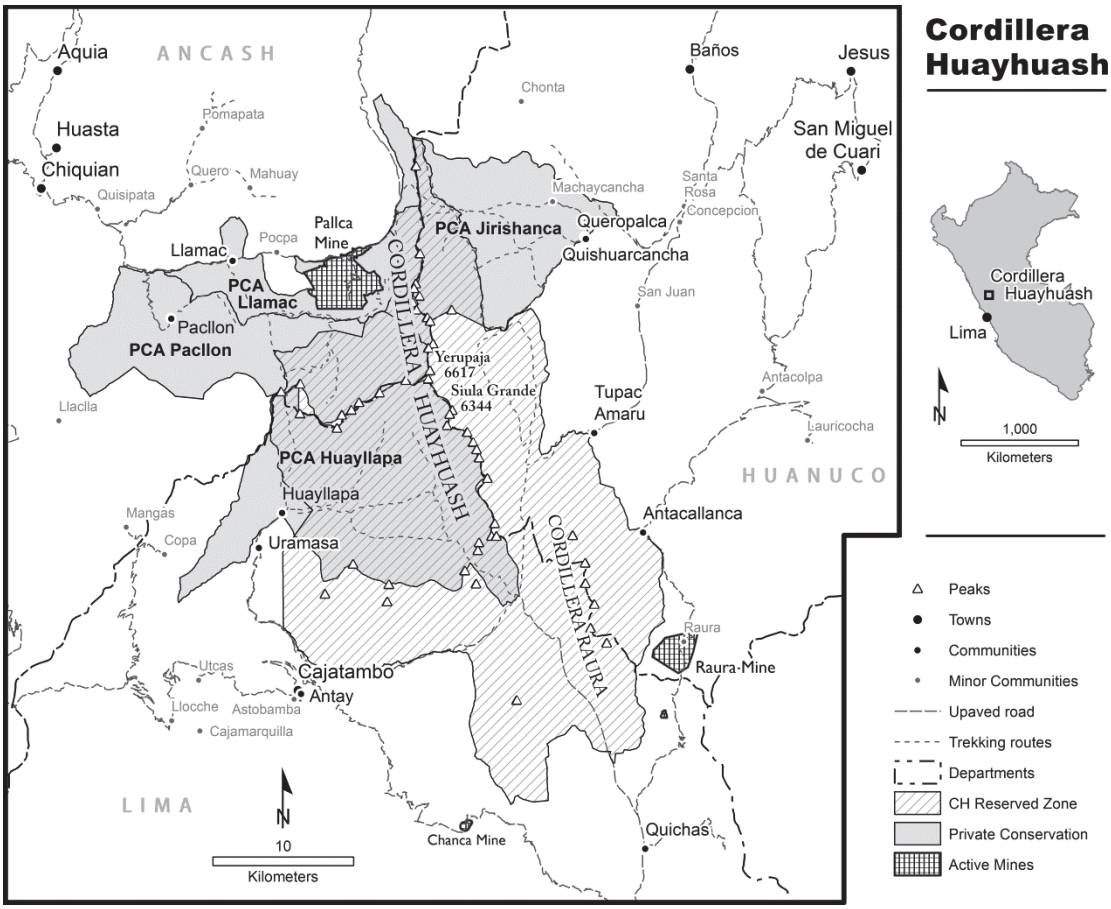


Figure 3.1: The Cordillera Huayhuash.

The region is the home of the vizcacha (*Lagidium peruanum*), Andean fox (*Pseudalopex culpaeus),* vicuña (*Vicugna vicugna*), puma (*Puma concolor*), 62 bird

species including the "near threatened" Andean condor (*Vultur gryphus*), over 1000 vegetative species, and the endemic and "vulnerable" tree species, the quenal (*Polylepis spp.*) (Cerrate de Ferreyra 1979; Oxford University 1996; Kolff and Bartle 1998; TMI 2001; IUCN 2013). There are eight human settlements that occupy the watersheds below the glaciated portion of the range (within seven legally recognized communities) that vary in size from 600 to over 1000 inhabitants. Including outlying areas the total population estimate is 18,100 (TMI 2001) while within the eight settlements the population is approximately 6,400. This population is divided administratively across three political departments, Lima, Ancash, and Huánuco (similar to US states).

3.3 Fire - Relic Forests

3.3.1 Introduction

Measures of forest-cover change can be used to evaluate environmental outcomes and sustainability of socio-natural systems (Ostrom and Nagendra 2006; Turner and Robbins 2008). The endemic *queñal* (*Polylepis spp.*) forests of the Andes are an important component of the landscape scale ecosystem complex (Fjeldsa and Kessler 1996) and are characterized as relicts (small patches) that grow between 3500-5000 masl and can contain up to 16 different species of *Polylepis* (Kessler 2002). All but one of the 16 known species of *Polylepis* are considered "vulnerable" by the IUCN (IUCN 2013). The patches of *Polylepis* provide important habitat for birds, wood fuel for local populations, and environmental services in the form of water retention during the dry season; the amount of water retention is likely linked to

pasture productivity in the dry season. Historical trends of distribution are contested as are the factors that drive these trends, but there is a consensus that distribution has diminished throughout the last millennia and that anthropogenic impacts through grazing, fire and harvest, and climactic factors such as shifts in local microclimates and moisture balances, play negative roles in maintaining sustainable stands (Gosling, Hanselman et al. 2009). In the Cordillera Huayhuash one study recently evaluated the extent of distribution of these forests in the Huayhuash (TMI 2001), but no studies have evaluated trends of *Polylepis* forest cover in the region. This research extends the TMI's (the Mountain Institute) work and evaluates temporal trends of forest cover in the region. The guiding hypothesis was that forest cover will be shown to be remaining constant throughout time (cf Byers 2000).

3.3.2 Methods

Forest (*Polylepis spp.*) cover was measured within the territories of all of the communities present at the meeting in March of 2007. Partial territories of two additional communities—Mahuay and Pomapata—were added to the original design as they also contain important *Polylepis* stands. Within the territories of these two communities the stands are extensive and well managed, they form part of a habitat corridor between the Huascaran National Park to the north and the Cordillera Huayhuash Reserved Zone to the south, and there is community interest in developing private conservation areas and tourism infrastructure based upon these forest resources (see Figure 3.2). The baseline data (2013 and 2011 combined) was created using Google Earth® and ArcMap® as platforms for head-up digitizing

(manual image interpretation). In Google Earth® the 2013 GeoEye® images (each pixel is 2 meters square) were digitized at a scale of 1:4,000 and 2011 ASTER composite satellite images created from the B1 (0.520-0.600 μm), B2 (0.630-0.690 μm), and B3 (0.760-0.860 μm) spectral bands (each pixel is 15 meters square) were digitized in ArcMap at a scale of 1:8,000. While these separate digitizing processes across years, data sets, and platforms were not ideal, the results are the most complete set of data for the region created to date.

To complete a temporal analysis 10 sets of satellite imagery spanning over 30 years was acquired from the ASTER, LANDSAT, and EO-1 remote sensing programs. The baseline data created as polygons from the 2013 and 2011 images (outlined above) was visually compared to all of the acquired images and eventually five sets of images were chosen for the final temporal analysis as follows: Landsat 1975 (60 meter pixels), Landsat 1988 (30 meter pixels), Aster 2000 and 2002 (combined) (15 meter pixels), and the Landsat 2008 (30 meter pixels). The final analysis from the satellite imagery spans 38 years with a total of five observations. The broad differences in pixel dimensions from the grouped sets of images, ranging from 2 meter pixels to 60 meter pixels, made quantitative comparisons difficult due to variation in delineation error. Instead qualitative visual comparisons were made. Vector (polygon) shape files demarcating prior patch extent in the northern and

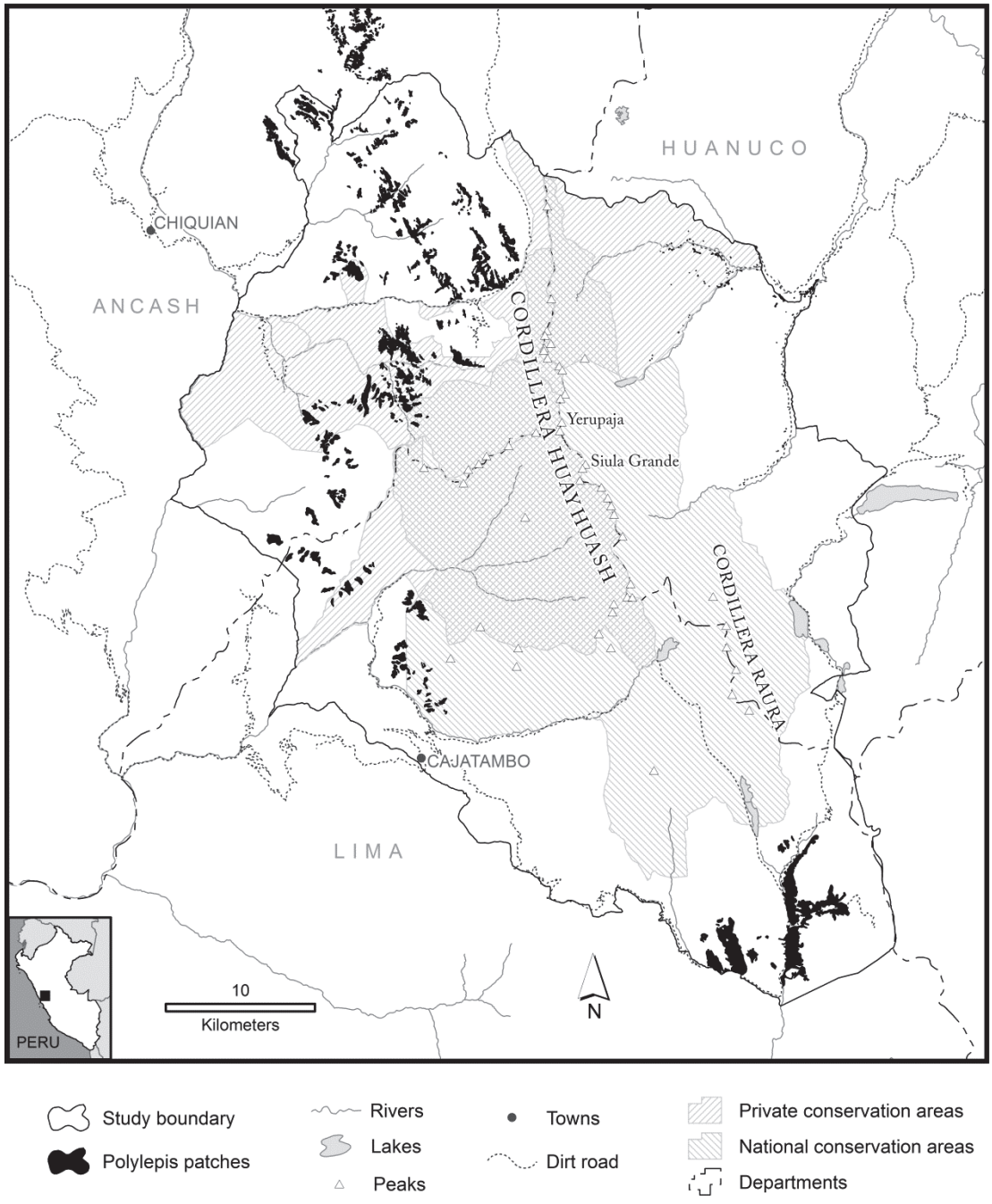


Figure 3.2: Distribution of the *Polylepis spp.* patches identified from the 2013 and 2011 satellite images. Note that almost all of the forest patches are located outside of the national conservation area. In the supplementary dissertation materials the file "Huayhuash2011-13PolylepisCover.kmz" contains this geographic data.

western part of the range were acquired from ECOAN—a Peruvian NGO dedicated to reforestation and restoration of *Polylepis* stands across the Andes—and included in the temporal analysis (ECOAN 2010). Due to errors identified in the delineation of the polygons in the ECOAN study, there is no reason to make a quantitative comparison between the ECOAN data and the delineations made in this study. Personal observations and key informant interviews made between 2003 and 2011 were used to corroborate the quantitative results from the GIS work.

3.3.3 Results

A total of 3,900 hectares of *Polylepis* in 570 forest patches were identified within the bounded study area (1,763 Ha from the 2013 GeoEye images and 2,137 Ha from the 2011 Aster imagery). The largest forest patch is approximately 360 Ha and the smallest a mere 65 square meters (a single tree). The mean patch size is slightly less than 7 Ha and the median is slightly less than one Ha (296 of the patches are less than one Ha).The largest *Polylepis* patches are located in the Cordillera Raura (see Figure 3.2) and are not properly part of the Cordillera Huayhuash. Nearly 100% of the identified forest patches are located in drainage basins flowing to the Pacific with a mere 20 Ha, or 0.5% of the forest area identified, located in the Amazon drainage basin.

The longitudinal analysis produced no quantifiable results other than that there is no detectable change. From experience in the communities and the periodic site visits made between 2003 and 2011, several qualitative observations merit mention. On the eastern side of the range there are very few natural patches of *Polylepis,* instead the

patches identified are largely household or family groves that are maintained. The communities on this side of the continental divide have strict rules about wood collection and favor burning cattle dung or coal for fuel. On the western side of the range there are two general areas of *Polylepis* forest, one on the pacific flank of the Cordillera Raura and the other on the northwestern flanks of the Cordillera Huayhuash. Of all the forest patches only 144 Ha (3.7%) fall within the national Cordillera Huayhuash Reserved Zone and 661 Ha (17%) fall within existing private conservation areas. The communities on the western side of the range have a heterogeneous set of rules and norms limiting (governing) wood harvest. In 2011 tree cutting was observed in one community in Ancash (western side), tree planting financed by external actors was observed in two communities in Ancash (these efforts failed due to conflicts and misunderstandings between the external conservation actors and the communities; see chapter 4), and locally financed (and successful) tree planting was observed in three communities in Huanuco (eastern side).

3.4 Water – Rivers and Lakes

3.4.1 Introduction

Access to fresh water of sufficient quality is without doubt a pre-requisite for sustainable socio-natural systems (Bartram and Ballance 1996). A corollary of this statement is that inadequate access to quality freshwater may lead to social instability and conflict. Thus monitoring water quality is important in contexts where there are weak institutions that govern activities (extractive or otherwise) which affect water quality negatively (eg. WHO 1991; Bartram and Ballance 1996; Bebbington and

Williams 2008). Bebbington and Williams suggest that, when possible, participatory monitoring is the preferred option to reduce the potential of conflict. While this claim is not yet accepted by either the mining industry or the Ministry of Energy and Mines in Perú, it is the approach that was taken for this research. Drawn from concerns at the 2007 meeting water quality in this study is determined by concentrations of heavy metals (fear of contamination from mining) and fecal coliforms (fear of contamination from tourism).

While there is some interest in participatory water monitoring in the central Peruvian Andes, see the *Agua Para Siempre* (Water for Ever) project as an example (Gasco, Ruíz Ríos et al. 2002), the approach is not yet common (but see also de Echave, Keenan et al. 2006; Scurrah 2008). Most likely there are two general reasons for this lack of work. First, water chemistry work is expensive and designing a financially sustainable monitoring program is difficult. Each laboratory analysis for heavy metals can run over $100 and additional analyses, such as the field tests or biological laboratory tests, add costs to each monitoring point. Furthermore, the monitoring must be done by a licensed professional who works for one of several possible government agencies to be legally valid. Contracting such personnel adds further expense. And second, bridging the chasm between local perceptions of water quality and laboratory reports on heavy metal concentrations is difficult at best and can cause conflicts based on misunderstandings (see chapter 5). This second concern is often cited by environmental engineers at the mines as a reason not to release water quality data to the public. (Nalven 2007; Rojas Villanueva 2011). A possible solution

to both of these problems is the use of bio-indicators to monitor water quality, but this methodology is relatively new and may run into the same problems.

This study in the Cordillera Huayhuash is the first of its kind in the region.

3.4.2 Methods

We, the author and participating community members, performed two rounds of water quality sampling and testing at identified monitoring stations. The selection of monitoring stations was guided by several criteria. At least two monitoring stations were identified per watershed; one at the headwaters (slightly downstream from a trekking camp if possible) and one near the confluence with the neighboring watershed. One monitoring station was identified at the source of drinking water for each community. Additional monitoring stations were identified as potential sites of contamination from mining activities. All of the monitoring station identification met Peruvian Ministry of Energy and Mines published protocols (MEM 1994). Samples were collected during April and May across two consecutive years; 51 stations in 2010 and 36 stations in 2011 of which 32 stations were used both years (see Figure 3.3). Field measurements were made for temperature, pH, conductivity, salinity, total dissolved solids, and dissolved oxygen with two distinct field instruments (the Oakton Instruments PCSTester35 multi-parameter tester and the Oakton Instruments ExStik® DO600 oxygen meter respectively).

To measure the impact of trekking and camping on water quality in the region observed occurrence and abundance of *enterococcus* bacteria was used. The *enterococcus* group of fecal coliform bacteria includes more than 17 individual

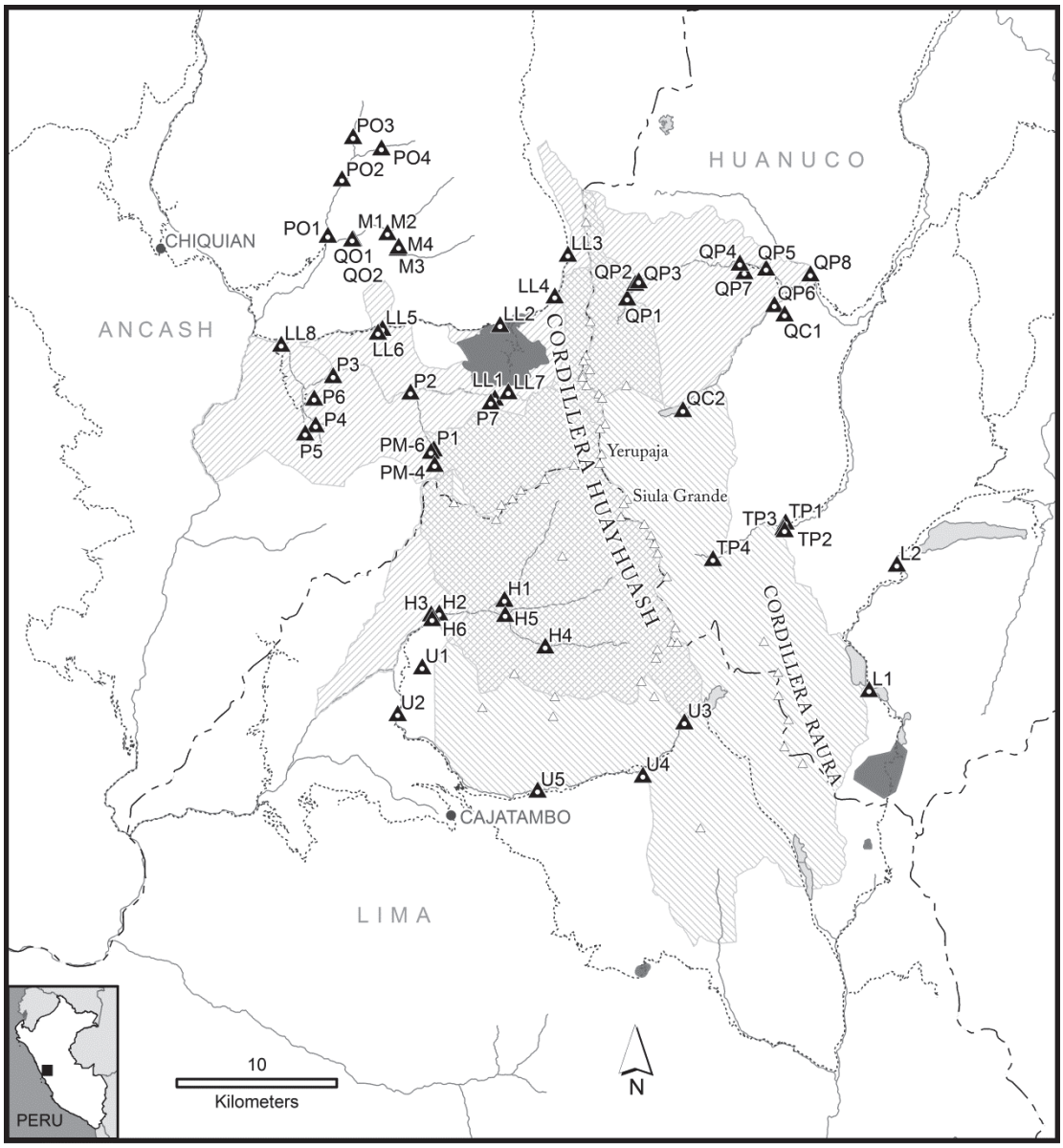


Figure 3.3: Locations of the water monitoring stations.

species of which most originate in the human digestive tract. *Enterococcus* concentrations cannot be considered a direct measure of human impact (Ahmed, Neller et al. 2005), yet this measure is considered one of the best proxies (EPA 2006). The American Public Health Association (APHA) methods 9222 and 9230 (APHA 2005) were followed for the analysis of fecal coliforms (*Enterococcus spp.*) in the field. Each measured sample was filtered with a 0.45 micron gridded filter. Each filter was then incubated at approximately 44.5° C for twenty four hours on Agar specially formulated for *Enterococcus* growth. The number of colonies that appeared was counted and a most probable number (MPN) was calculated using the number of colonies observed and the amount of water originally filtered.

