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AGROFORESTRY POLICY THE SILVER-BULLET FOR SUSTAINABLE AGRICULTURE?

A multi-stakeholder analysis of Peru's Agroforestry Policy in fostering sustainable smallholder agriculture in the Peruvian Amazon.

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Abstract

Over three-quarters of the world's poor live in rural areas and many of them depend on agriculture to earn a living. In a context of climate change, Agriculture, Forestry and Other Land Use (AFOLU) is addressed as one of the main sources of Greenhouse Gas (GHG) emissions. Hence, the sustainability transition in the agricultural sector has become one of the most prominent development areas in the 2030 agenda for Sustainable Development. The Amazonian rainforest is acknowledged as an indispensable source of ecosystem services, threatened by deforestation due to unsustainable land use practices. Peru, together with several developing countries has put its faith in agroforestry systems as a key strategy to foster sustainable agriculture. In the country, the vulnerability of small-scale farmers has forced them to clear forest land in search for fertile grounds. Therefore, the aim of this study is to explore *the potentials and challenges of Peru's Agroforestry Policy (PAP) in fostering smallholder sustainable agriculture in the Amazon* through a multi-actor case-study at the region of San Martín. The study is based on qualitative and participatory methods which involved more than 50 stakeholders in the Region of San Martín in the Peruvian Amazon. Sustainability is assessed from the holistic and interconnected perspective of the SAFA framework (FAO, 2013). The main findings stress that PAP has fostered more sustainable agricultural practices at the Amazon, however, the challenged remains whether it has the ability to foster and address equal, fair and just conditions for smallholder agroforestry farmers.

Key words: Agroforestry, Peru, Smallholders, Sustainable Agriculture.

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Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
AGROTORAL	Programa de Desarrollo Productivo Agrario Rural Development Program for Agrarian Development
ARA	Autoridad Regional Ambiental Regional Environmental Authority
CO ₂	Carbon Dioxide
FAO	International Fund for Food and Agriculture
FONCODES	Fondo de Cooperación para el Desarrollo Social Cooperation Fund for Social Development
GHG	Greenhouse Gas
ICRAF	International Centre for Research in Agroforestry
IFAD	International Fund for Agricultural Development
INDC	Intended Nationally Determined Contributions
La Red	La Red de Asociaciones Asamsa Limón The Network of Associations Asamsa Limón
MAS	Multi-Layer Agroforestry System
MINAGRI	Ministerio de Agricultura y Riego Ministry of Agriculture and Irrigation
MINAM	Ministerio del Ambiente Ministry of Environment
NDC	National Determined Contributions
NGO	Non-Governmental Organization
PAP	Peru's Agroforestry Policy
SDG	Sustainable Development Goals
SERFOR	Servicio Nacional Forestal y de Fauna Silvestre National Forest and Wildlife Service
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund

1. Introduction

Over three-quarters of the world's poor live in rural areas and many of them depend directly upon agriculture to earn a living. The agricultural sector in the developing world is dominated by small family farms that supports the livelihoods for up to 2.5 billion people. However, smallholder farmers still face several social and economic barriers, while the pressure on the agricultural sector and the natural resource base increase with population growth, climate change and unsustainable land use practices as deforestation and land use conversion (IFAD, 2016). Over the past 50 years, GHG emissions resulting from 'Agriculture, Forestry and Other Land Use' (AFOLU) have nearly doubled, and projections suggest a further increase by 2050 (Smith et al., 2014). Consequently, incorporating sustainability into agricultural activities has been one of the most salient topics in the international development debate and regarded as one of the foremost priorities in an urgent need to reconcile the goals of agricultural production and environmental conservation. Sustainability in agriculture is much more than ensuring the protection of the natural resource base, it is about meeting the needs of present and future generations while ensuring profitability, healthy ecosystems, and social and economic equity (FAO, 2014:12).

In light with this idea, governance arrangements as the Sustainable Development Goals (SDG's) have become essential in harmonizing a common pathway towards agricultural sustainability locally and internationally. The SDG agenda acknowledges the capacity of the agricultural sector in fostering sustainable livelihoods, food security, and poverty reduction. Additionally, to the implementation of the SDG agenda, 90 percent of the countries in the world address the agricultural sector in their Intended Nationally Determined Contributions (INDC) to reduce their ecological footprint and fulfil the Paris Agreement (FAO, 2016: 2015:7). In such context, over a third of the world's developing countries intend to mitigate climate change with agroforestry (CGIAR, 2019) defined as an ecological and sustainable land management system, with the potential to foster sustainability in both economic, social and environmental terms. Agroforestry practices are widely recognized to reduce soil erosion, increase soil fertility, improve the quality of water resources, as to provide increased carbon storage and reduce the carbon released into the atmosphere, while simultaneously contributing to smallholders sustainable

livelihoods (FAO, 2015; Fischer & Vasseur, 2002; Nair and Garrity, 2012; Meijer et al., 2015; Montagnini, 2017).

Based on the sustainability potentials of agroforestry, Peru, like many other developing countries in the world, has adopted this land management system to address global climate change and other development commitments (World Agroforestry Center, 2017). Peru is as well considered one of the most biodiverse countries in the world where over 330,000 people depend directly on the country's forests for their livelihoods and ecosystem services those forests provide (WWF, 2015). However, the Peruvian Amazon is at the same time one of the most threatened forests related to deforestation and biodiversity loss. For long one of the main drivers behind the deforestation at the Amazon have been unsustainable agricultural practices where the lack of livelihood opportunities has forced resource poor smallholders to clear new land, often rich in flora and fauna, in search for fertile soils for agriculture (Zeili et al., 2014:17-18). To tackle this issue, Peru's Agroforestry Policy (PAP) has been implemented with a multi-sectoral and multi-stakeholder approach in the upper part of the Amazonian rainforest, at the region of San Martín; a region characterized by a longstanding history of deforestation, smallholder agriculture and coffee production (PNUD, n.d.).

The aim of this thesis is thus to explore *the potentials and challenges of Peru's Agroforestry Policy in fostering sustainable smallholder agriculture in the Amazon* through a multi-actor case-study at the region of San Martín. The cross-sectoral dynamics which characterizes agroforestry -forestry, agriculture, and sustainability- imminently involves a variety of stakeholders and are central aspects to the outcomes of sustainability practices, which this thesis will explore. The study departs from a production and smallholder perspective and acknowledges the pivotal role of smallholders, as practitioners of agroforestry systems and their immediate relationship to the social, economic and environmental aspects of agriculture. There is a general recognition that sustainability in itself cannot be achieved without bridging economic, social and environmental dimensions. Also identified as the concurrence of the planet, people and profits (Hansman, 2012). Sustainability in agriculture will, therefore, be understood by assessing its economic, social and environmental dimensions, where governance has been incorporated as a key dimension due to its role in achieving all sustainability dimensions simultaneously. With a qualitative approach, the study searches to gain a detailed and holistic understanding of the interaction

between the sustainability dimensions of PAP in fostering sustainable land use practices for smallholder farmers in the Amazon. The study will be guided by the Sustainability Assessment of Food and Agricultural Systems Framework (SAFA) comprised of the four dimensions of sustainability: Good governance, Environmental, Economic and Social dimension (FAO, 2013). In line with each sustainability dimension, the research questions addressed in this master's thesis will be the following:

1. *Environmental Dimension: In what major ways have smallholder's land use practices transformed with PAP and what are the main barriers and opportunities for improved ecosystem services with PAP?*
2. *Economic Dimension: What are the main barriers and opportunities of PAP in reducing smallholder's economic vulnerability?*
3. *Social Dimension: What are the main barriers and opportunities of PAP in fostering fair trading practices and smallholder's associativity?*
4. *Good Governance Dimension: What are the main barriers and opportunities of PAP in fostering stakeholder participation and cooperation?*

The thesis will be structured as follows: a background will give a contextual introduction to agroforestry in the world and provide a deeper understanding of agroforestry in Latin American and in relation to Peru's Agroforestry Policy (PAP). Thereafter, the literature review will explore the existing debates and research regarding sustainable agriculture, especially in relation to smallholders and agroforestry. The analytical framework will explore the concept of sustainability and the SAFAs framework that was applied to analyze the data followed by the methods sections that will clarify the methodology used in the study. The analysis is structured in line with the four dimensions of sustainability of the SAFA framework 1) Environmental dimension 2) Economic dimension 3) Social dimension and finally the 4) Good Governance dimension, in order to answer each one of the research questions. The analysis will also position the main findings in current research to finally present the concluding remarks.

2. Background

2.1 Contextualizing Agroforestry

Agroforestry is a land management system, which involves both traditional and modern land-use methods where trees are managed together with crops and/or animal production in agricultural settings. Agroforestry systems are dynamic and ecological, based on diversification and sustained production to generate social, economic and environmental benefits for land users at all scales (FAO, 2017). Cultivating trees and agricultural crops in an intimate combination with one another is an ancient practice that farmers have used throughout the world ever since agriculture first began. However, during the 1970s the concept attracted the attention of academics and the international development community due to its potential as a sustainable land management system in response to the environmental and social side effects of the Green Revolution (Montagnini, 2017; FAO, 2015). Agroforestry is both a production system and a protection system for crops and animals. More recently, in light of climate change and global warming, agroforestry has developed into a mitigation strategy which offers adoption benefits to farmers, as well as decreased CO₂ emissions, carbon storage and biodiversity conservation opportunities (UNFCCC, 2018). The different purposes and components of agroforestry systems will be summarized below.

- i) *Shelter: Systems in which trees provide shelter for crops, pastures or livestock. The main purpose is agriculture; trees fulfil a service role.*
- ii) *Forest grazing: The grazing of livestock in forests or woodlands not originally planted with grazing in mind. The main purpose is forestry, with agriculture playing a supplementary role.*
- iii) *Silvopastoralism: The deliberate integration of trees and livestock.*
- iv) *Shifting cultivation: or periodic agriculture within a natural forest environment.*
- v) *Agrosilviculture: Combinations of trees and crops.*
- vi) *Agrosilvopastoralism: The integration of trees, crops, and livestock - often in a temporal sequence as well as in a spatial pattern” (FAO, 1985)*

Specifically, from a global development perspective, agroforestry is commonly discussed in the light of climate change and sustainability. The Paris Agreement on Climate Change, approved by 196 parties specifically set a route towards climate change adaptation, to foster climate

resilience and decrease GHG emissions globally, without threatening food production and maintained finance flows. Henceforth, agroforestry has been identified as a prominent land management system by most developing countries in their Nationally Determined Contributions (NDCs) to accomplish with the objectives of the Paris Agreement. Particularly, the NDCs represent an agenda of prioritization in which countries consider options and possible scope for contributing to global climate mitigation objectives and adaptation beyond 2020 (World Agroforestry Center, 2017). Despite, the promising potentials of agroforestry, the outcomes of agroforestry rely on an amount of mechanisms, like resource allocation, governance, as for example organizational and institutional arrangements, as well as knowledge. In light with the importance of agroforestry the development of agroforestry practices will be further discussed within the Latin American context.

2.2 Agroforestry in Latin America

Agroforestry, as explained above is a common system of production all around the globe. Nevertheless, it has developed differently in different settings and environments. In Africa, special attention has been given to agroforestry as a food production system in seasonally dry and semiarid areas to sustain crop productivity, increase soil fertility and enhance food security (Nair and Garrity, 2012). In Asia, research has focused more on the forest aspects of agroforestry in tree-crop-based systems, agroforests as well as food production in forest and fruit gardens, especially in population dense. On the other hand, in Latin America, agroforestry has mainly been implemented on silvopastoral and multistrata systems with tree crops like coffee and cacao. The approach in Latin America arose from commercial tree crop and animal productions systems, but also from a strong biodiversity and conservation perspective. Particularly in the Amazon, agroforestry is often related to soil quality improvement of land degradation of slash and burn agriculture and as a climate change mitigation strategy (Somarriba et al., 2012).

The agroforestry coverage in Latin America is estimated to between 200 to 357 million hectares, between 14-26 million hectares in Central America and 88-315 million hectares in South America (Ibid). Of it, the most prominent agroforestry system in the continent are silvopastoral systems, shade-grown coffee and cacao tree-crop systems. Coffee and cacao cultivation cover an area of 5.41 million hectares respectively 1.63 million hectares in Latin America. The majority of the around 20 million coffee producers are smallholder farmers. Relevant to mention is that

agroforestry research has concluded that “*the major types of agroforestry systems are structurally similar in areas with similar ecological conditions*” (Somarriba et al., 2012:431). Hence, shade-grown coffee is also the most common cultivation method in tropical regions and agro-ecological regions can thereby be taken as a basis for the design of agroforestry systems (Ibid). The different agro-ecological regions where agroforestry takes place in Latin America have been divided into the categories of FAO: humid/sub humid lowlands, dry regions (semiarid and arid), and highlands. Today agroforestry is an integrated concept in both national laws, agendas, policies, international commitments, in science and technology, practiced by farmers and different types of land users all over the Latin American continent (Somarriba et al., 2012). To further understand the multidisciplinary nature of agroforestry the following section will give an introduction to the Peruvian Agroforestry Policy.

2.3 Peru’s Agroforestry Policy

Peru is considered one of the most biodiverse countries in the world, characterized by three different geographical zones; the coast, the highlands and the rainforest. The total land area of the country is 1 285 216 km² (FAO, 2010) and almost half of the country is covered by forests (Global Forest Watch, 2010) where the rainforest represents 94 percent of the total forest coverage in the country (WWF, 2015). However, from 2001 to 2017 Peru lost 2.67 million hectares of tree cover (Global Forest Watch, 2010). Land conversion of small-scale agriculture has been one of the the main causes behind the deforestation in the country which accounts as well as one of the main drivers behind tropical deforestation globally (MINAM, 2016; WWF, 2015). Land conversion and deforestation in the Amazon release up to 0.5 billion metric tons of carbon per year, thus rendering the Amazon an important factor in regulating the global climate (WWF, 2015). In the context of land degradation, deforestation, and climate change, agroforestry emerged as an instrument promoted by the government at different levels in an attempt to foster sustainable agricultural practices with economic, social and ecological outcomes (World Agroforestry Center, 2017).

To begin with, the foundation of Peru’s Agroforestry Policy (PAP) is the Forest Law (N° 29763), approved in 2000-2001 with the aim to promote sustainable forest management, biodiversity conservation and livelihood improvement in the country. The Forest Law supports plantation of forests and agroforestry management understood as:

“A type of land use systems that consist of the associated management of forestry species and agriculture in the same plot in space and time. It includes practices of integration, preservation, and management of tree species in perennials and annual agricultural production systems” (SERFOR, 2015:10).

According to the law, the state will promote the development of forest plantations and agroforestry systems at the national level by generating the adequate conditions for agroforestry, seeking to increase productivity levels and strengthen competitiveness. Based on social and environmental standards within the framework of forest management, and under an ecosystem approach, the law aims to generate greater social, economic and environmental benefits for the population. Agroforestry systems will primarily be established in forests or protected land areas that have been transformed and are considered special treatment areas for agroforestry or silvopastoral production, or coverage recovery forest zones for the purpose of either forest production, forest restoration or conservation. Peru’s Agroforestry Policy (PAP) seeks to maintain or recover the provision of goods and ecosystem services located in these areas (SERFOR, 2015). By 2021, the Peruvian government furthermore aims to preserve a total of 54 million hectares of forest and reduce the deforestation to zero (TheReddesk, 2019).

Additionally, in 2016, The Cession in Use land entitlement concession was introduced to the Forest Law seeking to decrease deforestation and promote restoration of previously cleared land by formally recognizing smallholders land rights on state forest land if they commit to either establish or maintain agroforestry systems (World Agroforestry Center, 2018). The new concession Cession in Use gives smallholders who encroached state land since 2011 rights over the land up to 40 years (Ibid). The Cession in Use specifically has been implemented in the Region of San Martín since December 2018 and it is expected to take place throughout the country in the upcoming years (Ibid). Furthermore, over the last year, Peru presented a new multi-sectoral and multi-stakeholder approach to the National Determined Contributions (NDC) based on the Law on Climate Change (Law N° 30754), which was adopted by the Peruvian government in March 2018 (MINAM, 2018). The NDC presents four central development areas, among which agriculture and forests are two of these main areas of action. Land Use, Land-use Change, and Forestry (LULUCF) and Agriculture are thus, identified as the

sector with the biggest potential for reduced GHG emissions. In such a context, agroforestry has been identified as a key system to accomplish such reduction, specifically for smallholder farmers in coffee and cacao production, on the path towards sustainable agriculture in the Amazon (MINAM, 2015). The figure below will portray the main elements of PAP.



Figure 1: The Components of Peru's Agroforestry Policy. Source: The authors (2019).

Consequently, the abovementioned regulatory frameworks are the foundation of PAP, which at a national level are managed by the Ministry of Environment (MINAM) and the Ministry of Agriculture (MINAGRI) through the National Service for Forests and Wildlife (SERFOR). At the regional level, the responsible authority is the Regional Environmental Authority (ARA), which primarily works in cooperation with SERFOR. As well as the Regional Government of the Region of San Martín. Moreover, within the private sector, coffee and cacao cooperatives are involved in supporting, training and certifying farmers in sustainable agricultural methods, as for example agroforestry and organic coffee production. External, national and international investors, companies or partners are also involved in supporting or financing agroforestry initiatives through for example REDD+ and carbon compensation. The last actor's group involved in the implementation of PAP in practice are comprised of civil society actors represented by farmer communities, coffee and environmental associations, and NGOs, who primarily provide the farmers with support in form of resources and capacity building in agroforestry methods. The chapter below will provide a literature review over sustainable agriculture, smallholders and agroforestry to situate the research topic in current research.

