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PAYMENT FOR ENVIRONMENTAL SERVICES IN EASTERN COSTA RICAN WATERSHEDS: INSTITUTIONS, PUBLIC PARTICIPATION AND DEMAND

BY

Daniel Vicente Ortega-Pacheco

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ABSTRACT

PAYMENT FOR ENVIRONMENTAL SERVICES IN EASTERN COSTA RICAN WATERSHEDS: LOCAL MARKETS INSTITUTIONS, PUBLIC PARTICIPATION AND DEMAND

By

Daniel Vicente Ortega-Pacheco

Proper management of watersheds is essential for the protection of natural resources, the environment, ecosystems and the socio-economic health of regions. The present work examines the viability of using local payments for watershed services as an incentive-based instrument for protecting and managing drinking water sources in eastern Costa Rica. Specifically, this thesis addresses the need for analyses of institutional impact of Payment for Environmental Services (PES) programs, as well as the need for empirical research on demand for and public participation in PES programs. Research methods include an institutional analysis of local-scale PES, household surveys, and econometric analysis of households' willingness to participate in PES governance and to pay for PES programs. The household survey was implemented in July 2006 using face-to-face interviews that achieved an 84% response rate. The empirical results indicate that there is significant demand for the proposed PES program across all income segments of the communities studied. The results also identify factors within households that are related to individual's willingness to participate in program administration and willingness to finance payments to protect local drinking water sources in surrounding micro-watersheds. Knowledge gained from this study can aid decision-makers in developing watershed-scale, community-based and institutionally-sound PES programs.

DEDICATION

Ad maiorem dei gloriam

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To my family, my loving fiancée Paula, and those close friends who supported this effort.

To whom I am much in debt for his continuous guidance, support and understanding, Frank Lupi, my major professor. To my guidance committee, Professors Michael Kaplowitz and A. Allan Schmid for their collegiality and for their patient, thoughtful review of several iterations of this work.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Policy instruments can be designed to modify the incentives faced by resource managers in a way that encourages sustainable management and conservation. Incentive-based instruments such as programs for Payment for Environmental Services [PES] are one case of conservation policy. This thesis work presents a systematic analysis of the viability for using local PES program in eastern Costa Rican watersheds. For so doing, we will look closely to local institutions, public participation and demand.

The literature has identified several critical elements that need to be addressed with regard to PES program (see FAO 2004; Pagiola, Bishop, and Landell-Mills 2002; Pagiola 2006; Postel and Thompson 2005). In particular, investigators working on various types of conservation policies have stressed the need for empirical research on the potential for ecosystem-based, collective and locally-financed institutional arrangements such as PES programs (see Ferraro and Kiss 2002; Pagiola 2002; Postel and Thompson 2005; 2005; Sanchez-Azofeifa *et al.* 2002). Watershed-based PES programs are an alternative policy tool offering a promising means for addressing resource use conflicts in eastern Costa Rican watersheds and for securing the provision of drinking water. Knowledge generated from this study provides insights into stakeholders' willingness to support participatory, self-financing and institutionally sound watershed management in Costa Rica and elsewhere.

The goal of this thesis is to investigate local institutions, public participation and demand for PES programs to protected drinking water sources in eastern Costa Rican watersheds. The three main objectives are as follows:

I. To examine the institutional impact of watershed-based, collective, and locally-financed PES programs, through the lens of the institutional economics Situation, Structure and Performance [SSP] Framework

II. To identify, through statistical analysis, the factors influencing participation in community-based management of PES

III. To identify and quantify, using the Contingent Valuation [CV] Method, the demand for a local PES watershed protection program of the Costa Rican communities of Cairo-Francia and Milano.

To accomplish these objectives, this thesis presents three essays analyzing local institutions, public participation and demand, if any, for a program to protect headwaters and their associated ecosystem services. The discussion throughout this text considers land uses taking place under private ownership and water delivered downstream from these land uses via community-owned and administered rural water aqueducts.

Essay 1 discusses alternative institutional structures for provision of drinking water in eastern Costa Rica. Essay 2 analyzes certain respondents' characteristics affecting willingness to participate in the administration of a local PES program to protect drinking water sources. A contingent valuation exercise is presented in Essay 3, along with estimation of willingness to pay for the PES program. Conclusions and a summary make up the ending of this thesis. Finally, the appendix contains copies of the survey questionnaire in English and Spanish, other reference material used during the survey implementation, and diagrams and maps of the study's watersheds.

ESSAY 1:
PAYMENT FOR ENVIRONMENTAL SERVICES AND OTHER INSTITUTIONS FOR PROTECTING DRINKING WATER IN EASTERN COSTA RICA

1.1. INTRODUCTION

Communities across the globe increasingly confront environmental and natural resource management decisions that require expenditures to protect and conserve ecosystems. These decisions typically require consideration of bio-physical, political, economic, and other factors. Institutional economic thinking and analyses provide a framework for assessing and understanding the relative benefits of alternative institutions for managing environmental and natural resources. Using an institutional economic analysis, this chapter provides an evaluation of two alternative policy instruments - a local payment for environmental services scheme and a national watershed conservation tax - for protecting drinking water in eastern Costa Rica.

Costa Rica has abundant natural resources (Auty 2001). However, Costa Rica continues to face high rates of deforestation (Chomitz *et al.* 1998; FONAFIFO 2000; World Bank 2000), land cover change for agriculture and pasture, and adverse impacts to Costa Rica's water services (Kaimowitz 2000; Kaimowitz 2004). Threats to Costa Rica's potable water sector include: urban development; inadequate water supply system maintenance; high treatment costs due to surface water pollution; lack of rural water quality monitoring; nitrate contamination; and the absence of watershed and aquifer protection (Espinoza *et al.* 2003; Sanchez-Azofeifa *et al.* 2002). However, groundwater sources (including natural springs) in many places in Costa Rica are of high quality and

do not require much, if any, treatment and represent an "important source of potable and industrial water" (Calvo, 1990).

Because of its location in the tropics, Costa Rica does not typically face water quantity shortages. However, as already mentioned, water quality and distribution problems do pose challenges to Costa Rica's communities and local governments. Water quality scarcity in Costa Rica has also been attributed to uneven water service distribution and deficient water treatment (Calvo 1990). For example, in 2005 only 82% of the Costa Rican population had access to a drinking water supply system and approximately 30% of the water provided by Costa Rican municipalities and communities failed to fully meet international standards of quality (Astorga 2005). The vast majority of the Costa Rican population (80%) gets drinking water from rural aqueduct systems where it has been reported that about half of those drinking water supplies fail to meet international health standards (Espinoza *et al.* 2003). This situation in Costa Rica may worsen in light of growing drinking water demands (FAO 2000) and increasing financial constraints in the municipal water sectors (see Astorga 2005; AyA and OPS/OMS 2002; Espinoza *et al.* 2003).

In response to these and other threats, Costa Rica has created environmental policies aimed at managing natural resource use, conflicts, and degradation in watersheds and other ecosystems. These policies range from stringent regulations (e.g., prohibitions) to incentive-based institutions (e.g., payment for carbon sequestration schemes). However, these policies have been implemented mostly at a national level in a top-down fashion (see Steinberg 2001; Steinberg 2003). Until recently, there have been few attempts to include local communities in conservation decisions (Silva 2003; Steinberg 2003). One

key exception has been in the area of Costa Rica's water law which has moved towards mandating: a) strong focus on the watershed as the unit of management, and b) active community involvement in decisionmaking (see Astorga 2005; MINAE 2005).

Increasing concern in Costa Rica for the social and environmental costs of ecosystem harm from unregulated watershed activity prompted policymakers to consider watershed-based and community-oriented regulation and laws. However, successful ecosystem management for protecting, maintaining, and restoring ecosystem services requires planning that recognizes ecosystem, temporal and social dynamics (Cumming *et al.* 2006). Furthermore, local community support appears to be a requisite and key element for sustainable development outcomes (Sathaye *et al.* 2007). As a result, there are questions about the appropriateness and effectiveness of Costa Rica's watershed protection scheme. This chapter uses an institutional economic framework to evaluate alternative policy instruments for the protection of drinking water sources for two rural communities in eastern Costa Rica.

To organize our analysis, we use the *Situation, Structure* and *Performance* (SSP) framework first articulated by Schmid in 1978 (Schmid 1987). Doing so allows us to specify relationships, describe the attributes of the goods and services that create human independencies (situation), explore the characteristics of the alternative institutional arrangements (structures), and evaluate the alternatives' relative efficacy (performance) (see also Boerrke 2001). After discussing elements of the institutional economics approach and the SPP framework, the chapter focuses on the case study of protecting drinking water sources in eastern Costa Rica. We describe two communities in eastern

Costa Rica and their drinking water systems, the situation. Next, we present and describe alternative institutional programs for protecting the headwaters (sources) of these communities' drinking water, the structure. The chapter then lays out a series of predictions concerning the operation for the alternative structures in the two communities, the performance. These predications will be evaluated using evidence from field research, previous experience, and other data. The chapter concludes by identifying key lessons for policy makers and possible avenues for future research.

1.2. INSTITUTIONAL ANALYSIS/SITUATION-STRUCTURE-PERFORMANCE FRAMEWORK

Institutions structure incentives, shape people's beliefs and preferences, and introduce predictability to human interaction (Schmid 2004). As such, human institutions (i.e., ways of organizing activities) may affect the resilience of the environment and environmental services (Dietz *et al.* 2003), and they may contribute to biodiversity loss (Barbier *et al.* 1994; Wells 1998). Institutions and resource protection may be evaluated and compared in contexts that take account of institutional performance and relationships (Wells 1998). Focusing on institutions can help policymakers evaluate alternative arrangements for natural resource protection and facilitate community participation in natural resource management (Agrawal and Gibson 1999). Local payments for the provision of environmental services (PES) and a new nationwide ecosystem protection tax are examples of two institutional arrangements that may help achieve water source protection goals in eastern Costa Rica. This chapter uses institutional impact analysis to evaluate the potential of a local payment for environmental services scheme and a national watershed protection tax.

The Situation, Structure and Performance (SSP) framework (Schmid 1987) allows for an analytical institutional impact assessment. That is, it provides an organizing framework for predicting and comparing alternative institutions in terms of substantive performance measures (e.g., economic outcomes and distributions). The SSP framework may help answer questions about who is impacted and how they are impacted. Starting with the observation of "variables" in their context (i.e., the situation), which are taken as given, interdependencies arising from characteristics of the "good" and actors involved in "transactions" are identified. These transactions, the interplay of individuals and their contexts including ever-present costs, are the unit of observation. Institutional impact analysis of an established situation (e.g., the provision of drinking water) under the SSP framework allows for comparing institutional alternatives (i.e., structures) that may control and impact interdependencies related to the good(s) and individuals. That is, by holding the "situation" constant, alternative "structures" may be evaluated in order to predict relative "performance." Performance, in this context, is a relative measure associated with a given set of social goals (e.g., efficiency, equity). Predicted performance may be based on notions of social goals (benefits) based upon theory, data collected from interested parties, or lessons learned from cases with similar situations and structures. Evaluating presumed or actual performance allows for the articulation of conclusions and/or insights concerning the alternative structures' likelihood of achieving targeted social goals.

1.3. THE SITUATION

The case study examines land use and watershed protection as they relate to the provision of drinking water in two sets of neighboring rural communities in eastern Costa

Rica. Like many rural areas in Costa Rica and elsewhere in Latin America, these areas face growing resource development conflicts and environmental degradation. In addition to supporting the production of market goods (e.g., agricultural commodities and timber), rural land use change may also result in unintended environmental effects (e.g., alteration in hydrological cycle, erosion) with potentially adverse impacts on the provision of environmental services (e.g., drinking water). As a result, national governments and local communities are considering alternatives approaches to water source protection.

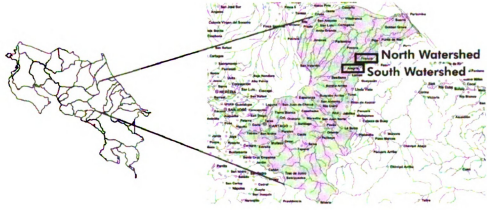

Figure 1.1. Reventazón River Watershed and Eastern Costa Rican Case Study Sites.

1.3.1. Case Study Communities

This case study focuses on six communities in Siquirres (canton), Limon (province) in eastern Costa Rica--Milano, Cairo-Francia, Herediana, La Florida, La Alegría, and Portón Iberia. The six communities are about 65 miles from the capital city, San José in the Atlantic coastal plain. The case study communities are in the Reventazón River watershed - the largest watershed in eastern Costa Rica (see Figure 1.1 and Table 1.1).

The Reventazón watershed has among the highest rates of forest fragmentation in Costa Rica with less than half of forest cover intact. As a result, adverse water quality and quantity impacts are to be expected (Sanchez-Azofeifa *et al.* 2002). Tributaries and subwatersheds of the Reventazón supply drinking water to local communities in the eastern slope including the study sites. This region supports large-scale banana and pineapple production/processing activities as well as other agricultural practices. Concerns have been raised in eastern Costa Rica about possible risks to people from agricultural practices especially pesticide contamination in surface waters (Castillo *et al.* 2005) with special concern in those areas with crops such as banana (Ballestero and Reyes 2006) and pineapple (Castillo *et al.* 1997).

Given their geographical distribution and organizational characteristics, the case study communities were grouped together into two clusters. Each cluster shares subwatersheds and drinking water sources, faces similar land tenure and use, and uses similar water distribution systems. Therefore, we will refer to the "South watershed" (case 1) as the cluster of the communities of La Alegría, Portón Iberia, La Florida, and Herediana and to the "North watershed" (case 2) as the cluster of the communities of Milano and Cairo-Francia (see Table 1.1). These clusters of communities get their household drinking water using rural aqueduct systems that collect potable water from upstream water sources (i.e., springs) and distribute the drinking water via a collectively operated system of pipes and storage tanks. The two clusters of communities have approximately 4,500 households serviced by their rural aqueduct systems.

Table 1.1. Characteristics of two rural communities' water service system in Eastern Costa Rica

Characteristics	Case 1: South watershed	Case 2: North watershed
Village names	La Alegría, Portón Iberia, La Florida, and Herediana	Cairo-Francia and Milano
Water aqueduct committee	ASADA of La Herediana • Executive board of members elected by the community. • Hired manager administers the water service system.	Two independent CAARS • Board of directors elected by the community • Head of the board volunteers to manage water service system.
Water spring location	• Within a small area (<2 hectares) owned by the community • Located at Turrialba Volcano's hillsides • Surrounded by many different land uses.	• Two springs at the east margin of San José – Limón highway. • One spring in forest owned by a company with tax-free status • One spring in farm adjacent to large scale pineapple operation.
Dinking water distribution	Joint service for all villages and their neighborhoods in region.	Independent service systems. One for each village-Cairo-Francia & Milano.
Aqueduct	• Extends from communities 'near' source to other communities within 4-5 miles range • Slope differential of about 140 m.	• Independent aqueducts are no longer than 3-4 miles • Slope differential of < 17 m
Water users' income sources	May not be directly linked to agricultural activities in land nearby the water sources	Mostly linked to agricultural and processing activities in land nearby the water sources
Principle land uses	Forests and agriculture	Factor-intensive and large scale pineapple production and tropical fruit processing
Water supply Land owners	Many owners live in the area: • Occupy small/medium parcels near water sources. • Have some semi-intensive agriculture or forestry activities • For some, there may be ambiguity in the land owner of record Some owners do not live in area and: • Own relatively large parcels for part-time residences/ranches and large-scale forest plantations	Most owners • Live outside the area • Own large parcels • Have factor-intensive pineapple plantations presumably vertically integrated to a fruit processor/exporter of banana, pineapple and mango products

As Table 1.1 illustrates, the two clusters of communities share many characteristics but have some noteworthy differences. The South watershed has a rural aqueduct system that is managed by a full-time manager employed by the ASADA, has its water sources surrounded by a large number of land owners and land uses, and operates an aqueduct system over a large, steep area in multiple communities. In contrast, the North watershed manages its rural aqueducts systems with volunteers, has its water sources near the highway on large agricultural (monoculture) landowners' parcels, and operates separate smaller and less steep aqueduct systems. In both clusters, North and South, available household data suggest that the average monthly household income appears to be on par with the national average household income (i.e., 140,000 colones) and slightly lower than household incomes in urbanized and metropolitan areas of Costa Rica's Central Valley.

1.3.2. Rural Drinking Water Service

As mentioned, the North and South watersheds each operate their own collective rural aqueduct systems. Local administration and financing of such drinking water systems is common in rural Costa Rica. Community members actively engage in their drinking water system activities for their mutual benefit. Such activities include water aqueduct construction, setting local policies, volunteering on community committees/boards, voting in local elections, helping to collect water use payments from neighbors, etc. There are community-elected executive boards of the Water Aqueduct Committees (CAARS, a Spanish acronym) or Water Aqueduct Associations (ASADAS, a Spanish acronym). CAARS/ASADAS are in regular contact with the Costa Rican National Aqueducts and Sewage Agency (AyA), Public Utilities Regulating Authority (ARESEP),

and units of the Ministry of Environment and Energy (MINAE) (e.g., National Forestry Financing Fund (FONAFIFO)). These agencies help with technical and environmental issues, regulatory considerations, and sometimes assessments of financial impacts of policy changes. CAARS/ASADAS were initially organized during the construction phase of the rural aqueduct systems to administer, operate and maintain the drinking water supply (Espinoza *et al.* 2003). The principle difference between ASADAS and CAARS is that the former have been authorized by AyA using service distribution agreements.

In our two clusters of communities, ASADAS managers or CAARS presidents are involved in the day-to-day operations of the drinking water system, and they work closely with field assistants. In the case of ASADA in the South watershed, the elected community water board hired a full-time water service administrator. In the CAARS in the North watershed, the community elects a community water board and expects the president of that board to manage their water system. In both instances, field assistants perform the maintenance tasks on the aqueduct systems as well as implement water service disconnections (cut-offs) (e.g., for payment failure) and (re)connections of water service. The ASADAS and CAARS also perform monitoring and administrative activities, including water bill collection.

Revenue from the water bills are the primary funding source for supporting the operation and maintenance of the local drinking water aqueduct systems. The households in the study area that receive drinking water from the aqueduct systems are charged a fixed or preset monthly water bill ($\approx$ 1000 colones / USD$ 2 per month) and their consumption is not metered. These fees are reported to be much less than those fees charges to urban water users. Some community members are selected based on their

social standing in the community and recruited and trained to collect the monthly water charges from their neighbors.

1.3.3. Interdependencies

Three main interdependencies seem to arise from characteristics of drinking water and the actors involved in drinking water transactions in eastern Costa Rica: 1) potential incompatible use of the land adversely impacting water quality, 2) pricing issues associated with the provision of potable water where the marginal cost of additional users in the system may be very low, and 3) lack of information concerning transaction costs. A complete articulation of the incompatible use of the land in the watershed is outside the scope of this chapter. However, the incompatible or alternative use of lands at the headwaters or sources of the clusters' drinking water systems will be addressed. Suffice to say, the interdependencies that arise from the incompatible land uses are linked to questions of factor ownership. Solutions to the issue of incompatible use of the land, once factor ownership is given, would depend essentially on whether the continued or proposed use of the land adds more to the landowners' income than it subtracts from the water users'. Consequently, landowners may be willing to receive payments to discontinue a particular land use or adopt certain practices to protect water sources and secure the provision of the service.

Second, while drinking water is not a nonrival good (e.g., household A cannot drink the water consumed by household B), once an aqueduct system is built, assuming adequate water supplies, the marginal cost of adding an additional user to the system is virtually zero. There is also a certain degree of jointness of consumption of water quality (i.e., in an aqueduct system everyone must use some given quality). Constructing an

aqueduct and altering the quality of water at an aqueduct source are both characterized by having potentially large fixed costs and almost no marginal costs for adding another user. Hence, the pricing for drinking water must address sharing the relatively large fixed costs associated with the construction and management of the drinking water system across water users.

Thirdly, incomplete information about the protection of drinking water quality may complicate increased provision of drinking water supplies as well as affect transaction costs. Although it is possible for rural Water Aqueduct Committees to monitor the outcomes of their water service by analyzing water quality through laboratory tests, determining and monitoring the upstream land use activities that will deliver potable water of desired quality is more complicated. This is particularly true given the lack of scientific and technical information on how best to provide, protect, and augment sources of drinking water (Pagiola *et al.* 2002b). Potential water service suppliers may not know what specific activities should be implemented or changed in order to reach certain level of provision of quality or quantity of drinking water. All of these add to the uncertainties and transaction costs associated with any arrangements between Water Aqueduct Committees and land holders at aqueduct headwaters.

1.4. STRUCTURE

Our case study focuses on two institutional arrangements that have the potential to promote protection of drinking water in rural communities in eastern Costa Rica: a new national water tax and a local payment for environmental services (PES) program. Table

1.2 outlines some elements of these two institutional arrangements, the two alternative structures.

Table 1.2. Institutional Characteristics of Two Policy Instruments (Alternative Structures)

Characteristics	Payment for Environmental Services	New National Water Tax
Instrument Type	Contractual agreements -payments for land use restriction	Regulation -annual fee added to water bill
Enabling institution	Forestry Law 7575. (República de Costa Rica 1996) • Communities manage water system • Community members participate	Executive Decree No. 32868. (República de Costa Rica 2006) • Communities manage water system • Community members participate
Administration Activities	Local coordination of guidelines, procedures, data, fee collection, payments to landowners, and monitoring	National collection of annual tax. National agency responsible for implementing, monitoring and evaluating.
Environmental Fee	Payments to landowners for protecting drinking water source • share costs among water users • differentiate the amount to be paid across users	Water tax with 50% allocated to water use and 50% water source protection. • shared across national water users • fees depends on water source and type of end use
Water Bills	• Contractual agreements in locale • Payment in addition to regular water charges	• National tax added to water bill • Communities with a PES program pay only the water use part of tax
Funds distribution	• An environmental fee collected locally is paid to local households protecting water source • Funds protect the originating micro-watersheds. Small portion for administration costs	Water source protection fees (50% of tax) divided: • 50% to a national strategy for integrated water resource mgmt. • 25% to the National System of Conservation Areas (SINAC) • 25% to the National Fund for Forest Investments (FONAFIFO) • FONAFIFO's share goes back to communities for local programs to protect areas of water recharge.
Implementation	Landowner transfer land use rights to CAARS/ASADAS. • CAARS/ASADAS oversight • FONAFIFO-MINAE to ensure protection activities and AyA-ARESEP to ensure water billing structure is appropriate	FONAFIFO funds finance protection of drinking water sources • CAARS/ASADAS implement water tax • AyA reports outcomes

1.4.1. Local Payment for Environmental Services [PES]

Local PES may be thought of as voluntary contractual agreements taking place between multiple ecosystem service beneficiaries or users (e.g., local water users) and a number of providers of the those ecosystem services (e.g., landowners in/around drinking water sources). The agreements typically require a third-party to facilitate and implement the transaction such as a local agent (e.g., aqueduct managers such as CAARS/ASADAS). PES programs provide a mechanism so that land owners who voluntarily agree to apply and follow specified pro-environmental conservation practices on their lands (e.g., sustainable forest management, preservation, reforestation, etc.), which provide a stock and flow of ecosystem services to others (beneficiaries), receive cash payments from the service beneficiaries for some period of time (e.g., five year term). The terms of this arrangement are typically recorded in a contract which may be of fixed duration, renewable, or permanent.

Costa Rica has experience with a national systems of PES including an approach of direct payments to land users for land use decisions resulting in the provision of environmental services (Chomitz *et al.* 1998; FAO 2004; Salzman 2005; World Bank 2000). Costa Rica's national system of environmental service payments (Pagos por Servicios Ambientales, PSA) was designed for landowners to receive direct compensation for land use decisions that provide four types of environmental services: 1) mitigation of greenhouse gases, 2) provision of hydrological services, 3) biodiversity conservation, and 4) provision of scenic beauty for ecotourism (Pagiola *et al.* 2002a). While the PSA is national in scope, only a very small portion of eligible landholders have participated in the PSA (Pagiola 2002, Pagiola *et al.* 2005). There is one reported PES program in Costa Rica that appears to have a local focus, the Procuencas program.

Procuencas operates in Heredia province with the help of large agencies (e.g., national electric company) and provides incentives to upstream landowners to maintain and improve forest ecosystems (Castro 2001; Redondo-Brenes and Welsh 2006). A local PES program for protecting the headwaters (source) of rural aqueduct drinking water systems would require that users of the communities' water system come together to administer a system so that they can make institutional arrangements to pool their funds to provide incentives to landowners in their watershed's headwater region to implement pro-environmental land use practices.

