

Effects of Land Privatisation on the Use of Common-pool Resources of Varying Mobility in the Argentine Chaco

Mariana Altrichter^{a,b,#} and Xavier Basurto^{c,d}

^aCurrent affiliation: Environmental Studies, University of Redlands, 1200 East Colton Avenue, P.O. Box 3080, Redlands, CA 92373-0999, USA

^bResearch undertaken at: School of Natural Resources, University of Arizona, 104 BioScience East, Tucson, AZ 85721, USA

^cWorkshop in Political Theory and Policy Analysis, Indiana University, 513 N Park, Bloomington, IN 47408-3895, USA

^dDuke Marine Laboratory, Duke University, 135 Duke Marine Lab Road, Beaufort, NC 28516-9721, USA

[#]Corresponding author. E-mail: mariana_altrichter@redlands.edu

Abstract

During the last few decades there has been a strong tendency towards privatisation of land tenure to increase protection and sustainable use of natural resources. We assess this approach in the context of land privatisation in a dry region of the Argentine Chaco where low income peasants depend on multiple common-pool resources (CPRs) to survive and where most recently privatisation of land tenure has also included large absentee landowners. We hypothesise that the results of such policies depend in part on the mobility of the resources in question, and compare the harvesting practices of CPRs of varied mobility before and after the conversion of land to private property to assess the effects of privatisation. We found that privatisation by low income peasants increased control of access to stationary and low mobility CPRs but highly mobile species continued being used as open access and over-exploited. In contrast, the later privatisation of land by large absentee landowners is likely to pose serious threats to the conservation of the ecosystem in general, and to the ability of low income peasants to maintain their livelihoods in this region.

Keywords: Argentina, Chaco, common-pool resources, *Impenetrable*, land tenure, privatisation, property rights, wildlife.

INTRODUCTION

PROPERTY RIGHTS are the social institutions that determine the range of actions that an individual or group of individuals can take over a given resource (Libecap 1989). Well defined property rights, when properly monitored and enforced, can reduce the uncertainty about who is going to bear the costs and reap the benefits of investments made towards maintaining the resource. For this reason, securing property rights is frequently advanced as an effective strategy to promote protection, conservation or sustainable use of natural resources (Gordon 1954; Scott 1955; Dorner 1972; Anderson & Hill 1975; Johnson & Libecap 1982; Harrison 1987; McKean 2000). In this context, the objective of this article is to assess the privatisation of land tenure as a tool to increase the protection

and sustainable use of common-pool resources (CPRs) in a dry region of the Argentine Chaco where low income peasants depend on multiple CPRs to survive. CPRs are frequently owned under communal tenure and include groundwater basins, irrigation systems, fisheries, forests or wildlife. What they all have in common is that they are subtractable: once a unit of the resource is extracted from the common-pool it is not available to anybody else. It is also very costly to exclude other potential users (Ostrom 1990; Ostrom *et al.* 1994). These two defining characteristics make CPRs susceptible to overuse.

During the past 20 years scholars have successfully challenged the frequently made assumption that CPR users *cannot* avoid the over-exploitation scenarios typically depicted by Hardin (1968). Through field and laboratory work, scholars have started to identify the institutional ar-

rangements under which appropriators are able to avoid the societal losses of open access CPRs (Ostrom 1990; Ostrom *et al.* 1994; Baland & Platteau 1996; Ostrom 1999). There is general agreement on a set of factors that can increase the likelihood that users will engage in collective action to govern the resource. These factors include the appropriators' heavy dependence on the resource, continued dependence over a long period, high levels of trust and some degree of autonomy to make their own access and harvesting rules (Ostrom 2005). Scholars have also seen that when users are able to monitor and learn the general change dynamics of the CPR, they are more likely to find incentives to organise its management (Basurto 2005). Previous research has demonstrated that in certain instances CPR users can develop their own institutional arrangements to avoid over-exploitation of their CPRs—especially when they *can communicate* directly to establish agreements and change the rule structure under which the resource is used (Dietz *et al.* 2003).

In many instances, however, users of a given CPR *are not* able to communicate effectively with other users to find adequate institutional arrangements to avoid the social cost of open access scenarios. In these cases scholars agree that over-exploitation is likely to take place (Gordon 1954; Libecap 1989; Ostrom 1998). The inability of a group of CPR users to reach agreements will cause them to maximise their own short term self interest, yielding outcomes that leave all participants worse off than feasible alternatives. These social dilemmas are also known as public good problems (Olson 1965), free-rider problem (Grossman & Hart 1980), shirking (Alchian & Demsetz 1972) or the moral hazard (Holmstrom 1982). To avoid these social dilemmas, economists have frequently proposed granting private property rights as an adequate policy solution to promote conservation of CPRs.

In the last few decades, especially in developing countries, governments have strongly promoted the privatisation of communal property and state property land (Feeny *et al.* 1990), with one of the objectives being to increase protection and sustainable use of natural resources (McKean 2000; Barrett *et al.* 2001; Gibson *et al.* 2002). The standard argument is that private property allows for the internalisation of many of the external costs associated with communal ownership because owners can appropriate all the benefits by excluding others (Alchian & Demsetz 1973). This concentration of benefits and costs on owners can create incentives to utilise resources more efficiently and reduce transaction costs and over-capitalisation (Scott 1955). The above arguments have led advocates of private property rights to state that because private ownership allows the owner to capture the full capital value of the resource, the owner has an incentive to maintain its long term capital value. The owner of the resource wants to enjoy the current and future bene-

fits of the resource and for that reason will attempt to manage it on a sustained yield basis (Smith 1981).