3. The Path Towards Sustainable Agriculture

3.1 The Development of Agriculture

Over three-quarters of the world's poor live in rural areas and many of them depend directly upon agriculture to earn a living. Yet, a growing population, poverty, unsustainable land use and climate change are imminent pressures on how agriculture will be able to produce and deliver a global demand for food for the present and future generations (IFAD, 2016). An extensive body of literature has analyzed the implication of different trends of land use over agriculture practices and outputs. Such research has been based on the dilemma of which agricultural system will be most effective in satisfying the world demand for food and tackle poverty in a sustainable way (Byerlee et al., 2009; Carswell, 1997; Byerlee et al., 2007; Van Grinsven et al 2015). Historically there have been two main pathways in agricultural development, that until 1950 were characterized by the dual economy theories of development, where the traditional or subsistence sector in agriculture was understood as the fundament for economic growth by modernizing the agricultural sector into large scale as commercial farms and plantations. Based on the idea that large farms can make more efficient use of technology and resources. However, during the 1960s the paradigm shifted to consider small scale agriculture the very key to rural development, characterized by intensification rather than extensification (Ellis and Biggs, 2001:440). The debate has been, whether agricultural intensification -increase in the productivity of land measured by the real value of agricultural output per hectare- or extensification a substantial increase of the areas of cultivation by expanding land- are the most effective ways in providing food security, growth and poverty reduction. Both patterns of land use have been defined intrinsically as opposed to one another, guided by the incertitude of whether agricultural growth is driven by factors of accumulation or productivity.

In regard to productivity, land intensification was promoted during the agenda of the so-called Green Revolution. It essentially represented a package of inputs as fertilizers, high yielding seed varieties, and mechanization that were designed with the aim of strengthening land practices (Carswell, 1997). Academics highlight that the Green Revolution was the result of a “paradigm shift” in rural development into small-farm agriculture and intensification (Ellis and Biggs, 2001:440). Although evidence points out that agricultural intensification during the Green Revolution significantly led to pro-poor growth and agricultural productivity with unprecedented

crop yields in some regions, it also caused yield deterioration in many regions (Carswell, 1997; Rosegrant and Livernash, 1996). Agricultural intensification required the use of fertilizers and chemicals to increase land productivity, which had remarkable consequences to the environment as many countries experienced land deterioration, soil erosion, and depleted water resources (Van Grinsven et al., 2015). Although, authors such as Phalan et al (2011), address land intensification as the best global strategy to spare land and halt biodiversity loss. On the other hand, Van Grinsven et al. (2015) problematizes the role of intensification in minimizing cropland and detain deforestation by looking into the global dynamics of intensification. A clear example is Brazil, where intensification is combined with extensification in soybeans plantations caused deforestation, the same case was experienced in Indonesia with palm oil. Authors underscore that in specific regions deforestation is likely to continue and occur with intensification practices if not combined with natural resource management and technology to cushion environmental impacts (Fischer et al., 2014).

Interestingly, in many developing countries land extensification has merged with intensification practices of crops such as soy, palm, sugarcane, and maize due to large demands to serve global food markets or new biofuel markets (Phalan et al., 2013). This type of land practice is strongly related to an overall impact on deforestation, carbon and biodiversity loss. In Brazil, for instance, land extensification combined with intensification practices is regarded as one of the main causes of biodiversity and environmental damage in the Amazon. Rubber and cocoa have also expanded rapidly at the cost of forests and biodiversity. Hence, the question in rural development has been to assess which farming system is the most effective to foster economic growth and decrease poverty, without undermining the environment. Research evidence that neither of both pathways of land use has had the absolute answer to economic growth and poverty reduction, nor sustainable development, as both encompass risks and opportunities (Ellis and Biggs, 2001). Extensification nor intensification have been the silver bullets to foster sustainable food systems or to address the risks of environmental degradation of agricultural activities. Therefore, sustainability has become one of the most important backbones in agricultural development to balance food production, with human livelihoods and healthy ecosystems.

3.2 The Importance of Sustainable Agriculture

Recent research has revealed that the pressure of human activities threatens the resilience of the earth system in changing the planet's climatic, geophysical, atmospheric and ecological processes,

which has reached a scale where abrupt global environmental change no longer can be unheeded (Rockström et al., 2009, 2017; Steffen et al., 2015). These authors derive the pressures to the extensive use of fossil fuels after the industrial revolution as well as the intensification of industrial agriculture. Based on the global recognition of the degradation of ecosystems and estimations of climate change, sustainability has become an answer to maintain and enhance social, environmental and economic development (Quintero-Angel and Gonzáles-Acevedo, 2016). Consequently, incorporating sustainability into agricultural activities has been one of the most salient topics in the international development debate and one of the foremost priorities in modern society (FAO, 2017: 4-7). Sustainability in the agricultural sector is commonly understood as:

“The management and conservation of the natural resource base in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.” (FAO, 1989:65).

Sustainability in agricultural systems thus incorporates concepts of both resilience -the capacity of systems to cope with shocks and stresses- and persistence (the capacity of systems to continue over long periods) and addresses wider economic, social and environmental outcomes (Rahn et al., 2014:1124).

However, sustainable agriculture becomes paradoxical when assessing to what extent agriculture actually is able to conserve land and natural resources, meanwhile attending a growing demand for food and the 1.3 billion smallholder livelihoods that directly depend upon it (FAO, 2012). Likewise, the discussion has been centered on whether agriculture is comparable to environmental sustainability in healthy ecosystems, to economic sustainability for rural livelihoods and the world food market, while encompassing social sustainability for present and future generations around the globe. Especially when agriculture is identified as one of the main drivers of climate change, in relation to AFOLU, and at the same time particularly vulnerable to such change (IPCC, 2014). The figure below shows AFOLU with a significant share of Greenhouse Gas (GHG) emissions, with a total of 24 percent direct emission (Ibid).

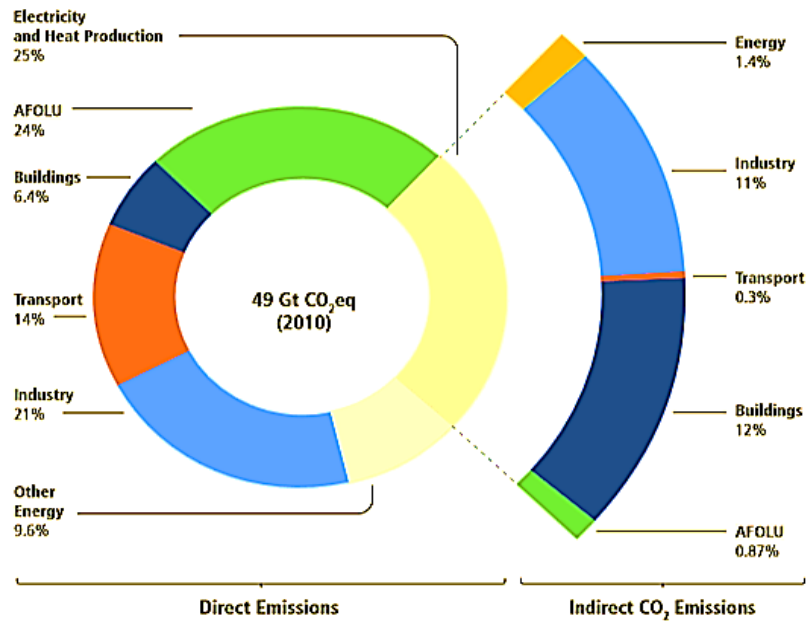


Figure 2: Greenhouse Gas Emissions by Economic Sectors. Source: IPCC (2014:44).

In this context, Pretty (2007:447) underscores the importance of developing agricultural technologies and practices that do not have adverse effects on the environment, that are accessible to and effective for farmers, and lead to both improvements in food productivity and have positive side effects on environmental goods and services. According to research, the adoption of such practices are most likely to emerge from new governance arrangements which comprise relations of trust embodied in new social organizations, and new horizontal and vertical partnerships between institutions. Consequently, in order to accelerate the path towards agricultural sustainability, Rasul (2016) and Rockström et al., (2017) highlight the relevance of institutional and coordination mechanisms such as the Sustainable Development Goals (SDGs). The SDGs require productive agriculture that does not degrade land or lead to deforestation. Specifically, the SDG number two “End hunger, achieve food security and improved nutrition and promote sustainable agriculture.” (UN, 2015) recognizes the inter-linkages among sustainable agriculture, empowering small-scale farmers, promoting gender equality, ending rural poverty, ensuring healthy lifestyles, tackling climate change (UN, 2019). One of the sub-goals of SDG number two accentuates those linkages as follows:

By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity

for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality” (FAO, 2019).

Hence, agriculture at the current development agenda seeks to make the best use of nature’s goods and services, technologies and practices with the end goal of fostering sustainability at all levels. For the achievement of the agenda, Doelle (2016) stresses the importance of support from non-state actors and sub-national actors and to make it work in concert with and to mobilize regional, national and sub-national efforts. Nevertheless, the Sustainable Development Agenda has also been criticized to be weak in terms of agency in its inability to enforce strict obligations for governments, businesses and consumers (Meuleman and Niestroy, 2015; Spangenberg, 2017). Spangenberg (2017) calls for an agenda that rather addresses sustainability on the grounds of needs and limitations, as the present agenda requires compromises which in practice could be contradictory. Nevertheless, the concept of sustainable agriculture is based on new structures of governance which aim to involve stakeholders at different levels and sectors around the globe. This set of new rules and practices inevitably gives farmers a central role in the future of sustainable agriculture as the majority of the world’s agricultural production in the developing world takes place on small farms (Rapsomanikis, 2015:1), and partly as smallholder farmers face unique challenges due to their vulnerable position in the transition towards sustainable agriculture, which will be explored in the section below.

3.3 Smallholders in Sustainable Agriculture

About two-thirds of the developing world’s 3 billion rural population lives in about 475 million small farm households and work on land plots smaller than 2 hectares (Rapsomanikis, 2015:1). In such a context, diverse literature has underscored smallholders as one of the cornerstones for sustainability practices in the sector as the majority of farms are small, managed by what is called smallholders (Brookfield, 2008; IFAD, 2016; Pokorny, 2013; Rapsomanikis, 2015). Smallholders produce 80 percent of the total food production outputs in Asia, Sub-Saharan Africa and Latin America (CFS, 2016) and are generally defined as either small-scale farmers, pastoralists, forest keepers and fishers who manage areas varying from less than one hectare to 10 hectares (FAO, 2012).

Other authors refrain from defining smallholders by land size rather chose to define smallholders by its family or household functions, of for example being family managed, using family labor

and use parts of the production for family consumption; also commonly called a family farm (Brockfield, 2008). Although, the concept of smallholders is often related to limitations; either in land size as mentioned before, but also in economic size, production, resources and vulnerability aspects of external shocks and stresses in comparison with other types of farms (Cohn et al., 2017, Morton: 2007, Brockfield, 2008). Besides, the concept of “pluriactivity” has become a characteristic of rural smallholder livelihoods in the combination of on-farm and off-farm activities (Brookfield, 2008). According to this concept, Ruben and Pender (2004) particularly highlight the importance to address rural heterogeneity in development and calls for two types of policies. Firstly, in improved opportunities by modifying asset control and market access and secondly in increased supply response based on improved conditions for smallholders collective, action, learning and rights.

In the sustainability literature smallholder farmers are discussed in both ends of climate change; as the main drivers and at the same time the one of the main answers to climate change (Bouroncle et al., 2017; Chandra, 2018; Cohn et al., 2017; Lipper et al., 2018; Rahn, 2014;; Morton, 2007; Recanati et al., 2017; Verchot et al., 2007). Firstly, CO₂ emissions from smallholder production and consumption are in general low, but smallholders generally produce products, crops, and livestock, that have high GHG intensities to other types of producers. Smallholders also play a vital role between the commodity market demand and deforestation, contributing to a big share of the emissions known as black carbon, a strong, but short-lived climate forcer. Hence, there is a relationship between smallholder agriculture, commodity markets, deforestation in the creation of new agricultural land, which often is practiced by slash and burn agricultural methods (Cohn et al., 2017:348-363). Moreover, various authors shed light on smallholder high vulnerability to climate change events, as this group, largely resource-poor live in developing parts of the world, in regions estimated to be the most heavily affected by actual and future climate change impacts (Bouroncle et al, 2017; Chandra et al., 2018; Cohn et al., 2017; Lipper et al., 2018; Morton, 2007; Verschot, 2007).

Moreover, the tropics are depicted as one of the region’s most vulnerable to climate change in terms of increased temperatures, crop sensitivity and stronger dry seasons (Bouroncle et al, 2017: Cohn et al., 2017, Morton, 2007). Henriksson Malinga et al., (2018) also refer to smallholder’s vulnerability in lack of resources to mitigate unsustainable land use which leads to overuse and

land degradation. Furthermore, Cohn et al., (2017:365) agree with this argument and accentuate smallholder vulnerability, highlighting that “*due to their location in tropical latitudes, dependence on natural resources, lack of access to markets or financial networks, and political marginalization.*” Thus, smallholders in sustainable agriculture face the controversy of being the main source as well as one of the main solutions to unsustainable land use. At the same time represent a generally resource-poor group, vulnerable to external factors and stressors. Furthermore, smallholders in the transformation from traditional agriculture to sustainable smallholder agriculture are challenged by several social, economic and environmental stressors. In the search of an agricultural system that can provide sustainable alternatives for smallholders and improved livelihoods, agroforestry has gained grounds in the international development agenda. Hence, agroforestry has been acknowledged with the greater potential to increase the amount of carbon sequestered compared to landscapes characterized by monoculture, as it provides carbon sequestration by incorporating trees in agriculture (Kirby and Potvin, 2007; Montagnini, 2017, Sharrow and Ismail, 2004).

The incorporation and maintenance of trees thereby enhance the ability to reduce CO₂ emissions, avoids deforestation and soil degradation, and simultaneously provides on-farm timber and tree resources for farmers (ICRAF, 2013). Several authors further stress the improved soil fertility, reduced erosion and decreased water pollution in agroforestry systems (Garrett and McGraw, 2000; Jose, 2009; Nair and Garrity, 2012; Ramachandran Nair et al., 2009, Scroth and Sinclair, 2003). Moreover, the contribution of agroforestry to rural livelihoods has been assessed. Montagnini (2017) for instance provides various examples of projects and studies of agroforestry in rural livelihood development in Nicaragua, Rwanda, Ethiopia, and Indonesia where the improvements in soil, water, and biodiversity were converted into economic and social benefits for farmers with limited resources. For example, agroforestry prolonged the time that crops could be grown in the same piece of land and thereby increased crop productivity. Furthermore, the World Agroforestry Center (2017) concludes that the widespread use of agroforestry (about one billion hectares) globally and the familiarity of smallholder farmers and local practitioners makes it a potential low-hanging fruit for achieving NDCs commitments and emission reduction in agriculture (Nair, 2012).

Particularly, slash and burn agriculture or migratory agriculture has been a common land use system in many parts of the tropics, which quickly erodes the soil and drives deforestation and ecological losses (Palm et al., 2005). Amazonas has been widely discussed in the dichotomy between conservation of forests and agricultural land (Porro et al., 2012). Several studies thus have highlighted the potential of agroforestry in sustaining the biodiversity and to store carbon to greater extent than traditional or monocrop systems especially in the field of coffee and cacao (Nair, 2012; Porro, 2012; Somarriba, 2012). However, several limitations and challenges have been identified for smallholders in incorporating and maintaining trees on their plots as limited resources and finances, lack of markets for forest products, lack of knowledge and technology (Kiyani et al., 2017; Montes-Londoño 2017; Nair and Garrity, 2012). Additionally, agroforestry is not adequate for all types of crops and settings, as for example rice and maize that often thrive better in open landscapes (Smith et al., 1994).

In combination with these limitations, governance in the form of institutional and legal frameworks are addressed and considered one of the main challenges in order to achieve the sustainability potentials of agroforestry systems (Nair and Garrity, 2012). Nair and Garrity (2012) specifically highlight the relevance of agroforestry policy research in Latin American, partly due to the expansion of agroforestry policy in the continent, and partly due to the big variations of legal, institutional and policy framework in agroforestry. Some policy research has been carried out (Current and Scherr, 1995; Follis and Nair, 1994; Lehrer, 2009; Place and Dewees, 1999), but Nair and Garrity (2012:443) particularly accentuates that *“the agroforestry sector, with potential for large and long-term impacts, requires special and preferential attention due to its complexity, specificity, and conflicting interests.”* In line with this statement, FAO (2013b) and ICRAF (2017) highlight the multidisciplinary stage, -actor and cross-sectoral characteristics, as well as the critical role of national and local institutions commitment in the implementation of agroforestry systems. In light with the multiple functions in agroforestry, financial and technology resources, including land, tree tenure, and carbon rights, have been specifically challenging in order to provide smallholder development in agroforestry policy (ICRAF, 2017; Nair and Garrity, 2012).

In summary, agroforestry has been acknowledged to entail more environmental benefits than traditional agricultural systems, that to a larger extent are practiced in large scale agriculture than by smallholders. Agroforestry is a system based on and adapted to smallholder practices,

presenting sustainability outcomes of both environmental, social and economic character. Nevertheless, it does not represent a unanimous answer to sustainable agriculture, because of its multi-sector dynamics where multiple interests are at stake. Limitations in smallholder contexts is also a distinctive topic in relation to the development challenges in agriculture, as in the implementation of agroforestry systems, which limits smallholders to fully benefit from the potentials of agroforestry. Governance, in the implementation of such systems, seems to be a central factor in the sustainability puzzle, as well as a challenging aspect throughout sustainability assessments, possibly, because of the conflicting interests and actors that characterize sustainability practices as in agroforestry policy.

4. Analytical Framework

In the previous section, agriculture has been discussed in the search for the path of sustainable smallholder agriculture, both in terms of agricultural contexts, methods, and aim. Since this study intends to discover the potentials and challenges of Peru's Agroforestry Policy in fostering sustainable smallholder agriculture in the Amazon this section will conceptualize sustainability in the policy context. The concept of governance will be incorporated as an element and requirement for sustainability implementations. Based on these concepts the analytical framework for the study; the four-dimensional Sustainability Assessment Framework of Food and Agricultural Systems (SAFA) will be introduced and operationalized in order to understand and assess the sustainability potentials and challenges of agroforestry policy for smallholder farmers in the region of San Martin.

