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Using payments for environmental services to secure environmental services and livelihoods in coffee agroforests – A project portrayal

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Abstract

An ongoing PhD project investigates the potential of Payments for Environmental Services (PES), one of the latest market based mechanisms for conservation of ecosystem services, to secure not only ecosystem or environmental services, but also the livelihoods of small scale farmers in Central America. This is done in the context of small holder coffee agroforestry systems in Costa Rica and Nicaragua, where vulnerability to coffee price fluctuations and uncertainties in the production are driving farmers towards more intensive cropping systems that do not provide nearly the same level of ecosystem services as shade coffee. The dismantling of the International Coffee Agreement in 1989 and price stabilization schemes (Costa Rica) left coffee farmers exposed to world price variability after a long period of relatively stable prices. This has had a profound impact on the vulnerability of coffee farmers' livelihoods and the ecological important shade coffee systems, as was witnessed during the coffee crisis in 2001/02. In both Nicaragua and Costa Rica certification schemes ensuring a minimum price or a price premium are widely adopted, but 'true' PES schemes involving direct payments based on provision of a certain environmental service from coffee agroforests are still in its infantry. PES schemes targeted at agroforestry systems, a label that also fits shade coffee systems, have been in work since 2003 in Costa Rica. In Nicaragua PES is being introduced in cocoa production systems that are similar to coffee systems in various ways. Furthermore, PES is being widely implemented in silvopastoral systems across the region. The organisation of coffee farmers in cooperatives dispersed throughout the coffee producing areas have a potential positive role in the facilitation of a PES scheme targeting small

holder coffee farmers. By drawing on PES experiences from other regions and sectors, and through an investigation of the livelihood strategies of coffee farmers and the role of cooperatives, the PhD project aims to formulate recommendations for the design of PES schemes that in an effective, efficient and equitable manner can sustain environmental services and improve livelihoods in the small holder coffee sector. The project is carried out in the collaborative auspices of CATIE in Costa Rica and University of Copenhagen, Denmark.

Keywords: Payments for environmental services, coffee, livelihood, PhD project, Central America.

1. Importance of small holder coffee systems

Coffee is a very important commodity in several Latin American countries, both ecologically and economically. It is often cultivated in biodiversity hotspots, where coffee agroforests[33]provide connectivity within degraded and fragmented forest, and facilitate movement and maintain viability of key wildlife populations (e.g. Messer et al, 2000; Beer et al, 1998). Shaded coffee systems are found in buffer zones of protected areas and inside the Mesoamerican Biological Corridor that all Central American countries are working together to develop and maintain (Pagiola & Ruthernberg, 2002; Kaiser, 2001). When located in watersheds that supply water to urban areas, coffee agroforests help to maintain the provision of clean water (Verbist et al, 2005). The ecological importance of coffee agroforests is matched by the socio-economic importance of the crop. In periods coffee is second only to oil in terms of commodity value on the international market (Ponte, 2002a). It is produced by more than 25 million farmers in 80 countries. 10 million small holder farmers depend on coffee as their primary source of income (Oxfam, 2001). In Central America coffee is planted on nearly 1 million ha and sustains the livelihood of 300.000 farmers (CIRAD, 2005). Small holder coffee farmers are often among the poorest segments of society in Latin America and depend on alternative products from the shade trees, e.g. medicinal plants, fire wood and timber (Gordon et al, 2007). However, when coffee prices or yields drop the shade tree products are not enough to sustain livelihoods.

[33] Coffee agroforests are often traditional coffee fields with diverse and multi-layered shade tree cover that serve the double role of reducing the need for inputs such as fertilizers, and provide alternative products such as fire wood, fibres, medicinal plants and other non timber forest products.

1.1 Fluctuating coffee prices

The International Coffee Agreement, an export quota system that involved both exporting and importing countries, was established in 1962 with the aim of stabilizing world coffee prices. In 1989 it collapsed after several countries withdrew from the agreement. One year later a World Bank report by Akiyama & Varangis (1990) described the agreement as at least partly successful, despite large fluctuations in the world price during the period. From 1961 to 1997 the coefficient of variation (CV) around the trend of Costa Rica's export price was 38 % and in recent decades the CV of average producer prices have been over 30 % and closely correlated with the world price (Hazell, 2000). In Nicaragua the situation is the same, though with general lower producer prices compared to Costa Rica (ICO, 2008). The dismantling of the ICA coupled with a considerable increase in the world coffee production during the 1990's led to general lower and continuously unstable world prices (World Bank, 2004; Varangis *et al*, 2003; Ponte, 2002b).

