Artículo

Situating the value of ecosystem services in rural Paraguay

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Abstract

This paper focuses on the adscriptions of value to ecosystem services in rural Paraguay. The study relies in primary data obtained through fieldwork in the San Pedro Department, Paraguay. The paper questions the devaluation of ecosystem services while including a smallholders' perspective. Transitions from traditional family farms to industrial farming are contextualized in changing landscapes and socio-cultural patterns.

Keywords: Paraguay; Smallholders; Ecosystem services; Traditional knowledge; Soy; Agriculture; Development.

Resumen: *Situando el valor de los servicios ecosistémicos en el Paraguay rural*

Este artículo se centra en adscripciones de valor a servicios ecosistémicos en el Paraguay rural. El estudio se desarrolla desde datos primarios obtenidos a través de trabajo de campo en el departamento de San Pedro, Paraguay. El artículo pone en cuestión la devaluación de servicios ecosistémicos incluyendo la perspectiva de pequeños agricultores. Las transiciones de la agricultura familiar tradicional hacia la

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agricultura industrial se contextualizan en paisajes y patrones socio-culturales cambiantes.

Palabras clave: Paraguay; Campesinos; Servicios ecosistémicos; Conocimiento tradicional; Soja; Agricultura; Desarrollo.

Introduction

Paraguay has experienced intense deforestation since the 1940s. While the western Chaco has only recently started being deforested, the Upper Paraná Atlantic Forest, distributed in the eastern regions, faces severe depletion. Only 10% of its original cover remains in Paraguay. Causes of deforestation are long-term perceptions of the forest as non-productive, frequent unsustainable usage of resources by settlers and, most recently, a steady expansion of land coverage devoted to agriculture, especially soy (Huang et al., 2009).

While conducting fieldwork in late 2017, I encountered two main farming systems: Small and medium-scale farms based on family economies, and larger landowners performing industrial agriculture. This distinction of models is not always clear, as local communities tend to an abandonment of traditional management in favour of new agro-technologies. *Family farming* performs as a subsistence economy based on a variety of strategies, is mostly limited by manual labour, and is not primarily focused on commerce. On the other hand, *industrial farming* aims strictly to the marketization of high-capacity yields, includes modern technologies, and its management is applied by following parameters for optimal production only.

An increment of industrial agriculture is achieving national economic growth, with historical records of a 12.90% growth in 2013. The role of foreign agro-investors, especially from Brazil, is key in the implementation of this model. Landscapes in east Paraguay are transitioning, from mixed-sized farms and sub-tropical forest to a more uniform landscape of soy fields. Soy production has expanded from 8.2 million tonnes in 2013 to 9.3 MT in 2016-17 (NEPCon, 2017). Industrial agriculture is the main driver of deforestation: 80% of the forest areas cleared between 1989 and 2000 have been converted to large-scale industrial farms, while only 20% to small or medium-scale farms (Pavetti and Saito, 2012).

For decades, Paraguayan policy-makers have centralized efforts to develop the agricultural sector. The regime of Alfredo Stroessner (1954-1989) favoured the colonization of eastern forested areas of the country, inhabited by Guaraní communities. In departments like Caaguazú, Canindeyú and San Pedro, new settlers were granted the land that they could afford to manage. An agrarian reform in 1963 was established under the premises that the process was necessary to transform the *tierras incultas* ("illiterate land") into *rational land* (Fleytas, 2007, p. 81). These settlers established the family farms and communities visited for this study.

The National Plan for Development set for the years 2014-2030 shifted to three pillars: poverty reduction and social development, inclusive economic growth, and insertion of Paraguay in the international market (Convention on Biological Diversity, 2016). These lines are formulated as a correlation where, ideally, more economic growth implies inclusion, as integration in the market-value chains expects an improvement in the quality of life. In this context, the old dichotomy illiterate-land/rational-land takes renewed relevance, especially among farmers that are transitioning from family to industrial farming. For such transition, "rational" production-optimization requires the abandonment of "obsolete" practices.

Transitioning systems affect the set of *knowledges* held by traditional farmers. Knowledges are regarded by their capacity (or lack of it) to respond to the newest productive strategies. As a variety of ecosystem services, i.e., agricultural, silvicultural, apicultural and healing services, fail to meet such needs, knowledge held by young, formally educated agronomists becomes a reason of social status.

This study explores perceptions of value on ecosystem services made by informants of each agricultural system, with the aim to contextualize the "value-monist" perspective (focus on a single type of value) that is becoming predominant in spite of devaluated traditional subsistence strategies.

Through an approach to the knowledge held by some informants, this study aims to bring evidence on the plurality of ecosystem services performed by smallholders for the sake of their well-being, that also bring additional outputs like biodiversity conservation. This leads to the questions: 1) What drives the prioritization of a single type of value on ecosystem services in rural Paraguay? 2) What values transcending monetary value are generated from traditional ecosystem services?

With these questions, the current study approaches the social and environmental dimension of smallholders' lives in the scenario of fast-paced transforming landscapes and lifestyles, while exploring the potential of alternative assessments both for social and environmental justice.

Methods

Study Area

For six weeks, fieldwork was conducted in the department of San Pedro, Paraguay. Unlike other departments situated more to the east, San Pedro was only recently transforming its forest and pasture landscapes to soy crops. Transitional landscapes in San Pedro drive resistances and socio-political conflict. The cities and communities visited during the fieldwork were Nueva Germania, Choré, Guayaibí, Naranjito, Luz Bella, Agüerito, Tava Guaraní, Diez de Agosto and San Pedro Poty (Picture 1).