1.4.2. New National Water Tax

Under Costa Rica's "old" national PES program, a five percent tax on gasoline and private sector contributions were used to make payments to landowners in watersheds producing hydroelectricity for planting and maintaining trees (Redondo-Brenes and Welsh 2006). As mentioned above, this system has not resulted in widespread adoption or success. In response, a new national water regulation scheme has been adopted by Costa Rica that mandates a (tax) payment from each water user in addition to normal water service fees (República de Costa Rica 2006). Although this new national water tax will be enforced nationwide, by law the local water service providers (e.g., CAARS, ASADAS) are responsible for its implementation at the community level and for transferring monthly water tax revenues to the Department of Water at the Ministry of Environment and Energy (MINAE).

The new water tax will be implemented gradually over a seven year period. The first year, there will be a 10% payment of the total tax amount. After that, MINAE will increase the tax an additional 15% each year to reach 100% of the total tax by the seventh

year. However, no more than 25% of these water tax revenues will be directly transferred back to the originating communities. This tax is structured so that half of the tax is for water use and the other half of the tax is for resource conservation. So, half of the water tax funds will be directed to support the implementation of a national strategy for integrated water resources management. The national integrated water resources management strategy includes research and development, as well as capacity building to promote conservation, restoration, protection and sustainable management of watersheds and water resources. The other half of the water tax revenues will be distributed between two national agencies - the National System of Conservation Areas (SINAC) and the National Fund for Forest Investments (FONAFIFO). Those FONAFIFO funds are the funds targeted for return to the originating communities for local watershed protection. It is important to point out that communities participating in PES programs may apply to FONAFIFO to be relieved of paying that part of the new water tax related to water resource management.

1.5. PERFORMANCE

We now consider the characteristics of the alternative institutional arrangements, the two structures for protecting drinking water sources in our case study, and make some preliminary predictions about their likely performance. We then go on to discuss in more depth the expected relative performance of these structures in light of the two case study communities. We evaluate potential strengths and weakness of the alternative programs in the study area using some Costa Rican household data, estimates reported in the literature, and household survey data.

1.5.1. Performance Predictions

Many communities in rural eastern Costa Rica may be able to collectively protect the sources of their drinking water by implementing local PES programs. That is, potential PES revenue in these communities may be large enough to compensate landowners of headwater areas for implementing conservation activities. For example, a household PES survey (Ortega-Pacheco 2007) in eastern Costa Rica revealed sufficient willingness to fund headwater protection for adequate payments to landowners in the headwater area so that those landowners might change detrimental land use practices in/around drinking water sources.

Furthermore, local PES programs appear to involve relatively low additional financial costs to communities already monitoring and enforcement activities related to drinking water provision. Any additional PES program monitoring and enforcement activities would likely be subsidized by relatively small changes to community participation already taking place as part of the communities' local water aqueduct system. Likewise, given the existing fee collection infrastructure, adding a PES fee to current water billing practices does not seem to present administrative difficulties and would allow members of communities to share the fixed costs of service provision among all households. A potential obstacle to local PES approaches may be the transaction costs associated with identifying and implementing those alternative land use and watershed service protection practices in the headwater areas that will result in water quality improvements in particular watersheds and aqueducts.

Alternatively, revenues generated from the new water tax may fall short of allowing communities in rural eastern Costa Rica to adequately protect their drinking water sources. The new water tax revenues that may eventually flow to communities, which

amount to the 25% of the tax revenues that go to FONAFIFO, may simply be too little and too late to enable rural communities to purchase headwater lands and/or make sufficiently large payments to headwater landowners in exchange for the adoption of water protection and conservation practices. Nevertheless, the new water tax is currently the national regulatory instrument for generating and accumulating revenues for the eventual purchase of land for conservation and watershed protection purposes. Complicating matters, these new taxes are being phased-in gradually forestalling the possibility of immediate implementation of conservation efforts in the study sites using water tax revenues.

The new national water tax will likely involve increased costs associated with implementation, monitoring and enforcement activities relative to those associated with local PES programs. For one, the national system may have less potential for using and relying upon local volunteers. There will also be increased costs associated with the coordination of activities and information at national and local levels as well as between national and local authorities. Recall also that the water tax pricing structure requires all water users to share in the fixed costs of the national service programs and only returns to the communities up to 25% of their water taxes.

1.5.2. Performance Discussion

Local PES Program Potential

Local PES programs may be viable options for protecting drinking water sources in communities where potential revenues from downstream beneficiaries are large enough

to adequately entice landowners on or around water sources to agree to limit their activities to benign or pro-environmental activities on or near water sources. Previous studies in Costa Rica suggest that forests that are on soils suited for agriculture can be protected and maintained as forests by using conservation incentives of about $120 per ha per year (Bouman *et al.* 1998; Nieuwenhuyse *et al.* 2000). Those studies, however, do not fully compare to our case study areas where large-scale pineapple production and processing play a larger role.

In our case study areas, pineapple production as well as banana production are major land uses. For one of our case study sites in the North watershed, a drinking water source for the community's aqueduct is surrounded by pineapple production. Estimates of the revenues and opportunity costs for pineapple production in Costa Rica are uncertain (Haggar *et al.* 2003) and vary widely (Vega and Vega, 2002). However, pineapple growing land is generally associated with large relative rental rates and revenues as compared to similar land in our case study area (Vega and Vega, 2002). Our field experience suggests that large-scale pineapple producers face relatively large opportunity costs for changing land use/production practices (i.e., taking land out of production). The principle land uses and types of landowners in the South watershed differ from those in the North watershed. In the South, the drinking water sources are on small collectively owned plots or a small landowner's parcel and they are surrounded by a relatively large number of small landowners engaged in a range of agricultural and other practices. As mentioned, in the North watershed, the drinking water sources are on land owned and operated by large landowners engaged in large-scale agricultural production (e.g., pineapple producers).

Analytical estimates based on national and field research data appear to support the notion that revenues generated in a local PES program may be substantial enough to compensate landowners for pro-environmental behavior (see Table 1.3). However, in the North watershed, the local PES revenues may not be great enough given the relatively larger opportunity costs of the larger-scale land owners (e.g., pineapple producers) and the relatively small number of downstream water users. Also in the North, downstream drinking water users are likely employed by upstream pineapple producers so that changes to pineapple producer's land use/production practices are likely to impact local employees' income and ability to finance headwater protection schemes. Similarly, the transaction costs in the South watershed are not likely zero. Landowners in and around the drinking water source in the South watershed have reported some ambiguity in land ownership records raising the potential for land tenure issues (uncertainty) which might make entering into enforceable conservation agreements less likely to occur. However, local PES schemes seem capable generating sufficient revenues for some communities to financially support local drinking water source protection activities. Local PES approaches in rural areas may be able to have their monitoring and enforcing activities subsidized through ongoing community participation (e.g. volunteer time) in local aqueduct systems. That is, CAARS/ASADAS personnel, in addition to local aqueduct duties, may also help monitor the PES program including monitoring targeted quality levels (e.g., collecting samples at final distribution points that can be tested).

Table 1.3. Estimated revenues (millions of colones per month) from National Water Tax and Local PES programs in Case Study Sites (1USD = 510 colones).

Cases	Communities	Households	Water Tax Revenues*	Total Water Tax Revenues*	Local PES Revenues**	Total Local PES Revenues
North watershed	Milano	344	0.005	0.014	0.69	2.00
	Cairo-Francia	656	0.009		1.31	
South watershed	Herediana	1596	0.023	0.050	3.91	7.06
	La Florida	996	0.014		1.99	
	La Alegría	524	0.007		1.05	
	Portón Iberia	416	0.006		0.83	

* Estimated tax revenues correspond to 25% of the total water tax, the share of the tax that is slated to be transferred back to the communities. Estimates are based on 2002 national estimates of water consumption (0.54 Km3/year), population (3,925,330), average number of household members in study site (3 persons), and a per unit water use tax specified in the regulation (0.82 colones per m3 of water).

** Local PES estimates are based on amounts that local households' water users in Cairo-Francia and Milano indicated that they would be willing to pay per month to protect their water sources – about 2,000 colones (Ortega-Pacheco, 2007).

Water Tax Potential

The analyses seem to show that the new water tax revenues will not be large enough in the rural communities in our case study area to fund the purchase of land for conservation purposes nor enough to entice upstream landowners to modify their land use practices in and around headwater areas (see Table 1.3). In the South watershed, possible land tenure uncertainty along with the relatively large number of different owners makes the possibility of purchasing the necessary headwater lands less likely given the revenue potential of the water tax. In the North watershed with its larger-scale agriculture and fewer land owners, the water tax would seem less likely to generate sufficient revenue to allow the communities to purchase land for drinking water sources protection. As Table 1.3 illustrates, our estimates of the new water tax revenues in our study area indicates that

communities would have to amass their water tax conservation fund revenues from the tax for several years before accumulating enough to potentially purchase headwater lands. Unfortunately, that would leave these drinking water sources unprotected, possibly irrevocably, during the interim. Moreover, the tax mechanism of having water tax protection funds collected locally, transferred to national accounts, and eventually transferred back to the community in part (maximum 25%) adds further lags and costs to undertaking designed to protect the areas' drinking water sources.

Relative to the alternatives, the new national water tax may also increase costs, relative to the alternatives, associated with implementing, monitoring, and enforcing drinking water source protection activities because, all else equal, the water tax program requires the coordination of national agencies and the various local community ASADAS/CAARS. If the national water tax has to be implemented at the local level by CAARS/ASADAS, some monitoring and enforcing costs can be also subsidized through community participation (e.g. volunteer time). However, the coordination costs of monitoring and enforcing activities may be higher under the water tax because national agencies would have to be involved in the collection and sharing of the revenue. In fact, the coordination involved with the national tax scheme not only adds one more layer of administrative tasks and associated costs but also introduces more costs given that national authorities will have to somehow control and monitor the activities of local agencies.

Joint Use of Local PES and Water Tax

Given the reality of the new water tax, consideration of the potential implementation of local PES in conjunction with the tax is in order. From the perspective of the communities in our case study, local PES programs seem to be a good source of financing local drinking water protection efforts. The current water use fees paid by the communities in our case study area are lower than water fees in Costa Rica's urban areas (Ortega-Pacheco 2007). The addition of the new water tax, especially if all or a portion of the environmental stewardship component returns to the community, is not a significant increase. Previous work shows that these local environmental service beneficiaries are willing to pay substantially more than their current water use fee to protect their drinking water sources. However, local PES may not work and may not be feasible in other areas. The new water tax may be implementable nation wide but it may not generate sufficient revenues to adequately protect rural drinking water sources such as those in the case study communities. Given situational specific characteristics of the actors involved (e.g., size of potential providers and type of land uses), local PES program may be more viable in some communities than in others (e.g., it is more likely to take place in our South watershed rather than North watershed).

Our case study shows that in eastern Costa Rica formal (i.e., legal framework) and informal institutions (i.e., communities' habits, customs and social norms) may enable community-level implementation of both policy instruments-a national water tax and a local PES scheme. We see potential for a mixed strategy combining the implementation of a) the national water tax, and b) local PES programs in those communities in such

places as our South watershed where both seem viable and reasonable approaches for protection drinking water sources

For such a mixed policy strategy to work, the regulatory framework should be modified to:

a) Allow local communities to use water tax revenues not only to purchase land but also to implement local PES programs enabling periodic payments to landowners engaged in appropriate drinking water protection activities;

b) Allow CAARS/ASADAS to keep "their" portion of water tax's revenues in their communities instead using the more costly procedure of transferring funds to national accounts and then back to communities or in the alternative be allowed to collect larger PES payments from users and be excused from some of the national water tax; and

c) Provide FONAFIFO/DW-MINAE/AyA-ARESEP oversight of CAARS/ASADAS responsible for collecting and administering funds for protection activities. This oversight should help ensure that collection of water bills is appropriate, that monitoring and enforcement is undertaken and that costs are subsidized through community participation (e.g. volunteer time).

In addition, the data from our case study area clearly suggests that the tax rates of the national water tax fall far short of realistic costs of water source protection in rural areas. The water tax fees likely need to be modified at a national level to increase the amount of revenues that can be generated for expenditure especially in rural communities. Although current fees may allow large urban areas with their many water users to protect their

water sources, our case study indicates that small rural communities would not generate sufficient revenues to do so. Our own field experience indicates that in rural areas, communities are acutely aware of the various environmental threats to their water sources, and to protect water sources they would be willing to pay monthly water fees that are significantly higher than the water tax currently enforced by law.

1.6. CONCLUSION

It appears that for the case of eastern Costa Rica with rural communities that rely on local, self-financed aqueduct systems, the new national water tax scheme may fail to provide adequate funds at the right time to help them protect their current sources of drinking water. This may not be true for the urban areas of Costa Rica that have reasonably functioning municipal potable water services. In the rural aqueduct setting, the purchase of land around watersheds headwaters as well as the provision of incentives to surrounding landowners to adopt pro-environmental land use practices may represent the least cost, most beneficial approach to providing long-term drinking water protection. While it appears that local PES schemes may be both viable and effective in the rural settings of our case study, the implementation of the new national water tax adds a layer of bureaucracy and potential funding that may be beneficial.

Ideally, the water tax rates (and reimbursement rates to communities) might be adjusted to more equitably share infrastructure, maintenance, and enforcement costs. Additionally, there should be some allocation of national water tax funds to the generation and dissemination of knowledge and information on approaches to improve watershed services and protection of drinking water supplies. Increased effectiveness of

any of the policy instruments would benefit from improved technical information about the protection and "production" of drinking water. Our case study indicates that with better information, monitoring and enforcing tasks could be locally tailored to report performance outcomes of watershed protection efforts.

Finally, future research exploring the cost-effectiveness of incentive-based conservation policies should account for so-called land market feedback effects that could result from payments or land purchases. Market feedbacks will arise due to any change in supply and demand for land. The local PES approach and the water tax approaches add to demand for certain types of land (e.g., headwater areas of watersheds) by introducing periodic payments or direct purchases. In addition, setting aside land for conservation as is currently mandated by the water tax regulation may also increase the price of remaining lands or displace development toward more ecologically valuable lands (Armsworth *et al.* 2006; Wu 2000). Such land market feedbacks due to the implementation of institutional arrangements result in changes to future costs and threats (Naidoo *et al.* 2006). A better understanding of these dynamic effects on performance of incentive-based institutional structures may warrant further examination in the Costa Rican context.

REFERENCES

Agrawal, A., and Gibson, C. C. (1999). "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." *World Development*, 27(4), 629-649.

Arce, R. (2004). "Resumen Diagnóstico Cuenca Reventazón." Comisión Nacional de Prevención de Riesgos y Atención de Emergencias (CNE), NU. Fondo de las Naciones Unidas para la Infancia (UNICEF), Radio Nederland Training Centre (RNTC), Oficina de Asuntos Humanitarios de la Comunidad Europea (ECHO). Programa de Preparativos, Mitigación y Prevención de Desastres (DIPECHO), San José, Costa Rica.

Armsworth, P. R., Daily, G. C., Kareiva, P., and Sanchirico, J. N. (2006). "From the Cover: Land market feedbacks can undermine biodiversity conservation." *Proceedings of the National Academy of Sciences* 103(14), 5403-5408.

Astorga, Y. (2005). "Estado y gestión del recurso hídrico en Costa Rica: Informe Final." Programa Estado de la Nación (PEN), San José, Costa Rica.

Auty, R. M. (2001). *Resource Abundance and Economic Development*, Oxford University Press.

AyA, and OPS/OMS. (2002). Agua potable y saneamiento de Costa Rica: Análisis sectorial: Resumen Ejecutivo, Instituto Costarricense de Acueductos y Alcantarillados (AyA) and Organización Panamaericana de la Salud/Organización Mundial de la Salud (OPS/OMS) San José, Costa Rica.

Ballestero, M., and Reyes, V. (2006). "Water Quality Management in Central America: Case Study of Costa Rica." In *Water Quality Management in the Americas*, A. K. Biswas, B. Braga, C. Tortajada, and D. J. Rodriguez, eds., Springer, Berlin.

Barbier, E. B., Burgess, J. C., and Folke, C. (1994). *Paradise lost? The Ecological Economics of Biodiversity*, Earthscan, London.

Boerrke, P. J. (2001). "Putting the 'political' back into political economy." In *Economics Broadly Considered*, J. E. Biddle, J.B. Davis, and S.G. Medema, ed., Routledge, London and New York.

Bouman, B. A. M., Schipper, R. A., Nieuwenhuyse, A., Hengsdijk, H., and Jansen, H. G. P. (1998). "Quantifying economic and biophysical sustainability trade-offs in land use exploration at the regional level: a case study for the Northern Atlantic Zone of Costa Rica." *Ecological Modeling*, 114(1), 95-109.

Calvo, J. C. (1990). "Water resources development in Costa Rica 1970-2000." *Hydrological Sciences Journal*, 35(2), 185-196.

Castillo, L. E., de la Cruz, E., and Ruepert, C. (1997). "Ecotoxicology and pesticides in tropical aquatic ecosystems of Central America." *Environmental Toxicology and Chemistry*, 16(1), 41-51.

Castillo, L. E., Wesseling, I., and Ruepert, C. (2005). "Research capacity building in environment and health in Central America." Global Forum for Health Research, Forum 9 Mumbai, India, 12-16 September 2005.

Castro, E. (2001). "Costar Rican experience in the charge for hydro environmental services of the biodiversity to finance conservation and recuperation of hillside ecosystems." International Workshop on Market Creation for Biodiversity Products and Services, OECD, Paris, 25-26 January 2001.

Chomitz, K. M., Brenes, E., and Constantino, L. (1998). "Financing Environmental Services: The Costa Rican Experience and its Implications." *Science of the Total Environment*, 240, 157-169.

Cumming, G. S., Cumming, D. H. M., and Redman, C. L. (2006). "Scale mismatches in social-ecological systems: causes, consequences, and solutions." *Ecology and Society*, 11 (1), 14-34.

Dietz, T., Ostrom, E., and Stern, P. C. (2003). "The Struggle to Govern the Commons." *Science*, 302(5652), 1907-1912.

Espinoza, A., Morera, A., Mora, D., and Torres, R. (2003). Calidad del agua potable en Costa Rica: Situación actual y perspectivas, Organización Panamericana de la Salud/Organización Mundial de la Salud (OPS/OMS), Ministerio de Salud de Costa Rica e Instituto Costarricense de Acueductos y Alcantarillados, San José, Costa Rica.

FAO. (2000). "AQUASTAT-Information System on Water and Agriculture: Countries and Regions - Costa Rica." AQUASTAT-Sistema de Informacion sobre el Uso del Agua en la Agricultura y el Medio Rural de la FAO, Food and Agriculture Organization of the United Nations (FAO) - Land and Water Development Division, Roma.

FAO. (2004). "Regional Forum Payment Schemes for Environmental Services in Watersheds." Third Latin American Congress on Watershed Management, Arequipa, Peru.

FONAFIFO. (2000). "El Desarrollo del Sistema de Pago de Servicios Ambientales en Costa Rica." Fondo National de Financiamiento Forestal (FONAFIFO), San José.

Haggar, J., Rheingans, R., Arroyo, P., and Alvarado, B. (2003). "Benefits and costs of intercropping reforestation in the Atlantic lowlands of Costa Rica." *New Forests*, 25(1), 41-48.

Kaimowitz, D. (2000). "The political economy of environmental policy reform in Latin America." In *Modern political economy and Latin America: theory and policy*, J. Frieden, M. Pastor, and M. Tomz, eds., Westview Press, Boulder.

Kaimowitz, D. (2004). "Useful myths and intractable truths: the politics of the links between forests and water in Central America." *Forests, water and people in the humid tropics: past, present, and future hydrological research for integrated land and water management*, M. Bonell and L. A. Bruijnzeel, eds., Cambridge University Press, Cambridge, UK.

MINAE. (2005). "Primera Etapa: Estrategia para la Gestión Integrada de Recursos Hídricos En Costa Rica." Proyecto BID ATN/WP - 8467- CR, Ministerio del Ambiente y Energía (MINAE) & Banco Interamericano de Desarrollo, San José, Costa Rica.

Naidoo, R., Balmford, A., Ferraro, P. J., Polasky, S., Ricketts, T. H., and Rouget, M. (2006). "Integrating economic costs into conservation planning." *Trends in Ecology & Evolution*, 21(12), 681-687.

Nieuwenhuyse, A., Hengsdijk, H., Bouman, B. A. M., Schipper, R. A., and Jansen, H. G. P. (2000). "Can forestry be a competitive land use option?: Model simulations from humid tropical Costa Rica." *Forest Ecology and Management*, 137(1-3), 23-40.

Ortega-Pacheco, D. (2007). "Payment for Environmental Services in Eastern Costa Rican Watersheds: Institutions, Public Participation and Demand," Masters Thesis, Michigan State University, East Lansing.

Pagiola, S., Bishop, J., and Landell-Mills, N. (2002a). *Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development*, Earthscan., London.

Pagiola, S., Landell-Mills, N., and Bishop, J. (2002b). "Making Market-base Mechanisms Work for Forests and People." In *Selling forest environmental services: Market-based mechanisms for conservation and development*, S. Pagiola, J. Bishop, and N. Landell-Mills, eds., Earthscan, London.

Redondo-Brenes, A., and Welsh, K. (2006). "Payment for hydrological environmental services in Costa Rica: The Procuencas case study." *Tropical Resources Bulletin*, 24, 19-25.

República de Costa Rica. (1996). "Ley Forestal." Asamblea Legislativa.

República de Costa Rica. (2004). "Proyecto de Ley del Recurso Hídrico " Legislative file No.14585 Asamblea Legislativa - Comisión Permanente Especial del Ambiente.

República de Costa Rica. (2006). "Canon por Concepto de Aprovechamiento de Aguas." El Presidente de la Repúbica y el Ministro del Ambiente y Energía (MINAE).

República de Costa Rica. (2007). "Tarifas vigentes de los Acueductos Comunales." Autoridad Reguladora de los Servicios Públicos (ARESEP).

Salzman, J. (2005). "Creating markets for ecosystem services: Notes from the field." *New York University Law Review*, 80(3), 870-961.

Sanchez-Azofeifa, G. A., Harriss, R. C., Storrier, A. L., and de Camino-Beck, T. (2002). "Water Resources and Regional Land Cover Change in Costa Rica: Impacts and Economics." *International Journal of Water Resources Development*, 18, 409-424.

Sathaye, J., Najam, A., Cocklin, C., Heller, T., Lecocq, F., Llanes-Regueiro, J., Pan, J., Petschel-Held, G., Rayner, S., Robinson, J., Schaeffer, R., Sokona, Y., Swart, R., and Winkler, H. (2007). *Sustainable Development and Mitigation.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Schmid, A. (2004). *Conflict and Cooperation: Institutional and Behavioral Economics*, Blackwell, Malden, MA.

Schmid, A. A. (1987). *Property, Power, and Public Choice: An Inquiry into Law and Economics*, Praeger Publishers, New York.

Silva, E. (2003). "Selling Sustainable Development and Shortchanging Social Ecology in Costa Rican Forest Policy." *Latin American Politics and Society*, 45(3), 93-127.

Steinberg, P. F. (2001). "Domestic Political Resources. In *Environmental Leadership in Developing Countries: Transnational Relations and Biodiversity Policy in Costa Rica and Bolivia*, MIT Press, Cambridge.

Steinberg, P. F. (2003). "Understanding Policy Change in Developing Countries: The Spheres of Influence Framework." *Global Environmental Politics* 3(1), 11-32.

Vega, E., and Vega, M. (2002). "Determinación del Costo de Oportunidad y Clasificación por clases de capacidad de uso (CCU)." INBIO, NIVA, Norwegian Institute for Nature Research (NINA) en colaboración con Instituto de Políticas para la Sostenibilidad (IPS) y Australian Museum, Heredia, Costa Rica.

Wells, M. (1998). "Institutions and Incentives for Biodiversity Conservation." *Biodiversity and Conservation*, 7(6), 815-835.

World Bank. (2000). "Ecomarkets Project: Project Appraisal Document." Report No.20434-CR, World Bank, Washington.

Wu, J. (2000). "Slippage Effects of the Conservation Reserve Program." *American Journal of Agricultural Economics*, 82(4), 979-992.