4.1 Conceptualizing Sustainability

One of the core concepts in this study is sustainability which refers by definition to the “*to the satisfaction of the needs of the present without compromising the ability of future generations to meet their own needs*” (Keeble, 1988). Or, if framed in isolation from the idea of development, the general consensus on sustainability can be summarized as “*a way of thinking about how to simultaneously meet the needs of people and the environment by enhancing human well-being without undermining ecological integrity*” (Mansfield 2009:37). Nowadays, there is a general recognition among different sectors which underscore that sustainability itself cannot be achieved without incorporating different dimensions into its realm of action. Therefore, sustainability should be understood as an integrative concept which considers social, environmental and economic aspects as its three fundamental dimensions (Hansman et al., 2012; Littig, B., & Griessler, E. 2005). These three dimensions have been denoted as pillars of sustainability, which reflect that development requires the consideration of environmental, social, and economic development (Elkington 2013; Kajikawa 2008; Schoolman et al. 2012) or as Hansman et al., (2012:451) highlight: the planet, people, and profits. The proposed equal treatment of the three pillars is based on the conclusion that human needs cannot be sufficiently met just by providing an ecologically stable and healthy environment, but if a society is indeed committed to sustainability it should promote social justice, equality and as well as address a fairer distribution of economic gains and goods. Although the recognition of the three pillars of sustainability is widespread, conflicting issues in

incorporating and bridging all the pillars in development policy and practice have been identified as a major challenge in sustainability research (Boström, 2012; Gibson, 2006; Redclift, 1987).

In the literature, the challenges have been identified as trade-offs between pillars, conflicting interests between actors and shortcomings in governance in allocating resources and implement the principle of “sustainability” (Bostöm, 2012). McKenzie (2004) for instance reveals that social sustainability particularly has been left aside in sustainability assessments because it has been more difficult to quantify than economic growth and environmental impacts. Such constraints have often been present in sustainability assessments where the different pillars have been studied separately or as fragmented entities (Hansmann, 2012). Hansmann et al (2012:451-459) for instance argues that many studies also have focused on questions of trade-offs between the pillars instead of looking at how the different pillars could be achieved conjointly. The recognition of sustainability as a holistic concept with the potential to bridge the social, economic and ecological underpinnings of society, should, therefore, be considered. Where all the elements of sustainability should be integrated as dimensions which nurture from one another.

In light with this argument, this study will assess the pillars of sustainability as integrated dimensions, rather than by looking at individual pillars separately. From this point of view, trade-offs could rather be understood as investments in one dimension from another. For example, to foster one dimension, you have to take from another, for instance, from the economic to invest in the social as in knowledge, in order to achieve more environmentally friendly agricultural practices. Whether that is a trade-off or an interplay of synergies where one dimension is growing with support from another, rather than at the expenses of another may depend on the lens or perspective from which sustainability outcomes are understood, which also is determinant for the underpinnings of sustainability policy.

To further develop this argument, McKenzie (2004:5) claims that the “*great stumbling block*” when defining sustainability is that the context in which the definition is applied has turned out to be more important than the wording. One of the reasons perhaps being that the holistic definition of sustainability imminently calls for the interdisciplinarity and the interrelation of nature, society, and the economy, where the agenda of the implementers determine the conditions for the integration of all sustainability dimensions in practice. As accentuated in the literature review, governance in terms of stakeholder involvement and allocation of resources has been

acknowledged as one of the major challenges in the implementation of sustainability initiatives in relation to smallholders and agroforestry systems. This scenario calls for the fourth dimension of sustainability to complement the traditional three pillars, which has been mentioned by research as either the political or institutional pillar (Budford et al., 2013). Thus, as this study aims to explore potentials and challenges in agroforestry policy from a multi-actor perspective, governance will be incorporated as a fourth dimension in search of a holistic and integrated approach to sustainability research.

In light with the previous idea, governance is a concept which since its recognition has been incorporated into different disciplines and contexts (Andonova et al. 2009; Betsill and Corell 2001; Biermann et al. 2010). In the sustainability debate, it is recognized that governance plays a significant role in the integration and promotion of the different dimensions of sustainability (Leal Philo et al., 2016; Sexsmith & McMichael, 2015; Sharma 2003). The context of climate change, population growth, and deforestation have urged stakeholders to move towards approaches of collective action which facilitate the agency of actors to promote and incorporate the different sustainability dimensions (Piñeiro, 2004). Leal Philo et al. (2016) highlight the role of governance to enhance the transition towards sustainable societies stressing the importance of multi-stakeholder – public, private and civil society actors, including grassroots and NGOs-involvement, participation, and interaction for sustainable governance. Leal Philo (2016) and Bosselman et al. (2008:6) further refer to good governance as stakeholder participation, accountability, effectiveness and policy coherence, as important aspects in facilitating sustainability transformations. To further develop this idea Niesten et al. (2017) argue that this interaction has to be characterized by collaboration and joint-efforts to enhance stakeholder's reciprocity and trust. Based on this understanding of governance, stakeholder cooperation is fundamental to sustainability in the continuity of policy and institutional arrangements.

Consequently, incorporating good governance as a fundamental dimension of sustainability, equal to the economic, social, and environmental dimensions, makes it possible to address the several shortcomings and challenges in the context of smallholder agriculture present throughout the literature review. Good governance thus, is the only dimension that has the potential to address injustice, inequality and fairer distribution of economic gains and goods – some of the most elementary aspects of sustainability according to Hansman et al., (2012), as well as some of the most crucial challenges to sustainability in smallholder agroforestry research. Based on this

four-dimensional understanding of sustainability the following section will introduce the Sustainability Assessment Framework of Food and Agricultural Systems (SAFA) that was applied to this study to gain an equal understanding of all aspects of sustainability, as the interplay between dimensions and stakeholders in agroforestry policy.

4.2 Sustainability Assessment Framework of Food and Agricultural Systems

The Sustainability Assessment Framework of Food and Agricultural Systems is a globally applicable guiding framework for sustainability assessments in the food and agricultural sector developed by FAO (2013a:2-3). The framework was developed with the aim of harmonizing sustainability approaches within the food value chain and to fill the gap between sustainability tools and to enhance partnership for more sustainable food value chains. The framework was specifically chosen for this study due to its holistic approach which integrates the different dimensions of sustainability in assessing food and agricultural systems. The framework is comprised of four sustainability dimensions; the Environmental Dimension, the Economic Dimension, and the Social Dimension and the Good Governance Dimension. The SAFAs framework is further comprised of 21 core sustainability issues or universal “themes” which are associated to the sustainability dimensions, each one representing a key aspect in the sustainability of agricultural production and food systems. The following figure presents the different dimensions of the SAFA framework

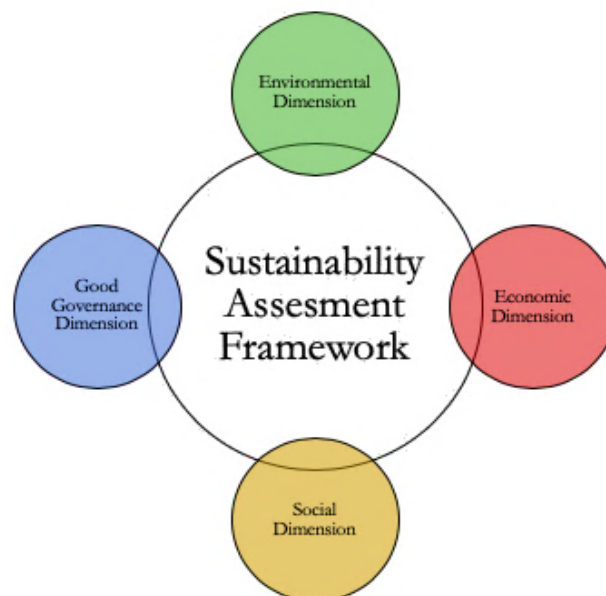


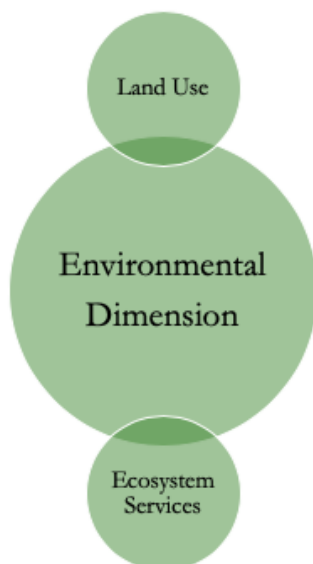
Figure 3: SAFAs Framework Dimensions. Based on FAO (2013a).

One of the unique features of SAFA, which makes it applicable to this study, is that like many other sustainability frameworks and tools which assess sustainability as a triple bottom line (environment, social and economy); SAFA understands the importance of governance and explicitly incorporates it into the concept of sustainability. Governance is recognized in its transversality in bridging all the other dimensions of sustainability. The framework specifically stresses the essential role of governance by “*The challenges of delivering sustainability lies in an effective integration of the environmental, economic and social dimensions of development. This can only be achieved through good governance.*” (FAO, 2013a:12-13). Furthermore, SAFA takes into account trade-offs and synergies between all dimensions of sustainability and was developed to facilitate a clear understanding of the constituent components of sustainability and how the strengths, weakness, and the progress of sustainability dimensions could be addressed by different actors as for example companies, smallholder farmers and governments (FAO, 2013a:2). The SAFA assessment framework is also developed to facilitate its adaptability to specific geographic locations, individual and sector relevant themes, which has been the case for this study in addressing smallholder’s agroforestry practices in Peru. Considering these factors, flexibility was applied to the study in order to avoid imposing themes which might not be relevant to the specific location or scenario.

Moreover, it is important to underline that SAFA acknowledges the importance of smallholders in agricultural sustainability due to their particular vulnerability in relation to other actors, resources and externalities (FAO, 2013a: 34-35). The different themes in the framework, which will be explained in the operationalization below, have thus been adapted to explore the context-specific potentials and challenges of PAP in fostering sustainable smallholder agriculture in the Amazon. Hence, the framework was chosen for its applicability to a smallholder context, holistic sustainability scope and the aim of a multi-actor analysis of agroforestry (FAO, 2013a). Furthermore, it is important to acknowledge the possible limitations of the SAFA framework as reducing the complexity of sustainable agriculture into themes that might lead to exclusions and simplifications. However, the study has been carefully developed to address this issue by including the themes that were relevant to the specific context in close dialogue with the participants of the study. Each dimension of the SAFA framework will, therefore, be explained by including the different themes which have been considered relevant in analyzing and

operationalizing the challenges and opportunities for sustainable smallholder's agriculture at the Region of San Martín. One theme, associativity, within the social dimension was not an explicit theme within the framework but has been incorporated and accentuated as community organizations and structures appeared as central elements during the data collection process. It is important to stress that, as this study is mainly of qualitative nature, each theme was assessed according to the perceptions and experiences of the stakeholders involved in PAP. Below the operationalization of the SAFA framework will be presented by reintroducing the dimension, the corresponding research questions and how the theme will be assessed in the analysis of the data. The analysis will also be structured in alignment with these dimensions and themes.

Environmental Dimension: In what ways has smallholder's land use practices transformed with PAP and what are the main barriers and opportunities for improved ecosystem services with PAP?



The environmental dimension refers to the importance to respect planetary boundaries and to protect the integrity of the earth and ecosystems (FAO, 2013a). It consists of maintaining life support systems essential for human survival by minimizing the negative environmental impacts of agricultural activities. The study will look into the following themes that are regarded as essential to the development of sustainable agriculture:

- *Land use:* This theme is concerned about the environmental impacts of land use change and agricultural practices. This aspect will be explored by assessing smallholder's perceptions of changes in land practices after the implementation of PAP.
- *Ecosystem services:* This theme relates to soil quality, water quality, and land degradation. Soils provide ecosystem services such as water purification, nutrient cycling, and carbon storage and soil quality refers to soil improvement practices as for example organic cultivation methods. Land degradation refers to conservation and rehabilitation possibilities of soil, forest, and cropland. In this study, this theme will be assessed by smallholder's perceptions of soil, crop and water quality after the implementation of PAP.

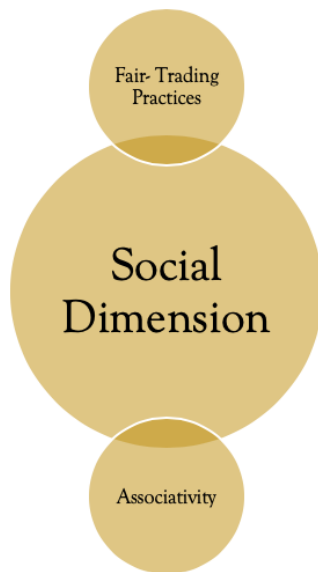
Economic Dimension: What are the main barriers and opportunities of PAP in reducing smallholder's economic vulnerability?



The economic dimension focuses on the economic resilience of agricultural systems. Agricultural activities are understood in a context of stresses and shocks which take into consideration the use of labor, natural resources and capital to produce goods and services to satisfy people's needs (Jörissen et al., 1999 in FAO, 2013a). In this dimension themes such as vulnerability and smallholder opportunities in the local economy are acknowledged to be crucial for the achievement of sustainable agriculture. Within the economic dimension the following themes will be assessed:

- *Economic Vulnerability*: Vulnerability relates to the capacity of households or individuals to prevent, mitigate or cope with economic stresses and shocks. This theme will be assessed by looking into smallholder's perceptions to cope with economic stresses and shocks with PAP.
- *Local Economy*: The theme eludes to the potentials of agriculture to foster the local economy by improving income opportunities, as well as generating market and commercialization opportunities. These aspects of the local economy will be assessed by the smallholder's perceptions of access to markets, commercialization and income opportunities within PAP.

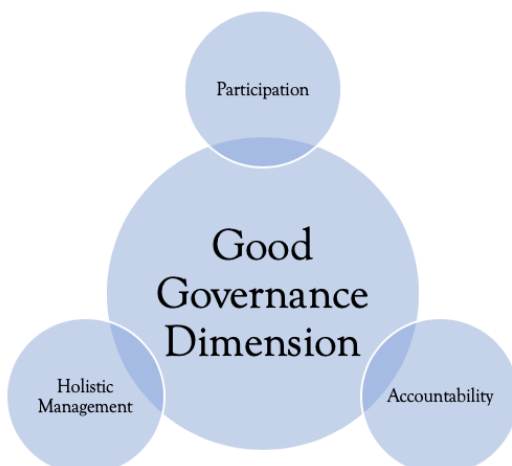
Social dimension: What are the main barriers and opportunities of PAP in fostering fair trading practices and smallholder's associativity?



The social dimension refers to the idea of fulfilling basic human needs and enjoys rights and freedom to satisfy one's aspirations for a better life (WCED, 1987 in FAO, 2013a). This dimension could also be understood from a human rights perspective and refers to the inherent rights of all human being rights to knowledge, freedom, work, associativity, food, land, safety and many more. This study will explore the following themes within the social dimension:

- *Fair Trading Practices:* Fair trade practices include both legal and human rights for primary producers, in this case, smallholders, that allows access to fair markets in price, contracts, negotiation, competition and agreements, which could be either written or verbal. This theme will be assessed by looking at smallholder's perceptions in accessing to fair markets related to PAP.
- *Associativity:* This theme relates to the right and capacity to associativity, organization and collective action. This theme could also be understood in relation to fair trade capacities and will, therefore, be assessed by smallholder's perceptions regarding the opportunities and barriers to associativity in relation to PAP.

Good Governance Dimension: What are the main barriers and opportunities of PAP in fostering stakeholder participation and cooperation?



Good governance is defined in the framework as the process of making and implementing sustainability decisions by taking into consideration the different actors which are involved in agriculture activities (UNESCAP, 2009 in FAO, 2013a). Importantly, the framework assumes the position that if good governance is not achieved, sustainability in

agricultural systems will remain an illusion. In this dimension aspects of participation, accountability, and holistic management are fundamental parts of the well-functioning of sustainable agriculture at all scales.

- *Participation*: Stresses the potential of involvement of relevant stakeholders those who are materially affected. This theme will be assessed by looking into smallholder's perceptions of their participation and access to decision-making platforms within PAP.
- *Accountability*: Refers to stakeholders' access to credible information about strategies, goals, and policies, which will be assessed by smallholder's perceptions on access to information about PAP.
- *Holistic Management*: Explores how different stakeholders cooperate to promote all sustainability dimensions in relation to synergies and trade-offs. This aspect of Good Governance will be assessed by perceptions of cooperation among stakeholders within PAP.

5. Methodology

The present chapter provides an orientation of how the study was designed by explaining the methodological choices and considerations. The section will present the site selection for the study, discuss the data collection methods and sample size, and explain the method of analysis for the collected material in the study. Throughout the chapter the strengths and weaknesses of the methods will be discussed as well.

5.1 Research Design

The objective of the study was to explore the sustainability potentials and challenges of PAP in fostering sustainable smallholder agriculture in the Amazon and in order to do so, the research was built as a case study. One of the main strengths of a case study is that it enables the researcher to explore a complex phenomenon in detail according to its context using a variety of data sources within boundaries in time and place (Creswell, 2012; Denscombe 2009:60); which corresponds with the aim of the present thesis. The case study design provides the possibility as well to combine different types of methods, quantitative and qualitative, from different epistemological standpoints, and thereby the possibility to adapt the methods to the characteristics of the case (Creswell, 2012). The study departed from a social constructivist perspective, where knowledge was built on the views of the participants and through social interaction (Creswell, 2012). It is comprised by a combination of in-depth interviews, participatory workshops and focus group discussions, complemented with quantitative data in the form of a minor survey.

5.1.1 Site Selection

In order to understand the sustainability dimensions of PAP, the study had to take place in Peru. Over the last 20 years, Peru has developed agroforestry initiatives consisting of legal frameworks, local and national institutional arrangements, to become the main policy in the field of sustainable agriculture in the country. The region of San Martín located in the upper part of the Amazon became especially relevant to the study as it is a region which has been severely affected by deforestation. It is furthermore a region characterized by smallholder agriculture and at the forefront in implementing PAP. During the time lap of the case study one of the core elements of the policy, the Cession in Use land entitlement program was also implemented in San Martín, as a pilot region for the initiative. Moreover, with decreased levels of deforestation San Martín,

is nationally understood as an example of good practice in environmental governance. The specific locations for the data collection will be explained in detail in the sampling section below. However, it is relevant to mention that these locations were also selected upon the degree of involvement in PAP of the different actors.

5.1.2 Sampling

The sampling of the participants in the study was primarily done through snowball sampling where the researchers established initial contact with a small group of people relevant to the topic and then used these contacts to make further contact with people relevant to the study (Bryman, 2012:21-207). This sampling technique helped to develop contact with different actors and sectors that were interconnected because of their involvement in PAP, which facilitated the analysis of the sustainability dynamics of the policy. Smallholder farmers from three different communities: Progreso, Nuevo San Ignacio and Paraiso that practiced agroforestry methods were thereafter selected and identified through purposive sampling, defined as a sampling technique that selects its units of analysis based of their availability or convenient access (Silverman, 2016). The advantages of this type of sampling are the availability and the efficiency with which data can be gathered.

