

BRINGING FOREST AND POVERTY INTO FOCUS IN THE CHACO ECOREGION – ARGENTINA

Descriptive and Quantitative analysis

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1 Introduction

It is estimated that about 1.3 billion people—nearly 20 percent of humanity—rely on forests and forest products for their livelihood, with most of them living below the extreme poverty line (Sunderlin et al., 2007). Earlier work using either case study data (Debela et al., 2012; Fisher, 2004; Wunder et al., 2014), or global datasets such as the Poverty Environment Network (results published in Angelsen et al., 2014) shows the importance of forest resources for poor households throughout the world. Forest products help households to fulfill their basic food and energy needs (Angelsen et al., 2014), to cope with shocks (Angelsen and Dokken, 2018), and to improve welfare (Fisher, 2004; Perge and McKay, 2016). To assess the extent to which forests can improve welfare, Shyamsundar et al. (2020) identify five independent or reinforcing pathways: increasing the productivity of forest land and labor; empowering forest communities; improving forest-related institutions; creating or developing markets; and protecting forest ecosystems.

The population of the Argentinian Chaco Ecoregion in the provinces of Salta, Jujuy, Formosa, Chaco, Santa Fe, Córdoba, Catamarca, Tucumán, Santiago del Estero, is one of the poorest in Argentina. Although there are no formal data on poverty in rural Argentina, poverty in the urban areas of the Chaco Ecoregion in the first semester of 2019 was about 10 percentage points higher than the average poverty rate of 25 percent for Argentina as a whole in the same period (INDEC, 2019). The population in Chaco Ecoregion includes a blend of campesinos¹ and indigenous peoples whose economic activities rely mainly on forests and livestock: wood and non-wood forest products (NWFPs) are used for sale and consumption and represent an important source of livelihood for the population. Additionally, the forest influences people's ways of life, decisions, life organization, social integration, and community activities. To improve forest households' livelihoods, the Government of Argentina implemented in 2017 the "Native Forest and Community"² project to support and assist communities to implement an Integrated Community Plan (PIC)³ aimed at establishing planification of forest, agricultural, and livestock activities in a participative way within these communities.

Although the present report is not meant to be an evaluation of this project, it aims to assess households' dependence on forest resources, in the communities where the project is implemented and to identify how forests can help to improve welfare. This assessment provides a description of households' activities and their reliance on forest resources and explains how households' uses of these resources could change in the face of changes to the regulations on forest uses and climate change. This report relies on quantitative and qualitative data on campesinos and indigenous households in Chaco, Salta and Santiago del Estero provinces between 2017 and 2019. A qualitative survey administered in 2018 provides information on the perceptions and

¹ Campesinos is the Spanish word used to describe peasants or farmers working on small-scale production.

² In Spanish Bosques Nativos y Comunidades.

³ Plan Integral Comunitario.

behaviors of interviewees concerning the relationship between forest resources and welfare, use of forest products, and forest-related ways of life, and perceptions and knowledge about forest institutions, and perception of changes and adaptations to their environment. The quantitative data come from two surveys: a comprehensive survey of 253 households which provides detailed information on income sources (farm and non-farm) for 2017, and a most recent survey from 2018 and 2019 focusing on sales and self-consumption of forest and livestock resources but providing no information on other sources. Unfortunately, neither of these surveys collected data on household characteristics and off-farm/off-forest activities.

According to the descriptive analysis, access to water is scarce for campesinos and indigenous peoples in all the provinces. Firewood is used to supply energy for cooking, heating, and lighting for most households. In terms of productive activities, more than 90 percent of campesinos and indigenous people participate in forest activities. Most wood products are sold (round-wood, wooden posts, charcoal) although firewood is produced mainly for self-consumption. Other products sold are handicrafts, honey, and livestock (mainly cattle and goats). Earnings from wood products are the more profitable, following by livestock. The higher participation of campesinos in these activities explain in part their higher income. In fact, indigenous people are more dependent on forest, mainly NWF and craft production, and campesinos are more dependent on livestock and wood production.

For indigenous peoples, forest resources represent the raw material for their production, medicine for health care, energy for their houses, and food for their families. They perceived the arrival of agroindustry and the associated deforestation as a threat to their livelihoods. Also, climate change is affecting their economic activities, mainly through the impact on water for consumption and production. The communities are organized in associations, which support commercial and productive activities, education, forest conservation, and land rights. These associations serve as a cope mechanism against threats.

The report is organized as follows, section 2 discusses the study context and describes the forest project at the origin of this report. Section 3 explains the research framework. Sections 4 and 5 present respectively the descriptive statistics for living conditions and economic activities among the households surveyed. Section 6 discusses households' welfare and links to forest, and section 7 concludes the report.

2 Forest and poverty in Argentina and the Chaco Ecoregion

Eleven percent of the land area in Argentina is covered by forest with 90 percent of this in the Chaco Ecoregion in northern Argentina. The Chaco Ecoregion includes from the northwestern two-thirds of western Paraguay, to the east of the Andes in southeastern Bolivia and northwestern Argentina (Olson et al., 2001). Its forest

habitats are diverse, varying from savannah to thorn forest. The most important trees species are Quebracho (white and red), Prosopis (algarrobo, a thorny legume), Mistol, and Bromelia serra (chaguar). Quebracho woodland, is more open than thorn forest, and is characterized by thorny bushes (e.g. chaguar), shrubs, and cacti, with a scattering of trees of up to 13 meters in height.⁴ The biodiversity of the region is very rich, with 145 mammal species (12 endemic), 409 birds (7 endemic), 54 reptiles (17 endemic), 34 amphibians (8 endemic), and more than 80 plant genera (3,400 species, of which 400 are endemic) (Piquer-Rodríguez et al. 2015).

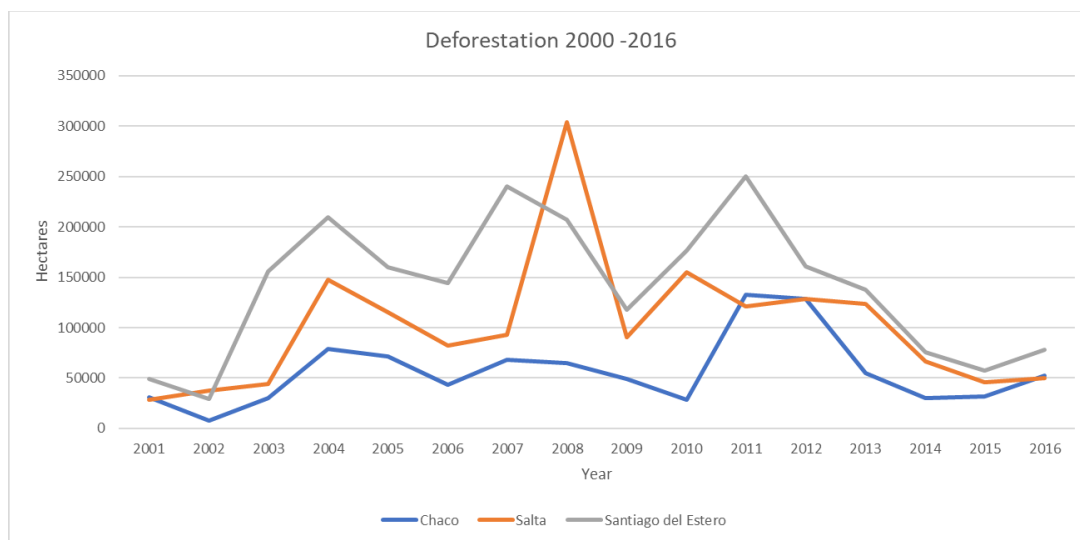
This study focuses on three of the nine provinces in the Chaco Ecoregion in Argentina: Chaco in the Northeast region, and Salta and Santiago del Estero in the Northwest region. These three provinces are home to over 3 million people (7 percent of Argentina's total population) and cover 60 percent of the Argentine Chaco Ecoregion surface.

Unfortunately, the region has the highest rates of deforestation in the country, and Argentina the highest rate of deforestation in the Latin American region. Between 2010 and 2015, Argentina was ranked 9th in the world top ten countries reporting the greatest annual net loss of forest area, with an average loss of 1.1 percent per year (FAO, 2015), and a deforestation rate three times higher than Latin America (OECD, 2019). Between 2006 and 2011, more than 1.5 million hectares of natural forest in the Chaco Ecoregion were destroyed due to the expansion of soy and cattle production, and uncontrolled (often illegal) forest exploitation. From 1977 to 2010, the Chaco Ecoregion suffered a total loss of 22.5 percent of its forest (Piquer-Rodríguez et al., 2015). Deforestation figures for the three provinces in the study area are correlated and vary between 50,000 and 300,000 hectares per year and per province (figure 1) (Barra and Russ, 2019). Biodiversity is being reduced, soil and water resources are being degraded, and carbon emissions are increasing.

This degraded environment is home to Argentina's poorest communities. Poverty in Argentina is geographically disparate with indigenous people the most likely to be poor. Although among the countries in the Latin America and Caribbean regions, Argentina has the lowest poverty rates, it has significant regional differences in poverty levels and access to basic services. In 2010, according to a basic needs index, 18 percent of its rural residents had unmet basic needs compared to 9 percent of urban households. The provinces of Chaco, Salta, and Santiago del Estero are among the most vulnerable provinces: the percentage of households with unmet basic needs in these provinces is almost the double the Argentinian average, with rural households being especially vulnerable (figure 2).

⁴ <https://www.worldwildlife.org/ecoregions/nt0210>

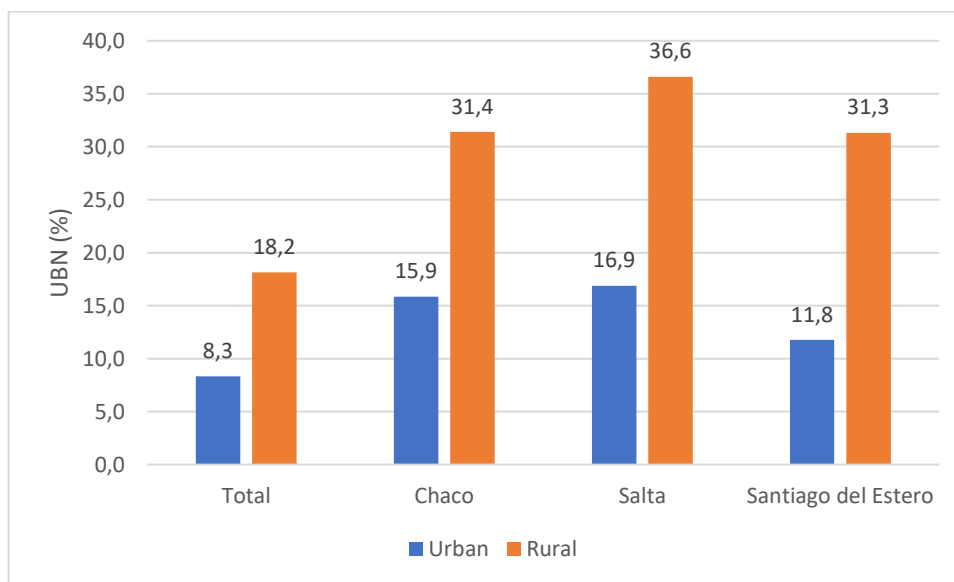
Figure 1: Evolution of the deforestation in Chaco, Salta, and Santiago del Estero



Source: Extracted from Barra and Russ (2019).