Other scholars are more cautious and argue that among other things, the positive effects of privatisation will vary depending on the mobility of the CPR. Mobility affects 'the quantity, quality and the cost of information users possess about their resource' and the problems they experience to coordinate their activities and capture the benefits created from such coordination (Schlager *et al.* 1994). When CPRs are spatially stationary their property rights can be easily attached to those of the land (Weimer & Vinning 1992); however, when CPRs are non-stationary such as in the case of wildlife, it has been proposed that land ownership might not be a good strategy to generate incentives for conservation (Naughton-Treves & Sanderson 1995). The analysis of land privatisation for natural resources conservation is further complicated by the fact that people—especially in subsistence settings—depend not on one but on multiple CPRs of varying mobility to sustain their livelihoods (Steins 1999; Dolšak & Ostrom 2003; McGrath *et al.* 2007). With the purpose of contributing to advancing our understanding of this policy issue, the objective of this article is to assess the effects of privatisation of land tenure on the use and conservation of multiple CPRs of varied mobility using a before and after approach. We examine a case in the *Impenetrable*, a region located within the Argentine semi-arid Chaco, where a frontier population of low income *mestizo* peasants depend on a variety of wildlife and forest resources to sustain their livelihoods (Altrichter 2005a). In this region, the central government decided to advocate privatisation of land under the assumption that converting large open land areas to delimited and fenced units will encourage sustainable exploitation of natural resources, including wildlife, and improve rural peoples' livelihoods (Saravia-Toledo 1972; Saravia-Toledo 1985; Bucher & Huszar 1999).

To develop our argument we describe how wildlife and forest use was practiced in this region of the Argentine Chaco before the privatisation process began, when most wildlife and forest resources were treated as open access, and how it is practiced today under the private property regime. Then, we compare the privatisation process undertaken by the government and its effect on the use of wildlife and other natural resources. The government started off by selling small parcels of land to local peasants and later went on to sell large parcels of land to non-local people. However, this is not a study of a change in property rights alone. As in other frontier environments many other factors were also undergoing change (Alston *et al.* 1999), and thus the difficulty of isolating the impacts of changes due to privatisation alone. For this reason, throughout the paper we describe and discuss other important variables such as changes in human population, land use and land cover, and the potential influence of laws concerning international game products trade.

The paper proceeds in the following manner: first, we describe the study design, data gathering methods, and the physical and socio-economic setting. Next we recount the history of the region from a property rights perspective in order to be able to compare the changes in forest and wildlife use before and after property rights were modified. We then discuss the relationship between multiple CPR use with varying degrees of mobility and the implementation of private property in this setting. Although it was not the focus of our research, we include a discussion about the implications that the privatisation by large non-local owners have on the conservation of the Chaco ecosystem and local peasants' welfare. We end with some concluding remarks about the implications of privatisation policies on wildlife conservation.

MATERIALS AND METHODS

Study Design

We use a historical approach to compare CPR use before and after the land privatisation process was implemented by the provincial government. We seek to study the effects of property rights regimes over resources and ultimately to resource conservation. Thus, we trace changes in access and resource use from open access to private property during the period of the study. We consider perceptions of ownership and conflicts among neighbours as indicators of changes in access rights to resources.

The wildlife and forest resources of local importance and varying mobility that we examined include several species of trees (*Schinopsis quebracho-colorado*, *Aspidosperma quebracho-blanco* and *Bulnesia sarmientoi*), one species of parrot (*Amazona aestiva*), several species of armadillos of the family *Dasyproctidae*, and the three species of peccaries of the family *Tayassuidae*. Trees and parrots are considered stationary CPRs. As CPRs, trees are cut for commercialisation of fence posts and charcoal, and provide an important source of income for many local families (Altrichter 2005a). Although parrots are highly mobile during their adult phase, they remain in one specific site during their nesting period, at which time the chicks are harvested for trade, bringing an important source of cash to local families (Altrichter 2005a). Armadillos are considered CPRs of low mobility because they have small home ranges that vary up to 90 ha (Parera 2002). In contrast peccaries are highly mobile. As big social animals (around 30 kg) that group in herds, peccaries have very large home ranges that vary between 600 to more than 3000 ha (Taber *et al.* 1994; Sows 1997). Armadillos and peccaries are an important part of the locals' diet and have high consumptive value (Altrichter 2005a, 2005b). These are the second and third most consumed species in this region after rabbits (*Sylvilagus brasiliensis*). We did not consider appropriate to include rabbits in our analysis because their abundance

varies largely due to diseases and not so much due to human consumption.

In Argentina, wildlife species are considered to be the legal (*de jure*) property of the state and not linked to the land property rights which they inhabit. Thus, a private land owner cannot harvest any wildlife without permission from the state. In practice, however, people have their own perception about withdrawal and use rights (Ostrom & Schlager 1996) towards wildlife in relation to the land property regime where wildlife species inhabit. *De facto* property rights are illustrated by emerging conflicts among neighbours regarding varying perceptions of withdrawal and user rights to wildlife and natural resources in general. For this reason, part of our field research was focused on understanding people's perceptions of ownership and arrangements among neighbours (conflictive or not) to use natural resources.