The visits to the three communities were conducted in contact with three different key informants living in each one of the aforementioned communities. The researchers invited both male and female adult farmers, with the criteria that they practiced agroforestry and belonged to the specific community. The researchers strived of heterogeneous participation to reach a representative sample as possible from the three communities. The researchers also made efforts for equal representation of men and women in the study, however, the majority of the respondents turned out to be men. This group also tended to be overrepresented at the leading positions at the public and private sectors. Furthermore, more men than women attended the participatory workshops in the communities, even if the key informants facilitating the workshops and inviting the community members in two of three cases were women, which the researchers thought would attract more female participants. However, relevant to mention is that women took part in all the phases of the data collection as respondents among all actor groups, however, their underrepresentation has to be recognized and the presence of a male bias in the study. The table below presents the sample of participants in the study from the three communities: Progreso, Nuevo San, Ignacio and Paraiso.

Community	Inhabitants	Families	Participants in the study	Male participants	Female Participants
Progreso	149	28	9	7	2
Nuevo San Ignacio	129	43	19	13	5
Paraíso	180	36	15	11	4

Table 1. Smallholder sample and participants in the study. Source: The Authors 2019, based on Practical Action 2016.

Moreover, the research was bounded in time and resources, which limited the researchers from expanding the study to more communities, involve more actors in relation to the policy, which gives certain sample limitations and geographical restrictions for the study. Furthermore, the data is limited to those who were willing or able to participate in the study (Funder, 2005) and to the knowledge of the participants, where some participants had more knowledge than others about the thesis themes. This is a weakness of a purposive sampled group, where the convenience and access risk to compromise the quality of the information (Creswell, 2007).

5.2 Data Collection

As stated above, the thesis was built with a qualitative approach and various data collection methods in the form of interviews, participatory workshops, and focus group discussions, complemented with a minor survey. For each one of the data collection activities the researchers elaborated guides and protocols. The protocols and workshop guide were slightly modified over time as the researchers learned more and wanted to develop and focus on certain themes within the sustainability dimensions. Secondary sources were also used in the form of online literature from Lund university online library and published material by NGOs and the Regional Government of San Martin. Below, each methodological step will be explained further in detail, strengths, and weaknesses for each method as well as the main limitations will be considered.

5.2.1 Semi-structured Interviews

In total 12 semi-structured in-depth interviews were conducted: **six** interviews with public authorities related to the implementation of PAP; **one** interview was conducted with a civil society organization; **one** with a coffee cooperative and finally **four** interviews with smallholder agroforestry farmers from the three visited: communities; Progreso, Nuevo San Ignacio, and Paraíso. The interviews were conducted between the 1st to the 14th of November and the 2nd

to the 9th of December 2018. The interviews with public and private actors were conducted by both researchers at the offices of the authorities and the cooperative in the city of Moyobamba, San Martín. Four of the interviews with authorities and with one civil society actor were conducted during and after a public agroforestry event “*Ceremonia Protocolar Sobre Acciones de Gestión Forestal y Ambiental*” in the city of Juanjui (5th of December) organized by the Regional Government of San Martín. The interviews with smallholders were conducted in their respective communities. During these interviews, the researchers divided the interviewees between them and undertook the interviews individually. All interviews were carried out by the researchers in Spanish and recorded with a phone recorder and thereafter transcribed into text. Only the citations used in the analytical section were thereafter translated into English by the researchers.

The semi-structured interviews were a suitable method since such interviews have fairly structured questions, but at the same time encouraged the respondent to elaborate their answers in order to deepen the understanding of the topic in question, leaving some space to flexibility in the research as new topics can appear (Bryman, 2012). All interviews were conducted in privacy letting the interviewee decide the location for the task. In understanding the credibility of the semi-structured interviews, it is important to acknowledge that the interviewees represent a group, institution or organization, but at the same time individuals with personal values, perceptions, thoughts and emotions which were manifested during the interviews. Nevertheless, all interviewees were done with stakeholders at leading positions, as either directors or community leaders, with major influence over the organizations and the institutions they represented and who possessed a deep knowledge about agroforestry, sustainability and PAP.

5.2.2 Participatory Workshops

The participatory element in the study was adopted as a method to involve the participants, in this case the agroforestry farmers, in the construction of the study. To facilitate the interaction between researchers and participants, as to incorporate different data collection techniques with a larger sampling group (Creswell, 2012:21-22). The participatory workshops were conducted between the 5-7th of December. One in each community that went on for approximately four hours. In total, 43 farmers participated in the workshops. The workshops were carried out with the support from key informants in each community, who facilitated the meeting facilities, invited the community members and informed them about the purpose of the visit of the

researchers. During the workshops, the participants were divided into smaller groups of 3-5 people and the researchers led activities where the participants elaborated drawings and carried out presentations of their work. The participants were given big papers to attach to the wall, then in each group they painted, drew, and wrote about either the coffee market, the community or cultivation methods in relation to agroforestry with stickers and pencils. Each group thereafter presented their work for the researchers and the other participants. During the workshops, the researchers took turns in leading the activities and taking notes.

The participants were also divided into focus groups during one part of the workshop where the researchers led discussions based on the interview guide for smallholders. It is important to highlight that flexibility was given so themes could emerge during the workshops. At the end of the workshops, the researchers led a SWOT-analysis of agroforestry practices with the whole group based on the previous focus group discussions. In total, 13 drawings were elaborated and presented by the participating farmers. The co-created drawings were photographed, and the presentations and focus group discussion were recorded with a mobile phone recorder. Important to mention is that the elaborated material has been interpreted by the researchers based on the farmer's presentations, where the farmers also answered questions about their work, asked by either the researchers or other participants. The participatory workshops and focus group discussions were specifically useful to engage all participants, as well as a larger sample group effectively, than for example in comparison with the semi-structured interviews. The workshops could also be considered to limit possible biases as participants were given open instructions and were free to engage and create information on their own terms, either by discussing, writing, presenting or drawing. However, even if all 43 smallholders participated in the workshops, some tended to participate more than others, which will cause certain biases. Furthermore, contradictory perspectives or sensitive topics may also be more difficult to express in front of a larger group of people. The researchers searched for consensus and interacted with all participants; however, participants may have agreed rather than raising conflicting arguments, which has to be acknowledged as a weakness of participatory methods.

5.3.3 Survey Questionnaire

To begin the participatory workshops the participants were encouraged to respond to a survey questionnaire with 19 closed-ended questions. The different questions in the survey explored smallholder profiles and the sustainability dimensions of PAP. The survey questionnaire also

allowed for triangulation to some extent to verify, reject or reinforce the results from the qualitative data collected and vice versa (Bryman, 2012). However, the survey is not representative and was primarily used as a complement to identify and map the characteristics of the sample group, in for example gender, land use, and cultivation methods. The participants were asked to answer the questions individually and each question in the survey was read to the group as a whole. However, it turned out to be difficult for some of the farmers to answer as individuals because of difficulties with reading and writing, and unfamiliarity to participate in a survey. In these cases, other participants helped out to answer the questions and some question were discussed as a group, between participants and researchers, because of uncertainties in how to answer. This may have led to certain biases, where the participants have chosen to answer in line with what others answered, instead of as individuals. However, based on the interviews and focus group discussions the researcher could control the answers where uncertainties had come up during the survey. Due to these limitations and to limit the risk for biases only parts of the survey have been used in the analysis and do not indicate any representative numbers. Nor could the results in the survey be analyzed separately from the qualitative data.

5.3 Ethical Considerations

The study has been carried out with ethical considerations since the very beginning of the elaboration of the study based on Bryman's (2012) four ethical principles: do no harm to participants, informed consent, privacy and deception (Bryman, 2012:135). No harm is understood as the absence of physical or physical harm during the execution of the study or future consequences related to the study (Bryman, 2012:135-142). To comply with these ethical principles the researchers assured to inform that participation in any form is voluntary and all participants at the workshops and interviews, as well as the respondents of the surveys. The participants were also informed of the aim, the role of their participation, timeframes and how the information would be processed. The interviews with the farmers were only conducted by one of the researchers with the intention to make the process more comfortable for the interviewee. Furthermore, the researchers, at the beginning of every participatory workshop informed all participants that they could participate in the way that they felt comfortable and if they wanted to present, paint, draw or listen, or abstain from participation at any moment. The surveys were anonymous, and the interviewed smallholders have been given fictitious names in the analysis to secure their privacy.

The researchers experienced that the workshop activities of drawing and writing encouraged and facilitated participation among all participants, as they could participate in the way they wanted to without the risk of reading and writing skills limiting their participation. In this sense, the methodology itself of using participatory elements had an ethical angle to ensure a cooperative environment between researchers and participants, as well as among participants. Finally, the researchers aimed to create an environment of transparency discussing expectations of the study, the roles of participants and researchers, where both researchers and participants shared their thoughts and perspectives. The format of the workshops enabled such conversations where the participants could ask and present their thoughts and uncertainties. Funder (2005) explains this element as a method for consensual research in making power relations equally understood of the researchers and participants.

5.4 Validity, Reliability and Generalisability

The validity refers to the extent research accurately represents the social phenomena to which it refers to in the first place (Silverman, 2012:368). In qualitative research Creswell (2007) argue that validity represent credibility and trustworthiness of which data have been gathered, interpreted and described. Based on this argument, to assure the accuracy of concepts the researchers consulted key informants working in the field to develop the surveys, workshop and interview guides to match the context. The researchers also spent in total four months in Peru and three weeks in the region of San Martin to accurately design the study. It is important to mention that the participants in the study had differentiated knowledge about the themes operationalized, which intrinsically will influence the credibility of the data. However, the qualitative interviews with experienced actors in the framework of PAP is considered to strengthen these weaknesses of the data. Furthermore, the quantitative data, even if only considered a compliment to the qualitative data, also served to confirm the reliability of the concepts in the study through triangulation.

The reliability of a study is reflected in the extent the results are repeatable and if the measures of concepts are consistent in the study (Bryman, 2012). Hence, every step of the research was carefully planned and documented to strengthen objectivity and replicability of the study, based on the sustainability dimensions and themes of the SAFA-framework. Nevertheless, the nature

of a case study design is limited in time and space, constraining the scientific replicability and generalizability (Creswell, 2007). However, agroforestry practices and policy are present in several countries and locations around the globe, and similarities between these cases are feasible which makes the study transferable to a certain extent. A major limitation of the study is that more technical aspects of sustainability are not quantitatively measured, especially in relation to the environmental dimension, as for example soil and water quality, carbon dioxide release and storage.

5.5 Method of Analysis

Traditional Text analysis with key quotes was thereafter applied to analyze the material from the semi-structured interviews and the focus groups discussions. Traditional Text Analysis or Traditional coding (TTA) "*is a process where data coders place each piece of data into various categories*" (Bright and O'Connor, 2007:2). Hence, all interviews and focus group discussion were audio-recorded upon participant's consent and thereafter transcribed and divided into the four dimensions of sustainability. Those were organized and coded according to the different sustainability dimensions from the operationalization of the SAFA-framework. The themes of each dimensions in the SAFA-framework guided thereafter the coding process to identify key-themes within the material in line with each dimension. Some of the 21 themes of the framework emerged and others not, consequently some themes have been left out and others have been merged together, as presented in the operationalization.

TTA was a suitable coding method for this study since it allows a human interpretation of data as computers could miss the meaning of the sentences due to the automatization of the software. It also makes possible to code and interpret all the information of the interviews as slangs or incorrect spelling, might not be interpreted correctly by software based on pre-programmed vocabulary (Bright and O'Connor, 2007:2-3). A limitation of TTA is the tendency for data coders to "read between the lines", meaning that the information is interpreted according to the researchers understanding of the topics. However, to cope with this issue, categories and themes were clearly set from the beginning of the study. To further strengthen the validity of this method of analysis, citations have been included in the analysis to depict in the most accurate way the experiences of the participants in the study. Furthermore, regarding the quantitative data, the survey questionnaire was manually coded in an excel document, question by question,

summarizing the number of respondents to each question. Tables and circle diagrams were developed thereafter to show significant findings, presented in line with the themes of each sustainability dimension in the analysis.

6. Analysis

Returning to the aim of the study, this thesis aims to explore the potentials of Peru's Agroforestry Policy in fostering sustainable smallholder agriculture in the Peruvian Amazon. This chapter will be divided into the following sections: Section 6.1, which briefly gives a contextual introduction to the site of the case study, the region of San Martín. Section 6.2 presents and discusses the findings according to SAFAs four dimensions of sustainability. The four corresponding research questions will guide the analysis throughout the environment, economic, social and good governance dimension. Thereafter, Section 6.3 positions the findings in current research and gives recommendations for future research.

6.1 The San Martin Region

As mentioned, the Peruvian government has politically committed towards a sustainable path of agricultural practices where the Region of San Martín plays a pivotal role due to its rich biodiversity and forests. San Martín is located in north-eastern Peru in the upper part of the Amazon rainforest. The population is estimated to 840 790 inhabitants where the most populated provinces are San Martín with 187 320 inhabitants, Moyobamba with 148 160 inhabitants and Rioja with 128 367 inhabitants (BCRP, 2017). In 2017, it was estimated that 35 percent of the population lived in rural areas, 65 percent in urban areas, and the population living in poverty was estimated to 23 percent, 3 percent higher than the national average. Agriculture is the main productive activity in the region dominated by small-scale farms where the main cultivated crops are yellow corn, rice, banana, palm oil, sugarcane, cocoa and coffee (BCRP, 2017).



Figure 4: Map of Peru and the San Martín Region. Source: Región de San Martín (2018).

The majority of smallholder farmers in San Martín migrated from a harsh climate in the Peruvian Andes in search for better farming conditions to the rainforest. When the first farmers arrived in San Martín in the 70s-80s they were primarily dedicated to the cultivation of coca leaves (Larrea et al., 2014). Conversely, in the 1990s the Peruvian authorities prohibited coca leaf production in the region to fight the illegal trade of cocaine and the violent terrorist group Sendero Luminoso, strongly connected to the coca market (IU, 2018). The authorities succeeded to eradicate the coca production by introducing new crops, such as coffee in the case of San Martín, due to the appropriate climate conditions for high rainforest coffee production (Larrea et al., 2014). Today, the region of San Martín corresponds to 91 percent of the total coffee production in the country (MINAGRI, 2015b). In the Amazon, coffee is the cultivated crop with the most agricultural land coverage, covering up to 25 percent of the total agricultural land. Coffee is also the main product of export with 75 percent of the total production being exported, making Peru the seventh biggest exporter of coffee in the world (UNDP, n.d.). The majority of the coffee farmers in the country are smallholders, who cultivate between 1 ha to 5 ha of land. In San Martín thus over 50 percent of the smallholder farmers are principally dedicated to the cultivation of coffee (Larrea et al., 2014).

However, most farmers in the region, the majority smallholders, do not possess land titles and have limited access to livelihood resources and capacities, in terms of social, economic and technical capacities (Ibid). In this sense, the lack of access to knowledge and resources for coffee production have forced farmers to practice cultivation methods which rapidly erode the soil leading to deforestation, the contamination of water resources and soil degradation (MINAGRI, 2015a). Hence, the vulnerability of the rural population has become a main driver of land degradation and deforestation of the upper part of the rainforest. Conversely, from being one of the most deforested regions, San Martín has also shown the biggest reduction with 1 512 ha less rainforest loss in 2016 compared to 2015 of other tropical regions (MINAGRI, 2017). Accordingly, Peru's Agroforestry Policy has thus been implemented and promoted as one of the most important governmental strategies to reforest the Amazon, promising sustainable economic growth in the agricultural sector and livelihood improvements for the rural population. Likewise, agroforestry has been promoted by several NGOs as an important area of action by providing capacity building and training to farmers.

6.2 Findings Sorted in Dimensions

In this subsection, the findings are sorted into the SAFA dimensions and the themes operationalized within each dimension. Each of the research questions below corresponds to one of the dimensions of the framework and will be answered within the corresponding dimension. At the end of each dimension, the main findings will be summarized to answer the specific research question.

Research Questions:

1. *Environmental Dimension: In what ways has smallholder's land use practices transformed with PAP and what are the main barriers and opportunities for improved ecosystem services with PAP?*
2. *Economic Dimension: What are the main barriers and opportunities of PAP in reducing smallholder's economic vulnerability?*
3. *Social Dimension: What are the main barriers and opportunities of PAP in fostering fair trading practices and smallholder's associativity?*
4. *Good Governance Dimension: What are the main barriers and opportunities of PAP in fostering stakeholder participation and cooperation?*

6.2.1 Environmental Dimension

All smallholders that participated in the study at the communities of Progreso, Paraiso and Nuevo San Ignacio had adopted agroforestry methods with assistance from NGOs and the public fund FONCODES, where they had received training and tools to implement what they call the Multilevel Agroforestry Systems (MAS). One of the farmers, Jaime Gonzales, who holds the role as community agroforestry trainer in cooperation with FONCODES, explains the functions of MAS in their community as:

“For me the multilevel agroforestry system is made up of four components; the first one is the coverage which we have implemented with a plantation of forage peanut. The second is coffee, the third one is guava and the fourth is comprised of forest timber trees. Each component with an important function that generates greater productivity and more than that, a stable environment and a stable ecosystem.”

Before agroforestry systems were adopted by smallholders, slash and burn agriculture was the most common farming method in all of the three communities. None of the farmers that participated in the study were applying this type of method anymore. Of the 43 smallholders that participated in the study, all had adopted agroforestry systems in combination with coffee crops on parts of their plots. The majority cultivated on a land area between 1-2 ha and practiced agroforestry on a land area between 0.5-1 ha as seen in the table below.

Total Land with Agroforestry	No. of Farmers
0,5-1 ha	29
1-2 ha	9
2-4 ha	2
4 ha or more	3

Table 2: Table of smallholder land use in agroforestry (Based on the survey in A)

Furthermore, all 43 respondents indicated that the soil quality had increased with agroforestry practices and 42 pointed out that they take better care of nature and cut down fewer trees than before. In fact, the majority mentioned that they do not cut down forest trees at all. Specifically, 37 out of 43 farmers, indicated that the coffee bean quality had increased with agroforestry practices. Accordingly, Maria Reyes from Progreso highlighted:

“The more trees, the better coffee production, aroma and grain. Nowadays I have mahogany, cedar, moena and ishpingo in my farm. Having trees in the farm is a paradise. If I had known about the benefits of the forests on coffee production and soil quality I would never have deforested in my life.”