In 2001 the world coffee prices fell to the lowest real term level in 100 years, which marked the peak of the latest coffee crisis which adversely impacted the lives of hundreds of thousands of coffee producing families as well as the environment (Oxfam, 2001). In Mesoamerica alone an estimated 600.000 farmers and employees in the coffee industry lost their jobs[34] and thousands of Nicaraguan families left their coffee fields and lived under miserable conditions in the outskirts of urban areas. Rural emigration led to social unrest and increased crime rates in the areas receiving the immigrants, and the number of households living under the poverty-line increased. Many abandoned coffee agroforests were encroached and converted to intensively managed and short lived crops due to insecure tenure of the newcomers. Other coffee agroforests were converted to treeless pasture, intensively managed full-sun coffee or urban sprawl with resulting adverse effects on the environment (Bacon, 2005; Osorio, 2004; Gresser & Tickell, 2002).

The severe impact of a price fall on a single commodity indicates the significance of the crop and how vulnerable coffee farmers are to price falls. The shock effects of large decreases in prices emerge in the form of ruined lives and degraded environments, but the mere risk of price or yield decreases also affects small scale farmers who often do not have insurances

[34] Including Mexico, according to Rainforest Alliance. Other sources refer to other figures, e.g. 170.000 full time jobs in the five CA countries from Costa Rica to Guatemala (Varangis et al, 2002), 300.000 jobs in Mexico alone (Oxfam, 2002).

or other safety nets. Many farmers in both Nicaragua and Costa Rica have organized themselves in producer cooperatives that provide elements of risk pooling, e.g. through joint processing and marketing. Cooperatives are not effective when it comes to systemic risks, such as adverse weather and sudden commodity price falls (Varangis & Lewin, 2006), but they do offer certain elements of economies of scale and other advantages, e.g. joint purchase of better plant material, cooperative funds that pay for research and extension services, joint facilities for quality testing, and possibilities for Fair Trade certification and contracts with apex cooperatives that often pay half of purchased coffee up front at a predetermined price (Mosheim, 2002; Fontenay & Leung, 2002; own observations).

2. Payments for environmental services

Even though household incomes may be at a reasonable level for small holder farmers who produce coffee in agroforestry systems, the environmental services are not necessarily secured. In the last decade coffee farmers in Ecuador have been recommended to shift to other crops, as a result of low coffee prices and increasing demand for other crops. This has resulted in a decline of agroforestry systems in buffer zones around national parks, leaving the treeless agricultural frontier at the edge of the parks. Only recently have park authorities realized the adverse effects of the recommendations. A similar development is taking place in Costa Rica, where increasing prices on crops for biofuel are resulting in land use changes that favour intensive agricultural systems over agroforestry systems, including shade coffee (De Clerk, F., personal communication[35]).

There is a need to support the environmental services provided by agroforestry systems, such as shade coffee, as well as to reduce the income vulnerability of farmers and enhance their livelihoods. Payment for environmental services (PES) is a relatively new instrument in market based conservation that has attracted increasing attention for its ability to translate external, non-market values of the environment into real financial incentives for local actors to provide such services. Following the definition by Wunder (2005) PES schemes are voluntary transactions where a well-defined environmental service is being 'bought' by a service beneficiary from a service provider if and only if the provider can ensure provision of the service. Product based payments, such as premium prices for certified coffee, are sometimes included as a PES (Wunder, 2005). In the context of this PhD project certification schemes are not 'true' PES. The PES approach

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was originally conceptualized as a mechanism to improve the efficiency of natural resource management. However, in recent years PES has received increasing interest as a mechanism for simultaneous conservation of the environment and ecosystem services, development of rural areas and alleviation of poverty (e.g. Engel et al., 2008; USAID, 2007; Wunder, 2007). Indeed, as PES is based on the beneficiary-pays rather than on the polluter-pays principle, it is an attractive instrument in settings where providers of environmental services are poor, marginalized land-holders (Engel et al., 2008).