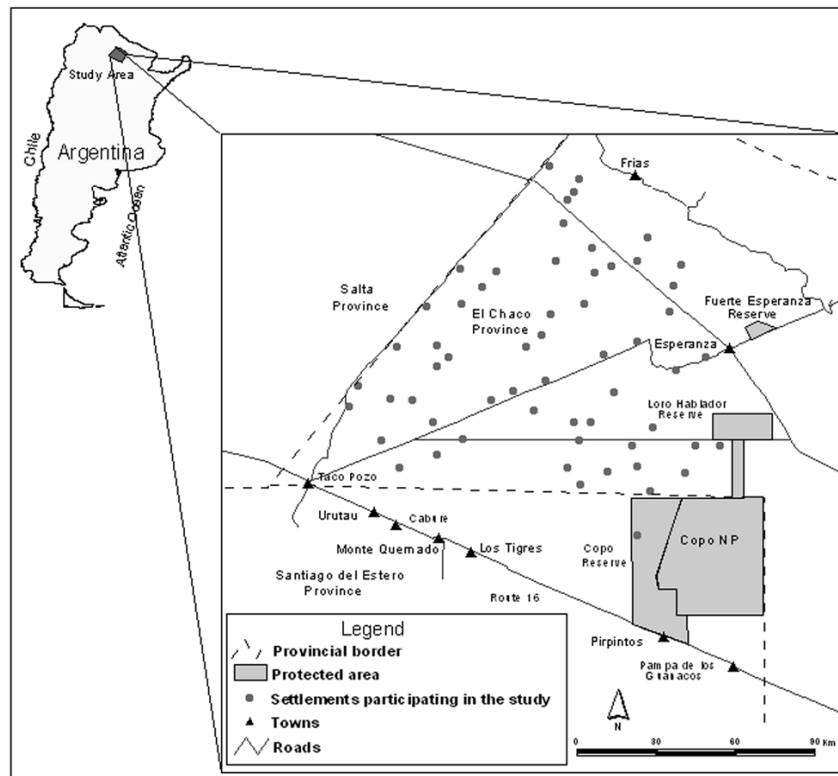
As mentioned before, this is a study of changing property rights (from open access to private property) in the context of a frontier environment where many factors were also undergoing changes. While we could not isolate the impacts of changes in resource use due to privatisation alone, we have reasons to believe that other competing factors are not playing such a strong role. For instance, changes in hunting regulations and laws on international commerce of wildlife were established several years before changes in the property rights regime. Thus, during the period of study these new regulations were already being fully implemented. Changes in population size, land use and land cover did take place as changes in the property rights regime were also taking place, however, as we will describe, these factors affected resource conservation roughly in an equal manner. In contrast, changes in property rights did not affect all natural resources and local residents equally, which we argue helps to explain the resultant variation in the use and conservation of wildlife resources in the region.

Finally, by the end of our fieldwork season in 2003 the land privatisation process had attracted wealthy land buyers to acquire large tracts of forested land (Altrichter 2005a). These owners were not planning to live in this region or maintain their property for long periods. We include in the analysis the privatisation process by large absentee owners because of the effects that they bring to wildlife and forest conservation and *mestizo* peasant's ability to sustain their livelihoods.

Field Methods

We conducted fieldwork in the *Impenetrable* (Figure 1) between June 2000 and August 2003, with an accumulative total of 11 months in the field. Our field study included collection of data on species' relative abundance, hunting rates, reproduction of the most important game species and evaluation of hunting sustainability that has been published elsewhere (Altrichter & Boaglio 2004;

Figure 1
Study area and location of homesteads that participated in the study



Altrichter 2005a, 2005b). For this particular study, we worked with a sample of fifty-eight local families that were chosen randomly from different homesteads (27 per cent of the total number of homesteads and 11 per cent of the total number of households in the study area), and with key informants, some of whom were not part of this initial sample. We visited each selected family several times and during each visit we spent time with them (from several hours to a few days) participating in their daily activities and in hunting events. Throughout the study period, we conducted informal and semi-structured interviews with adult members of these families. We recorded socio-economic information such as household size, sources of income and economic situation. Although all households had several sources of income, we identified the main source for each household as originating from livestock, forest exploitation (charcoal and fence posts) or jobs (salaried or wage labour). From this initial sample of local households, we extended to key informants to learn about the story of the first years of colonisation. Fifteen of these key informants were elderly peasants who were the first settlers in this area, arriving 50–80 years ago. From the time of their arrival, they have experienced changes in land tenure regimes. These elders can recount the evolution of rules, enforcement and monitoring that occurred in this region related to the use of natural resources as they experienced these changes. Testimonies of twenty-five younger peasants were added to

understand more recent changes (from the last 40 years till date). This was complemented by our own observations, participation and secondary sources of literature. We also participated in several local events such as celebrations and meetings. Additionally, we interviewed local teachers, health workers, veterinarians, and personnel of the Colonization and the Forest Institutes.

Given that published literature about the history of this specific area is very scarce, we used local people's accounts as the main source to reconstruct the history of changes in land tenure and use of wildlife. For the same reason we were not able to compare oral testimonies with data from published literature, except by the larger patterns of colonisation which we found to coincide with the available literature. The use of key informants, however, had its limitations because we had to rely on elders' (ranging from 65 to 93 years old) memory of people's behaviour and attitudes towards hunting many years back into the past. In some cases these informants were very young when they arrived in the region. However, high consistency among key informants indicated the validity of the information.

Oral testimonies provided the main source of data. Initial data were obtained through observations and informal interviewing techniques, asking open ended questions regarding the process of colonisation as experienced by themselves, changes in land use and tenure, hunting practices, other subsistence practices, agricultural activities,

relationships with neighbours, and participation in groups, committees and cooperatives. Data were recorded into a journal after the interviews. The patterns and major themes that emerged and are reported here are the result of not only an iterative process of information gathered in the interviews but also through observations in the field and continuous fact checking in each of the later interviews as to be able to support, contradict or gain further insight on the emerging themes and trends.