Picture 1: Locations visited in San Pedro. The soy frontier is expanding from the Brazilian border in the North-East, depicted in yellow (Google Earth, 2018).

Only two hours by car separate the Brazilian border from Santa Rosa del Aguaray, a growing city that functions as a neuralgic centre of the region. National roads built in the last decade have incentivized internal trade and transformed local economies, incentivizing domestic trade as well as trading fluctuations with Brazil.

Data collection

Fieldwork

The convergence of divergent agricultural systems generates specific complexities. A fieldwork approach was key to access relevant locations like private farms and cooperatives, as well as local authorities. Thanks to a first contact, I pulled the string to create a network of informants, with the intention of studying different profiles involved in farming: essentially smallholders, but also larger owners, local authorities, local activists, and subsidized farmers. A sample of the informants is provided in the Annex 2.

The first week I met César, an agricultural advisor living in Nueva Germania, who became a key informant. I accompanied him to a meeting with agro-cooperatives for the integration of smallholders in market value chains. Later that day, we visited a cooperative of sesame producers, were I met farmers Raúl and Héctor, who became important informants. A reunion with representatives of the Korean Project for Agricultre for sustainable development (KOPIA) was attended in this cooperative. This week I also stayed with Raúl in Luz Bella, where four family farms were visited.

Larger industrial farms were visited as well; A landlord in Nueva Germania (investor and local authority), and the ranch of the Secretary of Environment and Livestock. The next week was spent in Héctor's hometown Naranjito, where he lectured me on ecological knowledge while touring his family farm. I also interviewed smallholders with diverse profiles: A small-scale soybean producer, a former beekeeper, a Mbyá-Guaraní smallholder, and Héctor's grandfather. Another week in the Agüerito area was spent visiting self-governed communities Agüerito and Tava Guaraní.

Field diary

A field diary was written during the fieldwork. It compiles data of the informants such as their educational level, profession, ethnicity, and role in the community. The diary also compiles sketches of farms, and ethnographic data such as local knowledge about animal and tree species, subsistence strategies and provisioning, regulating and cultural ES, with a special focus on agriculture, but including other practices like hunting, pastoralism, bee-keping and charcoal production. The ES samples presented in the following pages are not meant to represent the totality of strategies from the area, which would require an essay on itself. They are meant to represent services that are common among smallholders, to facilitate the posterior analysis. In that sense, ES like charcoal production were documented, but as were not generally present in most farms, are not developed in extension. Perceptions about changes on climate, landscapes and farming practices were also annotated. Annotations about informal conversations, socio-cultural organization -i.e., labour gender division, use of language, food habits- were taken for posterior analysis of the socio-cultural background. Casual situations could be considered relevant. For instance: "The informant tells César that the community has ran out of water and local authorities are not solving it. He asks for his influence to fix it, to what César compromises. The favour might be in return of the time spent with me answering my questions". This note would be side-tagged as a possible power exchange.

Interviews

A total of 33 interviews were recorded and transcribed. The interviewees were 27 farmers, 1 activist, 1 worker of a soy large-scale farm, 3 licensed agronomists and 1 local leader. Complementary non-structured interviews and conversations provided with data that also contributed to the presentation of results.

Key concepts and theoretical framework

Diverging values on Ecosystem Services; a question of exclusion

A measurement of *ecosystem services* (ES) is the predominant approach to human-nature relations in research about conservation and sustainable development (Robbins, 2019). ES are understood as "the conditions and processes through which

natural ecosystems, and species that make them up, sustain and fulfil human life" (Daily, 1997). Such assessments conclude with a final monetary estimation that facilitate pragmatic results in terms of human benefit (De Groot et. al., 2012). Hence, ecosystem services are a practical tool for policy-makers (Fisher et al., 2009). ES classic categories are provisioning ES (i.e., food, water, wood), regulating ES (i.e., climate regulation, carbon storage, pollination) and cultural ES (i.e., spirituality, recreation, aesthetic). They involve material and non-material aspects of human-nature interactions, but assessments on forest services usually focus on the monetary benefits of the forest's functions (see Krieger, 2001; Xiao et al., 2000).

Menzel and Teng profess criticism on previous ES research: "the projects are driven by biophysical data and (formally educated) experts […] and the projects involve people and their actual values very late in the process" (2010, p. 907). More participatory research, they argue, contribute to build more resilient communities, bigger acceptance of its implementation and compliance with conservationist measures. In a study about perceptions of value of the Upper Paraná Atlantic Forest, Da Ponte et al. (2017) challenge the idea that forests in Paraguay are unproductive, although being mostly perceived as such. Other studies about forest ES in developing geographies, bring attention to the existence of indirect, not merely provisioning ES (Xiao, 2000).

In the IPBES[2] theoretical framework from 2017, *nature's contributions to people* (NCP) replace ES as conceptual framework. The NCP category is considered to better grasp non-beneficial contributions, hence departing from a less-utilitarian basis (IPBES/5/INF24, 2017). Ango et al. (2014) also argue that the study of 'ecosystem disservices' can offer a more complete assessment of social-ecological dynamics beyond the benefits. Most perceptions of ES value in rural Paraguay match an utilitarian point of view. A more holistic approach is necessary to re-situate the 'underestimation' of disregarded services, to emphasize the interconnectivity between the three foci of value -nature, ecosystem services and quality of life- that the IPBES conjugates and aims as important to preserve.