Note: Y axis represents the deforested land area in hectares. X axis represents the years. Chaco in blue, Salta in orange, and Santiago del Estero in gray.

Figure 2: Unmet basic needs (UBN) in urban and rural areas in 2010



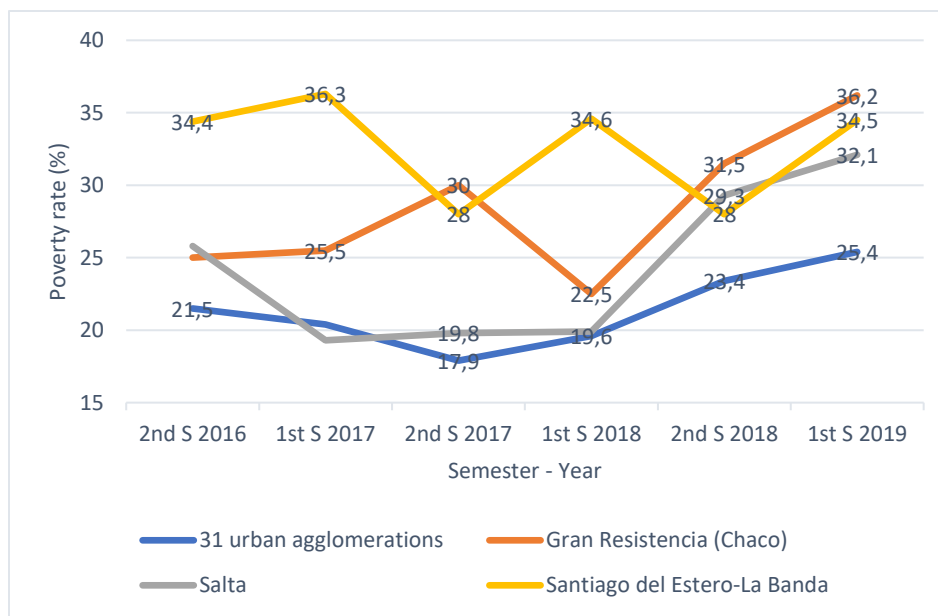
Source: Own computation using data from Population Census 2010

Note: Y axis represents unmet basic needs (UBN) in percentage. Urban areas in blue and rural in orange.

In terms of poverty in urban agglomerations, the poverty rate in the first semester of 2019 ranged from 36 percent in Gran Resistencia (Chaco Province), 34 percent in Santiago del Estero (Santiago del Estero Province),

and 32 percent in Salta (Salta Province) compared to the average poverty rate of households in Argentina of 25.4 percent (figure 3). Overall, in the 2016-2019 period, the poverty rate in these provinces was consistently below the Argentinian average (with the exception of Salta in the first semester of years 2017 and 2018).

Figure 3: Poverty rate in urban agglomerations of Argentina 2016-2019



Source: Own computation using data from INDEC (2019).

Note: Y axis represents the poverty in percentage. X axis represents the semesters. A set of 31 agglomerations in blue, Chaco in orange, Salta in gray, and Santiago del Estero in yellow.

These communities depend to a great extent on forests for their livelihood. The provinces studied (Chaco, Salta, and Santiago del Estero) are inhabited by campesinos and indigenous peoples who are small-scale producers of forest and livestock products. Indigenous people are one of the largest and most vulnerable groups of rural poor.

Traditionally, the indigenous peoples, mainly from the Wichí group, were nomads and participated in hunting, fishing, and harvesting activities. They now live in rural and peri-urban settlements, with some communities still nomads, and continue to practice the same activities based on the diversified use of natural resources, in addition to paid jobs and government and association aid. Their language is Wichí-Ihamtes which has several dialects. They reside mainly in Formosa, Chaco, and Salta and in 2004 numbered between 36,000 and 50,000 people, with 28 percent living in urban agglomerations.⁵ The social and political organization of the Wichí population is structured in family networks in communities without centralized political power known as

⁵ Encuesta complementaria de Pueblos Indígenas, 2004-2005.

“egalitarian societies”. Other smaller indigenous groups in the studied areas include Toba (Salta), Tonocoté, Lule (Santiago del Estero), and Qom (Chaco).

The campesinos or *criollos* arrived in the Chaco region in the 20th century as part of the agro-industrial expansion. They live in a dispersed way, with the family (rather than the community) as the social unit. They participate mainly in livestock activity but combine this activity with harvesting and hunting.

Extensive cattle raising was introduced in the region in the mid 18th century together with systematic forest exploitation. Red quebracho was exploited as the raw material for tannin, firewood, wooden posts, and railroad ties. White quebracho and algarrobo were used to produce charcoal. Nowadays large-scale agro-industrial producers have entered in the region and are engaged in extensive cattle rearing and soybean production. The increasing demand and profitability of soy products is increasing the pressure on soy producers and investors. Argentina is the third world producer of soybean but the remaining land area available for soy production is marginal. This has resulted in increased exploitation of arid and forest zones for soy production, especially in the Chaco region. In 2003, the agricultural sector in Chaco, Salta, and Santiago del Estero contributed respectively 17 percent, 22 percent, and 21 percent to provincial gross domestic product (GDP) (Nolte et al., 2017). In the period from 1990 to 2005, agriculture activities were the drivers for 90 percent of the forest loss: half due to pasture and half to commercial crop (De Sy et al., 2015). As a result, the former big grasslands have disappeared, and forest coverage and quality have been hugely reduced with lowland forest and shrubs of different species more common. This has led to use of the term “bush” (“monte” in Spanish) rather than “forest” in the local vocabulary, as a derogatory term. Nevertheless, this “low value forest”, is still of high value to local population. It is a source of wood for housing construction, work tools, and energy, fruits, natural medicine, raw material for craft work, and food for livestock.

This uncontrolled deforestation led to adoption of the latest Forest Law⁶ which was sanctioned in 2007 and enacted and regulated in 2009 to establish the basis for environmental protection in Argentina, for enrichment restoration, conservation, and sustainable management of forest resources. The Law has three main instruments: a) Territorial Organization of Native Forests (OTBN);⁷ b) the National Program for the Protection of Native Forests; and c) the National Fund for the Enrichment and Conservation of Native Forests (FNECBN).⁸

According to the OTBN, each province contributes to a participatory process to create zonings or categories of forest areas: areas for protected forests (category I, red); areas for sustainable forest uses (category II, yellow);

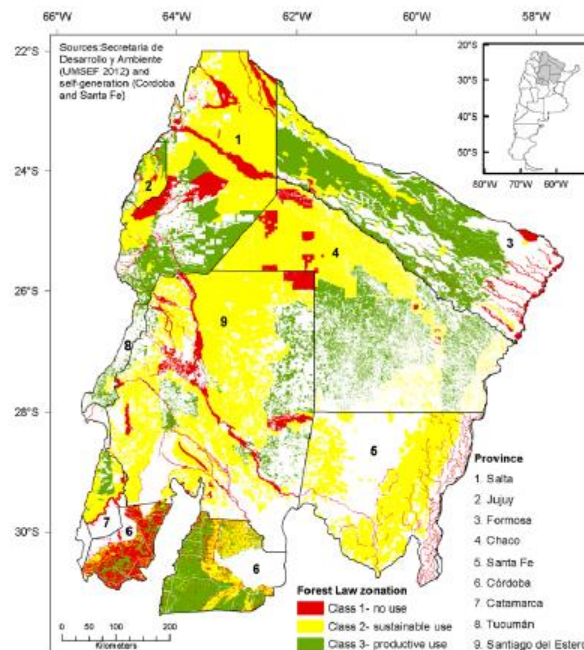
⁶ Ley 26.331 de Presupuestos Mínimos de Protección Ambiental de los Bosques Nativos.
<http://servicios.infoleg.gob.ar/infolegInternet/anexos/135000-139999/136125/norma.htm>

⁷ Ordenamiento Territorial de los Bosques Nativos.

⁸ Fondo Nacional para el Enriquecimiento y la Conservación de los Bosques Nativos.

and areas for commercial uses including conversion to agriculture (category III, green). The red areas have high conservation value and cannot be exploited except by indigenous communities or for research. The yellow areas have medium conservation value and can be used for sustainable uses, harvesting, tourism, and research. The green areas are forests with low conservation value, and can be exploited fully or partially following the norms established by the Forest Law (figure 4)

Figure 4: Forest cover and uses in Argentine Chaco Ecoregion



Source: Extracted from [Piquer-Rodríguez et al., 2015](#).

Note: Forest for commercial uses in green, for sustainable uses in yellow, and protected forests in red.

The objective of the National Program for the Protection of Native Forests is: to promote and establish regulation for sustainable management of native forests in categories II and III, taking into account the indigenous communities which are dependent on forest resources; encourage the creation and management of forest and reserves; promote plans for the reforestation and restoration of forests; generate and update information on forest cover; provide technical support for formulation and monitoring of the Management and Conservations Plans; and promote conservation, restoration, use, and zoning measures.

The FNECBN instrument is a Payment for Ecosystem Services (PES) system which compensates (pays) the jurisdictions that conserve native forests which provide environmental services. According to the Forest Law, at least 0.3 percent of the national budget and 2 percent of the revenue from export taxes to agriculture and forestry products should be allocated to the FNECBN ([OECD, 2019](#)). The fund is allocated as follows: 30

percent goes to the local authorities to provide technical and financial support for the monitoring of native forests and implementation of programs for small producers (indigenous and campesinos communities); 70 percent goes to forest land holders who submit Annual Operation Plans (POA)⁹ for Conservation Plans (PC), Sustainable Management Plans (PM), and/or financial assistance to formulate those plans (FP). The Management and Conservations Plans (PM and PC) allow the owners of native forest to plan the forest protection and recuperation and allow better exploitation of forest resources.

Figure 5 shows three types of farm territorial organization. The first is traditional use of land by communities (figure 5.A). The forest communities - campesinos and indigenous - operate communitarian land management based on the organization and use of natural resources, shared grazing land, areas assigned to the harvesting and gathering of forest products (wood and non-wood), hunting, and fishing. This type of organization results in moderate degradation of forests since there is no planned forest protection or management. The second is a territorial organization by properties (figure 5.B). The plans inscribed in the Forest Law promote this type of organization, and define the territorial organization of forest and other farming activities. However, this territorial organization fails if the area delimited is small: production, mainly livestock, is intensified which can result in major degradation of natural resources and family economies.