Study Area: The *Impenetrable*

The Chaco is a vast plain covering an area of about 1.3 million sq km and consisting of dry subtropical forest (Bucher 1983), and extending over part of Paraguay, Argentina and Bolivia. The Chaco is divided into sub-regions based on an east-west rainfall gradient (Morello & Adamoli 1968; Bucher 1983) and covers parts of five provinces. Our study area is located within the semi-arid sub-region in the west portion of the Chaco province and covers about 12,000 sq km of the *Impenetrable* (Figure 1; 24°30' to 25°30' S and 62°50' to 61°40'W). The semi-arid region is markedly seasonal, with an annual rainfall between 450–700 mm and a dry season that lasts for 4–6 consecutive months. The vegetation is a medium-tall xerophilous forest (Bucher 1983). The Chaco ecosystem has been largely degraded by deforestation, agriculture and over-grazing, and this trend has accelerated during the last few years (Torrela *et al.* 2003; Zak *et al.* 2004). The *Impenetrable*, however, was until recently a region with very low human density and the largest extension of continuous forest. It is also one of the poorest, least developed regions of the country (Saravia-Toledo 1985). We did not include in our study area the northern part of the *Impenetrable* that is crossed by the Bermejito and Bermejo rivers where a mixed indigenous and *mestizo* population lives, in order to maintain a more homogeneous physical and cultural study setting.

RESULTS

Communal Setting: Living at the Frontier

The *Impenetrable* presents a particular setting and range of conditions that have not received much attention in the literature, presenting certain contexts that contrast with the rest of the nation: it is a recently settled area (or frontier zone, with homesteads, that on an average were about 30 years old; Table 1) and it is a non-tribal human population with little interaction between neighbouring homesteads as people live spread out in the forest. Furthermore, people's livelihood depends on their ability to use the surrounding biodiversity (Altrichter 2005a). The environment is not suitable for large scale agricultural farming, therefore, people have to make use of forest and wildlife resources for fodder, fuel, food and cash income.

Today, most of the *Impenetrable* is forested and inhabited by peasants who live in approximately 210 small homesteads¹ spread out in the forest in groupings of an average of 1.8 households in the rural area (Table 1).

A typical homestead has a house built with mud and wood, corrals for cattle and goats, and a small deforested area (1–20 ha) where mainly corn and squash used for domestic consumption is cultivated. The rest is forest in different levels of deterioration and exploitation. All households own cattle, goats and chickens, and many have pigs, sheep, and fowl. Livelihoods of rural peasants are based on a combination of activities such as cattle and goat ranching, logging, charcoal, fuelwood production, and to a lesser degree, wage labour. Traditional animal husbandry has been a free ranging system without fencing. Cattle feed on the forest over large areas and only occasionally return to the homesteads when water availability in the forest decreases during the dry season. Although small scale cattle ranching has been the main source of income for peasants since they arrived in this region, forest exploitation started to become more important during the last few years. By 2003, small scale commercialisation of cattle was the primary means of revenue for about 50 per cent ($n=58$) of rural households, small scale logging for about 40 per cent of households, and the remaining 10 per cent obtained their main income from wage labour and jobs.

Colonisation of the *Impenetrable*

The *Impenetrable* has been the last frontier colonised within the Chaco region and remained state property land until recently (Saravia-Toledo 1985). There is no well documented information on the former inhabitants of this region, but apparently, the region was used only occasionally by the semi-nomadic hunter gatherers, the Wichí native people, as part of their seasonal movements, but they did not permanently live in the region because of the lack of water. Starting in the mid eighteenth century, as a result of the Spanish colonisation and the influence of Jesuits and Franciscans, the indigenous people were gradually relegated to a few villages to the north and along the rivers (Caziani *et al.* 2003; Table 2).

Currently, the Wichí indigenous populations are mainly concentrated in villages in Formosa and Salta provinces

Table 1
Characteristics of homesteads and households in the study area

	Mean (SD)*	Mode	Min/max
Individuals per household	5.8 (2.4)	4	1–11
Houses per homestead	1.8 (1.1)	1	1–7
Time homestead has been established (years)	36.2 (18.8)	30	4–83
Current hunting rates of peccaries (individuals/year/family)	3.6 (3.2)	6	0–20

*SD=Standard deviation

Table 2
Main historical events relevant to this study

Period	Main events relevant to this study
1740–1850	Arrival of Jesuits and Franciscans. Indigenous populations are relegated to villages. Slow and scattered process of colonisation by peasants with livestock from the southern part of the Chaco region begins. Open access to land.
1850–1900	The slow colonisation of the region by peasants with livestock continues following a pattern from south to north. No regulations in terms of use of land and settling.
1890–1915	First period of wood exploitation by national and foreign logging companies.
1900–1930	Colonisation of the region by small and large scale cattle ranchers continues.
1920–1930	Expansion of railroads. Increased logging exploitation by British companies and increased rate of colonisation and livestock ranching. Logging sites are determined by logistic constraints such as proximity of roads.
1950–1970	Most intense period of forest exploitation by British companies. Many people from neighbouring provinces arrive in the region to work for these companies and get established as peasants. Commercial hunting for hides becomes an important source of income for peasants. No regulations are implemented in terms of numbers of animals harvested or hunting sites. Non-locals hunt in the region regardless of local peasants' homestead locations.
1980s	High rates of parrot harvest. Between 1985 and 1989 about 210,000 parrots are exported without legal regulations.
1981	Argentina joins Convention on International Trade in Endangered Species (CITES).
1981	The talking parrot <i>Amazona aestiva</i> is included in CITES Appendix II.
1982	The provincial government (El Chaco province) starts to promote privatisation and divides for sale about 2 million ha.
1987	The white-lipped peccary <i>Tayassu pecari</i> and collared peccary <i>T. tajacu</i> are included in CITES Appendix II and chacoan peccary <i>Catagonus wagneri</i> in Appendix I.
1990	Export of hides of several wild species is banned. Commercial hunting decreases significantly as a source of income for peasants.
1992–1994	The export and the national commercialisation of parrots are banned.
1997	A project for the sustainable harvest of parrots is implemented by the National Wildlife Agency.
1995–2000	Peasants begin the titling process of the land they have inhabited. Small scale forest exploitation becomes legal with the titling. Delimitations of properties are marked and peasants begin to associate the natural resources within their property limits with ownership.
2001–2002	Economic crisis in Argentina, devaluation of the national currency and increased value of products for export such as wood, charcoal, meat etc.
2002	Major influx of non-locals purchasing large portions of land from the provincial government or from local peasants.