In 2010 split filtered (0.45 micron) and unfiltered samples were collected for heavy metal analysis at each monitoring station and in 2011 only unfiltered samples were collected. Across both years ½ liter was used as the sample volume. In September of 2011 three additional stations were identified near a mine exploration site due to fears of contamination from a diesel spill and the exploration activities themselves. The collection bottles were provided by the laboratory and were guaranteed to be clean (according to EPA protocols detailed below). The collection of samples in the field followed the EPA protocols published in each method detailed below. In 2010 the unfiltered sample was analyzed for dissolved mercury (Hg) concentrations in a laboratory in Lima (EnviroLab S.A.C) using EPA method 1631 (Cold Vapor Atomic Fluorescence Spectrometry) (EPA 2002). The Mercury measurement was not repeated the second year as no sample from 2010 yielded a

positive result and no new sources of mercury were identified. The elimination of this test reduced laboratory expenditures in 2011. In 2010 the unfiltered sample was analyzed for a full run of elemental concentrations (As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn, Ag, B, Bi, Ca, Fe, K, Li, Mg, Na, P, Si, Sn, Sr, and Ti) with the EPA 200.8 method (inductively coupled plasma - mass spectrometry) (EPA 1994). In 2011 the elemental analysis was narrowed to aluminum (Al), arsenic (As), cadmium (Cd), copper (Cu), manganese (Mn), nickel (Ni), lead (Pb), and zinc (Zn) based on the results from 2010.

All of the results from the field measurements, including the MPN for *Enterococcus*, and the results from the laboratory were compared to published drinking water standards and maximum effluent levels for mining activities in Perú (MINAM 2008; MINAM 2010).

3.4.3 Results

PH measurements over both years have an average value of 7.8 with the highest and lowest values being 8.83 and 5.59 respectively (the drinking water standard has a range from 6.5 to 8.5) (see Table 3.1). Natural springs tended to have the lowest pH from 5.59 to 6.61 and effluent that flowed from the Pallca mine was at 6.54 to 6.7. The relatively high pH across the region can be explained by the high levels of calcium and magnesium observed in the results from 2010. There were several dissolved oxygen measurements that were below the standard for drinking water for both years (below 6mg/l): five stations in 2010 and four stations in 2011. In all of these cases the sample was taken from either a slow flowing spring or an enclosed

catchment tank for drinking water both of which have lower exposures to oxygen than an open body of water.

Table 3.1: Summarized results of the field measures for water quality.

		Temp (°C)	pH	Conductivity (µS/cm)	Salinity (ppm)	Total Dissolved Solids (ppm)	Dissolved Oxygen (mg/l)
Drinking water standard - D.S. 002-2008-MINAM			**6.5-8.5**	**< 1500**		**1000**	**>= 6**
2010 (May)	**(N=51)**						
mean		12.85	7.83	217.82	105.76	153.87	6.64
min		8.30	5.59	28.80	17.50	20.50	3.16
max		18.60	8.83	525.00	259.00	373.00	9.03
Monitoring stations outside drinking water standard D.S. 002-2008-MINAM			H2-H6, LL1, LL2, LL8, QP3,U2-U5				H2, H3, P6, QO2, QP2, QP3, U1
2011 (May)	**(N=36)**						
mean		10.79	7.77	228.56	109.63	162.37	6.74
min		6.10	6.33	4.40	10.00	3.30	4.57
max		18.00	8.66	486.00	236.00	342.00	9.25
Monitoring stations outside drinking water standard D.S. 002-2008-MINAM			H4, H5, QP1, QP6, U2				P5,P6,QP2, TP4
NO RESULTS							LL4-LL6
2011 (September)	**(N=4)**						
mean		8.40	5.47	400.75	191.50	285.00	6.33
min		7.90	4.15	220.00	104.00	156.00	6.00
max		9.00	6.85	662.00	322.00	472.00	6.69
Monitoring stations outside drinking water standard D.S. 002-2008-MINAM			P1, PM-4, PM-6				

The 2010 results for *Enterococcus* were confounded by problems with the incubator and are not complete. In 2011 the incubator functioned more consistently

and the results are more complete. Nevertheless, there were 16 samples that were contaminated with fecal coliforms in 2010 and 22 samples observed in 2011 (see Table 3.2).

Table 3.2: Summarized results for the *enterococcus* MPN counts.

	Most Probable Number (*enterococcus*/100ml)
Drinking water standard D.S. 002-2008-MINAM	**0**
2010 (May) (N=51)	
mean	2.31
min	0
max	25
Monitoring stations over drinking water standard D.S. 002-2008-MINAM	H1, H5, LL1, LL3, LL5, LL8, P4, P7, QC2, QP2, QP4-QP6, TP1, TP2, TP4, U3
No Data	H2, H6, L1, L2, LL2, LL4, LL7, M1-M4, PO1-PO4, QO1, QO2, QP3, QP8, U2, U5
2011 (May) (N=36)	
mean	23.59
min	0
max	600
Monitoring stations over drinking water standard D.S. 002-2008-MINAM	H1-H6, LL5, P1-P4, P6, QP1,QP2,QP6,QP7,TP2,TP3,U2,U3-U5
No Data	LL2, LL4, LL6
2011 (September) (N=4)	
mean	1.67
min	1
max	3
Monitoring stations over drinking water standard D.S. 002-2008-MINAM	PM-4, P1, P2
No Data	PM-6

The combined results show that the mean MPN counts for samples taken from within one km of a settlement (mean MPN 6.9), within one km of a camp (mean

MPN 1.9), potable water catchment tanks (mean MPN 1.5), and in water bodies in the *campo* (not near to concentrated human activity, mean MPN 0) are significantly different once the outliers were removed (one way ANOVA p-value is 0.004 with 3 and 48 degrees of freedom) (see Table 3.3).

Table 3.3: *Enterococcus* MPN counts and distance to human activity

	1 km from settlement	1 km from camp	Potable water tanks	All other
MPN/100 ml (mean)	6.9	1.9	1.5	0

One-way ANOVA p-value 0.004 with 3 and 48 degrees of freedom

According to observed concentrations of metals, in 2010 there were 14 samples that exceeded the drinking water standards and none that exceeded the permissible limits for mining activity (see Table 3.4 and the supplementary materials). The problematic metals in 2010 were as follows: aluminum (6 samples), arsenic (10 samples), cadmium (1 sample), manganese (3 samples), nickel (1 sample), lead (1 sample), iron (4 samples), and in two samples molybdenum exceeded the World Health Organization's drinking water standards (there is no drinking water standard for this metal in Perú). In 2011 there were 16 samples that exceeded the standards for metal concentrations in drinking water with the same problematic metals from 2010 observed. Nine of the samples exceeded the standards were from the same stations as in 2010. Three samples from other stations showed heightened aluminum

Table 3.4 Summarized results of heavy metal concentrations.

	Aluminum (Al)	Arsenic (As)	Cadmium (Cd)	Copper (Cu)	Manganese (Mn)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
Drinking water standard (D.S. 002-2008-MINAM)	200	10	3	2000	100	20	10	3000
MPL for mining activities (D.S. 010-2010-MINAM)		100	50	500			200	1500
2010 (May) (N=51)								
mean	56	7	0	7	37	2	0	69
min	0	0	0	0	0	0	0	0
max	631	49	6	30	576	32	16	393
Monitoring stations over drinking water standard	H1, M1, M2, P2, QO2, QP2	H1, H5, H6, L1, LL1, LL2, P7,U1	QC1		LL2, P2, QO2	P7	QO2	
2011 (May) (N=36)								
mean	165	5	1	0	92	2	1	121
min	0	0	0	0	0	0	0	1
max	1934	56	15	13	1708	24	31	2490
Monitoring stations over drinking water standard	P1, P2, P4, P5, P6, QP2, TP4	H1, H5, H6, LL1, LL2, P7, U1	LL2, P1, P2		LL2, P1, P2, P5	P1, P5	LL2	
Monitoring stations over MPL for mining								P1
2011 (September) (N=4)								
mean	2062	2	10	4	2867	21	6	2832
min	558	1	5	1	524	10	2	1287
max	3847	2	15	7	5611	34	13	4517
Monitoring stations over drinking water standard	PM-4, PM-6, P1, P2		PM-4, PM-6, P1, P2		PM-4, PM-6, P1, P2	PM-4, P1	PM-4	
Monitoring stations over MPL for mining								PM-4, P1, PM-6

NOTE: all metal concentrations in µg/liter

For the entire data set please refer to the supplementary materials.

concentrations as compared to 2010 and now exceeded the standard for this metal. The remaining three samples with results that exceed the standards for drinking water were collected at the newly identified stations beneath mining exploration at *Diablo Mudo* (no samples from 2010). The concentration of zinc from the samples collected at the three new stations P1, PM-04, and PM-06 (2011 only) exceeded the maximum permissible limits for effluents from mining activities.

With the exception of five monitoring stations, LL2, L1, P1, PM-4, PM-6, and, which are the stations at the outflow of the settling ponds for the Pallca mine (LL2), the lake beneath the Raura mine (L1), and two creeks below the exploration at Diablo Mudo (P1, PM-4, PM-6), all of the samples with results that exceed the drinking water standards for metal concentrations show evidence of natural contamination (i.e. there is no nearby mining activity). In 2010 the sample from station LL2 was outside of drinking water standards for arsenic, manganese and iron, and in 2011 the results showed increased concentrations of aluminum, arsenic, cadmium, copper, nickel, lead, and zinc. For both years, by the time the water flowed several kilometers to the station LL5 (in a nearby community), the pollutants had been diluted sufficiently from the inflow of tributaries to meet the drinking water standards.

The results from the samples taken from P1, PM-4, and PM-6, in addition to exceeding the maximum permissible limits of Zinc concentrations for mining effluents, show concentrations that exceed drinking water standards for aluminum, cadmium, manganese (all three), and nickel (only PM-4 and P1). Directly beneath the Raura mine on the eastern side of the range, the results from station L1 showed

concentrations that exceed the drinking water standard for arsenic. In both cases (beneath the exploration at *Diablo Mudo* and beneath the Raura mine) the results from samples take at stations further downstream in the respective watersheds showed that the high levels of pollutants had been diluted sufficiently to meet the drinking water standards (similar to the case of the Pallca mine). Nevertheless, at station P2 three data points were collected between May of 2011 and September of 2011 which show increasing concentrations for zinc, nickel, and cadmium and slightly decreasing concentrations for aluminum and manganese during this period.

3.5 Earth – The Productivity of Pasture

3.5.1 Introduction

The relationship between grassland ecosystems, management practices, and institutions have been extensively studied, yet there is little literature with a focus in the Andes (but see Tapia Nuñez and Flores Ochoa 1984; Ruiz Canales and Tapia Nuñez 1987; Wilcox, Bryant et al. 1987; Florez 2005; Farriss 2007). The general consensus in Perú is that 80% of high Andean pastures are currently overgrazed and most of the blame is placed on poor management techniques (Florez 2005), yet it has been suggested that additional factors such as tourism and market pressure may be driving pasture degradation (Farriss 2007). For example tourism can lead to pasture degradation as follows: 1) tourists tend to hire pack animals to reach remote destinations; 2) the rental of pack animals can be an important source of income to rural households; 3) thus it follows that raising large herds of pack animals is a good economic decision, but 4) the extra grazing pressure can lead to pasture degradation.

Indeed, the study was guided by the hypothesis that tourism as adventure based trekking has negative effects on local grazing areas in terms of productivity (as casually observed by local ranchers).

The grasslands of the Andes are classified into three vegetative communities by the local residents and scientists alike. *Pajonal de ichu* is high altitude grassland found on sloping hillsides dominated by *Stipa ichu* (a clumping perennial grass). *Cesped de puna* is high altitude grassland found on valley floors dominated by *Calimagrostis spp., Azorella spp., and Aciachne pulvinata*. *Occonales* or *bofedales* are wetlands dominated by *Distichia muscoides, Plantago rigida,* and *Scirpus californicus* (sometimes these are referred to *totorales,* but only when *Scirpus calificornicus,* a giant bulrush known in Quechua as *Totora,* is present). All three of these associations are important for cattle and sheep ranching and management schemes generally involve the movement of animals from one vegetative community to another over the course of the varying wet and dry seasons throughout the year.

The small body of work that does evaluate Andean pasture condition tends to be based on measures of productive capacity due to the fact that livestock are a substantial component of (semi) subsistence livelihoods in the Andes (Brush and Guillet 1985). This literature highlights cycles of energy and water and how animals effect these cycles through the removal of vegetation, yet the focus is on production animals (cows, sheep, alpaca, etc.) and does not often consider pack animals (donkeys and horses) (Tapia Nuñez and Flores Ochoa 1984; Ruiz Canales and Tapia Nuñez 1987; Florez 2005). Few studies consider biodiversity measures in Andean pasture

ecosystems and the intermediate disturbance hypothesis (Connell 1978) is not considered when interventions are designed (but see Farriss 2007). By evaluating pasture condition in an area impacted by tourism this study contributes to the understanding of grassland ecosystem change in high Andean landscapes and provides baseline data for future studies.

3.5.2 Methods

Pasture condition at twenty different sites throughout the Cordillera Huayhuash was assessed by the author, a local agronomist, and collaborating community members two times over the course of one year. The assessments were made during the months of April, May and June in 2010 and then again in the same months of 2011. In 2010 19 sites were chosen: the selection included six campsites along the trekking circuit and 13 sites based on local knowledge and interest in evaluating a range of grasslands that are maintained as communal grazing areas. In 2011 an additional campsite was chosen. Over two years there were six campsites and 11 grazing sites that could be compared (see Figure 3.4). The *transecto al paso* (step transect) method was used to evaluate pasture condition as a measure of productive capacity (Florez 2005). To perform the step transect, species present and basal cover are recorded within a 2.5 centimeter diameter circle every step for 100 steps. Two or three transects were walked at each site (depending n time available) and the results were averaged. By considering what animal is the dominant grazer in the site (based on local knowledge), an indicator species is chosen and 20 measures of the plant height are averaged to calculate a plant vigor index.

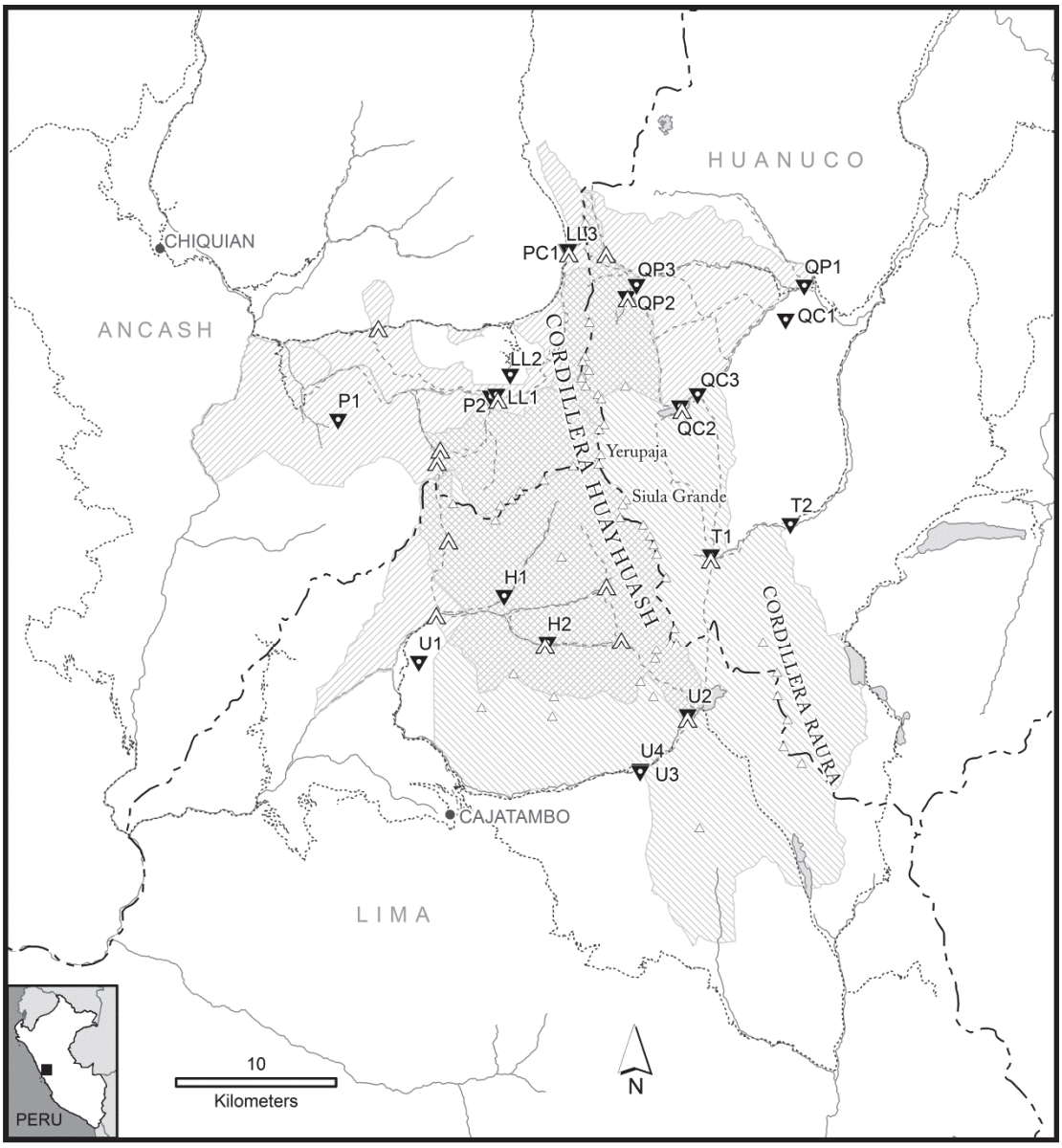


Figure 3.4: Locations of the pasture evaluation sites

The pasture condition, on a scale of 1-100, is calculated by weighting the indices and then adding them together by using the following equation.

$$P = X_d(0.5) + X_f(0.2) + V(0.1) + 100 - BG(0.2) \quad \text{Equation (1)}$$

Where X_d is the abundance of desirable species (depends on the dominant grazer), X_f is the abundance of all forage species, V is the average plant height of the indicator species, and BG is the number of bare ground (non-vegetated) observations recorded along the transect. This index was calculated using both cows and sheep to determine the desirable and indicator species. Pasture with an observed index from 79-100 is considered excellent, from 54-78 is good, from 37-53 is regular, from 23-36 is poor, and below 23 is very poor. A disturbance index was calculated with species abundance of several forage species using the following equation:

$$D = \frac{(0)X_0 + (-1)X_1 + (-2)X_2 + (-3)X_3}{X_0 + X_1 + X_2 + X_3} \quad \text{Equation (2)}$$

where X_i is the abundance of species with a palatability index of i scored for both cows and sheep (Farriss 2007): X_3 is the abundance of the most desirable species (same as X_d from equation (1); dependent on dominant grazer) and X_0 is the abundance of species that a cow or sheep does not eat (X_f from equation (1) is equivalent to $X_1 + X_2 + X_3$). An undisturbed site has an index of -3 and a completely disturbed site has an index of 0. A linear model that uses disturbance to predict productivity was constructed.

$$P = \beta_0 + \beta_1 D \quad \text{Equation (3)}$$

The Shannon's H diversity index was calculated with the following equation:

$$H' = -\sum_{i=0}^{R} p_i \log p_i \qquad \text{Equation (4)}$$

Where R is species richness and p_i is the abundance of the i^{th} observation. A linear polynomial regression model was constructed in the open source statistical package "R" to predict species diversity from the disturbance index.

$$H' = \beta_0 + \beta_1 D + \beta_2 D^2 \qquad \text{Equation (5)}$$

All of the indices (productivity, disturbance, and diversity) were categorically compared across sites that are camps and sites that are common grazing areas using Pearson's Chi^2 in the open source statistical package "R." Using the same method all of the indices were also categorically compared across the two years that the data was collected.

3.5.3 Results

Within the total of 22 total sites evaluated, 12 were identified as *cesped de puna*, five were identified as *occonal,* three were identified as *pajonal de ichu,* and two were determined to be in transition from *occonal* to *cesped de puna*. From the 10,400 observations recorded in the pasture transects 150 different species were identified across 20 plant families and 74 genera. The distribution, by *family (number of species identified|percentage of total observations)* ordered by abundance*,* is as follows: Graminaeae or Poaceae (89:49.3%), Asteraceae or Compositae (21|10.0%), Cyperaceae (8|8.4%), Rosaceae (10|8.3%), Geraniaceae (2|5.1%), Fabaceae or

Leguminosae (6|5.0%), Juncaceae (12|2.7%), Plantaginaceae (3|2.6%), Malvaceae (3|0.8%), Apiaceae (2,|0.6%), Lamiaceae (1|0.5%), Santalaceae (2|0.4%), Chenopodiaceae (1|0.3%), Cactaceae (1|0.2%), Iridaceae (1|0.2%), Ranunculaceae (1|0.2%), Scorphulariacea (1|0.1%), Amaranthaceae (1| <0.1%), Ephedraceae (1|<0.1%), and Hydrocharitaceae (1|<.1%) (see appendix A).

The observed productivity index for cows ranged from a low of 36.8 to a high of 70.4 (see Table 3.5 and appendix B). One observation falls in the *poor* category, 13 observations fall in the *regular* category and 25 observations fall in the *good* category. For sheep the values ranged from a low of 50.4 to a high of 84.5. Two observations fall in the *regular* category, 28 observations fall in the *good* category, and nine are in the *excellent* category. The observed mean productivity index for cows is 55.17 and for sheep is 73.08. These mean scores indicate that on average the pastures of the Cordillera Huayhuash are in good condition.