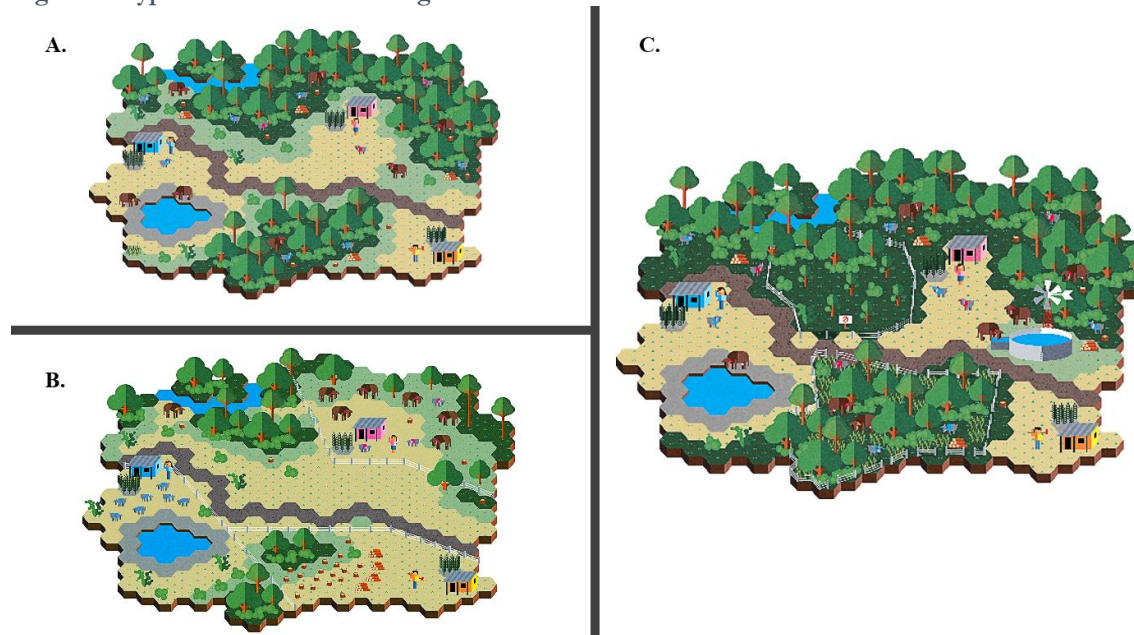
To mitigate this risk, a third type of territorial organization has been implemented by the Government of Argentina Native Forest and Community Project, financed by the World Bank (P132846), where fences and delimitations are proposed by the PIC, thought with the communities (figure 5.C).

The project is being implemented in selected communities in Chaco, Salta, and Santiago del Estero and provides benefits to small producers including indigenous people and campesinos in forest dependent communities. The project aims to maintain the traditional forest community organization while improving productivity through formalization in written plans related to exploitation of forest resources, use of improved production technology, and improved access to basic services and markets within sustainable use of forest resources. The PIC is defined formally as “a document or instrument of participative planning of the forest, agricultural, and livestock production activities in the territory occupied by one or more communities. The objective is to give sustainability to the livelihoods of communities, while maintaining and recovering the forests that they use or own” (Manual PIC). The conditions for households to participate in the PIC are linked to their biophysical and social living conditions. Biophysical conditions include: household location in one of the selected departments; use by the community members of native forest areas in any OTBN category; minimum and maximum PIC surface of respectively 2,000 and 100,000 hectares; and minimum 60 percent native forest coverage. The social conditions include: an interest in community projects and forest management (based on written assessments);

⁹ Plan Operativo Anual.

inclusion in a campesinos community, or an indigenous community, or being a small producer or family farmer; being one of 10 to 60 families in a PIC; living continuously on the land for previous 10 years; and application for investments in the communities.

Figure 5: Types of farm territorial organizations



Source: Manual PIC.

Note: A. Traditional organization of the land; without fences and propriety delimitations. Production in communities with moderate forest degradation. B. Fences and delimitations established by the Argentinian Forest Law. Intensive production with high forest degradation. C. Fences and delimitations proposed by the PIC, thought with the communities. Environmental plan, integrating forest and production.

A PIC is based on community management of the land and the forest, based on the collective decisions and actions of the members of the community. Community participation promotes fair distribution of benefits and responsibilities, management and zoning of different productive activities, and forest conservation to maintain its functions and biodiversity. In addition, a PIC establishes participatory planification and consensual decisions and implementation by the group. It is aimed at enforcing the responsibilities and engagement of group members for their common welfare. The existence of a PIC approved by the local authorities allows formalization of commercialization of forest products for households in the PIC, and improves market access for household production while maintaining sustainable use of the forest. The PIC integrates productive activities in the forest including identification of different needs related to access to basic services, and improved productive and consumption activities. For instance, the project is investing in infrastructure to allow better access to water (wells, tanks, dams), installation of alternative energy and wood energy systems, a beekeeping

infrastructure, metal ovens to improve charcoal production, and training to improve production and commercial activities.

3 Research framework

The study uses a mixed methods approach using quantitative and qualitative data collected from the project communities. Both types of data were collected in the Chaco, Santiago del Estero and Salta provinces in the Chaco Ecoregion. A first analysis of the 2017 quantitative data was used to inform the 2018 qualitative study. Additional quantitative data were made available following the qualitative survey on a larger sample of communities.

Results from the quantitative and qualitative analyses are complementary in the interpretation of the findings (Cullen, Coryn, and Rugh, 2011). Using a mixed method design allows deeper insights into experiences and perceptions of changes (Greene, Benjamin, and Goodyear, 2001).

The *quantitative method* consisted of analyzing household survey data collected by the project implementation unit (PIU) and the *qualitative method* consisted of semi-structured interviews and focus-group discussions with a selected sample of villages from the project. All the surveyed communities are part of the Native Forest and Community Project but since selection of the communities for the two surveys was done by two different teams, overlaps in the collection of data on households are unlikely.

The *quantitative* data come from two datasets: a long dataset including 253 households in 2017, and a shorter 2018-2019 dataset that includes 1,993 households. A total of 2,246 households in the provinces of Chaco (730 households in General Güemes), Salta (927 households in Rivadavia and San Martín), and Santiago del Estero (589 households in Copo, Alberdi and Pellegrini) were surveyed for 78 PICs.¹⁰ All the interviewed households participated in a PIC, and the 2,246 households represent the total beneficiaries. Thus, the data are representative of all households in the PICs where survey was undertaken but are not representative of the provinces. The 2017 dataset included questions on multiple sources of income but the 2018-2019 dataset includes only information on households' economic activities, household characteristics, and access to water, energy, and cooking facilities. 77 of the 78 PICs are located in a sustainable forest uses, category II area (yellow), with the 79th located in an area for protected forests, category I (red).

The quantitative data have two main shortcomings. First, the reduced information derived from the 2018-2019 dataset limits the analysis of income sources and livelihood diversification to an analysis of earnings from forest

¹⁰ Appendix table A-1 provides a list of PIC names.

and livestock. Second, the data refer to a single point in time and do not include past changes or provide information on welfare changes or prospects over time.

The *qualitative* data help to overcome the second limitation by providing information on welfare changes over time. The objective of the qualitative component of this study is to describe households' dependence on forests, and the links between forest dependence and land tenure, access to basic services and markets, and social inclusion. The qualitative data consisted of: (a) a desk review of project documents and the relevant literature; (b) semi-structured interviews, focus group discussions, and community mapping; and (c) interviews with key-informants knowledgeable about the PIC. The qualitative analysis involved collection of information based on observation of spontaneous behaviors, speech, and open answers for post interpretation and deriving conclusions. The data capture individual experiences, perceptions, attitudes, behaviors, beliefs, opinions, emotions, community dynamics, and contextual factors.

The qualitative interviews were conducted in six communities in the provinces of Chaco (in General Güemes), Salta (in Rivadavia), and Santiago del Estero (in Alberdi and Copo) during October, November, and December 2018. The 155 interviewees included 69 individuals, 72 focus group members, and 14 key informants. The individual semi-structured interviews included previously defined questions but included flexibility to allow the interview to follow the interviewees' interests. The interviewees include balanced combinations of indigenous people and campesinos, women and men, young and older individuals, and individuals living in communities with and without a PIC. The focus group discussions were structured in a similar way and involved groups of two to six respondents. The responses of interviewees in the focus groups were influenced by the other members of the group who reinforced or challenged the views expressed. Two interviews were based on ethnic group, and gender; four interviews were based on province. The key informants included local and national public officials engaged in forest policy, World Bank staff members, and representatives from companies and civil society.

The four local interviewers were given interview guides. The data were recorded with interviewees' consent, and subsequently were transcribed verbatim. The questions focused on four areas: 1) income and welfare sources, and life conditions; 2) forest uses and household economy; 3) legislation on use of forest resources; 4) perception of changes and adaptations. Data analysis consisted of standard qualitative processes of transcribing and translating interviews from recordings, coding the data as per the analytical criteria, organizing the codes into categories, and conducting thematic analysis to arrive at the findings about welfare improvements. Sources of interview quotes and interview and focus group locations are excluded to protect the identities of the respondents.

4 Describing households' living conditions in the Chaco region

The surveyed households include a well-distributed representation of men (53 percent) and women (47 percent), with a majority (61 percent) of indigenous households. The distribution of campesinos and indigenous households is heterogenous across provinces (table 1): most households surveyed in Santiago del Estero are campesinos (84 percent), and those in Chaco and Salta are mainly indigenous (62.5 and 89 percent respectively). The distribution in the sample reflects the one in the region.

Table 1: Distribution of campesinos and indigenous households across provinces

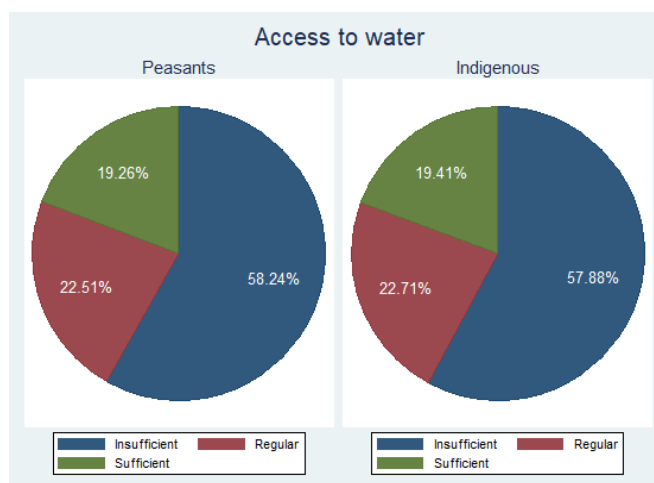
Province	Total			Peasant			Indigenous		
	No.	%	%	No.	%	%	No.	%	%
Chaco	730	32.5	100.0	274	31.5	37.5	456	33.1	62.5
Salta	927	41.3	100.0	100	11.5	10.8	827	60.1	89.2
Santiago del Estero	589	26.2	100.0	495	57.0	84.0	94	6.8	16.0
Total	2,246	100.0	100.0	869	100.0	38.7	1,377	100.0	61.3

Source: Survey Native Forest and Community Project, 2017-2019.

Access to public services such as drinking water, electrical energy, housing, and schools has improved in urban areas while rural areas are lagging. Access to water is considered the most important basic service for home-consumption or production and is scarce or absent in several communities as stated by the interviews: *“There is only a water well, sometimes there is no water; sometimes we have access to water but only a few and without pressure...and for the sowing, we need pressure...”*. The most isolated communities are supplied by cisterns and receive water only intermittently. They store water in plastic bottles or tanks. In some communities in Chaco, water is transported in buckets – sometimes over distances of more than 3 km. More than half of the households interviewed declared insufficient access to water, 23 percent said they had regular access to water, and only 19 percent stated that they had enough water supply (figure 6). The distribution of access to water between campesinos and indigenous people is similar, and the Chaco province has the best access.