The drawing below was elaborated by a group of smallholders during the participatory workshop in Nuevo San Ignacio and visualizes these changes in land practices and ecosystem services from traditional agriculture (to the left in the picture) to agroforestry systems (to the right in the picture).



Figure 5: Plot Change with Agroforestry Systems. Source: Participatory Workshop Nuevo San Ignacio (2018).

Consequently, to the right in the picture, farmers have implemented agroforestry and it is possible to infer an increased tree coverage, improved soil layers and soil quality with bigger coffee plants as in size, roots, and beans. In all the three communities' smallholders relate the

increased coffee bean quality and yield productivity to the shade of the trees from agroforestry systems that enriches the soil humidity. In addition, some of the smallholders also expressed that the reforestation and maintenance of the tree coverage have had a positive impact on the biodiversity as it has attracted bees and birds as trees are also combined with various plants and flower species. However, indicated with red dots in the picture, is the reappearance of the yellow coffee rust. A plague which has severely affected the yield and coffee bean quality especially in the communities of Nuevo San Ignacio and Paraiso. The yellow coffee rust was nearly combated after a major outbreak in 2011-2012, but reappeared in 2018, and caused economic losses for all farmers.

Overall at the participatory workshops, a clear majority of smallholders acknowledged the positive impacts of agroforestry methods on ecosystem services, as in soil and crop quality. However, three main challenges in relation to the environmental dimension were identified as climate change, and the lack of access to technology and knowledge. Regarding climate change, some of the smallholders perceived that the temperatures had increased during the last 10 years, with less rain and more irregular seasons, making it more difficult for the farmers to work. Maria Reyes from Progreso explains how these changes have affected her farming activities.

“The climate in San Martín has changed significantly. Before, when we cut down the trees it rained a lot, but not anymore and that affects the harvest. The coffee grain becomes smaller. It affects all plants and even us. In the summertime we cannot even work, and we cannot plant trees (because of the heat). Climate change affects everything we do.”

Additionally, some farmers also address the reappearance of the yellow coffee rust to increased temperatures, but the public and private actors rather addressed the reappearance to lack of plague control. To cope with climate factors, technology solutions as irrigation systems had been implemented by smallholders in the community of Progreso with support from the governmental institution AGRORURAL. According to the president of the community coffee network La Red, Daniel Tapia, Progreso was also the community with the highest yields and coffee bean quality. Several smallholders in both Nuevo San Ignacio and Paraiso expressed that they wanted to install water irrigation on their plots, but that they did not have the economic resources or knowledge about where to apply for grants or funds. Another issue raised in relation to coffee bean quality was the lack of communal coffee dryers. This kind of technology was identified as main barrier

for the smallholders in reaching the adequate humidity level for high-quality coffee and to access higher revenues for their coffee yields.

Lastly, the lack of knowledge was identified as a challenge during the SWOT-analysis (see in Appendix 2) at all communities in how to control coffee pests and plagues. Knowledge about cultivation methods and market opportunities for other crops that coffee to increase diversification in their agroforestry systems was another challenge. Knowledge was also identified as a strength by the communities, especially in relation to agroforestry, where all farmers expressed confidence in implementing agroforestry practices on their plots. It is also important to mention that smallholders use organic fertilizers and have diversified to a greater extent with agroforestry systems than before, however, far from all of them use exclusively organic fertilizers.

Consequently, the main findings of the environmental dimension stress that PAP has been able to transform agricultural practices as farmers have moved from slash and burn agriculture to practices that enhance reforestation, organic cultivation and improved ecosystem services. The land change transformation from slash and burn agriculture is mainly addressed to smallholder's knowledge in agroforestry methods and practices. However, it should be recognized that smallholders limited resources to invest in technology and extension services as well as limited knowledge in pest and plague control represent one of the main barriers within the environmental dimension. These barriers also limit possible synergies between the environmental and economic dimension, as access to irrigation systems, plague and pest control, and adequate coffee bean dryers, which could enhance coffee quality and thereby smallholder access to higher revenues for their production. The economic dimension of PAP will be further explored below.

6.2.2 Economic Dimension

Expanding the opportunities to generate additional incomes for smallholder has been one of the key priorities of PAP. Peruvian authorities as the executive manager of SERFOR John Leith highlights: *“One of the reasons why we focused on agroforestry is because it generates an alternative income to tackle poverty, as you know Peru has been dominated by migratory agriculture. Very much driven by poverty.”* The director of the Department of Economic Development of the Region of San Martín, José Enrique Delgado adds to this argument:

“Nature is our wealth and this wealth has to serve to generate better incomes. If we do not create conditions for farmers to have better financial opportunities to adopt technologies at their farms, they will continue to deforest.”

At the community level, however, PAP has been mainly promoted on coffee production, a crop which is not just vulnerable to a changing climate, pest and plagues as well irregular seasons but on the trends of external markets. Such reliance is problematic for the economic dimension especially as coffee prices are dependent on international commodity prices. To get an understanding of the coffee price trends over the years, the table below displays the changes in coffee prices per quintal according to smallholders at all communities.

Year	Price in PEN per quintal
1970-1980	200
1990	400
1995-1996	450
2011	420
2012	300
2013-2014	200
2018	200

Table 3: Price trends of coffee based on community drawings. Source: Participatory Workshops (2018).

The income of farmers has been directly affected by the historically low prices of coffee as they highlight that the revenue per quintal of coffee is the same today as it was in the 70s-80s, which is around 60 dollars. If the current coffee quintal price considers economic inflation means that farmers do receive even less for their coffee today as they did forty years ago. Although, 35 smallholders out of 43 agreed that coffee productivity improved with agroforestry practices. As seen in Figure 5; 41 out of 43 smallholders perceive that their income level has stagnated over the last years even after PAPs implementation (Figure 6).

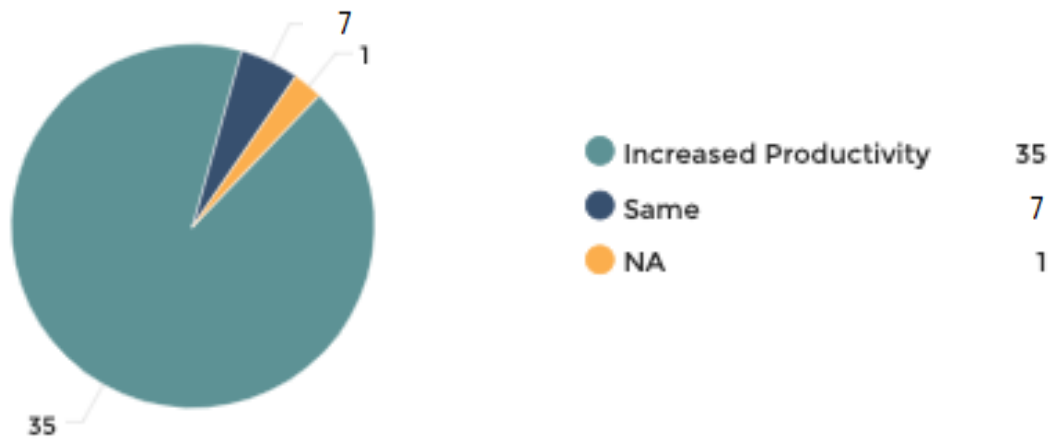


Figure 6: Agroforestry Systems Impact on Productivity. Based on surveys at Nuevo San Ignacio, Paraiso and Progreso (2018).

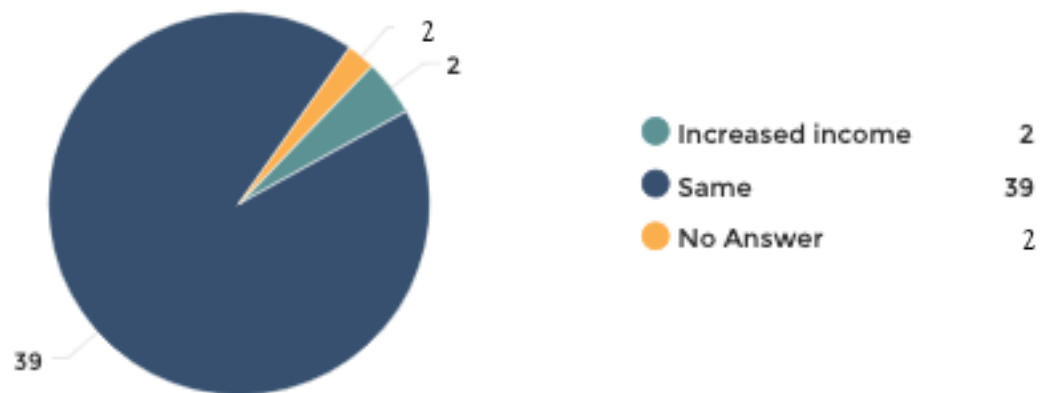


Figure 7: Agroforestry Impact on Household Income. Based on surveys at Nuevo San Ignacio, Paraiso and Progreso (2018).

One of the main barriers for farmers to access better prices even if productivity and coffee quality at the communities have increased, is that coffee commercialization opportunities are dependent on intermediaries or middlemen. Across the community's several smallholders mentioned that

middlemen push down the prices of coffee per bag. Maria Reyes from Progreso highlighted *“It is difficult for us to sell agroforestry coffee with so much intermediary, the intermediary puts the price. Most of the time they lie and say that our coffee is of less quality. The necessity obliges us to accept any price.”* Guadalupe Lopez, from Nuevo San Ignacio, accords with the argument and adds *“Middlemen impose the price, nobody controls them”*. Farmers however mentioned that even if some community coffee associations would pay them a fairer price, middlemen pay them in cash and in advance. The majority of the smallholders thus mentioned that their immediate needs represent a pressure for them to accept low prices as they cannot wait to *“bring bread to their tables”* as a farmer in Nuevo San Ignacio accentuated. Farmers mentioned there are some companies in the region’s administrative capital Moyobamba that do pay higher prices per coffee bag as for example Alto Mayo’s Cooperative, which pays 60-105 USD or others which pay 84 USD. During the participatory workshops it became clear that the cooperatives such as Alto Mayo, pay for quality, and not per quantity as middle-men. Yet, the reappearance of the yellow coffee rust has had a negative impact on the coffee bean quality, particularly in Nuevo San Ignacio and Paraiso, thereby the majority of farmers are not able to sell their coffee to the cooperatives. In addition, the lack of sufficient road infrastructure at the communities combined by the high transportation costs makes the cooperatives located in Moyobamba inaccessible to most of the smallholders.

Nevertheless, to increase their income opportunities and foster the local economy some farmers in Progreso have started to diversify their agricultural production with crops such as the *“Andean peanut”*, *sacha-inchi* and started up with fish farms. However, such opportunities remain still uneven among communities and farmers. At the focus group discussions in Nuevo San Ignacio and Paraiso smallholders stressed that although they consider diversification important and fundamental to improve their income, they lack the knowledge in how to address diversification in relation to the market demand. Daniel Tapia explains: *“We want to know for what crops there is a market. We are not sure about the market: who to sell to, the management, and the pesticides. We are in need of technical assistance to develop those capacities. It is not just to plant.”*

In relation to economic vulnerability, the majority of the smallholders at the focus groups discussions acknowledged that incorporating trees into their farms will be an opportunity to address their vulnerability to the shocks and stresses of the international prices of coffee. At the focus group discussion in Progreso farmers agreed *“Of course, agroforestry will bring us additional*

income with the trees, in the long run. That is seen over time when the trees get bigger. In 4 years, we will be able to sell the trees”. In Nuevo San Ignacio one smallholder mentioned “In the future, we believe that the trees that are planted will give us more income because of the wood.” Lastly, smallholders in Paraiso highlighted that “Agroforestry is a long-term income for us.” Nevertheless, an issue raised in all the communities is that agroforestry puts pressure on smallholder’s household income as it requires more labor inputs and economic resources to implement and maintain than traditional agriculture. At the focus group discussion in Progreso one farmer underlined: “Agroforestry costs more money. We don’t have it. To start agroforestry, you need a heavy investment. We would like to plant more but we do not have the resources.” A farmer in Nuevo San Ignacio furthermore stressed:

“It costs more to practice agroforestry, because more labor is needed to plant the trees and seeds, as well as to harvest. We don’t get support from anyone. We would like more seeds for example to form a tree nursery, but we do not have the resources to buy seeds.”

This argument is also summarized within the figure below where nearly all smallholders related agroforestry with additional costs.

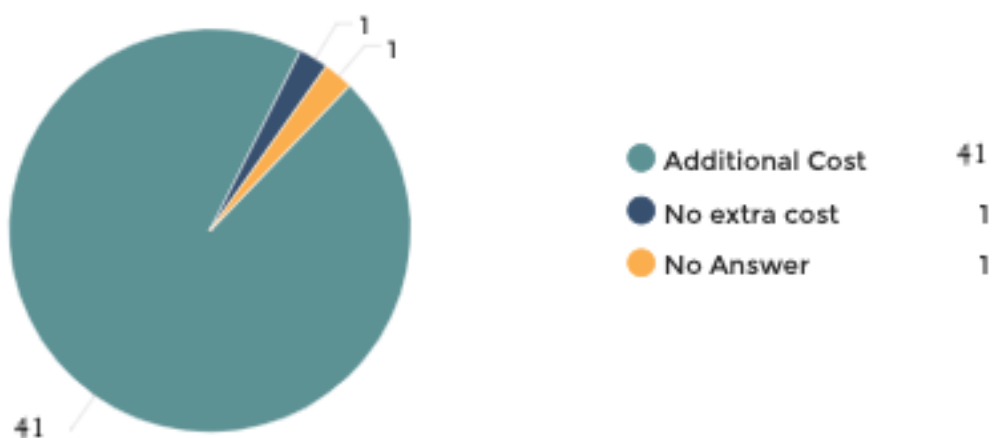


Figure 8: Farmers Perceptions of Additional Costs and Resources Required for Agroforestry. Based on surveys at Nuevo San Ignacio, Paraiso and Progreso (2018).

Furthermore, the majority of smallholders stressed that their income generated from coffee is barely enough to meet their basic needs, while on top their agroforestry parcels require more labor and economic inputs. The additional costs and inputs of agroforestry systems are thereby reinforcing the smallholder's economic vulnerability as they are currently not receiving any additional support to maintain their agroforestry systems. Additionally, even if they would benefit from the long-term economic opportunities of agroforestry systems promoted by PAP, the illegal wood market in the region will become a threat to smallholder's vulnerability. Ruben Paitán from SERFOR explained the situation accordingly during the interview:

“So, I think the issue of the illegal wood market in the region also is a challenge for PAP. This will affect the price of wood coming from forests under agroforestry systems. To remove the wood from the forest in an illegal way is done practically under zero cost. You just go to the forest with the saw, cut the tree and done. On the other hand, a farmer which trades with legal wood must invest on his plantations with fertilizers, labor and so on and when he sells it to the market it will sell it at the same price as the illegal one.”

Authorities at all levels seem to be aware of the situation and during the different interviews with governmental officials from SERFOR, ARA and the Regional government it was mentioned that they plan to create a fund of 5 million PEN under the slogan of “Fair Trade Wood” in the framework of PAP. This fund intends to pay a decent price to smallholders for wood from agroforestry systems, taking into consideration the additional inputs that are required to maintain the tree coverage. Although the fund remains in plans and depends a lot on the national budget and political will from the central government, it has the potential to address smallholder's vulnerability. This fund could compensate for additional inputs for agroforestry wood and become an incentive for farmers to continue with their agroforestry systems, plant more trees, and increase their household income.

Thereupon, the main findings point out that the opportunities of PAP in fostering the economic dimension of agricultural sustainability depend on smallholder's commercialization opportunities and the revenue of agroforestry products, which in this case are limited to wood and coffee. The illegal wood market in combination with the currently low outputs for agroforestry coffee currently represent the main barriers to the economic dimension of PAP for

smallholders at all communities. Policy mechanisms as “Fair Trade Wood” however, represent an opportunity to address smallholder’s vulnerability and some of the main economic stressors for farmers in the long-run. The economic dimension also reflects its interconnectivity with the environmental dimension as if farmers do not have incentives to practice agroforestry it may become a major barrier for sustainable agricultural practices.

6.2.3 Social Dimension

Both the director of SERFOR, John Leith and the director José Enrique Delgado from the Economic Department of San Martín highlighted the importance of associativity in fostering smallholder access to markets as those require bigger volumes which are impossible to reach for most smallholders as individuals. Aligned with the governmental discourse, community structures seemed to have changed with the implementation of PAP. The majority of the smallholders perceived that the process of implementing agroforestry methods had enhanced cooperation, trust and thereby associativity among them. Community associations thus, serve as meeting platforms for organizing duties at the community level as agriculture, cleaning and building roads, community houses, garbage management and sometimes for selling the coffee production jointly. Importantly, smallholders from the communities of Progreso, Nuevo San Ignacio, Paraíso and, Laurel established an umbrella community organization La Red comprised of all four communities. Smallholders mentioned that the primary aim of La Red was to enhance joint coffee commercialization among their communities and support each other with tools for agroforestry and coffee production. Important to mention is that throughout the study communities identified associativity as a bridge to access to credit, enhance their opportunities for coffee commercialization and to gain space in decision-making platforms and thereby boost the synergies between the economic and the Good Governance dimension.

However, beside from being a platform for cooperation among communities, La Red, so far has been unable to address smallholders bargaining power as their capacities seem to be limited by economic and market factors.

“Now we manage better relationships of trust in the community, but we do not have resources neither the money to invest in community infrastructure that would help us to sell coffee together...”

Market actors as well do not care if we are associated or not, in fact, they do not like it. They just care about coffee quality.”

When discussing the issue of associativity with the general manager of the coffee cooperative Alto Mayo, Vicente Minga, the aforementioned argument seems to hold true as the cooperative is rather willing to foster competition rather than associativity among farmers.

“It is about creating competition between the farmers. That they see who gets more money. That is something that works. The coffee bean quality varies a lot between producers and by competing they learn from each other... In fact, I do not buy or will buy coffee from associations, they have too many internal problems and I don’t have the time neither the energy to lose a good client for dealing with coffee farmer associations.”