Table 3.5: Summarized results for the pasture sites

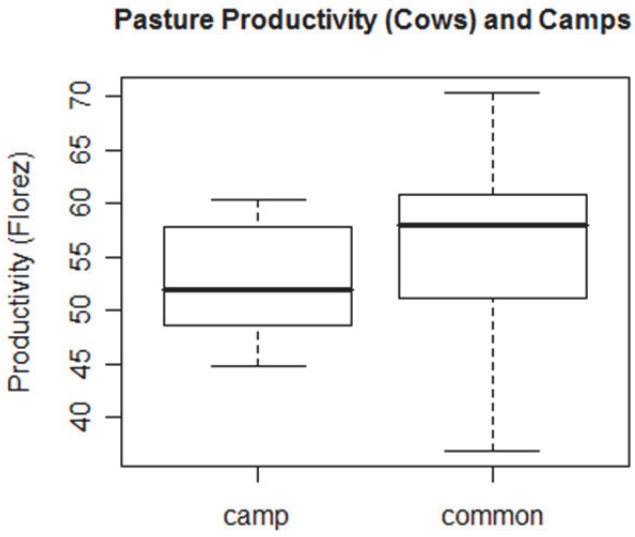
Response Variables							
Name	Type	N	Mean	Median	Stdev	Min	Max
Productivity for cows (eq. 1)	continuous	39	55.17	56.30	7.72	36.8	70.40
Productivity for sheep (eq. 1)	continuous	39	73.08	75.63	8.56	50.47	84.53
Species Diversity (eq. 4) (Shannon's H)	continuous	39	3.012	3.067	0.279	2.442	3.505
Species Richness	continuous	39	30.79	30.00	7.11	17.00	44.00
Explanatory Variables							
Name	Type	N	Mean	Median	Stdev	Min	Max
Grazing disturbance for cows (eq. 2)	continuous	39	-0.932	-0.943	0.246	-1.520	-0.527
Grazing disturbance for sheep (eq. 2)	continuous	39	-1.814	-1.853	0.249	-2.150	-1.280
Camp	ordinal two classes	22	7 camp 15 common				
Private conservation	ordinal two classes	22	12 PC 10 N				

When classified by camps and common grazing areas the mean values for cows are 52.46 and 56.52 respectively. With a one-sided Welch two sample t-test we reject the null hypothesis that the means are the same with a p-value of 0.037. Thus the pastures at campsites are significantly poorer in terms of productivity and fall into the classification of *regular* as compared to *good* for the common grazing areas (see Figure 3.5(a)). For sheep the difference in means between camps and common grazing areas is not significant.

The observed disturbance index for cows ranged from a minimum of -1.52 (least disturbed) to a maximum of -0.53 (most disturbed) with a mean of -0.943. When classified by camps and common grazing areas the mean values for cows are -0.792 and -0.976 respectively. With a one-sided Welch two sample t-test we reject the null hypothesis that the means are the same with a p-value of 0.010. For sheep the respective means are -1.921 and -1.768 respectively and the p-value to reject the null hypothesis is 0.052. The linear regression model constructed to predict productivity from disturbance showed a strong negative correlation (β_1 coefficient of -30.48 with a p-value of 8.8×10^{-15} and an R-squared value of 0.81). As higher levels of disturbance are observed productivity values go down. These results suggest that pastures near to campsites are under more grazing pressure than common pastures which would explain the different levels of production observed between camps and commons

The polynomial linear model to predict diversity from disturbance shows the highest levels of diversity at intermediate levels of disturbance (β_1 coefficient of -2.97 and β_2 coefficient of -1.39 with p-values of 0.01 and 0.02 respectively and an

(a)



(b)

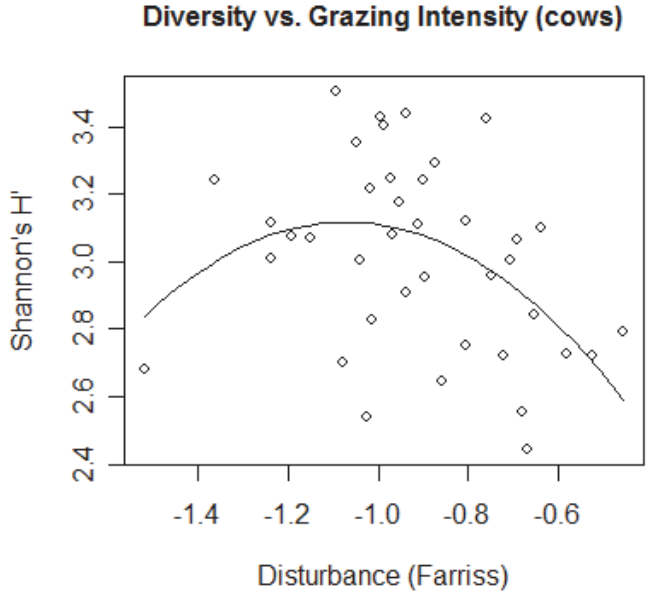


Figure 3.5 (a) Pasture productivity calculated for cows compared across camps and common grazing areas. The Welch two sample t-test (one-sided) rejects the null hypothesis that the means are the same with a p-value of 0.03722. (b) Species diversity (Shannon's H') vs. disturbance calculated for cows from equation (2). The linear polynomial model provides evidence that Conell's intermediate disturbance hypothesis applies to high altitude Andean grasslands.

R-squared value of 0.20). This model confirms that the intermediate disturbance hypothesis is applicable to Andean grazing ecosystems (see Figure 3.5(b)).

The comparisons of indices across years show no statistically significant results. For the average productivity index for both cows and sheep at camps a decline is observable, for the disturbance index for both cows and sheep at camps an increase is observable, and for the diversity index a rise in average values at the camps and in general is observable, nevertheless. While no conclusions can be drawn from the productivity and disturbance indices, it is likely that the observed increase in diversity is due to a steep learning curve for species identified (we were able to identify more species the second year as a result of our experience from the first year).

3.6 Conclusions

The three studies presented in this article were undertaken with two specific purposes in mind. All three efforts provide baseline data necessary for future evaluations of environmental changes that result from both anthropogenic (mining, tourism, and local economic activities) and natural (climactic and geological) drivers. As mining activity and tourism continue to expand in the area, studies to repeat the measurements and evaluate subsequent environmental change are of high importance. The raw data collected through the studies discussed is available as supplementary information available online at: <online address here>. The second purpose of the work is specific to only the water and pasture work; to involve local people in the science of evaluating environmental "goods" and "bads." This was successful in a limited sense. Successful in that several members of each community learned a great

deal about the methodologies behind water quality monitoring and the evaluation of pasture productivity. Limited as the participating community members were generally older males; several exceptions included younger males, yet in no cases was a woman identified to perform the work (see chapter 5).

The forest results support the conclusion that patterns of change stabilized some time ago and that local institutions governing forest use (and fuel gathering in general) are well developed. While very different histories of use and management were observed across the Pacific and Amazon drainage basin, taboos regarding illegitimate tree harvest are strong across the region and punishments meted out by community councils can debilitate a family that incurs infractions. Tourism presents a possible threat to maintained forest cover as most trekking and tour agencies are not local and do not abide by the local institutions, but instead want to please their foreign clients who desire a fire at camp. On a methodological note, the use of historical satellite images to measure trends and patterns in *Polylepis spp.* distribution over time is very difficult in this region due to the varying image resolutions and the small patch size of the forest fragments. Future work in this region should strive to bridge both natural and social science in order to render a more complete set of observations regarding temporal trends in *Polylepis* forest cover.

The findings from the water quality study confirm that mines and camping can be linked to water contamination, metals and *coliforms* respectively. There is no direct evidence that mining causes contamination as the results are confounded by natural contamination. This does not excuse the mines from responsibility, but instead shows

a difficulty in interpreting the results in an objective manner. Complimentary studies, such as contaminant levels found in blood samples of local residents are necessary to better understand these phenomena. The results show that arsenic is the most common contaminant in the Cordillera Huayhuash (approximately 20% of the monitoring stations revealed arsenic level above drinking water standards); this agrees with a growing consensus that levels of arsenic over 10µg/l in about 20% of wells that supply drinking water is a global phenomenon. The research proved to be a learning process for all; paid researchers, mining engineers, and community members. It was expected that results from the laboratory would provide simple binary yes/no or good/bad answers to water quality issues, but this was not the case. Instead the results pointed to new questions that were sometimes difficult to address. This process is part of necessary conflict resolution work and will lead to better governance, yet it will be a long learning process. While there is a rapidly increasing body of work on water governance and water scarcity (arguably more important than quality), much is needed in terms of water quality in areas influenced by extractive industries. This work is a necessary step towards sustainable development and should be continued in the Huayhuash and repeated elsewhere.

The results from the pasture study show that tourism is a drain on productivity in Andean pastures. As the locals already know, horses and donkeys are like cows, but they eat more. The evidence suggests that pasture condition is not yet a general problem in the Huayhuash, but in some places there are indications that current management strategies will not lead to sustainable use. There is not enough data

across a temporal span to conclude that degradation through time is taking place, but local opinion, drawn from increased observations of the cactus *Opuntia flocosa S.D.* (locally known as "warco"), known to be a sign of desertification, indicates that negative change is already underway. It is known that anthropogenic and climactic/geophysical factors drive this change, but more work is needed to understand this system and tease out the contributions of various drivers.

In some cases, and at some of the evaluation sites, the original fears of the leaders who were present at the meeting in 2007 were confirmed. Both mineral extraction and adventure-based tourism, economic activities brought to the Huayhuash by non-local actors, contribute negatively to the sustainability of the ecosystems in the Cordillera Huayhuash. In other cases local residents learned that some of their practices are factors in the degradation of the local environment; letting pigs root in the *occonales* and *bofedales* can cause severe disturbances and loss of productivity, for example. And in still other cases, problems that stem from geological processes were discovered in places that were not expected. It is this shared discovery of the human-environment relationship that will lead to conservation landscapes based on sustainable use while maintaining a keen eye on the resilience of ecosystems and their ability to maintain biodiversity as well has the human species.

Supplementary Materials

Filename	Description
2011-13_Huayhuash_PolylepisCover.kmz	A zipped KML file with the forest patch delineation data. Note this is a merged dataset across the two years 2011 and 2013 (as described in the chapter text).
2010-11_Huayhuash_WaterQuality.xlsx	A Microsoft Excel file that contains four sheets. The first sheet is a small summary of all the observations (mixed English and Spanish. The second sheet is the raw data from May of 2010, the thirds sheet is the raw data from May of 2011, and the fourth sheet is the data from September of 2011 (sheets two through four are in Spanish).
2010-11_Huayhuash_PastureCondition.xlsx	A Microsoft Excel file with two sheets that contain the raw pasture transect data (all in Spanish). The first sheet contains the 2010 transect data and the second sheet the 2011 transect data.
2010-11_Huayhuash_SpeciesList.xlsx	A Microsoft Excel file with one sheet that contains the combined species list from the pasture transects (for both 2010 and 2011).

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APPENDIX A
Species list for pasture transects
Cordillera Huayhuash
2010 - 2011

Count summary
20 families
74 genera
150 species

Created by:
Timothy B Norris:
tibben@ocf.berkeley.edu

Gustavo Escobar la Cruz

Key for species palatability
MD = very desirable
D = desirable
PD = little desirable
NC = does not eat

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
	AMARANTHACEAE							
1	Gomphrena meyeniana		PD	PD	D	1	0	1
	APIACEAE							
2	Azorella crenata	"Yareta"	PD	NC	D	11	1	12
3	Lilaeopsis andina	"Laya laya", "Chinga"	PD	NC	PD	40	12	52
	CACTACEAE							
4	Opuntia flocosa S.D.	"Wagur", "Warco"	NC	NC	NC	9	13	22
	CHENOPODIACEAE							
5	Beta sp.	"Acelga chilena"	PD	D	PD	0	28	28
	COMPOSITAE (ASTERACEAE)							
6	Achyrocline alata (H.B.K.) D.C.	"Yurac cora"	NC	NC	PD	18	11	29
7	Bidens andicola	"Sillcau"	NC	NC	PD	15	50	65
8	Chuquiraga spinosa (R&P) D.Don	"Huaman Pinta"	NC	NC	PD	3	1	4
9	Escorzonera sp.	"Escorzonera"	NC	NC	PD	5	10	15
10	Gnaphalium sp.					3	0	3
11	Hypochoeris sp.		D	NC	PD	88	28	116
12	Hypochoeris stenocephala		MD	PD	PD	11	24	35
13	Hypochoeris taraxacoides (Walp.)B&H	"Cuchi cora", "Pilli pilli", "Pilli"	MD	NC	PD	52	96	148
14	Lepidophyllum quadrangulare		PD	PD	PD	9	0	9
15	Loricaria graveolens Wedd.	"Gallopa chaquin"	NC	NC	NC	4	0	4
16	Lucilia aretioides		PD	NC	PD	7	1	8

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
17	Lucilia tunariensis		PD	NC	PD	16	0	16
18	Paranephelius bullatus A.Gray	"Millhua cora", "Panas"	PD	PD	PD	11	112	123
19	Pseudonoseris szyszylowiczii	Antacsha				0	13	13
20	Senecio sp.					0	2	2
21	Senecio canescens (H.B.K.) Cuatr.	"Ancush cora"	NC	NC	NC	18	7	25
22	Senecio spinosus DC.	"Pacha casha"	NC	NC	PD	2	6	8
23	Sonchus oleraceus Linneo	"Casha gania"	PD	NC	PD	4	11	15
24	Taraxacum officinale Wigg.	"Chicoria"	PD	NC	PD	1	9	10
25	Werneria caespitosa Wedd. E	"Cebolla wiscor"	D	NC	PD	46	93	139
26	Werneria nubigena HBK	"Calhua calhua" "Cebolla wiscor"	D	NC	PD	55	124	179
27	Werneria villosa A. Gray	"Condorpa cebollan"	D	NC	PD	44	28	72
	CYPERACEAE							
28	Carex boliviensis Van Heur. & Muell.	"Ajshallay"	MD	D	PD	0	4	4
29	Carex ecuadorica Kuekenthal	"Socco cora", "Ccora", "Sergua"	MD	D	PD	199	244	443
30	Carex hebetata Boolt	"Sequia cora"	MD	D	D	0	32	32
31	Cyperus niger Ruiz & Pavón	"Ichic ututo"	MD	D	D	5	2	7
32	Eleocharis albibracteata Ness & Mey	"Quemillo", "Chucro pasto"	MD	D	D	117	158	275
33	Scirpus rigidus Boeckeler	"Totorilla", "Anccuya"	PD	D	D	61	53	114
	GERANIACEAE							
34	Erodium cicutarum Linneo L´Héritier	"Auja auja", "Alfilerillo"	NC	NC	NC	2	11	13
35	Geranium sessiliflorum Cavanillas	"Paca make", "Malvatina", "Rachichi"	PD	NC	PD	224	293	517
	GRAMINEAE o POACEAE							
36	Aciachne pulvinata	"Ucush casha", "Pacu pacu"	NC	NC	PD	162	168	330
37	Agropyron breviaristatum Hitchcock	"Trigo Soclla"	PD	PD	PD	0	6	6

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
38	Agrostis breviculmis Hitchcock	"Champa", "Chiji"	D	PD	D	184	147	331
39	Agrostis hankeana Hitchcock	"Chiji", "Pajonal"	PD	PD	PD	24	19	43
40	Agrostis tolucensis H.B.K.	"Champa", "Chiji","Cebadilla", "Crespillo grande"	PD	PD	PD	34	69	103
41	Alocuperus aequalis Sobol.		PD	PD	PD	0	6	6
42	Aristida enodis Hackel	"Orqo iru", "Sunka pasto"	PD	PD	D	2	25	27
43	Axonopus elengatulus (Presl) Hitchcock	"Quima Hueta"	PD	PD	PD	4	1	5
44	Brachypodium mexicanum Link	"Tullu soclla"	PD	PD	PD	0	5	5
45	Bromus catharticus Valh	"Shola", "Cebadilla"	D	D	D	225	158	383
46	Bromus lanatus Humb.Bonpl. &Kunth	"Shola", "Cebadilla"	D	D	D	124	93	217
47	Bromus pitensis Humb.Bonpl. &Kunth	"Shola", "Shoclla"	D	D	D	5	14	19
48	Bromus trinii		D	D	D	0	1	1
49	Bromus unioloides	"Shola", "Shoclla"	MD	MD	MD	34	29	63
50	Calamagrostis amplifora Tóvar	"Oqu ocsha"	PD	PD	PD	15	14	29
51	Calamagrostis antoniana (Grisebach) Steudel	"Ocsha"	PD	PD	PD	8	0	8
52	Calamagrostis brevifolia (Wedd.) Pilger	"Llama pasto"	PD	PD	MD	73	170	243
53	Calamagrostis curvula (Wedd.) Pilger	"Qoshru ocsha"				0	26	26
54	Calamagrostis eminens	"Sora"	PD	D	MD	3	24	27
55	Calamagrostis glacialis (Weddell) Hitchcock	"Atoqpa chupan"	PD	PD	PD	11	0	11
56	Calamagrostis heterophylla (Weddell) Pilger	"Ocsha"	PD	PD	PD	14	14	28

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
57	Calamagrostis macrophylla Pilger	"Chucro pasto", "Callo callo", "Huellap ocsha"	PD	PD	PD	4	12	16
58	Calamagrostis ovata (Presl) Steudel	"Centeno pasto", "Jurahua"	D	PD	PD	11	27	38
59	Calamagrostis recta (HBK) Trinius	"Zutsu ocsha"	PD	D	D	52	18	70
60	Calamagrostis rigescens (Presl) Scribner	"Chucro pasto", "Callo callo"	NC	PD	PD	76	127	203
61	Calamagrostis rigida H.B.K.	"Chucro ocsha", "Kachi ocsha"	PD	PD	PD	13	59	72
62	Calamagrostis spiciformis Hackel ex Stucker	"Hatun Crespillo"	D	PD	D	36	40	76
63	Calamagrostis vicunarum (Weddell) Pilger	"Crespillo", "Coshllo pasto"	PD	PD	MD	160	110	270
64	Dielsiochoa floribunda Pilger	"Pluma ocsha"	PD	PD	PD	5	0	5
65	Dissanthelium breve Swallen &Tóvar	"Patza hueta"	D	PD	PD	4	3	7
66	Dissanthelium calycinum (Presl) Hitchcock		D	PD	PD	7	0	7
67	Dissanthelium macusaniense (Krause) F & S	"Ichic soclla"	PD	PD	PD	64	96	160
68	Dissanthelium mathewsii (Ball)Foster & Smith	"Jirca soclla"	PD	PD	PD	3	0	3
69	Dissanthelium peruvianum (Ness & Meyen) Pilger		PD	PD	PD	5	8	13
70	Distichlis humilis		D	PD	PD	1	0	1
71	Festuca dichoclada Pilger	"Yulac cachi"	PD	PD	PD	3	21	24
72	Festuca dolichophylla Presl	"Cachi", "Chiliwa"	PD	MD	MD	35	18	53
73	Festuca glyceriantha Pilger		PD	PD	PD	0	7	7
74	Festuca huamachucensis Infantes		PD	PD	PD	3	0	3

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
75	Festuca peruviana Infantes	"Cebadilla cachi"	D	PD	PD	8	20	28
76	Festuca rigescens (Presl) Kunth		PD	PD	PD	7	9	16
77	Festuca rigidifolia Tovar		PD	PD	PD	0	6	6
78	Festuca weberauerii Pilger	"Llullac cachi"	PD	D	D	8	3	11
79	Hordeum muticum Presl	"Ucushpa chupan", "Cola de ratón"	MD	MD	MD	19	44	63
80	Muhlembergia fastigiata (Presl) Henrad	"Grama"	MD	MD	MD	75	38	113
81	Muhlembergia ligularis (Hackel) Hitchcock	"Coccho pasto", "Atun chiji"	MD	PD	PD	161	340	501
82	Muhlembergia peruviana (P.Beauvois) Steudel	"Janan pasto", "Cushu pajonal"	MD	NC	PD	139	149	288
83	Nasella pubiflora (Trinius et Ruprecht) Desvaux	"Plumilla", "Tullma tullma"	PD	PD	PD	10	3	13
84	Paspalum lineispatha Mez.	"Jirca wecta", "Sogo champa"	D	PD	PD	0	11	11
85	Paspalum pilgerianum Chase	"Jirca wecta", "Sogo champa"	D	PD	PD	25	21	46
86	Paspalum pygmaeum Hackel		MD	NC	D	13	30	43
87	Paspalum tuberosum Mez.	"Jara wecta"	D	PD	PD	0	3	3
88	Paspalum vigatum		D	PD	PD	0	18	18
89	Penisetum clandestinum Hoshstetter	"Kikuyo", "Grama"	D	D	D	25	74	99
90	Piptochaetum sp.		PD	PD	PD	0	2	2
91	Piptochaetum featherstonei (Hitchcook) Tóvar	"Condorpa cebollan"	PD	PD	PD	7	7	14
92	Piptochaetum panicoides (Lam.) Desv.	"Espiga ocsha", "Condorpa cebollan"	PD	PD	PD	1	6	7
93	Poa aeguigluma Tóvar	"Pacha pasto"	D	PD	PD	33	114	147
94	Poa amnua Linneo	"Shoclla", Ocsha champa"	MD	D	D	132	163	295

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
95	Poa aspesiflora Hack	"Cocchu ocsha"	PD	PD	PD	2	5	7
96	Poa candamoana Pilger	"Altu shoclla"	MD	PD	PD	45	42	87
97	Poa fibrifera Pilger	"Ocsha"	D	D	D	3	2	5
98	Poa gilgiana Pilger	"Machay shoclla"	D	MD	MD	38	14	52
99	Poa gymnatha		D	MD	MD	28	14	42
100	Poa infirma Kunth	"Champa cora"	D	PD	PD	6	16	22
101	Poa ovata Tóvar	"Patza champa"	PD	PD	PD	13	3	16
102	Poa spicigera Tóvar	"Patza hueta", "Shoclla", Ocsha champa"	D	PD	PD	2	9	11
103	Poa subspicata (Presl) Kunth	"Ocsha"	MD	PD	PD	2	12	14
104	Poidium monamdrum (Hackel) Mattei	"Tembleque", "Chucru ocsha"	PD	PD	PD	3	10	13
105	Polypogon elongatus HBK	"Chucru ocsha", "Oqu soclla"	PD	NC	NC	7	2	9
106	Sporobolus indicus		PD	PD	PD	0	1	1
107	Stipa brachyphylla Hitchcock	"Grano ichu"	D	PD	MD	3	33	36
108	Stipa depauperata Pilger		PD	PD	D	4	1	5
109	Stipa hans-meyeri Pilger	"Puka hueta ocsha"	PD	PD	PD	3	7	10
110	Stipa ichu (Ruiz & Pavón) Kunth	"Ichu", "Peckoj", "Llama ichu"	PD	PD	PD	33	9	42
111	Stipa mexicana Hitchcock	"Centeno ocsha"	PD	D	D	23	5	28
112	Stipa mucronata HBK	"Grama ichu"	D	D	D	4	16	20
113	Stipa obtusa (Nees & Mey)	"Cocchu ocsha"	PD	D	D	4	7	11
114	Stipa smithii Hitchcock	"Pashu ocsha"	PD	PD	PD	3	0	3
115	Trisetum spicatum (Linneo) Richter	"Soclla kora"	PD	PD	PD	5	11	16
116	Vulpia australis (Ness) Blom	"Pajilla"	PD	PD	PD	2	0	2
117	Vulpia bromoides (L.) Gray	"Pajilla"	PD	PD	PD	3	0	3
118	Vulpia myuros (Linnaeus)	"Pajilla"	PD	PD	PD	0	5	5