Sources: Saravia-Toledo 1985; Barbarán 1999; Brassiolo *et al.* 2001; Caziani *et al.* 2003; Trucco 2005; Bolkovic & Ramadori 2006; CITES 2008.

and along the rivers in the northern part of the Chaco province, which was not included in our study area.

Provincial governments have made several attempts to promote colonisation and development of this region through construction of roads, wells, aqueducts and the establishment of villages (Saravia-Toledo 1985). Although the land was state property, access was unregulated and open to everyone who wanted to settle in this region. The largest migration into the *Impenetrable* was between 1920 and 1970 with the expansion of railroads and the logging exploitation by British companies (Saravia-Toledo 1985; Table 2). Peasants looking for land moved from other parts of the Chaco, especially from the neighbouring Santiago del Estero province in the south and Salta province in the west. Some arrived in the region as workers of large logging companies and then settled in the region, while others came looking for new land where they could raise their cattle. Many of them were previously living in other regions of the Chaco where food for cattle in the forest was exhausted and human density was increasing to a point where each family was not able to have enough cattle. Elders explained how they would walk long distances into the forest, sometimes for days, until they would decide at some point to settle down and create their new home. The main criteria they had in mind to choose a site was that neighbours would not be too close in order to avoid overlap of their cattle's ranging

area, and that it would have natural water holes within the range of livestock daily movements, or the possibility to obtain drinkable water from underground reservoirs. The use of this distance criterion created a regular pattern of distribution of homesteads with an average distance of 5 km between neighbouring homesteads. The government dug some wells as an incentive for colonisation of the region; these were also at a distance of 5–10 km from each other. After an initial cleaning of the area, the pioneers brought their families, built homes with wood and mud, brought their livestock and established their homes. Although the state did not regulate homesteads or grazing, peasants were expected to pay the provincial government a 'right to pasture' fee that was proportional to the number of cattle owned by them. Very few peasants paid this fee and there was no enforcement. This process of colonisation is still ongoing, although more slowly, with peasants arriving from other parts of the country, or with the descendants of the older settlers who are looking for new land to start their own ranches.

From Open Access to Private Property in the *Impenetrable*

In less than 90 years, land property rights regimes have changed several times in the *Impenetrable*. Initially, all

land belonged to the state but a *de facto* open access regime prevailed. Since 1982, the provincial government started to promote privatisation and divided for sale more than 2 million ha (Saravia-Toledo 1985). Privatisation has been promoted in two ways. First, the government provided incentives to local peasants for acquiring the title of the land they had been living in for a long time (at least 30 years). Later, the government started selling large portions of state land to non-local people and livestock ranch companies.

During the last two decades, the provincial government gave the opportunity to local peasants who live in this region to acquire titles for the land. However, this process did not really take place until around 1995. The title acquisition opportunity was different for older settlers and newcomers. Settlers who had been living in the region for more than 30 years could buy 250 ha of land at a very low price (1/4 of daily wage per ha), and they could buy additional land at a higher price (about two daily wages per ha). Children of settlers, and recent settlers (who have lived in the region for less than 30 years) could also buy land at the higher price. The titling process, done through the Institute of Colonisation (IC), has three phases: 1) the settler requests the IC for a title for the land he had been occupying; 2) the IC reviews and evaluates this solicitation and assigns the land to the settler; and 3) after the settler pays the total price and fulfills some requirements, he obtains the final title to the land. The land is assigned to the settler after the IC assesses the household situation, the limits of the property have been marked and the settler has paid a certain portion of the total price. At this point the settler can log the forest for fence posts or charcoal production under forest management plans approved by the government. In order to acquire the final title, peasants have to pay the full price of the land and are required to make 'improvements' such as building their houses with bricks and concrete and fencing the property. However, by 2003 none of the local peasants interviewed had fenced their property or changed their house construction. Some people marked the limits of the property by bulldozing a strip of about 5 m around their properties while others left it unmarked. By 2003, most rural households (70 per cent) owned or were in the process of adjudication of land ranging from 250 ha to 3500 ha, with a mode of 250 ha and a mean of 1029 ha (SD=934.5, $n=58$). Only 22 per cent ($n=58$) of rural households had been assigned more than 1500 ha. Because the title becomes necessary only for selling the land and most peasants had no intention to sell, they had little incentive to obtain the final title. The situation started to change around 2002 when non-locals began to purchase land in the region.