[2] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

Integrating knowledge Systems; a matter of inclusion

Research on ecosystem services can benefit from the inclusion of non-formal knowledge (Reyes García, 2007). The IPBES also warns about the necessity of seeking for mutual understanding of worldviews, for the benefit of sharing knowledge, and for the inclusion of all the participants in decision-making, especially indigenous people and local communities (Nauber and Paulsch, 2015).

Such differences are generally contrasted on a categorical differentiation of two 'supra-worldviews' (Tengö et. al., 2014): *Scientific knowledge*, and *traditional/local knowledge* that is orally transmitted, collective, diachronic, and not detached from moral and spiritual values. However, Kimmerer argues that "both knowledge systems yield detailed empirical information about natural phenomena and relationships among ecosystem components. Both have predictive power, and in both intellectual traditions, observations are interpreted within a particular cultural context" (2011, p. 265). This common ground is taken one step further by Agrawal (1995), who questions the separation between knowledge systems, appealing to their shared capacity of resolving problems. In all cases, he argues, there is a process of validation. With similar postulates, Altieri argues: "Most traditional agriculture is place-specific, evolving in time in a particular habitat and culture, and this is both where and why it tends to be successful" (2004, p. 36). This paper presents some cases where knowledge from family-based farmers 'unlocks´ a diversity of ES, this is, functioning as the conduit for their applicability. Bringing importance to such knowledge has the potential of facilitating community-based conservation strategies (Corrigan et al., 2013; Oliver et al., 2012).

Differing knowledge systems, indigenous and formal, can be integrated. However, in previous integration efforts, non-scientific knowledge is evaluated through an extra level of validation: "Scientific validation of traditional or local knowledge is often a more or less explicit requirement for inclusion of other knowledge systems […]. This one-way process has been questioned for a number of reasons, such as whether the validation measures used are appropriate, exclusion of relevant and locally legitimate knowledge, and disempowerment of local communities" (Tengö et. al., 2014, p. 582). In the communities I visited, agronomists with formal education held the authority

to supervise cash-crops, whereas any smallholder would implement traditional farming for their self-subsistence, as I later develop in the case study of Agüerito.

Development and conservationism; a matter of environmental justice

The most predominant conservationist strategies are based on compositionalism, separating humans from nature, while functionalism integrates the Homo Sapiens as part of the ecosystem and focuses on ecosystem health, the acceptance of external disturbances and transformative equilibrium (Callicott et al., 1999, p. 3). Unlike the *land sparing* conservationist model, the *land sharing* model points to the inclusion and engagement of local communities in the area through a more functionalist perspective.

Paraguay conservation policies follow land sparing principles, increasing surface of high-yield farming that alternates with protected reserves like the National Park Ybycuí and Mbaracayú. While reserves have prevented deforestation within their areas, all forest around 5 km of its boundaries maintained an average depletion rate of the 30% between 1989 and 2000 (Huang et al., 2009). This model generates an *opposition* of farms against the landscapes. But the idea that ecosystems could transform biophysically, without diminishing ecological processes or production capacity, reclaims smallholders as social and environmental subjects of the landscape. Family farming transcends agricultural activities, to establish a pattern of social organization of families managing their natural environment in a daily basis. Hence, comprehension about their ecosystem management can suppose the basis for land-sharing conservationism and social inclusion alike. East Paraguay exposes a map of contested cultural landscapes and power relations, with on-going challenges like health hazards from chemical use, soil erosion and biodiversity loss, that imply social and exclusion of disempowered smallholders and Guaraní communities.

A sample of ecosystem services in rural San Pedro

Provisioning Ecosystem Services

Family-based subsistence is a combination of strategies with different levels of participation. The *chacra*, a portion of crops species like mandioca, corn, beans, pumpkin, and peanut, supposes the main output of money (Picture 2). It becomes,

thus, the primary activity in most family farms. Vegetable gardens are separated from the chacra. They are devoted to seasonal fruits and vegetables -i.e., pepper, tomato, pineapple- and herbal remedies called *yuyus*. Vegetable gardens are perceived as a side occupation, less important than the chacra for its only purpose of self-consumption.

Picture 2: A chacra in Luz Bella. Martín Barranco, 2017.

Domestic animals are named "minor animals", as opposed to livestock. Minor animals -chickens, ducks, pigs- are set free most of the day and fed with local varieties of corn. Their care is considered a women's responsibility. A young woman complained that their role is often undermined: "Women say they are just wives. But a man without a woman produces much less in the chacra, has less time for everything". Women control food supplies and are responsible for the agricultural calendar.

Cattle livestock is not always considered part of the family farming, but it is if the number of heads can be integrated within the other activities of the farm. Most small farms own between two and five cows and, to obtain the forage, a portion of land is devoted to 'alzado', unattended land with wild weeds. These portions can represent a significant percentage of the total. A farmer devoted 3.5 ha. of the total 5 ha. that he owned. His neighbour devoted half of his 7 ha. farm to pasture, and the other half

to agricultural production. Ranches dedicated exclusively to the production and reproduction of cattle would never be regarded as family farming by informants.

Hunting is a complementary subsistence activity. According to an informant in Luz Bella, the only remaining large mammal is carpincho (capibaras). There were other cinegenic species years before, like guazú (deer, Blastocerus dichotomus). *Fishing* in the nearby river Curuguaty'y was another susbsistence strategy for this family. Two sons showed me how they fished pacú with a berry attached to a fishing line. While hunting has become unfeasible because of biodiversity loss, fishing was recognized still feasible, although specific species like the big pacú are no longer present in the river, according to informants.