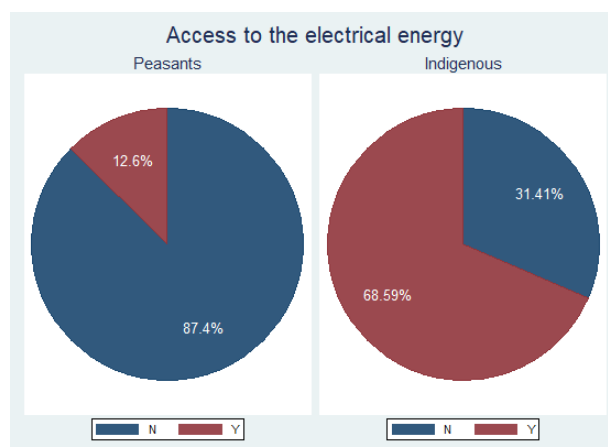
Electrical energy is supplied mainly by generators and solar panels. The costs of running a generator are high, and power generation is intermittent; solar energy is used to power low energy consuming equipment. Energy for cooking, heating, and lighting comes from firewood. In the sample, 62 percent of households declared having access to electrical energy. Access is higher among indigenous communities compared to campesinos communities: 69 percent of indigenous families have access to electricity compared to only 13 percent of campesinos households (figure 7).

Figure 6: Distribution of declared quality of access to water by campesinos and indigenous populations



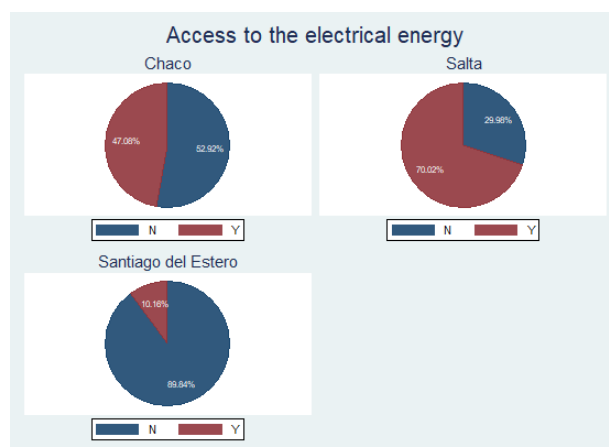
Source: Survey Native Forest and Community Project, 2017-2019.
Note: Green means "sufficient", red "regular", blue "insufficient".
 Campesinos distribution on the links, indigenous on the right.

Figure 7: Distribution of declared access to electrical energy by campesinos and indigenous populations



Source: Survey Native Forest and Community Project, 2017-2019.
Note: Blue means "no access", red "access". Campesinos distribution on the links, indigenous on the right.

Figure 8: Distribution of declared access to electrical energy by province



Source: Survey Native Forest and Community Project, 2017-2019.
Note: Blue means "no access", red "access". Chaco distribution on the top and links, Salta on the top and right, Santiago del Estero on the bottom and links.

The highest rate of access to electrical energy is in Salta which has the largest indigenous population (figure 8). A possible explanation for this higher access is that Salta was affected by the indigenous population conflict known as the “55 and 14 parcels”. The origin of the conflict was demand for recognition by the indigenous communities of territory ownership and respect for human rights. The Inter-American Commission

on Human Rights supported their case and put pressure on the Argentine government. The conflict started in the 1980s and has been ongoing ever since. However, certain measures have been taken to improve access to electrical energy.

For cooking, households mainly use firewood. Campesinos consume higher quantities of gas bottles and firewood than indigenous peoples (table 2) probably because they tend to live closer to urbanized areas which gives them better access to the market compared to indigenous people. Most indigenous households use firewood for cooking (94 percent), and only a few (8 percent) use bottled gas. To reduce consumption of firewood, the project has invested in more efficient cooking stoves which should reduce firewood and gas consumption and cooking costs.

Table 2: Use of firewood and bottled gas for cooking among campesinos and indigenous populations

Variable	Mean	(sd)	% HH
Total			
Firewood [m3/week]	0.9	(0.7)	92
Gas bottle [10kg/week]	0.7	(0.5)	26
Campesinos			
Firewood [m3/week]	1.1	(0.6)	89
Gas bottle [10kg/week]	0.7	(0.5)	34
Indigenous			
Firewood [m3/week]	0.9	(0.7)	94
Gas bottle [10kg/week]	0.6	(0.4)	8

Source: Survey Native Forest and Community Project, 2017-2019.

In relation to education, most adults had not completed primary schooling and expressed regret at this. They recognize the importance of the forest and its resources for their livelihood and quality of life, since without education job opportunities are scarce: *“Without forest, it will be horrible, there will be nothing to feed the children, because I don’t have education”*. Access to education is improving for the younger generation and the rate of individuals finishing secondary school has increased. However, access to tertiary studies, and thus, a profession beyond the family farm remains difficult.

5 Analyzing households' economic activities and income

5.1 Forest- and farm-based livelihood strategies

Farm production activity is defined as any production activity conducted on the farm for sale or self-consumption such as forest wood, NWFP, crafts, hunting and fishing, agriculture, and livestock. Craft is considered part of the forest activity since the inputs for craft production come from the forest.

Indigenous households are engaged in a wider range of activities than campesinos households who report raising livestock as their main activity. Across all households, 4 out of 10 report forest and craft activities as their main activity, and about 38 percent of households report livestock activities (table 3). However, from the distribution of activities by population type, the majority of campesinos report livestock raising as their main activity (76 percent), followed by forest (21 percent). Indigenous peoples are more diversified: 53 percent report forest and craft as their main activities, for 19 percent the main activity is hunting and fishing, for 11 percent raising livestock is the main activity, and 12 percent have other main activities (mainly day laborers). Only 4 percent of the sample report agriculture as main activity; this low rate can be attributed to the fact that agriculture is mostly rainfed with all the risks entailed by frequent water shortages. Forest and livestock resources are used for self-consumption and for sale, and represent an important and often unique source of cash income.

Table 3: Distribution of the declared main activity for campesinos and indigenous populations

Productive activity	Total			Peasant			Indigenous		
	No.	%	%	No.	%	%	No.	%	%
Forest without craft	305	15.9	100.0	172	21.5	56.4	133	11.9	43.6
Craft	461	24.0	100.0	4	0.5	0.9	457	40.8	99.1
Livestock	726	37.8	100.0	607	76.0	83.6	119	10.6	16.4
Agriculture	72	3.8	100.0	13	1.6	18.1	59	5.3	81.9
Hunting and Fishing	211	11.0	100.0	1	0.1	0.5	210	18.8	99.5
Wage	7	0.4	100.0	2	0.3	28.6	5	0.4	71.4
Government	2	0.1	100.0	0	0.0	0.0	2	0.2	100.0
Others	135	7.0	100.0	0	0.0	0.0	135	12.1	100.0
Total	1,919	100.0	100.0	799	100.0	41.6	1,120	100.0	58.4

Source: Survey Native Forest and Community Project, 2017-2019.

Note: Distribution of the responses to the survey question "What are the three main productive activities of the family?". Survey sample of 1,919 households (85% of the survey sample (42% campesinos and 58% indigenous), the remaining observations are missing values).

Considering all households participating in livestock and forest activities regardless of whether they are their main activity or not, almost all households produce forest-related products and half engage in raising livestock (table 4). One in three households is engaged in NWFPs and about 95 percent in wood products. A larger share

of campesinos compared to indigenous people participate in raising livestock while a larger share of indigenous people are engaged in NWFP extraction and crafts.

The number of households focused only on raising livestock is small, and nearly half of all households (and 72 percent of indigenous households) produce only forest-related products. Indigenous households specialized in forest are engaged in wood, NWFP, and craft production.

Table 4: Participation and specialization rates for forest and livestock activities among campesinos and indigenous populations

	Total (% HH)	Campesinos (% HH)	Indigenous (% HH)
Participation			
Forest (woof, NWFP, and Craft)	95.1	93.4	96.1
Wood forest products	93.4	91.5	94.6
NWFP	34.0	20.5	42.6
Craft	35.0	3.9	54.6
Livestock	48.4	86.25	24.3
Specialization			
Forest (woof, NWFP, and Craft)	49.0	13.5	72.4
Wood forest products	16.4	9.8	20.5
NWFP	0.3	0.1	0.4
Craft	0.3	0.0	0.5
Livestock	2.4	5.1	0.7

Source: Survey Native Forest and Community Project, 2017-2019.

Note: NWFP = non-wood forest products. Forest refers to wood, NWFP, and craft as a single production activity. Participation rate is defined as the percentage of households that produces a product in the corresponding activity (forest, a specific forest activity, or livestock), and specialization rate is defined as the percentage of households that produces only the corresponding activity. “% HH” means percentage of households.

Bovine rearing is confined mainly to men and caprine, porcine and poultry production to women.

Bovine production is traditionally in open areas in the forest, although some enclosures have been constructed recently, financed mainly by government and NGO projects. In open areas, men are responsible for looking after the cows, herding them, and supervising their location and their health. Women milk the cows and are responsible for goat and poultry rearing. The open pasture system complements other forest activities such as collection of wild honey and fruits, and hunting.

The forest is perceived as a “big natural supermarket”. Although the Wichi report not extracting forest resources on a daily basis, they use these resources to satisfy their basic needs: *“the forest is our life, we go there to hunting, and if we find a red brocket, we can have meat for a week, or if we find a pig, we have meat for a week, but if we only find a rabbit, we have meat for one day”* ... *“The forest serves us for everything, as shadow, as food for us and for animals... it is*

the livelihood of the family, the forest gives you everything, the life... there is where you find everything for consumption... it is our resource, our richness, it always saves you". The forest supplies wood to build houses, produce charcoal, and make posts. Forest resources are used to produce fibers and colorants for handicrafts, forage for animals, firewood for heating and cooking, and medicinal plants to ward off several diseases. The Wichí depend heavily on forest for their survival *"Without the forest, we are nothing"*.

Firewood is the most important forest product extracted by households. While firewood is collected by almost all households (92 percent), it is used only for home consumption. In contrast, wooden posts produced by 10 percent of households, and charcoal produced by 7 percent of households are for the most part sold and only rarely consumed at home (table 5).

A wide range of trees is used for wood or to produce NWFPs. Timber is extracted mainly from palo santo (*Bursera graveolens*), quebracho Colorado (*Schinopsis balansae*), and quebracho blanco (*Aspidosperma quebracho-blanco*) trees. This timber is used to construct houses, and fences. Cedar trees are a source of round-wood. Wooden posts are produced from quebracho colorado. Charcoal and firewood are produced from quebracho colorado, quebracho blanco, mistol, tusca, and algarroba trees. Firewood is used for home for heating, cooking, and lighting, and to produce wooden bricks.

Other NWFPs are collected for home consumption or for handicraft production. Fruits, mistol, algarroba, and honey are collected mainly for home consumption, while households collect chaguar, and palo santo from the forests for textiles and other handicraft production. Algarroba is transformed by households into flour or insect repellents. It is used also as a natural colorant for handicraft production. Palo santo is a wild tree used by the indigenous peoples to make cutlery, human and animal figures, and plates. Chaguar belongs to the Bromeliaceae plant family and is used as a resistant fiber. It has value only for indigenous peoples who use it to make handbags, backpacks, and belts. A wide variety of trees and plants are used for medicinal purposes, mainly to treat flu, and stomach, kidney, and liver complaints. The interviewees said that the activity most affected by deforestation and climate change is fruit harvesting.