Most peasants acquired the land surrounding the homestead where they had lived for several years. However, some peasants (about 15 per cent of our sample) were given land that was far from where they lived, and they either moved to their new property or stayed in their ex-

isting homesteads and continued using the land they occupied. These were cases where peasants had been living in somebody else's land as caretakers, or they had been leasing the land by sharing with the owner the income generated from livestock sales and forest exploitation. Some peasants had established their home on land that was later declared as an indigenous reserve, and for that reason they were assigned land far from their homesteads. In a few cases, there was not enough land for some families to acquire around their home and for that reason they were given land far away. It will be later explained how those located at a distance from their land faced obstacles to monitor their property.

A more recent form of privatisation is the titling of large extensions of land by non-locals. This process does not go through the assignation period but directly to titling. Because of the 2001 national currency devaluation, previously marginal land such as the *Impenetrable* acquired more value given the high prices and scarcity of land elsewhere and the increased value of wood, cattle and agricultural products to export. At the time of our fieldwork, the titling of land by companies and by non-local ranchers was starting and rapidly accelerating. Absentee owners were buying large portions of land (from 1500 to 10,000 ha) from the government or from local peasants. After buying the land, new owners fenced their property and removed livestock of local people that were grazing inside. Then, some engaged in extractive activities such as forest exploitation or livestock ranching, while others did not use the land in any way but rather kept it as an investment.

Changes in Forest and Wildlife Use

Users and scale of use of forest has changed with changes in property rights. During the colonisation of this region, resident peasants were not able to legally exploit the forest for commercial purposes, nor did they have the means to do it. However, large logging and charcoal companies working under concessions granted by the provincial government heavily exploited the forest between the 1950s and the 1970s (Table 2), with regions closer to main roads and towns suffering the most intensive exploitation (Saravia-Toledo 1985). Because of this intensive logging, most valuable tree species were removed and the forest became dominated by thorny bush species. For several years, companies exploited the forest regardless of the presence of peasants, who recounted that they were unable to stop these companies from logging next to their homesteads. Instead, they found ways to capture some of the benefits of their presence by working for them or selling goods and services to company workers.

After the process of land acquisition by resident peasants began, commercial exploitation of forests became possible for them. The government encouraged locals to exploit the forest as a way to obtain cash to pay for the land title, and in recent years, the increased value of for-

est products for export has provided additional incentives for logging. However, the scale of forest exploitation practiced by peasants is still small, limited in part by economic and logistic constraints, and in part by the need to maintain the forest as fodder for livestock. By 2003, many households had not begun to exploit the forest even when they legally had the capacity to do so.

Wildlife exploitation has also changed; first as a consequence of international wildlife trade regulations and later as a consequence of property rights modifications. Wildlife exploitation changed from commercial, large scale unregulated hunting to subsistence and small scale, regulated commercial hunting. For almost 20 years, commercial hunting of wild species for hides constituted one of the main sources of income for rural people in the *Impenetrable*. Locals recall that there were no formal or informal regulations in terms of hunting sites and quantities of animals that could be hunted. Hunters used to move throughout the landscape without recognising neighbours' properties, and would hunt or put traps anywhere they wanted. People said that they hunted as much as they could because it represented a quick and easy way to obtain income without much effort. For example, trading one skin of a wild cat (*Felis geoffroyi*) would provide enough money to purchase food for one week. Non-local hunters also had open access to wildlife in the rural area, operating anywhere without needing to obtain permission from the locals. These hunters would camp close to a homestead and spend days harvesting wild animals. Because these hunters had better technology, worked in groups and were completely dedicated to this activity, they were able to hunt many more animals than their local counterparts could. Local peasants said that depletion of species of value was evident after these hunters had been in a site for several days. However, they could not deny access to them because of the absence of ownership of the land: 'The land and every natural thing on it belonged to everybody.'

Then the international market for hides decreased and Argentina joined the CITES in 1981. The CITES Argentine authority regulated export of hides of peccaries in the late 1980's until all hides in stock were sold (Barbarán 1999; Table 2). Although commercial hunting for hides decreased after exports were banned, local and outside hunters continued harvesting in large quantities those species that had value in the black market as pets (parrots) and meat (armadillos). Even though state and provincial laws regulate hunting, due to the lack of enforcement capabilities, locals continued practicing subsistence hunting in an unrestricted way in terms of species, season, number of animals harvested per hunter, and places to hunt. However, since the privatisation process promoted by the provincial government began, there has been an evident change in how people perceive the rights to use different species of wildlife. Such perceptions are influenced by the varying mobility of each species.

Mobility, Private Property and Access Controls

Perception of ownership of some resources has changed with the transition from an open access regime when anybody could harvest resources anywhere, to a private property regime where owners have incentives to control access to their properties. These changes of perceptions are illustrated by the emergent conflicts between neighbours regarding rights to use natural resources. These changes, however, have not occurred equally for all resources. Resources with no mobility such as trees rapidly became considered as private by resident peasants concomitantly with their acquisition of land properties. Today most settlers consider the trees on their lands as private property. Even though most property limits are not marked, peasants are now aware of them and patrol the limits of their property on a regular basis. Those who live far from the property that they were adjudicated expressed resignation about the loss of trees since they could not control access to the land.

The adjudication of land to peasants has also influenced the relationship between local peasants and logging companies. Unlike in the past, logging companies could no longer operate on land that was currently under the process of acquisition by locals or under private ownership, unless they had permission from the owner. Logging companies, however, continued operating in the remaining open access lands.

