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Proposal for a PhD Thesis:

ANALYZING SOCIAL-ECOLOGICAL SYSTEMS (SES):
A CASE OF TROPICAL FOREST IN SOUTHERN OF ECUADOR

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INFORMATIVE DATA

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TITLE OF PROJECT

ANALYZING SOCIAL-ECOLOGICAL SYSTEM (SES): A CASE OF TROPICAL FOREST IN SOUTHERN OF ECUADOR

ABSTRACT

The following proposal has been realized by Virginia Vallejo under Marta Rivera direction and Federica Ravera co-direction. As part of the requirements established to continue the "Doctoral Programme in Sustainability" of the Polytechnic University of Catalonia. The document structure shown here tries to allow a clear overview of the research proposed. We have proposed to analyze a socio-ecological system under two policy targets: (a) food sovereignty and (b) green economy. The food sovereignty will be taken as conceptual framework to able to achieve rural development together with environmental protection within a socio-ecological system. The socio-ecological system (SES) framework will be used as diagnosis methodology. The main originality of this research is the use of SES framework to create scenarios according to political targets that are behind them. To determinate how the interactions between the subsystems within a SES vary with a policy target. The research area proposed is a tropical forest in southern of Ecuador. This territory shows a mega biological diversity with cultural richness and faces to high deforestation rates that threat their biodiversity.

*Can we protect natural habitats
without abusing the people who live in them?
(Chapin, 2004)*

PROBLEM STATEMENT AND JUSTIFICATION

The world is currently threatened by considerable damage to or losses of many natural resources, including fisheries, lakes, and forests, as well as experiencing major reductions in biodiversity and the threat of massive climatic change. On the other hand, each territory is unique with singular features that have been shaped and are adapted continuously in time. No single blueprint policy can solve these complex problems. All humanly used resources are embedded in complex, social-ecological systems.

With this research we aim to understand, within a socio-ecological context, how the interactions between a resource system, resource units, governance systems and users vary when there is a political target behind. This is the new main contribution that warrants the investigation proposed. The diagnostic tool we will use to analyze these interactions is the social-ecological system (SES) framework. In this research we intend to validate this tool and use it to set up two scenarios under two different policy approaches. This has never been done before, since previous works using SES only have used the framework to describe and examine cases studies.

The research will be performed in an ecosystem of Ecuador which is known by its megadiversity status. The Ecuadorian Andes is one of the global biodiversity hotspots. But this country suffers one of the highest deforestation rates in South America. Deforestation is the main threat to biodiversity in the Andes “hot spot”. At the same time Ecuador, has a cultural biodiversity which is being also threatened by external forces, mainly economic drivers.

To face these problems the Ecuadorian government has proposed a policy plan which can be considered to match with the green economy framework. Since January 2009 the national programme called “Programa Socio Bosque” has been implemented specifically to conserve the tropical forests. These schemes are primarily designed to improve natural resource use, but they often are not linked to rural development. However, the creation of conservation programs must respond to the needs of both biological and human diversity. For this reason, we propose the food sovereignty policy framework to analyze this problem. The food sovereignty is proposed as a political tool which can facilitate rural development together with environmental protection. At the same time, it is one of the central elements of the governmental agenda to rural territories in Ecuador. In that manner, we will run a theoretical SES analysis of the area both under a green economy and a food sovereignty framing. Afterwards the area will be visited to determine the real SES configuration. In that manner, the required changes to promote one or the other policy will be detected. We believe that findings of this research can help policymakers make better decisions. The governance of tough social-ecological problems is a continuous learning process rather than imposing final solutions.

Finally, this area shows a particular academic and scientific interest. The research in southern Ecuador, started in 1997 by a German-Ecuadorian team research has led to a generation of wide data collections. And a new program is planned, namely a “Platform for Biodiversity and Ecosystem Research and Monitoring in South Ecuador” (Bendix & Beck ,2011). I believe this is a great opportunity to continue with collaborative research. The findings of those researchers together with guidance and training provided by Center for Agro-food

Economy and development (CREDA) team, mainly of Marta Rivera, will help me to meet the aims of this research within the deadline appointed.

HYPOTHESIS

The set of primary and second level variables in the core subsystems of the social-ecological system (SES) framework will vary according to different policy targets.

RESEARCH QUESTIONS

The key questions of this research are:

How does the configuration of the components within a social-ecological system (SES) vary according to policy target?

Can the SES framework be used as a practice tool within policy formulation process?

AIMS

Overall objective

To determine the validity of the Social-Ecological System (SES) framework as a mean in the design of sustainable agri-food policies.

Specific objectives

To implement the SES framework in the study area: the settlement around the Podocarpus National Park; based in socio-economic, physical and biological data available in literature.

To determinate the SES framework changes under two different policy proposals: Food sovereignty vs Green economy.

To determinate in the field which proposal is of main interest to the populations studied.