These arguments picture a market environment where smallholders, despite their efforts in establishing associations are unable to access the market actors such as coffee cooperatives in an organized manner. It also portrays how the cooperative sets the “rules of the game,” where smallholders have little influence over the market environment. Accordingly, the current market dynamics become a barrier to the social dimension, where community structures in the form of associations and organizations as La Red are not valued, in fact, they are discouraged. One smallholder from the community of Progreso further explains that:

“Market actors do not care if we practice agroforestry or if our coffee is organic or not. They pay for coffee quality in the cup. They do not buy our coffee for a fair price because all they want is to get their share.”

In contrast to this argument, Vicente Minga explains the complexity to please all actors in sustainable agriculture as it puts economic trade-offs at stake.

“We say to the producers that we will not lose a good client because of a bad producer. At the time of delivery, they will become aware of that. If you bring me a bad coffee, I will liquidate you with low coffee quality. Some of the producers say I am organic, I am fair trade, but in reality, they are not. That is not fair. If we talk about fair trade, let’s be really fair.”

This citation evidences how economic market incentives represent a barrier to foster the social dimension of agricultural sustainability, where profit is prioritized at the expense of fair-trade practices. It furthermore gives insight into the relationship between the cooperatives and smallholders, where smallholder's inputs in agroforestry systems and organic production are not compensated with fairer prices for coffee production.

To summarize the main findings of the social dimension evidenced that market structures are forged by elements of inequity between actors which limits smallholder associativity, thereby their bargaining and fair-trade possibilities. Furthermore, smallholders input in agroforestry and organic coffee production are not compensated with a fair price. Without more equal conditions and fairer markets and prices for agroforestry products, smallholder's social sustainability will remain limited in PAP. Fair prices for agroforestry products and organic cultivation methods also encompasses possible synergies between the social, economic and environmental dimension. The private sector plays an essential role whether such exchange could occur, which will be further discussed in the good governance section. Important to remark is that social aspects of sustainability also seem to be tightly interconnected with the economic dimensions in either providing opportunities or becoming barriers, as Daniel Tapia referred to it "*trust is not enough to make a living.*"

6.2.4 Good Governance Dimension

Along with the study, PAP was depicted by key authorities as a policy which has incorporated participation and the voice of different actors as a central element to regional development. Nevertheless, at the community level, farmers highlighted a general absence of participatory platforms with regional and local authorities. Overall, smallholders mentioned that their communities are only approached during election campaigns, but never to discuss topics related to agriculture or community development. The lack of dialogue with governmental authorities has hindered smallholder access to knowledge about PAPs implementation, agenda and priorities as the Cession in Use that at the time of the study was implemented. Accordingly, the majority of smallholders in Progreso accentuated for instance that when they signed to take part in the Cession in Use, they did not even have the previous knowledge of how it was going to be implemented, managed or why it was important for their communities. Farmers in Progreso expressed that regional authorities convinced them to take part in the land entitlement program

by promising that if they signed up for it, they would get access to credits and loans. In light with this idea, a farmer expressed: *“We did not know what we signed up for with the Cession in Use, because we are naive, we agreed to sign.”* Another farmer further mentioned: *“They offered me that if I signed up to the Cession in Use, I will have access to credit, loans. But me as the majority did not want to accept because of the distrust we have to the government, it was on the last minute that they convinced us.”*

Importantly, it seems that smallholders in Progreso agreed to participate at the Cession in Use not because they were well-informed about PAP, but because it represented an opportunity for better income or access to assets. Moreover, smallholders at the communities of Nuevo San Ignacio and Paraiso, which are located more distant to the regions administrative center Moyobamba, mentioned that they did not have any information, knowledge or were even considered to be part of the Cession in Use. However, when the question of *“would you have accepted to take part of this policy?”* was asked, members of both communities agreed that even if the state authorities would have approached them, they would have rejected to sign any contract. For example, one farmer during a focus group discussion in Paraiso stated, *“Politicians always want a piece of the cake, we do not believe in anything they say.”* The distrust towards governmental institutions was also stressed in Nuevo San Ignacio:

“We lack support from the state. We don’t trust politicians. They say they will improve productivity (of coffee production), but here in the countryside, we are abandoned. What should we do if we have no support or help? The government wants everything to be “green”. They have the resources, but they do not help us. The trees need care and sometimes we do not even have money for that, and the little tree dies.”

The lack of participatory platforms makes little space left for smallholders to hold governmental authorities accountable in for example demand the support they would need for their community’s development. Corruption was as well a topic discussed at the different focus groups and interviews and mentioned as a major barrier for trusting and holding local authorities accountable. Many mentioned for example that better roads, electricity, and water have been demanded for years without any answer or action from the government.

Nevertheless, PAP seems to have boosted the dialogue and coordination efforts between different governmental authorities. Local and regional authorities mentioned that Peru has been historically characterized by a centralized political system where decisions about regional development have been taken at the capital without taking into consideration the specific settings, needs, and complexities of the region in terms of sustainability. The situation is perceived to have shifted to a certain extent with PAP as José Enrique Delgado from the Regional Government highlighted:

“With PAP we are now coordinating and managing the region’s development with the central government. For the first time, the Region has the power to voice and channel their concerns in national policy for agricultural sustainability. National authorities are now understanding that they have to listen to us in order to promote development.”

On the other hand, when asking national authorities how they are addressing an agenda of agricultural sustainability in the region, Lucia Delfina Ruiz Ostoic, the minister of MINAM further stressed:

“The establishment of the Amazonian interregional committee is one of the most prominent actions taken in the field of sustainability. With it, we are promoting the continuity of actions in the field of agricultural sustainability.”

Mario Garcia, Director of the Preservation of Natural Resources at ARA specifically mentioned that with PAP, coordination mechanisms, committees and institutional arrangements and actions have been established at multiple levels as for example the Zonification of Land. In that framework authorities for the first time are working jointly on land categorization according to its economic, agroforestry or conservation potential, with the aim to foster the economic and environmental dimensions of agriculture. Nevertheless, when asking Mario Garcia on how PAPs coordination has been transferred to the community level his answer was, *“We do not enter at the micro level with the cultivation, the people, and those things. For that, there are all those NGOs that are working in the field with technical assistance.”* It is by no surprise then that smallholders highlighted the lack of participatory platforms with their local and regional government as seen before, as authorities seem to give the responsibility for training and capacity building to NGOs.

Moreover, regional authorities mentioned that the coordination efforts are reaching and engaging the private sector through the “*San Martin Brand*”. The brand intends to promote different agricultural products in the region through a common certificate of products which involve low CO₂ emissions, are produced within agroforestry systems, and do not threaten the regions biodiversity or involve illegal logging. José Enrique Delgado from the Regional Government highlighted: “*Through the San Martin Brand we are gradually involving market actors in the region such as Alto Mayo’s Coffee Cooperative, Acopagro, and Oro Verde in an effort to boost private actor engagement to the regions sustainability agenda, promote competitiveness and inclusion.*” In order to deepen the understanding of how market actors are perceiving their involvement into this sort of initiatives, Vicente Minga, CEO of Alto Mayo’s Coffee Cooperative mentioned the following:

“It was exciting for us to join the San Martin Brand, but disappointing when after six months after joining, there was still no buyers, no clear organization of how the commercial activities were going to be developed, marketed, etc. Everything remained in ideas that sounded beautiful but were not transformed into practice. That is the experience of many of us that got involved with the brand. We finally understood then that our biggest ally is the international market, not any local or regional government.”

Therefore, it is visible, that despite the intention of creating mechanisms for private sector involvement, PAP still faces major coordination constraints. It is important to mention that the San Martin Brand is still at an initial stage, but with improved cooperation and dialogue the San Martín Brand could represent an opportunity to effectively address market actor’s involvement into agricultural sustainability in the region. Additionally, the aim of the San Martin Brand is to address a value chain for agroforestry products which also could foster possible synergies between the environment, economic and social dimensions.

In consequence, the main findings point out that there is a visible disparity between the discourse and the practice of PAP in fostering the good governance dimension. Evidently, PAP has represented an opportunity for coordination and stakeholder involvement primarily between public actors with institutional arrangements such as the Zonification of Land and the Cession in Use. However, at the communities, there is a latent lack of participatory platforms which could

bridge those initiatives to smallholders. It thereby represents a barrier to participation for smallholder as well as their ability to hold responsible actors accountable of PAP. Nevertheless, the good governance dimension also represents a tool and opportunity to further strengthen actor cooperation and thereby foster synergies among all dimensions.

6.3 Positing the Findings in Current Research

This section will position and discuss the main findings in the analysis in relation to current research in sustainability, agroforestry and agriculture. Within the ongoing sustainability debate, this case study has pictured the challenges and potentials of agroforestry for smallholders within the transition from traditional to sustainable agriculture in the Peruvian Amazon. Contradictory to the theory of the three pillars of sustainability, and the risk for trade-offs and incomparability among the pillars (Elkington 2013; Kajikawa 2008; Schoolman et al., 2012), this study rather pictures the circular process of sustainability. Such a process has been able to transform the pillars from separate entities to interconnected circles with good governance as an integrated fourth dimension. Consequently, the dimensions of sustainability are understood in their connectivity, as in line with (Hansman et al., 2012) argument of looking into the relationships between pillars and how they could be achieved and fostered in a holistic way. A circular understanding shows the interdependence between the people, profit and planet, as the possibility to transform one dimension into another. Instead of picturing the incomparability between social, environmental and economic dimensions of sustainability.

In relation to the environmental benefits of agroforestry, this study coheres with previous research where agroforestry succeeded to incorporate more sustainable patterns of agricultural practices for smallholders in the combination of trees and cultivated crops (Kiyani et al., 2017; Montagnini, 2017; Ramachandran, 2009; Ramirez et al., 2012; Sharrow et al., 2004). Agroforestry represented an opportunity to move from traditional agricultural practices mainly dominated by deforestation to improved ecosystem services and reforestation. However, as several authors as Leal Filho et al., (2016) Meijer et al., (2015) FAO, (2013a) highlighted, the role of governance has been pivotal in addressing, implementing and coordinating different sectors and actors involved in agricultural sustainability. Within PAP, channelling smallholder participation and vulnerability into the regional and local development agenda, was identified as one of the main barriers in the good governance dimension. Hence, participatory elements

remain a challenge in sustainability policies as Meijer et al., (2015) and Fischer et al., (2002) have underscored, especially in reaching the most vulnerable groups in agroforestry with information and knowledge.

Moreover, in line with previous research the study also confirms several limitations particular to the smallholder context such as the lack of economic resources, technology and knowledge which represent a barrier to reach the sustainability potentials of agroforestry (Kiyani et al. 2017; Montes-Londoño, 2017). The findings also adhere to the several characteristics of smallholder vulnerability especially in the tropics that Cohn et al., (2018) refers to as smallholder's dependence on natural resources, lack of access to markets, and financial networks in combination with political marginalization, as this study explored in the context of San Martín. Consequently, the implementation of purely agroforestry systems does not improve rural livelihoods for resource-poor smallholders but require policy mechanisms that also address the vulnerability of this specific group. In that sense, the findings further cohere with Ruben and Pender's (2004) statement of addressing both improved opportunities in asset control and market access, where the smallholders in San Martín are almost completely dependent on the coffee crops within the agroforestry systems to earn a living. It also represents one of the major challenges to foster the economic dimension in PAP. In addition, Ruben and Pender (2004) also stress the importance of addressing collective action, learning and rights, which were primarily discussed within the social dimension, where lack of support for smallholder associativity, fair trade and markets, as well as collective bargaining power possibilities remain low in PAP.

Moreover, from a global development perspective, agriculture is an activity which is characterized by its transversality towards the achievement of almost all the SDGs. It has inter-linkages among countless of sustainability indicators as empowering small-scale farmers, ending rural poverty, food security, tackling climate change, decent employment, etc. (FAO, 2019). Accordingly, Doelle (2016) stresses that crucial importance should be given in exploring the interplay of non-state and sub-national actors in order to effectively address the SDGs. The study aligns with this argument by highlighting the interplay between authorities, cooperatives, civil society and smallholders in mobilizing efforts towards the achievement of sustainable agriculture. By looking into the interplay of multiple actors it was possible to explore the main bottlenecks, which in the future can help to set strategies to strengthen the capacities of actors and cooperation in order

to enhance synergies and advance the sustainability agenda. Accordingly, both ICRAF (2017), Nair and Garrity (2012) have stressed the relevance of agroforestry policy research in Latin America. Although, extensive studies in the region have explored the benefits of agroforestry systems related to food security, ecosystem services, and climate change, governance dynamics, and decision-making processes within agroforestry policy in the tropics has been less explored, especially in the Latin American continent.

This study thus contributes to a regional understanding of sustainability transitions by studying this phenomenon from the lenses of smallholders in Peru. Furthermore, it contributes to a holistic understanding of sustainability from a multi-actor perspective in bridging the different sustainability dimensions. Moreover, good governance is understood as a transversal dimension with the potential to foster synergies between all sustainability dimensions. By assessing multiple sustainability themes, it was also possible to explore the main trade-offs within PAP and the opportunities to transform these into synergies. This understanding of agroforestry could hopefully also address barriers that might hinder the potential of agroforestry in fostering sustainable smallholder agriculture from a development perspective. Future quantitative studies regarding the environmental and economic dimensions could further strengthen the understanding of smallholder capacities and limitations in climate change mitigation and adaptation as well as household income trends over time. Another central sustainability aspect of agroforestry that arose during the study was the importance of agroforestry value chains, which should be explored in order to assess and enhance partnerships between smallholders and the private sector. Hence, to assess the market demand for agroforestry products in the Amazon and smallholder's abilities to access these markets, represents another area of future investigation in agroforestry policy.

7. Concluding Remarks

The purpose of this study was to explore the potentials and challenges of Peru's Agroforestry Policy (PAP) in fostering smallholder agricultural sustainability in the Peruvian Amazon. This study explored different dimensions of sustainability in PAP through SAFAs Framework dimensions of good governance, economic, social and environmental. Overall, PAP has succeeded in developing a common institutional agenda for sustainable agriculture in the Region of San Martín. Coordination mechanisms that did not exist prior among governmental authorities at both the regional and national level have been reached and implemented through the policy. Specifically, they have been transformed into concrete initiatives and institutional arrangements as the Cession in Use, the Zonification of Land and the San Martín Brand. At the community level, PAP has fostered environmental awareness through agroforestry knowledge, primarily with the technical assistance from NGOs and FONCODES, where smallholders have been able to translate agroforestry knowledge into practice. The majority of the smallholders that participated in the study acknowledged the ecosystemic benefits of agroforestry, indicating improves coffee crops and soil quality, as well as increased coffee productivity. Deforestation practices do not take place at any of the communities anymore due to the perceived ecosystemic benefits of forests and trees on agricultural crops such as coffee.

Nevertheless, the principal sustainability challenge of PAP was found within the economic and governance dimensions. The long-term sustainability of PAP depends on the crops that are integrated with agroforestry systems, as well as smallholder involvement and participation in the policy. The current low coffee revenues in combination with higher inputs in labour and resources for agroforestry production have become a source of smallholder's economic vulnerability, as well as the main barrier to foster economic, environmental and social synergies. Secondly, PAP has so far been unable to address the value chain for agroforestry products, which will be of crucial importance to smallholder's long-term involvement in agroforestry practices, investments, and capacities to generate better economic returns. At this stage, PAP may face the risk of smallholders cutting down trees because of urgent economic needs, despite their acknowledgement of the ecosystemic benefits of trees at their parcels. Additionally, smallholders lack the support to access fair trade and fair prices for their agroforestry products, as to develop stronger smallholder's associations to gain the bargaining capacities to access better prices. Still

private actors as the Alto Mayo's Cooperative recognized the improvement of coffee bean quality to agroforestry practices. Consequently, PAP encompasses the potentials to foster more sustainable agriculture in the Amazon, but the challenge is whether PAP also inhibits the potential to foster equal, fair and just conditions for sustainable smallholder agriculture for the many smallholders living in Progreso, Nuevo San Ignacio and Paraiso.

References

- Andonova, L. B., Betsill, M. M., & Bulkeley, H. (2009). Transnational climate governance. *Global environmental politics*, 9(2), 52-73.
- BCRP (2017). Informe Económico y Social Región San Martín. Available at: <http://www.bcrp.gob.pe/docs/Proyeccion-Institucional/Encuentros-Regionales/2017/san-martin/ies-san-martin-2017.pdf> [Accessed 2018-11-21].
- Betsill, M. M., & Corell, E. (2001). NGO influence in international environmental negotiations: a framework for analysis. *Global Environmental Politics*, 1(4), 65-85.
- Biermann, F., Betsill, M. M., Gupta, J., Kanie, N., Lebel, L., Liverman, D., ... & Zondervan, R. (2010). Earth system governance: a research framework. *International Environmental Agreements: Politics, Law and Economics*, 10(4), 277-298.
- Bouroncle, C., Imbach, P., Rodríguez-Sánchez, B., Medellín, C., Martínez-Valle, A. and Läderach, P., (2017) Mapping climate change adaptive capacity and vulnerability of smallholder agricultural livelihoods in Central America: ranking and descriptive approaches to support adaptation strategies. *Climatic Change*, 141(1), pp.123-137.
- Bright, M. A., & O'Connor, D. (2007). Qualitative data analysis: comparison between traditional and computerized text analysis.
- Brookfield, H., (2008) Family farms are still around: time to invert the old agrarian question. *Geography Compass*, 2(1), pp.108-126.
- Bryman, A. (2012). *Social Research Methods*. Oxford: Oxford University Press.
- Burford, G., Hoover, E., Velasco, I., Janoušková, S., Jimenez, A., Piggot, G., ... & Harder, M. (2013). Bringing the “missing pillar” into sustainable development goals: Towards intersubjective values-based indicators. *Sustainability*, 5(7), 3035-3059.
- Carswell, G. (1997) *Agricultural Intensification and Rural Sustainable Livelihoods: a 'Think Piece'*, IDS Working Paper 64, Brighton: IDS.
- CFS. (2016) *Connecting Smallholders to Markets* Available at: <http://www.fao.org/cfs/home/activities/smallholders/en/> [Accessed 2019-03-02].
- CGIAR (2019) Over a third of developing countries intend to mitigate climate change through agroforestry. Available at: <https://ccaafs.cgiar.org/blog/over-third-developing-countries-intend-mitigate-climate-change-through-agroforestry#.XNkyeI4zbIU> [Accessed 2019-02-27].
- Chandra, A., McNamara, K.E. and Dargusch, P., (2018) Climate-smart agriculture: perspectives and framings. *Climate Policy*, 18(4), pp.526-541.
- Cohn, A.S., Newton, P., Gil, J.D., Kuhl, L., Samberg, L., Ricciardi, V., Manly, J.R. and Northrop, S., (2017) Smallholder agriculture and climate change. *Annual Review of Environment and Resources*, 42, pp.347- 375.
- Creswell, J. W., (2012) *Qualitative Inquiry & Research Design, Choosing Among Five Approaches*. Thousand Oaks: Thousand Oaks: Sage.