Hunting activity is confined mostly to indigenous people with a limited number of campesinos engaged in this activity. The animals hunted are birds, red brocket, wild boar, rabbit, vizcacha,¹¹ and iguana. Beekeeping is an important activity for indigenous and campesinos, and in Chaco and Santiago del Estero it has become industrialized.

The role of women in the farm activities of campesinos and indigenous populations is often neglected. Although women are presented as housewives, they are responsible for the farm animals (goats, pigs, sheep,

¹¹ Rodents native to South America which resemble rabbits.

poultry), orchard production, handicrafts, harvesting of forest fruits, cheese production, and management of the house and the children. Women in the campesinos population have exclusive responsibility for goat rearing which is a very profitable activity and involves the formal market. Bovine production is exclusively a male responsibility.

Table 5: Sale and self-consumption of forest and livestock products

Products	Number of households	% of product sold
Timber		
Round-wood	37 (1.6%)	90.7
Wooden posts	231 (10.3%)	98.9
Charcoal	162 (7.2%)	99.9
Firewood	2,074 (92.3%)	5.4
NTFP		
Honey	537 (23.9%)	63.8
Algarrobo	443 (19.7%)	2.0
Chaguar	348 (15.5%)	17.9
Mistol	372 (16.6%)	1.9
Palo Santo craft	95 (4.2%)	90.6
Chaguar craft	634 (28.2%)	86.9
Livestock		
Bovine	605 (26.9%)	72.6
Goats	712 (31.7%)	48.3
Pigs	628 (28.0%)	44.2
Poultry	639 (28.5%)	9.3

Source: Survey Native Forest and Community Project, 2017-2019.

Note: The first column presents the number and percentage of households that produce the product, the second presents the percentage of the production that is sold.

Small handicraft production is confined mostly to women for home use or for the market. Women traditionally produce handbags, cloth, netting, and ropes for use by their own households, and wallets, belts, bracelets, and necklaces to sell. The women collect the chaguar every two or three days: “*that [activity] is [only] for women*”. However, it is becoming more difficult to find chaguar in the forest due to deforestation and increased enclosures which make it difficult to access some land. This is increasing the distances that must be covered to find chaguar. Natural colorants are extracted from algarroba (black), pata (brown), abreboca (orange), guayacan (gray), and lapacho (red). Crafts based on timber are engaged in also by men. They use algarroba, quebracho Colorado, palo santo, palo cruz, and other trees to produce spoons, toys, key chains, and small animal sculptures.

Non-governmental organizations of indigenous women from the Wichí and Qom groups organize training for the commercialization of the craft products. Wichí and Qom women producing handicrafts receive little or no support from the government, are not formally recognized, and find it difficult to access

markets. Handicraft activity is organized in artisan groups in the communities which facilitate production and commercialization. Handicrafts are an important source of revenue for the families although it is an informal household activity with no formal business structure. There are no policies related to the development of craft activities although the Forest and Communities project is providing finance to integrate value added in craft production.

5.2 Household farm and forest income in the three provinces

Based on data from the short questionnaire, households' incomes are derived only from livestock and forest.¹² The income figures include cash income (sales), non-cash income (self-consumption), and total (sold and self-consumption).

For both indigenous and campesinos, wood products commercialization is the most profitable activity followed by livestock. While only a few households (16 percent of the sample) receive a cash income from this activity, sale of wood products has the highest earning values for households logging timber (table 6). Non-cash income is more important than cash income in the case of NWFPs and indigenous people which suggests the higher dependence of the indigenous population on forest resources to fulfil their basic needs. Almost all households consume wood products (mainly firewood), and a third both sell and consume NWF. On average, for campesinos income from livestock is greater than their total income from forests while the reverse applies to indigenous people.

Campesinos are almost four times richer than indigenous people. Considering total forest and total livestock income combined, campesinos earn on average AR\$ 71,888 per year while indigenous people earn an average of AR\$ 18,616 per year (table 6). This difference can be explained partly by the higher participation rate of campesinos in the sale of high-value products and partly by the small amounts sold by the indigenous people (cash income from wood and livestock) which gives campesinos more income than received by indigenous people from other activities.

¹² The income calculations might be biased due mostly to measurement errors. There are several sources of measurement errors. First, the survey was administered in written format, and then translated first into an Excel format. Then an Excel database were constructed. Each of these steps can introduce errors. Several verifications and corrections were made to reduce this bias. Second, the questionnaire was extensive, and calculation of income includes numerous variables such as production quantities, prices, part of production sold, month of harvesting. It is possible that households under- or overestimated this information. This bias could be reinforced by a third source of measurement error which is that the survey was administered in different months (and thus differing harvest seasons) and over more than one year. Therefore, information on quantities might vary depending on the month the households was surveyed (a good harvest month or not). Robustness could be tested by comparing production and sold quantities, and prices in different months/years of the survey to check for differences. We conducted such a test but found no seasonal errors.

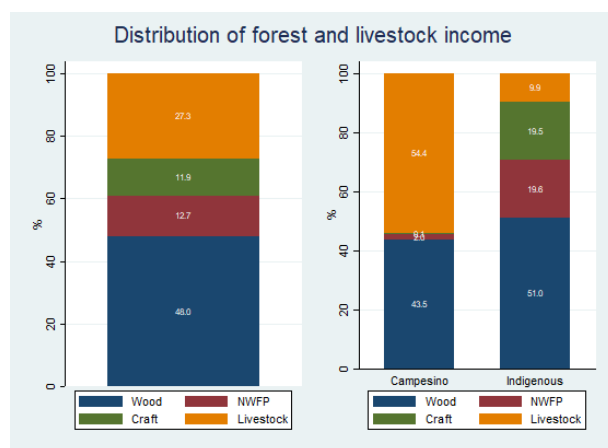
Table 6: Household annual income from forest and livestock for campesinos and indigenous populations

Types of income	Total			Campesinos			Indigenous		
	Mean	(sd)	% HH	Mean	(sd)	% HH	Mean	(sd)	% HH
Cash income: Wood	71,130	(72,035)	16.7	74,678	(72,898)	32.9	58,929	(68,004)	6.2
Non-cash income: Wood	5,771	(6,465)	94.9	7,508	(5,383)	90.4	4,734	(6,826)	97.7
Cash income: NWFP	7,603	(10,743)	10.7	10,507	(15,431)	7.5	6,503	(8,102)	12.7
Non-cash income: NWFP	6,427	(7,034)	30.9	1,993	(2,863)	17.4	7,683	(7,352)	39.6
Cash income: Craft	5,518	(5,119)	29.0	10,200	(7,660)	0.4	5,495	(5,102)	47.4
Non-cash income: Craft	3,622	(4,303)	8.1	1,500		0.1	3,634	(4,312)	13.3
<i>Total forest income</i>	<i>22,583</i>	<i>(41,468)</i>	<i>97.5</i>	<i>34,366</i>	<i>(56,951)</i>	<i>94.7</i>	<i>15,333</i>	<i>(25,410)</i>	<i>99.3</i>
Cash income: Livestock	32,941	(38,780)	33.3	42,556	(41,682)	58.8	11,349	(17,557)	16.9
Non-cash income: Livestock	13,907	(15,528)	46.8	16,980	(16,454)	84.3	6,512	(9,638)	22.6
<i>Total livestock income</i>	<i>35,106</i>	<i>(44,690)</i>	<i>49.8</i>	<i>44,767</i>	<i>(48,588)</i>	<i>87.9</i>	<i>13,420</i>	<i>(22,446)</i>	<i>25.2</i>
Total forest and livestock income	39,505	(57,908)	100.0	71,888	(73,474)	100.0	18,616	(30,391)	100.0

Source: Survey Native Forest and Community Project, 2017-2019.

Note: Income is measured in AR\$/year in 2017 prices. Forest income includes wood products, NWFPs, and craft as one production activity. Only households participating in the activity are counted in the statistics, the percentage of households participating is presented in the “% HH” column. Standard deviation in parentheses.

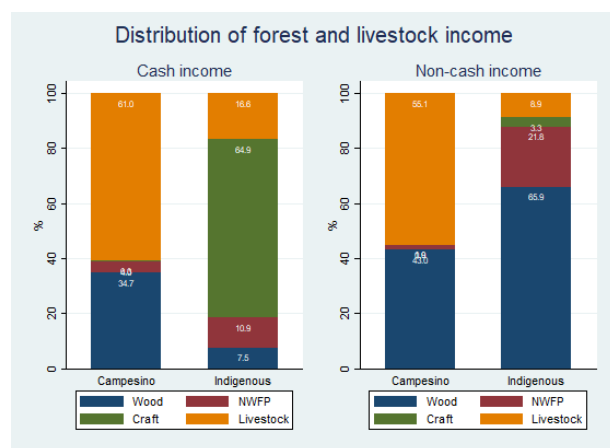
Figure 9: Income contribution of forest and livestock (percent)



Source: Survey Native Forest and Community Project, 2017-2019.

Note: Wood products in blue, NWFP in red, craft in green, livestock in yellow. Total income on the left, by campesinos and indigenous populations on the right.

Figure 10: Income contribution of forest and livestock by cash and non-cash income (percent)



Source: Survey Native Forest and Community Project, 2017-2019.

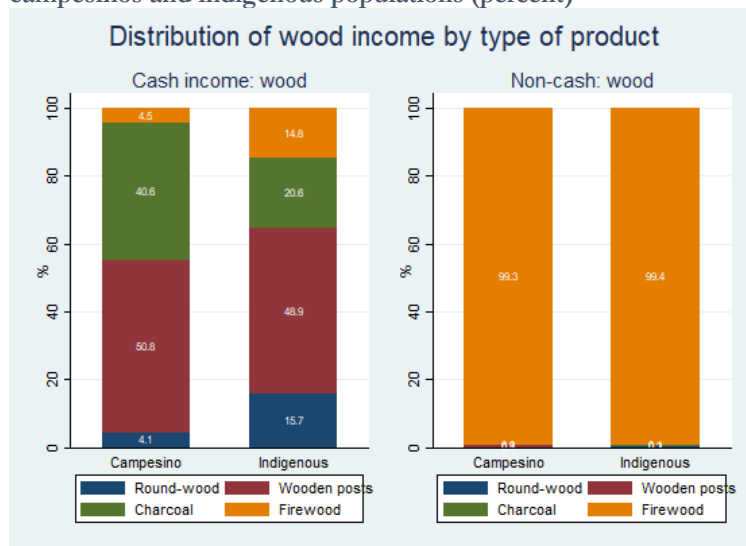
Note: Wood products in blue, NWFP in red, craft in green, livestock in yellow. Total income on the left, by campesinos and indigenous populations on the right.

Forestry is the main source of income for indigenous households engaged in these activities. Overall, on average forestry represents 73 percent of total household income, and livestock represents 27 percent. The contribution to household income from wood products is four times the contribution made by NWFPs and crafts. The split among income sources is different for campesinos and indigenous people (figure 9). The main

source of income for an average campesino household is livestock production (54 percent), followed by timber (44 percent), with a small contribution from NWFPs and crafts. In contrast, an average indigenous household receive 90 percent of their income from forestry products (wood, NWFPs, and crafts). However, distinguishing between cash and non-cash income (figure 10), the proportion for indigenous people changes since handicrafts contribute more to cash income and wood contributes more to non-cash income.