Farmers' knowledge on provisioning ecosystem services

Yuyus herbs and the knowledge about their properties is considered cultural heritage of Paraguay. Knowledge on yuyus is richer among the older generations. A 34 years-old informant explained: "Normally we drink the tereré, it is really healthy, we put kaharé, cedrón, and other yuyus in it. But my parents know much better". He argued that such knowledge was legitimate, 'even recognized by real doctors'. As an example, the native plant Stevia (ka'a he'e in Guarani) was referred. His eight-year-old son expressed that he could not relate to any of the yuyus names, while Héctor and an elder farmer provided a lecture on their ecological knowledge:

> Caruré is anti-inflammatory. Verbena is antispasmodic and anti-inflammatory. Menta'i is sedative, and rosa monotí works as a purging remedy. Pará-paraí is a good antibiotic. Menta'i, 'cola de caballo' and cedrón are wild plants that help with high blood preassure. Salvia prevents cancer. Avocado is good for the kidney. Ka'avotory flower has astringent and cardiotonic properties, but only grows in non-polluted environments. Guayaibí is an entangling plant. The termite kupi'i reveals good quality soil, but it can become a plague because it feeds on dry wood. The anteater kaguaré eats termites, but it is also dangerous to people. The best wood for building is from the urunde'y, as it is the hardest and can resist up to 100 years underground. The guapo'i tree has white sage that can be applied on bounds. The guambé-pi herb is used as a plague control, it is very toxic. The amba'y fruit makes good syrup with anti-flu and expectorant properties. Agrial (Picture 3) is used in the tereré and

other drinks, it is also a relief for teeth pain. Putting leaves of the yvirá'ro under your hat is good protection from the Sun. Ysipó lianas are good for bundling. Guabirá bark is good for wounds, and the leaves prevent bad smells if put in the armpits. Timbó tree is the fastest to rot, so is good for coffins. The white sage in the curupí'i is also good for wounds, and this tree hosts the *Pombero*.

Picture 3: Héctor shows agrial during the tour in his family farm. Martín Barranco, 2017.

The *Pombero,* or "king of the forest" (Ka'aguy jarví), is a mythical creature. As a child, Héctor and his cousin used to plant lots of traps to catch animals. One day they heard a big noise from a moving tree. As they ran home, their grandfather told them that it was the Pombero in anger. Another myth was the Yasy Yateré, a creature that whistles imitating birds to lure children. When I was asking about biodiversity in an interview, an informant mockingly replied that Yasy Yateré was a bird species.

An example from a larger farm

The ranch belonging to the Secretary of Agriculture and Livestock of San Pedro expanded through 1100 ha., owning 2500 heads of cattle that occupied 800 ha., while 300 ha. had recently been devoted to soy. The objective was to increase soy production up to eight times the current amount. As all farmers incorporating new technologies, they bought the patented strain seeds and chemicals (1000kg of phosphorus and lime had been used the last season) in Mennonite communities. The Mennonites are religious communities of European heritage, characterized by their communal entrepreneurship and isolation. In words of the Secretary, they are the more technologically advanced in the agro-industry, and the example to follow.

Regulating Ecosystem Services

There is the commonly accepted idea among farmers that the forest plays a role of buffering against the climatic extremes. Some farmers considered leaving a forested portion of their properties for this purpose, while others considered it a responsibility of the administration, or just considered unfeasible devoting a portion of their land to forest, considering it non-productive.

Buffering against the extremes

Héctor explained how the first ever hailstone storm during winter ruined his crops, generating food insecurity: "One storm caught us off-guard; we never had seen anything like this, it rained in a day the amount of an entire month". Another climatic extreme mentioned was raising temperatures, reaching above 40ºC daily during summer, which supposes an impediment to grow two seasons of vegetables annually.

Growing trees is the usual measure of prevention used against hazards like chemical spraying and climatic adversities. Colonies of small-scale farms are usually divided in rectangular lots following pre-designed urban planning. When some forest is left, it is commonly situated at the very end of the rectangle. Another forest service is providing shade to protect animals from the intense heat. The main economic occupation of an informant was silviculture instead of the chacra, which was not common. He managed paraíso, bitter orange, yvyrá pitá, chirca and bocaya (coconut). Tree stripes are also used as barriers, ideally of primary forest, against the beforementioned extremes, as well as chemical exposure from industrial farms.

Biodiversity and plagues

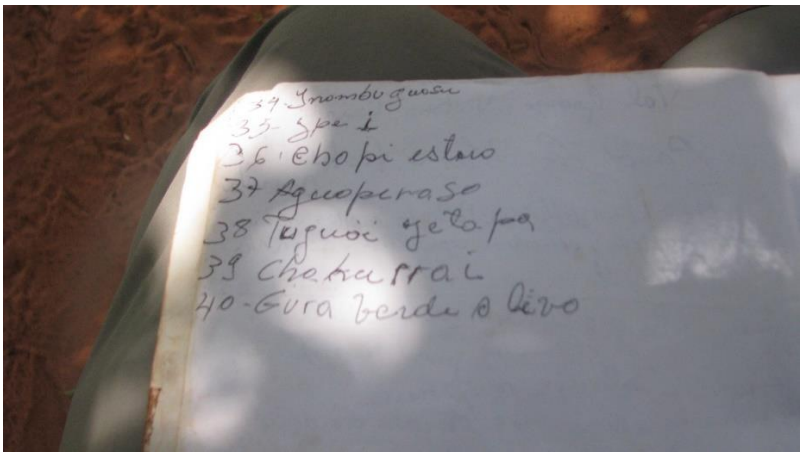
Farmers perceive specific species as allies or pests, according to their interests. Anó (Crotophaga ani) and pirita (Guirá Guirá) were considered key species, due to their function as regulators, and were predominantly mentioned and described: "the anó is black and has a wide beck". Or: "the pirita and the anó can gather together in groups and even share their nests. The pirita eats worms (marandobá in Guarani)". These species are getting poisoned by the consumption of locusts that are resistant to pesticides. Deforestation was pointed out as a threat to other bird species like yacú