- Creswell, J. W., (2012). *Qualitative Inquiry & Research Design, Choosing Among Five Approaches*. Thousand Oaks: Thousand Oaks: Sage.
- Current, D., & Scherr, S. J. (1995). Farmer costs and benefits from agroforestry and farm forestry projects in Central America and the Caribbean: implications for policy. In *Agroforestry: Science, Policy and Practice* (pp. 87-103). Springer, Dordrecht.
- Denscombe, M., 2009. *Ground rules for social research: Guidelines for good practice*. McGraw-Hill Education (UK).
- Doelle, M., (2016) The Paris Agreement: historic breakthrough or high stakes experiment? *Climate Law*, 6(1-2), pp.1-20.
- Elkington, J. (2013). Enter the triple bottom line. In *The triple bottom line* (pp. 23-38). Routledge.
- Ellis, F., and Biggs S., (2001) Evolving Themes in Rural Development 1950s-2000s *Development Policy Review*, 2001, 19 (4): 437-448
- FAO (1985) Chapter 5 - Agro-forestry, a new fashion of old tradition? Available at: <http://www.fao.org/3/u2246e/u2246e06.htm> 2019-05-13 [Accessed 2019-03-22]
- FAO (1989). *The state of food and agriculture* (Vol. 37). Food & Agriculture Organization of the UN (FAO). Available at: <http://www.fao.org/3/a-i6583e.pdf>. [Accessed 2018-12-08].
- FAO (2010). *Global Forest Resources Assessment 2010: Main report*, Rome: Food and Agriculture Organization of the United Nations (Forestry Paper 163) Available at: <http://www.fao.org/docrep/013/i1757e/i1757e.pdf> [Accessed 2018-12-13]
- FAO (2012) Smallholders and family farmers. Available at: http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALL_HOLDERS.pdf [Accessed 2019-03-13]
- FAO. (2013a). *Sustainability assessment of food and agriculture systems: SAFA guidelines, version 3.0*. Rome: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/SAFA_guidelines_Version_3.0.pdf [Accessed 2018-11-13]
- FAO. (2013). *Advancing Agroforestry on the Policy Agenda: A guide for decision-makers*, by G. Buttoud, in collaboration with O. Ajayi, G. Detlefsen, F. Place & E. Torquebiau. *Agroforestry Working Paper no. 1*. Food and Agriculture Organization of the United Nations. FAO, Rome. 37 pp. Available at: <http://www.fao.org/3/a-i3182e.pdf> [Accessed 2019-04-10].
- FAO (2014). *Building a common vision for sustainable food and agriculture*. Available at: <http://www.fao.org/3/a-i3940e.pdf> [Accessed 2018-12-08].
- FAO. (2015). *Traditional Agroforestry*. Available at <http://www.fao.org/forestry/agroforestry/89997/en/>. [Accessed 2018-09-20].
- FAO. (2016). *The agricultural sector in nationally determined contributions (NDCs)*. Available at: <http://www.fao.org/3/a-i6400e.pdf> [Accessed 2018-11-20].
- FAO. (2017a) *The future of food and agriculture –Trends and challenges*. Available at: <http://www.fao.org/3/a-i6583e.pdf> [Accessed 2018-11-20].

- FAO. (2017b). Agroforestry. Available at: <http://www.fao.org/forestry/agroforestry/en/>. [Accessed 2018-09-20].
- FAO. (2019) Sustainable development goals. Available at: <http://www.fao.org/sustainable-development-goals/indicators/241/en/> [Accessed 2019-05-13].
- Fischer, A., & Vasseur, L. (2002). Smallholder perceptions of agroforestry projects in Panama. *Agroforestry systems*, 54(2), 103-113.
- Fischer, T., Byerlee, D., & Edmeades, G. (2014) *Crop yields and global food security: will yield increase continue to feed the world?* Australian Centre for International Agricultural Research (ACIAR).
- Follis, M. B., & Nair, P. K. R. (1994). Policy and institutional support for agroforestry: an analysis of two Ecuadorian case studies. *Agroforestry systems*, 27(3), 223-240.
- Funder, M. (2005) Bias, intimacy and power in qualitative fieldwork strategies. *The Journal of Transdisciplinary Environmental Studies*, 4(1), 1-9.
- Funder, M., (2005) Bias, intimacy and power in qualitative fieldwork strategies. *The Journal of Transdisciplinary Environmental Studies*, 4(1), 1-9.
- Garrett HE & McGraw RL. (2000). Alley cropping practices. In: Garrett HE, Rietveld WJ, Fisher RF (eds) *North American agroforestry: an integrated science and practice*. ASA, Madison, pp 149-188
- Gibson, R. B. (2006). Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic and ecological considerations in significant decision-making. *Journal of Environmental Assessment Policy and Management*, 8(03), 259-280.
- Global Forest Watch (2010). Peru. Available at: <https://bit.ly/2HZmVbU> [Accessed 2019-06-07].
- Gobierno Regional de San Martín (2018). Mapa de la Región de San Martín Available at: <http://www.regionsanmartin.gob.pe/> [Accessed 2019-09-17].
- Hansmann, R., Mieg, H. A., & Frischknecht, P. (2012) Principal sustainability components: empirical analysis of synergies between the three pillars of sustainability. *International Journal of Sustainable Development & World Ecology*, 19(5), 451-459.
- Henriksson Malinga, R., Jewitt, G., Lindborg, R., Andersson, E., & Gordon, L. (2018) On the other side of the ditch: exploring contrasting ecosystem service coproduction between smallholder and commercial agriculture. *Ecology and Society*, 23(4).
- ICRAF (2013). Strategy 2013-2022, transforming lives and landscapes with agroforestry. Available at: <http://www.worldagroforestry.org/downloads/Publications/PDFS/RP17554.pdf> [Accessed 2019-03-10].
- IFAD (2016). Rural development report 2016. Available at: <https://www.ifad.org/documents/38714170/39155702/Rural+development+report+2016.pdf/347402dd-a37f-41b7-9990-aa745dc113b9> [Accessed 2019-03-04].
- IU, 2018. Jordbruk och fiske. Available at: <https://www.ui.se/landguiden/lander-och-omraden/sydamerika/peru/jordbruk-och-fiske/> [Accessed 2018-09-10].

- Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: an overview. *Agroforestry systems*, 76(1), 1-10.
- Kajikawa, Y. (2008). Research core and framework of sustainability science. *Sustainability Science*, 3(2), 215-239.
- Keeble, B. R. (1988). The Brundtland report: 'Our common future'. *Medicine and War*, 4(1), 17-25.
- Kirby, K. R., & Potvin, C. (2007). Variation in carbon storage among tree species: implications for the management of a small-scale carbon sink project. *Forest Ecology and Management*, 246(2-3), 208-221.
- Kiyani, P., Andoh, J., Lee, Y., & Lee, D. K. (2017). Benefits and challenges of agroforestry adoption: a case of Musebeya sector, Nyamagabe District in southern province of Rwanda. *Forest Science and Technology*, 13(4), 174-180
- Larrea, C., Eckhardt, K., & Arana, A. (2014). El impacto económico del cambio climático en la selva alta para el cultivo del café. *Digital*.
- Leal Filho, W., Platje, J., Gerstlberger, W., Ciegis, R., Kääriä, J., Klavins, M., & Kliucininkas, L. (2016). The role of governance in realising the transition towards sustainable societies. *Journal of Cleaner Production*, 113, 755-766.
- Lehrer, N. (2009). Negotiating a political path to agroforestry through the Conservation Security Program. *Agroforestry systems*, 75(1), 103-116.
- Lipper, (2018) Climate Smart Agriculture Building Resilience to Climate Change, FAO 2018.
- Littig, B., & Griessler, E. (2005). Social sustainability: a catchword between political pragmatism and social theory. *International journal of sustainable development*, 8(1-2), 65-79.
- Mansfield, B. (2009). Sustainability. *A companion to environmental geography*, 37-49.
- McKenzie, S. 2004. Social Sustainability: Towards Some Definitions, Hawke Research Institute Working Paper Series No. 27. University of South Australia: Adelaide.
- Meijer, S. S., Caracutan, D., Ajayi, O. C., Sileshi, G. W., & Nieuwenhuis, M. (2015). The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability*, 13(1), 40- 54.
- Meuleman, L., & Niestroy, I. (2015) Common but differentiated governance: A metagovernance approach to make the SDGs work. *Sustainability*, 7(9), 12295-12321.
- MINAGRI. (2015a). Características generales del departamento de San Martín. Available at: <http://minagri.gob.pe/portal/221-especiales/bioenergia/4214-san-martin>. [Accessed 2018-09- 14]
- MINAGRI. (2015b). La situación actual del café en el país. Available at: <http://minagri.gob.pe/portal/485-feria-scaa/10775-el-cafe-peruano> [Accessed 2018-11-21]
- MINAGRI. (2017). *Datos Oficiales de Bosques y Pérdida de la cobertura de Bosques húmedos Amazónicos - 2017*. Available at: https://www.scribd.com/document/358714812/datos-de-perdida-de-cobertura-de-los-bosques-humedos-amazonicos-en-el-2016#fullscreen&from_embed [Accessed 2018-09-19].

- MINAM. (2015). Informe Final Comisión Multisectorial Resolución Suprema N° 129-2015- PCM. Available at: http://www.minam.gob.pe/wp-content/uploads/2015/12/Informe-T%C3%A9cnico-Final-CM-R-S-129-2015-PCM_Secretar%C3%ADa-T%C3%A9cnica-18-09-2015-vf.pdf [Accessed 2018-11-21]
- MINAM. (2016). El Perú y el cambio climático. Lima: Ministerio del Ambiente. Available at: <http://www.minam.gob.pe/wp-content/uploads/2016/05/TerceraComunicaci%C3%B3n.pdf>. [Accessed 2018-09-10].
- MINAM. (2018) Reglamento de la Ley Marco sobre Cambio Climático, Ley No. 30754 Available at: http://www.minam.gob.pe/cambioclimatico/wp-content/uploads/sites/127/2018/07/REGLAMENTO-DE-LA-LEY_CAMBIO-CLIMATICO_11.07.2018.pdf [Accessed 2018-11-25]
- Montagnini, F. (Ed.). (2017). *Integrating Landscapes: Agroforestry for Biodiversity Conservation and Food Sovereignty*. Springer.
- Montes-Londoño, I. (2017). Tropical dry forests in multi-functional landscapes: agroforestry systems for conservation and livelihoods. In *Integrating Landscapes: Agroforestry for Biodiversity Conservation and Food Sovereignty* (pp. 47-78). Springer, Cham.
- Morton, J.F., (2007) The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the national academy of sciences*, 104(50), pp.19680-19685.
- Nair, P. K. R., & Garrity, D. (2012). Agroforestry research and development: The way forward. *Agroforestry the future of global land use (Advances in Agroforestry 9)*. Springer, Dordrecht, 515-531.
- Nielsen, E., Jolink, A., de Sousa Jabbour, A. B. L., Chappin, M., & Lozano, R. (2017). Sustainable collaboration: The impact of governance and institutions on sustainable performance. *Journal of cleaner production*, 155, 1-6.
- Padoch, C., & Pinedo-Vasquez, M. (2010). Saving slash-and-burn to save biodiversity. *Biotropica*, 42(5), 550-552.
- Palm, C., Vosti, S. A., Sanchez, P. A., & Ericksen, P. J. (Eds.). (2005). *Slash-and-burn agriculture: the search for alternatives*. Columbia University Press.
- Phalan, B., Onial, M., Balmford, A., & Green, R. E. (2011) Reconciling food production and biodiversity conservation: land sharing and land sparing compared. *Science*, 333(6047), 1289-1291.
- Piñero, D. (2004). Movimientos sociales, gobernanza ambiental y desarrollo territorial rural. *Montevideo: Centro Latinoamericano para el Desarrollo Rural*.
- Place, F., & Dewees, P. (1999). Policies and incentives for the adoption of improved fallows. *Agroforestry systems*, 47(1-3), 323-343.
- UNDP (n.d.) Contribuir al incremento del valor de los bosques - DCI. Available at: <http://www.pe.undp.org/content/peru/es/home/projects/contribuir-al-incremento-del-valor-de-los-bosques.html> [Accessed 2018-12-10]
- Pokorny, B. (2013). *Smallholders, forest management and rural development in the Amazon*. Routledge.
- Porro, R., Miller, R.P., Tito, M.R., Donovan, J.A., Vivan, J.L., Trancoso, R., Van Kanten, R.F., Grijalva, J.E., Ramirez, B.L. and Gonçalves, A.L., 2012. Agroforestry in the Amazon region: a pathway for

- balancing conservation and development. In *Agroforestry-The Future of Global Land Use*(pp. 391-428). Springer, Dordrecht.
- Quintero-Angel, M. & González-Acevedo, A., (2018) Tendencies and challenges for the assessment of agricultural sustainability. *Agriculture, ecosystems & environment*, 254, pp.273-281.
- Rahn, E., Läderach, P., Baca, M., Cressy, C., Schroth, G., Malin, D., van Rikxoort, H. and Shriver, J., (2014) Climate change adaptation, mitigation and livelihood benefits in coffee production: where are the synergies? *Mitigation and Adaptation Strategies for Global Change*, 19(8), pp.1119-1137.
- Ramachandran Nair, P. K., Mohan Kumar, B., & Nair, V. D. (2009). Agroforestry as a strategy for carbon sequestration. *Journal of plant nutrition and soil science*, 172(1), 10-23.
- Rapsomanikis, G., (2015) The economic lives of smallholder farmers: An analysis based on household data from nine countries. Food and Agriculture Organization of the United Nations.
- Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. *Environmental Development*, 18, 14-25.
- Recanatì, F., Castelletti, A., Dotelli, G. and Melià, P., (2017) Trading off natural resources and rural livelihoods. A framework for sustainability assessment of small-scale food production in water-limited regions. *Advances in water resources*, 110, pp.484-493.
- Redclift, M.R., 1987. Sustainable development: exploring the contradictions. Routledge, London, New York.
- Rockström, J., Steffen, W.L., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J. and Nykvist, B., (2009) Planetary boundaries: exploring the safe operating space for humanity. *Ecology and society*.
- Rockström, J., Williams, J., Daily, G., Noble, A., Matthews, N., Gordon, L., ... & de Fraiture, C. (2017) Sustainable intensification of agriculture for human prosperity and global sustainability. *Ambio*, 46(1), 4-17.
- Rosegrant, M. W., & Livernash, R. (1996) Growing more food, doing less damage. *Environment: Science and Policy for Sustainable Development*, 38(7), 6-32.
- Ruben, R. & Pender, J., (2004) Rural diversity and heterogeneity in less-favoured areas: the quest for policy targeting. *Food policy*, 29(4), pp.303-320.
- Schoolman, ED, Guest, JS, Bush, KF and Bell, AR. (2012) How interdisciplinary is sustainability research? Analyzing the structure of an emerging scientific field. *Sustain Sci.*, 7(1): 67-80.
- Schroth, G., & Sinclair, F. L. (Eds.). (2003). *Trees, crops, and soil fertility: concepts and research methods*. CABI.
- SERFOR, 2015. Reglamento para la gestión de las plantaciones forestales y los sistemas agroforestales. Available at: <https://www.serfor.gob.pe/wp-content/uploads/2015/11/REGLAMENTO-PARA-LA-GESTION-DE-LAS-PLANTACIONES-FORESTALES-Y-LOS-SISTEMAS-AGROFORESTALES.pdf> [Accessed 2018-11-22]
- Sexsmith, K., & McMichael, P. (2015). Formulating the SDGs: Reproducing or reimagining state-centered development? *Globalizations*, 12(4), 581-596.

- Sharma, S., & Ruud, A. (2003). On the path to sustainability: integrating social dimensions into the research and practice of environmental management. *Business Strategy and the Environment*, 12(4), 205-214.
- Sharrow, S. H., & Ismail, S. (2004) Carbon and nitrogen storage in agroforests, tree plantations, and pastures in western Oregon, USA. *Agroforestry Systems*, 60(2), 123-130.
- Silverman, D. (Ed.). (2016) *Qualitative research*. Sage.
- Smith, P., Bustamante, M., Ahammad, H., Clark, H., Dong, H., Elsiddig, E. A., ... & Masera, O. (2014). Agriculture, forestry and other land use (AFOLU). In *Climate change 2014: mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Smith, N.J., Falesi, I.C., Alvim, P.D.T. and Serrao, E.A.S., 1996. Agroforestry trajectories among smallholders in the Brazilian Amazon: innovation and resiliency in pioneer and older settled areas. *Ecological economics*, 18(1), pp.15-27.
- Somarriba, E., Beer, J., Alegre-Orihuela, J., Andrade, H. J., Cerda, R., DeClerck, F., ... & Krishnamurthy, L. (2012) Mainstreaming agroforestry in Latin America. In *Agroforestry-The Future of Global Land Use* (pp. 429-453). Springer, Dordrecht.
- Spangenberg, J.H., (2017) Hot air or comprehensive progress? A critical assessment of the SDGs. *Sustainable Development*, 25(4), pp.311-321.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., De Vries, W., De Wit, C.A. and Folke, C., (2015) Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), p.1259855.
- The Redd Desk (2019). REDD in Peru. Available at: <https://theredddesk.org/countries/peru> Accessed 2019-02-020
- Tscharntke, T., Clough, Y., Wanger, T. C., Jackson, L., Motzke, I., Perfecto, I., ... & Whitbread, A. (2012) Global food security, biodiversity conservation and the future of agricultural intensification. *Biological conservation*, 151(1), 53-59.
- UN. (2015) Transforming Our World: The 2030 Agenda for Sustainable Development. Available at: https://www.un.org/pga/wp-content/uploads/sites/3/2015/08/120815_outcome-document-of-Summit-for-adoption-of-the-post-2015-development-agenda.pdf [Accessed 2019-03 13].
- UNFCCC. (2015) Paris Agreement: Available at https://unfccc.int/sites/default/files/english_paris_agreement.pdf [Accessed 2018-09-08]
- Van Grinsven, H. J., Erisman, J. W., de Vries, W., & Westhoek, H. (2015) Potential of extensification of European agriculture for a more sustainable food system, focusing on nitrogen. *Environmental Research Letters*, 10(2), 025002.
- Verchot, L.V., Van Noordwijk, M., Kandji, S., Tomich, T., Ong, C., Albrecht, A., Mackensen, J., Bantilan, C., Anupama, K.V. and Palm, C., (2007) Climate change: linking adaptation and mitigation through agroforestry. *Mitigation and adaptation strategies for global change*, 12(5), pp.901-918
- World Agroforestry Center. (2017) Peru's integrated approach to nationally determined contributions can boost agroforestry's role in fighting climate change. Available at:

<http://blog.worldagroforestry.org/index.php/2017/12/14/perus-integrated-approach-to-nationally-determined-contributions-can-boost-agroforestrys-role-in-fighting-climate-change/> [Accessed 2018-11-21].