Sales of wooden posts and charcoal account for the most important share of cash income from wood products. Half of the cash income from wood products for an average campesino household comes from sales of wooden posts and 40 percent comes from sales of charcoal (figure 11) with very little non-cash income since 99 percent of the production of wooden posts and charcoal is sold (table 5). On the other hand, firewood is used at home and represents nearly all of a households’ non-cash wood-related income. However, an average indigenous household receives 15 percent of their wood-related income from sales of firewood (figure 11).

Figure 11: Distribution of forest wood income by type of product, for campesinos and indigenous populations (percent)

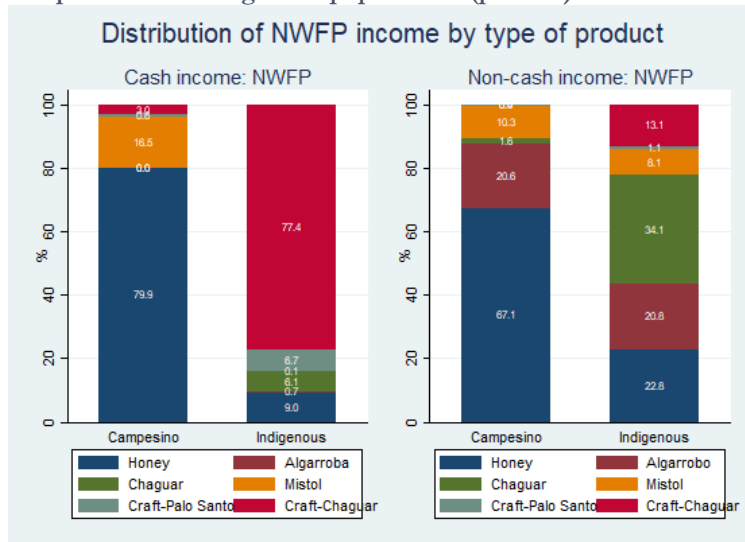


Source: Survey Native Forest and Community Project, 2017-2019.

Note: Round-wood in blue, wooden posts in red, charcoal in green, firewood in yellow. Cash income distribution on the left, non-cash income on the right.

Indigenous and campesinos have different income sources: three quarters of income of an average indigenous household comes from crafts using chaguar; a similar proportion comes from honey for campesinos. Both campesinos and indigenous households are specialized in a product to generate income from NWFPs (figure 12). However, for indigenous households, non-cash income from NWFP is split across four products which account for 90 percent of this income. In contrast, campesinos’ reliance on NWFP is accounted for mostly by honey (67 percent) and to some extent algarrobo.

Figure 12: Distribution of NWFP income by type of product, for campesinos and indigenous populations (percent)



Source: Survey Native Forest and Community Project, 2017-2019.

Note: Honey in blue, algarroba in dark red, chaguar in green, mistol in yellow, craft in light blue and red. Cash income distribution on the left, non-cash income on the right.

Poorer indigenous households are mostly engaged in a single activity (forest) while richer households receive income from both forestry and livestock. Only 11 percent of households in the bottom 20 percent of the income distribution generate income from both forest and livestock activities, compared to 92 percent of the richest households (table 7). Participation in forest activities is similar, and very high across all income levels, while participation in livestock production increases with income level. The participation in livestock production at the bottom of the income distribution can be explained by the need to have some financial capital to start this activity (to buy the animals) while starting forestry activities require less capital as forest resources are available for free and production costs are much lower. Four out of five households in the bottom quintiles of the income distribution are indigenous while less than one in five households in the top income quintile is indigenous.

The level of forest income increases with income level. While the average forest income for the bottom 60 percent is higher than their income from livestock, this relationship reverses for the top 40 percent of the income distribution (table 7). In the top income quintile, forest and livestock incomes are almost equal (table 7). However, for the bottom income quintiles, households rely more on forest income which can represent between 80 percent and 90 percent of household income (figure 13).

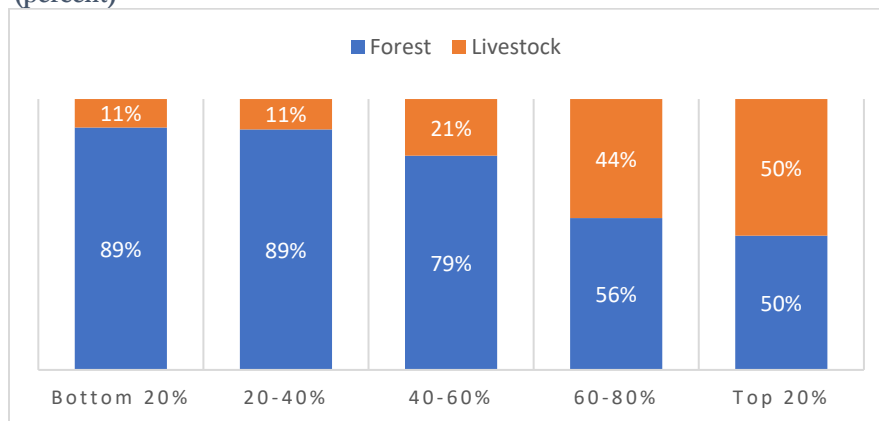
Table 7: Participation and income of households in forest and livestock production by quintile classes

Quintile (AR\$/year)	% of households participating			% of households	Mean (AR\$/year)	
	Livestock + Forest	Forest	Livestock	Indigenous	Forest	Livestock
Bottom 20% (2,971)	11	97	14	87	2,747	2,200
20-40% (8,435)	25	98	27	84	7,645	3,539
40-60% (17,827)	43	98	45	72	14,298	8,331
60-80% (36,985)	66	97	69	46	21,322	23,669
Top 20% (131,470)	92	97	94	15	67,225	69,940

Source: Survey Native Forest and Community Project, 2017-2019.

Note: Quintiles are defined on total income for households with an income above zero which results in 2,183 observations (97% of the survey). Quintile values in parentheses. Columns 2, 3, and 4 present the percentages of households diversified into livestock and forest, and participating in forest and livestock, by quintile. Column 5 presents the percentage of indigenous people in each quintile. Columns 6 and 7 present forest and livestock income in unadjusted AR\$/year.

Figure 13: Income distribution among forest and livestock for quintile classes (percent)



Source: Survey Native Forest and Community Project, 2017-2019.

Note: Y axis represents percentage of household income. Forest in blue, livestock in orange.

This pattern of forest and livestock dependence is consistent with other countries. For example, in Madhya Pradesh, India, environmental (farm) and forest relative dependence decreases systematically for each additional quintile of the total income distribution (Joshi et al., 2016). In general, case studies show that poorer households are more reliant than richer households on forests (e.g. Cavendish, 2000; Yemiru et al., 2010). Nevertheless, in the case of the provinces in the Chaco Ecoregion studied here, absolute forest income increases for each additional quintile, while in the province of Bas-Congo, Democratic Republic of Congo for instance, absolute forest income increases up to the third quintile and then decreases in the fourth quintile (Nielsen et al., 2012). Consider also that unlike other studies we do not have information on total farm income which makes direct comparison more difficult.

The analysis presented here is limited by the available information on forestry and livestock income and households in the studied sites that participate in hunting and fishing and also take employment outside the farm are not considered. Using comprehensive income data for Santiago del Estero, allows investigation of the contribution of these latter activities to household livelihoods. In the case of Santiago del Estero, the 2017 dataset provides information on income from hunting and fishing, agriculture, temporary and permanent jobs outside the farm, and help from the government or family members. These data can be used to construct an income aggregate and allow some measure of relative poverty in this province.

5.3 Household total income in Santiago del Estero

The data on households in eight PICs in Santiago del Estero provides information on all income sources. Data on all income sources are available for a subset of 253 households in Santiago del Estero, related to 8 PICs and for the campesinos population. Although these data are not representative of all the PICs since the productive activities of campesinos and indigenous populations are very different, they provide some interesting information on additional sources of income.

Households generate their income from farm production for sale or self-consumption, wages earned working outside the family farm, pensions, and financial help from family and friends. This subset of campesinos households in Santiago del Estero provides a better picture of households' different income sources: in addition to forest and livestock, 11 percent of households participate in hunting and fishing, 6 percent participate in agriculture, 32 percent work outside the farm, and 89 percent receive aid from their network and/or government (table 8). About 97 percent of surveyed households participate in at least one farm or forest activity (wood products, NWFP, craft, fishing and hunting, agriculture and/or livestock). The main farm activities are livestock and forest with more than 60 percent of households engaging in more than one activity.

Since for each farm and forest-related activity and type of product households declared the quantities produced and sold, and the prices obtained, the income from each farm activity/product was calculated as the sum of the quantity produced multiplied by the unit price. Total household income is composed of farm income (wood, NWFP, craft, hunting and fishing, livestock, agriculture), and non-farm and non-forest income (wage, pensions, and financial help).

The most important source of income is help from family, friends, and the government. Forest income contributes up to 23 percent of households' total income while livestock accounts for 12 percent of their total income (table 9). While average forest income is higher than livestock income, households receive more income from other sources. Wage and "other sources" represent 65 percent of total income. This income distribution, even if only in a subset of the PICs population, suggests that other income sources are very important in the

total income of households, and in order to know the real contribution of forest income to total income is important to consider the entire income of households.

Table 8: Distribution of Santiago del Estero households by income sources

Income source	No.	%
Forest without craft	173	68.2
<i>Wood</i>	164	64.8
<i>NWFP</i>	85	33.6
Craft	8	3.2
Livestock	207	81.8
Hunting and Fishing	27	10.7
Agriculture	15	5.9
Wage	82	32.4
Other sources (pension, family, friends)	225	88.9

Source: Survey Native Forest and Community Project on 8 PICs in Santiago del Estero, 2017.

Note: Based on 253 observations of campesinos from Santiago del Estero.

Table 9: Household annual income (AR\$/year) and contribution to total income (%), by sources for campesinos in Santiago del Estero

Type of income	Value		% of income	
	Mean	(sd)	Mean	(sd)
Forest (wood + NWFP)	43,477	(43,691)	23	(25)
Livestock	35,665	(28,976)	12	(20)
Total farm	54,573	(48,036)	35	(28)
Wage	32,865	(41,646)	10	(20)
Other sources (pension, family, friends)	63,175	(37,011)	55	(31)
Total	110,027	(62,029)	-	

Source: Survey Native Forest and Community Project on 8 PICs in Santiago del Estero, 2017.

Note: Based on 253 observations of campesinos from Santiago del Estero. Income is measured in unadjusted AR\$/year. Only households participating in the activity are counted in the statistics. In this data subset, there is no income from crafts, fishing and hunting, or agriculture. Standard deviation in parentheses.