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
	HYDROCHARITACEAE							
119	Elodea potamogeton	"Llachu"	D	D	D	1	1	2
	IRIDIACEAE							
120	Sisyrinchium junceum Meyen	"Maquilina cora", "Canastilla"	PD	PD	PD	4	11	15
	JUNCACEAE							
121	Distichia humilis		D	PD	PD	2	0	2
122	Distichia muscoides Ness & Meyen	"Kunkush", "Tiña"	MD	NC	PD	81	46	127
123	Distichia sp.		D	NC	NC	14	0	14
124	Juncus articus var.andicola	"Totora cora"	PD	PD	PD	1	0	1
125	Juncus brunneus Buchenau	"Ututo"	PD	PD	PD	14	4	18
126	Juncus bufonius Linneo	"Casha huaylla", "Ichic mutu"	D	PD	PD	24	3	27
127	Luzula peruviana Desvaux	"Puchca pasto", "Umasutu"	PD	PD	PD	10	22	32
128	Luzula racemosa Desvaux	"Junquillo"; "Secse"	PD	PD	PD	0	2	2
129	Oxichloe andina		NC	NC	PD	6	5	11
	LAMIACEAE							
130	Lepechinia meyenii	"Pachasalvia"	PD	PD	PD	14	34	48
131	Salvia sp.					0	1	1
	LEGUMINOSAE o FABACEAE							
132	Astragalus garbancillo Cav.	"Garbancillo", "Garbanzo cora"	PD	PD	PD	27	19	46
133	Lupinus sp.	"Chocho silvestre", "Tarwi silvestre"	NC	NC	NC	10	10	20
134	Medicago hispida Gaert.	"Tribol pasto", "Carretilla"	D	D	D	3	59	62
135	Trifolium amabilie H.B.K.	"Layo", "Jirca tribol"	MD	PD	PD	155	159	314
136	Trifolium repens Linneo	"Trébol blanco"	MD	MD	MD	21	41	62
137	Vicia andicola H.B.K.	"Pacha talhui"	PD	PD	PD	4	8	12
	MALVACEAE							
138	Acaulimalva engleriana (Ulbrich) Krapov.	"Jirca makey"	PD	PD	PD	18	15	33
139	Nototriche acaulis (Cavanilles) Krapov.	"Jirca racacha", "Azul tucto"	D	PD	PD	23	23	46

	FAMILY Genus Species	Common Name	Sheep & Alpacas	Cows	Llamas	2010 obs.	2011 obs.	total obs.
	PLANTAGINACEAE							
140	Plantago australis V.hirtella H.B.K.	"Llánten"	D	PD	PD	41	20	61
141	Plantago lamprophylla Pilger		PD	NC	NC	7	2	9
142	Plantago rigida H.B.K.	"Occo pasto", "Pasto estrella"	D	PD	PD	138	64	202
	RANUNCULACEAE							
143	Ranunculus praemorsus H.B.K.	"Waranisa", "Alljupa-lajchin"	PD	D	D	5	14	19
	ROSACEAE							
144	Alchemilla diplophylla Diels	"Yacu pasto", "Libro libro"	MD	NC	PD	20	78	98
145	Alchemilla erodifolia		MD	NC	D	34	16	50
146	Alchemilla pinnata Ruiz & Pavón	"Sillu sillu", "Latac pasto"	MD	NC	D	306	407	713
147	Tetraglochin strictum Poepp.					2	3	5
	SANTALACEAE (SCHOEPFIACEAE)							
148	Quinchamalium procumbens Ruiz & Pavón	"Chinchimallin cora", "Gusanera"	PD	PD	PD	22	17	39
	SCROPHULARIACEA							
149	Castilleja sp.	"Miskiqo"	PD	PD	PD	0	9	9
	URTICACEAE							
150	Urtica sp.		NC	NC	NC	0	3	3

APPENDIX B

Pasture data by site and year

Pasture site data for 2010

Site Code	Year	Type	Altitude (m)	Camp	PC	Productivity for Cows	Productivity for Sheep	Species Richness	Species Diversity Shannon	Disturbance by Cows	Disturbance by Sheep
PN-H1	2010	Cesped	4078	common	PC	60.90	79.73	28	3.00	-1.04	-2.08
PN-H2	2010	Transicional	4332	camp	PC	56.22	81.89	22	2.75	-0.81	-2.26
PN-LL1	2010	Cesped	4060	camp	PC	58.13	75.63	35	3.35	-1.05	-1.91
PN-LL2	2010	Cesped	4850	common	PC	40.13	50.47	29	3.07	-0.69	-1.17
PN-LL3	2010	Cesped	4150	camp	PC	57.83	78.17	44	3.44	-0.94	-2.03
PN-P1	2010	Cesped	4150	common	PC	45.53	54.03	27	2.72	-0.72	-1.24
PN-P2	2010	Cesped	4060	common	PC	60.25	70.75	28	3.07	-1.15	-1.63
PN-PC1	2010	Cesped	4150	common	N	58.05	80.80	30	3.17	-0.96	-2.01
PN-QC1	2010	Pajonal	4252	common	N	51.07	68.07	31	3.12	-0.81	-1.60
PN-QC2	2010	Cesped	4154	camp	N	52.00	71.50	17	2.44	-0.67	-1.64
PN-QC3	2010	Occonal	4139	common	N	57.50	79.00	28	2.91	-0.94	-1.83
PN-QP1	2010	Cesped	3805	common	PC	60.73	83.98	23	2.64	-0.86	-2.19
PN-QP2	2010	Occonal	4200	camp	PC	48.29	76.04	27	2.79	-0.46	-1.81
PN-QP3	2010	Occonal	4150	common	PC	48.30	71.55	24	2.84	-0.66	-1.67
PN-QP4	2010	Occonal	4150	common	PC	70.40	78.90	19	2.68	-1.52	-1.86
PN-T1	2010	Transicional	4350	camp	N	48.60	76.10	21	2.55	-0.68	-1.80
PN-T2	2010	Cesped	4000	common	N	58.20	77.95	30	3.08	-0.97	-1.90
PN-U1	2010	Ladera	3622	common	N	61.68	73.18	43	3.08	-1.19	-1.70
PN-U2	2010	Cesped	4253	common	N	67.03	84.53	33	3.01	-1.24	-2.24
PN-U3	2010	Ladera	4280	common	N	53.17	54.50	32	3.22	-1.02	-1.30
Summary: N=20											
Cesped: 11		Camps: 6			Min	40.13	50.47	17.00	2.44	-1.52	-2.26
Pajonal: 1		Commons: 14			Max	70.40	84.53	44.00	3.44	-0.46	-1.17
Ladera: 2					Mean	55.70	73.34	28.55	2.95	-0.92	-1.79
Occonal: 4		PC: 11			Median	57.67	76.07	28.00	3.01	-0.94	-1.82
Transicional: 2		N: 9			Stdev	7.35	9.81	6.93	0.26	0.25	0.31

Pasture site data for 2011

Site Code	Year	Type	Altitude (m)	Camp	PC	Productivity for Cows	Productivity for Sheep	Species Richness	Species Diversity Shannon	Disturbance by Cows	Disturbance by Sheep
PN-H1	2011	Cesped	4078	common	PC	57.77	81.10	25	2.70	-1.08	-2.15
PN-H2	2011	Transicional	4332	camp	PC	48.80	71.63	27	2.96	-0.75	-1.82
PN-LL1	2011	Cesped	4060	camp	PC	58.47	75.80	41	3.43	-1.00	-1.98
PN-LL2	2011	Cesped	4850	common	PC	49.33	60.33	31	3.11	-0.91	-1.43
PN-LL3	2011	Cesped	4150	camp	PC	53.70	79.70	39	3.29	-0.87	-2.07
PN-P1	2011	Cesped	4150	common	PC	36.80	52.47	26	2.72	-0.53	-1.28
PN-P2	2011	Cesped	4060	common	PC	70.03	78.70	39	3.24	-1.36	-1.90
PN-PC1	2011	Cesped	4150	common	N	60.53	78.03	44	3.51	-1.09	-2.05
PN-QC1	2011	Pajonal	4252	common	N	55.47	73.97	32	3.24	-0.97	-1.75
PN-QC2	2011	Cesped	4154	camp	N	48.73	72.90	29	3.00	-0.71	-1.86
PN-QC3	2011	Occonal	4139	common	N	46.03	65.53	37	3.10	-0.64	-1.55
PN-QP1	2011	Cesped	3805	common	PC	55.87	74.87	36	3.24	-0.90	-1.97
PN-QP2	2011	Occonal	4200	camp	PC	60.30	75.63	27	2.54	-1.03	-2.11
PN-QP3	2011	Occonal	4150	common	PC	62.07	80.23	22	2.83	-1.01	-2.09
PN-T1	2011	Transicional	4350	camp	N	44.77	73.77	26	2.73	-0.58	-1.97
PN-T2	2011	Cesped	4000	common	N	59.37	72.53	41	3.40	-0.99	-1.73
PN-U1	2011	Ladera	3622	common	N	67.13	78.47	33	3.11	-1.24	-1.85
PN-U2	2011	Cesped	4253	common	N	56.30	70.97	33	2.95	-0.90	-1.81
PN-U4	2011	Cesped	4380	camp	N	46.13	66.63	42	3.42	-0.76	-1.72
Summary: N=19											
Cesped: 12		Camps: 7			Min	36.80	52.47	22.00	2.54	-1.36	-2.15
Pajonal: 1		Commons: 12			Max	70.03	81.10	44.00	3.51	-0.53	-1.28
Ladera: 1					Mean	54.61	72.80	33.16	3.08	-0.91	-1.85
Occonal: 3		PC: 10			Median	55.87	73.97	33.00	3.11	-0.91	-1.86
Transicional: 2		N: 9			Stdev	8.26	7.28	6.68	0.28	0.22	0.23

Chapter 4

Commodification across Vertical Boundaries: Mining and Conservation in the Peruvian Andes

> "Minerals are where you find them. The quantities are finite. It's criminal to waste minerals when the standard of living of your people depends on them. A mine cannot move. It is fixed by nature. So it has to take precedence over any other use. If there were a copper deposit in Yellowstone Park, I'd recommend mining it. *Proper use of minerals is essential*. You have to go get them where they are. *Our standard of living is based on this.*" Charles Park, geologist (McPhee 1971 p 21 italics mine).
>
> "The mine will affect anybody in this whole area who *looks* at Glacier Peak. One of the last great wildernesses in the United States would have to be punctured, like a worm penetrating an apple. There would not only be a pit but also the dumps, the settling ponds, the tailings, the mill, machine shops, powerhouses, hundred-ton trucks." David Brower, conservationist (McPhee 1971 pp 39-40)
>
> "Miners like wilderness" – Charles Park, (McPhee 1971 p 61)

Abstract: Perú is known as one of the top ten mega-biodiverse countries in the world and is also a top exporter of several mineral commodities. Through the course of the last 15 years the corresponding sectors of conservation and extraction grew along remarkably similar trajectories. This parallel growth, perhaps an outcome of neoliberal reform in the 1990s, has forced extraction and conservation into close physical proximity across Perú's diverse landscapes. Conservation and extraction now take place side by side; no longer are these activities separate. This begs the question: how does this "co-existence" between apparent opposites function? How might the commodification of the underground through mineral extraction affect the

commodification of the surface through market-based conservation and vice-versa? I argue that in Perú mining and conservation are working together in a somewhat surprising convergence of interests based on the shared need to persuade people to allow for specific activities to be carried out on private/communal lands. To make this argument the theoretical ties between property institutions and persuasion will be coupled with the recent literatures on the commodification of nature; particularly the work on mining and conservation. Evidence from Perú and the Cordillera Huayhuash is presented as a case study, and a nested comparative case study respectively, which illustrate how the commodification of both the underground and the landscape are linked. The findings do not demonize conservation efforts linked to extractive activity, but instead can be used to better navigate emergent market-based approaches to biodiversity conservation in resource rich environments.

Keywords: Cordillera Huayhuash, Mining, Conservation, Private Conservation, Commodification of Nature

4.1 Introduction

Mining has a reputation of causing negative environmental impacts such as water contamination (heavy metals, particulates, acid drainage, and cyanide, and so on), forest destruction (historically for smelting and construction materials, now from flooding for hydroelectric dams; both principally for energy), and more recently the physical displacement of large amounts of earth. Additionally extractive activities are

associated with negative social impacts such as inequality, dispossession, migration, slavery, disease, and death. To contest these negative environmental and social ills, mineral production is credited with the generation of incredible power, wealth, and productivity. Mineral extraction *is* the ultimate get-rich-quick scheme—in the speculative sense—for everyone involved; investors, politicians, managers, owners, workers, and so on. This tension between socio-ecological destruction justified by the creation of wealth reaches far back into the human history and remains present to this day. Brower and Park express the contradictory sides of this activity in their discussion over Kennecott Copper's concessions to mine the Glacier Peak Wilderness in northern Washington State (USA). While their statements suggest vastly different understandings of wilderness (cf Cronon 1996) they reflect a shared belief that mining operations and the conservation of wilderness are not compatible land-use prescriptions. This notion that mining and conservation are incompatible begs our common sense to agree, yet there are initial indications that these activities can align (and ally) themselves in the name of capitalist development (cf. Chapin 2004). Indeed, the emergent relationship between mining and conservation in Perú provides insights into how these contradictory resource uses coexist in shared socio-natural spaces.

It is remarkable that the mining and conservation sectors, perhaps due to a shared process of neoliberal reform, grew with similar trajectories in Perú over the course of the last two decades (see Figure 4.1). While not entirely without conflict, this "peaceful co-existence"—a secret code for "demobilize an aroused population"

(Hecht and Cockburn 1990)—somehow transcends the diametrically opposed opinions expressed by Brower and Park. Need we still wonder whether mining and conservation can co-exist in the same material space? As one mid-level bureaucrat in Perú's protected area service (*Servicio Nacional de Áreas Naturales Protegidas* – SERNANP) explained, it is not possible to create a protected area in the Peruvian Andes without accepting the fact that mines will be involved (Arenas 2011). This leads to the more pertinent question of how will this co-existence between apparent opposites function (cf Peluso 2012)? How might the commodification of the underground affect the commodification of the surface and vice-versa? I argue that in Perú mining and conservation are working together in a somewhat surprising convergence of interests based on the shared need to persuade people to allow for specific activities to be carried out on private/communal lands. Although the activities

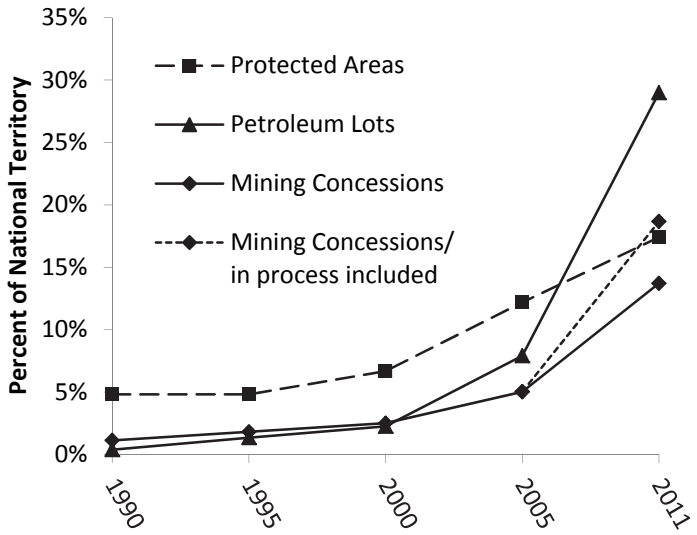

Figure 4.1: Growth of Extraction and Conservation in Perú

of mining and conservation remain distinct, the work of persuasion can be undertaken together in a mutually beneficial manner. In this sense of persuading others to give up rights, the age-old process of mining as the commodification of the underground aligns with recent developments in conservation and how its particular commodification of the planet's surface is understood. Market-based conservation instruments that include various forms of private conservation also need to convince property owners to allow for flows of capital to pass through the landscape (Igoe, Neves et al. 2010; Arsel and Büscher 2012; Fairhead, Leach et al. 2012). To make this argument the theoretical ties between property institutions and persuasion (Rose 1994; Freyfogle 2007; Rousseau 2011 [1755]) will be coupled with the recent literatures on the commodification of nature; particularly the work on mining and conservation.

The article will proceed as follows. The first section will review key concepts in the commodification of nature literature and will articulate this body of theory to understand how persuasion and property work together. Then both mineral extraction and conservation will be explored through this lens and the nature of persuasion in both sectors will be highlighted. To introduce the case study, a brief history of Perú's neoliberal reform is outlined with particular attention given to the reforms in the extractive and conservation sectors. Next, evidence from Perú and the Cordillera Huayhuash is presented as a case study and a nested comparative case study respectively which illustrates how the commodification of both the underground and the landscape are linked. Concluding remarks follow that aim to elicit how the

findings can be used to better navigate emergent approaches to conservation in resource rich environments.

The analysis presented is based on data collected through outreach, activist, and academic work in the Cordillera Huayhuash conducted from 2003 until 2011. Mixed methods were employed which relied primarily on participant throughout various events and activities which include: co-leading a process to create a protected area in the Cordillera Huayhuash, attending a private conservation conference in Lima, testifying as an expert witness for a conflict resolution process (*mesa de dialogo*), and serving as a volunteer assessor (water quality) and consultant for government agencies, Andean communities, and local NGOs. Over 200 interviews were conducted in 2011 across a broad section of rural civil society, within government conservation agencies, within several leading conservation NGOs, and with several engineers employed at two mines, and two executives at the mines. Also important to the analysis is a collection of archival data and documentary texts drawn mostly from government and other secondary sources such as community records. This broad set of mixed methods allows for what Denzin and Lincoln refer to as methodological triangulation (2005) in which the goal is to elicit a nuanced interpretation, perhaps even a "thick description" (Geertz 1973), of the of how the institutional complex that is commodification unfolds in certain cultural and natural settings. Please see chapters two and three along with previous publications (Bury 2006; Bury 2008; Bury and Norris 2013; Norris in press) for background descriptions of the physical and social dimensions of the Cordillera Huayhuash.

4.2 Commodification, n (/kəmɒdɪfɪ'keɪʃən/)

Commodification is defined as "the action of turning something into, or treating something as, a (mere) commodity; commercialization of an activity, etc., that is not by nature commercial" (OED 1989). In turn, the noun commodity is defined as "a kind of thing produced for use or sale, an article of commerce, an object of trade . . . especially food or raw materials, as objects of trade." (OED 1989). These references neatly match one part of Marx's commodity as something *produced* for exchange (Marx and Engels 1967 [1867]), yet they leave ambiguous Marx's idea that a commodity is something that was produced for the explicit goal of accumulation for accumulation's sake (Smith 1984; Castree 2001). In addition the Latin root *commodus* signifies due measure, fitness, and convenience and the Spanish word *commodificar* shares the same Latin root, but the verb translates as "to make something comfortable."[1] Considering these roots, commodification might be understood as making something comfortable for a market exchange by measuring it or making it fit. This approximation can now include what Polanyi (Polanyi 1944) considered as the fictitious commodities which are exchanged on the market but are not produced by human labor: land, labor itself, and money (Polanyi 1944 p. 75). Coupling these various approaches to the commodity, Castree (2001 p. 1522) suggests an approximate definition as the "foci of diverse modalities of social relationality that are somehow made commensurable during the capitalist phase of

[1] The correct translation of commodification in Spanish is *mercantilización* from the Latin root *mercātus* (market) or *mercāri* (to buy or trade).

their existence." Commodification of things can be understood as a sort of continuum that starts with non-commodities, transitions to fictitious commodities, and then the thing becomes a true commodity (Dore 1988; Peluso 2012). The process is a multi-step, dynamic, dialectic, social and material means of assigning commensurable exchange value to things where there was none before with the explicit purpose of allowing value to circulate and become capital.

Within critical Geography six aspects of commodification have been identified: privatization, alienability, individuation, abstraction, valuation, and displacement (Castree 2003; Prudham 2009). These aspects are recognized as abstractions with less than concrete boundaries and can be combined in a variety of configurations to better understand how "things" become commeasurable and are exchanged through a common monetary denominator in societies based on capitalistic production and reproduction (Castree 2003). Recent scholarship in this vein has examined commodification across a broad swath of material resources found in nature such as water (Bakker 2005), trees (Prudham 2003), minerals (Bridge 2000), and ocean fisheries (Mansfield 2004), while other efforts look at material processes in nature such as ecosystem services provided by wetlands (Robertson 2007) and forests (McAfee 2012), and still others analyze the commodification of biodiversity (Igoe, Neves et al. 2010) or of organisms and life itself (Kloppenburg 2004; Prudham 2007). Critical scholars have categorized these distinct material and social processes under the broad label of the "neoliberalization of nature" by focusing on the shared aspects of privatization and valuation of natural resources as markets appear and evolve for

these commodities (Heynen and Robbins 2005). While there is danger in conflating any one of these six aspects with the process of commodification itself, the privatization and valuation of fictitious commodities as processes that form part of both mineral extraction and conservation will be used as a starting point for analysis.