Costa Rica is a regional leader in the design of environmental programs and PES was written into the law in 1996 (Zbinden & Lee, 2005; Rojas & Aylward, 2003). It is one of the few countries where PES schemes are working, whereas other countries in the region, e.g. Nicaragua, seem to lack the legal and institutional settings to implement PES schemes effectively (Diaz & Jackman, 2007). Wunder (2007) mentions demand-side and supply-side problems; too few service users are convinced to pay and too little is known about what kind of resource-use incentives and institutional preconditions are needed. These are likely some of the main reasons why almost all PES schemes in developing countries are governed by central state authorities, as is the case in the government-led PES programmes in Costa Rica and Mexico (Pagiola, 2008; Muñoz-Piña et al., 2008). There are some examples of decentralized PES schemes, e.g. payments for watershed protection governed by municipalities in Ecuador, where water consumers pay farmers to protect a watershed (Wunder & Albán, 2008). Government authorities, central as well as non-central, are increasingly seeing PES as more efficient in reaching conservation goals than traditional command-and-control measures, because of the ability of PES to find and focus on higher-benefit cases with lower costs and the build-in feedback mechanism; service users have a strong incentive to ensure that their payments are used efficiently and if not they can request changes or stop the payments (Pagiola et al, 2004; Pagiola et al, 2002).

2.1 PES experiences

In Costa Rica the four categories of the PES programme; biodiversity conservation, carbon sequestration, watershed protection, and landscape beauty, are all targeted through payments for reforestation, forest protection and management, forest plantations, agroforestry systems and silvopastoral systems. An semi-autonomous agency, FONAFIFO, is managing the PES programme, though restricted by central government approval of all activities through budget approval and executive decrees that

set the level and priorities of payments (Pagiola, 2008). Funds for payments are derived from different sources, e.g. the Global Environment Facilty, Conservation International, a 5 % fuel tax, and water users are increasingly paying for watershed protection through water levies. Thus, the PES programme is mainly a 'supply side' programme. Coffee agroforests are contained in payments for agroforestry systems, but currently payments are a one-time amount pr tree. It remains to be seen if coffee production under close canopies of remnant forest trees is eligible for payments under the forest management programme. Aspects of the silvopastoral programme, which is receiving much attention, may be relevant for PES in coffee agroforests.

In Nicaragua a coherent PES programme has been underway for some time, inspired by the programme in Costa Rica. A National Board on PES was created in 2003, but it has not yet been legally approved and due to collaboration problems with other government institutions, such as the Ministry of Environment, it is in reality not working (Díaz & Jackman, 2007). PES experiences in Nicaragua are limited to a few implemented PES schemes involving water protection and a range of schemes in the planning phase involving carbon trading and silvopastoral systems. However, though a coherent national effort seems to be wished for, many new initiatives are underway, e.g. PES targeted at cocoa producers in buffer zones of national parks (Jensen, L. B., personal communication[36]).

2.2 Paying for environmental services through coffee cooperatives

In order to secure environmental services in coffee agroforests, entice shifts from sun coffee to shade coffee production, and reduce farmers' vulnerability to price falls and losses in yield and enhance household livelihoods, it is necessary to develop PES schemes that target coffee agroforests. Payments should be open-ended and allowed to change as condition change, perhaps even vary in size depending on coffee producer prices, as opposed to the fixed one-time payment pr tree as it is working today in Costa Rica. However, if PES schemes are targeted at individual land users they may prove to be inefficient and ineffective, because of high transaction costs and small land holdings. Unlike the large coffee estates found in e.g. Brazil, small producers with small land holdings predominate in most of the coffee areas of Central America. As previously noted, small holder coffee farmers are often organized in coffee

[36] Former embassysecretary and in charge of the regional programme for environment, The Danish Embassy in Nicaragua, Managua.

cooperatives. There is a need to examine if targeting of PES schemes at such existing rural institutions would cater for higher efficiency and ease the implementation across many environmental service providers (Oberthur, T., personal communication[37]). It would ensure that environmental services are provided over a larger area and result in lower transaction costs for each member. However, often the poorest farmers are not in cooperatives and a sole focus on cooperatives for PES implementation risks a further marginalization of the poorest farmers. The project would benefit from attention given to this group in order to assess possible tradeoffs between PES efficiency and effect on poverty.