ESSAY 2:
PARTICIPATION IN COMMUNITY-BASED MANAGEMENT OF PAYMENT FOR ENVIRONMENTAL SERVICES

2.1. INTRODUCTION

2.1.1. Watershed protection and management

Water resources conservation and management occupy an increasingly important place in the international development agenda because of the growing pressures on important ecosystems and those relying on the associated ecosystem services (Millennium Ecosystem Assessment 2005). It has been asserted that new conservation and development efforts should be better tailored and more responsive to site-specific ecological and socio-economic conditions for effective and sustainable preservation and management of threatened natural habitats (Bawa *et al.* 2004; Ferraro 2001; Ferraro and Kiss 2002). There is a growing consensus that local management is essential for addressing site-specific complexities that externally imposed management systems would likely fail to appreciate (Kerr 2002, p. 1388). One promising approach for rural communities to manage their natural resources is through local, collective management systems (Baland and Platteau 1996). Participation of local beneficiaries (i.e. community-based management) in natural resources management has received increasing support in the literature because of the potential for such an approach to achieve environmental and natural resource goals (Agrawal and Gibson 1999). At the same time, multilateral agencies like the World Bank and countries such as Costa Rica, have been increasingly their support of ecosystem and incentive-based approaches for watershed management (Pagiola *et al.* 2005). Payment for environmental services (PES) programming is an

incentive-based mechanism that has been used in efforts to protect watersheds and watershed services such as water quality (FAO 2004; Herrador and Dimas 2000; Pagiola 2002; Postel and Thompson 2005).

One area that lends itself to both local community participation and incentive-based approaches is watershed management (Kerr 2002). Improved management of watersheds, especially those that support highly valuable hydrological services such as water quality and quantity, might be advanced by identifying and understanding the factors influencing local beneficiaries' willingness to participate in such protection and management programs. Despite the interest in local management approaches as well as the use of incentive mechanisms to finance conservation of natural resources, the literature in both fields has not adequately explored the factors influencing local resource beneficiaries' willingness to participate in such programs (Agrawal and Gibson 1999; Baland and Platteau 1996; Engel *et al.* 2005; FAO 2004; Ferraro and Kiss 2002; Herrador and Dimas 2000; Pagiola *et al.* 2005; Postel and Thompson 2005; Redondo-Brenes and Welsh 2006; Sarin 1996; Shackleton *et al.* 2002). Using data collected with household surveys, this paper examines the economic and household factors associated with respondents' willingness to participate in community-based management of a potential PES program for protecting and managing hydrological services of subwatersheds in Eastern Costa Rica.

This paper proceeds by describing current water quality and deforestation issues in Costa Rica and Costa Rica's efforts and experiences with water resources management and payments for watershed services. Then, this paper briefly reviews some literature on community-based natural resource management and factors influencing public

participation. The paper next describes the research site (six communities in eastern Costa Rica) and the survey methods for collecting the data from the six communities where the communities' previous experience with locally-financed and administered drinking water aqueduct systems suggest that collective, local management of PES may be feasible. An empirical model of participation in local management of PES programs is then developed presented before research results are presented and discussed.

2.1.2. Water quality and management in Costa Rica

In Costa Rica, water quality scarcity has been attributed to uneven distribution of drinking water relative to demand and to deficient water treatment (Calvo 1990). In 2005, only 82% of the Costa Rican population had access to a drinking water supply system, and 30% of the water provided by municipalities and communities was not potable based on international standards (Astorga 2005). Given its location in the tropics, water quantity per se is not presently an issue for Costa Rica. Costa Rica receives 170 km3 of water via precipitation each year and has 0.54 km3 of average drinking water demand (Espinoza *et al.* 2003). However, the local scarcity of water of potable quality is a problem that may increase in the near future because of expected growth in demand estimated at about 45% for the period 2000-2025 (FAO 2000), and severe financial constraints facing the national water agency may face (Astorga 2005; AyA and OPS/OMS 2002; Espinoza *et al.* 2003).

While there are some uncertainties linking land-use changes and watershed services, the adverse impact of tropical deforestation on water quality sources seems clear (Bruijnzeel 2004). Costa Rica's rate of deforestation between 1986 and 1992 was about 4% per year, and is expected to continue in the country's unprotected remaining forest cover (Sanchez-Azofeifa *et al.* 2001). In the absence of proper watershed management, uncontrolled

deforestation will most likely adversely impact the future availability of potable water in Costa Rica.

Recently, Costa Rica adopted a policy change to shift towards a more integrated and watershed-oriented management approach toward its water resources. Two core changes in Costa Rica's water policy are: 1) the use of watersheds as the resource management planning units, and 2) the mandatory incorporation of local resource beneficiaries in key roles in watershed management and conservation (Astorga 2005, p. 4; MINAE 2005). Costa Rica's water policy change may be thought of as a shift towards a more sustainable management strategy for the conservation of water sources (e.g., de Sherbinin *et al.* 1996; e.g., Postel *et al.* 1996).

2.1.3. Costa Rica's System of Payment for Watershed Services

Throughout the Americas, watershed-based payment for environmental services [PES] programs have been explored as means for promoting residents' conservation and development of hydrological services (e.g., Echavarria 2002; FAO 2004; Postel and Thompson 2005; Southgate *et al.* 2005). In PES programs for watershed protection, upstream land users (e.g., farmers) are paid by downstream water users for adopting land use practices (e.g., forest land uses) that limit deforestation, erosion, and flooding risks (Wunder 2006). In the case of Costa Rica, the country's PES experience has been largely limited to a national level approach that, among other conservation goals, has focused on protecting upstream forests in large watershed that typically provide hydroelectricity (Pagiola 2002; Pagiola 2006).

Under the current national PES scheme in Costa Rica, water conservation payments are contracted via ad-hoc voluntary agreements between single dominant water users (e.g.,

hydroelectric companies) and a semi-autonomous state forestry agency (FONAFIFO). FONAFIFO administers the contracts and financial operation of the national PES program. In addition, there is at least one "local' PES program in Costa Rica in the province of Heredia-the Procuencas program (Castro 2001; Montagnini *et al.* 2005; Pagiola 2006). Local management with participation of community members and independence from FONAFIFO is considered a reason behind the success of the Procuencas program (Redondo-Brenes and Welsh 2006).

Given the potential that community participation and PES programs together may offer communities improved tools to address the water resource management, this paper considers community-based management approaches and tries to understand determinants of public participation in environmental governance in order to identify those factors most likely to positively affect local involvement in watershed management.

2.2. CONCEPTUAL FRAMEWORK

2.2.1. Community-Based Natural Resource Management (CBNRM)

Participatory approaches devolve decision-making rights, benefits, and responsibilities to local populations (World Bank 2000). Public participation has been recognized, within the context of natural resources management, as an effective means for giving local populations a voice in the use of and access to resources, thereby helping with the development of appropriate institutions for sustainable management (Beierle and Cayford 2002). The literature suggests that community-based approaches receive special attention when the resource problems require solutions that: i) concern the management of local resources; and ii) demand action at the community level (e.g., Agrawal and Gupta 2005; Engel *et al.* 2005; e.g., Shackleton *et al.* 2002). If such resource management regimes are

based on local context and support of local participatory governance structures, they are more likely to enhance system performance (Ostrom 1992).

According to Agrawal and Gupta (2005), some of the earliest research on participation focused on individuals' propensity to participate in political activities. Studies of participation in natural resource management have built upon previous work by incorporating equity and distributional concerns (Agarwal 2001; Weinberger and Jutting 2001). To a large extent, previous examinations of individuals' participation in community-based management have been limited to decisions concerning common property resources management (e.g., Agrawal and Gupta 2005; e.g., Baland and Platteau 1996; Engel *et al.* 2005; Sarin 1996; Shackleton *et al.* 2002). The area of understanding participation of local beneficiaries in community-based management of PES programs for protecting and managing tropical watersheds and their related environmental services has not been previously reported.

2.2.2. Determinants of Participation

Previous research into public participation in governance has asserted that participatory governance processes may be successful if users see net potential gains of taking part in decision-making activities (Ostrom 1990). Therefore, we will considerer households' opportunity costs associated with participation in the study's proffered participatory management scheme. Participation takes time, so it is natural to consider labor availability within households. For instance, since the size of a household may serve as an indicator of labor availability as well as potential side-benefits to be derived from resources (Naik 1997), the influence of a households' size should be considered. Moreover, studies of participatory development suggest that women may be less likely to participate in environmental decision-

making where male dominated social structures are in place (Agarwal 2001). So, gender may be a key variable worth investigating.

The literature also suggests that households' benefits from participation in collective governance processes may come from: i) influencing decisions in its favor given their dependence on the resource, and, ii) the ability to influence decisions when participating (Behera and Engel 2005). In line with this literature, some studies in participation of watershed management have found that most people only participate on personally critical issues (Irvin and Stansbury 2004) such as a dependency on the subject matter resources (e.g., access to drinking water). Therefore, we expect that households with a critical dependence of watershed services and those that perceive decision-making benefits from participating in the process will positively influence their willingness to participate. In terms of the ability of the households to influence decisions when participating, learning from past experiences in decisionmaking such as voting in local elections seems to play an important role. For instances, mental reinforcements from previous experiences in decision making are often found to be central in determining beliefs regarding the value of taking part in a particular planning process (Tuler *et al.* 2002). This literature suggests that unless there is a strong feeling among the participants that they can not influence decisions based on previous experiences, individuals are likely to participate (Halvorsen 2006).

Likewise, households' trust in current administrative structures and its positive effect on participation have been highlighted in the literature (Smith and McDonough 2001a). Therefore, we expect that communities with watershed administrations perceived as trustworthy to positively influence local beneficiaries willingness to participate (Webler and Tuler 2001). The participation literature has also examined the role of household heads'

demographic characteristics (e.g., income – education level, and age) on their decision to participate. Studies of participation in natural resource management have found that higher income community members (often more educated) may be more likely to influence decisions compared to those belonging to marginalized segments of the population (Lise 2000; McComas 2001). Traditional power structures seem to dominate community decision-making and, thus, higher income or education may be a proxy for greater bargaining power and, hence, ability to influence decisions (Engel *et al.* 2005). The role of age as a proxy for experience is more ambiguous (Zbinden and Lee 2005) since reluctance of individuals to engage in new activities may increase with age.

To implement our participation study, the abovementioned determinants will be examined in the context of an existing drinking water distribution system and a proposed watershed management approach in eastern Costa Rica. In the following section we present general information about the research site and research methods. We also present research findings and a discussion of the results.

2.3. STUDY SITE, SURVEY, DATA, AND SUMMARY STATISTICS

2.3.1. Study Site

The setting of the reported research is in Siquirres canton, eastern Costa Rican's humid tropics. The study area is located within the Reventazón River macro-watershed (about 65 miles from the capital city, San José). A river with the same name is the primary river in the region with its tributaries supplying water to local communities. The Destierro, Cairo, Peje, Vueltas and Germania Rivers, all tributaries of the Reventazón, constitute five micro-watersheds in which intensive systems of banana and pineapple production for export are the major land use.

This study collected information in six different communities in the Reventazón watershed. These communities have prior experience with locally-financed and administered drinking water systems (i.e., aqueducts). The six rural aqueducts in this study provide water to approximately 4,500 households distributed among several communities within five of the six districts within the Siquirres canton (See Table 2.1). Because the water in the local river is too polluted for drinking, water is collected via aqueducts to the natural springs at the headwaters of the Destierro, Cairo, Peje, Vueltas and Germania Rivers. The rural aqueducts are administrated by community-based committees called "Asociaciones Administradoras de Acueductos y Alcantarillados" (ASADAS) or "Comités Administradores de Acueductos Rurales" (CAARS). These associations/committees were organized at the time that construction of the drinking water supply systems took place to administer, operate and maintain the drinking water supply systems (Espinoza *et al.* 2003).

The six reported rural communities' micro-watersheds are of interest because they face growing resource development conflicts and degradation issues. There is increasing demand for water in the lower reaches of these watersheds because of the proliferation of agricultural production and processing, particularly pineapple and banana crops. At the upper reaches of these watersheds, increased deforestation threatens the quality of the water sources. The threats to water sources coupled with current environmental concerns has driven local agencies' to consider alternative and participatory approaches to water source management including local, collective protection of watersheds.

Table 2.1. Reported communities' aqueducts

Micro-watershed	Altitud (m)	Community Aqueduct	Type of Operator	Neighborhoods Served	Estimated Households Serviced	Interviews Collected
Río Destierro	79-62	Milano	CARRS	Milano	344	136
Ríos Cairo y Peje	88-71	Cairo-Francia	CARRS	Cairo y Francia	656	164
Ríos Vueltas y Germania	218- 98	Herediana	ASADA	Herediana, Alto Herediana, La Esmeralda, Germania, Alto Germania, El Ceibo	1596	399
Río Peje	201-160	La Florida	CARRS	La Florida, Calle Fuentes, El Cruce, Barrio Nuevo	996	249
Ríos Peje y Vueltas	345-175	La Alegría	ASADA	La Alegría	524	131
		Portón Iberia	CARRS	Finca Portón Iberia	416	104

2.3.2. Survey Methods

This research results are based on data collected use a face-to-face household survey. The survey was designed to determine households' willingness to participate in a local committee for administering a possible payment for environmental services [PES] program for protecting their drinking water sources. The program would help change land uses in the study areas' headwaters to protect water quality, quantity and reliability. Using an iterative design approach, the household survey was pretested and refined to assure respondents' understanding of the policy context, trade-offs, and elicitation method (Kaplowitz *et al.* 2004). The survey provided background information to the respondents about the communities' water supply aqueducts and land use issues within

the watershed, and it also made clear that management programs may require participation of members of the community to help administer operations. The survey questionnaire collected data on respondents' socio-economic characteristics, water-related perceptions, and governance attitudes. Specifically, the questionnaire asked if respondents would participate in a local committee administering a PES program to protect their current drinking water sources.

The in-person interviews were implemented during a 31-day period in July 2006 in six Costa Rica communities that rely upon the local watershed for drinking water. The research target population were male or female heads of household (18 years of age or older) that receive their water from a community-owned rural aqueduct. Satellite photographs were used to divide the target watershed communities into clusters. Clusters were then randomly selected to determine the households to be interviewed. If a head of household was not available during a first attempt to conduct an interview, that house was revisited up to two additional times. A total of 1182 completed interviews were obtained. Adopting AAPOR's (2006) standards for survey and public opinion research, our study has a minimum response rate (RR1) of 84% and a 96% minimum cooperation rate (COOP1).

2.3.3. Summary Statistics

Key summary statistics from the survey are presented in Table 2.2. We found that, on average, the ratio of adults (≥18 years old) to children (<18 years old) living within households was less than 2:1. As a result, we estimated slightly less than 4 members per household in the study area. Heads of household were 73% female; have lived in the community no longer than 11 years; and 73% have less than a primary school education

level. Average household monthly income was estimated to be about 140,000 colones (1 US dollar = 510 colones). Incomes were obtained directly from respondents and, if respondents refused to provide an open-ended response, income was estimated using mid points values from follow-up income-range questions.

Respondent's water-related behaviors revealed that water use within the studied communities is entirely aimed for domestic purposes. On average, 50 % of the respondents perceived water service as having "Good Pressure" (i.e., equivalent to a 2) using a 1 to 5 scale with 1 being Extremely Good Pressure and 5 being Extremely Poor Pressure. In addition, we found that 60% of respondents reported have voluntarily participated in community activities such as voting, and 61 % trust the current water service administration. We also found that approximately 50% of respondents indicate a willingness to participate in the Aqueduct Committee that administers the PES program.

Table 2.2 Variables definitions and descriptive statistics

Variable	Description	Measurement	Mean	Std. Dev.	Min	Max
PARTICIPATION	Dummy (=1 for participating in local committee to administer PES program)	1 or 0	0.475	0.499	0	1
PREVOTE	Dummy (= 1 for vote in previous elections)	1 or 0	0.512	0.500	0	1
YEARS	Natural log of the number of years living in the community	Positive real numbers	2.431	1.076	0	4.431
SIZE	Number of adults and children living within household	Integer	3.902	1.811	1	15
RATIO	Ratio of adults (≥18 years old) to children (<18 years old)	Positive real numbers	1.708	1.147	0	8
INCOME	Monthly income	10,000 colones	14.271	14.444	0.7	200
GENDER	Dummy (= 1 for female household head)	1 or 0	0.716	0.451	0	1
EDUCATION	Dummy (= 1 for level of education less than primary)	1 or 0	0.730	0.444	0	1
PRESSAT	Scale 1-5, 1 being Extremely Good Pressure and 5 being Extremely Poor Pressure	1,2,3,4,5	2.364	1.133	1	5
TRUST	Dummy (=1 for trust in current aqueduct management)	1 or 0	0.668	0.471	0	1
PREVOTE-hat	Predicted probability of voting, an Instrumental Variable	Positive real numbers	0.497	0.115	0.07	0.761

2.4. PARTICIPATION MODEL

Let us assume that households' decisions are consistent with maximization of an underlying preference function. Therefore, a household's choice to participate in the local committee for administering the water service PES program depends on the expected benefits. However, willingness to participate may vary from one household to another as they are not equally endowed (Engel *et al.* 2005).

We model a two-stage individual household (i) decision to participate in community-based management of PES (y) as a binary outcome dependent on a set of household's socio-

economic factors (Z_i) and household's previous voting in community elections (g_i). The reasons for including the various elements of Z_i and g_i draw from the literature on participation in environmental governance. Likewise, we hypothesize that the effect of (g_i) is endogenous since it may be affected by some of the same household and individual characteristics influencing the participation decision (y_i). Methodologically, we test for this endogeneity, and we solve this problem by applying a two-stage probit instrumental variable method (Gujarati 2003; Wooldridge 2001).

Taking into account the binary nature of our dependent variable, we derive the following probit specification for the probability of outcome y_i as given by:

$$\Pr(y_i = 1) = \Phi(\beta_1 W_i + \beta_2 F_i + \beta_3 L_i + \beta_4 H_i + \beta_5 T_i + \beta_6 \hat{g}_i) \qquad (1)$$

where, Φ is the cumulative density function for the standard normal distribution, and $\Pr(y_i=1)$ represents the probability that household i is willing to participate in the local committee to administer the PES program. W_i, F_i, L_i, H_i, and T_i represent the following household and individual characteristics: income, natural log of years living in the community, water pressure satisfaction, household size, and trust in current aqueduct management, respectively.

$\hat{g}_i$ is the predicted probability of voting in past community elections resulting from the estimation of the following probit specification:

$$\Pr(g_i = 1) = \Phi(\alpha_1 W_i + \alpha_2 S_i + \alpha_3 E_i + \alpha_4 F_i + \alpha_5 R_i) \qquad (2)$$

where, $\Pr(g_i=1)$ indicates the probability of household i voting in local elections, and, W_i , S_i E_i, F_i, *and* R_i represent household and individual characteristics, income, gender, education, natural log of years living in the community, and household ratio, respectively (see Table 3).

A consequence of our formulation is that we can distinguish between: a) direct effects of household and individual socio-economic factors ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$) on the decision to participate in the local committee administering the PES program, and b) indirect effects of some of the same factors ($\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$) embedded in $\hat{g}_i$ by estimating (β_6) where β_6 represents the second stage parameter for the effect of the probability of previous voting in community elections on the decision to participate. The adoption of this model specification and the estimation of eq. (1) enable us to draw conclusions on total effects and account for the potential endogeinity of previous voting. The dependent variables in the two stages are: (1) Previous Voting in Local Elections (g_i), a dummy variable taking the value 1, if the household has voted in local elections, and 0 otherwise, and (2) Participation in the local committee administering the PES program (y_i), a dummy variable that takes the value 1, if a household is willing to participate, and 0 otherwise.

Table 2.3. Variables' hypothesized effects on participation based on previous research studies

Variables		Expected Effect	Associated Research
YEARS	F_i	-	(Zbinden and Lee 2005, p. 5)
SIZE	H_i	+	(Naik 1997)
RATIO	R_i	+	(Naik 1997)
INCOME	W_i	+	(Engel *et al.* 2005; Lise 2000; McComas 2001)
GENDER	S_i	-	(Agarwal 2001).
EDUCATION	E_i	-	(Adhikari *et al.* 2004; Lise 2000; Stem *et al.* 2003; Verba *et al.* 1993)
PRESSAT	L_i	+	(Irvin and Stansbury 2004)
TRUST	T_i	+	(Smith and McDonough 2001b; Webler and Tuler 2001)
PREVOTE-hat	g_i	+	(Halvorsen 2006; Tuler *et al.* 2002)

2.4.1. Model estimation and results

For estimating our participation model, an instrumental variable probit model was used for equations (1) and (2) using the STATA software package. Observations with missing data were excluded from the estimation. Overall, the chi-squared test of the first and second stage of the model indicates that the model is highly significant ($p<0.000$). Key variables in the model were also significant and of the expected sign. Coefficients, test statistics, robust standard errors and marginal effects for the participation decision are reported in Tables 2.4 and 2.5.

Table 2.4. Household Participation First Stage Model Estimated Results

(PREVOTE)

	Coefficients	Z-values[a]	P-values[a]	Marginal Effects[b]	Means
FIRST STAGE: ***Participation in Local Elections***					
INCOME	-0.004	(-1.23)	0.219	-0.0015	14.268
GENDER	-0.285	(-3.32)	0.001	-0.1132	0.728
EDUCATION	-0.031	(-0.35)	0.723	-0.0124	0.723
YEARS	0.238	(6.55)	<0.001	0.0951	2.421
RATIO	-0.075	(-2.22)	0.027	-0.0300	1.707
Constant	-0.181	(-1.19)	0.236		
N	1140				
LogL	-759.700		<0.001		
-2ln(Lr/Lu)	59.58				
$P(y_i = 1 \mid X_i)$			0.494		

a. Z-stats and P-values are based on robust standard errors computed using the sandwich estimator.
b. Marginal effect of variable on the probability of yes outcome evaluated at the mean values of the independent variables as well as at for discrete change of dummy variable from 0 to 1.

As is shown in Table 2.4, we found with regard to the first stage that GENDER ($p=0.001$), YEARS ($p<0.001$), and RATIO ($p<0.05$) significantly influence household's PREVOTE. For instance, based on our results we could infer that women heads of household with positive RATIO who have recently moved to the community are significantly less likely to

vote in community elections than other community segments. Another insight from the model's first stage, although not significant, is the observed negative effect of INCOME and RATIO on previous voting in local elections. This result indicates that people who have a higher level of income may face larger opportunity cost of time for participating. This stage serves as the basis for computing the estimated probabilities for PREVOTE-predicted (i.e., the instrumental variable in the second stage).

Table 2.5. Household Participation Second Stage Model Estimated Results

	Coefficients	Z-values[a]	P-values[a]	Marginal Effects[c]	Means
SECOND STAGE[b]: *Participation in local committee for administrating the PWES*					
PREVOTE- hat	1.832	(9.79)	<0.001	0.6396	0.512
INCOME	0.004	(1.95)	0.051	0.0017	14.271
YEARS	-0.212	(-6.32)	<0.001	-0.0846	2.431
SIZE	0.02	(0.96)	0.335	0.0079	3.902
PRESSAT	0.055	(1.77)	0.076	0.0218	2.364
TRUST	-0.008	(-0.1)	0.922	-0.0033	0.6683
Constant	-0.718	(-3.95)	<0.001		
N	1043				
LogL	-1430.3188		<0.001		
-2ln(Lr/Lu)	163.85				
Wald test of exogeneity chi^2	11.76		0.001		
$P(y_i = 1 \mid X_i)$			-0.036		

a. Z-stats and P-values are based on robust standard errors computed using the sandwich estimator.
b. Values are computed using the Instrumental Variable Probit regression tool in STATA.
c. Marginal effect of variable on the probability of yes outcome evaluated at the mean values of the independent variables as well as at for discrete change of dummy variable from 0 to 1.

We found during the second stage model estimation that key variables in the model were significant (at the 10% level) and of the expected sign (See Table 2.5) with the exception of TRUST which was not significant. As expected, PREVOTE-predicted shows a positive effect ($p<0.001$) during the second stage on participation. Another insight from the model is the observed negative effect of YEARS ($p<0.001$), and positive effect of both INCOME

($p<0.1$), and PRESSAT ($p<0.1$). In particular, the model indicates that YEARS has a significant negative effect on PARTICIPATION. Members who have lived longer in the community tend to be less likely to participate. The positive effect of INCOME and SIZE may be attributed to the relationship they have with the degree of participants' investment in the outcome of decision-making. For instance, our model suggests that a higher income, better educated household head with a large size family may be more inclined to participate in the local committee.