Privatization is generally understood in two modes: first the movement from state or sovereign owned property to individually owned property, and second the movement from collectively owned property to individually owned property. It is the first meaning that is more relevant to the argument in this article; both mineral rights and conservation management are being privatized in this sense.[2] Both approaches obviate the original creation of property (although the second approach is close); the enclosure or "primitive accumulation," that is a pre-condition for capitalist social relations to exist (Marx and Engels 1967 [1867]; Smith 2005 [1776]). More recent understandings of the role of "so-called primitive accumulation" suggest that it is an ongoing process, termed "accumulation by dispossession," and is part of the "spatial fix" that can temporarily resolve tensions between capital's inherent contradictions of production and consumption (Harvey 1982). This creation and justification of private property in land, whether historical or contemporary, relies on one of three basic premises: a claim to ownership by labor mixed with the land (for example see Locke 1823 [1689]), through a claim of previous ownership (for example Smith 2005 [1776]), or simply by using force (sanctioned or not) (for example Marx and Engels 1967 [1867]). This small spectrum demonstrates an important contradiction; the

[2] There is some privatization in the second sense within the study communities.

difference between property as a natural human right and property as a dispossession of certain rights of some group or individual by another group or individual (MacPherson 2011 [1978]).

Rose (1994) keenly observed that across this spectrum, whether choosing to justify property by force or not, there is effort spent to persuade people that individual rights in property exist (see also Harvey 2004 [1996]; Freyfogle 2007; Rousseau 2011 [1755]). This effort, as work or labor, is made as an investment to improve the property in question. Indeed, if property in land is understood not as a material thing but instead as an individual right to a revenue stream generated from the material thing (MacPherson 2011 [1978]), then the work of persuasion will serve to guarantee a greater revenue stream or return on the investment. This follows Smith's labor theory of value; the labor of convincing or persuading others that something is privately owned is embedded in the commodity and serves the dual purpose of making the commodity the property of the laborer and adds value to the commodity, be it a fictitious commodity or not. In this sense, in any analysis of property and value, the labor that is invested in maintaining a Gramscian hegemony (Gramsci 2005 [1971]) that allows for private property to exist in any of its myriad of forms should be accounted for, particularly when the property is in a fictitious commodity such as land or mineral rights. It is this modern understanding of private property as a right to an income stream that can be improved through the labor of persuasion, particularly convincing holders of the rights to allow or deny access to certain income streams that I use to articulate the activities of mining and conservation.

4.3 Commodification of the Underground: Mineral Extraction

> ". . . the ore that I have digged [sic] in any place, where I have a right to them in common with others, become my property without the assignation or consent of anybody." (Locke 1823 [1689] Second Treatise, Chapter V, paragraph 27)

> "The discovery of gold and silver in America, the extirpation, enslavement and entombment in mines of the indigenous population of that continent . . . are all things [sic] which characterize the dawn of the era of capitalist production. These idyllic proceedings are the chief moments of primitive accumulation." (Marx and Engels 1967 [1867] p 703)

> "Of all those expensive and uncertain projects, however, which bring bankruptcy upon the greater part of the people who engage in them, there is none, perhaps, more perfectly ruinous than the search after new silver and gold mines." (Smith 2005 [1776] Book IV Ch VII Part I paragraph 18 p 453)

The basic process to produce a commodity from mineral ores located in the earth's surface can be outlined in five steps: prospecting, exploration, development, extraction (including refining), and finally fashioning an object from the metal.[3] In the modern mining process there is an additional step that results from the transition to capitalist social relations of production; the acquisition of the rights of access to the mineral resource. While this step existed before the advent of capitalism, it can be historically relegated to "so-called primitive accumulation." In the contemporary world the access rights are either purchased and owned outright, gained through the payment of taxes or fees for a concession to extract the mineral resources owned by a sovereign state, or some combination of both means. Within the industry this step is bundled with prospecting and both of these activities are largely undertaken by

[3] A further step that is largely invisible, as it is not directly an activity requiring human labor, is the abandonment or closure of the mine site.

mining companies known as “juniors” that do not sell minerals, but instead sell known mineral deposits with the bundle of rights ready for the exploration phase of mining. This division of labor within the sector is in part due to the different capital investment necessary to complete the different steps (different technologies, machinery, knowledge, financial resources, and so on), but can be understood theoretically as a difference between the development and exchange of fictitious commodities to the development and exchange of material commodities. While this distinction is clearly an abstraction (some juniors do extract minerals and sell them and some major players do their own prospecting and legal rights development), it can be useful for understanding the two distinct moments of the commodification of the underground. For the purpose of this essay the first, or fictitious moment, will be used to analyze articulations between the commodification of the underground and the commodification of nature through conservation.

At one level the search for mineral resources is based on the physical attributes of mineral deposits, such as location and grade of the ore, and the technologies available to extract and refine the material. Yet on another level the geography of mining exploration and investment is not solely derived from the physical location and quality of mineral resources. The political, economic, and institutional context within which mining takes place can be a greater influence in the decision as to where mining investment is directed (Bridge 2004). Strong private property rights that guarantee these investments and land tenure institutions which facilitate access to sub-surface resources are powerful drivers of the geography of mining exploration.

Yet liberal rules of the economic game that favor mining operations often foment resistance from below as the people who do not benefit from mining, often rural agriculturalists with limited financial means who live in areas of mining development, see these institutional constructs as a form of class warfare, primitive accumulation, and accumulation by dispossession (although perhaps not stated in these terms). Both the physical and social factors which determine the geography of exploration and extraction give rise to tensions and contradictions in the accumulation process that limit the sustainability of mining operations (O'Connor 1994). Capital must seek Harvey's "spatial fix" must constantly be sought and new resource frontiers must be opened in order to resolve these contradictions within specific geographies of resources and institutional contexts (Harvey 1982; Tsing 2005; Redclift 2006).

In Bridge's words this combination of material and social constructions has created "hot spots" that attract extractive investment across the globe. Neoliberal reforms, including the restructuring of property institutions, are at least as important, and more so for some cases, in determining the outcome of extractive development as the physical location of the mineral resource (Bridge 2004). But this account of mineral geographies does not consider the role of locally led resistance to extractive development (cf. Hecht and Cockburn 1990; Bebbington and Bury 2009). As a product both rising indigenous awareness of territorial rights and the industry strategies of "corporate social responsibility" and the "triple bottom line" (Elkington 1998), the term "social license" is emerging in common discourse as the final stage of gaining the necessary property rights to undertake sub-surface resource extraction

(Damonte 2012). Historically mining operations used force to gain control over local territorial rights and labor power. This is no longer culturally acceptable and more subtle means of persuasion are necessary. The social license is not a government stamp that grants *de jure* rights, but instead is a negotiated *de facto* community approval of mining activity as granted by the indigenous and native people who claim territorial rights to the surface where the extraction operation will be located. Without the social license the mining operation faces possible violent resistance, lack of political support, and eventually lack of investor buy in (Bebbington, Humphreys Bebbington et al. 2008; Damonte 2012; Himley 2012). It is the process to gain this social license that can bridge the goals of capitalist mineral extraction and conservation for biodiversity or environmental services.

4.4 Commodification of the Surface: Neoliberal and Market Based Conservation

The conservation of wilderness and the philosophy behind it has a long history of seeing and understanding nature as an accumulation strategy (Katz 1998; Zimmerer 2000; Smith 2007). Indeed, the principal historical reason for the preservation of wilderness was to create exclusive hunting grounds as a surplus reserve for the rich (Neumann 1996; Neumann 1998). While this conservation purpose still exists, either as hunting with guns or as hunting with cameras, the rhetoric for justifying the enclosure has continuously evolved. Modern conservation is driven by first, the hegemonic imperative to preserve biological diversity in the form of living genetic resources, second, tourism and its many forms of generating income, and third, as a

novel way to provide and sell ecosystem services that well managed conservation areas can bring to the market (McAfee 1999; Fairhead, Leach et al. 2012).

Yet the continued creation of protected areas under these guises remains an act of enclosure, either the by state or an individual, which includes the restriction of rights to income streams (local livelihoods) that can be broadly understood as a form of primitive accumulation (cf Kelly 2011). The creation of new protected areas fuels an ongoing debate over the conservation of what, for whom, and how to resolve the basic issue of enclosure for conservation (Merenlender, Huntsinger et al. 2004). This debate first appeared in the 1980's as tensions between indigenous groups and conservationists peaked. In 1989 the ILO convention 169 (International Labor Organization Convention 169 Indigenous and Tribal Peoples Convention) was drafted as a potential mechanism to protect indigenous rights in resource governance decisions that include the creation of protected areas across the globe. In countries where the convention has been ratified—in Perú in 1994—the creation of protected areas now includes a process of informed consent with peoples who have livelihood interests and practice customary resource uses in the proposed area.

This convention and its accompanying discourse at international levels helped spur the "third wave" of conservation that focuses on protected areas and resource management as a means to reduce poverty, conserve biodiversity, and meet the goals of capitalist sustainable development on productive landscapes (Zimmerer 2006). As this model of conservation and development gained support and spread across the globe a whole raft of "new" and "inclusive" conservation models such as community

based conservation, community based natural resource management, indigenous reserves, and so on were touted as the way forward within international development agencies (Chapin 2004; Blaikie 2005; Brosius, Tsing et al. 2005). While these new approaches can contribute to easing the tensions and give reason for hope (for example Chambers 2007), it can sometimes serve the conservation development agency (or researcher) more than the community (for example Rocheleau 1994).

In parallel to these inclusive developments, and as a mechanism to finance them, "eco-tourism" was promoted as a means to provide alternative incomes to local producers who might otherwise engage in destructive livelihood practices. It was suggested that tourism could "enhance the value of intact wild lands and thereby promote conservation" (Yu, Hendrickson et al. 1997 p 130). Several early problems were observed with this model of landscape commodification that is based upon restricting property rights (for example hunting restrictions or development restrictions) to govern income streams (based on shifting land use such as increased tourism and decreased hunting). First, tourism does provide income, but often not to local people, and if it is captured by local people, the new income may be captured unevenly by local elites (Campbell 1999; Auer and Norris 2001; Farriss 2007). Second, objectives of increasing the value of the landscape through tourism can be successful but are not always aligned with objectives of conservation (for example Goodwin 1996). Third, tourism can contaminate water sources and degrade the landscape through over-use, particularly the over-use of means of transportation, be it machines or pack animals (see chapter 3). Fourth, benefits to local communities are

too small, dispersed, and are dependent on international markets and trends (Igoe, Brockington et al. 2007). And fifth, biodiversity conservation outcomes are hard to measure where the development of eco-tourism is the goal and funding source for conservation (Kruger 2005). Nevertheless, the development of ecotourism brought conservation into closer relationships with business interests, and where possible, attempted to bring local and indigenous peoples into market based economies as a form of development through negotiated "co-existence" (Brockington, Igoe et al. 2006; Igoe, Neves et al. 2010).

Also from the 1990s it is well known that "biodiversity" became the *raison d'être* for conservation efforts through the widely publicized Rio Earth Summit in 1992. Conservation organizations such as CI (Conservation International) have now mapped the globe and identified "biodiversity hot spots" as targets for conservation investment. Successful investment requires a team of specialists that includes conservation biologists, population ecologists, GIS technicians, lawyers, and so on, for the creation and maintenance of a protected area that will return positive biodiversity conservation outcomes (see Leach and Mearns 1996 for the development version). This techno-scientific approach to biodiversity conservation is contradictory to the community-based approach outlined above and is fraught with power imbalances; how knowledge is defined, created, and used is the sole realm of the scientist and other ways of knowing are obviated (cf Foucault and Rabinow 1984).

And finally, since the turn of the 21st century there has been a meteoric rise of private conservation instruments which provide incentives to property owners to

voluntarily give up rights on their land.[4] In some cases certain rights attached to property in land are either purchased or leased in exchange for the realization of conservation objectives and in others property owners voluntarily give up their rights as a conservation easement exchanged for actual or perceived financial benefits. Conservation banking through assigning value to ecosystem services that can be bought or sold on a market is also becoming popular (for example Robertson 2006). Through assignation of value to, and exchange of, assets found in nature, be it in the form of "biodiversity conservation, biocarbon sequestration, the protection of ecosystems services, ecotourism or 'offsets' related to any and all of these," conservation is now explicitly commercial (Fairhead, Leach et al. 2012 p 239).

All of these forms of the commodification of nature through conservation require specialist assessment and services or a "rendering technical" (Li 2007) in the form of scientific appraisal of the dollar value of an ecosystem (for example Costanza, d'Arge et al. 1998). The emergent emphasis on valuation of nature has transformed global conservation discourse from one of ecology to one of natural capital (Corson and MacDonald 2012) and conservation organizations draw from this arsenal of commodification processes to increase capital flows and thereby sustain themselves. This vision of conservation bears a remarkable resemblance to what Sachs calls "sustainable development" as a process anchored within the market, state, and science (Sachs 1992). The market, state science construction is now the "financial-scientific-

[4] In some cases this means outright private ownership of wildlife that roams particular territories (wildlife ranching) while in others it can simply mean private control over access to certain landscapes (Brockington, Duffy et al. 2008).

policy nexus" and the process itself is simply called "conservation" (Fairhead, Leach et al. 2012).

4.5 Commodification across vertical boundaries: rethinking mining and conservation

As these two commodification processes unfold in the same physical space, capital begins to circulate in novel ways as values are assigned to specific aspects of, or rights to, the natural world in the name of mining *and* conservation. Nearly a decade ago in a scathing polemic Chapin observed that the international conservation sector had become uncomfortably close to the interests of large trans-national corporations (Chapin 2004). Now that the shock of the polemic has passed, extractive industries and conservation organizations make explicit agreements to work together to open these new circuits of natural capital through the interplay of extraction and conservation. Indeed, CI broadcasts such a partnership in the Andes of Perú from their website:

> "CI-Perú has been working with the Antamina mining company through Asociación Ancash (AA) since 2004 to protect Andean ecosystems in the Conchucos corridor between Huascaran National Park and the Cordillera Huayhuash Reserved Zone" (CI 2012).

This document is an interesting deviation from what actually takes place on the ground. First, the photo of the girl on the first page is from nowhere near Conchucos (the hat is from the Cusco region) and second Pacllon and Llamac (shown on the map) are not located in the Conchucos region!! The pamphlet mentions 320 Ha of *Polylepis* forest protected of which I observed several hectares clear cut in 2011. While it is clear that the forest should be protected and financial resources are

necessary to reach this goal, does this conservation need justify CI to distribute misinformation in order to persuade people to donate money to their operation, one of the largest conservation organizations in the world?

The valuation and exchange of environmental services be they carbon sequestration, biodiversity conservation, the provision of fresh water, or the maintenance of "spectacular" landscapes and ecosystems, is now a part of the hegemony of global capitalism (Igoe, Neves et al. 2010). *Investment* in conservation is seen as the only way forward. Market mechanisms to conserve biodiversity *are* the solution. This opportunity is not lost on investors who practice 'philanthrocapitialism' (Holmes 2012). The conservation investments can be understood as a potential "fix" for to James O'Connor's second contradiction of capitalism (1994) or as part of an integrative solution to financial and environmental crises of capitalism in general (Sklair 2001; Sullivan 2011). Following Harvey (1982), new frontiers for investment must be opened and nature becomes an opportunity for this investment through both mining and conservation. This investment money can also be seen as "guilt" offsets; in order to feel better about destructive practices necessary for the accumulation of capital, wealthy investors (or everyday consumers) can reduce their guilt by spending on conservation (Igoe, Neves et al. 2010).

While this juggernaut of investment moves forward, the question remains of how to persuade landowners—as communities or individuals—to allow these new capital flows pass through their private property. In certain situations direct financial incentives may work; for example private conservation, carbon credits, or wildlife

derivatives in places or contexts where institutional strength is sufficient to provide concrete backing for the economic incentives. But in the context of weak land tenure institutions and collective ownership of private property the outcome is not so obvious. The incentives for holders of collective rights to give up some sticks in their bundle for the conservation of biodiversity are not so clear. While the term "social license" is not yet used within the conservation sector, there is still a need to gain this type of informal (or formal) consent to implement conservation activities, especially in countries where the ILO 169 framework has been ratified and incorporated into legal conservation frameworks. Presenting conservation work as legitimate restriction of rights can be difficult when benefits for local people appear few while benefits for specialized conservation professionals appear abundant. This process is different for state-led vs. private conservation efforts only in whom must do the persuading and what restrictions are (or are not) placed on negotiation strategies. For example state-community negotiations may be more regulated than NGO-community relations; often the private sector has more freedom in what they can offer in exchange for consent to practice conservation. Sovereignty over land gained through some form of indigenous rights can become a commodity itself (Brockington, Duffy et al. 2008).

4.6 The Peruvian Context

Shortly after Park and Brower's encounter in the late 1960s the mid-20th century era of Keynesian social democracy in the "West" came to a close. Ten years later a return to liberal economic policy was espoused and embraced and within just twenty years neoliberal reforms swept the entire globe (Harvey 2005; Klein 2007). Perú's

neoliberal transformation was punctuated in 1993 by the "dictator" Alberto Fujimori as he ushered in a new constitution which reified property rights and private investment as the solution to the 1980 Latin American debt crisis, hyperinflation, and a devastating civil war. As the country convulsed in the last moments of the war, the mining industry in Perú was in a crisis and state-led conservation had been stagnant for almost 15 years. Both of these sectors underwent reform in 1993: sub-surface mineral rights were restructured to be private property that could be purchased with few restrictions and within four years new conservation laws—with an emphasis on biodiversity conservation—were drafted that allowed for conservation activities and investments on privately held land. In terms of land-use prescriptions, in 1993 a larger percentage of the country was designated as protected areas than the percentage to which sub-surface mineral rights were privately controlled (5% and 1% respectively, see Figure 4.1).[5]

Throughout the 1990s the country's economy stabilized in the aftermath of the civil war. Inflation returned to single digits from a peak of over 5000% in 1990, yet there was little visible change with respect to mining investment or protected area management. By the year 2000 the percentage of the country designated as protected areas had grown modestly to 7% and the percentage of land beneath which there were privately owned mineral rights was a mere 3%. There was no large response in either sector to the reforms that Fujimori brought about. The lack of grand change can be

[5] Note that the data for areas controlled by private mineral interests are calculated as areas of active mining concessions. The data presented is not a direct measure of mining activity, but rather a proxy for mining investment.

attributed to minimal foreign investment and minimal state resources respectively. The recent civil war coupled with a history of prior nationalizations in the mining sector kept investor confidence low.[6] With a subsequent lack of government income in this period, public funds were scarce for conservation efforts. When Alexander Toledo, a Stanford trained economist, became president through democratic elections in 2001, this situation changed. Toledo continued neoliberal reform and, as the centerpiece of his presidency, promoted the decentralization law of 2002 which he coupled to extensive efforts to build democracy and participation. He also formalized the new conservation laws drafted under Fujimori and privately funded conservation became legal in Perú. Several of the main planks of neoliberal reform, private property, decentralized governance, and increased democratic participation (Batterbury and Fernando 2006; Castree 2008; Himley 2008), were now in place. By 2005 the reforms Fujimori initiated in the mining and conservation sectors were taking hold, investor confidence was increasing under Toledo's leadership, and both sectors were growing rapidly. This trend continued to accelerate when Alan Garcia returned to Perú for his second presidency that spanned 2006-2011.[7]

Indeed, the once populist Garcia returned to Perú as a neoliberal populist. Upon

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[6] Low levels of investor confidence can also be attributed to Perú's pendulum like swings throughout the 20th century between state-led mining activities and foreign-backed enterprises (Thorp and Bertram 1978; Dore 1988). The most recent private to state swing was the 1968 expropriation of all-but-one foreign-owned enterprises and subsequent state-led mining operations that lasted from 1968 through the early 1990's (de Echave 2008; Scurrah 2008).

[7] Alan Garcia's first term was from 1985-1990, during which Perú experienced inflation in the triple digits, Garcia attempted to nationalize the banking system, and the country was ravaged by an ongoing civil war.

his return he addressed the nation with the now (in)famous *Perro de Hortelano* speech through which he accused anyone who opposed the development of natural resources, such as minerals or hydrocarbons, as an unpatriotic "dog in the manger" (Garcia 2007).[8] His message was intended for native Amazonian and indigenous Andean communities who hold land titles that overlap with either mining or hydrocarbon concessions and resist the extractive development. After this dramatic entrance he then continued with neoliberal economic reform in both the rollback and rollout forms (Peck and Tickell 2002). In 2008 he signed a free-trade agreement with the United States which Toledo had initiated. Part and package of this new agreement were over 200 presidential decrees that Garcia slid into the legislative package for the agreement claiming that they were a necessary component of the new trade terms with the United States. His claim was not entirely true yet the decrees further strengthened private property law, undermined the inalienability of communal titles to land, placed new regulations on polluting industries, and opened the floodgates for foreign investment. Within months several decrees were deemed unconstitutional as they allowed for outright dispossession of rural livelihoods by transnational corporations and violent protest had erupted. Nonetheless, by the end of 2011 fully 14% of Perú's territory was officially claimed for mineral extraction by private interests (with another 7% being actively pursued), 29% of Perú's territory was designated for hydrocarbon exploration (INGEMMET 2011), and over 17% of Perú's territory was considered as some kind of protected area (SERNANP 2011). This

[8] This fable imparts the lesson that it is incorrect to say: "If I can't have it, you can't either."