(Penelope superciliaris), ñandú (Rhea Americana), ñakurutú-hu (Strix huhula) and guyrá (Procnias nudicollis).

Deforestation was also linked to the depletion of mammals like the tatú (armadillo, Priodontes maximus) and curuí. The aguará-guazú is only found in the Chaco region now (manned wolf, Chrysocyon brachyurus). The weasel eirá (Eira Barbara), preys now on hens in family farms. Same does the aguará'i (fox), which traditionally preyed on the inambú, a partridge species. As the forest diminishes, family farms preserving a diversity of landscape become refugia for minor and middle carnivorous.

Informants expressed how animals were pushed into their properties. The most mentioned plague species was the ant isaú, locusts and worms, as they supposed a direct negative impact for crops. Other pests suppose a disturbance for the farmers' well-being beyond agricultural hazards. For instance, more bugs generate discomfort, and snakes exceeding traditional habitats increase insecurity. In the area of Agüerito, Tavá Guaraní and Diez de Agosto, swarms of polvorín ("powder" of very little flies) bitte on the skin at any given time.

Héctor explained that the kaguaré anteater (*Tamandúa tetradactyla*) controls the isaú ant. Another informant explained that the commodities he integrated in his family farm (mandioca, corn, sesame, lapacho tree) could resist plagues without chemicals, which was not possible for GMO destined to commercialization. He explained that he could not afford pesticides, but he did not need them, since he was focused on self-consumption instead of commercialization.



Picture 4: Logbook of birds and other animal species owned by a smallholder with the purpose of "remembering them". Martín Barranco, 2017.

Wildfires for deforestation

The frequency of plague disservices in the area surrounding one of the communities incremented since a wildfire in a near property occurred in 2011. The owner was a member of a powerful Brazilian family, who after acquiring a property of approximately 20.000 ha., burnt it down entirely, 12.000 ha. at once. Forage seeds were then spread from airplanes to establish a livestock farm. The smoke caused respiratory problems to nearby farmer communities, a wave of monkeys invaded their farms, temperatures raised, and hailstorms became acute: "Not a single tree was left. Now, in summer, very strong winds burn on the skin". Bugs and diseases increased among domestic animals. And, an emotional impact was also acknowledged, from the concern about future soy implementation with pesticides, as well as the sudden loss of their known landscape. In 2004, the government established the prohibition "to conduct activities of transformation of forest surfaces into surfaces aimed for agricultural exploitation in any of its forms" (Law nº 2524, 2004). But the law is permissive with agro-investors from Brazil (Nickson, 2013). In this case, a patch of forest was presented as the argument to consider the property "a natural reserve" (Picture 5).

Picture 5: Thousands of hectares of former forest with a patch left remaining. The dark marks are tree stumps. Martín Barranco, 2017.

Cultural ecosystem services

Perceptions about traditional farming lifestyles

There were smallholders with concern about losing their lifestyles, the traditional way of farming. This concerns fit in classic arguments of the food sovereignty school of thought: "Youngsters are not interested on working the land, their lifestyles are changing. This also changes their eating habits" (informant Andrea). Or: "Cultural values are lost in the modern chacra. Before, families kept their seeds, women classified and kept the seeds. Losing cultural values has repercussions, families cannot produce enough because they no longer own the seeds" (informant Raúl).

Visions on cultural values fell in confronted positions. Farmers favouring industrial farming and licensed agronomists expressed negative perceptions about them more likely. But there were also mixed perceptions, advocating for the equilibrium between the ethics of conservation and the need for monetary results. Very positive perceptions on traditional values emphasized the idea of ecosystem balance:

> The Paraguayan campesino is partly indigenous. Guaranies used to arrive somewhere in the forest, clear out an area big enough for the community, then move away for its recovery. Since farmers cannot be wandering around, they included forest in their 10-hectare farms. But they are accused of laziness for leaving it forested, when it is a matter of preference (Informant praising traditional farming).

Negative perceptions on traditional farming appeal to its obsolescence. A farmer exclusively dedicated to soy production expressed: "the technology used in Paraguay is the same used by my grandfather in Brazil… more than a hundred years ago." Another owner from a farm partially dedicated to soy, was in favour of 'agricultural experts' (referring to technicians, engineers) integrating in family farms. However, he proclaimed that traditional farmers were guardians of nature. All this range of mixed, or even opposed conceptions, profess a similar underlayment that draws an opposing line between the human and non-human worlds. Tradition or modernity, production or conservation.

Identity and sense of place

Some smallholders expressed a sense of belonging towards their lifestyles:

> The chacra is my roots, where I was born and grew up. I am a campesina as well as my parents and brothers, I just integrated it. People say that family farming is a thing of the past, but if we are poor, we have to cultivate the chacra.