2.4.2. Marginal Effects

The marginal effects are computed and reported in the second-to-last column of Table 2.4. These effects represent the unconditional marginal effects of each variable on the probability that a respondent would be willing to participate. The marginal effects are evaluated at the sample means. Another finding from our model is the observed marginal effect of PREVOTE-predicted. The average probability of previous participation was estimated to be about 50%. Hence, it is predicted that every percentage point of increased probability of PREVOTE-predicted increases the likelihood of a person being willing to participate in the local committee for administrating the PES program by about 0.63 percentage points.

Likewise, the mean perception level of PRESSAT was estimated to be about 2, which indicates that respondents perceive their current water services as having good pressure. The marginal effect indicates that a one unit increase in one's PRESSAT score would increase the probability of participating in the program by about 2.2 percent points (probability increases by 0.022 per unit). In other words, a person who perceives the water service pressure as being Extremely Poor (i.e., level 5) is about 11.0 percentage points more likely to participate than a

person who perceives the water service pressure as being Extremely Good. In addition, the mean YEARS were estimated at about 11, so an additional year of residence decreases the probability of participating by about 0.7 percentage points. Accounting for the non-linear effect of this variable, a person with 10 years residing in the community is about 11.5 percentage points more likely to participate than a person with 40 years. The model also shows that an additional 10,000 colones per month in average INCOME, about 140,000 colones, is predicted to increase the probability of participating by 0.17 percentage points (probability increases by 0.0017 per colones). Lastly, the average household's SIZE was estimated to be about 4 persons. Although the effect was not found to be significantly different than zero, an additional household member is predicted to increase the probability that a household head decides to participate by 1 percentages point (probability increases 0.01 per member).

2.5. CONCLUSIONS AND POLICY IMPLICATIONS

It has been increasingly recognized that participatory and ecosystem-based management approaches might lead to more effective protection of global water supplies. Consistent with this idea is the possibility of enhancing progress by working with affected populations within a watershed context, where relationships between forest-use practices and the condition of water quality can be better recognized and managed. In Costa Rica, there has been a recent move toward more sustainable and integrated forms of water resources management jointly with a significant proliferation of ecosystem-based financial instruments as mechanisms of support for conservation activities. Despite recent emphasis on these concepts, water quality scarcity, degradation of watershed's forest and associated stress on human populations continue. Therefore, our attempt to

improve understanding with regard to participation in community-based management of payment for environmental services programs for protecting watersheds is consistent with fostering the development of both local management approaches, and with the use of incentive mechanisms to finance conservation of natural resources.

This study examined households' willingness to participate using an empirical model and identified factors that appear to significantly influence the participation decision. We implemented a two-stage instrumental variable probit regression in order to estimate the relative importance of factors influencing household's potential participation. At the first stage, we analyzed the determinants influencing decisions to vote in local elections. At the second stage, we estimated the extent that certain determinants, including voting in previous elections, have on willingness to participate in local committee to administrate a PES program for protecting watersheds. Using this approach, we found that about half of our sample's respondents indicated a willingness to participate in the proposed committee. As hypothesized, voting in past local elections was a crucial determinant, and the number of years leaving in the community was also relevant. To a lesser extent, income and satisfaction with regard to current water service pressure were also important factors determining willingness to participate. In particular, people within our study communities who have previously voted in local elections, have higher income (often more educated), have not resided more than 11 years in the community, tend not to have trust in the current water administration, and feel unsatisfied with their current water service's pressure, are more likely to participate than other types of people in the communities.

Two important policy implications from our empirical results can be drawn. First, our research finds a strong indication of support for local, collective management and protection of hydrological services in the study areas' headwaters. The results are evidence that local participation in community-based management is not an obstacle for the viability of PES approaches for protecting and managing tropical watersheds and associated services. Second, there is potential for transferring our results to similar settings within Costa Rica where PES programs could benefit from local participation. This may also apply to communities in other countries, where community elections and provision of drinking water via locally-financed and administered rural aqueducts are familiar processes to local residents.

REFERENCES

AAPOR. (2006). *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, The American Association for Public Opinion Research (AAPOR), Lenexa, Kansas.

Adhikari, B., Di Falco, S., and Lovett, J. C. (2004). "Household characteristics and forest dependency: evidence from common property forest management in Nepal." *Ecological Economics*, 48(2), 245.

Agarwal, B. (2001). "Participatory Exclusions, Community Forestry, and Gender: An Analysis for South Asia and a Conceptual Framework." *World Development*, 29(10), 1623-1648.

Agrawal, A., and Gibson, C. C. (1999). "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." *World Development*, 27(4), 629-649.

Agrawal, A., and Gupta, K. (2005). "Decentralization and participation: The governance of common pool resources in Nepal's Terai." *Word Development*, 33(7), 1101-1114.

Astorga, Y. (2005). "Estado y gestión del recurso hídrico en Costa Rica: Informe Final." Programa Estado de la Nación (PEN), San José, Costa Rica.

AyA, and OPS/OMS. (2002). *Agua potable y saneamiento de Costa Rica: Análisis sectorial: Resumen Ejecutivo*, Instituto Costarricense de Acueductos y Alcantarillados (AyA) and Organización Panamaericana de la Salud/Organización Mundial de la Salud (OPS/OMS), San José, Costa Rica.

Baland, J. M., and Platteau, J. P. (1996). *Halting Degradation of Natural Resources: Is there a Role for Rural Communities?* Clarendon Press: United Nations food and Agriculture Organization and Oxford, New York.

Bawa, K. S., Seidler, R., and Raven, P. H. (2004). "Reconciling Conservation Paradigms." *Conservation Biology*, 18(4), 859-860.

Behera, B., and Engel, S. (2005). "Who forms local institutions? Levels of household participation in India's Joint Forest Management program." Annual Meetings of the International Society for New Institutional Economics (ISNIE), Barcelona, Spain.

Beierle, T. C., and Cayford, J. (2002). *Democracy in Practice: Public Participation in Environmental Decisions*, Resources for the Future., Washington, D.C.

Bruijnzeel, L. A. (2004). "Hydrological functions of moist tropical forests: not seeing the soil for the trees?" *Agriculture, Ecosystems and Environments*, 104, 185-228.

Calvo, J. C. (1990). "Water resources development in Costa Rica 1970-2000." *Hydrological Sciences Journal*, 35(2), 185-196.

Castro, E. (2001). "Costarrican experience in the charge for hydro environmental services of the biodiversity to finance conservation and recuperation of hillside ecosystems." International Workshop on Market Creation for Biodiversity Products and Services, OECD, Paris, 25-26 January 2001.

de Sherbinin, A., Dompka, V., and Bromley, L. (1996). "Water and Population Dynamics: Case Studies and Policy Implications." The International Union for the Conservation of Nature and Natural Resources (IUCN), Montreal, Canada.

Dietz, T., Ostrom, E., and Stern, P. C. (2003). "The Struggle to Govern the Commons." *Science*, 302(5652), 1907-1912.

Echavarria, M. (2002). "Financing Watershed Conservation: the FONAG Water Fund in Quito, Ecuador." Selling Forest Environmental Services: Market-Based Mechanism for Conservation, S. Pagliola, J. Bishop, and N. Landell-Mills, eds., Earthscan, London, UK, 91-101.

Engel, S., Iskandarani, M., and Useche, M. d. P. (2005). "Improved water supply in the Ghanaian Volta Basin: Who uses it and who participates in community decision making." EPT Discussion Paper No. 129., International Food Policy Research Institute (IFPRI), Washington, DC.

Espinoza, A., Morera, A., Mora, D., and Torres, R. (2003). *Calidad del agua potable en Costa Rica: Situación actual y perspectivas*, Organización Panamericana de la Salud/Organización Mundial de la Salud (OPS/OMS), Ministerio de Salud de Costa Rica e Instituto Costarricense de Acueductos y Alcantarillados, San José, Costa Rica.

Executive_Decree_No.32868. (2006). "Canon por Concepto de Aprovechamiento de Aguas." El Presidente de la Repúbica y el Ministro del Ambiente y Energía.

FAO. (2000). "AQUASTAT-Information System on Water and Agriculture: Countries and Regions - Costa Rica." AQUASTAT-Sistema de Informacion sobre el Uso del Agua en la Agricultura y el Medio Rural de la FAO, Food and Agriculture Organization of the United Nations (FAO) - Land and Water Development Division, Roma.

FAO. (2004). "Payment schemes for environmental services in watersheds - Land and Water Discussion Paper 3." Regional Forum, Arequipa, Peru, June 9–12, 2003, Food and Agriculture Organization of the United Nations - Regional Office for Latin America and the Caribbean, Rome, Italy.

Ferraro, P. J. (2001). "Global Habitat Protection: Limitations of Development Interventions and a Role for Conservation Performance Payments." *Conservation Biology*, 15(4), 990-1000.

Ferraro, P. J., and Kiss, A. (2002). "Direct Payments to Conserve Biodiversity." *Science*, 298(5599), 1718-1719.

Gujarati, D. N. (2003). *Basic Econometrics*, McGraw-Hill.

Halvorsen, K. (2006). "Critical Next Steps in Research on Public Meetings." *Human Ecology Review*, 13(2), 150-160.

Herrador, D., and Dimas, L. (2000). "Payment for Environmental Services in El Salvador." *Mountain Research and Development*, 20(4), 306-309.

Irvin, R. A., and Stansbury, J. (2004). "Citizen participation in decision making: Is it worth the effort?" *Public Administration Review*, 64, 55-65.

Kaplowitz, M. D., Lupi, F., and Hoehn, J. P. (2004). "Multiple-Methods for Developing and Evaluating a Stated Preference Survey to Value Wetland Ecosystems." e. a. S. Presser, ed., John Wiley and Sons, Inc., Hoboken, NJ, 503-524.

Kerr, J. (2002). "Watershed Development, Environmental Services, and Poverty Alleviation in India." *World Development*, 30(8), 1387-1400.

Lise, W. (2000). "Factors influencing people's participation in forest management in India." *Ecological Economics*, 34, 379-392.

McComas, K. A. (2001). "Public meetings about local waste management problems: Comparing participants to nonparticipants." *Environmental Management*, 27, 135-147.

Millennium_Ecosystem_Assessment. (2005). *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington, DC.

MINAE. (2005). "Primera Etapa: Estrategia para la Gestión Integrada de Recursos Hídricos En Costa Rica." *Proyecto BID ATN/WP - 8467- CR*, Ministerio del Ambiente y Energía (MINAE) & Banco Interamericano de Desarrollo, San José, Costa Rica.

Montagnini, F., Cusack, D., Petit, B., and Kanninen, M. (2005). "Environmental Services of Native Tree Plantations and Agroforestry Systems in Central America." *Journal of Sustainable Forestry*, 21(1), 51-67.

Naik, G. (1997). "Joint forest management: Factors influencing household participation." *Economic and Political Weekly*, 32 (48), 3084-3089.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, Cambridge.

Ostrom, E. (1992). *Crafting Institutions for Self-Governing Irrigation Systems*, Institute for Contemporary Studies Press, San Francisco, CA.

Pagiola, S. (2002). "Paying for Water Services in Central America: Learning from Costa Rica." Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development, S. Pagiola, J. Bishop, and N. Landell-Mills, eds., Earthscan, London, 37-62.

Pagiola, S. (2006). "Payments for Environmental Services in Costa Rica." revised version of a paper presented at the ZEF-CIFOR workshop on Payments for environmental services: Methods and design in developing and developed countries, Titisee, Germany, June 15-18, 2005.

Pagiola, S., Arcenas, A., and Platais, G. (2005). "Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America." *World Development*, 33(2), 237-253.

Postel, S. L., Daily, G. C., and Ehrlich, P. R. (1996). "Human Appropriation of Renewable Fresh Water." Science, 785-788.

Postel, S. L., and Thompson, B. H. (2005). "Watershed protection: Capturing the benefits of nature's water supply services." *Natural Resources Forum*, 29, 98-109.

Redondo-Brenes, A., and Welsh, K. (2006). "Payment for hydrological environmental services in Costa Rica: The Procuencas case study." *Tropical Resources Bulletin*, 24, 19-25.

Sanchez-Azofeifa, G. A., Harriss, R. C., and Skole, D. L. (2001). "Deforestation in Costa Rica: A Quantitative Analysis Using Remote Sensing Imagery." *Biotropica*, 33(3), 378-384.

Sanchez-Azofeifa, G. A., Harriss, R. C., Storrier, A. L., and de Camino-Beck, T. (2002). "Water Resources and Regional Land Cover Change in Costa Rica: Impacts and Economics." *International Journal of Water Resources Development*, 18, 409-424.

Sarin, M. (1996). "From conflict to Collaboration: Institutional Issues in Community Management." Village Voices, Forest Choices: Joint Forest Management in India, M. Poffenberger and B. McGean, eds., Oxford University Press, USA.

Shackleton, S., Campbell, B., Wollenberg, E., and Edmunds, D. (2002). "Devolution and community-based natural resource management: creating space for local people to participate and benefit." Oversea Development Institute, London.

Smith, P., and McDonough, M. (2001a). "Beyond public participation: Fairness in natural resource decision making." *Society and Natural Resources*, 14, 239-249.

Smith, P. D., and McDonough, M. H. (2001b). "Beyond public participation: Fairness in natural resource decision making." *Society and Natural Resources*, 14, 239-249.

Southgate, D., Haab, T., and Rodríguez, F. "Payments to the Rural Poor for the Sake of Conserving Tropical Watersheds: A Contingent Valuation Analysis in Ecuador." *meeting of the Association of Environmental and Resource Economists*, Providence, Rhode Island.

Stern, C. J., Lassoie, J. P., Lee, D. R., Deshler, D. D., and Schelhas, J. W. (2003). "Community Participation in Ecotourism Benefits: The Link to Conservation Practices and Perspectives." *Society and Natural Resources*, 16(5), 387-413.

Tuler, S., Webler, T., Shockey, I., and Stern, P. C. (2002). "Factors influencing the participation of local governmental officials in the national estuary program." *Coastal Management*, 30, 101-120.

Verba, S., Schlozman, K. L., Brady, H. E., and Nie, N. H. (1993). "Citizen activity: Who participates? What do they say?" *American Political Science Review*, 87(2), 303-318.

Webler, T., and Tuler, S. (2001). "Public participation in watershed planning." *Human Ecology Review*, 8(2), 29-39.

Weinberger, K., and Jutting, J. P. (2001). "Women's Participation in Local Organizations: Conditions and Constraints." *World Development*, 29(8), 1391-1404.

Wooldridge, J. M. (2001). *Econometric Analysis of Cross Section and Panel Data*, The MIT Press.

World Bank. (2000). "Chapter 6: Making State Institutions More Responsive to Poor People." World development report 2000/2001: Attacking poverty., World Bank.

Wunder, S. (2006). "Are direct payments for environmental services spelling doom for sustainable forest management in the tropics?" *Ecology and Society*, 11(2), 23-35.

Zbinden, S., and Lee, D. R. (2005). "Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program." *World Development*, 33(2), 255-272.

ESSAY 3
PAYMENT FOR ENVIRONMENTAL SERVICES: ESTIMATING DEMAND WITHIN A TROPICAL WATERSHED

3.1. INTRODUCTION

Resource use conflicts and degradation problems affecting ecosystems and associated human populations continue to grow. Tropical deforestation, deployment of advanced technologies for resource use, and population growth are considered among global factors threatening ecosystems (Dietz *et al.* 2003). Moreover, in the international donor community there has been a shift in general priorities from the environment toward poverty alleviation strategies resulting in decline in conservation funding from mainstream sources of green aid (Wunder 2006). From the early to late 90s, the simultaneous drop in bilateral and multilateral agencies' forest-sector funding can be estimated to be approximately about 25 and 60%, respectively (Molnar *et al.* 2003). In response to these trends, the adoption of approaches to capture some of the value of natural assets to finance in-situ conservation and management of watersheds services is increasingly promoted by multilateral agencies like the World Bank (World Bank 2003) and countries such as Costa Rica (e.g., Castro 2001; Miranda *et al.* 2007). One such approach, Payment for Environmental Services (PES), is the subject of this study.

3.1.1. Costa Rican Watersheds' Threats

Deforestation and water quality scarcity in Costa Rica may be fostering the country's interest on alternative approaches to watersheds management. Deforestation and forest fragmentation in Costa Rica are thought to have implications for the national watershed systems. Costa Rica's estimated deforestation rate between 1986 and 1992 remained on

the order of 4% per year and is expected to continue to affect the country's unprotected remaining forest cover (Sanchez-Azofeifa *et al.* 2001). Moreover, a recent study reported that most of the drainage basins in Costa Rica have less than 50% forest cover. Moreover, forest fragmentation was highest in few noteworthy river basins such as the Reventazón macro-watershed, which is the major watershed of this study's concerns (Sanchez-Azofeifa *et al.* 2002).

Water quality scarcity exist in Costa Rica due to uneven water service distribution relative to demand and deficient water treatments (Calvo 1990). This situation might be accentuated in the medium term by an expected demand growth that was estimated about 45% for the period 2000-2025 (FAO 2000) and financials constraints that the national water agency may face if proposed new financing mechanisms are not undertaken (see Astorga 2005; AyA and OPS/OMS 2002; Espinoza *et al.* 2003). Although water quantity has not generally been a problem in many areas of Costa Rica, in 2005 only 82% of the Costa Rican population had access to the drinking water supply system, and 30% of the water provided by municipalities and communities was not potable (Astorga 2005).

3.1.2. Financing Conservation & Payment for Environmental Services (PES)

Institutional arrangements involving incentives for locally protecting and managing watershed services may help address the goal of achieving long-term financing of conservation activities. Payment for Environmental Services (PES) approaches are one attempt to use economic incentives to protect natural resources and accommodate agricultural production, forestry, tourism, and drinking water supply (Wunder 2007). The core of watershed PES programs are designed to directly compensate resource users upstream for their natural resource stewardship and the associated ecological services provided to

downstream beneficiaries (Wunder 2006). In fact, direct payment approaches such as PES have been empirically found to be cost-effective means to financially support conservation and sustainable ecosystem management (Ferraro and Simpson 2002).

Costa Rica has implemented a well-known system of PES programs focused on compensating provision of specific forest services such as carbon sequestration, biodiversity protection, and watershed protection (República de Costa Rica 1996). The Costa Rican PES programs have been designed, implemented, and supported at the national scale with external financing from such agencies as the World Bank (Pagiola *et al.* 2005). Like most PES programs so far, the Costa Rican experience has operated as monopsony (Salzman 2005), with only one larger buyer (i.e., FONAFIFO governmental agency) for multiple service provider sellers (Pagiola 2002; República de Costa Rica 1996). To increase it effectiveness, recent assessments of the Costa Rican PES scheme have recommended: a) reducing transaction costs associated to equity concerns (e.g., minimize contractual stages, and facilitate access to information among landowners groups, small farmers in particular) (Zbinden and Lee 2005), b) to target payment schemes, on a priority basis, to encourage the sustainability and recuperation of forest in selected drainage basins; not just in conservation areas (Sanchez-Azofeifa *et al.* 2002), and c) to use differentiated payments so as to allow for differences in both the level of service provision and the opportunity cost of providing services (Pagiola 2006).

Along these lines then, this paper argues that linking beneficiaries with providers via local payments for environmental services programs may be a workable alternative to financially support protection and management of watershed's hydrological services in Costa Rica. Local PES programs are thought to enhance progress towards in-situ conservation by

working with affected populations within a watershed context, where relationships between forest-use practices and the condition of water can be better recognized and managed (FAO 2004). On-going efforts such as the New York City-Catskill PES case (Postel and Thompson 2005) and the Procuencas program in Costa Rica Central Valley (Miranda *et al.* 2007, p. 17; Redondo-Brenes and Welsh 2006) provide evidence that successful PES schemes may be watershed-based, may not require international or national financing, and can result in economic, environmental and equity gains. Likewise, Costa Rica is a country that may offer institutional advantages for the viability of direct watershed-based PES programs. For instance, this country has in place a supportive watershed-based and community-oriented water policy framework (Astorga 2005; MINAE 2005). Additionally, many rural areas of Costa Rica have prior experience with community-financed and operated aqueduct systems (Espinoza *et al.* 2003).

3.1.3. PES: harnessing demand

An interesting feature of most watersheds and their services, however, is that the costs and benefits of their protection and provision are usually borne by different parties spatially and temporally separated, situation which may poses challenges in designing instruments for protecting hydrological services (Postel and Thompson 2005). In the context of Eastern Costa Rican watersheds, environmental steward land-owners upstream may provide hydrological services such as water quantity and quality while local rural aqueducts and their communities' users downstream benefit from those services without compensation. Hence, generating information about trade-offs that people are willing to make across alternative ecological services within the suite of feasible ecological services, perhaps costly, can serve as a guide to policy development (Heal *et al.* 2001).

Economic valuation has been proposed as one tool for organizing that information in a way that can help guide decision-making, and, if wielded together with financial instruments and institutional arrangements that allow individuals to capture the value of ecosystem assets, it is thought to lead to favorable effects (Daily *et al.* 2000).

Based on these insights, the use of direct payment approaches to locally provide and protect watershed environmental services in Eastern Costa Rica makes intuitive economic and policy sense. Researchers working in PES programs argue, however, that a better understanding of demand for the services channeled by PES programs may be one necessary pre-condition for implementation of PES schemes (FAO 2004) and to potentially mainstreaming these institutional arrangements in the tropics (Wunder 2007). In fact, the increased interest in local PES for watershed management has been accompanied by an increased call for empirical research on the demand for and financial sustainability of such programs (e.g., Arocena-Francisco 2003; Postel and Thompson 2005).

To address this empirical need, this research examines the viability of using locally-financed payments to protect watershed services (i.e., PES programming) as an incentive-based policy instrument for protecting and managing watersheds in eastern Costa Rica. Using a dichotomous choice Contingent Valuation [CV] survey, this work measures household's willingness to pay [WTP] higher water bills for PES program payments to change land uses to protect water quality, quantity and reliability. Given the wide range of potentially tradable watershed services and the uncertainties associated to the relation between land uses and specific service provision, this paper continues in section two by elaborating on key analytical considerations that will facilitate our analysis (i.e.,

determining the specific service to be delivered, who the providers and beneficiaries may be, and how the service is to be provided). Then, we review the underlying concepts and premises of the economic approach to understand nonmarket watershed services and its demand. The next section describes the research site and the method used to collect household's data for this nonmarket valuation study in two different Costa Rican communities, each of which has prior experience with locally-financed and administered aqueducts. Section four describes and reports findings for the empirical model of demand for PES programs to protect watershed's hydrological services, and the paper concludes with section five.

3.2. WATERSHED SERVICES DEMAND

Environmental issues related to drinking water may be addressed within the context of watershed management. Hydrologic and ecologic processes are thought to govern the quality of water resources within the watershed[1]. Watersheds are a basic hydraulic unit[2], defined as a delineated area with a well-defined topographic boundary and water outlet (Lal 2000). Within its topographic boundaries, a watershed may comprise a complex set of land uses (e.g., agriculture, forestry, settlements). The extent of the effect of land uses such as forests or agriculture on watershed services has been argued to remain imprecise (Pattanayak 2004). For PES to succeed, understanding the biophysical service delivery pathway is important to identify which specific landscape management practices need to be encouraged (e.g., sustainable forest management or conservation agriculture) or,

[1] A watershed may range in size or it may be simple one with a first-order stream, or a complex conglomerate comprising a network of drainage channels.

conversely, those that need to be discouraged by the policy instrument (e.g., deforestation or factor-intensive agriculture) to secure the provision of the watershed service (Salzman 2005). This task, however, may be a difficult one.

3.2.1. Understanding the science of watershed services

The underlying scientific uncertainty in the link between land uses and watershed services provision has been seen to pose a great challenge in PES design (Pagiola *et al.* 2002). Given this uncertainty, researchers working on PES programs argue that what could be traded trough these contractual schemes is not the desired service itself but a proxy (e.g., paying for protection in selected areas from which communities derived its water supply) (Pagiola *et al.* 2002). Then, the provision of drinking water could involve trading land uses that are thought to generate the desired watershed service. This study continues by exploring some of the current literature on issues concerning the relationship between land use changes and watershed services provision which seem to have built inroads toward this objective.