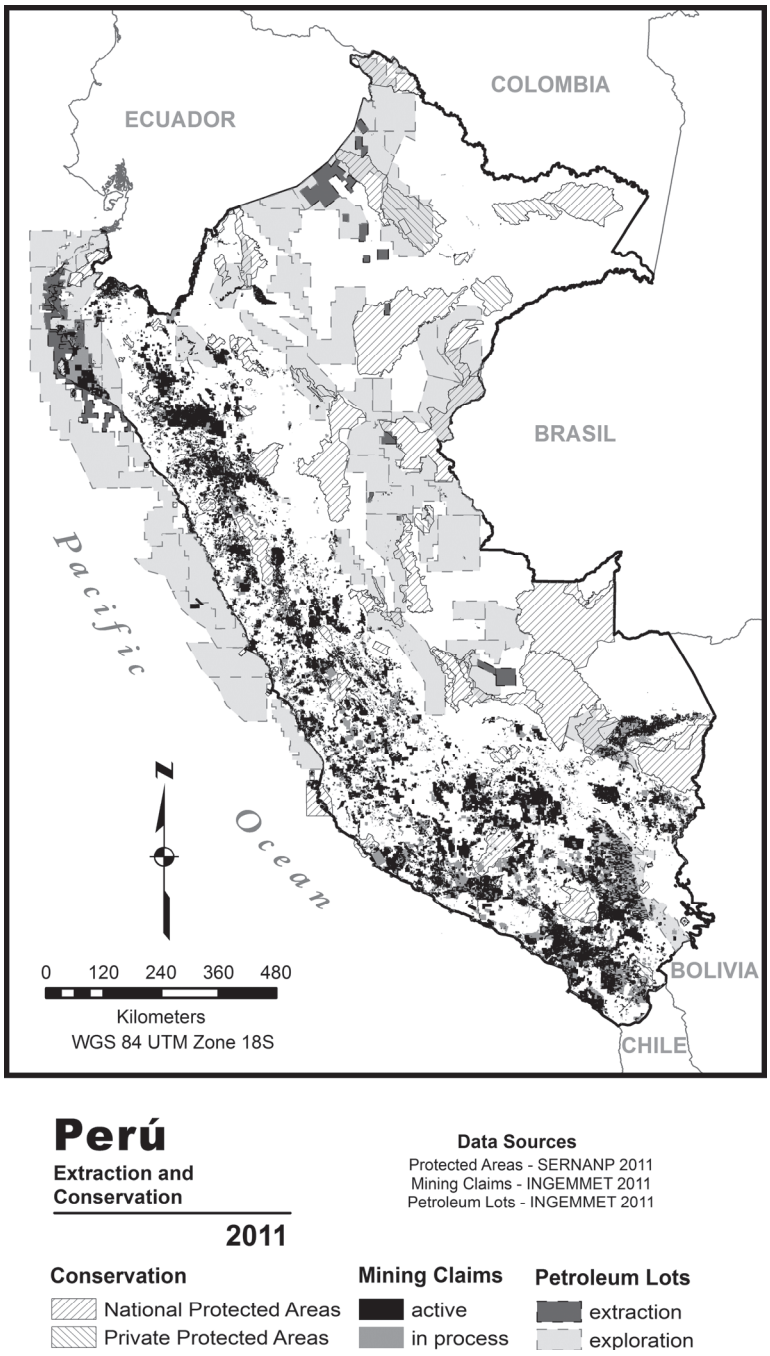

Figure 4.2: Geography of Extraction and Conservation in Perú

massive reallocation of resource rights has been recently likened to the dislocation of peasant producers from productive lands in England during the industrial revolution (Bebbington and Bury 2013). For the first time in Perú's history there is more area under private mining claims than there is designated as protected areas (not including the hydrocarbon lots) (see figure 4.2).[9]

4.7 Commodification of the Underground: the exchangeable social license

For the first decade of the 21st century, and particularly the years directly following the 2008 financial crisis, Perú was an extractive industry investment hotspot in Bridge's (2004) terms. The constitutional and legislative reform from the 1990's made Perú a rising star in terms of return on investment in extractive activities. Evidence exists in recent trends of purchases of mineral rights by mining companies (see Figure 4.1 and Figure 4.2), in the dollar amounts recorded by the Ministry of Energy and Mines for investment in metallic mining (see Figure 4.3), in Moody's rising credit rating for the government of Perú (see Figure 4.3), and the World Banks "Doing Business" rankings rate Perú third for ease of doing business and second for investor protection in the Latin America and Caribbean region (after Chile in both cases and Puerto Rico for the former). Out of 185 countries assessed worldwide by the World Bank, Perú ranks thirteenth in terms of protecting investments (World Bank 2013).

[9] Additionally, 0.25% of the area designated as protected areas in 2011 is designated as "private conservation" (see below) whereas at the turn of the century, there were no private conservation areas in existence (SERNANP 2011).

One possible investment method is that taken by Kartikay Peruvian Mining Company, a junior mining firm established in 2009.[10] Kartikay's business activities were described as follows by the CFO who had arrived in Perú with ten million USD

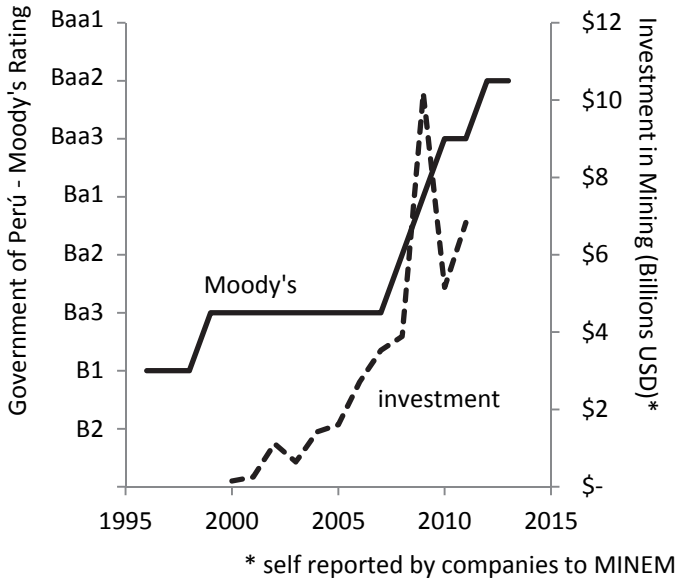

Figure 4.3: Moody's investment rating for the government of Perú and investment in extractive industries.

to invest in mining concessions.[11] The employees of the firm consist of several prospectors (geologists who enjoy the mountains of Perú), a small legal team, and a few administrative assistants. Using satellite imagery the geologists identify places likely to have mineral deposits that are not already claimed. The mining rights are

[10] What follows is based upon an interview with Hemant Aviv Nangia, CFO Kartikay Peruvian Mining Company S.A.C. March 2011.

[11] Mr Aviv described himself as a "victim" of the 2008 financial crisis (he lost his Wall Street job at Price Waterhouse Coopers) and his rich uncle had sent him to Perú with the investment money as a temporary means to make an income.

purchased from the Ministry of Energy and Mines and the geologists then go out into the field to recover evidence of mineral deposits. If the prospecting is successful then the CFO visits the title holder—most often an Andean peasant or Amazonian native community—and within one hour with a translator, tell them "all they need to know about private property." After the brief lesson on property and rights, the community members then sign a consent agreement recorded in the community's *libro de actas* (book of acts) indicating that mining exploration will be allowed within their territory.[12] With a few mineral samples and this "proof" of social license, a simple photocopy of the agreement in the *libro de actas*, the mining rights are then resold to either a firm that is capable of exploration or to another investor eager to make a quick turnaround.[13] The CFO's experience clearly demonstrates the possibility of acquiring the social license through a few hours of labor necessary to persuade the community to allow access to their lands and then to exchange this "new" commodity on an open market.

These *de facto* rights can also gain value by geographical proximity as evidenced in the Cordillera Huayhuash (please reference Figure 4.4 for the visualization of the place names mentioned below). In 1995 the Raura Mining Company acquired the

[12] The *libro de actas* is a tool for the community to record internal agreements between community members, the constituent assembly, and the presiding community officials. Often agreements with external actors are recorded as well, but until external agreements are brought before a judge or notary and formalized, they hold little legal weight. The *libro de actas* is the lowest form of law in Perú, just beneath municipal codes and above informal cultural norms.

[13] In the period from May to September of 2008 these agreements only needed a few signatures to be valid, and even now unwary investors may consider agreements valid with only signatures from the "authorities" within the community (president, secretary, treasurer, controller, and so on).

rights to the mineral deposits below the peak known as *Diablo Mudo* (mute devil) which marks the boundary between the communities of Huayllapa and Pacllon (both of which were recognized as private conservation areas in 2005). The mining enterprise was faced with the option of gaining permission for surface access, the social license, from one or the other of the two communities. In 2006 both

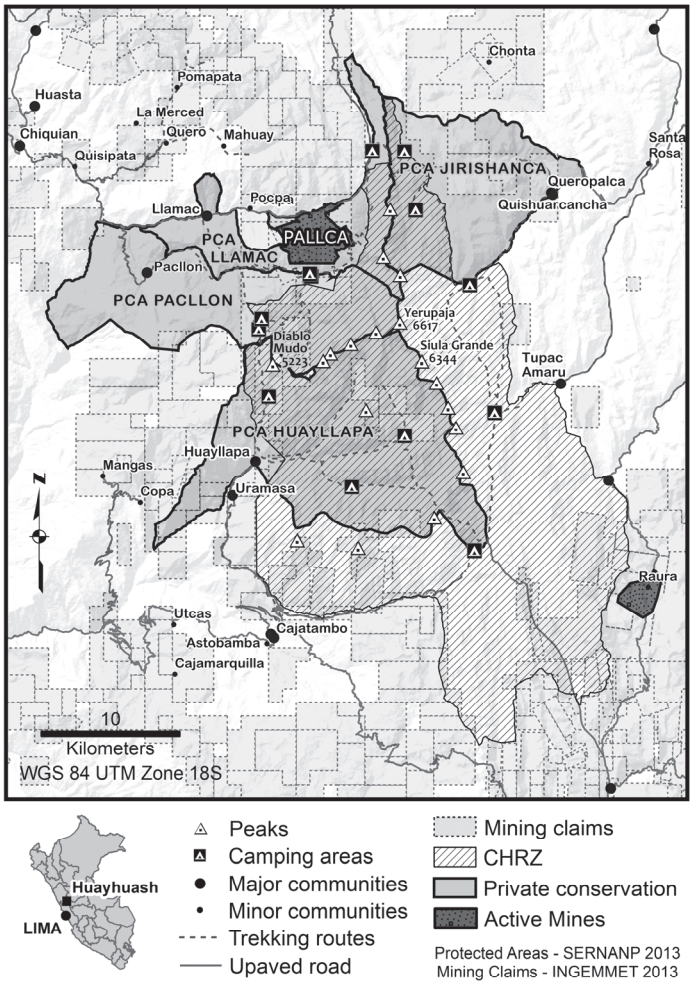

Figure 4.4: Mining and conservation in the Cordillera Huayhuash

communities were courted by mining engineers and, while both communities expressed interest in maintaining their PCA status, it quickly became apparent that Huayllapa was more open to granting permission to a mining operation than Pacllon. This is likely due to several factors: Pacllon has previous negative experience with a different mine, Pacllon has greater access to tourism income, and Pacllon has previous and negative experience with development NGOs (see chapter 2). In any case, in 2007 young men from Huayllapa agreed to work turns at another of Raura's nearby mines and soon were 'hooked' into the cash economy.[14] Some of these men neglected to plant their potatoes in 2008 and were directly affected by the global economic crisis when the mine cut back production as metal prices plummeted and mining production slowed down. There were no longer sufficient shifts or earnings for these men to purchase wheat noodles to feed themselves and their families and Huayllapa faced a mini potato crisis.

Shortly after the 2008 presidential decrees that eased the alienability of private property held by legally recognized communities (a few months after the global crisis and production slow-down), the mine approached several leaders in Huayllapa and negotiated an agreement that gave the mine permission to begin exploration on *Diablo Mudo*. Not surprisingly, within the signed agreement there were articles outlining the construction of a new road, a new health post, and improvements for the school including two computers, legal help to formalize the community boundaries,

[14] The *engancho* (literally 'the hook') is an old method of labor recruitment whereby cash or goods are handed out to potential workers who must then repay the debt by working shifts for the mine or *hacienda.*

and up to (but not guaranteed) twenty ten hour shifts at the mine of manual labor paid a total of $12 US per shift for the hungry young men. Each one of these contractual clauses was an exchange for the social license whereby the value of each development initiative in the community was made commensurable with the value of access to the minerals for the mine.

The low value that the Raura Mine paid for this social license in Huayllapa did not go unnoticed by other investors. Within three years of signing the agreement Huayllapa found that it had over 3000 hectares of new sub-surface mining concessions being negotiated in its territory while during the same period in Pacllon there were less than 100 additional hectares of concessions (which are small overlapping corners of concessions that lie mostly in the territory of neighboring communities). The majority of the new concessions in Huayllapa were purchased by Australia's BHP Billiton. This investment, in turn, is not lost on local politicians. The provincial mayor (similar to a county) of this area now encourages the communities to grant the social license to the mines as the concessions, whether developed or not, bring development money from the state. While speaking in front of Uramasa, a neighboring local community, he pleaded simply: "Let the mines enter, we need the money."[15]

A second example of the commodification of the social license drawn from the

[15] This was said at an informal discussion between Miguel Carlos Castillo (then the mayor of Cajatambo) and several presiding officers and community members from Uramasa on May 26th 2011. The discussion was in the context of a *Pachamanca* (earth oven meal) at the end of a day's labor spent by all to verify (ground truth) the overlap of a mining concession with the community territory of Uramasa.

Cordillera Huayhuash emerged from a long-term mining operation in the community of Llamac in the department of Ancash (again see Figure 4.4). In this example the negotiation of the social license took place *ex-post* the original negotiation of permission to access the sub-surface concessions which took place before the term social license was recognized in the extractive sector. Mitsui Mining and Smelting Company began exploration in Llamac's territory in the early 1990s just after the new constitution had been ushered in by Fujimori. Several respondents indicated that the original contracts between the mine and the community were finalized under conditions of *negocio forzado* (forced business) in Lima behind closed doors at the ministry of Energy and Mines. Most likely the contract was signed under the new constitutional clauses that are similar to eminent domain whereby, if the business investment is beneficial to the greater Peruvian state (as mining projects are often considered) the government has the right to "force" the deal and compensate the land-owner at current market prices. Although a deal was made whereby the mine gained access in exchange for several development projects (irrigation, school, and road) the community was not entirely satisfied; there was no social license.

In 1999, following an accident which released water from an underground aquifer into the Rio Llamac killing fish, sickening cows, and discoloring the water, the community attempted to shut down the mine's generator and violence ensued (Kolff 2000). The situation worsened in 2001 when the mine moved from exploration to extraction and publicly presented a flawed environmental impact statement (EIA). Two neighboring communities of Pocpa and Pacllon joined in the public protest along

with several regional, national and international actors. Nothing came of the protest, the EIA was approved and frustrations mounted. When the irrigation project was finally inaugurated in 2005 and the community discovered that the new aqueduct would not meet their irrigation needs due to design flaws, instead of protesting or reacting violently, Llamac hired a lawyer.

The mine no longer had the *de facto* approval from Llamac for its operations, yet the community could not stop the mining activity with violence or public protest. The director of community relations from the mine expressed that while operations continued, the increasing tensions were a major concern at the mine, nevertheless (Calderon 2011). In 2007 the community formally sued the mine in the regional court system on the grounds that the original contract was invalid. The argument presented declared that the mine (and implicitly the government) had underestimated the value of the land in the original contract and that the irrigation project cannot be considered an exchange for the land because it does not work correctly; thus the community was cheated by the mine. The argument was accepted by the judge and the case moved forward. The community asked for several million soles (equivalent to about one million US$) as payment to make up the difference calculated based upon their argument. Several respondents in the community believed, at the time, that they were going to win the case. In May of 2008 the community and the mine settled out of court through an agreement titled *Convenio de Cooperación para el Desarrollo y la Convivencia Pacífica Suscrito Entre la Comunidad Campesina de Llamac y la Compañía Minera Santa Luisa S.A.* (Agreement of Cooperation for Development and

Peaceful Living Together between the Community of Llamac and the Santa Luisa Mining Company) for several more development projects valued at S/.1,000,000 (Llamac and A. 2008).[16] Through the new *convivencia* (co-existence), and a set of development projects which the mine paid itself to execute (which some might argue that the government should be responsible for), social license was secured and operations continue. In 2012 construction on a new hydro-electric project in Pocpa began; while this will serve the mine, it was also likely "sold" to the communities of Pocpa and Llamac as a benefit to all further securing the social license.

4.8 Commodification of the Landscape: the License to Conserve

Perú is considered one of the top ten mega-diverse countries of the world. As the biodiversity discourse spread globally in the early 1990s Perú adopted the biodiversity convention in early 1993, mandated the conservation of biodiversity in article 68 of the new constitution later in 1993, and re-wrote conservation legislation in the following years to incorporate biodiversity conservation into the system of protected areas (GOP 1997). The Peruvian Amazon is the center of the biodiversity within the country and most conservation investment is directed to protecting this Amazonian biodiversity. While just over 15% of Perú's territory falls under some sort of government protection, over 21% of the Amazon is classified as protected while less than 7% of the Andes and less than 5% the coastal desert are considered protected (SERNANP 2011). This does not imply that conservation in the Amazon is

[16] The *convivencia* recalls, in a not so subtle manner, the agreements between the revolutionary APRA party and the Prado government in the 1950s whereby the property owning class maintained its status quo with the growing working classes in Lima.

over-prioritized, but instead that the Andes and the coast may be under-prioritized for conservation investment. Often the decision of where to invest in conservation is not made in Perú but instead is governed by the international donors who give conservation money on the condition that they control where the investment is made.[17] In this context conservation efforts in Perú have become investment strategies and "conservation is business or it is just conversation."[18] This approach is now becoming hegemonic in conservation circles worldwide and leaves the practice of conservation in areas that are not considered sound investments, even if they are considered biodiversity hotspots, such as large stretches of the Andes, difficult at best due to lack of investment interest.

A solution to the lack of conservation investment in the Andes was discussed in stark terms at the second conference on private conservation in Perú, held in an upscale hotel in an exclusive neighborhood in Lima in September of 2011.[19] Present

[17] "We work beneath international conservation interests" (Aucca 2011). In another interview with Peter Weinert in 2005, the then program officer for KFW Bankengruppe's conservation program in Perú, he flatly stated that KFW controls where their investment money is directed. And as a final example, Pedro Solano of the SPDA indicated that he could not get reimbursements for travel to the Huayhuash in 2009 as the SPDA's then current funder specified that no monies spent outside of the Amazon would be reimbursed.

[18] Felipe Carcelen Romero, the driving force behind the private conservation area in Cañoncillo, second private conservation area in Perú financed mostly by the United Nations Small Development Program, speaking at a conservation workshop in Chiquian (of the Cordillera Huayhuash) on October 24th 2005.

[19] The conference was coordinated by The SPDA (Peruvian Society for Environmental Law). The SPDA has been instrumental in the creation of private conservation frameworks in Perú. They were consultants to SERNANP as the laws were being drafted and now are funded through private donations to partner with SERNANP as private conservation is promoted. The SPDA has representatives that work and have offices located in SERNANP's government building. This public-private partnership is a great example of neoliberal conservation at work.

at the meeting were registered owners of lands recognized as PCAs in Perú, many municipalities interested in the legalities of decentralized conservation frameworks, and non-government organizations involved with promoting private conservation. One of the keynote addresses was given by a representative of ECOAN (*Ecosistemas Andinas*), which is a well respected NGO with decades of experience dedicated to conserving bird habitat and the reforestation of *Polylepis* in the Andes. This representative repeated Garcia's *Perro de Hortelano* speech almost word for word with the difference that instead of natural resources as the focus of access, it was that communities should give conservation organizations access to community territory to undertake their biodiversity conservation activities no matter if the investment came from extractive industry.[20] In a sense he repeated the sentiment of the SERNANP bureaucrat mentioned in the introduction: if conservation is to take place in the Andes, accept partnerships with mines. These words were not mere rhetoric but were carefully planned to persuade certain participants to sign conservation agreements. Leadership from the community of Pacllon was present at the conference; their conference fees, transport, and lodging paid for by ECOAN. Pacllon was at that time considering the renewal of an agreement with ECOAN to continue forestation work which would be financed by the Raura mine (see above).

In the end this agreement was renewed but was not financed by the Raura mine due to water contamination from the exploration process (see chapter 3) and territorial

[20] Costantino Auca, president of ECOAN in his address to the national forum on private conservation on September 28 2011 in Lima.

demarcation errors (corruption?) discovered in both Huayllapa's and Llamac's land titles that favored the mine (Norris in press). Instead Conservation International and the Association Ancash footed the bill (actually financed by Antamina). The plan was finished in a timely manner, but was never used; "it was just that, a plan and nothing more" (ECOAN 2013). Pacllon did complete some reforestation projects, but ended up designating the area as common pasture and the tree saplings were subsequently eaten by cows. The publicly known possibility of business between the Raura and ECOAN combined with the knowledge that Antamina financed the tree planting removed the social license for conservation in Pacllon.

Also present and similarly financed at the conference was the leadership from Llamac. The community of Llamac is Pacllon's direct neighbor, its territory is also recognized as a PCA, and it also was working with ECOAN on a reforestation project. Distinct from Pacllon, Llamac is considered the tourism gateway to the Cordillera Huayhuash, it has direct and troublesome experience with the Mitsui Mining and Smelting Co. which started exploration in Llamac's territory in the early 1990s and extraction of zinc, lead and copper in 2003, and it had difficult experiences with the conservation NGO TMI (the Mountain Institute) and the development NGO CARE (Cooperative for Assistance and Relief Everywhere) in the late 1990s. Respondents from Llamac indicated that often community expectations are not been met in these experiences, but that the community had learned to better negotiate with external actors. In 2010, when ECOAN first negotiated with Llamac (and Pacllon) for the "social license" to undertake reforestation projects it was disclosed that the

investment would be coming from CI (Conservation International) and that CI had negotiated this investment with the Association Ancash. Most people in Llamac and Pacllon also knew that the Association Ancash is a semi-autonomous entity that is entirely financed by the nearby mega-mine, Antamina, as a voluntary expenditure on local development projects. The Association Ancash is a giant public relations project for Antamina used to secure social license across the entire region of the mine's influence. With this in mind Llamac placed a condition on the conservation agreement: only if ECOAN purchased and installed a cellular communications tower that would serve Llamac would the agreement be signed.