One of the other important resources with no mobility, parrot chicks, also became considered as private property by resident peasants after the privatisation of land tenure. Although adult parrots are highly mobile, the time for harvesting is when chicks are still in the nest and thus immobile. Parrots have high commercial value for export as pets and the government has developed harvesting restrictions. Local peasants harvest parrots as part of a project designed by the Argentine Federal Wildlife Agency. This agency regulates the collection of parrots and their commercial sale. Some locals receive an important amount of cash from this activity, equivalent in 2003 to about 2 months of work at minimum wages. As an incentive to titling, only households who have land adjudicated can participate in this project, and they can only harvest a given number of parrots within their property limits. Government officials determine the number of parrots allotted to each landowner.

Peasants were unambiguous when responding that parrots belong to the owner of the land where they are nesting and can be harvested only by the landowner, which is a very different perception of ownership than the one people had before the privatisation, as demonstrated by their harvest patterns. Before privatisation, local families would regularly harvest hundreds of parrots, regardless of their properties' location. Currently, the quota is fixed by the government and does not exceed thirty parrots per family. Because locals can easily recognise nesting trees,

they can adequately estimate the number and location of nests within their property. However, the amount and distribution of suitable nesting trees existing within the property of each settler varies. As long as peasants can find enough nesting parrots within their private property no conflicts emerge among harvesters. Conflicts emerge, however, when people cannot obtain the maximum number of permitted parrots within their property limits, and find it worthwhile to trespass into somebody else's property to complete their allocated quota. This may occur because of different property holding size, different quality of forest between properties or because of the patchiness of the distribution of nesting trees. The perceptions about ownership of armadillos are similar.

Armadillos are animals of low mobility and six species are used for food in this region (Altrichter 2006). Armadillos are a traditional favourite source of meat, constituting the second most consumed wild meat, after rabbits. As with valuable trees and nesting parrots, people stated that armadillos inhabiting their property belonged to them. Thus, conflicts have started to emerge when people trespass property limits to harvest armadillos. Peasants' reactions to intruders varied between letting intruders hunt because it would be rude otherwise, and asking them to leave. Others responded that they negotiate, asking intruders to hunt only a few individuals or share the harvest. This variation in responses to intruders may reflect the fact that armadillos are not yet a scarce resource. It may also reflect a period of transition of perceptions, between the past notion that access to hunting could not be restricted and the new notion that a private property regime provided them with the right to restrict access.

It is difficult to assess whether the current hunting pattern of armadillos under a private property regime is more sustainable than in the past under an open access one. According to all interviewees, the frequency of armadillo hunting and the number of individuals killed per hunting event have decreased, but this could also reflect a decline in armadillo populations rather than a change in hunter's behaviour. However, what is clear is that there has been a change in perception of 'ownership' of these animals, as well as an emergence of the notion of taking care of the resource. Locals' attitude towards illegal commercial hunters from nearby towns and cities is very different from the past. While in the past non-local hunters would harvest armadillos anywhere, today they find it more difficult. Most (80 per cent) of the peasants interviewed who had begun the titling process of the land stated that they deny access to commercial hunters into their properties. The most common reason they gave (85 per cent) for this change was that outside hunters can deplete the local armadillo population. Other reasons mentioned were that outsiders may kill domestic animals, steal fencing or other tools etc. Denying access to commercial hunters is probably related to the fact that armadillos' home ranges are usually smaller than land

holdings, and thus, owners can develop knowledge about the distribution and abundance of the resource within their property. Thus, they are able to recognise armadillo population trends in short periods of time. By controlling access to commercial hunters locals may be reducing overall hunting pressure, which in turn may lead to a more sustainable use, even in the absence of a change in their own hunting patterns.

These changes observed in the use and access controls for trees, parrot chicks and armadillos have not occurred with regard to more mobile game species, such as peccaries. These species continue to be used as open access resources and are over-exploited (Altrichter 2005b). Peccaries have very large home ranges surpassing the mode property size of 250 ha. One of the three species of peccaries, the white-lipped peccary, has been classified as migratory or nomadic, travelling in large herds (Sowls 1997). Peccaries are highly appreciated as a source of meat, and constitute the third most consumed wild meat in the region. In the past, their hides had high commercial value, whereas currently they are used only for domestic purposes.

Local peasants did not show a change of attitude and perception towards the rights to use these species related with the acquisition of land ownership. When specifically asked about ownership of peccaries, peasants who periodically hunt these species (thirty-seven out of fifty-eight) unequivocally responded in ways that indicated the undefined ownership of these animals: variations of the response 'peccaries do not belong to anybody' were common among these hunters, in contrast to 'if they are in my property, they are mine' when referring to armadillos or parrot chicks. Hunting rates estimated at the time of this study (Altrichter 2005b) confirmed this perception, as it was found that hunting efforts had not decreased in comparison with the period before land titling and hunting sites were independent of property boundaries. We did not find evidence of conflicts among neighbours regarding places to hunt peccaries or number of animals harvested.

The land privatisation process has not affected peccary harvesting practices of locals or non-local hunters. The incorporation of firearms has increased the efficiency of peccary hunting. The number of individuals killed per event was only limited by logistic constraints, such as the capacity to bring the harvested animals back to the house. The number of peccaries harvested ranged between four and twenty animals per family per year. This unrestricted hunting has negatively affected peccary populations; peccaries have been declining during the last decades, and they have disappeared in sites with higher human density as a result of overhunting (Altrichter & Boaglio 2004; Altrichter 2005b).

This lack of change in perception about ownership and rights of access to peccaries may result from the fact that local peasants are unable to develop information about the behaviour of the peccary populations and of their fellow

users because home ranges of peccaries are bigger than each household's land holding. Locals mentioned that peccaries pass by their properties but do not permanently reside within it, and it is unpredictable where and when they will pass again. Therefore, people try to avoid missing the opportunity to hunt peccaries when a herd passes by their property, and they kill as many as they can.