Smallholders often embraced their condition of poverty as an identitarian question. A teenager girl expressed that she aspired to attend college, but her family was not supportive about the decision. She claimed: "Law students are not poor. Studying would be as if I deny my own family". A retired farmer who was more than eighty years old believed that it was the end for the traditional farmers' lifestyle:

> There was guabirá in the forest before, and fruits, but these do not grow anymore. That is why I tell you; nature is ending. Nature is something that gives life to humans. We receive from it, and it receives from us as well. We work in the chacra, it is our culture and our food. We were able to handle plagues before. We prayed in the chacra and the pests went away. Praying.

He expressed this spiritual connection with the chacra and nature in general; farming as a way of building nature. For him, this world that he was familiar with, and that was about to end, was not only material.

Farm transitions: Market Value becomes "the best" value

Through the Project for the Inclusion of Family Agriculture in Value Chains, the Ministry of Agriculture and Livestock of Paraguay aims "to increment the actives, economic inputs and quality of life of the rural poor"[3]. The project relies in the collaboration between smallholders' associations with the private sector, to enhance participation in the national and international markets.

[3] http://www.mag.gov.py/

Implementation of development policies faces an irregular acceptance among small farms in San Pedro, as introducing family farming into market chains was perceived very complicated. The volatility of prices established on traditional yields was usually mentioned as an impediment for prosperity and pointed out as consequence of poor policy making.

In a meeting of cooperatives integrated by family farms, that was held by stewardship agents, a farmer argued that the law of public procurement was too bureaucratic for his understanding. Other complaints argued that easy access to mechanisation was a hoax, as it required an unrealistic investment. The hosts defended that the program had been successful before, remarking that it was a public policy for the public benefit. Their slide presentation appealed to a "simplified and accessible process".

Farm transitions in Agüerito

While some farmers take individual action towards market integration, settlements like Agüerito apply the transition on a community level. Besides the private lots, local authorities in Agüerito manage 50 ha. of communal land. Family farms apply traditional farming, while the communal land is industrial. A local licensed agronomist, who was interviewed, is part of the committee in charge of its management. He explained: "We are changing the productive system, we had rudimentary technology before. Now, although facing greater economic expenses, we achieve serious production. However, we rely on family farming when it comes to our own subsistence".

When asked if traditional knowledge was useful, he answered: "Yes, but traditional methods can work one single hectare in ten days, while a tractor can till fifty hectares in one day." But implementing modern technologies require an investment that is difficult to reach at the individual level, which incentivizes the use of conventional methods. Some expand their farms through family links, joining lots to reach an area with capacity for industrial farming. A correlation between size and costs was mentioned as a requisite for soy production: "Volume matters. Only by producing 10.000 kg. of a crop, is it possible to tilt prizes to your advantage". Marketization of the communal land receives government funds. The program consists on modernizing family farms, providing GMO seeds and education on industrial farming. The

interviewed agronomist claimed that local farmers needed more formal education about newer agro-technologies in order to be empowered.

Farm transitions in Tava Guaraní

Farmers in Tava Guaraní manage farm lots that they do not own. These are land concessions made after political conflict (land occupation) in the 1990s. Besides family farms, most of the land in concession has not been managed. The National Institute for the Rural and Land Development (INDERT) has warned that if such land remains unproductive, land concessions will be withdrawn. This opened a schism within local authorities. The faction in power, Association of Producers Dr.Francia, defends the 'Agüerito model'. Another faction, the new Association of Agro-Pastoralist Producers (APAIGA) defends active resistance against the INDERT, under the argument that privatization would open the door to external agents, especially soy investors: "If this social territory is made private, each owner will sell. And then there will be more deforestation for sure". One informant defended privatization but opposed selling: "The buyer comes and offers what it would seem like a lot of money. What will you do with it, though? You will end up on the streets of Asunción. We do not know how to use it". There were other negative stories about cases of selling land: "A young man sold his land, he spent it on alcohol and a motorbike, he crashed and died".

Farm transitions in San Pedro Poty

The case of San Pedro Poty supposed a contrast with the previous examples, as most family farms there were already implementing soy crops. I wrote in my field diary:

> We have visited six households in San Pedro Poty, all of them grow soy. In this colony, 900 ha. of the total 3200 are soy fields. Land here is granted through concessions from the INDERT, with the pre-condition of implementing soy. Ownership is to be granted, but in some cases, farmers have been waiting twenty years for it. Technologies are acquired at the Mennonite colonies. The investment is significant, but it doubles the benefits, according to informants. But others have expressed the risk of becoming highly indebted.

Not all the farmers could afford this investment, and some others implemented it through loans. The Secretary of Agriculture and Livestock and his family are local authorities here. My main informant claimed: "they are the ones helping the people

here. For example, they lend us a bull to fertilize our cattle, tractors, and all sorts of aid". This informant was enrolled in the Partido Colorado, which is also the one in power at the national level and the one of the Secretary.

Farmers´ valuation of ecosystem services

As opposed to secondary/tertiary forests, tree plantations of cash-crops like eucalyptus were claimed to be reforestation projects, and environmentally beneficial. This is an example of how the monetary value prevails and influences perceptions about other types of value (see Annex 1), which is consistent with the idea that "benefits mediated through markets with middle-men are almost certain to be thought of -and valued- in largely instrumental terms" (Chan et al., 2012, p. 11). At the practical level, this supposes that the portion devoted to forest coverage is conditional to activities like cash crops or livestock.