THE STATE OF THE ART

1. The food sovereignty within a Social-Ecological System context

The concepts of food sovereignty and ecologically based production systems have gained much attention in the last two decades to face global trends derived from the Green Revolution (Rivera-Ferre, 2008; Altieri, 2009) both at the local and global levels. Food sovereignty deals with the right of people to decide how to produce and consume their food. It is related to institutions, governance, and agricultural systems, thus, it is about the organization of complex socio-ecological systems (Rivera-Ferre, 2012). In the contexts of the study, different social groups with divergent interests are found. Some prioritize their traditional livelihoods, while others prefer to be involved in main stream development programs with a strong economic perspective. It is believed, however, that if economic development is the main priority, people would not conserve ecosystems. In these local

contexts the food sovereignty concept can be applied and analyzed using a social-ecological system framework.

1.1. Policy framework: Food sovereignty

The food sovereignty was proposed in 1996 by the international peasant organization La Vía Campesina as a reaction against the capitalist agricultural system which according to them, was pushing peasants from farming and increasing food insecurity and rural poverty worldwide (García, 2003; Borras, 2004; Rivera-Ferre, 2007; Desmarais, 2002). The promise, endorsed by 189 world leaders at the UN (United Nations) in September 2000; to halve, between 1990 and 2015, the proportion of people who suffer from hunger, apparently will not be fulfilled. According to The Millennium Development Goals Report (2011) the proportion of hungered people in the developing world 2005-2007 remained stable at 16%, despite significant reductions in extreme poverty. Based on this trend, and in light of the economic crisis and rising food prices, it will be difficult to meet the hunger-reduction target in many regions of the developing world. The disconnection between poverty reduction and the persistence of hunger has brought renewed attention to the mechanisms governing access to food in the developing world (UNDP, 2011).

Currently, the attention is focused on the ability of the world food system to “feed the world” (Vía Campesina, 2010). However, the contemporary food crisis is not really derived from the failure to produce food it is more due to other factors (IPC, 2002; Borras, 2004; López i Gelats, 2004; ETCgroup, 2009; Entrepueblos & IIEEP, 2010; Ortega-Cerdà & Rivera-Ferre, 2010) like lack of access to resources to produce food (land, water), misguided policies like the promotion of agrofuels that devote farm land to feeding cars instead of feeding people, food speculation, agricultural policies that encourage agroindustrial models, the global injustices that result in some eating badly and too much while many others don't have money to buy adequate food (La Vía Campesina, 2010). However we cannot deny that an important piece in the jigsaw puzzle of ending hunger is considering not only the collective ability to grow enough food, but crucially, how it is grown. Here, peasant-based sustainable farming systems based on agroecology and food sovereignty offer so much hope (Altieri, 2009; Vía Campesina, 2010).

1.1.1. Definition and principles of food sovereignty

As defined in the Declaration of the Forum for Food Sovereignty, Nyéléni 2007, *the food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers and users. Food sovereignty prioritizes local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal - fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just incomes to all peoples as well as the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food. Food sovereignty implies new social relations free*

of oppression and inequality between men and women, peoples, racial groups, social and economic classes and generations (La Vía Campesina, 2009).

To implement the food sovereignty policy framework there are principles that are interlinked and inseparable. According to the International Planning Committee for Food Sovereignty (IPC, n.d.) those are summarized in six principles: (1) Focuses on food for people, (2) Values Food Providers, (3) Localizes food systems, (4) Puts control locally, (5) Builds knowledge and skills, (6) Works with Nature. These are shown in the Box 1.1.

Box 1.1. Principles to implement the food sovereignty policy framework

Principle	Explanation
1. Focuses on food for people	Food sovereignty puts the right to sufficient, healthy and culturally appropriate food for all individuals, peoples and communities, including those who are hungry, under occupation, in conflict zones and marginalized, at the centre of food, agriculture, livestock and fisheries policies; and rejects the proposition that food is just another commodity or component for international agri-business.
2. Values food providers	Food sovereignty values and supports the contributions, and respects the rights, of women and men, peasants and small scale family farmers, pastoralists, artisanal fisherfolk, forest dwellers, indigenous peoples and agricultural and fisheries workers, including migrants, who cultivate, grow, harvest and process food; and rejects those policies, actions and programmes that undervalue them, threaten their livelihoods and eliminate them.
3. Localizes food systems	Food sovereignty brings food providers and consumers closer together; puts providers and consumers at the centre of decision-making on food issues; protects food providers from the dumping of food and food aid in local markets; protects consumers from poor quality and unhealthy food, inappropriate food aid and food tainted with genetically modified organisms; and rejects governance structures, agreements and practices that depend on and promote unsustainable and inequitable international trade and give power to remote and unaccountable corporations.
4. Puts control locally	Food sovereignty places control over territory, land, grazing, water, seeds, livestock and fish populations on local food providers and respects their rights. They can use and share them in socially and environmentally sustainable ways which conserve diversity; it recognizes that local territories often cross geopolitical borders and ensures the right of local communities to inhabit and use their territories; it promotes positive interaction between food providers in different regions and territories and from different sectors that helps resolve internal conflicts or conflicts with local and national authorities; and rejects the privatisation of natural resources through laws, commercial contracts and intellectual property rights regimes.
5. Builds knowledge and skills	Food sovereignty builds on the skills and local knowledge of food providers and their local organisations that conserve, develop and manage localized food production and harvesting systems, developing appropriate research systems to support this and passing on this wisdom to future generations; and rejects technologies that undermine, threaten or contaminate these, e.g. genetic engineering.
6. Works with nature	Food sovereignty uses the contributions of nature in diverse, low external input agroecological production and harvesting methods that maximize the contribution of ecosystems and improve resilience and adaptation, especially in the face of climate change; it seeks to “heal the planet so that the planet may heal us”; and rejects methods that harm beneficial ecosystem functions, that depend on energy intensive monocultures and livestock factories, destructive fishing practices and other industrialized production methods, which damage the environment and contribute to global warming.