Privatisation and Resource Conservation Under Recent Large Land Ownership

It is important to remark that the acquisition of large extensions of land by absentee owners is not only ineffective for wildlife protection but it is also having negative effects over the small local owners' ability to maintain their livelihoods. As Libecap (1989: 22) stated in the past, 'where the parties are heterogeneous and where customs have governed resource allocation and use, the installation of more formal property rights may involve risks for some groups.' In this case, as large absentee owners fence off their private properties, livestock owned by small local owners will not be able to roam large areas in search of food and available water holes as they did in the past. For example, two of the families with whom we worked had to reduce their livestock by half when the grazing area for their cattle decreased after being surrounded by large properties with fenced boundaries. Due to the degraded conditions of the land and patchy distribution of grazing areas in the *Impenetrable*, cattle and goats need to range over large extensions of land in order to survive most of the year. These areas are much bigger than the average property size of local peasants. It has been estimated that a minimum economic unit for agriculture is 650 ha and for livestock ranching is 1200 ha in this type of environment (CEIS NM 2006). However, the size of the land assigned to the majority of families did not exceed 500 ha.

As the process of privatisation by non-locals becomes more prevalent, local peasants may only be able to sustain the amount of livestock that their own small properties can support. If these people's economic situation worsens, they may have to sell their properties and move away, or become employees of the new absentee owners, or have to increase their forest exploitation and hunting activities to obtain food, thus increasing pressure on vital natural resources. As it has been found in this region and other parts of Latin America, poorer households tend to consume more wild meat than richer ones (Ojasti 1996; Altrichter 2005a). It has been extensively argued that over-grazing in the Chaco has been the major factor degrading the ecosystem and lowering productivity since the colonisation by peasants (Morello & Saravia-Toledo 1959; Morello & Hort 1985; Bucher *et al.* 1998; Bucher & Huszar 1999). However, under the traditional system of the rural peasants the ecosystem has been degraded but not totally transformed into agricultural lands. This trans-

formation is likely to occur under the new privatisation regime by large owners, as it is happening in other parts of the semi-arid Chaco of Argentina where soybean plantations are rapidly replacing the forest (Torrela *et al.* 2003; Zak *et al.* 2004; Grau *et al.* 2005). Although information about the most current land tenure situation in the *Impenetrable* is not accessible, provincial statistics indicate a pattern of land concentration and privatisation by large owners. Seventy percent of land is concentrated with seven per cent of owners. In 1995 there were between 2.5 and 4 million ha of state land, but in 2005 this was reduced to about 700,000 ha destined for small and medium producers and indigenous populations (CEIS NM 2006).

CONCLUSION

In this paper we describe how access and use rights have changed when private property rights have been developed in the context of multi-CPR use with varying levels of mobility. The results of this study indicate that the management of highly mobile wildlife resources such as peccaries continues to be under an open access regime. As the size of their home range exceeds the size of local peasants private properties, owners cannot develop information about future returns, nor find incentives to develop mechanisms to monitor and control access to this resource. Thus, private property owners are likely to face incentives to take as many peccaries as possible while these are within their property. A previous study showed that peccary populations have been declining steadily during the last decades. Even though commercial hunting was illegal, hunting of these species continued to be unsustainable (Altrichter 2005b). In contrast, stationary and low mobility resources such as trees, parrots and armadillos seem to be managed in a more controlled manner by local peasants. Private land tenure has facilitated the emergence of access controls to resources of low mobility. Local peasants now perceive these resources to be of their private property, and find incentives to control access of non-local hunters, bargain and negotiate with neighbours and with logging companies, and make decisions about what resources they want to exploit and how. This is an evident change since the times when access to resources was open: with no restrictions on hunting, locals and non-locals exploited all wildlife as open access and logging companies exploited the forest anywhere.

By the same token that privatisation brought a more controlled use of stationary and low mobility resources, privatisation also brought large absentee land owners who were on the path of transforming the *Impenetrable* landscape into agricultural or cattle monocultures. Absentee land owners have acquired the land at a very low cost, and a maximum rapid return from it is what makes more economic sense. For them, cattle ranching offers the best use and brings the highest benefits in return to their in-

vestment, and so they are not hesitating in transforming the forest into a pastureland, which will in turn threaten most wildlife species including those of low mobility.

Using private land tenure as a policy to increase protection and sustainable use of species of low mobility will yield favourable results as long as protection and sustainable use provides the best use and the highest benefits to the landowner. Conservation will not be favoured as long as transforming or liquidating the natural resource brings the highest rewards (Alston *et al.* 1999). Such uses can take the form of the commercialisation of wood and charcoal or clearing forest for pasture (Acheson 2000).

In brief, the use of privatisation as an effective policy to promote the protection of all wildlife species and the use of sustainable natural resources becomes hard to sustain. In subsistence settings, where people depend on the use of multiple CPR systems to sustain their livelihoods and where the CPR units are of varying mobility, special caution should be exercised when assessing the use of private property policies. Privatisation policies can create social inequalities that can further make conservation of natural resources more difficult to achieve and leave local resource users worse off than before privatisation policies were implemented. If policy makers are indeed committed to promoting the conservation of wildlife and other natural resources in the *Impenetrable*, we encourage them to devise policies that prevent the loss of suitable habitat for wildlife. Such policies must be able to assure fair basic rules for all stakeholders involved, so that they can all find incentives to participate in designing enforceable limitations to the conversion of forest into agricultural land.

Note

1. We use the term 'homestead' to refer to a group of related households, however, we found a few exceptions in *Impenetrable*.

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