Wood ecosystem services provide another example for this dynamic. Timber usage at the family level is considered important for energetic demands, habitat creation and fence-building (see Annex 1). But shared perceptions of social and economic status compromise this valuation. In other words, the "real" value of wood was not mentioned openly by the informants. At least two hosts apologized for their "precarious" wooden houses, while brick houses were considered a symptom of economic status, and ceded to me during my visits. However, such brick-and-mortar houses, often built through aid development projects, were disregarded for their own living and, not rarely, used as warehouses. Wooden houses were preferred instead, since they are better adapted to the climate, fresher, and more silent during storms. A Mbyá-Guarani informant explained: "My father's house is made from hay and wood. He liked the smell of hay, the wind between planks, the small noises, he liked to feel all of this" (Picture 6). Forest services such as habitat construction imply a juncture of instrumental and immaterial values, experiential and sensorial, that are not necessarily recognized.

Picture 6: Mbyá-Guarani smallholder explains lifestyle transitions in his community. In the background, a traditionally built house. Martin Barranco, 2017.

Transitions in knowledge systems

According to Diaz et. al. (2015), a knowledge system is "a body of propositions that are adhered to, whether formally or informally, and are routinely used to claim truth". A "truth" repeatedly expressed through the interviews was that traditional farming is unsustainable, due to the lack of knowledge held by smallholders. *Conservation* becomes one of the pillars of "truth" in rural Paraguay. The other is *increasing productivity* for the sake of economic growth. These two objectives are accepted by different collectives alike; family farmers, transitional farmers, agronomists, or even activists. For instance, César argued: "family farming must integrate a part of the past when it comes to the management of means of production like land, water or seeds. But production is not optimal in family farms". Agronomists in Agüerito defended a complementation of "knowledge from before, basic knowledge from the parents and grandparents", through an inclusive educational plan. In this process, the integration of the indigenous peoples was perceived negatively, complicated at the least: "The issue is the root of the problem, their culture, which is backwards. Our ancestors struggle to think, so they do nothing. They receive public aid, but they prefer to spend the day sleeping and drinking".

Discussion

I opened this paper questioning the potential of an assessment on traditional ES that transcends monetary value. The current preference for monetary value over other values is historical. This section will deepen on how the tendence towards value-monism has structural causes. In the 20th century, Stroessner's regime pushed the colonization of forest regions, considered 'illiterate' due to their indigenous inhabitants and lack of productivity, into farming land.

As they colonized forested areas, farmers in a condition of isolation due to poor or inexistent public infrastructure, concentrated their efforts towards self-subsistence. Their extractive capacity was limited by the power of manual labour. Hence, families in these communities had not a formal economy, but displayed a set of ecosystem services that provided wellbeing. This does not mean that farmers avoided money willingly, but their situation of isolation made of it a very little part of their daily lives. However, a utilitarian approach on the forest was already very present, through ES for necessities like health, nutrition, shelter. Their arrival supposed an anthropogenic 'disturbance' on the ecosystem, as well as a disturbance (prosecution) to Guarani nomadic groups who were considered backwards, illiterate, and unable to farm. I showed how such perceptions are still vivid among informants that I interviewed.

Ludwig (2000) warns about the limitations of purely economic assessments of ecosystems services. In contemporary rural Paraguay, yuyus, or 'fresh' wooden houses, exemplify adaptive strategies which value cannot be reduced to monetary parameters. "Feeling the fresh air" between house planks, the sense of belonging, the convenience of preserving key species for plague-control, are examples of such boundaries. Regulating ES like forest climate amelioration, are also disregarded or subedited to market value on an increasing trend. But this exacerbated trend is not but a new chapter of a utilitarian perspective that has been well rooted in smallholders' minds for decades. However, family-farming tend to regard cultural and regulating values to some extent, whereas industrial farming clearly prioritizes value-monism and a single type of value exclusively.

The implementation of democracy in 1989 opened Paraguay to the word, and stewardship efforts aimed to adapt to international markets for the sake of national development. Smallholders were displaced in favour of foreign investors, creating a

context of *campesino* conflicts and mobilizations. As the trend towards intensive agriculture and a market economy has grown, a narrative that justifies this transition is needed. In such narrative, smallholders are more likely to be described as illiterate. They are accused of being unable to optimize production with their obsolete farming methods, and of environmental malpractices -like hazardous fire usage- by modern farmers, who argue about the necessity of *educating* them.

In the contemporary context of farming transitions, a new-old contrast is perpetuated; the old opposition of rational against irrational subsistence, where now traditional farmers take a social position similar to the one traditionally attributed to indigenous guaranies. Such dichotomy takes relevance in the smallholders' identitarian claims, that are often displayed as in contrast to the alterity from other social and ethnic groups. For example, they express a positive sense of belonging towards the forest ecosystem when they oppose themselves to industrial farmers. But when they refer to the guaranies ('our ancestors'), they appeal to their alleged backwardness and forest-dominated lifestyles.

It is under these cultural perceptions that traditional knowledge gets displaced, while formal agricultural knowledge grows in demand and public approval. For one, formal knowledge represents development and the advance to a formal economy. It is also provided through formal institutions that are not accessible for everybody. This further disempowers the holders of traditional knowledge, perceived as illiterate regarding their low productive capacity. However, their disempowerment appears more obvious with their struggle to integrate into market-value chains, and with on-going dynamics of exclusion such as evictions or soy fields overlapping their communities and way of life, generating hazards such as chemical poisoning.