Source: International Planning Committee for Food Sovereignty, n.d.

1.2. The diagnostic tool: Social-Ecological System (SES) framework

A brief definition of a Social-Ecological System (SES) or also called human-environment systems is a system composed of multiple subsystems and internal variables within these subsystems at multiple levels (Ostrom, 2007; Ostrom, 2009) analogous to organisms composed of organs, organs of tissues, tissues of cells, cells of proteins, etc. (Pennisi, 2003). A SES is characterized to be a nested and decomposable system (Ostrom, 2007; Ostrom, 2009). The Figure 1.1 provides an overview of the SES framework, showing the relationships among four first-level core subsystems of a SES that affect each other as well as linked social, economic, and political settings and related ecosystems. The subsystems are: (i) resource systems (e.g., a designated protected park encompassing a specified territory containing forested areas, wildlife, and water systems); (ii) resource units (e.g., trees, shrubs, and plants contained in the park, types of wildlife, and amount and flow of water); (iii) governance systems (e.g., the government and other organizations that manage the park, the specific rules related to the use of the park, and how these rules are made); and (iv) users (e.g., individuals who use the park in diverse ways for sustenance, recreation, or commercial purposes). Also, each core subsystem is made up of multiple second-level variables as shown in box 1.2 (e.g., size of a resource system, mobility of a resource unit, level of governance, users' knowledge of the resource system), which are further composed of deeper-level variables (Ostrom, 2009).

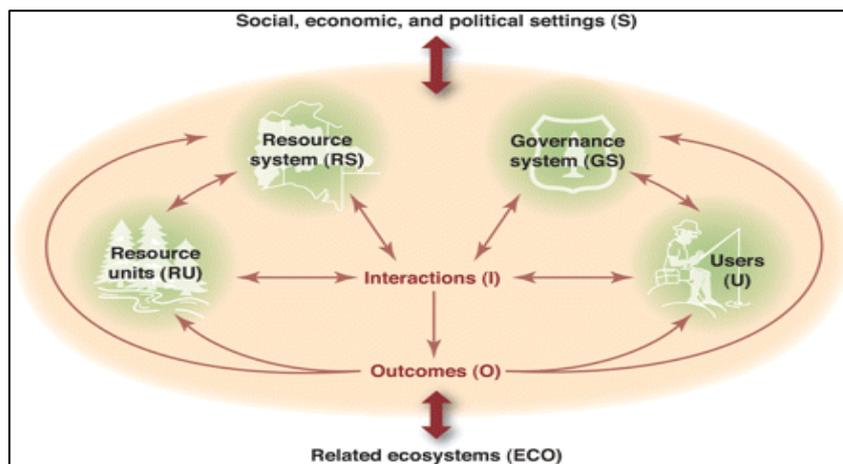


Figure 1.1. The core subsystems in a framework for analyzing social-ecological systems.

Source: Ostrom, 2009.

The ecosystems that many want to protect are embedded in different levels of social organization (Brondizio *et al.*, 2009; Ostrom, 2009; Ostrom & Cox, 2010). At the same time, people who use or are affected by these ecosystems are also organized through diverse forms of social capital at multiple scales (Castiglione *et al.*, 2008; Brondizio *et al.*, 2009), as integral part of SES. In this sense, the institutions at (and linking) multiple levels are essential for both the management SES (Rammel *et al.*, 2007) and the long-term protection of ecosystems, for example forest resources (Merino, 2004). Because the focus only at a local, regional, national, or international level is itself a source of inadequate policy designs (Brondizio *et al.*, 2009). Analyzing the factors that favor these multi- and cross- tier interactions are critical and can help us to face current global environmental problems as deforestation. The use of SES framework has been already used by scholars to examine these social-ecological interactions

within a forest resource system (Ostrom, 1999; Nagendra, 2007; Chhatre & Agrawal, 2008; Brondizio *et al.*, 2009; Ostrom & Cox, 2010; Blanco & Fedreheim, 2011).