There is recent evidence reporting specific linkages between changing land uses and provision of water quality (Bruijnzeel 2004), which may adequately serve the purpose of guiding policy analysis. In fact, this proposition has been satisfactorily examined elsewhere (see Kosoy *et al.* 2007). It will suffice to mention that the recent study of watershed PES schemes in Central America by Kosoy and his colleagues argue that watershed PES programs are more likely to be effective when they are targeted to address water quality problems. Kosoy, *et al.*'s (2007) state that this may be the case because

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[2] Regardless the water sources (e.g., rainfall, ground water, local surface storage), hydrologic processes (e.g., infiltration or run-off) within a watershed are interlinked and can be assessed within its confine.

there is less scientific ambiguity concerning the relationship between land use changes and water quality, and less divergence between public expectations and scientific evidence on the link between land use and water quality. Building on Johnson and Baltodano's (2004) previous study in a Nicaraguan watershed, Kosoy *et al.* argue that the local perception that water provision is one of the main forest benefits, and the conventional wisdom that links larger upstream forest cover to both better downstream water quality and greater quantity seem to be common notions among rural dwellers in Central America.

The above information suggests that current empirical and conventional knowledge on the relation between land uses and water provision may support the viability of direct watershed-based PES programs. Subsequently, having narrowed down our discussion so as to identify the specific service to be delivered, who the providers and beneficiaries may be, and how the service is to be provided, this study proceeds by reviewing the underlying concepts and premises of the economic approach to conservation relevant to our valuation exercise.

3.2.2. Nonmarket environmental services values & PES

In addition to generate goods (e.g., agricultural commodities, and timber) different land uses within a watershed may result in unintended environmental effects (e.g., alteration in hydrological cycle, erosion) with potential associated consequences in the provision of environmental services (i.e., drinking water). Conceptually it may be useful to think of these effects as the basis of a demand function for the continuation and protection of drinking water sources (i.e., avoidance of environmentally threatening land uses). For example, a households' utility can be increased if watershed protection through the implementation of

certain land uses reduce the potential risks associated to future access to drinking water.

Given the situation described above, the watershed environmental services of concern (i.e., provision of drinking water) can be thought as a prime case of goods with nonmarket values. Nonmarket goods are often times characterized by high transaction costs in the form of incomplete information about the nature and magnitude of agents utility gains (i.e., preferences) (Boggess *et al.* 1993). In this context, payment for environmental services (PES) approach is one institutional arrangement that may help to align incentive structures in a way that shift the externality problem of protecting those highly valuable watershed land uses providing ecosystem services. The core idea of PES is that external beneficiaries of environmental services make direct contractual *quid pro quo* payments to local landowners in return for adopting land and resource uses that secure ecosystem protection (Wunder 2007). However, one issue with nonmarket values is how to measure beneficiaries' willingness to pay for watershed protection. In a more positive way, this implies a challenging empirical problem: how to measure utility gains associated with watershed protection and the provision of drinking water.

Generating information about service value relative to cost of provision, in fact, has been acknowledge to be important for making good conservations decisions (Stevens 2005). Also, the literature on nonmarket values suggests that the process of commoditization of nonmarket services like the provision of drinking water may require necessary preconditions such as rigorous identification and measurement of demand and assignment of money values with a particular and precise meaning, that is, to reflect social values (Loomis 2005). This paper attempts to generate this information in the context of Eastern Costa Rican communities. To carry out our objective, among the various techniques for estimating environmental

nonmarket values this study make use of the stated preference survey approached called the Contingent Valuation Method (CVM).

3.2.3. Measuring nonmarket values: The Contingent Valuation Method (CVM)

The contingent valuation method (CVM) is a non market valuation technique used to estimate the benefits derived from environmental amenities (Carson 2000; Carson and Groves 2007; Chilton and Hutchinson 1999; Cummings *et al.* 1986a). A CVM survey elicits an individual's trade-off through questionnaires. Key elements of the questionnaires involve a constructed or contingent market featuring the reasons why a payment is needed, the good's description, and a careful presentation of the payment vehicle (Zilberman and Marra 1993).

Under a commonly used CV question format, the respondent is offered a binary choice[3] between two alternatives (often set in the context of a referendum) (Carson and Groves 2007), one being the status quo policy and the other alternative policy having a cost greater than maintaining the status quo (Carson 2000). As long as the economic agents being surveyed believe that their responses might influence policy actions, the standard economic model suggests that agents should respond to the survey in such a way as to maximize their expected welfare (Carson and Groves 2007). The referendum model for eliciting economic values in a contingent valuation framework has had great appeal since popularized by Bishop and Heberlein's (1979) and Hanemann (1984). Among its virtues are the apparent incentive

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[3] A single binary discrete choice question, with one of the alternatives typically being the status quo, is one of the most commonly used preference elicitation formats and has a long history of use in survey research. Bishop and Heberlein (1979) showed that this format could be used along with a random assignment of different monetary costs to different respondents, to obtain the empirical distribution of willingness-to-pay or willingness-to-accept (WTA) values in a given population. Later papers by Hanemann (1984) formally worked out the utility-theoretic approach from a random utility perspective (McFadden 1974); McConnell (1990), Kriström (1997), Haab and McConnell (1997, 1998, 2002) and Hanemann and Kanninen (1999) have also examined the statistical issues involved in using the binary discrete choice format (Carson and Groves, 2007).

compatibility and informational properties (Carson and Groves 2007). The referendum approach, in fact, was endorsed by the NOAA Panel on Contingent Valuation (Haab and McConnell 1998). Applications are particularly common in environmental valuation (e.g., Bateman *et al.* 2006; Cummings *et al.* 1986b; Hanemann 1994; Smith 1993) and in developing countries (see Pearce *et al.* 2002).

In recent years, the CVM has been used to inform policy makers about individuals' preferences for the basic infrastructural projects in developing countries such as water supply and sanitation (e.g., Merrett 2002; Whittington 1998), and surface water improvement (e.g., Choe *et al.* 1996; Desvousges *et al.* 1983). A recent study in a micro-watershed in the hillsides of Nicaragua employed the CVM to assess the economic value of improving local watershed services for rural residents (Johnson and Baltodano 2004). The good being valued in most of these studies is drinking water and it is usually provided through some type of water project. We follow that approach here but explicitly include PES payments to local land holders in the specification of the provision of the good, protection of drinking water.

3.2.4. CVM: Design Considerations

Some methodological issues with CVM stem from the contingent character of the data -- answers to survey questions rather than observations of behavior. As with data from other types of survey questions, research has shown that the economic values from CVM are sensitive to the framing of the survey questions (Gregory and McDaniels 1987). Never the less, there are reasonable grounds in the literature to support the idea that carefully designed contingent payment situations can approximate actual payment situations with sufficient accuracy to be a useful component of policy process (Mitchell and Carson 1986). Here we briefly review some of the design characteristics that have been argued to minimize potential

sources of error and biases in CVM surveys (see Carson 2000; Carson and Groves 2007; Carson 1997; Cummings *et al.* 1986b; Venkatachalam 2004 for a comprehensive treatment).

The literature recognizes that serious consideration should be given to the incentive and informational properties of preference questions. This study uses the binary-choice referendum format because of the desirable incentive properties that have been identified in the literature (as mentioned above), but also because residents in the study area are familiar with making decisions in a referendum context. The literature also recommends framing of the referendum so that willingness to pay is elicited, as opposed to willingness to accept (Mitchell and Carson 1986). In CVM, respondents must understand the commodity to be valued, how it will be provided and how it will be paid for (Mitchell and Carson 1986). In our case respondents have experience and are familiar with acting collectively to finance and operate community aqueducts for providing drinking water. The payment vehicle, a monthly charge to the water bill, is also familiar and credible since all of the households currently face a monthly water bill to pay for the operation and maintenance of the current aqueduct.

Given the qualitative character of CVM, the literature suggests that good CVM should combine quantitative and qualitative insight if it is to be utilized to its full potential (Chilton and Hutchinson 1999). Among some qualitative methods potentially contributing to the content validity of CVM studies, researchers suggest (and this study has accounted for) the use of focus groups, in-depth interviews, pretests and pilot studies. Some other recommendations may involve: in-person interviews involving visual materials such as maps and pictures, high survey response rates to help minimize potential problems with extrapolating to the population of interest, the employment of professional interviewers, and the selection of household as the unit of observation if a payment vehicle like utility bills is

used (Carson 2000).

We continue by presenting information about our research site and the method used to collect household's data for this nonmarket valuation study in two different Costa Rican communities with prior experience with locally-financed and administered aqueducts. This information may not only provide insights about forces driving communities' interest on alternative approaches to watersheds management, but may also aid to our understanding of communities' characteristics associated with demand for drinking water.

3.3. STUDY SITE, SURVEY, DATA, AND SUMMARY STATISTICS

3.3.1. Study Site

The research setting is in eastern Costa Rica about 130 Km from the capital city, San José. The research site is located in the lower basin of the Reventazón watershed. The Reventazón watershed is the second largest watershed in the country (≈3000 Km2) (Espinoza *et al.* 2003). Its tributaries include the Destierro, Peje and Cairo Rivers, which make up two subwatersheds supplying water to the research site's community aqueducts. Specifically, the communities of Cairo-Francia and Milano rely on the local watershed to supply drinking water to their aqueducts because the nearby surface water is too polluted for potable uses. Intensive systems of pineapple and banana production for export are the largest reported land uses in the area. Other land uses in the area include private forest, pastures, tourism activities, rural towns, and commercial and industrial facilities.

The communities of Cairo-Francia and Milano were selected for this study because of their prior experience with community-financed aqueduct systems. Moreover, these subwatersheds, like many in the area, face potential environmental threats due to

increasing deforestation, urban expansion, and proliferation of factor-intensive agricultural production, especially pineapples. In response to these changes, local agencies must often consider projects to relocate drinking water sources in order to pipe in drinking water from alternative drainage basins. The costs associated with moving drinking water sources mean that in-situ alternatives, such as better protection of available water sources, merit close attention.

The rural aqueducts in this study provide water to Cairo-Francia and Milano communities (See Table 1). The water to Cairo-Francia and Milano is transported via two independent aqueducts, which are administrated by community-based committees called "Comités Administradores de Acueductos Rurales" (CAARS). These committees were organized during the construction of the water infrastructure to administer, are financed by revenues from a set monthly water fee, and operate and maintain the drinking water supply systems. In fact, approximately, 80% of the Costa Rican population receives waters from one of 1,572 locally-financed rural aqueducts operated by some form of CAARS[4] (Espinoza *et al.* 2003).

Table 3.1. Characteristics of the Two Community Aqueducts

Micro-watershed	Elevation (m)	Community Aqueduct	Estimated Households per Aqueduct	Interviews Collected
Río Destierro	79-62	Milano	344	136
Ríos Cairo y Peje	88-71	Cairo-Francia	656	164

[4] CARRS are also called Asociaciones Administradoras de Acueductos Rurales (ASADA). The only difference between these locally administered organizations is that ASADAs have gained legal authorization as a service provider from AyA, the Costa Rican National Aqueducts and Sewage Agency.

3.3.2. Survey Methods

The research results are based on a nonmarket valuation study of household's demand for protecting and maintaining their watershed's hydrological services using a community-based PES program. A dichotomous choice contingent valuation [CV] survey was used to measure household's willingness to pay higher water bills for PES program payments to protect their water quality, quantity and reliability. Using an iterative approach, the CV questionnaire was pretested and refined to appraise scenario plausibility and respondent's understanding (Kaplowitz *et al.* 2004). The survey provided background information about the aqueduct for the communities' water supply and land use issues within the watershed. The CV scenario asked if respondents would vote for the PES program to protect their drinking water at a specific monthly cost. Respondents were also instructed that if the majority of the population votes yes the program would go forward and they would have to pay a monthly fee on the top of current water bill equal to the cost amount they were presented. The associated fee (i.e. bid) was randomly presented and followed up by a debriefing question to verify that the good was understood. The bid amounts were set based on priors from in-depth qualitative research.

The face-to-face interviews were implemented during a 31-day period in July 2006 in two Costa Rican subwatersheds that rely upon the local watershed for drinking water. The target population of the research was heads of household (18 years of age or older). Satellite photographs were used to divide the two target watersheds into clusters. Clusters were then randomly selected to determine the households to be interviewed. Households that could not be interviewed on an initial visit were revisited up to two additional times in an effort to include those households' responses in the dataset. The survey yielded 300 completed interviews. Based on AAPOR's (2006) standards for reporting response rates

from survey and public opinion research, the present study had 81% and 94% minimum response (RR1) and cooperation (COOP1) rates, respectively.

3.3.3. Summary Statistics

Key summary statistics from the survey are presented in Table 2. We found that on average, monthly income was about 135,400 colones. Income values were assessed directly from respondents or calculated from additional income range type questions, if income amounts were not directly provided. On average, we found that households perceived that resource protection in the area was somewhat poor. Most of the households believed that water sources would be threatened in future, absent an intervention to protect them.

Table 3.2. Descriptive statistics for the variables (N=286)

Variable	Description	Measurement	Mean	Std. Dev.	Min	Max
Vote	Dummy (= 1 for yes vote)	1 or 0	0.692	0.462	0	1
Monthly Cost	Program Monthly Costs (bid amount)	10,000 colones	0.124	0.075	0.04	0.24
Income	Monthly income	10,000 colones	13.688	11.591	1.70	85.00
Current Protection	Scale 1-5, 1 being Drinking water sources Extremely Well Protected and 5 being Extremely Poorly Protected	1,2,3,4,5	3.811	0.969	1	5
Threatened in Future	Dummy (=1 for being Drinking water sources threaten in future if nothing else is done to protect them)	1 or 0	0.828	0.377	0	1

3.4. CVM MODEL

Following economic theory, we assume that if a respondent's true WTP is greater than the cost (i.e., bid amount), then the respondent is assumed to vote "yes", and "no"

otherwise. WTP should reflect the benefit that individuals perceived they will receive from the protection of drinking water sources, and it is the portion of its budget the individual is willing to forgo investing in alternative uses. Specifically, we assume that person j will vote for the program ($y_j = 1$) if WTP is greater than the program cost, or will vote against otherwise ($y_j = 0$). We measure this with error, so we have the standard statistical model of $WTP_j = \beta_j Z_j + \varepsilon_j$ where the latter term, $\beta_j Z_j$, represents the parametization of the mean, μ for j's demographic variables, Z_j. Consequently, we model the probability of a yes vote as

$$Prob(yes\ \ vote) = \Phi((B_j Z_j - C_j)/\sigma) \qquad (1)$$

where, Φ is the cumulative density function for the standard normal distribution, and σ is the common standard deviation of the underlying errors. This specification of the econometric model allows as to recover estimates of the variance term σ by observing that the parameter on the cost term will be equal to $1/\sigma$ (Cameron 1988).

3.4.1. Variables & Hypothesis

The dependent variable in our model, Vote for the PES program (y_j), is a dummy variable taking the value 1, if the household votes yes to support PES program and 0 otherwise. Based on economic theory we expect that PES program monthly cost has a negative effect. Moreover, we hypothesize that believing that drinking water sources were threatened in future, absent an intervention to protect them, would have a positive effect on the household's WTP higher water bills for PES program payments to change land uses to protect water sources.

3.4.2. Model significance, parameters estimates and computed marginal effects

The probit model estimated household votes for the proposed PES program using data from the 293 completed questionnaires. Coefficients, test statistics, robust standard errors and marginal effects for the participation decision are reported in Table 3.3. Overall, the chi-squared test of the model indicates that it is significant ($p<0.000$). The key variables in the model were significant and of the expected sign. For instance, as expected, the monthly cost of the protection program had a negative effect ($p<0.000$). Income per month also had positive effect ($p=0.054$) on estimated household's WTP. Another important contribution of our model is the estimated marginal effect of household beliefs regarding the potential for water sources to be threatened in future if nothing else is done to protect them ($p=0.038$). This effect means that people who believe that their drinking water sources were threatened in the future if nothing else is done to protect them are more likely to vote yes to pay for the PES. Results suggest that a higher income household head who believed that their water sources were threaten in the future absent any form of intervention may be more inclined to pay for supporting a watershed protection program.

The marginal effects are the unconditional marginal effects of each variable on the probability of voting yes to a referendum. The marginal effects evaluated at the sample means are computed and reported in the second-to-last column of Table 3.3. For instance, an additional 10,000 colones per month is predicted to raise the likelihood of voting yes by less the 0.6 percentage points. Another contribution of our model is the estimated marginal effect of a household's belief that water sources' are threatened in future, absent an intervention to protect them, which increased the probability of their voting yes by about 16 percentage points.

Table 3.3. Single probit model estimates and statistics

Estimates[b]	Coefficients	Z-values[a]	P-values[a]	Marginal Effects	Mean Values
Monthly Cost (in 10000 colones)	-4.976	-4.70	0.000	-1.7033	0.124
Income (in 10000 colones)	0.017	1.92	0.054	0.0059	13.689
Current Protection	0.041	0.47	0.636	0.0140	3.811
Threaten In Future	0.437	2.07	0.038	0.1592	0.829
Constant	0.419	1.15	0.011		
N	286				
LogL	-160.505				
-2ln(Lr/Lu)	29.11		0.000		

a. Z-stats and P-values are based on robust standard errors computed using the sandwich estimator.
b. Values are computed using the *Single Probit* regression tool in STATA.

3.4.3. Analysis of Willingness To Pay [WTP]

The results yield an estimated mean WTP for the sample of about 2,300 colones per month per household. The estimated mean WTP values are about twice the current average monthly water bills of 1,015 colones. We also found that the estimated WTP is robust to a wide range of model specifications including the range of demographic variables collected in the survey. The elicited WTP amounts to support the PES program are additional fees on top of the current monthly water bill.

There are issues that have been raised in the literature regarding the equity and distributional effects of PES programs that the research examines (see Grieg-Gran *et al.* 2005 for an exhaustive discussion; Pagiola *et al.* 2005; Zbinden and Lee 2005). Among equity issues associated with provision of drinking water in Eastern Costa Rica we have: 1) issues that can arise among water users willing to pay for the provision of the service

given the differences in income level across population (i.e., proxy for distribution of costs burden), and, 2) issues generated from the transactions between groups of rural water users relatively poorer and potential landowner service providers such as very large pineapple and banana producers or processors.

Figure 1 illustrates the effect of household income levels on WTP. It shows the probability of a yes vote at the 10, 50 and 90th percentiles for income from our sample data (40,000, 120,000 and 290,000 colones of monthly income, respectively). At these income levels, mean WTP is estimated as 2,020, 2,300 and 2,885 colones, which roughly represent 5, 2 and 1% of the corresponding income levels.

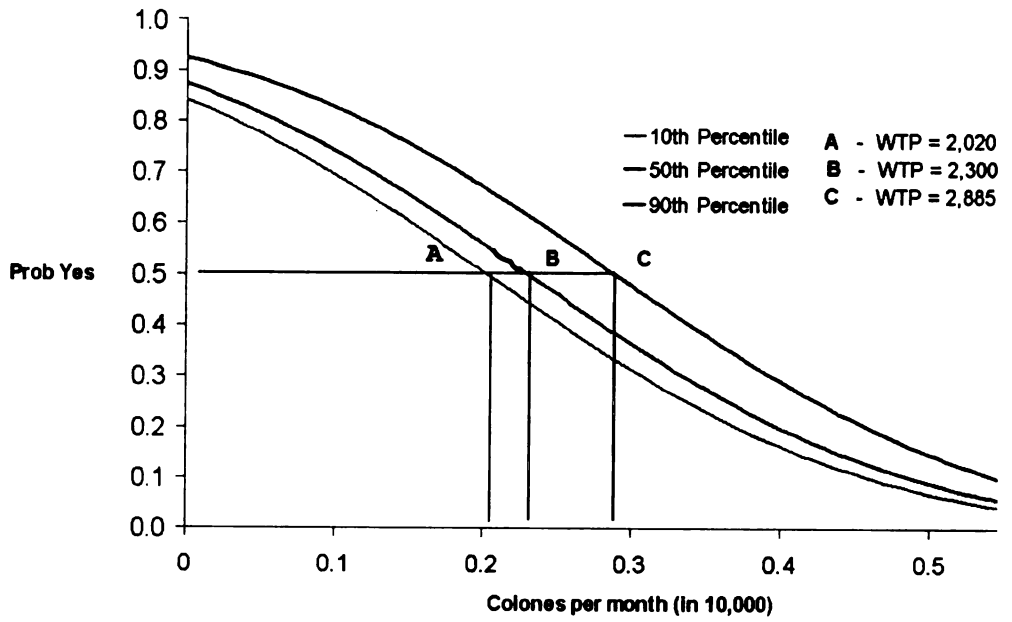


Figure 3.1. Mean WTP and Probability of Yes Vote at Different Monthly Income Levels

First, these results demonstrate that every segment of the population exhibited significant demand and willingness to finance PES program to protect local water quality. The results also suggest that households in the lower income level of the population are

WTP a higher share of monthly income for protecting their watershed and, therefore, secure their sources of water services. As a matter of fact, these results indicate that total household's expenditure in water would represent less than 8%, which may be an affordable share of income having in mind the importance of water resources for supporting and maintaining life.

In, addition, another study of Eastern Costa Rican watersheds by Miranda, *et al.* (2004), using a multi-criteria analysis and a open-ended question format estimated individual water users' WTP an extra water fee to protect water sources. The surveyed population received water service via rural aqueducts and on average, individuals' water bills were about 1,200 colones (Miranda *et al.* 2004). WTP amounts were estimated about 190 colones per month. Although lower than the findings from our case study, these figures represent a total of water expenditures equal to 1.6 % of the income.

From this analysis, we could argue that in the context of our communities, water users indicate substantive willingness to pay for the provision of the service and that imbalance in distribution of provision costs burden across differing segments of population does not seem to constitute a barrier to local-scale PES programs to protect water. This may be particularly true if we also consider that the resulting total water bills under the proposed PES program with an additional monthly charge equal to the mean WTP would still be about half the amount of the basic water tariffs imposed by governmental water authorities in more developed communities near the study site ($\approx$ 6,000 colones). Our results also follow the findings from a recent households-level empirical study by Mendoza, Cash, and Adamowicz (2007). These researchers examined WTP for improved water supply services in Queretaro, Mexico and found that residents from informal

settlements (i.e., non urbanized areas with very low income levels and lacking private piped water services), are willing to pay a relatively higher proportion of their income levels for private piped water services than residents from regular urbanized neighborhoods.

An unresolved question is whether PES revenues generated from these WTP amounts would offset opportunity costs that pineapple or banana producers would face if they participated in the PES program, and, consequently, changed their agricultural practices (i.e., reduced inputs, set asides, switching crops). Further analysis of this complexity would involve better understanding of the supply functions of drinking water services including the costs to agricultural producers and the degree to which different types of land use changes improve or protect drinking water services.

3.5. CONCLUSIONS

The potential for PES programs as an in-situ incentive-based policy instrument to financially support conservation is increasingly of interest among ecologists, environmental scientists, and policymakers. A better understanding of demand for the services provided by PES programs may be a key to successful implementation of locally-financed PES schemes. To address this research need on the demand side of local PES approaches, we estimated households' demand for protecting and maintaining their watershed's hydrological services by community-based PES programs.

Our research finds a strong indication of support for local, collective protection of hydrological services in the study areas' headwaters. Using data from a dichotomous choice Contingent Valuation [CV] survey, we have empirically analyzed the factors influencing household's demand. We also measured household's willingness to pay

higher water bills for PES program payments to change land uses to protect water quality, quantity and reliability. We found that the WTP is significantly affected by the program's monthly cost, and households' income and belief that water sources are threatened in future, absent an intervention to protect them. The results yield an estimated mean WTP for the sample of about 2,300 colones per month per household. Moreover, in an attempt to examine issues regarding the equity and distributional effects on those that would have to finance a local-scale PES programs, we found that every income segment of the population exhibited significant demand and willingness to finance the PES program to protect local water quality.

To sum up, in our case study, local demand is not an obstacle for using locally-financed PES approaches as a mechanism for the protection of watershed and associated ecological services. However, it is necessary to acknowledge some of the limitations of our analysis to assess the viability of PES approaches in Eastern Costa Rica. First, this study argues that further research is needed to generate accurate hydrological information concerning the specific link between certain land uses and the several dimensions embedded in the provision of drinking water (i.e., quantity, quality, and spatial and temporal distribution). Second, an exhaustive examination of the supply-side of a potential trading schemes it is also necessary so as to identify potential matches or mismatches between water users' *willingness to pay* for provision of watershed services provision and landowners service providers' *willingness to accept* that compensation. Ultimately, we also believe that it is necessary to scrutinize the institutional dimension of PES programs as a policy instrument that could effectively align incentives to sustainably finance the provision of environmental services from watersheds.