3. Project Objectives

Considering the socio-economic and ecological importance of shade coffee systems, there is a need for research on PES design that take into account the characteristics of shade coffee production and the risks that small holder coffee producers live with, both within and outside the institutional settings of cooperatives. The development objective of the project is to improve livelihood security of small holder coffee farmers through the development of PES schemes targeted at coffee producers and conditioned by a provision of environmental services from coffee agroforests. The immediate objectives are to assess livelihood strategies, with specific focus on land use decision making and risk management strategies, among small holder farmers in Costa Rica and Nicaragua and to investigate how direct payments to farmers conditioned by provision of certain environmental services influence livelihood strategies. Furthermore, to investigate how the institutional structure of coffee cooperatives in the same areas can facilitate PES implementation in small holder coffee agroforests based on the cooperatives' influence on cost and benefits of and incentives to engage in PES schemes. Finally, based on the analyses, to provide recommendations for design of PES schemes that target small holder coffee farmers with and without institutional association.

4. The PES frontier

PES as an instrument for environmental protection and poverty alleviation has been described quite voluminous in the last years, and especially within the last two years the number of scientific articles on different aspects of PES has increased substantially. In the peer-reviewed journal Ecological Economic two special editions on PES were published in

[37] Director of Markets for Ecoagriculture at Ecoagriculture Partners, Washington.

December 2007 and May 2008. However, detailed quantitative analysis of costs and benefits is poorly represented in the scientific literature and the most comprehensive review of PES initiatives is still the publication by Landell-Mill & Porras (2002), which covers 278 cases and concludes that the literature on environmental services fail to produce systematic analysis of the efficiency of emerging payment systems. As the interest of PES in poverty alleviation and rural development has increased, so has the number of studies concerning the dual objectives of service conservation and development. So far, published studies that show disproportionate benefits to larger and better-off landowners are more common than studies that show improved livelihoods of the poor, as outlined by Pagiola (2008). Besides conservation and poverty alleviation, recent PES publications deal with subjects such as PES design (Engel et al, 2008; Ferraro, 2008), decentralized PES (Wunder & Albán, 2008), spatial differentiation in the targeting of PES (Wünsher et al, 2008), impacts on land-use patterns (Koning et al, 2007), and organisational networks, access rights and equity (Cobera et al., 2007). No studies have been encountered that deal with PES and risk management. PES studies that include institutional aspects refer to a necessary 'de-bureaucratisation', promotion of organisational and community innovation and socio-institutional strengthening, but studies involving comparison of institutional settings among farmers in relation to implementation of PES are hard to come by (e.g. Grieg-Gran et al, 2005; Miranda et al, 2003). Many studies conclude that future research on differentiated and targeted PES schemes is needed (e.g. Pagiola, 2006; Wunder, 2006).

5. Project framework

5.1 Project components

The PhD project consists of three main components, of which two requires field work. Two potential locations for field work are currently being assessed; the Matagalpa region in Nicaragua, which is one of the main coffee producing areas in the country, and Turrialba in Costa Rica, where coffee also is grown extensively. The first two components of the project, as described in the following paragraphs, are linked with ongoing CATIE projects in these areas. Matagalpa, Nicaragua has partly been chosen for better integration of data and results with other projects in the region concerning research in institutional aspects of PES. The research and results from all components will to a large extent be valid for both countries as well as for Central America as a whole, though there is also a high potential for a

comparisons of Costa Rica, a forerunner in PES, and Nicaragua, a PES 'beginner'. The three components are based on the following research questions:

1) What are the potentials of PES in reducing vulnerability to falls in coffee yields and prices, and improving the livelihoods of small holder coffee farmers in the Turrialba canton in Costa Rica?

2) How can coffee cooperatives in the Matagalpa region of Nicaragua facilitate the implementation of PES schemes that target coffee agroforests to become efficient, i.e. lower transaction costs; effective, i.e. involve large areas; and equitable, i.e. include many small holder farmers?