Box 1.2. Second-level variables under first-level core subsystems (S, RS, GS, RU, U, I, O and ECO) in a framework for analyzing social-ecological systems.

<i>Social, economic, and political settings (S)</i>	
S1 Economic development. S2 Demographic trends. S3 Political stability. S4 Government resource policies. S5 Market incentives. S6 Media organization.	
<i>Resource systems (RS)</i>	<i>Governance systems (GS)</i>
RS1 Sector (e.g., water, forests, pasture, fish)	GS1 Government organizations
RS2 Clarity of system boundaries	GS2 Nongovernment organizations
RS3 Size of resource system*	GS3 Network structure
RS4 Human-constructed facilities	GS4 Property-rights systems
RS5 Productivity of system*	GS5 Operational rules
RS6 Equilibrium properties	GS6 Collective-choice rules*
RS7 Predictability of system dynamics*	GS7 Constitutional rules
RS8 Storage characteristics	GS8 Monitoring and sanctioning processes
RS9 Location	
<i>Resource units (RU)</i>	<i>Users (U)</i>
RU1 Resource unit mobility*	U1 Number of users*
RU2 Growth or replacement rate	U2 Socioeconomic attributes of users
RU3 Interaction among resource units	U3 History of use
RU4 Economic value	U4 Location
RU5 Number of units	U5 Leadership/entrepreneurship*
RU6 Distinctive markings	U6 Norms/social capital*
RU7 Spatial and temporal distribution	U7 Knowledge of SES/mental models*
	U8 Importance of resource*
	U9 Technology used
<i>Interactions (I) → outcomes (O)</i>	
I1 Harvesting levels of diverse users	O1 Social performance measures (e.g., efficiency, equity, accountability, sustainability)
I2 Information sharing among users	O2 Ecological performance measures (e.g., overharvested, resilience, bio-diversity, sustainability)
I3 Deliberation processes	O3 Externalities to other SESs
I4 Conflicts among users	
I5 Investment activities	
I6 Lobbying activities	
I7 Self-organizing activities	
I8 Networking activities	
<i>Related ecosystems (ECO)</i>	
ECO1 Climate patterns. ECO2 Pollution patterns. ECO3 Flows into and out of focal SES.	
*Subset of variables found to be associated with self-organization.	

Source: Ostrom, 2009.

1.3. Policies for forest conservation

Despite the interest in the world's forests conservation has grown to unprecedented heights, especially due their role in the global carbon cycle. By the possibility of mitigating climate change by reducing carbon emissions caused by deforestation and forest degradation, and by increasing carbon uptake through afforestation (FAO, 2010). The destruction of forest cover not only has accompanying fallout on global climate, health, biodiversity, air quality, soil fertility, water flow, and other environmental variables. Deforestation also impacts the lives and livelihoods of the many millions of forest-dependent inhabitants around the world (*quoted by Nagendra, 2007*). All this has led to governments and international organizations to propose and create an array of protection mechanisms that range from government-owned protected areas to private conservation parks and community reserves. However these efforts have had mixed success, and it is difficult to unambiguously attribute success or failure to a specific formal mechanism used (Dietz *et al.*, 2003; Ostrom & Nagendra, 2006).

Conservation organizations, indigenous communities, and policy makers continue to engage in often heated debates concerning the presumed single best approach to conserve forest biodiversity (Chapin, 2004) and to find the way for integrate the development with the conservation (Agrawal & Redford, 2006; Salafsky, 2011). One reason is that indigenous peoples live in most of the ecosystems that conservationists are so anxious to preserve (Chapin, 2004). Forming partnerships and collaborative alliances between indigenous and traditional peoples and conservationists is not an easy task, but it would seem to be one of the most effective ways to save the increasingly threadbare ecosystems that still exist (Chapin, 2004). The policies formulation should have active participation of all stakeholders. The creation of conservation programs must respond the needs of both biological and human diversity worldwide (Chapin, 2004), and includes biodiversity protection by, for, and with the local community (Western & Wright, 1994; Berkes, 2007). Within the *Global Objectives on Forests* have been recognized their importance. The Global Objective 2 says: *Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people* (FAO, 2010). At the same time, a key consideration of Convention on Biological Diversity is to design conservation-development arrangements that involve communities as partners (cited by Berkes, 2007).

The world's deforestation, mainly due to conversion of forests to agricultural land, shows signs of decreasing in several countries but continues at an alarmingly high rate in others (FAO, 2010). Although there are reports (Stokstad, 2001; Achard *et al.* 2002; DeFries *et al.*, 2002; FAO, 2005; FAO, 2010) that provide somewhat different estimates of global forest change, all are agree on the point that massive deforestation continues in the tropics. In these regions the dependence of rural communities on the biodiversity, ecological processes, and ecosystem services provided by tropical and subtropical forests is far greater in magnitude than in the temperate zone (Bawa *et al.*, 2004). Hence the losses in forest cover have had and have various consequences on people who living in these areas.