The contribution from forest income is lower than suggested by [Angelsen et al. \(2014\)](#) for Latin America where forest income accounts for 28.5 percent but in the same range. Livestock contribution to total income is the same: livestock accounts for 11.7 percent of total income in [Angelsen et al. \(2014\)](#). In Southern Malawi, earnings from forestry products represent 30 percent of total income ([Fisher et al., 2010](#)), in Zimbabwe the contribution of forest to rural income represents 35 percent on average ([Cavendish, 2000](#)), and between 17 percent and 45 percent in the case of Amerindian villages in the Bolivian lowlands and eastern Honduras ([Godoy et al., 2002](#));

in Tanzania these products account for only 13 percent of total income with livestock contributing 1.6 percent (Dokken and Angelsen, 2015).

6 Exploring households' welfare and links to forest

The main changes perceived by households refer more to the general living and working conditions, than to the change of types of productive activities. Land and forest availability have diminished, impacting their way of live and the access to resources. Deforestation, agroindustry development, climate change, and scarce access to basic services are the main threats that affect their livelihood. Nevertheless, the communities have developed adaptation mechanisms to cope with these threats and improve their welfare. Forest is also perceived by households in the studied communities as a way to improve welfare.

6.1 Barriers to welfare

Households in the research sites perceived three main barriers to improving their welfare and livelihoods in the short- and long-terms: (1) presence of agro-industrialization; (2) lack of access to basic services; and (3) deforestation and changes in precipitation.

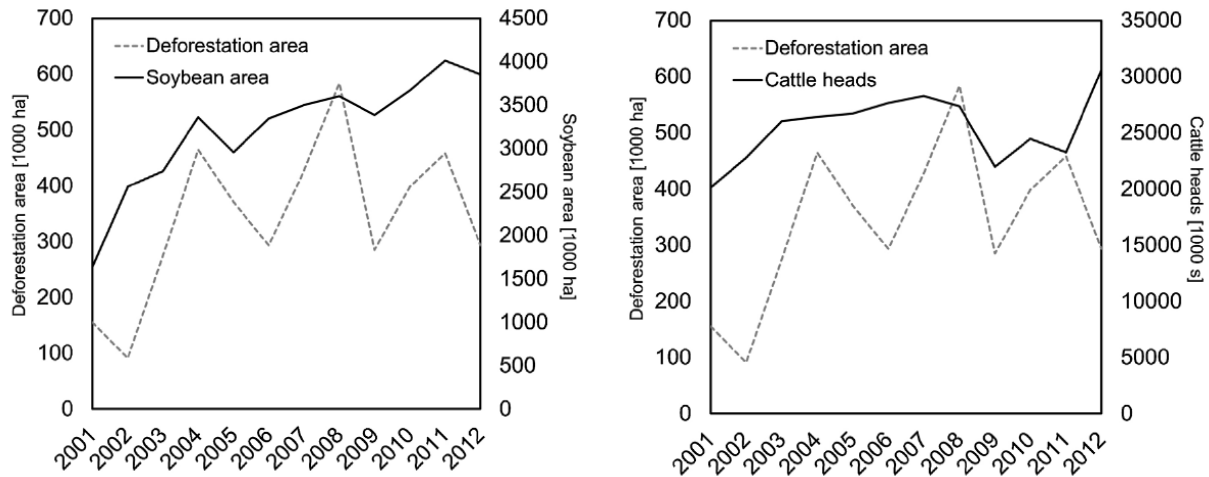
The presence of agro-industrialists is perceived as a barrier by most households for two main reasons: destruction of forest resources and the restriction to land access due to the erection of fences. The increased profitability from production of soya compared to livestock production is making the forest areas more attractive to investors. These big agricultural producers have destroyed large areas of the forest in the Chaco and their presence has increased the number of fenced enclosures. Indeed, Chaco, Salta, and Santiago del Estero considerable increased the production of soy in the last decade. Fehlenberg et al. (2017) estimate that in the Argentinian Chaco region, the soybean expansion goes from 1.6 Mha in 2001 to almost 4Mha in 20012 (+150 percent) (figure 14). The growth rate of cattle heads in the region in the same period and its correlation with deforestation were lower than it was for soybean.

Not only soybean cultivation, but also cultivation of wheat, sunflower, sorghum, corn, cotton, and cattle production on implanted pastures are increasingly carried out by medium- to large-scale agricultural companies (Fehlenberg et al., 2017) in the research sites. Additionally, more than 70 percent of the extraction of tree trunks from the Argentinian native forests are in these provinces: 56 percent in Chaco, 12 percent in Salta, and 4 percent in Santiago del Estero (OECD, 2019).

The management of cattle changes from open field, to fences and pasture. Campesinos raising livestock are facing increased costs since fenced enclosures restrict the areas that the animals can roam to find food.

Campeños reported having to purchase feed and collect water as a direct result of enclosures: “... *when we had the animals in an open field, they went far away... but they were beautiful, big, fat, they were well. And now that the field is smaller, you have animals but they are thinner... and you have to limit the quantities owned...*”

Figure 14: Deforestation area in relation to soybean area and cattle heads for the Chaco region in Argentina



Source: Extracted from [Fehlenberg et al., \(2019\)](#).

Note: Deforestation area in relation to soybean area links and cattle heads right. The x axes in both figures represent the years, and the left y axes denote the amount of deforestation area in thousand hectares. The right y axis on the left side represent the soybean area thousand hectares, on the right side the amount of cattle thousand heads.

Access to services especially water and education in the communities is very limited and reduces households’ welfare. Households perceive water scarcity as an important barrier for production: it is the cause of animal death and loss of crops. It also demands a lot of physical and time efforts to producers that have to search for water far away or to construct wells.

Regarding education, to complete secondary school and university requires the individual to leave the community; most communities have access only to primary school: “*I moved to Campo Gallo, because there is no secondary school here, to continue my studies there, in the Alberdi department, at 120 km from here*” (young person from Santiago del Estero). Secondary and university education represents a cost to the family which loses a unit of farm labor and also has to support a child living elsewhere. This results in most children returning to the farm before completing secondary school. However, the households interviewed wanted their children to leave the farm to study and then to return to implement what they have learned. At the same time, the households feared that sending their children away to study resulted in a reduction in the community’s young people, and loss of culture and way of living for the individuals involved and for future generations. Some of the young people interviewed said they intended to return to the family farm and help the community to improve its living

conditions including access to water and electricity, production technology, and land rights. Some organizations offer help for completion of secondary studies.

Households have observed a decrease in the forest land area with the main losses related to a reduced number of algarroba trees, a reduction of animals to hunt, and less land to find resources. The awareness that forest should be protected is present within all the households. In particular, the Wichí perceived deforestation as a big problem, since they associate the forest and deforestation with the availability of resources: *“they [the big companies] should stop deforestation. They cut chaguar, they cut algarroba trees”* (Wichí woman, Los Blancos), *“there is no more all the native forest that we had twenty years ago, there are also new forest trees, we have to take care of them”*.

Linking rainfall changes to deforestation, the Wichí and the campesinos reported experiencing more extreme rainfall and drought events in the last ten years.¹³ The households reported that the change to rainfall patters was affecting their harvesting of forest fruits and availability of several other forest resources as a male inhabitant of the Chaco province explained: *“because of a big drought, there was no water and additionally there was no grazing, nothing to eat, no stick, no branch... I sold the cows that I managed to save... with this money, I maintained the others. I bought corn to eat, ... it was unbelievable, there was no water, there was not food for the animals, they fell, I was no able to see that...”*. Climate change also affects the agricultural activity and increases the negative effect of water scarcity: *“15 years ago, people used to sow seed in this area, ... but since several years, droughts have affected the fields... and people have abandoned the agriculture activity... they seed and they lose everything, there is no precipitation, nor water for irrigation...”*. Additionally, conversion from forest to cropland and grassland contributed to 35 percent of total GHG emissions from agriculture activities in 2014 (OECD, 2019), what at the same time reinforce changes in weather patterns.

6.2 Perceived role of forest to improve welfare

To cope with these threats, the following analysis is performed through the P.R.I.M.E. framework. This framework identifies five pathways that can help forest-dependent households improve their welfare in a sustainable way (Shyamsundar et al., 2020): increasing the productivity of forest land and labor; empowering forest communities; improving forest-related institutions; creating or developing markets; and protecting forest ecosystems. Some of these pathways appears in the adaptation strategies of households in the Chaco Ecoregion, and in the PIC activities, other should be improved.

Productivity: The implementation of PIC was considered by households as having improved forest and land management, and potentially productivity. The plans established by the PICs include erecting

¹³ See the precipitation evolution in Argentina in Appendix figure A-1.

fences to better control livestock and improve their feeding and care. Fenced enclosures reduce the amounts of time and energy spent looking for animals lost in the forest. In particular, instead of rising fences in small areas resulting in cattle raising intensification, the PIC construct fences for a set of families in a community with the integration of forest land. A campesino said: *“in an open field management, without fences, you search for an animal maybe you will find it in a week if you look for every day ... while with fences, you look for an animal for a half an hour, or one hour his PIC favored us a lot, because we will work with the ten families in the PIC and you have fences, pasture...”*.

Investment in more efficient cooking stoves are part of the PIC, to reduce the consumption of firewood used by almost all the households for cooking. Other investments made by the PIC that may help to improve the productivity include beekeeping infrastructure and metal ovens to improve charcoal production.

Rights: Understanding of the rights and tenure arrangements related to forest resources is limited.

Most household members (and especially indigenous women and young people) were unaware of the legislation on use of forest resources and forest conservation. Those who knew about the Forest Law considered that the legislation was unfair; it imposed controls on indigenous people and farmers but not on the big companies. An evaluation of the Forest Law was conducted by the Argentinian government identified several limitations in its implementation: the budget assigned for conservation of native forests is below the minimum established by the Forest Law; PM in many sensitive areas are delayed or inexistent; and public consultation for designing conservation areas is missing in most of them (OECD, 2019). The households in the research sites emphasized the need to care for and preserve the forest. They believe that community organizations can achieve better conservation of the forest compared to government initiatives.

The existence of a PIC approved by the local authorities allows the formalization of commercialization of forest products for beneficiary households and improves market access for household production while maintaining sustainable use of the forest.

Empowering women is also part of a right-type pathway. Nevertheless, in some cases women in the provinces studied do not participate in the associations where the decisions are made. Additionally, their contribution in the productive activities and to household income are not valued in the communities.

Community associations are the places where campesinos and indigenous people manifest their decision-making power and resolve problem from land tenure to forest conservation in an informal way. In the research sites, community associations have been created to resolve conflicts among and between farmers and indigenous people and to establish some rules about land use and tenure, use of forest resources, and their commercial organization. Overall, the interviewees said that communities with associations were achieving better results on forest conservation and improving life conditions, filling the institutional gap left by government. For instance, households observed that one solution to the problem of agro-industrialists is to

organize themselves into groups to allow better management of access to water, pasture, and to use productive tools, and organization of farmers into groups.

The activities of the organizations include several P.R.I.M.E. actions like support for access to water and education, production and commercial management, forest conservation, and land rights. The decisions are taken in community and the agreements are generally tacit or verbal, without creating conflicts between them. If conflicts exist, campesinos and indigenous communities resolve them getting and speaking together in the associations. The producers are also organized in associations, to improve their business: *“now we are willing to organize an association for women artisans... it would be a dream for women to have an association”*.

Investments: Investment have been made in infrastructure to allow better access to water (wells, tanks, dams), installation of alternative energy and wood energy systems in the PICs. Nevertheless, water scarcity is a serious problem in the research sites and additional solutions should be found.