Llamac gained a cellular signal and business with external tourism agencies is more fluid, it completed a cooperative reforestation project with ECOAN financed by a neighboring mine, and it improved its private conservation area. Llamac successfully negotiated this myriad of novel flows of capital through its territory largely due to its previous experience with external actors. Their prior knowledge of the commodification of the surface and the underground allowed them to articulate the needs of the mine, ECOAN, and themselves as a mutually negotiated market exchange of social license. While for a moment this articulation appeared stable, in 2012 the cellular tower broke down and neither ECOAN nor Llamac had money for maintenance. Disgruntled community members burned the reforestation effort as a signal to ECOAN that the agreement to exchange an operational cell tower for the social license to practice conservation no longer was valid (ECOAN 2013). Worthy of note is that when all was said and done the community of Llamac lost nothing in

this exchange, indeed they benefitted while ECOAN and the mine lost their investment.

Other experiences in the Cordillera Huayhuash have varied considerably. The entire PC initiative in the Huayhuash spawned from the local population's resistance to grant the social license to the Peruvian state necessary to create a state managed protected area (see chapter 2). From the 2001 protected area law SERNANP needed a consensus approval from all of the communities who occupy the territory in the CHRZ (Cordillera Huayhuash Reserved Zone) to create a formal protected area; the law stipulates the need for the state to gain the "social license" to conserve. Fears of restrictions on livelihood practices, the appropriation of entrance fees, and centralized resource management spread among the communities and SERNANP never gained the consensus. Instead the communities began to collect entrance fees from tourists in 2005 and private conservation areas were created using this new found resource.[21] Nearly $70,000 was spent by four communities to develop the *expedientes técnicos* (technical dossiers) and *planes maestros* (master plans) to create the private conservation areas. At the time, this was the only example in Perú where the private conservation effort was specifically *not* financed by a large international conservation NGO. With the exception of Queropalca, where the money was paid directly to the community president to create the area (approximately $6,000 which included his travel, consultant hires, and other expenses incurred), the money in other

[21] The details of this story can be found in Bury and Norris (2013) and chapter 2.

communities was paid to environmental professionals of varying degrees of ability.[22] In Pacllon the hired consultant was expelled from a local university because of evidence of academic malpractice found in the work for the PCA. In Huayllapa the team consisted of 13 professionals from Lima who were paid approximately $30,000 for the PCA. The community sued the lead consultant on charges of corruption when it was found that he kept most of the money for himself. In Llamac, the initial consultant was not re-hired when the community discovered that they could do the work themselves with the help of a facilitator at a much lower cost. Ironically, the resistance to state led conservation led to a commodification of the landscape that instead of being appropriated by the state was largely appropriated by private consultants.[23]

Now that the private conservation areas have been created and this stage of commodification is completed, the question of how to use the surplus entrance fees within the communities is coming to a head as new social relations are built around the valuation of the landscape and the distribution of this new resource. While this

[22] It should be noted that in Queropalca's case some of the technical services were provided *pro bono* by the SPDA, but under several interesting conditions. The SPDA could not send consultants to Queropalca because they do not have any funds that they are allowed to use for Andean conservation (all of their funds are specifically for use in other areas). The only way the SPDA could provide help was if the community leadership visited the offices of the SPDA in Lima (then the billing for time could be hidden in other projects).

[23] Even more ironic is that many technocrats from SERNANP have discovered that private consultation is a much more lucrative way to practice conservation science. In recent years some of the best conservation advocates from the SERNANP are creating their own consultation services. While this serves personal interests of self-realization, when *campesinos* discover these activities it can tarnish the name of conservation as simply a means to personally accumulate finances flowing from international conservation and development organizations.

debate takes varied forms in all seven of the communities that collect entrance fees, there are several general outcomes. It is difficult to account for the fees collected due to direct appropriation by the fee collectors and community leaders managing the conservation areas. As one disgruntled informant in Pacllon flatly stated, "We just wait our turn [to play a leadership or collector role]." This sentiment was also evident in Queropalca and Huayllapa. In several of these communities some of the surplus fees are simply distributed annually to all community members. This small payout is a mechanism for community leaders to purchase the social license to continue management of the private conservation area and more importantly the continued management of the entrance fees. At the opposite end of the spectrum Tupac Amaru has placed all of its collected tourist fees into a "conservation fund" that has not yet been used, but will most likely go towards formalizing their land title, registering a private land title in the community's name, and creating their own private conservation area. Somewhere in the middle of the spectrum, the community of Uramasa has invested several thousand dollars into tourist infrastructure in the form of facilities for natural hot springs (several connected pools built of stone, changing rooms, and a permanent caretaker's hut with caretaker).[24]

At a broader level these difficulties and successes are part of a transition from subsistence livelihoods to a sudden cash economy; the commodification of the surface through tourism and the entrance fees. Evidence of the difficulties inherent in

[24] These last two communities, while they collect entrance fees, are not yet recognized as private conservation areas due to lack of a registered land title in the community's name.

this transition reared an ugly head as three fee collectors were brutally murdered in August of 2011 by jealous youth who made off with over $10,000 in cash.

4.9 Conclusions

In the age of corporate social responsibility it is clear that practitioners of both mining and conservation must secure a social license, as opposed to using force, in order to undertake their particular activities in territory on which there are existing property claims by others. The evidence presented in this article shows that there is no one form of articulation that links the persuasive effort necessary to gain the social license for mining to the social license to practice conservation. Instead, the form taken is contingent on local socio-natural histories (cf. Sayer 2010 [1984]). The interview with the junior mining company and the speech at the forum for private conservation demonstrate that the rights of access to territory for the purpose of either extractive or conservation activities is at the forefront of the conversation in each sector. In Huayllapa, the social license negotiated by the Raura mine became informally attached to Huayllapa's land title and increased the speculative value on other mining claims that fell within their territory. In Llamac the community showed that it is possible to bridge mining and private conservation goals through negotiating the social license as a fictitious commodity that can be exchanged with material commodities.[25] In the case of Pacllon historical anti-mining sentiment prevented any linkages from forming, but the issues of water quality from the nearby Raura mine are

[25] Similar evidence can be found as a bridge between nationally led conservation and mining in the landscape reserve Nor Yauyos Cochas further south in the Andes.

not resolved and ECOAN gained access to the stream of income generated from Pacllon's private conservation area through the reforestation project financed by the *Asociación Ancash,* albeit only for a short time. Finally the entire private conservation effort in the Huayhuash is an attempt by the communities to commodify the landscape for their benefit instead of for the benefit of the Peruvian state.

Some observers claim that a new environmental movement is emergent in Perú which will replace socialist movements as they recede into the annals of the 20th century. In the Huayhuash *the* environmental claim made by the communities is that the mines are contaminating the water. Currently a mine that seeks social license from one (or several) communities must persuade the people that water contamination will not be a livelihood problem. To create and run a successful water monitoring project initially costs tens of thousands of dollars to set up, requires skilled technical professionals, and then costs up to two hundred dollars per water sample tested for heavy metals and biological contamination (this cost includes transport, lab fees, and collection by a licensed professional). The mine is required by law make this investment and monitor its effluent, but the results do not have to be made public. The communities in the Huayhuash want information about water quality in their territories but are reluctant to invest the sums necessary to run a monitoring program. If they used their newly found entrance fee resource to finance water monitoring, their entire project to commodify their territory as a tourist landscape for their benefit would be appropriated by technical professionals, not the communities. Yet the communities are left alone as international conservation organizations are reluctant to

fund this type of work; conflicts of interest may become apparent if the conservation money for water monitoring is flowing from the extractive industry.[26]

The social license for extractive activity hovers on the borderlands of what it means to be a commodity and can be articulated with both the surface and sub-surface rights of access and exclusion. Its exchange value is based on social relationality that spans chasms of incommensurability; to the mine it can literally be worth billions of dollars in profits and to the communities it is the priceless value of a livelihood. There are indications that water monitoring and environmental quality will be one of the bridges that can be built to span this chasm. While this environmental concern appears hopeful, it may be subsumed entirely by the "financial-scientific-policy nexus" and become simply another means of "regulated" accumulation whereby social license is gained through a scientific way of knowing that excludes other interpretations of reality (see Fairhead, Leach et al. 2012 and ; Himley 2012 respectively). It was with the purpose to explore this possibility and understand how an articulation between mining and conservation comes to be that this essay was written. To those that practice conservation in resource rich environments this possibility holds both hope and danger of which both need consideration. With this vision conservation outcomes become possible that address concerns of biodiversity, tourism, essential ecosystem services and most of all, justice, be it environmental or social.

[26] CI refused several times to finance a water monitoring project in the Cordillera Huayhuash, although they will finance reforestation projects. On the other hand, the National Geographic Society's Conservation Trust was willing to finance the initial investment for water monitoring.

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Chapter 5

The way forward: participatory research, legitimacy, and environmental justice

5. 1 Introduction

In the chill of the pre-dawn morning on September 19th, 2011 a group of six people departed on small horses from the community of Pacllon in the Cordillera Huayhuash. The group consisted of me, a SERNANP official from the nearby Huascaran National Park, two environmental engineers from the Raura Mining Company, and two community members from Pacllon. Our task was to gather water samples from below the perforation platform constructed by the Raura mine and located on *Diablo Mudo* (the Mute Devil), a nearby peak whose flanks contribute to the Achin river watershed. In December of 2010 the community noticed contamination in the Qashpapampa River and cited evidence of detergent like bubbles on the surface, dead fish, and a strong odor of diesel. The mine denied any possibility of a diesel spill and the purpose of the collection of water samples on this day was to clarify any misunderstanding about water quality in this river. Both the engineers from the mine and I were to collect duplicate samples from monitoring stations, send the samples to different laboratories for the analysis of heavy metals, and then share the results with the community.

Approximately five hours after leaving Pacllon, and a rise in altitude from 3,300 masl (10,900 ft) to 4,650 masl (15,300 ft), the group left the horses (to rest and graze) and continued on foot to the perforation platform located at an altitude of 4,860 masl

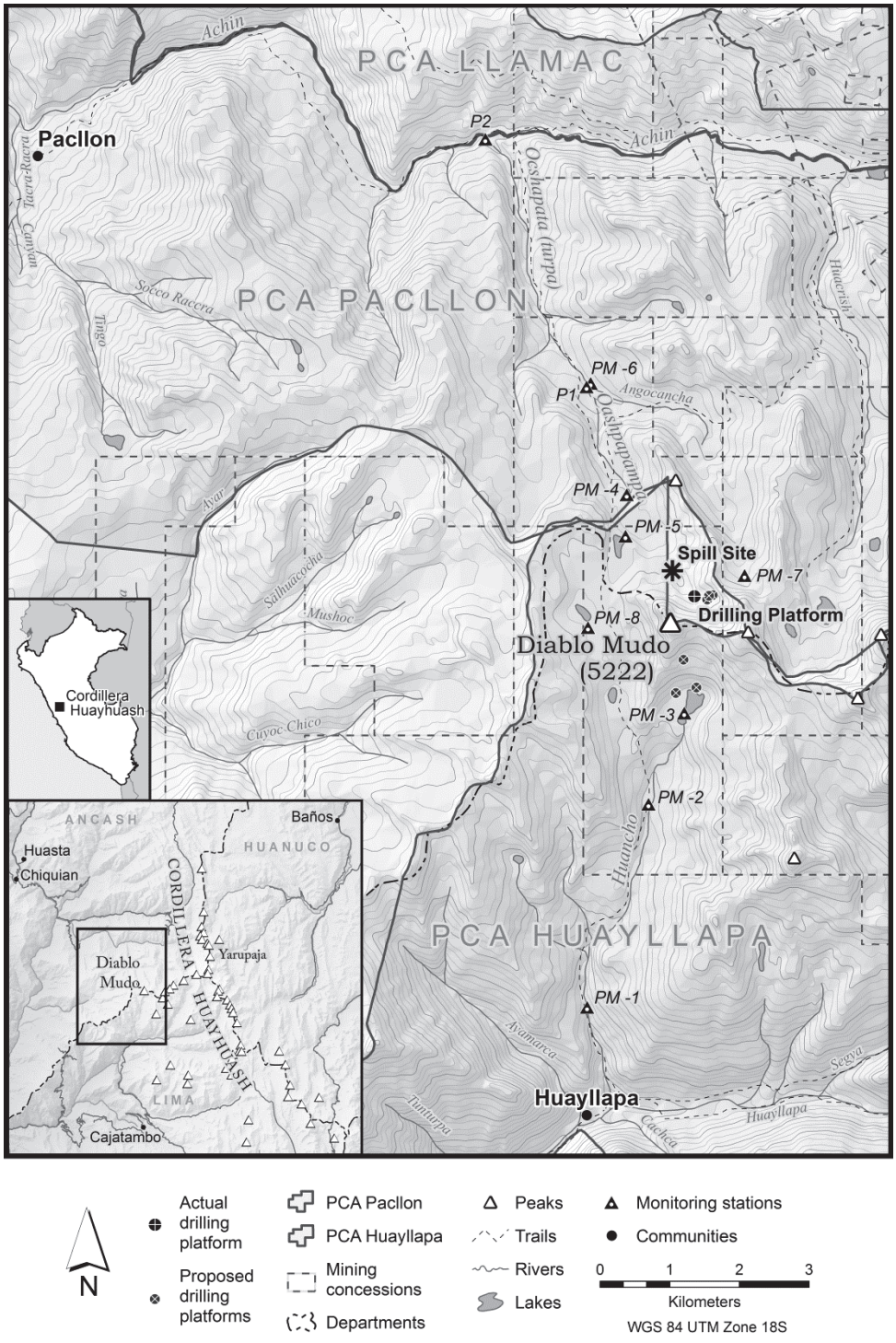

Figure 5.1: The drilling platform, monitoring stations, and location of the spill at the Diablo Mudo exploration operation developed by the Raura Mine. Sources: (IGN 1999), (INGEMMET 2011), (Raura no date), GPS ground truth May and Sept. 2011.

(16,000 ft) (see Figure 5.1). On the return trip from the platform to the horses the group encountered a greasy sheen floating on top of small patches of water in a *bofedal* (high altitude wetland) less than ten meters from the dirt and gravel access road. The sheen reflected rainbow colors in the powerful mid-day sunlight and emitted a smell that reminded myself, the SERNANP official, and the community members from Pacllon of diesel. Upon tasting the liquid both the SERNANP official and I concluded that the spill was indeed diesel. The two environmental engineers from the mine insisted that the greasy substance was most likely a biological product of some local plant. Unfortunately the "spill site" was not a designated monitoring station and neither the mine's engineers nor myself had any sampling equipment with us (the field instruments, liquid materials, and bottles for sampling are bulky, heavy, and difficult to carry around without the pack animals; we had left the sampling materials with the horses). The final judgment would be that of the "licensed" engineers; neither myself, the SERNANP official, nor the community members have this license. Even after it was clearly demonstrated that concentrations of several heavy metals had increased since the mine had begun exploration activities (see Figure 5.2), the spill was determined to be "not" diesel in the end as there was no direct legitimate evidence of a diesel spill.

This story clearly illustrates the difficulties to make a legitimate case through the "simple" use of human senses to determine the quality of water that is essential

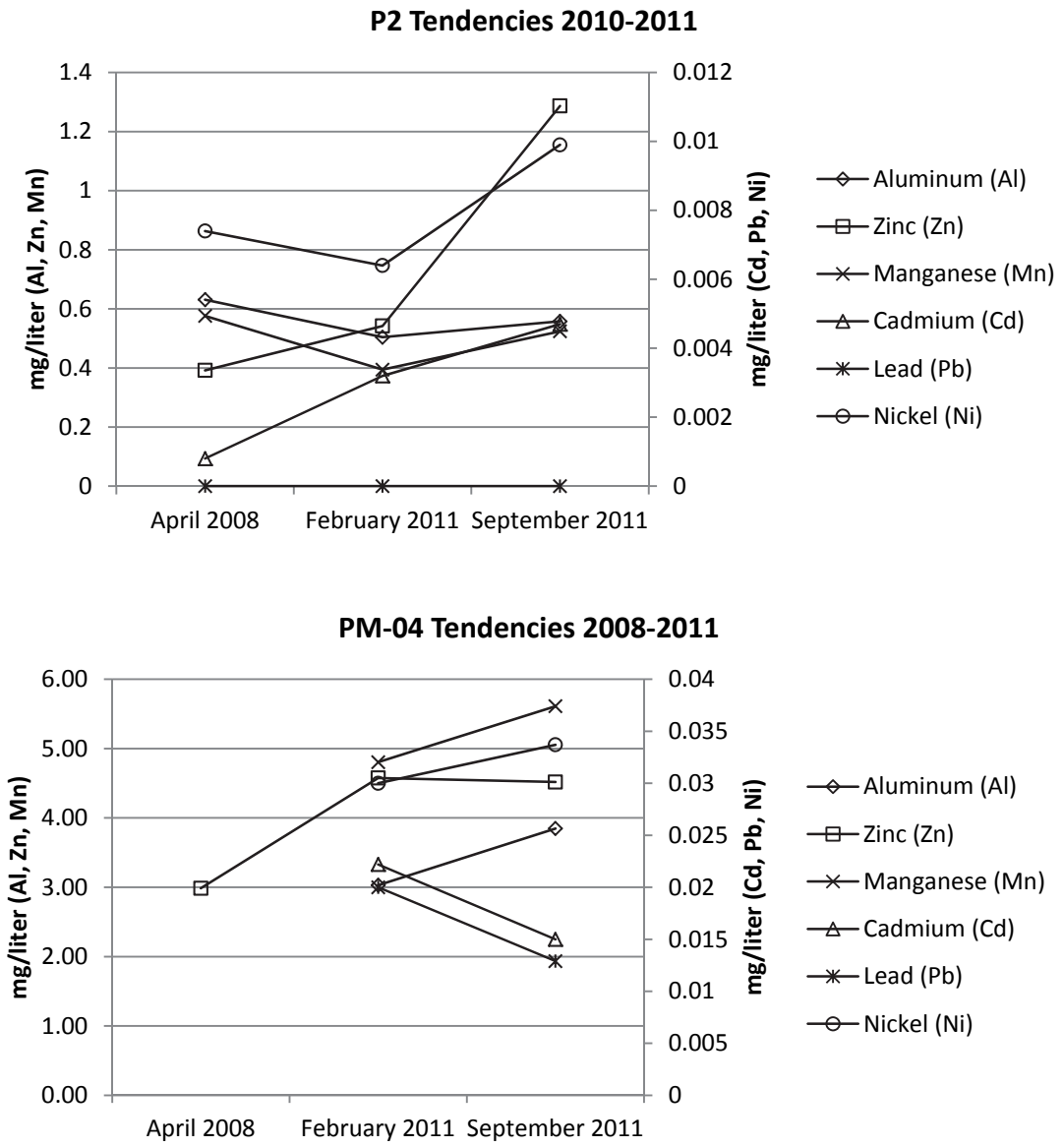

Figure 5.2: The tendencies of heavy metal concentrations at two of the water monitoring stations in the Ocshapata River watershed (part of the larger Achin River watershed) (see figure 1).Note that concentrations of Zinc, Nickel and Cadmium generally increase at P2 and the concentrations of Zinc, Manganese, and Aluminum generally increase at PM-04. Sources of the data are from water samples collected and analyzed by the author and by the Raura mining Company.

for all life. Without the legitimate evidence from "licensed" scientists it was not possible to make a case that the water was contaminated. While the immediate decision was fairly clear—the water was not contaminated by the mines activity—longer term observations shed some light on the process of legitimacy of a "participatory" monitoring effort as described above. Following the September outing SERNANP continued to place regulatory pressure on the mine. There was also a complete lack of "social license" in Pacllon for the mines continued activities (see chapter four). The mine retired from the region in the first months of 2012. While it is hard to ascertain what specific role the September visit played in this change of events, it seems likely that the sustained effort by both the communities and SERNANP worked together to achieve this outcome. This invites consideration of Nietschmann's assertion introduced in the first chapter of this dissertation in a broader context. Can participatory research aimed at understanding environmental quality contribute to the defense of "indigenous" territory under threat from extractive activities?

5.2 Participatory Research and Legitimacy

In the literature that follows the developments of participatory and action-oriented mapping methodologies used in the disciplines of applied geography and applied anthropology there is a well-known debate about the legitimacy of maps drawn by indigenous peoples verses the legitimacy of maps drawn by a government agency (see Herlihy and Knapp 2003; and Wood 2010 for summaries of opposing views). It is unlikely that this debate will be resolved and instead researchers,

governments, and private actors that include indigenous communities and extractive enterprises, will have to accept that there is an "*aporia*" (an irresolvable contradiction) in participatory mapping methods (Wainwright and Bryan 2009). The difficulty lies with incommensurable epistemologies of time and space that are the root of our everyday experience as we interpret the world around us (Rundstrom 1991). Simply put, some cultures use maps based on Cartesian understandings while others do not. But as Rundstrom noted over thirty years ago, it is the process of mapping that is more important than the final product frozen in time; the drawn map.

Yet the process of participatory mapping, or any participatory research for that matter, is rife with dilemmas. It leaves most participants and practitioners with some form of the ultimate question: to map or be mapped (Peluso 1995; Nietschmann 1997; Fox 1998; Hodgson and Schroeder 2002)? Yet as Denis Wood (2010) observes, perhaps this question is mute. The map that is ultimately legitimate is the one made by the state and is the only map that will wield power over resource allocation decisions; any map drawn by marginalized people will not be legitimate just because they drew it. This same observation can be made about determining the quality of water in the story from the Huayhuash. With the presence of the mine there is a powerful local incentive to assess water quality and perform testing independent of the government's or the mine's engineers, yet the only legitimate determination of water quality is the one sanctioned by the state.