At a regional level, South America suffered the largest net loss of forests between 2000 and 2010, about 4.0 million hectares per year (FAO, 2010). In these sense, an interesting case to research is Ecuador. A megadiverse country (Brehm *et al.* 2008; IGM, 2010; MAE, 2010) localized in this region, that shown high deforestation rates with variety social-ecological factors involved.

2. Case of study: tropical forests in southern Ecuador

Tropical mountain rain forests are among the most species-rich ecosystems of the world (Whitmore, 1998; Küper *et al.*, 2004), in Ecuador theirs are located along the Andean Cordillera which runs the length of the country (Beck *et al.*, 2008a). The Ecuadorian Andes are one of the global biodiversity hotspots (Meyers *et al.*, 2000; Brummitt & Lughadha 2003, Brehm 2005; MAE, 2010). But this country suffers one of the highest deforestation rates in South America (FAO, 2007). Therefore the deforestation is the main threat to the biodiversity in the Andes "hot spot" (Socio Bosque, 2010).

2.1. Drivers of forest change

In Ecuador, two major historical deforestation processes have contributed to the reduction of the forest area: first a long-lasting deforestation in the Sierra (areas with an elevation of at least 1200 m a.s.l.) in the pre-Columbian era and second a rapid forest conversion in the Costa region during the past century (Wunder, 2000). The era in between these two deforestation phases, dominated by the long Spanish colonial rule, was

characterized by an expansion of forests, caused by the dramatic decrease in population and also in population pressure on the forests following the Spanish conquest. After the declaration of independence in 1822 until the early twentieth century Ecuador's forest cover was largely preserved (Wunder, 2000). During the cocoa boom from 1900 to the end of the 1920s and intensified during the banana boom after the Second World War (main period 1950–1965) the coastal lowland forests were cleared for agricultural crops. Which with the opening up of the Oriente, Ecuador's Amazon region led to forest cover decrease (*quoted by Mosandl et al., 2008*). With the oil boom of the 1970s roads were build in the Amazonian forest, which attracted agricultural colonization and timber extraction (Wunder, 2000). The main cause that explain relatively high actual deforestation rate is the change in the land use, specifically the agropastoral land-use trends is a dramatic increase in pastures. And the driving forces for the conversion into pastures are very likely rooted in socio-economic reasons (*Mosandl et al., 2008*). A hotspot of biodiversity on the one hand and the highest deforestation rate on the other, this conflict is quite obvious in many valleys in the eastern Cordillera of southern Ecuador (Beck, 2008), such as those localized around the Podocarpus National Park.

2.2. Podocarpus National Park

The Podocarpus National Park is located in the provinces of Loja and Zamora-Chinchiipe (Fig. 2.1), with its northern edge demarcated by the valleys of the San Francisco and Zamora Rivers. The National Park is the core zone of the recently established Podocarpus-El Cónдор UNESCO Biosphere Reserve (MAE, 2010; UNESCO, 2010). Through the establishment of the Podocarpus National Park in 1982, the scarcity of land available for productive use has increased and several threats to the Podocarpus National Park are reported, including illegal colonisation and pseudo-colonisation (*Rahbeck et al., 1995; Keating, 1997*). The Podocarpus National Park has an area of ~146,000 hectares. It includes cloud forests, high-altitude grasslands, and a series of small Andean lakes (*quoted by Knoke et al., 2009*).

2.2.1. The settlement around the Podocarpus National Park

In the surroundings of the Podocarpus National Park live three ethnic groups: (1) the Shuar, (2) the Saraguros and (3) the Mestizos (Fig. 2.1).

The Shuar area of settlement extends from the lower levels of the tropical mountain rainforest (approx. 1,400 m a.s.l.) down to the Amazonian lowland (Oriente) in the region bordering Peru. The Shuar, Amazonian Indians, belong to the Jívaro linguistic group. They are typical forest dwellers who practice shifting cultivation in a subsistence economy. They also fish, hunt and gather forest products. During the last decades some Shuar have begun to raise cattle and some are also engaged in timber extraction (*Pohle et al., 2010*).

The Saraguros are Quichua-speaking highland Indians who live as agropastoralists, in the most part in the temperate mid-altitudes of the Andes (Sierra) between 1,700 and 2,800 m a.s.l.. As early as the 19th century the Saraguros kept cattle to supplement their traditional "system of mixed cultivation", featuring maize, beans, potatoes and other tubers (*Gräf, 1990*). Now, cattle's ranching has developed as the main branch of their economy (*Pohle et al., 2010*).