Access to education remains an important problem and requires the involvement of the government. More schools in rural areas, that teach forest and farm related professions, or better transport access to go to schools in urban areas are important investment with potentially radical impacts towards welfare.

Markets: Right to exploit wood given by the participation in a PIC increases automatically the access to the market, allowing a better power to negotiate fair prices. PIC activities also include training to improve production and commercial activities. For instance, the PIC included trainings to increase the value added of handicraft. These trainings aim to increase the prices and quantities sold of handicraft products, and to reach new markets.

The commercialization of products is generally informal. Markets are local and regional and sometimes involve intermediaries; price negotiations are difficult.

The Wichí sell their handicrafts in the more urbanized villages, and sometimes in national exhibitions. In Santiago del Estero, indigenous women produce individually at home, and commercialize as a collective. Their production is sent to Buenos Aires.

Campesinos sell their livestock to local butchers for slaughter. Livestock is a form of capital and is commercialized to provide the population with goods and basic needs rather than as part of a commercial strategy. For instance, the campesinos sell livestock if they need money because someone in the family is sick. There are some livestock auctions which are organized by local family associations and which are more profitable.

Commercialization of honey has increased recently. Some communities have established beekeeping cooperatives which increases honey production and allows its commercialization in a more formal market.

Others sell their honey to nearby villages. Round-wood is sold through intermediaries which fix its price. Locally, households exchange goods, for example mistol can be exchanged for clothing.

People expressed that forest is better conserved in campesinos and indigenous communities than in areas where the agro-industrial companies are implanted. A young of Santiago del Estero said: *“I always say that the bulldozers and everything that destroys the forest, is not destroying a plant, but a whole history of campesinos and indigenous communities”*. However, they are aware that the wood extraction for wooden posts and charcoal production is not suitable for forest conservation. At the same time, these products are an important source of income. The community organizations promote the reduction of wood exploitation and a substitution with other activities like beekeeping, reforestation, and sod seeding.

Ecosystems: The FNECBN instrument of the Forest Law is a PES system that may help forest-dependent populations in their pathway out of poverty. Barra and Russ (2019) studied the effect of the instrument on deforestation and found limited effect. However, we do not have evidence on the effect of the instrument on community’s income.

7 Conclusion

This study is part of the Native Forest and Communities project. We use survey qualitative and quantitative data from surveys conducted in 2017 and 2018/2019 of 2,246 households in Chaco, Salta, and Santiago del Estero provinces which asked in particular about use of forest resources and farm activities. The households surveyed are campesinos and indigenous households engaged mainly in forest and livestock activities. The objective of the study was to assess households’ dependence on forest resources and to identify whether forests provide opportunities for poor households to accumulate wealth to escape poverty.

Forest matters to Chaco households. They provide households with economic welfare, identity, a sense of belonging, health, and wellbeing. People living near to forests place a higher value on the environment and forest resources than populations in urban areas. However, access to basic public services is scarce, especially concerning access to water and education, both affecting the productivity of the population. For cooking, households mainly use firewood.

Forest resources are used for production and sale earnings, household consumption, and medicine. Forest is perceived as a big supermarket, where fruits, woods, animals, honey, medicine, food for households and animals can be found without the need to pay for. These natural resources are diverse and act as a safety net in bad times, reducing households’ vulnerability to poverty. The main forest products commercialized are wooden

posts, charcoal, handicraft made of chaguar, and honey. Within livestock, bovine, goats, and pigs are the most sold animals.

Both, indigenous and campesinos households are highly dependent on forest resources, but campesinos have higher dependence to livestock and indigenous people higher dependence to forest. Considering only forest and livestock income, campesinos are four times richer than indigenous. This can be explained partly because of the larger participation of campesinos in high return forest products (wooden posts, charcoal) and livestock. Nevertheless, other income sources where indigenous are more likely to participate are not considered here: hunting and fishing, jobs outside the farm, governments and household network financial aids. Indigenous diversify more their activities and the forest products consumed and sold. This fact may help them to cope with adverse shocks.

The main threats to welfare perceived by campesinos and indigenous people are the presence of big agro-industry companies that menace forest resources, climate change that affects the availability of natural resources and water, and scarce access to basic services like education and water.

To cope with these risks, campesinos and indigenous people use communities' associations, where they resolve or search for solutions to issues like land tenure, productive activities organization, support to education and improving access to water, sustainable management of forest uses, and access to markets.

However, several opportunities to improve welfare remain. Increasing the participation of indigenous people in high return activities may increase their welfare. For instance, they participate less in wood related production and livestock, which are the most profitable activities. Though, promoting these activities should be done in a sustainable way, since wooden activities and livestock have higher impact on forest degradation than NWFPA activities.

Another possibility is to increase the value added of handicraft products and to develop the market for these products. For this, handicraft women need the support of the government and of the associations in their communities. Here, policies to increase the empowerment of women, in particular Wichí women, are needed.

Welfare improvements will be possible only if there is more investment in basic services and education to keep productive members of the communities in the area.

Local governance and respect for traditional ways of life in the forest areas are important to enable sustainable management of forests and the contribution of forest products to livelihoods.

To go further, data on other sources of income are needed to estimate the total household's income and to define their real dependence on forest. Only with these data, we could draw conclusions on the capacity of forest to improve welfare or to trap households on poverty. Having more information on income sources and

household characteristics could help us to identify the determinants of farm and forest incomes and dependences, as well as to quantify the different impacts on indigenous and campesinos people.

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Table A-1: List of PICs

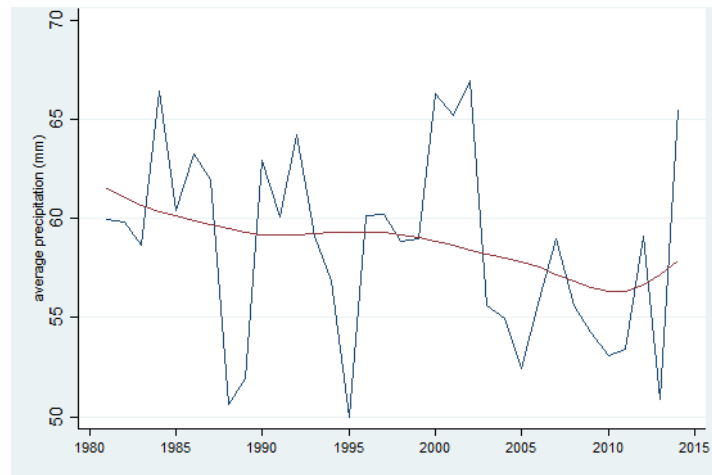
Province	PIC code	PIC name
Chaco	CH001	Los Labradores, Los Polvorines, Parajes las Lomitas
Chaco	CH002	La Esperanza
Chaco	CH003	La Fidelidad
Chaco	CH004	La Invernada, Los Bajos
Chaco	CH005	La Pasacana, El Chañar
Chaco	CH006	El Arroyito, Bandurria
Chaco	CH007	Pablo Segovia
Chaco	CH008	Seliton Merge
Chaco	CH009	Savan 1
Chaco	CH010	Savan 2
Chaco	CH011	La Armonía
Chaco	CH013	Las Flores
Chaco	CH014	Tales Posú
Chaco	CH015	El Sauzal
Chaco	CH016	Wichi el Pintado
Chaco	CH017	Pozo la Gringa
Chaco	CH018	Milagro
Chaco	CH019	El Zapallar
Chaco	CH020	Maulle
Chaco	CH021	Fortín Lavalle
Chaco	CH022	Santa Carmen
Chaco	CH023	Proyecto Qom
Chaco	CH024	Palahuo
Chaco	CH025	El Vizcacheral
Santiago del Estero	SE001	Santa Cruz Agrario, San Félix, Majancito, Bajo Lindo, Buen Lugar
Santiago del Estero	SE002	El Porvenir, Naranjito, Buen Lugar y Nueva Granada
Santiago del Estero	SE003	La Overa, Esperanza, Tijeras, Maravilla y Las Parvas
Santiago del Estero	SE004	Santa Rosa, Buena Parte y El Bordo
Santiago del Estero	SE005	Huiñaj Pozo y Vilmer
Santiago del Estero	SE006	Nuevo Yuchán, Casa Verde
Santiago del Estero	SE007	Piruas Bajo Gimnasia
Santiago del Estero	SE008	Nueva Esperanza, San Cristóbal, Lujan, Santa Cruz
Santiago del Estero	SE009	Pozo 1, El sufrido, El Guayacán, Huacana, Rio de la Plata
Santiago del Estero	SE010	Afbal
Santiago del Estero	SE011	Babilonia Bandedero
Santiago del Estero	SE012	Piruas Bajo (San Luis Gonzaga)
Santiago del Estero	SE013	San Antonio, Santa Lucia, Lujan , Campo de Mayo, Nueva York
Santiago del Estero	SE014	El Moradito
Santiago del Estero	SE015	Saladillo
Santiago del Estero	SE016	Retiro, Buen Lugar
Santiago del Estero	SE017	San Jose
Santiago del Estero	SE018	Pampa de los Guanacos Norte
Santiago del Estero	SE019	Malvinas Norte
Santiago del Estero	SE020	Malvinas Centro

continued from previous page

Province	PIC code	PIC name
Santiago del Estero	SE021	Pampa de los Guanacos Oeste
Santiago del Estero	SE022	Tala Pozo
Santiago del Estero	SE023	Morenita, La Cañada, Salvador
Santiago del Estero	SE024	San Francisco
Santiago del Estero	SE025	San Roque
Santiago del Estero	SE026	San Francisco y Pozo Salado
Santiago del Estero	SE027	San Ramon
Santiago del Estero	SE037	El Churqui
Santiago del Estero	SE040	Toro Pozo, Tajamar, San Miguel
Salta	SA001	La Esperanza
Salta	SA002	Kayip
Salta	SA003	Wichi Lewetes Kalehí (Los Baldes) Morillo
Salta	SA004	Wichi Lewtes, Pozo del Chañar
Salta	SA005	Wichi La Cortada, Palo Blanco
Salta	SA006	La Curvita
Salta	SA007	Monte Carmelo
Salta	SA008	Puntana II, Algarrobal y Quebrachal
Salta	SA009	Puntana, La Esperanza
Salta	SA010	Puntana Chica, Quebrachal
Salta	SA011	El Bordo, Buen Destino
Salta	SA012	Puntana Nueva y 27 de Junio
Salta	SA013	20 de Septiembre
Salta	SA016	Misión San Patricio
Salta	SA017	Paraje La Paz
Salta	SA018	Grupo Condominio de las 10000 has
Salta	SA019	Choway
Salta	SA020	12 de Octubre
Salta	SA021	Pozo El Mulato
Salta	SA022	La Junta
Salta	SA023	Capitan Juan Pagé
Salta	SA024	Unidad y Progreso
Salta	SA025	Desarrollo Chaqueño
Salta	SA026	Vecinos Unidos I
Salta	SA027	Vecinos Unidos II

Source: Survey Native Forest and Community Project, 2017-2019.

Figure A-1: Average precipitation evolution in Argentina, 1980-2014



Source: Author's calculations based on CRU TS3.21 data.

Note: The y axis represents the average annual precipitation in millimeters.