Wood's argument is also an echo of the conclusion made by Wainwright and Bryan (2009) that legal-cartographic approaches to community mapping show scant

results. Their conclusion used the case of the Maya Mapping Project and was published twelve years after the release of the *Maya Atlas* (Toledo Maya Cultural Council 1997)[1] and twelve years after the first lawsuit filed by the Maya of southern Belize against the Belizean government. In 2008 no legal rulings favored the Maya people of southern Belize and they remained without land titles; the project appeared to be a failure. In June of 2010 the Belizean supreme court ruled in favor of the Maya granting all Maya villages in the Toledo District of southern Belize customary tenure (Conteh 2010), yet to this day the Maya do not have secure land title (Coc 2013). Perhaps important in this outcome are the untimely deaths of Julian Cho in 1998, a powerful Maya leader who initiated the mapping project, and Dr. Nietschmann in 2000, who assisted Cho in realizing the mapping project. The loss of their leadership surely impacted all involved, yet at the end of the day the Maya effort to gain land title has produced very limited results as Wainwright and Bryan argue.

Even with this evidence of failure I contend that in certain contexts, under certain conditions, and practiced with a mindful awareness of all the potential problems, participatory research that uses mapping as one of its tools can help build legitimate institutions that recognize the rights of people previously ignored or not included in the state's vision. The *Instituto de Bien Comun's* (Institute for the Common Good - IBC) work in the Peruvian Amazon is a case of an effective long-term participatory legal-cartographic approach to titling indigenous territory. Over 20 years ago Dr. Richard Chase Smith started a small legal-cartographic approach to titling Amazonian

[1] It should be noted that I participated in the Maya Mapping Project and the subsequent production of the *Maya Atlas*.

lands in Perú to tribal groups. The IBC has continued this work and is responsible for helping countless native communities gain legal title to their land and maintain a GIS database, SICNA, that is trusted by both the communities and the Peruvian government (Benavides 2010). Nevertheless, in both cases of Belize and the Peruvian Amazon, it still remains to be seen as to whether these claims will be defensible as trans-national extractive interests pressure the governments of Belize and Perú for logging rights or access rights to sub-surface mineral resources respectively (Smith 2005; Coc 2013). Also worth considering is whether this contention can be extended to other forms of participatory research such as water quality monitoring and other forms of environmental assessments.

5.3 Discipline, liberation, and "the white man's [sic] burden"

While most agree with the possibility of claiming defensible territory through indigenous cartography, the practice of mapping either *with* or *for* marginalized non-western societies is a form of disciplining subjects (Foucault 1991) and building a hegemonic economic order based on private property rights (Fox 1998; Rocheleau 2005; Bryan 2011). As Rocheleau suggests, it is much like introducing money to people from non-monetary economies. In the same sense, undertaking a participatory water monitoring project or conservation zoning project are also forms of disciplining environmental subjects (Agrawal 2005) and build upon a hegemonic order of the supreme legitimacy of natural science in determining and managing environmental quality. Indeed, this argument can be applied to all forms of participatory research undertaken by a "Western" researcher *with* or *for* "non-Western" peoples. In a sense

this leaves all action-oriented research with the same "aporia" that Wainwright and Bryan speak of; it also leaves the same conclusion that they arrived at. While results are hard to come by, the research must go on. Indeed, all critics of participatory methodologies temper their arguments with broad statements that acknowledge the value of, and need to continue with, participatory and action-oriented research programs even though dilemmas, problems, impositions, inequality, and so on, are observed outcomes of participatory research.

This normative stance includes a valid yet dangerous assumption in its genesis. If the growth and evolution of a capitalist economy is inevitable, then participatory research is a means to liberate the "oppressed" class and resolve contradictions inherent in capitalist relations of production. Instead of simply becoming an object in the process of development, local people can claim the active role of the subject in the interpretation of their reality and autonomous development. While this assumption draws on the ideas of Marx (1967 [1867]) and Freire (1970) it also can take the form of the "white man's [sic] burden" if not considered carefully (Rundstrom 1998). Yet in a case such as Perú, and specifically the Cordillera Huayhuash, the role of local development is by default left to the mines. Much like West (2006) observed in the case of Papua New Guinea where local governance mechanisms were subsumed by the church, the Peace Core and international conservation organizations, the mining companies play the role of the government in local development by providing transportation and communication infrastructure, resources for school, agricultural supplies, and extension programs (cf Gil 2009; chapter 2; chapter 4). The mine does

not hesitate with this "burden" but instead embraces it as a mechanism for control. This does not imply that action oriented research should disregard mindfulness in participatory approaches and become an extractive activity, but instead that there is little room for hesitation in certain cases.

There is no doubt that whether a mine, a researcher such as myself, or the government engages with the local people in a dialog about their own development that there will be misunderstandings based on epistemological differences that Rundstrom observed. Also clear is that any outcome will not be based on local/traditional or non-local/liberal visions of organization and governance of the human-environment relationship, but instead will become some unique hybrid system contingent on institutional configurations which cross various scales (Peluso 1995; Vandergeest and Peluso 1995; Fox 1998; Walker and Peters 2001; Hodgson and Schroeder 2002; Offen 2003; Clapp 2004; Rocheleau 2005; Himley 2009; Wainwright and Bryan 2009). As argued in chapter two, the central Peruvian government, the mines, the local communities and certain outside actors (myself included) all had agency in the emergence of private conservation in the Huayhuash. Indeed, the participatory research design used for this dissertation was a contingent factor in the outcomes observed. What remains less clear is how this research effort can be judged in normative terms. Was the research successful and if so how? Can the process be understood as a "bridge" between the different epistemologies of the various actors? What lessons can be drawn from experience to inform future efforts?

5.4 Research as a bridge

Many known dilemmas and problems were observed throughout the research process. Certain community members were empowered while others did not receive this benefit. Participation was limited due to restrictions on temporal, financial, and human resources available. Sharp lines were visible between gender and age throughout the process. Boundaries on maps proved difficult to explain in the context of multiple-use landscapes that are perhaps "overlapping patchworks" (Zimmerer 1999) of uses and usufruct rights. Minor conflicts over the allocation and use of research resources, mostly based on misinformation spread in the communities, hindered participation and affected the results obtained. Dissimilarities between the state's preferred conservation management vision and local versions natural resource governance were mostly incommensurable.

Scientific epistemologies, while necessary to legitimatize the results to the state, the mine, and the research community in general, proved particularly difficult to explain in terms of local knowledge. The use of scientific names to identify plants to the species level proved difficult and somewhat meaningless to participants. Additionally using the plant identifications for lengthy calculations of diversity and productivity indices was outside of common experience for many. In a similar manner the water quality results proved difficult to interpret. Most community members want simple yes/no conclusions as to whether their water was safe. They want to know what role the mine plays in water quality issues. Is it the mines fault or not? Instead they received numerical results expressed as micrograms per liter and the

legal *limites máximos permisibles* (maximum permissible limits) for mining activities expressed in the same units. Often these limits are imported from other countries (de la Puente 2010) and the legislation governing the limits is co-written with legislators and mining executives working side by side (Nalven 2007). Further difficulty is introduced by the imprecise toxicology assessments used to determine the limits for several contaminants; is the possibility to contract cancer in 1 case in 1000 throughout the course of 15 years something to be concerned about in a community of 300 members? This is not to imply that toxicology assessments are undertaken with poor methodologies, but instead that drawing a "boundary" or setting a "limit" is sometimes difficult when human health is at stake. Often the only people to grapple with this difficult are the scientists themselves, not the people drinking the water in question.

These caveats of the methods employed are relatively easy to "see" when compared to identifying the positive outcomes of the research. At the time of writing several "positive" local changes merit mention, nevertheless. Two communities are working towards the tangible benefit of registering their land titles and two communities have avoided a potential boundary conflict. The conservation mapping exercise is a factor in these observed outcomes. The Raura Mining Company has retired from the region; it is likely the mapping and water work are factors in this reversal of interest. One community member incorporated the pasture evaluation work into their master's thesis in agronomy undertaken in a local institution of higher education. Two communities are seeking alternative fresh water sources as the water

quality work identified natural contaminants in their drinking water (lead and arsenic). Several communities have altered their institutions of pasture management including annual rotations and community regulations due to the increased understanding of pasture dynamics. Yet, while all of these tangible changes can be observed, it is very difficult to attribute them as a direct outcome of the research. It is more likely that the research is one of many contingent factors and may only show measurable change after several years of continued effort and observation.

It is likely that there are further "positive" outcomes that are intangible, immeasurable, and generally not easy to "see." For example there appears to be an increasing dialog between the communities of the Cordillera Huayhuash and SERNANP. Indeed, the entire process that includes the pasture and water work along with the conservation mapping exercise and survey was successful in building dialog and strengthening two specific conversations between the communities and SERNANP. First, all of the communities recognized as PCAs want SERNANP's technical help and advice with their PCAs, and second all of the communities who cannot be recognized as PCAs due to lack of property titles want a SERNANP's presence along with a nationally administered protected area as a means to slow the increasing mining activity in the region. At a regional meeting in December of 2011 in which the research results were presented and distributed to all of the actors involved, there was a consensus driven agreement that was transcribed as an *acta* (literally an "act," but more like meeting minutes) and signed by all present. The

agreement includes several concrete actions in which these two conversations are visible. The actions are as follows:

> "To amplify the categorization process through time to generate and detail information that will be made accessible to the communities in order to achieve a collective proposal for the area.
> All mining concessions granted after the creation of the Cordillera Huayhuash Reserved Zone will be re-evaluated and corresponding action will be taken.
> SERNANP will seek to create and fill a full time position in order to continue the categorization.
> The studies should be expanded to surrounding communities of Mangas, Huasta (Pocpa, Pomapata, and Mahuay), San Juan de Nupe, La Florida and Carmelita.
> The communities should continue to form and participate in an association to work on [the management of] shared interests such as tourism.
> SERNANP should state its official position [as a written document] about the tourist entry fees and restrictions on pasture use.
> SERNANP should perform its functions for the PCAs"
> (SERNANP 2011 translation mine)

While there has been a delay in implementing this set of recommendations, SERNANP has been working towards these goals and has negotiated with the Ministry of the Economy and Finances for a funding source to continue the work. There is hope that renewed work on the ground will continue through the end of 2014.

There is a long standing lack of trust between Andean communities and the Peruvian state. This situation has many historical and contingent factors. The participatory research undertaken, including the water quality monitoring, the pasture evaluations and the zoning exercise, partially addressed this lack of trust and has constructed an initial bridge between sympathetic SERNANP officials and the communities of the Cordillera Huayhuash. It is likely that better relations have been

constructed between the communities and the mines as well. If these bridges can be reinforced with further outreach by SERNANP and conservation NGOs, such as partnerships to improve pasture and water management important for local livelihoods, legal advice and consult with territorial conflicts, and truly participatory zoning exercises in which zoning categories are defined using local criteria, there is a possibility of "crossing the great divide" and co-producing (Ostrom 1996) a shared natural resource governance in the area (Berkes 2007). This possibility will depend ultimately on leadership and the role of environmental and spatial intellectuals, somewhat like Gramsci's role of the intellectual (2005 [1971]), in the relations between state and civil society. As mentioned in the conclusion of chapter two, the final outcome often depends on leadership within the community. As evidenced in the negotiations between the mine and the community in Huayllapa, it is all too easy for community leaders to sell-out, accept the bribe from the extractive industry, and never be seen again. Research on the role of the intellectual, or more specifically the role of leaders, in emergent conservation efforts in cases such as the Cordillera Huayhuash might bear interesting results.

5.5 Water and the new Environmental Movement

The above observations, both normatively positive and negative, emphasize the importance of process over product in any 'participatory' research exercise (Flavelle 1994). The research process served to build trust relationships between the actors present in the region and in this sense is contributing to the accumulation of social capital. While clearly there are short term concerns of legitimacy of the scientific

results generated with participatory methodologies, there is hope that in the longer term this legitimacy will be negotiated and re-evaluated. A good example of this re-negotiation or re-evaluation lies with the story of the water quality report sent to the National Water Authority (ANA) and to the Local Water Authority (ALA) shortly after the September 2011 *Diablo Mudo* outing. The report was prepared after the results from the laboratory were received and analyzed and then it was sent to ALA and ANA in November of 2011.

The water quality report for the watersheds beneath *Diablo Mudo* was received with perceivable hostility by ANA and ALA. Initially these agencies requested the report through SERNANP as they knew that a SERNANP official was present on the day of the water sampling. Then they demanded the report directly from me. The request letter indicated that the water quality assessment was not performed by an authority on the matter. The final written response, after they had evaluated the report, was that the results were invalid and should not be considered in any regulatory action that governs the mine's activities. This reaction is understandable as the report questioned their authority on the matter and was likely perceived as a threat to their sovereignty over the governance of water resources (cf Todd 2003; Brockington et al. 2008). Yet the final result was somewhat similar to a judge (the water authority) telling a jury (the community) not to consider the evidence of a witness to a death because of a lack of a coroner's or physicians' license. In the end the mine found it necessary to consider the communities perception and understanding of water quality; it is the community's understanding of purity and

pollution that determines the social license for the mine's presence, not ALA's or ANA's statement. It is not the legal *limites máximos permisibles* (maximum permissible limits) that matter but the *limites sociales permisibles* (permissible social limits – like the social license) that are important (de la Puente 2010).

A situation not dissimilar unfolded in the neighboring community of Huayllapa. The Raura Mining Company initiated a water monitoring program as part of their efforts to gain social license in the community. Nearly half the community relies on the water flowing from the *Huancho* watershed directly beneath *Diablo Mudo* (see Figure 1). Yet the environmental engineers from the mine chose to collect water samples in open buckets that they put in the back of a pickup truck for transportation to the laboratory in Lima. Everyone interviewed in Huayllapa commented on the poor sampling protocols; they know that this was not the correct method to take water samples and that the results would not be valid. While it is likely that the mine used these samples for the reports that they are required to make to the Ministry of Energy and Mines (MEM) and that they were considered legitimate by MEM, the monitoring performed by the mine was not legitimate within the community. The community's awareness of sampling protocols is very likely a direct result of the monitoring efforts made as a part of the research for this dissertation. This effort by the mine to gain social license through poorly executed water quality monitoring failed. Yet in the end their other efforts, such as offering financial incentives to community leaders, were successful in securing the license as a signed agreement under the 2008 decrees (not as a community consensus) (see chapter two).

Both of these stories resonate with that of environmental and social struggles that have taken place at the nearby La Oroya mine over the course of the last century. Since about 1920 La Oroya has been home to one of the more important smelting operations in Perú and is considered one of the most polluted places on the planet; health and environmental impacts abound (Scurrah et al. 2008). Environmental and health standards governing extractive activities were incorporated into Peruvian legislation beginning in 1992 yet MEM was the only official government agency with regulatory power over environmental and health concerns in this sector. Hence the same agency that benefited from extractive industry is the agency that regulated the selfsame sector. This was recognized to be problematic immediately and in 1994 the *Consejo Nacional del Ambiente* (the National Environmental Advisory) was created; but this agency did not have regulatory power. Over the course of the next fifteen years this regulatory "conflict of interest" persisted to the benefit of the extractive industry. Then in 2008 the Ministry of the Environment was created which housed a new oversight office that was not directly connected to MEM. Prior to 1992 and up until 2008 struggles over environmental and health concerns at La Oroya were generally downplayed and managed through a revolving door policy between MEM and the mine's executive leadership (Scurrah et al. 2008). Several notable gains were made through research and outreach performed by "unauthorized" church groups, foreign academics, NGOs, and the government health agency (DIGESA), nevertheless.

This possibility of environmentally based social movements with a particular focus on water is one that observers have noted to be growing rapidly in the Andean corridor (Bebbington et al. 2008; Perreault 2008; Scurrah 2008; Gil 2009; Bebbington et al. 2010; Himley 2012). As shown in chapter four, there is a direct articulation between the community's perception of water quality impacts from mining activity and the social license that is becoming more and more important for the mine to acquire. This statement can be generalized to articulate the community's perception of environmental impacts from extractive industries with the granting of the social license. Furthermore, not only does the mine require this social license if they want to avoid violent resistance, but as the case of Bagua, Perú shows—in which several Peruvian police officers were killed by "indigenous" people upset with the granting of Petroleum exploration rights beneath their "territory"—that the Peruvian State must also consider the social license before granting too many privileges to potential polluters (Smith 2008). In Perú this has been linked to a growing awareness of the 1993 constitution's article 2.22 that guarantees all citizens the right to a "environment that is balanced and adequate for the development of life" (GOP 1993 translation mine). More broadly yet, these observations follow the theory that as socialist movements lose popularity they are being replaced by environmental movements in Latin America and the World at large.

5.6 Water quality, participatory research, and environmental justice

In Perú local or 'indigenous' claims of negative environmental impacts from extractive activities are often not based on scientific evidence, but instead use

anecdotal sensory evidence or are based on no evidence at all. Indeed, for some claims it is possible that simple monetary compensation is being sought through exaggerated statements of environmental harms (Bebbington and Humphreys Bebbington 2009). This is not to imply that there are no valid claims of environmental injustice in Perú, indeed they abound and can be measured by the number of "social-environmental" conflicts registered in the Peruvian Ombudsman office (Bebbington and Bury 2009; de Echave et al. 2009). Instead, this observation reveals a difficult problem with claims of environmental injustice: the claims need to be validated somehow, and practitioners, policy makers, industry experts and the affected communities are left with an apparent choice between a scientific validation and a more sensual human evaluation. While both epistemologies *are* valid to those that adhere to their respective methods, bridging this epistemological divide is itself a problem of environmental justice (Harvey 2004 [1996]; Bebbington and Bury 2009).

The mines, and the government agencies working for the interests of the mines, are hesitant to release the scientifically derived water quality data as they fear that any lack of understanding by the communities affected might incite resistance or even violent protest.[2] This of course assumes that the extractive industries have nothing to hide, yet in many cases the data implies contamination, be it above or below legal permissible limits, and social license will be harder to acquire or maintain as *any* contamination often exceeds socially permissible limits. The communities want this

[2] This is a common explanation that was given by environmental engineers for both the Raura and the Pallca mines as to why they do not want to release their data (besides the fact that they are not legally obliged to).

scientific evidence, but when they receive it they find the information difficult to interpret and do not feel the immediate gratification of confirming their suspicions against the mining companies that was expected. Participatory water monitoring programs coupled to action-oriented research can be used as a way forward to breach this impasse (Bebbington and Williams 2008), but these methods will not be an immediate fix or a panacea to the epistemic divide. To build this kind of bridge will take time, investment by all, and a willingness to be flexible by all actors involved.

There is an imperative to repeat the natural science research reported on in this dissertation. All of the results from the water, pasture, and forest assessments reported on in chapter three serve as baseline data for future research. In order for this work to be useful, the same measurements should be repeated within five years and then again in ten years, and so on. Not only will repeat studies answer many questions about trends of environmental change, but if undertaken as participatory and action-oriented research it will serve several perhaps more important roles as well. First, continued outreach for conservation, environmental, legal, and tourist based capacity building can take place in the communities. With this support communities will be able to make more informed claims to defend their territories be it for furthering capitalist development or restricting economic activities. Second the initial bridges built by the research undertaken in the last several years can be strengthened. Relationships between SERNANP, the mines, NGOs, and the communities can be improved and made more just and equitable. Through a participatory research program it is likely that future governance of the natural resources in the Cordillera Huayhuash can

include all of these actors (cf INRENA 2006). And third, there is hope that this unique place on the planet earth and heritage to the world can be sustainably managed for generations to come, be it for freshwater resources, traditional livelihoods, adventure tourism, extraction of minerals, or any other use that is agreed upon.

As mentioned above, this sort of research program assumes the inevitability of capitalist development. This is not to conclude that capitalist development is the only way forward, but instead that it is the economic system within which we can work at our current juncture in planetary history. For this reason the conclusions in chapter four are particularly important. Conservation and extraction are two sides of the very same coin of a global capitalist economic system. Participatory research that purports to further conservation goals or purports to contribute to the governance of natural resources in a just and sustainable manner, is also a part of the global capitalist system. The connections that exist between conservation on the one hand and extraction on the other hand are all too real (Chapin 2004) and the commodification of nature that is an inherent part of these activities must be considered when designing any research or conservation intervention. Indeed, the negotiated valuation of nature, be it monetary or some other kind of value, is at the heart of how we define and talk about environmental justice (Harvey 2004 [1996]). Further research into the dynamics of these economic relationships between conservation and extraction is essential if we are to improve the just and equitable governance of natural resources.

5.7 Conclusions

The broad purpose of this dissertation was to assist local residents of the Cordillera Huayhuash to defend their territory through the generation of detailed information about their social and ecological communities. It is impossible to judge whether this goal was reached; only time will tell. In addition, the information generated serves local, regional, and national government agencies in Perú as they seek to build institutions for the governance of natural resources. There are many reasons to hope that the bridges built between these two broad goals will remain in place and continue to be fortified. Participatory research is no panacea for difficult resource governance problems, but with its promise of personal liberation and democratic participation, it is the best way forward.

Afterword

The findings presented in this dissertation have parallels to the tensions between extractive activities and conservation efforts in the context of developed countries as well. Consider the recent development of the Keystone XL pipeline in which private property owners are being forced to give up their rights in order for the pipeline to connect the Alberta oil sands with the Gulf Coast of Texas (Elbein 2012). The continued process of "accumulation through dispossession" is a global phenomenon, not just one delegated t resource sacrifice zones in developing countries. Consider also the case of PG&E vs. Hinkley. Groundwater contamination was discovered and exposed to a legal process in which the participants, the residents of Hinkley CA in conjunction with legal, scientific, and medical assessment, combined various approaches to environmental justice and eventually won a landmark case (Soderbergh 2000). The valuation of these negative externalities was a tool to promote environmental justice. There is resonance. The findings from Perú include lessons that are either shared by, or can be applied to, these two cases. Indeed the approach of applied research used in this dissertation can be applied anywhere.

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