REFERENCES

AAPOR. (2006). *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, The American Association for Public Opinion Research (AAPOR), Lenexa, Kansas.

Arocena-Francisco, H. (2003). "Environmental service payments: Experiences, constraints, and potential in the Philippines." World Agroforestry Centre (ICRAF), Indonesia.

Astorga, Y. (2005). "Estado y gestión del recurso hídrico en Costa Rica: Informe Final." Programa Estado de la Nación (PEN), San José, Costa Rica.

AyA, and OPS/OMS. (2002). *Agua potable y saneamiento de Costa Rica: Análisis sectorial: Resumen Ejecutivo*, Instituto Costarricense de Acueductos y Alcantarillados (AyA) and Organización Panamaericana de la Salud/Organización Mundial de la Salud (OPS/OMS), San José, Costa Rica.

Bateman, I. J., Day, B. H., Georgiou, S., and Lake, I. (2006). "The aggregation of environmental benefit values: Welfare measures, distance decay and total WTP." *Ecological Economics*, 60(2), 450-460.

Bishop, R. C., and Heberlein, T. A. (1979). "Measuring Values of Extramarket Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics*, 61(5), 926.

Boggess, W., Lacewell, R., and Zilberman, D. (1993). "Economics of Water Use in Agriculture." Agricultural and Environmental Resource Economics, G. Carlson, D. Zilberman, and J. A. Miranowski, eds., Oxford University Press, Inc., New York, NY, 319-391.

Bruijnzeel, L. A. (2004). "Hydrological functions of moist tropical forests: not seeing the soil for the trees?" *Agriculture, Ecosystems and Environments*, 104, 185-228.

Calvo, J. C. (1990). "Water resources development in Costa Rica 1970-2000." *Hydrological Sciences Journal*, 35(2), 185-196.

Cameron, T. A. (1988). "A New Paradigm for Valuing Non-Market Goods Using Referendum Data: Maximum Likelihood Estimation by Censored Logistic Regression." *Journal of Environmental Economics and Management*, 15, 355-379.

Carson, R. (2000). "Contingent valuation: A user's guide." *Environmental Science and Technology*, 38(4), 1413-1418.

Carson, R., and Groves, T. (2007). "Incentive and informational properties of preference questions." *Environmental and Resource Economics*, 37(1), 181-210.

Carson, R. T. (1997). "Contingent Valuation: Theoretical Advances and Empirical Tests since the NOAA Panel." *American Journal of Agricultural Economics*, 79(5), 1501-1507.

Castro, E. (2001). "Costarrican experience in the charge for hydro environmental services of the biodiversity to finance conservation and recuperation of hillside ecosystems." International Workshop on Market Creation for Biodiversity Products and Services, OECD, Paris, 25-26 January 2001.

Chilton, S. G., and Hutchinson, W. G. (1999). "Do focus groups contribute anything to the contingent valuation process?" *Journal of Economic Psychology*, 20(4), 465-483.

Choe, K. A., Whittington, D., and Lauria., D. T. (1996). "The economic benefits of surface water quality improvements in developing countries: a case study of Davao, Philippines." *Land Economics*, 72, 107-126.

Cummings, R., Brookshire, D. S., and Schulze, W. D. (1986a). "Comparison Studies: What is Accuracy?" Valuing Environmental Goods: An assessment of the Contingent Valuation Method, R. Cummings, D. S. Brookshire, and W. D. Schulze, eds., Rowman & Allanheld, Totowa, NJ, 71-110.

Cummings, R. G., Brookshire, D. S., and Schulze, W. D. (1986b). *Valuing environmental goods: a state of the arts assessment of the contingent valuation method*, Roweman and Allanheld, Totowa, NJ.

Daily, G. C., Soderqvist, T., Aniyar, S., Arrow, K., Dasgupta, P., Ehrlich, P. R., Folke, C., Jansson, A., Jansson, B.-O., Kautsky, N., Levin, S., Lubchenco, J., Maler, K.-G., Simpson, D., Starrett, D., Tilman, D., and Walker, B. (2000). "The Value of Nature and the Nature of Value." *Science*, 289(5478), 395-396.

Desvousges, W. H., Smith, V. K., and McGivney, M. P. (1983). "A Comparison of Alternative Approaches for Estimating Recreation and Related Benefits of Water Quality Improvements." Research Triangle Institute.

Dietz, T., Ostrom, E., and Stern, P. C. (2003). "The Struggle to Govern the Commons." *Science*, 302(5652), 1907-1912.

Espinoza, A., Morera, A., Mora, D., and Torres, R. (2003). *Calidad del agua potable en Costa Rica: Situación actual y perspectivas*, Organización Panamericana de la Salud/Organización Mundial de la Salud (OPS/OMS), Ministerio de Salud de Costa Rica e Instituto Costarricense de Acueductos y Alcantarillados, San José, Costa Rica.

FAO. (2000). "AQUASTAT-Information System on Water and Agriculture: Countries and Regions - Costa Rica." AQUASTAT-Sistema de Informacion sobre el Uso del Agua en la Agricultura y el Medio Rural de la FAO, Food and Agriculture Organization of the United Nations (FAO) - Land and Water Development Division, Roma.

FAO. (2004). "Payment schemes for environmental services in watersheds - Land and Water Discussion Paper 3." Regional Forum, Arequipa, Peru, June 9–12, 2003, Food and Agriculture Organization of the United Nations - Regional Office for Latin America and the Caribbean, Rome, Italy.

Ferraro, P. J., and Simpson, R. D. (2002). "The Cost-Effectiveness of Conservation Payments." *Land Economics*, 78(3), 339-353.

Gregory, R., and McDaniels, T. (1987). "Valuing environmental losses: What promise does the right measure hold?" *Policy Sciences*, 20(1), 11-26.

Grieg-Gran, M., Porras, I., and Wunder, S. (2005). "How can market mechanisms for forest environmental services help the poor? Preliminary lessons from Latin America." *Livelihoods, forests, and conservation*, 33(9), 1511-1527.

Haab, T. C., and McConnell, K. E. (1998). "Referendum Models and Economic Values: Theoretical, Intuitive, and Practical Bounds on Willingness to Pay." *Land Economics*, 74(2), 216-229.

Hanemann, M. W. (1994). "Valuing the environment through contingent valuation." *Journal of Economic Perspectives*, 8, 19-43.

Hanemann, W. M. (1984). "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses." *American Journal of Agricultural Economics*, 66(3), 332-341.

Heal, G., Daily, G. C., Ehrlich, P. R., Salzman, J., Boggs, C., Hellmann, J., Hughes, J., Kremen, C., Ricketts, T., and. (2001). "Protecting natural capital through ecosystem service districts." *Stanford Environmental Law Journal*, 20(2), 333-364.

Johnson, N. L., and Baltodano, M. E. (2004). "The economics of community watershed management: some evidence from Nicaragua." *Ecological Economics*, 49(1), 57-71.

Kaplowitz, M. D., Lupi, F., and Hoehn, J. P. (2004). "Multiple-Methods for Developing and Evaluating a Stated Preference Survey to Value Wetland Ecosystems." e. a. S. Presser, ed., John Wiley and Sons, Inc., Hoboken, NJ, 503-524.

Kosoy, N., Martinez-Tuna, M., Muradian, R., and Martinez-Alier, J. (2007). "Payments for environmental services in watersheds: Insights from a comparative study of three cases in Central America." *Ecological Economics*, 61(2-3), 446.

Lal, R. (2000). "Rationale for watershed as a basis for sustainable management of soil and water resources." Integrated watershed management in the global ecosystem, R. Lal, ed., CRC Press, London, 3-16.

Loomis, J. (2005). "Economic Values without Prices: The Importance of Nonmarket Values and Valuation for Informing Public Policy Debates." *Choices*, 20(3), 179-182.

Mendoza, G., Cash, S., and Adamowicz, V. (2007). "Willingness to pay for water supply improvements: A comparison of regular neighborhoods and informal settlements in Queretaro, Mexico." AAEA, WAEA, and CAES Joint Annual Meeting, Portland, OR.

Merrett, S. (2002). "Deconstructing households' willingness-to-pay for water in low-income countries." *Water Policy*, 4(2), 157-172.

MINAE. (2005). "Primera Etapa: Estrategia para la Gestión Integrada de Recursos Hídricos En Costa Rica." *Proyecto BID ATN/WP - 8467- CR*, Ministerio del Ambiente y Energía (MINAE) & Banco Interamericano de Desarrollo, San José, Costa Rica.

Miranda, M., Dieperink, C., and Glasbergen, P. (2007). "Voluntary agreements in watershed protection experiences from Costa Rica." *Environment, Development and Sustainability*, 9(1), 1-19.

Miranda, M., Reyes, V., Monge, C., and Salas, F. (2004). "Valoración Económica de los Recursos Hídricos en las Cuencas de los ríos Banano y Bananito." Programa Ambiental Regional para Centroamérica, Componente de Áreas Protegidas y Mercadeo Ambiental (PROARCA/APM); Centro Internacional de Política Económica para el Desarrollo Sostenible de la Universidad Nacional (CINPE-UNA), USAID-CCAD, and The Nature Conservancy (TNC), Guatemala, Guatemala.

Mitchell, R. C., and Carson, R. (1986). "Some comments on the state of the arts assessment of the Contingent Valuation Method Draft Report." Valuing Environmental Goods: An assessment of the Contingent Valuation Method, R. Cummings, D. S. Brookshire, and W. D. Schulze, eds., Rowman & Allanheld, Totowa, NJ, 237-246.

Molnar, A., Scherr, S., and Khare, A. (2003). "Who conserves the world's forests? A new assessment of conservation and investment trends." Ecoagriculture Partners, Washington, D.C., USA.

Pagiola, S. (2002). "Paying for Water Services in Central America: Learning from Costa Rica." Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development, S. Pagiola, J. Bishop, and N. Landell-Mills, eds., Earthscan, London, 37-62.

Pagiola, S. (2006). "Payments for Environmental Services in Costa Rica." revised version of a paper presented at the ZEF-CIFOR workshop on Payments for environmental services: Methods and design in developing and developed countries, Titisee, Germany, June 15-18, 2005.

Pagiola, S., Arcenas, A., and Platais, G. (2005). "Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America." *World Development*, 33(2), 237-253.

Pagiola, S., Landell-Mills, N., and Bishop, J. (2002). "Making Market-base Mechanisms Work for Forests and People." Selling forest environmental services: Market-based mechanisms for conservation and development, S. Pagiola, J. Bishop, and N. Landell-Mills, eds., Earthscan, London, 261-289.

Pattanayak, S. K. (2004). "Valuing watershed services: concepts and empirics from southeast Asia." *Environmental Services and Land Use Change: Bridging the Gap between Policy and Research in Southeast Asia*, 104(1), 171-184.

Pearce, D. W., Pearce, C., and Palmer, C. (2002). *Valuing the environment in developing countries*, Edward Elgar, Northampton.

Postel, S. L., and Thompson, B. H. (2005). "Watershed protection: Capturing the benefits of nature's water supply services." *Natural Resources Forum*, 29, 98-109.

Redondo-Brenes, A., and Welsh, K. (2006). "Payment for hydrological environmental services in Costa Rica: The Procuencas case study." *Tropical Resources Bulletin*, 24, 19-25.

República de Costa Rica. (1996). "Ley Forestal." Asamblea Legislativa.

Salzman, J. (2005). "Creating markets for ecosystem services: Notes from the field." *New York University Law Review*, 80(3), 870-961.

Sanchez-Azofeifa, G. A., Harriss, R. C., and Skole, D. L. (2001). "Deforestation in Costa Rica: A Quantitative Analysis Using Remote Sensing Imagery." *Biotropica*, 33(3), 378-384.

Sanchez-Azofeifa, G. A., Harriss, R. C., Storrier, A. L., and de Camino-Beck, T. (2002). "Water Resources and Regional Land Cover Change in Costa Rica: Impacts and Economics." *International Journal of Water Resources Development*, 18, 409-424.

Smith, V. K. (1993). "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal." *Land Economics*, 69(1), 1-26.

Stevens, T. H. (2005). "Can Stated Preference Valuations Help Improve Environmental Decision Making?" *Choices*, 20(3), 189-193.

Venkatachalam, L. (2004). "The contingent valuation method: a review." *Environmental Impact Assessment Review*, 24(1), 89-124.

Whittington, D. (1998). "Administering contingent valuation surveys in developing countries." *World Development*, 26(1), 21-30.

World Bank. (2003). "Water Resources Sector Strategy: Strategic Directions for World Bank Engagement." The World Bank, Washington, D.C.

Wunder, S. (2006). "Are direct payments for environmental services spelling doom for sustainable forest management in the tropics?" *Ecology and Society*, 11(2), 23-35.

Wunder, S. (2007). "The Efficiency of Payments for Environmental Services in Tropical Conservation." *Conservation Biology*, 21(1), 48-58.

Zbinden, S., and Lee, D. R. (2005). "Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program." *World Development*, 33(2), 255-272.

Zilberman, D., and Marra, M. (1993). "Agricultural Externalities." Agricultural and Environmental Resource Economics, G. Carlson, D. Zilberman, and J. A. Miranowski, eds., Oxford University Press, Inc., New York, NY, 221-267.

SUMMARY AND CONCLUSIONS

PES programs have been increasingly supported by international donors such as the World Bank, countries like Costa Rica, and many ecologists, environmental scientists, and policymakers interested in alternative instruments to address watershed conservation and management. PES programs seem to be relevant in the field of international development particularly. The lessons learned from this study attempt to contribute to an understanding of how watershed-based, collective, and locally-financed PES programs can be used to address resources use conflicts in watersheds. Lessons pertain to Eastern Costa Rican watersheds yet can be broadly transferable to other situations with similar socio-economic and environmental complexities.

Institutions

Our case study of alternative institutional structures to secure the provision of drinking water appears to suggest that for the case of eastern Costa Rica with rural communities that rely on local, self-financed aqueduct systems, the purchase of land around watersheds headwaters as well as the provision of incentives to surrounding landowners to adopt pro-environmental land use practices may represent the least cost, most beneficial approach to providing long-term drinking water protection. While it appears that local PES schemes may be both viable and effective in the rural settings of our case study, the implementation of the new national water tax adds a layer of bureaucracy and potential funding that may also be beneficial. However, the modest water tax revenues that could be collected from small, rural watersheds such as our case study sites appears to be insufficient to meet the water protection needs of these

communities. Ideally, the water tax rates (and reimbursement rates to communities) might be adjusted to more equitably share infrastructure, maintenance, and enforcement costs. Additionally, there should be some allocation of national water tax funds to the generation and dissemination of knowledge and information on approaches to improve watershed services and protection of drinking water supplies. Increased effectiveness of any of the policy instruments would benefit from improved technical information about the protection and "production" of drinking water. Our case study indicates that with better information, monitoring and enforcing tasks could be locally-tailored to report performance outcomes of watershed protection efforts.

Participation

This study examined households' willingness to participate in the administration and governance of a local PES program to protect drinking water. By implementing a two-stage instrumental variable probit regression, we have estimated the relative importance of factors influencing household's potential participation. Two important conclusions from our empirical results can be drawn. First, our research finds a strong indication of support for local, collective management and protection of hydrological services in the study areas' headwaters. The results are evidence that local participation in community-based management of local-scale PES programs is not an obstacle for the viability of PES approaches for protecting and managing tropical watersheds and associated services. Second, there is potential for transferring our results to similar settings within Costa Rica where PES programs could benefit from local participation. This may also apply to communities in other countries, where community elections and provision of drinking water via

locally-financed and administered rural aqueducts are familiar processes to local residents.

Demand

We estimated households' demand for protecting and maintaining their watershed's hydrological services by community-based PES programs. Our research finds a strong indication of support for local, collective protection of hydrological services in the study areas' headwaters. Using data from a dichotomous choice Contingent Valuation [CV] survey, we have estimated local demand for the PES program and empirically analyzed the factors influencing household's demand. That is, we measured household's willingness to pay higher water bills to finance PES program payments to change land uses to protect water quality, quantity and reliability. We found that the WTP is significantly affected by the program's monthly cost, and households' income and belief that water sources are threatened in future, absent an intervention to protect them. The results yield an estimated mean WTP for water protection for the sample of about 2,300 colones per month per household (just under 2% of the average income). Moreover, in an attempt to examine issues regarding the equity and distributional effects of PES programs, we found that every income segment of the population exhibited significant demand and willingness to finance PES program to protect local water quality. At its core, our study indicates that local demand is not an obstacle for using locally-financed PES approaches as a mechanism for the protection of watershed and associated ecological services.

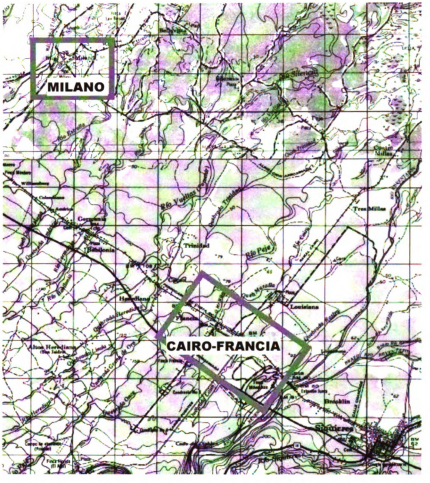
Future Research

To fully assess the viability of PES approaches in Eastern Costa Rica, this study argues that further research is needed to generate accurate hydrological information concerning the specific link between certain land uses and the several dimensions embedded in the provision of drinking water (i.e., quantity, quality, and spatial and temporal distribution). Also, an examination of the supply-side of potential trading schemes it is also necessary so as to identify potential matches or mismatches between water users' *willingness to pay* for provision of watershed services provision and landowners service providers' *willingness to accept* that compensation. Ultimately, future research exploring the cost-effectiveness of incentive-based conservation policies should account for so-called land market feedback effects that could result from payments or land purchases. Land market feedbacks due to increasing demand as a result of the implementation of new institutional arrangements may result in changes to future costs and threats (Naidoo *et al.* 2006). A better understanding of these dynamic effects on performance of incentive-based institutional structures to secure the provision of drinking water sources in watersheds may warrant further examination in the Costa Rican context.

APPENDICES

APPENDIX A

Appendix A. Cairo-Francia & Milano communities.



Source: Basic Map of Costa Rica 1:50 000: Sheet # 084 Bonilla #079Guácimo.

Figure A.1. Close up to Cairo-Francia & Milano communities

APPENDIX B

Appendix B. Non-Response-Appointment Sheet

Date: _____ Name: _____

ID Location	Directions	Happenings (reasons for disposition code DC)	1st Attempt		2nd Attempt		Final Attempt		Booklet ID
			Date	DC 1	Date	DC 2	Date	FINAL DC	

Notes: _____

APPENDIX C

Appendix C. Disposition Code Sheet

Date: _____ Name:				Booklet IDs	
1.0 Interview					
	1.1 Complete				
	1.2 Partial				
2.0 Eligible, Non-Interview					
	2.10 Refusal and break-offs				
		2.11 Refusals			
			2.111 Household-level refusal		
			2.112 Known respondent refusal		
		2.12 Break-off			
	2.20 Non-contact				
		2.23 Unable to enter building/reach housing unit			
		2.24 No one at residence			
		2.25 Respondent away/unavailable			
	2.30 Other				
		2.31 Dead			
		2.32 Physically or mentally unable/incompetent			
		2.33 Language			
			2.331 Household-level language problem		
			2.332 Respondent language problem		
			2.333 No interviewer available for needed language		
		2.35 Miscellaneous			
3.0 Unknown eligibility, Non-interview					
	3.10 Unknown if housing unit				
		3.11 Not attempted or worked			
		3.17 Unable to reach/unsafe area			
	3.20 Housing unit/Unknown if eligible respondent				
		3.21 No screener completed			
	3.90 Other				
4.0 Not Eligible					
	4.10 Out of sample				
	4.50 Not a housing unit				
		4.51 Business, government office, other organization			
		4.52 Institution			
		4.53 Group quarters			
	4.60 Vacant housing unit				
		4.61 Regular, Vacant residences			
		4.62 Seasonal/Vacation/Temporary residence			
		4.63 Other			
	4.70 No eligible respondent				
	4.80 Quota filled				

Notes: _____

APPENDIX D

Appendix D. Watershed Map

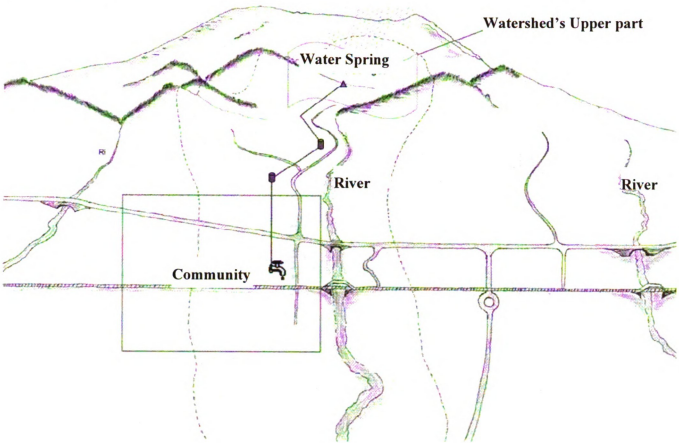


Figure D.1. Watershed Map of Survey.

APPENDIX E

Appendix E. Household Questionnaire English/Spanish Version

Household Questionnaire-Initial Contact Sheet

Name of Interviewer: _____ Date: _____

Location: _____ Cluster: _____

Questionnaire ID: _____ Time Start: _____ Time Finish: _____

[ONLY INTERVIEW HEAD OF HOUSEHOLD OR SPOUSE - 18 YEARS OF AGE OR OLDER][1]

Hello, my name is _____. I am working with researchers at Michigan State University in the U.S. and EARTH University here in Guácimo. We would like to talk to you about your water service.

I. Do you have piped water service in this house?

Yes **OK, are you one of the heads of the household?** [MARK]

Yes **Would this be a good time to talk to you about your water service?**

Yes [CONTINUE WITH CONSENT STATEMENT]

No **When would be a better time for us to speak?**

Yes [TIME: _____DATE:_____]

No **OK, thank you. Have a good day.**

No **When can I come back to speak with a head of household?** [TIME: _____ DATE: _____]

No **OK, since we're only talking with people about their piped water service we can't interview you for this study. Thank you for your time. Have a good day.**

Refusal **Can you just tell me if you have piped water in this house?**

Yes **OK, thank you for your time. Have a good day.**

No **OK, thank you for your time. Have a good day.**

[1] Sentences in CAPITAL LETTERS and within brackets [ ] represent hints for the interviewer, **Bold letters** indicate interviewer script lines

AFTER INITIAL CONTACT--INFORMED CONSENT AND INSTRUMENT

VERBAL INFORMED CONSENT STATEMENT

[REPEAT ONLY IF NEEDED, A RE-VISIT FOR EXAMPLE]

Hello, my name is _____. As I mentioned, I am working with researchers at Michigan State University in the U.S. and EARTH University here in Guácimo. I would like to ask you some questions to learn from you about how you perceive your current water service.

Before we go further there is some information I'd like to share with you. This interview should take about 30 minutes. Your participation in this interview is voluntary. There are no right or wrong answers. You do not have to answer any questions you do not like and you are free to stop the discussion at anytime without any problems or worries.

Your identity and responses will be kept confidential and your privacy will be protected to the maximum extent allowable by law. We will not use your name, only a code number, to identify you in our questionnaire and in analysis and reports. We will be careful not to describe you or your activities in ways that would allow someone to guess your identity and we will keep our data in a secure location.

I would like to accurately record everything you have to say. To help me do so, I will follow a specially designed survey questionnaire and record your comments in the spaces provided.

We hope that the information we learn from you and your fellow community members will help us and our colleagues at EARTH University better understand how we can help you and the communities in your zone.

Do you have any questions? Yes / No

[RECORD QUESTIONS RAISED AND REPLY AS TRAINED. REMEMBER TO REFER TO CONTACT SHEET AND PROVIED RESPONDENT WITH CONTACT SHEET.]

If you have questions later on about this study, please contact any of the people on the project contact information sheet [HAND THEM THE CONTACT INFORMATION SHEET].

If you have any questions or concerns regarding your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you many contact Peter Vasilenko, Ph.D., Director of Human Research Protections, Michigan State University. His information is also on the information sheet.

May we proceed with our interview?
Yes / No

Throughout our discussion, please feel free to ask me any questions you may have.