3) How can PES schemes targeted at small holder coffee farmers in and outside cooperatives be designed so that environmental services provided by coffee agroforests are conserved *and* the economic viability of small scale coffee agroforests is improved?

Research question 1 and 2 will be answered through extensive field work in Nicaragua and Costa Rica, where information on household characteristics of small holder coffee farmers based on household surveys, and institutional characteristics of coffee cooperatives will form the basis for analysis. Review of laws, decrees and regulations with relevance for PES, as well as interview with PES actors in both countries will also be used extensively. Experiences with PES in other crop systems, e.g. small scale cocoa production in Nicaragua and silvopstoral systems in the region, will be assessed in the context of the project. Field work will be carried out in spring 2009 an spring 2010. For further details on data requirements and data collection methods, see appendix a.

5.2 Theoretical background

The theoretical framework for the analysis will mainly consist of livelihood theory and economic theories. Livelihood theory evolves around livelihood strategies which encompass issues such as household risk strategies, household coping strategies, income-activity diversification, rural poverty, intra-household relations, rural growth linkages, rural non-farm activities, and rural-urban migration (Barret et al, 2001; Rakodi, 1999; Ellis, 1998). Economic theories are divided into a range of subfields, of which environmental policy (Baumol & Oates, 1988) and ecological economics

(Daly & Farley, 2003) are of special interest and both encompass market based conservation and incentive based natural resource management.

Another theory of relevance to the project is institutional theory on collective action and transaction costs (Ostrom, 1998; North, 1990). While Ostrom focus on institutions vis-à-vis collective action and social dilemmas dealt with through reciprocity, norms, rules etc., North's theory of institutions is a combination of theories of human behaviour, transaction costs, and production. Both are relevant for the role of cooperatives in efficient implementation of PES.

5.3 Research partners

The project has been developed in collaboration with the leading PES institution in Central America, CATIE[38] and staff at Forest & Landscape, University of Copenhagen. The project is closely linked to research activities at both research institutions, among these the EU funded CAFNET[39] project, which also involves the international organization Ecoagriculture Partners who work with the development of markets for ecoagriculture, a label that also fits shade coffee systems. The work in Nicaragua and Costa Rica will be carried out in collaboration with staff from CATIE. The Field work is funded by the Danish Development Assistance (DANIDA) and will partly be carried out in collaboration with other DANIDA funded projects involved in the development of market based conservation tools.

6. Main outputs

At least four articles will be submitted to international peer-reviewed journals. The case studies and results will be presented at relevant forums, mainly at the two collaborating research institutions.

Tentative list of papers:

1) Paper 1: Livelihood strategies among small holder coffee farmers and risk management in relation to uncertainties in yield and prices.

[38] Tropical Agricultural Research and Higher Education Centre.

[39] Connecting, enhancing and sustaining environmental services and market values of coffee agroforestry in Central America, East Africa and India. A partnership project under the EU Programme on Environment in Developing Countries between CIRAD; University of Wales; Bangalore University; CATIE; Coffee Board of India; and ICRAF.

2) Paper 2: The potentials of PES to enhance livelihoods of small holder coffee farmers and secure and increase environmental services in coffee agroforests.
3) Paper 3: Making PES efficient, effective and equitable - the role of coffee cooperatives in provision of environmental services.
4) Paper 4: Recommendations for design of PES schemes targeting small holder coffee farmers in and outside cooperatives.

The project investigates both sides of PES; the market based approach to conservation of environmental services for which PES was originally conceptualized, and the potential of using at least partly market based mechanisms to alleviate economic hardship among small holder coffee producers. Therefore, an important output of the project is a number of policy briefs, based on the scientific articles, which describe recommendations for design of PES schemes that target small scale coffee agroforests with the two-legged goal of conserving environmental services and improving farmers' livelihoods centred on coffee production.