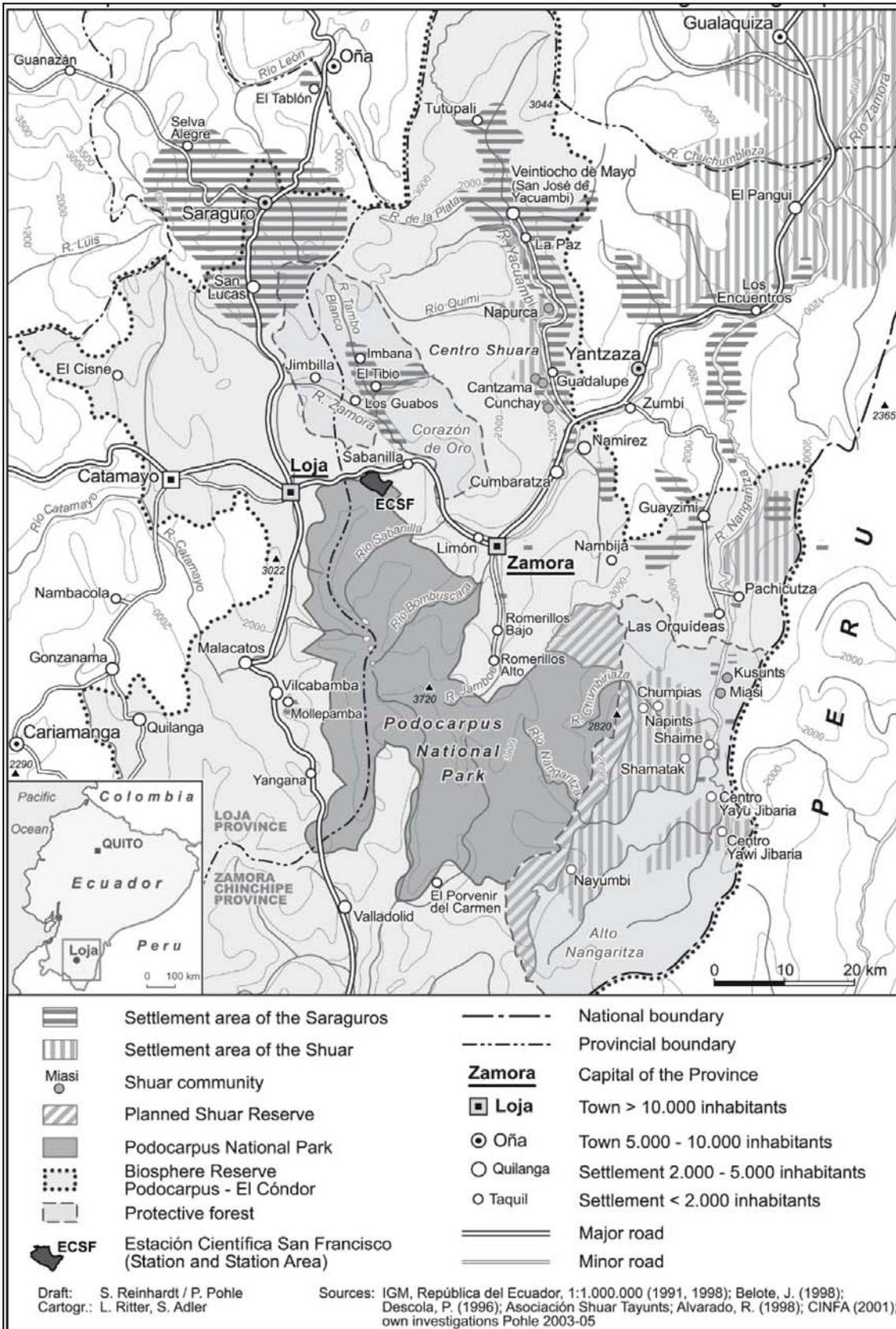


Figure 2.1. The Podocarpus National Park and the settlement areas of indigenous groups.

Source: Pohle *et al*, 2009

The Mestizos, a term generally used to indicate people of mixed Spanish and indigenous descent, are a very heterogeneous group who either live in towns, rural communities or scattered farms (*fincas*). In the area north of Podocarpus National Park they arrived from the 1960s onwards, encouraged by the national land reform of 1964, to log timber and to practice cattle farming and agriculture. As colonizers they converted large areas of tropical mountain rainforests into almost treeless pastures (Pohle *et al.*, 2010).

Despite that local populations have lived around the Podocarpus National Park area and sustained themselves for centuries, during the past five decades, these mountain rainforest ecosystems have come under enormous pressure due to the expansion of agricultural land - especially pastures (Mosandl *et al.* 2008, Göttlicher *et al.* 2009), the extraction of timber (Wunder, 1996), the mining of minerals (Confeniae, 2007, Mining Watch Canada, 2007) the tapping of water resources and other forms of human intervention (e.g. road construction, power supply lines) (cited by Pohle *et al.*, 2010). The most important works carried out in research area within the relationship between local population and nature conservation context are those performed by Pohle & Gerique (2006), Pohle (2008) and Pohle *et al.* (2010). The latest study document the traditional ecological knowledge among the three ethnic groups, to analyse current forms of land use including the cultivation of forest and home gardens, and to evaluate ethno-specific life-support strategies as well as strategies for natural resource management (Pohle *et al.*, 2010).