SECTION I – Natural Resource Management

[INTERVIEWER] I'd like to start off by asking you about natural resources. [EMPHASIS]
We use the term "natural resources" in this interview to describe places and things in the natural environment.

1. **OK. Keeping in mind the level of importance or unimportance of Natural Resources to your family's well being, please rate the importance or unimportance of the following natural resources to your family's well being where the lesser importance is equal to "Extremely Unimportant" and the grater importance is equal to "Extremely Important". Let's go one by one.**

[USING THE FOLLOWING SCALE]
1 = Extremely Unimportant
2 = Somewhat Unimportant
3 = Neither Important nor Unimportant
4 = Somewhat Important
5 = Extremely Important

[MARK ONLY IF THE PERSON EXPRESSES IT]
DK = Don't know

a.	**So thinking on the forests in the area, would you say that forests are** [READ EACH ITEM IN SCALE] **for your family's well being?**	1	2	3	4	5	NS
b.	**And with respect to rivers crossing throughout the area, would you say that they are** [READ EACH ITEM IN SCALE] **for your family's well-being?**	1	2	3	4	5	NS
c.	**How about water springs in this area, would you say that they are** [READ EACH ITEM IN SCALE] **for your family's well-being?**	1	2	3	4	5	NS
d.	**What would you say about the existence of fish in the area's rivers?** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	NS
e.	**Now, how about the presence of wildlife in the area?** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	NS
f.	**What would you say about the variety of trees and plants in the area?**	1	2	3	4	5	NS
g.	**What level of importance would you say that the presence of birds in the area has for your family's well being?**	1	2	3	4	5	NS

ID ☐

2. **Now, I'd like you to think about the protection of Natural Resources in this region. Would you say that the protection of Natural Resources in the area are being extremely well protected, somewhat well protected, neither well nor poorly protected, somewhat poorly protected, or extremely poorly protected?**
[MARK THE ONE THAT APPLIES]

1 = Extremely Well
2 = Well
3 = Neither Well nor Poorly
4 = Poorly
5 = Extremely Poorly

[MARK ONLY IF RESPONDENT EXPRESSES IT]

__ = Don't Know

SECTION II – Piped Water Use

[INTERVIEWER – MAKE A SHORT PAUSE]

3. **Water is another Natural Resource. Some characteristics of this area, such as the slope of the land and rainfall, allow for communities to collect water from sources in the higher parts of these lands. This situation usually happens in an area called a *watershed.* During this interview, a watershed is a portion of land where rainfall water runs downstream so as to reach one or several creeks, rivers or springs.**

   a. **Have you heard of this definition of watershed before?**

      Yes

      No [REINFORCE THE CONCEPT]

4. **We have heard that piped water in this area generally comes from one of several water springs. Who is your household's piped water service provider?**

   [MARK THE ONE THAT APPLIES]

   b. A y A

   c. _____ [WRITE THE NAME OF THE AQUEDUCT]

   d. Don't know

   e. Other_____

5. **What would you say is the largest quantity of water used for in your household?**

   a. **Domestic Use, meaning for drinking, cooking, showering, and washing clothes.**

      OR

   b. **Agricultural uses, meaning irrigation, cleaning hog pits/dairy facilities, and filling up tilapia ponds**

   [FILL IN ONLY IF RESPONDENT VOLUNTEERS OTHER INFORMATION]

   c. Other_____

6. **For the purpose of this interview, we are going to talk about three main characteristics of piped water for human consumption: water pressure, reliability of the service and water quality.**

   Let's think on water pressure as the quantity of water you get from your tap, fully open, in a given time.

   a. **Can you give me a short example about it?**

      [VERIFY THAT THE ANSWER MATCHES THE CONCEPT READ AND CLARIFY IF NECESSARY]

   b. **So, according to this, would you say that the typical pressure of your water service is** [REPLACE WITH EACH OF THE OPTIONS OF THE SCALE]? [MARK THE INDICATED OPTION – ONLY ONE]

      1 = **Extremely Good**
      2 = **Good**
      3 = **Neither Good nor Poor**
      4 = **Poor**
      5 = **Extremely Poor**

      [MARK ONLY IF RESPONDENT EXPRESSES IT]

      DK = Don't Know

7. **For our purpose today, water reliability refers to the period of time within which you received water without interruptions, not including those stoppages of water service caused by failure to pay the water bill**

   a. **Can you give me a short example about it?**

      [VERIFY THAT THE ANSWER MATCHES THE CONCEPT READ AND CLARIFY IF NECESSARY]

   b. **So, according to this, would you say that the typical reliability of your water service is** [REPLACE WITH EACH OF THE OPTIONS OF THE SCALE]? [MARK THE INDICATED OPTION – ONLY ONE]

      1 = **Extremely Good**
      2 = **Good**
      3 = **Neither Good nor Poor**
      4 = **Poor**
      5 = **Extremely Poor**

      [MARK ONLY IF RESPONDENT EXPRESSES IT]

      DK = Don't Know

c. **Would you say that your household has experienced piped water service interruptions?**

YES _____[CONTINUE TO LITERAL (i)]
NO _____[CONTINUE TO QUESTION 8]

i. **Regarding those water service interruptions that your household has experienced, let's think about those instances that occurred within the last 12 months, let's say since last July. Of those interruptions, how many would say lasted**

a. **Less than a day** _____[GET THE BEST GUESS IN A NUMBER]

b. **More than a day** _____ [GET THE BEST GUESS IN A NUMBER]

ii. **During the last 12 months, how long-lasting was the longest water service interruption that you recall your household has experienced?**

[PROBE FOR EXACT AMOUNT OF TIME IN HOURS OR DAYS]

_____ Hours _____ Days

iii. During the longest interruption, what did your family do to obtain household water?
[MARK THE OPTIONS THAT APPLY TO INDICATED ANSWER(S)]

a. Waited (did nothing)
b. Used water that we had stored in containers
c. Have a reservoir tank
d. Receive help from relatives
e. Purchase water in bottles
f. Purchase water from cistern trucks (stored it in a tank)
g. We used water from other source (rainfall, river, well, or spring)
h. We own a water pump to suction water from the pipe grid
i. Other_____

8. **For this interview, another characteristic of your piped water service that we are interested in is water quality, which refers to water taste, appearance, and safety. When we say water safety, we mean whether or not the piped water your receive is safe for your health and that of your family.**

   a. **Can you give me a short example about it?**

      [VERIFY THAT THE ANSWER MATCHES THE CONCEPT READ AND CLARIFY IF NECESSARY]

   b. **So, according to this, would you say that the typical reliability of your water service is** [REPLACE WITH EACH OF THE OPTIONS OF THE SCALE]? [MARK THE INDICATED OPTION – ONLY ONE]

      1 = **Extremely Good**
      2 = **Good**
      3 = **Neither Good nor Poor**
      4 = **Poor**
      5 = **Extremely Poor**

      [MARK ONLY IF RESPONDENT EXPRESSES IT]

      DK = Don't Know

9. **During the last year, do you think your household's piped water has had any impact on the health of any member of your family?**

   a. Yes **Can you briefly tell me about the health impact that you associate with your piped water?** [RECORD COMMENTS]

   _____

   b. No

10. **Now, thinking on possible alternative sources for your drinking water, do you or any member of your family buy bottled water to drink at home?** [MARK THE INDICATED OPTION]

    a. Yes **How many and how often do you buy water containers?** [FILL IN THE TABLE ANSWERS]

[SIZE OF CONTAINER]	[NUMBER BOUGHT]	[DAY]	[WEEK]	[MONTH]
1 lt. Bottle				
2 lt. Bottle				
1 Gallon				
5 Gallon				
Other				

    b. No

[INTERVIEWER: CAREFULLY READ THE ROLE-SCRIPT OF THE WATHERSHED DIAGRAM LOCATED AT THE END OF THE QUESTIONNARIE]

Experts have studied various activities taking place in surrounding areas of water springs that may impact the water pressure, reliability of the service and quality of water in aqueduct systems.

Some of the studied activities that may impact the water sources of aqueduct systems include:

1) **Timber-cutting taking place nearby water springs;**

2) **Agriculture that use agrochemicals, herbicides and fertilizers, that may infiltrate into the soil and reach water sources;**

3) **Livestock, dairy and hog operations generating manure that may get into waterways; and**

4) **The development of upper watershed areas for housing or hotels that may cause timber-cutting, as well as generates wastewater that may get into soil and reach water sources.**

11. **Knowing this, what do you think would happen to your water sources, if anything else besides what is currently done to protect them is done in the future?**

[INTERVIEWER: READ LIST AND MARK AS MANY AS APPLY. REMEMBER TO START READING THE LIST WITH A DIFFERENT ITEM FOR EACH INTERVIEW. MARK WITH "X" BY THE LETTER OF THE ITEM YOU START WITH. THEN READ IN ALFABETICAL ORDER FROM THE FIRST ITEM (for example: c, d, e, f, g, a, b).]

a. **They will remain the same**
b. **They will dry out**
c. **They will deliver less quantity of water**
d. **AyA or the Local Aqueduct Committee will protected them**

[USE ONLY IF THE RESPONDENT EXPRESSES IT]
e. **I don't know**
f. **Other** _____

Now, I would like to know if you think that the following activities are an issue now, or if they will be so in five years, in the area nearby the water spring.

12. Do you think that timber-cutting in the area nearby the water spring is currently a problem for your water source?

a. Yes No Don't know

¿What about in 5 years?

b. Yes No Don't know

13. Do you think that agriculture in the area nearby the water spring is currently a problem for water sources of your aqueduct?

a. Yes No Don't know

¿What about in 5 years?

b. Yes No Don't know

14. Do you think that development of new areas for housing or hotels in the area nearby the water spring is currently a problem for water sources of your aqueduct?

a. Yes No Don't know

¿What about in 5 years?

b. Yes No Don't know

SECTION III– Program Referendum Section
[INTERVIEWER: READ THE FOLLOWING STATEMENT CAREFULLY]

We have discussed so far your opinions concerning the drinking water service in this area. We have also talked about some land uses taking place in areas nearby the water springs, which may or may not impact current pressure, reliability and quality of water.

There a various programs that can be put into practice; I would like you to consider one possible program that could be designed to protect your community's drinking water sources for the long term.

Thw program would support the use of a new water spring different from the current one, and would focus on protecting land encompassing the new water spring. So, that you as a water user will continue to receive the:

a. **Same pressure, reliability and quality of water that you typically received during the last year.**

[ALTERNATIVE SCENARIO TO BE USED ON EVERY OTHER HOUSEHOLD. MARK X HERE _____WHEN USED]

b. Same pressure and same quality as you have typically received in the last year; however, reliability will be improved through better aqueduct maintenance so that you will have half as many interruptions as you have had in the last year.

For this to happen, the program would work with owners of land nearby the water sources to protect the land, or to practice low or no impact activities. For instances, land protection will prevent or reduce tree-cutting and impacts associated to agricultural operations.

The program would be implemented by registering voluntary cooperation agreement through a contract between the Aqueduct Administration, community's water users, and owners of land encompassing the new water spring.

The program to protect water sources will cost money. To finance this program, every household in your community will be asked to vote for or against the program. If a majority of the community members vote yes for the program, all water users will help to finance the cost of the program by paying an additional amount on their monthly water bill.

It is expected that some people will vote for supporting the program and some will vote against it. For example, some people might vote against the program because they think that activities nearby the water spring do not represent a problem for the water sources integrity; others might vote against it because they can get water from other sources.

On the other hand, some people might vote for supporting the program because they recognize that activities nearby the water spring represent a current or future problem for the water sources and they believe that a program to protect water sources will secure the long term provision of water.

Your input is important for the process. We want to know about your opinion if you were asked to cast your vote for this program to protect water sources.

15. **Would you vote for or against the program if you would have to pay** [SEE COST COLUMN FOR ALTERNATIVE] **colones more on your monthly water bill?**

[CLARIFY THAT TO VOTE FOR EQUALS YES AND AGAINST EQUALS NO]
[¡IMPORTANT! ALTERNATE INITIAL BIDS IN EVERY INTERVIEW. MARK WITH "X" BY THE LETTER OF THE ITEM YOU START WITH]
[MARK WITH "X" BY THE INDICATED ANSWER Y = YES OR N = NO]

	COST		
a.	**400**	Y	N
b.	**800**	Y	N
c.	**1600**	Y	N
d.	**2400**	Y	N

[PAUSE] [USE THE SAME ESCALE AND INSTRUCCTIONS ABOVE]

[MARK HERE____ IF YOU READ 16. a.i]

16. a. i) **It is not clear what the program cost would be; there are two estimates. If the program would cost your household** [SEE ALTERNATIVE FOR YES/NO IN COLUM COST] **colones more per month, would you vote for or against the program?**

[MARK HERE ____ IF YOU READ 16.a.ii]

16. a. ii) **And if the program would cost your household** [SEE ALTERNATIVE FOR YES/NO IN COLUM COST] **colones more per month, would you vote for or against the program?**

	Says that would vote for (YES)			**Says that would vote against** (NO)		
a.	**800**	Y	N	**100**	Y	N
b.	**1600**	Y	N	**400**	Y	N
c.	**2400**	Y	N	**800**	Y	N
d.	**4000**	Y	N	**1600**	Y	N

[IF RESPONSE WAS A NO – NO, ASK THE FOLLOWING QUESTION]

17. Would you vote in favor to pay any additional amount per month for this program?

SI **How much would that be?**
¢_____

No **Why?**_____

16. b) **What does the respondent say while making the decision?**
[MARK ALL THAT APPLY]

a. Says it's too much.
b. Says it's too little.
c. Says that she/he can't afford it
d. Discusses personal expenses.
e. Questions benefits for she/he.
f. Questions if project would work.
g. Recognizes that she/he should pay more but can't afford it.
h. Other: _____

18. If this program to secure water sources in this area is implemented and secures the provision of water for the long-term, do you think this program would provide other benefits?

a. Yes **Which ones?**
[MARQUE LA(S) MÁS CERCANA(S) O AGREGUE OTRA]?

i. Protect the rivers' water quality
ii. Birds protection
iii. Better fishing in the area
iv. Regulate the implementation of environmental-friendly agricultural practices
v. Minimize water related health risks
vi. Increase job opportunities
vii. Provide improvements to community's facilities
viii. Improve Aqueduct Management
ix. Increase reliability of water service
x. Other_____

b. No
c. Don't know

19. When we talk about long-term, what length of time would you say crosses your mind?

_____Years Don't know

20. On your opinion, what entity would you say is responsible for protecting the community's water sources?
[MARQUE WITH "X" OR ADD IN OTHER AS INDICATED]

a. AyA
b. Local Aqueduct
c. FONAFIFO
d. MINAE
e. Municipality
f. Don't know
g. Other _____

SECTION IV –Drinking Water Service Administration

21. With regard to your current water service, do you use water meter?

a. Yes [CONTINUE TO QUESTION 24]
b. No
c. Don't know

22. Do you pay a set monthly fee for your drinking water service?

a. Yes
b. No
c. Don't know

23. How much was your water bill last month?

_____Colones _____ Don't know [CONTINUE TO QUESTION 27]

24. Does you meter work?

a. Yes
b. No
c. Don't know

25. How often is the meter read?

a. Once a month
b. Other _____
c. Don't know
d.

26. Approximately, how much do you pay each month?

_____ Colones _____ Don't know

Now, I would like to discuss with you about the use of water meters

27. Using a scale of 1 to 5, with "1" being "Strongly Disagree" and "5" being "Strongly Agree", please tell us to what extent you agree or disagree with the following statements concerning water meter usage

[USANDO LA SIGUIENTE ESCALA]
1 = Strongly Disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agree
5 = Strongly Agree

[USE ONLY IF RESPONDENT EXPRESSES IT]
DK = Don't Know

[INTERVIEWER: READ LIST AND MARK AS MANY AS APPLY. REMEMBER TO START READING THE LIST WITH A DIFFERENT ITEM FOR EACH INTERVIEW. MARK WITH "X" BY THE LETTER OF THE ITEM YOU START WITH. THEN READ IN ALFABETICAL ORDER FROM THE FIRST ITEM (for example: c, d, e, f, g, a, b).]

"The use of water meter _____"

a.	**Improve billing practices because households only pay for water they use. Would you say that you** [READ EACH ITEM IN SCALE] **with this statement?**	1	2	3	4	5	DN
b.	**Improve water conservation because households will be more careful and not waste water.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN
c.	**Improve water service because the Aqueduct Administration will have more funds to render the service.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN

[USE SAME SCALE AND INSTRUCTIONS AS PREVIOUS]

"A water meter _____".

d.	**Miscalculates the amount of water households consume. Would you say that you** [READ EACH ITEM IN SCALE] **with this statement?**	1	2	3	4	5	DN
e.	**Results in higher monthly payments relative to a set monthly fee, even when water meter is working properly.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN
f.	**Require households to pay to install and maintain the meter.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN
g.	**Can be illegally tampered.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN

28. Researchers in this area have elaborated some suggestions about how to protect your current drinking water service .

I will read through a list of suggestion first, and, then, please I will ask you to tell us how important is for you each of this suggestions. Using a scale of 1 to 5, with "1" being "Extremely Unimportant" and "5" being "Extremely Important".

[USING THE FOLLOWING SCALE]
1 = Extremely Unimportant
2 = Somewhat Unimportant
3 = Neither Important nor Unimportant
4 = Somewhat Important
5 = Extremely Important

[MARK ONLY IF THE PERSON EXPRESSES IT]
DK = Don't know

[INTERVIEWER: READ LIST AND MARK AS MANY AS APPLY. REMEMBER TO START READING THE LIST WITH A DIFFERENT ITEM FOR EACH INTERVIEW. MARK WITH "X" BY THE LETTER OF THE ITEM YOU START WITH. THEN READ IN ALFABETICAL ORDER FROM THE FIRST ITEM (for example: c, d, e, f, g, a, b).]

a. **Provide more information/education to community members on how to help to protect water sources. Would you say that this suggestion is** [READ EACH ITEM IN SCALE]?	1	2	3	4	5	DN
b. **Improve participation of community's households in water conservation. Would you say that this suggestion is** [READ EACH ITEM IN SCALE IF NECCESARY]?	1	2	3	4	5	DN
c. **Improve community organization, would you say that it is** [READ EACH ITEM IN SCALE IF NECCESARY] **that this suggestion should be undertaken to protect water sources in this area?**	1	2	3	4	5	DN
d. **Improve communication and cooperation between the people in the community and government agencies.** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN
e. **Improve system's maintenance by Aqueduct Administration** [READ EACH ITEM IN SCALE IF NECCESARY]	1	2	3	4	5	DN
f. **Improve administration by Aqueduct Administration**	1	2	3	4	5	DN
g. **Conduct a study to locate an alternative water spring**	1	2	3	4	5	DN
h. **Protect the land around the water spring**	1	2	3	4	5	DN
[USE ONLY IF RESPONDENT EXPRESSES IT] Other_____						

SECTION V– Demographic Information

I have some general questions about you and your family
[INTERVIEWER: CIRCLE RESPONDENT'S GENDER]

Male / Female

29. What is your age? _____

30. a. How many persons 18 years or older live in this household? _____

b. How many persons under 18 years live in this household? _____

31. How long have you lived in this community?
_____Years

32. Are you planning to leave this community next year? Yes
No

33. What is the highest level of school that you have completed?
[MARK THE OPTION THAT APPLIES]

a.	**None or some years of primary school**	e.	**Some time at university**
b.	**Primary**	f.	**Bachelor's Degree**
c.	**Some years of high school**	g.	**Licentiate Degree**
d.	**High School**	h.	**Graduate Degree**

34. ¿What is your current civil status?

a.	Marries	[CONTINUE TO QUESTION 35]
b.	Civil Union	[CONTINUE TO QUESTION 35]
c.	Divorced /Separated	[CONTINUE TO QUESTION 36]
d.	Single	[CONTINUE TO QUESTION 36]
e.	Widow	[CONTINUE TO QUESTION 36]

35. What is the highest level of school that your spouse has completed?
[MARK THE OPTION THAT APPLIES]

a.	**None or some years of primary school**	e.	**Some time at university**
b.	**Primary**	f.	**Bachelor's Degree**
c.	**Some years of high school**	g.	**Licentiate Degree**
d.	**High School**	h.	**Graduate Degree**

36. The home that you inhabit is [READ OPTIONS]**?**

a. **Owned**
b. **Rented**
c. **Being taken care of**
d. **Borrowed**

e. **Don't' know**
f. Other_____

37. ¿Do you farm any land? Si No

38. Including all the members in your household, can you tell me approximately what the total monthly income in your household is?

¢_____ [REGISTER THE AMOUNT]

[IF RESPONDENT REFUSES TO PROVIDE AN ANSWER, ASK THE FOLLOWING]

a. Can you just tell me if your total household monthly income is less than 150,000 colones?

a) Yes
   i. If so, can you tell me if your total household monthly income is less than 75,000 colones?
      01. Yes
      02. No
b) No
   i. If so, can you tell me if it less than 240,000 colones?
      01. Yes
      02. No

39. Do you vote in any of the following elections [READ OPTIONS]? [MARK THE OPTION THAT APPLIES]

a.	**At a community level, for Development Committee for example**	Yes	No
b.	**At a local level, for Mayor or Regents for example**	Yes	No
c.	**At a cantonal level , for Member of Congress for example**	Yes	No
d.	**At a national level, for President**		Yes
	No		

40. Do you trust your current water service administration to manage the aqueduct?

a. Yes
b. No **Briefly, tell me why not?**
c. Don't know **Briefly, tell me why?**

_____

_____

41. Programs like the one presented in this interview are likely to require the participation of community members in a committee.

a. **Would you be willing to participate in this water aqueduct committee?**
Yes No

b. **Would any other member in your household older that 18 be willing to participate?** Yes No

[READ QUESTION 42 ONLY IF RESPONDENT SAYS "NO" TO PREVIOUS, IF NOT FINALIZE THE INTERVIEW]

42. In a short comment, what is the main reason that prevents you from participating in the Aqueduct Committee?

_____

_____

_____

_____

_____

Well, that was the last question. Thank you very much for your time.

We really appreciate your willingness to share your opinions about these issues.

Please do not hesitate to contact us if you have any questions or comments in the future.

Our contact information is on the information sheet we gave you earlier.

FINISHED WITH INTERVIEW

SECTION VII - For Interviewer Only

43. Did the person who responded to the questions seem disturbed (e.g., irritated, nervous) during the interview?

a. Yes
b. No

44. Do you think the respondent made an effort to tell the truth?

a.	About their perceptions	Yes/No
b.	About their income	Yes/No
c.	About their voting	Yes/No

45. In general, how would you rate the overall quality of the interview?

a. Extremely Good
b. Good
c. Neither Good nor Poor
d. Poor
e. Extremely Poor

If you have any comments you would like to make about the respondent's answers to this questionnaire or the questionnaire itself, please record them below.

CUESTIONARIO DOMICILIAR - PÁGINA DE CONTACTO INICIAL

Entrevistadora: _____ Fecha: _____

Lugar: _____ Cluster: _____

ID Cuestionario: _____ Hora Inicio: _____ Hora Finalizado: _____

[SE ENTREVISTA SOLO JEFES DE FAMILIA O CÓNYUGUES - MAYORES DE 18 AÑOS]

Buenos días, mi nombre es: _____. Trabajo para un proyecto de investigación social de la Universidad Michigan State en Estados Unidos y la Universidad EARTH de Guácimo. Nos gustaría conversar con usted acerca de su servicio de agua potable.

I. ¿Recibe usted agua entubada en esta casa?

Si **Gracias. ¿Es usted jefe/jefa de familia?** [MARCAR]

Si **Cree usted que podemos hablar acerca de su servicio de agua potable en este momento?**

Si [CONTINUE CON ACUERDO DE CONFORMIDAD]

No **¿Cree usted que habrá un mejor momento para hablar?**

Si [HORA: _____ FECHA:_____]
No **Gracias por su tiempo, que tenga un buen día**

No **¿Cuándo puedo regresar para hablar con uno de los jefes de la familia?**

[HORA: _____ FECHA: _____]

No **Gracias, pero como solo estamos entrevistando en las casas donde reciben agua entubada, no hace falta entrevistarlo(a) a usted para este estudio. Gracias de nuevo por su tiempo. Que pase un buen día.**

Rechazo **¿Podría solamente decirme si reciben agua entubada en esta casa?**

Si **Muchas gracias por su tiempo, que pase buen día**

No **Muchas gracias por su tiempo, que pase buen día.**

DESPUÉS DEL CONTACTO INICIAL – ACUERDO DE CONFORMIDAD Y CUESTIONARIO

ACUERDO VERBAL DE CONFORMIDAD

[REPITA SOLO SI ES NECESARIO- EL CASO DE UNA SEGUNDA VISITA POR EJEMPLO]

Como dije antes, mi nombre es: _____. Trabajo para un proyecto de investigación social de la Universidad Michigan State en Estados Unidos y la Universidad EARTH de Guácimo.