This study puts to question the perception of traditional knowledge as useless. If we implement the theory of the three foci of value from the IPBES, forest ecosystems, farms, and farmers, establish three foci of value. Ecosystems hold intrinsic, non-anthropogenic value, from which ES are generated as instrumental value for the sake of the farmers' quality of life. Reversing the order of factors, ecosystem health affects its capacity to provide services. Hence, external disturbances like forest depletion imply an impact -positive or not- in quality of life, i.e., through plagues. Departing from the undeniable reality of the on-going anthropogenic disturbances in rural Paraguay, farmers, as subjects of the foci of value, might provide anthropogenic

value for the conservation of ecosystems, through the combination of practices typical of family farming, implementing a productive system based on land-sharing postulates. Because even in small farms, the range of ecosystem services is becoming less diverse, as it becomes less diverse the diversity of animal and plant species that are managed. Strategies like bee-keeping, fishing, hunting, or foraging are left unfeasible due to ecosystem degradation and climate changes. But especially, due to the lack of governmental incentives and the underestimation of crops, services, and species reproduced in stewardship efforts focused on economic growth only.

The erosion of cultural subsistence strategies is parallel to the erosion of soil, to the degradation of basic ecosystem functions like carbon extirpation, or to the conservation of biodiversity. And although governmental projects aim to the inclusion of smallholders through market value-chains, this strategy faces challenges like their low capacity of investment or lack of education to implement the transition towards intensive agriculture. Opinions about traditional subsistence strategies are mixed among smallholders. Ultimately, they conform the basis for diverging positions through the political spectrum of a country that is still predominantly rural.

Conclusions

Paraguayan conservation strategies follow a land-sparing strategy based on compositionalist ideas, whereas "small" natural reserves contrast most of the land devoted to farming activities. Institutional action gives preference to farming strategies that are easier to integrate in market value chains, like soy. But this supposes evident environmental and social problematics, like biodiversity extirpation, land evictions, and chemical poisoning by agro-chemicals. The inclusion of smallholders in community-based conservation, following land-sharing principles, settles a starting point to reconcile the environmental and social challenges presented here. On the other hand, re-situating smallholders as holders of valuable knowledge about a diverse range of ecosystem services, reinforces a different paradigm for conservation and development, considering them as potential agents of positive change. This presents new challenges; to consider the range of values here presented, and to design policies able to integrate these ES in the national economy.

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Annex 1: Reported tree species in traditional family farms

Local name	Scientific name	Services	Observations
Amba'y	Cecropia adenopus	Fruits	Fruits can make an expectorant syrup
Curupí	Sapium haematospermum	Healing sage	
Eucalyptus	Eucalyptus melliodora	Tree-planting, shadow	Non-endemic, planted in rows
Lapacho amarillo	Handroanthus albus	Wood	
Manduvirá	Pithecellobium sahman	Shade, fodder	
Paraíso Gigante	Melia azedarach	Tree-planting	Planted in rows
Peterevy	Cordia trichotoma	Wood, shadow	Frequently used to build fences
Pino	Pinus taeda	Wood	
Tacuará	Bambusa quadua	Fodder, shadow	Combined with pasture land
Tatajyva	Chlorophoria tinctoria	Shade, wood, fruits	Combined with pasture land
Tataré	Pithecellobium scalare	Shade, fodder, wood	Frequently used to build fences
Timbó	Enterolobium contortisiliquum	Shade, wood	Frequently used to build fences
Toona	Toona ciliata	Shade, wood	Planted in rows, associated with yerba mate
Urunde'y	Astronium fraxinifolium	Wood, fruits, shade	Frequently used to build fences
Ysapy'y	Machaerium schleroxylon	Wood	Frequently used to build fences
Yvyrá'ju	Albizia hassleri	Wood	Planted in rows, combined with pasture land
Yvirá pepé	Holocalix balansae	Wood, fruits	Combined with yerba mate and citrics
Yvirá pytá	Peltophorum dubium	Wood, shade	Frequently used to build fences
Yvirá ro	Pterogyhe nitens	Wood and timber	

Annex 2: List of informants

Name (anonymized)	Profile
Florián	Traditional farmer
Basil	Traditional farmer
Javier	Traditional farmer
Julia	Traditional farmer
Miguel	Traditional farmer
Mala	Activist
Pablo	Traditional farmer
Simón	Traditional farmer
Aguirrez	Agricultural engineer
Ángel	Agricultural engineer
Pedro	Traditional farmer
Andrés	Traditional farmer
Andrea	Housewife/farmer
Segismundo	Former beekeeper/traditional farmer
Cristian	Day labourer/traditional farmer
Dimas	Traditional farmer
David	Traditional farmer
Eduardo	Local leader/farmer
Fidel	Traditional farmer
Hauer	Local leader/farmer
Héctor	Traditional farmer
Domínguez	Traditional farmer
Gabriel	Traditional farmer
Laura	Housewife/farmer
Luisa	Traditional farmer
Ramos	Politician/livestock/soy farmer
Raúl	Agricultural technician, teacher, traditional farmer
Soro	Traditional farmer
Chico	Small-scale soy farmer
Walda	Traditional farmer
Will	Traditional farmer
Paco	Traditional farmer
Alberto	Retired traditional farmer
Juan P	Small-scale soy farmer
Sr F	Retired farmer
Sra F	Retired housewife
Sra C	Housewife
César	Agricultural expert
Korean representative	International Aid
Young 1	Traditional farmer
Young 2	Student
Young 3	Student