2.2.2. Policies for forest conservation

Regarding to the political and administrative use agreements, in the research area (Fig. 2.1) there are numerous land use conflicts, such as forest conservation versus forest exploitation and pasture extension. One consequence of the varying land tenure regimes in the region is the insecurity of access to land and resources (Pohle *et al.*, 2010).

Around 14 conservation areas including protective forests exist within the Biosphere Reserve Podocarpus – El Cóndor (NCI-MAE, 2006). People who have settled the region for more than 50 years and live inside these areas or in the buffer zones either do not know about it or do not have enough information about its implications for land entitlement or legal access to forest and water resources. In the research area a special conflict exists between the local people and the Bosque Protector Corazón de Oro. Since the establishment of the Bosque Protector, tenure of land which has been in use for decades (sometimes a half century) cannot be passed to the next generation and farmers cannot get legal land titles for formal leasing. This is due to jurisdiction problems for land entitlement between the National Institution of Agrarian Development (INDA) and the Ministry of Environment. While the latter is responsible for entitlement in protected areas and national forest patrimony, entitlement in rural areas not being under any category of conservation, is in legal jurisdiction of INDA. In both cases procedures are complicated, timeconsuming and expensive (Burbano, 2008). Consequently, these unsolved problems have resulted in people in the study area being highly sceptical towards conservation measures: for them, conservation means restrictions for resource use and land entitlement (Pohle *et al.*, 2010).

The Ecuadorian government has been implemented a specifically program to conserve their tropical forests within the idea of a Green Economy. A Green Economy results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2011). Within this approach, the Reducing Emissions from Deforestation and Degradation (REDD) is seen as a catalyst for green development (Sukhdev *et al.*, 2011) and also as a controversial concept (Khor, 2011; Fatheuer, 2010; Unmüßig, 2012). In

November 2008 the national programme called “Programa Socio Bosque” was officially established through a ministerial agreement (de Koning *et al.*, 2011). The goals of the program as defined by Ministry of Environment of Ecuador (MAE) are: (1) protect over 3,600,000 ha of forest and other native ecosystems, there by conserving globally important biodiversity, reducing greenhouse gas emissions from deforestation, protecting soils and water, and controlling natural disasters, (2) increase income and protect human capital in the poorest rural communities of the country, with a target group of between 500,000 and 1,500,000 people (de Koning *et al.*, 2011). This programme provides financial incentives for the voluntary conservation of native forests (up to US\$ 30 per hectare per year) and is the central component of a national REDD proposal (cited by Knoke *et al.*, 2009). However, payments for ecosystem services (PES) schemes not always avoid undesirable social effects, because PES schemes are primarily designed to improve natural resource use and not for poverty reduction (Engel *et al.*, 2008; Paul *et al.*, 2009). This type of programs should not be seen as a stand-alone solution but rather as an integral part of a broader policy approach that comprises a diversity of interventions (Engel *et al.*, 2008).

2.2.3. Policies for food sovereignty

On the other hand, one of the central elements of the governmental agenda is “Good Living” or “Sumak Kawsay” (in the Quechua language) in rural territories. The food sovereignty concept has been included within Ecuadorian Constitution (2008). And their promotion linked to rural development constitutes an element of the National Territorial Strategy which has been established in the "National Plan for Good Living" 2009-2013.

Rural good living means abandoning a vision that focuses exclusively on the agrarian dimension of the rural sphere, to a vision based on an integral political economy of the rural world that takes into consideration the guarantee of rights, the links between agriculture, the manufacturing sector and services, and a diversity of work strategies and forms of income generation of rural families. Moving towards rural Good Living also requires mobilizing the resources and assets of populations (natural, physical, financial, human, social and cultural), as well as promoting the democratization of the access to the means of production (water, land, capital, knowledge), and the conditions that enable correcting market flaws such as the supply of infrastructure, education and health, without disregarding culture and interculturalism, science and technology, the recovery of ancestral knowledge and wisdom, the promotion of association, etc. Rural Good Living's territorial approach does not exclude sectorial policies for the agro-cattle-raising. On the contrary, it complements them by adopting a broader more comprehensive perspective of the rural economy and society. And takes into account the crucial importance that ethnic-cultural composition of the rural population, as well as the feminization of poverty (National Plan for Good Living 2009-2013; Hidalgo, 2010). If one is an indigenous of the sierra region that has less than 2 hectares, has low productivity in farming, works temporarily as agricultural wage, has a low educational level and is woman, the incidence of poverty is greater. At the same, if one is an eventual agricultural worker that has not access to land, has low level of schooling and is woman, the main trend is to be poor (Chiriboga & Wallis, 2010).