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Annex A:
Project Framework

Methods	Household survey of PES farmers and non-PES farmers Asset and farm survey	Household survey Semi-structured interviews
Data required	Household characteristics, income generating activities, crop types, farm size, assets…	The view and perception of farmer
Operational questions	What are the livelihood strategies among coffee farmers in the study area, in terms of alternative crop selection, income activities, and savings and loans?	What are the farmers' perceptions of risk?
Research questions	What are the potentials of PES in reducing vulnerability to falls in coffee yields and prices, and improving the livelihoods of small holder coffee farmers in the Turrialba canton in Costa Rica?	
Immediate objectives	Investigate the potential of PES to improve livelihoods among small holder coffee farmers	

Production record review, household survey	Household survey, production records, semi-structured interviews, follow up interviews,	Interview with FONAFIFO, review of existing agreements, interview with providers and beneficiaries (other systems),
Income from coffee, total household income	Historic coffee prices, yield records, coffee and total income, savings,	Payment size, frequency, period, who pays, open-ended, changeability, monitoring systems, conditionalities, fund management – from different PES schemes
How large a share of the household income comes from coffee production?	To what extent are farmers vulnerable to coffee price fluctuations and reduced yields?	What characterizes payments for environmental services in PES programs in which coffee agroforests are potential service providers?

Review of existing agreements, production and income records, visit to FONAFIFO, review of PES programmes, household survey	Household survey, interviews with farmers, review of agreements, secondary data from CATIE projects	Review of literature on land use systems, FONAFIFO, review of PES agreements
Size of payments in different PES programmes, income from coffee production, potential sources of funds	Coffee production system characteristics,	Characteristics of ES and alternative land use systems
What is the potential size of PES compared to income from coffee?	Which ES are or can be paid for in coffee agroforests?	Can provision of ES be continued in other land use systems?

Review of PES agreement, household survey, interviews with farmers, review of experiences from other agricultural systems, secondary data from CATIE	Household survey, interviews with farmers, PES agreement review	Review of PES laws, visit to PASOLAC office,	Interview with cooperative management and members, PASOLAC, review of PES agreements
Transaction costs, fixed costs, PES agreement specifics, livelihood strategy	Use of products from trees, farmers perception, PES specifics	Agroforestry systems contained in the PES programme today	Transaction costs, fixed costs, payment size, production constraints,
What are the potential costs of PES participation in terms of constraints on production and livelihood?	How do farmers themselves benefit from ES and are these benefits in conflict with potential PES?	What types of agroforestry systems are receiving PES today? (also relevant for the first research question)	What are the potential costs and benefits to cooperative members of participating in PES schemes?
		How can coffee cooperatives in the Matagalpa region of Nicaragua facilitate the implementation of PES schemes that target coffee agroforests to become *efficient*, i.e. lower transaction costs; *effective*, i.e. involve large areas; and *equitable*, i.e. include many small holder farmers?	
		Examine the role of cooperatives in efficient, effective and equitable PES schemes	

Review of PES agreements, interview with cooperatives (cocoa),	Review of PES agreements, review of PES system, PASOLAC, interview with PES actors	Interviews with farmers and cooperative management, review of membership contracts	Interviews with farmers and cooperative management,
PES agreement specifics, cost of PES in cooperatives and for private farmers	PES system characteristics, application procedures,	Cooperatives' institutional characteristics, membership contracts, farmers' view on coop,	Cooperative rules, farmer-cooperative contract specifics
What is the cost (benefit) reduction of PES through cooperatives compared to PES to single farmers?	How are PES agreements implemented and on whose incentive?	Other than economic considerations, how can cooperative membership influence farmers' incentive to engage in PES schemes?	What mechanisms and tools are available to cooperatives in ensuring continuous commitment to PES schemes among cooperative members?

Household survey of coffee farmers in cooperatives Farm and asset assessment	Policy implications: Recommendations for design of PES schemes that target small holder coffee producers in and outside producer cooperatives. Based on the following research question: How can PES schemes targeted at small holder coffee farmers in and outside cooperatives be designed so that environmental services provided by coffee agroforests are conserved and the economic viability of small scale coffee agroforests is improved? It will be based on a synthesis of the results and data from the first two components.	Project assumptions: 1) Experiences from cocoa production and silvopastoral systems and other agroforestry systems may be transferred to the case of coffee agroforests. 2) Coffee agroforests are providing some sort of environmental service, e.g. biodiversity conservation, carbon sink, water catchment protection or landscape values. 3) Coffee producing areas are located in buffer zones, biological corridors, or other ecological important areas.
Income level Assets Farm size Income activities		
What is the household level, in terms of income and assets, of cooperative farmers?		