World Agroforestry Center. (2018) Agroforestry Concessions are a strategic mechanism for smallholders in the Amazon. How do we make it work? Available at: <http://blog.worldagroforestry.org/index.php/2018/05/29/agroforestry-concessions-strategic-mechanism-smallholders-amazon-make-work/>. [Accessed 2018-09-20].

WWF. (2015) Deforestation in Peru. Available at: <https://www.worldwildlife.org/magazine/issues/fall-2015/articles/deforestation-in-peru>. [Accessed 2018-09-19].

Appendix 1: List of Interviewees

This list indicates all interviewees that participated in the study, name, the organizations they represent, location and date for the interview.

Name	Organisation and position	Date and Place of the interview
José Enrique Delgado	Director of the Economics Department at the Regional government of San Martín	Moyobamba 2018-03-12
Mario Torres García	Director of the Preservation of Natural Resources at ARA (belongs to SERFOR and is a part of MINAGRI)	Moyobamba 2018-03-12
John Leith	Director of SERFOR Peru	Juanjuí 2018-05-12
Lucía Delfina Ruiz Ostoic	Minister of MINAM Peru	Juanjuí 2018-05-12
Roldan Rojas	Director of the foundation FUNDAVI	Juanjuí 2018-05-12
Rubén Paitán	Director of the Forest Programme at SERFOR San Martín	Juanjuí 2018-05-12
Daniel Tapía	Farmer at the community of Paraíso and president of the community coffee network “La Red”.	Paraíso 2018-10-10
María Reyes	Farmer at the community of Progreso and president of the community association	Progreso 2018-09-10
Guadalupe Díaz	Farmer at the community of Nuevo San Ignacio	Progreso 2018-09-10
Jaime Gonzales	Farmer in the community of Nuevo San Ignacio, teacher and agroforestry trainer for AGRORURAL.	Nuevo San Ignacio 2018-11-10
Vicente Minga	Director at the cooperative Alto Mayo	Moyobamba 2018-04-12

Appendix 2: SWOT Analysis

SWOT Analysis: Agroforestry systems in Progreso

Strengths <ul style="list-style-type: none"> • Technology knowledge and practices (SAM) • Irrigation systems • Organic fertilizers • Fish breeding • Access to coffee dryers • Diversification 	Threats <ul style="list-style-type: none"> • Pests and plagues as the yellow rust • The low prices on coffee
Weaknesses <ul style="list-style-type: none"> • lack of knowledge of organic pesticides • Lack of knowledge of market possibilities for other crops than coffee • Weak organization, everyone works individually and do not accomplish with the expectations of working as a group • Lack of knowledge in the area of accountability, cost reduction, registration of plots and unawareness of expenses. 	Opportunities <ul style="list-style-type: none"> • Expanding the irrigation system to more households • Diversification and new markets: Sacha Inchi and Cacao • Form a cooperative of coffee and cacao farmers • Public-private partnerships • Increase networks and strengthen the organization to reach funds and commercialization

SWOT Analysis: Agroforestry systems in Paraíso

Strengths <ul style="list-style-type: none"> • Good cultivation techniques and practices • Reforestation • Capacities to compete for better prices • Stronger associativity • More resources • Better transportation (infrastructure, road, and vehicles) 	Threats <ul style="list-style-type: none"> • Diseases (The yellow rust) • Low prices on coffee • Climate change (it is warmer than before, less rain and seasons have changed, making it difficult for farmers to plan seeding, etc.) • The absence of authorities • Corruption
Weaknesses <ul style="list-style-type: none"> • Lack of financial resources • Lack of knowledge on how to compete with pest and plagues • Lack of knowledge of how to improve the quality of other products than coffee • Lack of capacities and knowledge for commercialization of coffee and other products • Lack of technology to be able to identify the grade quality of the coffee • Lack of incentives for associativity • Lack of direct market access, resources, and knowledge about cultivation methods for other crops than coffee 	Opportunities <ul style="list-style-type: none"> • Diversification: cacao, Sacha Inchi, corn, yucca, banana, vanilla • Reforestation • Breeding of animals (guinea pig and fishes) • Strengthen the organization for commercialization • Apply for funds as a group • Make contact with other NGOs

SWOT: Agroforestry systems in Nuevo San Ignacio

<p>Strengths</p> <ul style="list-style-type: none"> • Technology knowledge: SAM and coffee cupping • Good cultivation methods • The organization “Association” • Organic cultivation practices • Better access to market 	<p>Threats</p> <ul style="list-style-type: none"> • The stock exchanges • Low prices on coffee • Climate change: less rain, warmer, more pests, plagues, the yellow rust.
<p>Weaknesses</p> <ul style="list-style-type: none"> • No irrigation system • Not sufficient diversification and lack of knowledge of other crops and cultivation methods • Lack of articulation to the market as an organization and with foreign markets • No contact with authorities: No assistance or support is provided 	<p>Opportunities</p> <ul style="list-style-type: none"> • Caturra coffee plant • Activities that generate income • Cacao and Sacha Inchi, animal and fish breeding • Infrastructure • Increase networks and influence: Dialog with authorities and NGOs • Other business opportunities than coffee • Sell directly to the foreign market

Appendix 3: Interview Protocol Smallholders Peru's Agroforestry Policy

Environmental dimension

- How do you cultivate now with agroforestry in comparison to before?
- How does your agroforestry system work?
- How did you cultivate before?
- What are the main differences? (In coffee bean quality, soil quality, water sources and quality, productivity, diversification, biodiversity)
- Has the climate in your community changed over the last 10 years? If yes, how?

Economic dimension

- Are agroforestry methods an asset when you sell your coffee?
- Is there a demand for agroforestry coffee?
- Do the companies or cooperatives pay more for agroforestry coffee? Organic coffee in comparison with conventional coffee?
- Is the market dynamics different for agroforestry coffee than conventional coffee?
- Does it cost more or less to practice agroforestry? Why/Why not?
- Do you use organic methods? Why/Why not?
- To whom do you sell your coffee?
- What tools and technology do you need to practice agroforestry? Do you have access to these tools?
- Do you earn more or less now, with agroforestry, than before? Why/Why not?

Social dimension

- When you sell your coffee to the cooperative Alto Mayo, what are their requirements?
- What do they pay for conventional/agroforestry/organic coffee?
- Have community structures/organizations/associations changed since you started to practice agroforestry?
- Who practices agroforestry in your community?
- Who benefit the most from agroforestry? Are there differences in the community?
- Do you receive any support for your agroforestry production from the cooperatives, the government, NGOs? As for example loans, training, community visits or other type of support.

Good Governance dimension

- What actors do you have contact with and collaborate with for your agroforestry production/sale?
- Has your relationship with private and governmental actors, as well as cooperatives, changed since you started to practice agroforestry?
- What are your incentives to practice agroforestry?
- What are the main challenges in contact/cooperation with other actors? The government/cooperatives/companies?
- What are the demands of the market? Organic/quality/agroforestry?
- What are the main barriers to comply with demands of the market?
- What possibilities and challenges do you see in future agroforestry production for your community?

Appendix 4: Interview Protocol Authorities Peru's Agroforestry Policy

Environmental dimension

- What are the main environmental benefits of agroforestry to the region?
- How do you do to reach the environmental benefits of agroforestry?
- What are the main challenges in reaching these benefits?
- How do you work with forest and biodiversity conservation in agroforestry?
- To what extent could agroforestry mitigate climate change?

Economic dimension

- Are agroforestry practices more rentable than conventional or traditional methods?
- What are the commercialization opportunities for agroforestry products in the region?
- How has the low international prices on coffee affected the region?
- How can stallholders benefit economically from PAP?
- How do you work with the San Martín Brand?

Social dimension

- Can all farmers take part in PAP?
- Do you provide training in agroforestry methods?
- Do you give any support or provide any recourses, funds or other type of support in smallholder's implementation of agroforestry systems?
- What are the needs of the smallholders to implement and maintain agroforestry systems?
- How is the government working with fair trade in the region? What are the potentials and challenges in agroforestry for fair trade?
- Are farmers organized and associated? Why/Why not?

Good Governance

- How does the regional government work with the agroforestry policy in the region?
- What have been the main success of the policy?
- Who is in charge of the implementation of the policy and in what way?
- How do you collaborate with other actors and sectors to implement PAP? (Authorities, companies, NGOs, sectors, cooperatives and farmers)
- How are these actors involved in PAP? What is their role and is someone missing? Why?
- What are the main challenges in the implementation of PAP?
- What are the main incentives behind the implementation of PAP in the region?
- What is the future vision of PAP in the country?
- What opportunities and challenges can you identify at a national level in the implementation of PAP?
- How does the Cession in Use work? And how will it be implemented?

Appendix 5: Interview Protocol Cooperatives Peru's Agroforestry Policy

Economic dimension

- What coffee do you sell the most? Conventional or organic coffee?
- Which type is the most profitable for you as a cooperative?
- What are the market demands? Is there a demand for agroforestry coffee or organic coffee?
- To whom do you sell your coffee?
- Do you know about the Agroforestry policy and incentives in the region?
- What are the growing potentials for the cooperative?
- What are the economic potentials of agroforestry?

Social dimension

- Who can become a member of your cooperative?
- What are the requirements to become a member?
- Do you provide any training or support to your members or farmers that would like to become members?
- How are your members involved in decision-making processes?
- What is the profile of the farmers that are members of your cooperative? (Individuals, associations, women or men?)
- How many members do you have?
- How do you apply fair trade practices in your cooperative?

Environmental dimension

- What kind of cultivation methods do the farmers use that sell their coffee to you?
- Do they use sustainable methods?
- Do they practice agroforestry? Organic methods? Reforestation?
- What agricultural methods use farmers that sell coffee to you?
- Why do farmers use these methods?
- What methods do you support as a cooperative?

Good Governance

- What actors do you collaborate with?
- How do you work with governmental actors, NGOs, community organizations?
- Is it easy or hard to collaborate with these actors? Why/why not?
- How do you work with Rainforest Alliance and Fair trade?
- How do these organizations support you and how does it benefit you and your member farmers to cooperate with Fair trade and Rainforest Alliance?
- What are the future plans and ambitions for your cooperative?
- What are the main challenges to satisfy the international and local market/farmers and the government?
- What do you think are the potentials and challenges for agroforestry coffee production and sale?
- What do you think about the San Martín Brand?

Appendix 6: Workshop Guide “Smallholders Agroforestry Experiences”

The workshop was elaborated by the researcher inspired by participatory methods from the book “Como sal en la Sopa”. The workshop was given in Spanish and the guide has been translated from Spanish to English by the researcher.

13.00 Introduction

Presentation: We are Josefine y Sara, from Sweden and Ecuador, a researcher from Lund University Sweden. We are carrying out a study about agroforestry in San Martín and are interested to learn more about your experiences with agroforestry systems.

Time: The workshop will take around 3 hours. (13.00-16:00) with a coffee break between 15.00-15.30.

Aim of the workshop: We would like to have discussion and work in groups with you to get to know more about how you work with agroforestry methods, what you think about it and how you perceive that it has changed your way of cultivating, working together, access to the market, challenges and opportunities for your families that you relate to agroforestry practices. With the information we will elaborate a study that will be shared with actors, NGOs and authorities that work in the region with agroforestry. We hope to be able to identify, with your help, future possibilities and challenges in agroforestry systems.

The workshop has four parts: To start with we will do a timeline and an anonymous survey questionnaire. Thereafter we will elaborate drawings around different themes: the community, cultivation methods, and the coffee market in groups. Thereafter we will have Groups discussions based on the drawings and end together by discussing the drawings that we have created. We will guide the different activities. To participate is voluntary and you are welcome to participate in the way that you feel comfortable, either by writing, drawing or talking, and you are free to leave the workshop in any moment. If you have questions or are insecure about any of the tasks, questions or activities, just ask us. We are here to listen to your experiences and knowledge. We will also provide you with the material you will need to carry out the different tasks.

All participants present their names and occupation.

13.30 Survey

Survey questions are read to the group and participants answer individually.

13:50 Time-line

Activity: with support from the group the researcher elaborates a time live over the community.

Questions: When did you get to the community (born/migrated)? What did you cultivate during different periods in time? Projects you have been taking part in (with NGOs, state, companies)?

Other important events (climate change events, migration or conflicts).

14:20 Community drawings

Activity: The researchers divide the participants in small groups with around 3 participants in each group. Each group get a task thereafter they present it for the researchers and other participants. Everyone is invited to ask questions or add information.

Group 1: Cultivation methods before and after agroforestry practices

This group get the task to draw how they cultivation before and after they started with agroforestry (include type of crops, trees, soil and water source) and how the type of cultivation methods has influenced production, water, soil and the environment in their communities.

Group 2: Map over the community: Progreso, Nuevo San Ignacio y Paraiso

This group is responsible to make a drawing over their community including community facilities, social dynamics (meetings points, associations, organizations in the community), as well as social services that the community have access to. The drawing should also include natural resources and infrastructure that belongs to the community: houses, cultivated area, forest, water systems, lakes and rivers, mountains etc.

Group 3: Market dynamics and the coffee value chain

This group will make a drawing over the coffee market and the coffee value chain from a producer's perspective. Map out the most important sites for coffee production including farms, coffee associations, middlemen's, cooperatives, and production tools (transportation, coffee dryers, irrigations etc). This map could include the community, Roque and Moyobamba depending on where the farmers sell their coffee.

15:00 Coffee break

15.30 Presentation of drawings

Each group presents their drawings. Questions: Is anything missing in the drawing? Do you want to add something? What have changed since you started to practice agroforestry? What does the changes mean to you?

16.00 Focus group discussions

The participants are divided in two groups. Based on the elaborated drawings the participants discuss questions the researcher lead discussion in line with each dimension in the interview guides for smallholders.

16.30 SWOT-analysis

To end the workshop the researchers, lead a SWOT analysis over agroforestry practices with the participants. All drawings are attached to the walls and used to elaborate the SWOT.

Researchers ask:

- What do you think about the maps? Do you agree with the findings?
- What are the main strengths (benefits) of agroforestry for your community?
- What are the main weaknesses (internal limitations) for you to fully benefit from agroforestry?
- What are the main (external) Opportunities to improve agroforestry methods and production in your community?
- What are the main (external obstacles) Threats to your agroforestry production?

17.00 Workshop ends

Appendix 7: Survey

1. General Apects	No. Respondets
1.1 Community	
Progreso	9 (men:2; women:7)
Nuevo San Ignacio	19 (men 13; women:5)
Paraiso	15 (men:11; women:4)
1.2. Do you practice agroforestry systems?	
Yes	43
No	0
1.3 Do you use organic fertilizers ?	
Yes	18
No	0
Sometimes yes and sometimes no	25
1.4 Who teached you about agroforestry systems?	
NGO	38
Government	0
Both	4
NA	1
1.5 How do you sell your coffee production?	
Individual	30
Joint	1
Both	11
NA	1
1.6 To whom do you sell your coffee production	
Middleman	33
Cooperative	1
Both	9
1.7 Total area of your land	
0,5- 1 ha	3
1-2 ha	8
2-3 ha	11
4-5 hm	2
5 ha or more	17
NA	2
1.8 Total area cultivated	
0,5- 1 ha	6
1-2 ha	18
2-3 ha	8
4-5 ha	5
5 or more	5
NA	1
1.9 Total area with agroforestry systems	
0,5- 1 ha	29
1-2 ha	9
2-3 ha	2
4-5 ha	1
5 ha or more	2
1.10 Total area of coffee cultivated	
0,5- 1 ha	11
1-2 ha	28
2-3 ha	4
4-5 ha	1
5 or more	1
1.11 Family income per month	
0-100 S/.	18
100-200 S/.	
200-300 S/.	15
400-500 S/.	7
600-700 S/.	2
NA	1

2. Economic Sustainability			
Question	Yes	No	NA
2.1 Has your family income increased with the use of agroforestry systems?	2	39	2
2.2 Has coffee productivity increased with the use of agroforestry systems?	35	7	1
2.3 Have commercialization opportunities increased with the use of agroforestry systems?	30	11	2
2.4 Do agroforestry systems require more labour force?	34	9	0
2.5 Do agroforestry systems require more economic resources?	41	1	1
2.6 Do you diversify your agricultural production with agroforestry systems more than before?	37	6	0
2.7 Have your chances to access to credit increased since you started with agroforestry systems?	23	19	1
3. Social Sustainability			
Question	Yes	No	NA
3.1 Has cooperation between members of your community increased with agroforestry systems?	43		0
3.2 Has cooperation between communities increased with the use of agroforestry systems?	20	23	0
3.3 Has the cooperation between your community and the local authorities increased with the use of agroforestry systems?	34	9	0
3.4 Have agroforestry systems increased your access to sell your coffee production to cooperatives?	44	9	1
3.5 Have agroforestry systems increased your access to private actors more than before?	18	24	1
3.6 Has community trust increased with the use of agroforestry systems?	43	0	0
4. Environmental Sustainability			
Question	Yes	No	NA
4.1 Have your agricultural practices changed with the use of agroforestry systems?	43	0	0
4.2 Do you take care the nature more than before with the use of agroforestry systems?	43	0	0
4.3 Do you plant trees more than before with the use of agroforestry systems?	42	1	0
4.4 Do you cut trees less than before with agroforestry systems?	38	5	0
4.5 Has soil quality improved with the use of agroforestry systems?	43	0	0
4.6 Has coffee quality improved with the use of agroforestry systems?	37	3	3