Finally, food sovereignty implies recovering the role of society in deciding what, how, where, and for whom to produce, while emphasizing the strengthening of small producers who, in the case of Ecuador, cultivate the majority of food included in the "basic subsistence basket" (National Plan for Good Living 2009-2013). Analyzing the food sovereignty in complex landscapes, such as those where both the conservation and rural development interests are merged, is a current challenge.

METODOLOGY

1. Literature review

1.1. Research area

The research area comprises the northern and eastern surroundings of the Podocarpus National Park within the Biosphere Reserve Podocarpus –El Cónдор (Fig. 2.1). It is a part the buffer zone of the national park. For the literature review the of research area we will use the secondary information available in governmental institutions (as Ministry of Environment, municipalities and others), ONG's, conservation organizations (as Foundation Nature and Culture International), indigenous organizations, universities (National University of Loja and Technical University of Loja), research projects mainly those conducted by Perdita Pohle and her working team DFG Research Unit 816 (<http://www.tropicalmountainforest.org/>) and other reliable sources.

1.2. Socio-Ecological System (SES) framework

A comprehensive review will be performed to understand the characteristics of complex systems, centered on tools to analyzed them, such as the SES framework proposed by Ostrom (2009). Then we will use socio-economic, physical and biological study area data available in the literature to assemble them to a general Socio-Ecological System. The results will be submitted according the conceptual framework as shown in figure 1.1 and box 1.2. The SES framework is used to identify subsystems and their interactions within a complex system.

2. Field work:

2.1. Collection of data for SES analysis

On the one hand, the purpose of this activity will be to complete the missing data arising from the secondary information analysis of the area. Data will be collected by means of interviews to users, which include people from the different communities as well as staff of the national park and of the local and regional administration. The result will be a general SES as a baseline to understand the current situation.

By another, we will carry on a vulnerability assessment to visualize current exposition of local SES to current stressors. This assessment will be performed following the participative methodology: series of key informant interviews (N=5), focus group with village elders (N=12), focus group of local experts from NGOs and research institutes (N=12), and two series of in-depth and semi-structured interviews (approximately N=70) within categories of local stakeholders (landless people, small agropastoral farmers, medium-scale semi-rural cattle raisers, traditional large-scale landowners and commercial entrepreneurs, women as single parents, and youth), as proposed by Ravera *et al.* (2011). The people will be selected through snowball sampling for interviews. The villages selected will be a settlement area of Saraguro community and a settlement area of Mestizo community, see fig. 2.1.

3. Analysis:

The field information will be systematized in the SES framework. The focus of the analysis will be qualitative. Also, we will show the different sources of vulnerability perceived by Saraguros and Mestizos communities. We will not quantify the degree in which each source

of vulnerability increases or decreases vulnerability. Later these local perceptions will be unified during the building of SES scenarios.

4. Scenarios analysis

4.1. Literature review

We will do a comprehensive review of the policy concepts: Food sovereignty and Green economy in order to determine the main characteristics of each policy proposal and how each of them can affect the configuration, interactions and outcomes of the current analyzed SES.

4.2. Building scenarios and assessing SES under different scenarios

To design the different scenarios of the study area, the variables of the subsystems within each SES frameworks will be analyzed according to the principles and guidelines of the Food sovereignty and Green economy policy proposals. In the same way, the results will be submitted according the conceptual framework as shown in figure 1.1 and box 1.2. Our hypothesis here is that for each policy proposal, the SES will have a different configuration. We will detect the changes needed for each of the components of the current SES to achieve the objectives of Food Sovereignty or Green Economy. The description will be qualitative.

Also, we will describe the sources of vulnerability found for each scenario. In order to achieve this, we use focus groups (Ravera et al., 2011) to the different cultures that live in the research area.

5. Developing policy recommendations:

From the results of the different types of SES we can determine different recommendations depending on the policy objectives of the policy-makers. In the area there is a paradigmatic situation, since the constitution states the Food Sovereignty as the leading principle of the State, while the practices and policies developed by the Ministry of Environment are closer to the principles of Green Economy. How each of these proposals affects the configuration of the system and the policy required to achieve them will be suggested in this part of the PhD thesis.

WORK SCHEDULE

According to the work schedule, table 1 that shown below, it is expected that the research deadline, from formulation to thesis defense, will be four years.

Table 1. Work schedule by overall activities

Overall activity		Time*							
		Year 1		Year 2		Year 3		Year 4	
		S1	S2	S3	S4	S5	S6	S7	S8
A 0.	Formulation and writing the proposal thesis								
A 1.	Literature review								

A 2.	Field work								
A 3.	Results analysis								
A 4.	Writing the thesis (by articles)								
A 4.1.	Paper at regards to theoretical review								
A 4.2.	Paper at regards to current exposition of local SES to current stressors								
A 4.3.	Paper at regards to changes of SES under the two policy proposals								
A 4.4.	Administrative procedures to thesis defense								

* S = Semester

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