Antes de continuar, tengo información importante que me gustaría compartir con usted. La conversación durará aproximadamente 30 minutos. Su participación en esta entrevista es voluntaria. No existen respuestas correctas, ni incorrectas. No tiene que contestar a ninguna pregunta que no le guste, y tiene la libertad de dejar la discusión en cualquier momento sin problemas o preocupaciones por haberlo hecho.

Su identidad y respuestas serán estrictamente confidenciales y su privacidad será protegida al máximo, tanto como la ley nos lo permite. No utilizaremos su nombre, sino un código numérico para identificarle en nuestro cuestionario y en los análisis e informes. Seremos cuidadosos de no describir sus actividades en forma tal que permita que alguien pueda adivinar su identidad, y mantendremos nuestros datos siempre en un lugar seguro.

Quiero tomar nota cuidadosamente de todo lo que usted desee decir. Para ayudarme a hacer esto voy a utilizar este cuestionario.

Esperamos que la información que recibamos de su parte y de otros miembros de su comunidad sirva para entender mejor cómo nosotros y los colegas en la Universidad EARTH podemos apoyar a personas como usted y a las comunidades en esta zona.

¿Tiene alguna pregunta? Si
No

[REGISTRE LAS PREGUNTAS Y RESPONDA DE ACUERDO AL ENTRENAMIENTO. RECUERDE REFERIRSE A LA HOJA DE CONTACTO Y PROVEERLE AL ENTREVISTADO UNA COPIA DE LA MISMA.]

Si en el futuro usted tuviera alguna pregunta con respecto a este estudio, por favor contacte directamente a cualquiera de las personas indicadas en esta hoja [ENTREGAR LA HOJA CON INFORMACIÓN DE CONTACTO].

Si tiene alguna pregunta con respecto a sus derechos como participante de esta investigación, o está descontento en algún momento con este estudio, puede contactar al Dr. Peter Vasilenko, Director de Investigación que involucra sujetos humanos. Su información de contacto también está en esta hoja.

¿Procedemos con la entrevista? Si
No

Durante esta conversación por favor siéntase libre de hacerme cualquier pregunta que tuviera.

SECCIÓN I – Manejo de Recursos Naturales

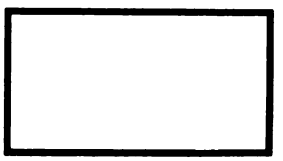
[ENTREVISTADORA] **Quiero comenzar preguntándole sobre recursos naturales** [ENFÁSIS] **Nosotros usaremos el término "recursos naturales" en esta entrevista para describir lugares y cosas en la naturaleza.**

1. **Ahora bien. Pensando en el nivel de importancia de los recursos naturales para el bienestar de su familia, diga por favor cuál es el nivel de importancia que tiene cada uno, donde lo menos importante es igual a "Sin Importancia" y lo más importante es igual a "Muy Importante". Vamos uno por uno.**

[USE LA SIGUIENTE ESCALA]
1 = Sin Importancia
2 = Poco Importante
3 = Ni Importante ni No Importante (Indiferente)
4 = Importante
5 = Muy Importante

[MARQUE SOLO SI EL ENTREVISTADO LO EXPRESA]
NS = NO SE

a.	**Entonces, pensando en los bosques de esta zona, usted diría que los bosques son** [LEA CADA OPCIÓN EN LA ESCALA] **para el bienestar de su familia?**	1	2	3	4	5	NS
b.	**Y al respecto de los ríos que cruzan la zona, ¿usted diría que los ríos son** [LEA CADA OPCIÓN EN LA ESCALA] **para el bienestar de su familia?**	1	2	3	4	5	NS
c.	**Que me dice de las nacientes de agua de esta zona, ¿usted diría que son** [LEA CADA OPCIÓN EN LA ESCALA] **para el bienestar de su familia?**	1	2	3	4	5	NS
d.	**¿Y qué me dice de la existencia de peces en los ríos de esta zona?** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS
e.	**Ahora, ¿cuando hablamos de la existencia de animales de montaña en esta zona?** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS
f.	**¿Y que me dice de la variedad de árboles y plantas en esta zona?**	1	2	3	4	5	NS
g.	**¿Qué importancia le asigna a la presencia de aves en esta zona para el bienestar de su familia?**	1	2	3	4	5	NS

ID 

2. **Ahora bien, me gustaría que piense en la protección de los recursos naturales en esta zona. ¿Diría usted que los recursos naturales de la zona están siendo muy bien protegidos; bien protegidos; ni bien ni mal protegidos; mal protegidos; ó muy mal protegidos?**
   [MARQUE LA OPCIÓN INDICADA]

   1 = Muy Bien
   2 = Bien
   3 = Ni Bien ni Mal (Indiferente)
   4 = Mal
   5 = Muy Mal

   [USE SOLO SI EL ENTREVISTADO LO EXPRESA]

   __ = No sé

SECCIÓN II – Uso de Agua Entubada

[ENTREVISTADORA – HAGA UNA CORTA PAUSA]

3. **El agua es un recurso natural. Algunas características del terreno en esta zona, como la pendiente y las lluvias, permiten a las comunidades recolectar agua desde fuentes. Esta situación se da en zonas llamadas cuencas. Para esta entrevista una cuenca es una porción de la tierra donde el agua de lluvias corre hacia abajo hasta alcanzar en conjunto una o varias quebradas, ríos o nacientes.**

   a. **¿Había escuchado esta definición de cuenca?**

      Si

      No [REFUERCE EL CONCEPTO]

4. **Hemos oído que el agua entubada en esta zona generalmente proviene de uno o varios nacientes, ¿Dígame por favor quién es el encargado de brindar el servicio de agua para su casa?**

   [MARQUE LA OPCIÓN INDICADA]

   a. A y A

   b. _____ [ESCRIBA EL NOMBRE DEL ACUEDUCTO]

   c. No sé

   d. Otro _____

5. **¿Para qué utiliza usted la mayor cantidad de agua en su casa?**

   a. **Uso Doméstico , es decir para beber, cocinar, bañarse o lavar ropa.**

      Ó

   b. **Usos agrícolas, es decir para riego, limpieza de chanchera o lechería, para llenar piscinas de tilapia, etc.**

   [USAR SOLO SI EL ENTREVISTADO VOLUNTARIAMENTE OFRECE OTRA OPCIÓN]

   c. Otro_____

6. **Para nuestra conversación y para fines de esta entrevista vamos a hablar de tres características importantes del agua entubada que se usa para consumo humano: presión del agua, confiabilidad del servicio y calidad del agua.**

   Entendamos presión como la cantidad de agua que usted recibe con la llave completamente abierta durante un determinado tiempo.

   a. **¿Puede darme un ejemplo corto al respecto?**

      [VERIFIQUE QUE LA RESPUESTA COINCIDA CON EL CONCEPTO LEÍDO Y CLARIFIQUE SI ES NECESARIO]

   b. **De acuerdo a lo anterior ¿Diría usted que la presión habitual de su servicio de agua es** [REEMPLACE CON LAS OPCIONES DE LA ESCALA]? [MARQUE LA OPCIÓN INDICADA – SÓLO UNA]

      1 = **Muy Buena**
      2 = **Buena**
      3 = **Ni Buena Ni Mala (Indiferente)**
      4 = **Mala**
      5 = **Muy Mala**

      [MARQUE SOLO SI EL ENTREVISTADO LO EXPRESA]

      NS = No sé

7. **Para nuestros fines, confiabilidad del servicio se refiere al tiempo en que usted recibe el agua sin interrupciones, no tomando en cuenta los cortes por falta de pago.**

   a. **¿Puede darme un ejemplo corto al respecto?**

      [VERIFIQUE QUE LA RESPUESTA COINCIDA CON EL CONCEPTO LEÍDO Y CLARIFIQUE SI ES NECESARIO]

   b. **De acuerdo a lo anterior ¿Diría usted que la confiabilidad habitual de su servicio de agua es** [REEMPLACE CON LAS OPCIONES DE LA ESCALA]? [MARQUE LA OPCIÓN INDICADA – SÓLO UNA]

      1 = **Muy Buena**
      2 = **Buena**
      3 = **Ni Buena Ni Mala (Indiferente)**
      4 = **Mala**
      5 = **Muy Mala**

      [MARQUE SOLO SI EL ENTREVISTADO LO EXPRESA]

      NS = No sé

c. **¿Dígame por favor si en su casa han experimentado interrupciones en el servicio de agua entubada?**

Si _____ [CONTINÚE CON EL LITERAL (i)]
No _____ [CONTINÚE CON LA PREGUNTA 8]

i. **Hablando de las interrupciones del servicio de agua que han experimentado en su casa, pensemos solo en las veces que ha ocurrido en los últimos doce meses, digamos que desde julio pasado. ¿De esas interrupciones, cuántas veces han durado?**

a. **Menos de un día** _____[OBTENGA LA MEJOR APROXIMACIÓN EN NÚMERO]
b. **Más de un día** _____ [OBTENGA LA MEJOR APROXIMACIÓN EN NÚMERO]

ii. **En los últimos doce meses, ¿cuánto tiempo duró la interrupción del servicio más larga que usted recuerda?**

[OBTENGA UNA APROXIMACIÓN EN HORAS O DÍAS – LO QUE APLIQUE]

_____ Horas _____ Días

iii. **Durante esa interrupción ¿recuerda usted qué hizo su familia para obtener agua?**

[ENCIERRE LAS OPCIONES QUE APLIQUEN A LA(S) RESPUESTAS]

a. Esperamos a que volviera (no hicimos nada)
b. Usamos agua que guardamos en recipientes
c. Tenemos un tanque de almacenamiento
d. Nos ayudaron unos parientes
e. Compramos agua embotellada
f. Compramos agua de un camión cisterna
g. Cogimos agua de otro fuente (lluvia, río, pozo, naciente)
h. Tenemos una bomba para jalar agua de la tubería
i. Otro_____

8. **Para fines de esta entrevista otra característica de interés es la calidad del agua, la cual se refiere a su sabor, apariencia, y seguridad. Cuando decimos seguridad estamos hablando de que si el agua es ó no apta para su salud y la de su familia.**

   a. **¿Puede darme un ejemplo corto al respecto?**

      [VERIFIQUE QUE LA RESPUESTA COINCIDA CON EL CONCEPTO LEÍDO Y CLARIFIQUE SI ES NECESARIO]

   b. **De acuerdo a lo anterior ¿Diría usted que la calidad habitual de su servicio de agua es** [REEMPLACE CON LAS OPCIONES DE LA ESCALA]? [MARQUE LA OPCIÓN INDICADA – SÓLO UNA]

      1 = **Muy Buena**
      2 = **Buena**
      3 = **Ni Buena Ni Mala (Indiferente)**
      4 = **Mala**
      5 = **Muy Mala**

      [MARQUE SOLO SI EL ENTREVISTADO LO EXPRESA]

      NS = No sé

9. **Durante el último año, ¿cree usted que su salud ó la de alguno de los miembros de su familia ha sido afectada por el agua que reciben en su casa?**

   a. Si **¿Cuénteme brevemente que tipo de padecimiento asocia usted al agua entubada?** [REGISTRE LOS COMENTARIOS]

      _____

   b. No

10. Pensando en fuentes alternativas de agua potable, ¿Usted o alguien de su familia compra agua embotellada para beber en casa?
[MARQUE LA OPCIÓN INDICADA]

a. Si **¿Cuántos envases compran y con qué frecuencia ?**
[ESCRIBA LAS RESPUESTAS EN LA TABLA]

[TAMAÑO DE ENVASE]	[NÚMERO COMPRADO]	[DÍA]	[SEMANA]	[MES]
Botella de 1 litro				
Botella de 2 litros				
1 Galón				
5 Galones				

b. No

[ENTREVISTADORA: CUIDADOSAMENTE LEA EL ESCRITO-GUIÓN DEL DIAGRAMA DE LA CUENCA QUE SE ENCUENTRA AL FINAL DE ESTE CUESTIONARIO]

Algunas personas expertas han estudiado varias actividades alrededor de la naciente que pueden tener cierto impacto en la presión, la confiabilidad del servicio y la calidad del agua de un sistema de acueductos.

De las actividades estudiadas algunas pueden o no tener un impacto sobre las fuentes de agua de un sistema de acueductos, tales como:

1) **La corta de árboles alrededor de la naciente;**

2) **Agricultura que usa agroquímicos, con herbicidas y fertilizantes, que pueden adentrarse en el suelo y llegar a las fuentes de agua;**

3) **Ganadería, lecherías o chancheras que pueden generar boñiga que puede llegar a las fuentes de agua; y**

4) **Las construcciones de casas y hoteles que ocasionan corta de árboles y generan aguas negras que pueden adentrarse en el suelo y llegar hasta las fuentes de agua.**

11. En base a lo anterior, ¿qué cree usted que sucedería con las fuentes de agua que abastecen su casa, si nada más de lo que se hace hoy para protegerlas, se hace en el futuro?

[ENTREVISTADORA: LEA LA LISTA Y MARQUE LAS QUE APLIQUEN. RECUERDE LEER LA LISTA COMENZANDO CON UN INCISO DIFERENTE EN CADA ENTREVISTA. MARQUE CON UNA "X" A LA PAR DE LA LETRA CON QUE COMENZÓ A LEER. SIEMPRE LEA EN EL ORDEN LISTADO (EJEMPLO: c, d, e, f, g, a, b).]

a. Se mantendrán igual
b. Se secarán
c. Darán menos agua
d. AyA o el comité del acueducto local van a protegerlas

[USE SOLO SI EL ENTREVISTADO LO EXPRESA]
e. No sé
f. Otro _____

Me gustaría saber si usted cree que las siguientes actividades son un problema actual o lo serán dentro de cinco años para la zona alrededor de la naciente.

12. ¿Cree usted que la corta de árboles alrededor de la naciente es un problema actual para las fuentes de agua?

a. Si No No sé

¿Y dentro de 5 años?

b. Si No No sé

13. ¿Cree usted que las actividades agrícolas alrededor de la naciente son un problema actual para las fuentes de agua de su acueducto?

a. Si No No sé

¿Y dentro de 5 años?

b. Si No No sé

14. ¿Cree usted que la construcción de casas y hoteles alrededor de la naciente son un problema actual para las fuentes de agua de su acueducto?

a. Si No No sé

¿Y dentro de 5 años?

b. Si No No sé

SECCIÓN III – Sección de Voto por el Programa

[ENTREVISTADORA: CUIDADOSAMENTE LEA EL SIGUIENTE ESCRITO]

Hasta ahora hemos conversado sobre sus opiniones acerca del servicio de agua en esta zona así como de los diferentes usos de la tierra alrededor de la naciente, los cuales pueden ó no tener un impacto en la presión, confiabilidad y calidad del agua.

Hay diversos programas que pueden ponerse en práctica, me gustaría que considerara un posible programa que podría ser diseñado para asegurar las fuentes de agua de la comunidad en el largo plazo.

El programa apoyaría el uso de una nueva naciente de agua diferente a la actual, y se enfocaría en proteger la tierra alrededor de esta nueva naciente. De este modo, usted como usuario seguirá recibiendo:

a. **La misma presión, la misma confiabilidad y calidad de agua que ha recibido típicamente durante el año pasado.**

[ESCENARIO ALTERNATIVO, A SER USADO CADA DOS CASAS
MARQUE AQUÍ CON UNA X CUANDO LO USE_____]

b. **La misma presión y calidad de agua que ha recibido típicamente durante el año pasado; pero con una confiabilidad mejorada, de modo que usted solo tenga la mitad de las interrupciones que tuvo durante el año pasado,**
b. **procurando mejorar el mantenimiento del acueducto.**

Para ello se trabajaría con propietarios alrededor de la fuente de agua para que protejan la tierra o practiquen actividades de poco o ningún impacto. Por ejemplo, la protección prevendrá o reducirá la corta de árboles y los impactos de las actividades agrícolas.

El programa se implementaría mediante un acuerdo voluntario de cooperación registrado a través de un contrato entre la administración del acueducto, los usuarios del agua, y los dueños de tierras alrededor del nuevo naciente.

Este programa de protección de las fuentes de agua costará dinero. Para financiar el programa, a cada hogar en su comunidad se le solicitará que vote a favor o en contra del programa. Si la mayoría de los miembros de la comunidad votan a favor, todos los usuarios ayudarán a financiarlo pagando un monto adicional en su tarifa mensual del agua.

Se espera que algunos voten a favor y otros en contra del programa. Por ejemplo, alguna gente podría votar en contra del programa porque piensan que las actividades alrededor de la naciente no representan ningún problema para la integridad de las fuentes de agua; otros podrían votar en contra porque tienen cómo obtener agua de otras fuentes. Por otro lado, alguna gente podría votar a favor del programa porque reconocen que las actividades alrededor de la naciente podrían ser un problema actual o a futuro para la integridad de las fuentes de agua y creen que un programa para proteger las fuentes de agua asegurará la provisión de agua en el largo plazo.

Sus opiniones son importantes para el proceso. Queremos saber su opinión en el caso de ser requerido para votar por este programa de protección de fuentes de agua.

15. **¿Votaría usted a favor o en contra del programa si tuviera que pagar** [VER ALTERNATIVA EN COLUMNA DE COSTO] **colones más en su recibo mensual de agua?**

[CLARIFICAR QUE A FAVOR ES SI Y EN CONTRA ES NO]
[¡IMPORTANTE! ALTERNAR COSTO INICIAL EN CADA NUEVA ENTREVISTA. MARQUE CON UNA "X" A LA PAR DE LA LETRA CON QUE COMENZÓ A LEER.]
[MARQUE LA ORESPUESTA CON UNA X EN S = SI Ó N = NO]

	COSTO		
a.	**400**	S	N
b.	**800**	S	N
c.	**1600**	S	N
d.	**2400**	S	N

[PAUSA] [USE LA MISMA ESCALA E INSTRUCCIONES PREVIAS]

[MARQUE ____ SI USÓ 16.a.i]

16. a. i) No está claro aún cuál sería el costo del programa; existen dos estimados. Si el programa le costara a su hogar [VER ALTERNATIVA SI /NO EN COLUMNA DE COSTO] **colones más por mes, votaría a favor o en contra del programa?**

[MARQUE ____ SI USÓ 16.a.ii]

16. a. ii) Y si el programa le costara a su hogar [VER ALTERNATIVA SI /NO EN COLUMNA DE COSTO] **colones más por mes, votaría a favor o en contra del programa?**

	Dice que a favor (SI)			Dice que en contra (NO)		
a.	**800**	S	N	**100**	S	N
b.	**1600**	S	N	**400**	S	N
c.	**2400**	S	N	**800**	S	N
d.	**4000**	S	N	**1600**	S	N

[SI LA RESPUESTA ES NO – NO, HAGA LA SIGUIENTE PREGUNTA:]

17. Votaría a favor de pagar cualquier cantidad adicional cada mes por este programa?

SI **Cuánto sería?**
¢_____

No **Por qué?**
_____

16. b) **¿Qué dice el entrevistado mientras toma su decisión?** [Puede marcar más de una]

a. Dice que es demasiado caro
b. Dice que es demasiado poco
c. Dice que no puede pagarlo
d. Habla de sus gastos
e. Duda del beneficio para él/ella
f. Duda que el proyecto funcionaría
g. Reconoce que debe pagar más pero que no puede
h. Otro: _____

18. Si este programa que pretende proteger las fuentes de agua de la zona se lleva a cabo asegurando la provisión de agua a largo plazo, ¿Cree usted que el programa proveería otros beneficios ?

a. Si **Cuáles?**
[MARQUE LA(S) MÁS CERCANA(S) O AGREGUE OTRA]?

i. Protección de la calidad del agua del río
ii. Protección para las aves
iii. Mejoramiento de la pesca en la zona
iv. Regular la implementación de prácticas agrícolas amigables con el ambiente
v. Minimizar riesgos de salud relacionados con el agua
vi. Aumentar las oportunidades de trabajo
vii. Mejorar la infraestructura en la comunidad
viii. Mejorar la administración del acueducto
ix. Aumentar la confiabilidad del servicio
x. Otro_____
_____

b. No

c. No sé

19. Cuando hablamos de "largo plazo", ¿díganos por favor cuánto tiempo viene a su mente?

_____Años No sé

20. Según su opinión ¿qué entidad es responsable por el cuidado de las fuentes de agua de la comunidad?
[MARQUE UNA O AGREGUE LO QUE APLIQUE]

a) AyA
b) Acueducto Local
c) FONAFIFO
d) MINAE
e) Municipalidad
f) No sé
g) Otro _____

SECCIÓN IV – Administración del Servicio de Agua Potable

21. Con respecto a su actual servicio de agua ¿Utiliza medidor?

a. Si [CONTINUE CON LA PREGUNTA 24]
b. No
c. No sabe

22. ¿Paga usted una tarifa mensual fija por su servicio de agua potable?

a. Si
b. No
c. No sabe

23. ¿Cuál fue el valor de su recibo de agua el mes pasado?

_____Colones _____ No sabe **[CONTINUE CON LA PREGUNTA 27]**

24. ¿Sabe usted si su medidor funciona?

a. Si
b. No
c. No sabe

25. ¿Sabe usted cada cuanto es leído su medidor?

a. Una vez al mes
b. Otro _____
c. No sabe

26. Aproximadamente, ¿cuánto paga usted por mes?

_____ Colones _____ No sabe

Ahora, me gustaría conversar con usted acerca del uso de los medidores de agua

27. Usando una escala de 1 a 5, donde "1" significa "Muy en Desacuerdo" y "5" significa "Muy de Acuerdo", por favor dígame cuan de acuerdo o cuan en desacuerdo está usted con las siguientes declaraciones relacionadas con el uso de los medidores de agua.

[USANDO LA SIGUIENTE ESCALA]
1 = **Muy en Desacuerdo**
2 = **En desacuerdo**
3 = **Ni de acuerdo ni en desacuerdo** (Indiferente)
4 = **De acuerdo**
5 = **Muy de Acuerdo**

[MARQUE SÓLO SI EL ENTREVISTADO LO MANIFIESTA]
NS = No sabe

[ENTREVISTADORA: RECUERDE LEER LA LISTA COMENZANDO CON UN LITERAL DIFERENTE EN CADA ENTREVISTA. MARQUE CON UNA "X" A LA PAR DEL LITERAL CON EL QUE COMENZÓ A LEER. SIEMPRE LEA EN EL ORDEN LISTADO (POR EJEMPLO: C, D, E, F, G, A, B).]

"El uso del medidor _____."

a.	**Mejora el sistema de cobro ya que los usuarios pagan solamente por la cantidad de agua usada. Dígame por favor si usted está** [LEA CADA OPCIÓN EN LA ESCALA] **con esta declaración?**	1	2	3	4	5	NS
b.	**Mejora la conservación del agua puesto que de esta manera los usuarios tendrán más cuidado de no desperdiciar el agua.** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS
c.	**Mejora el servicio de agua debido a que el Comité del Acueducto tendrá más fondos para brindar el servicio.** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS

[USE LA MISMA ESCALA E INSTRUCCIONES PREVIAS]

"Un medidor _____".

d.	**Calcula de mala manera la cantidad de agua que una familia consume. Dígame por favor si usted está** [LEA CADA OPCIÓN EN LA ESCALA] **con esta declaración?**	1	2	3	4	5	NS
e.	**Cobra más caro que lo que se paga en una tarifa mensual fija, aun si el medidor funciona bien.** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS
f.	**Requiere que las familias paguen la instalación y el mantenimiento.** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS
g.	**Puede ser alterado o modificado ilegalmente.** [LEA LA ESCALA SI ES NECESARIO]	1	2	3	4	5	NS

28. Existen algunas sugerencias por parte de expertos en el área acerca de cómo proteger su actual servicio de agua.

Permítame leer una lista de sugerencias y por favor dígame cuan importante o no es para usted cada una de ellas, usando una escala de 1 a 5, donde 1 es igual a "Sin Importancia" y 5 es igual a "Muy Importante".

[USANDO LA SIGUIENTE ESCALA]
1 = **Sin Importancia**
2 = **Poco Importante**
3 = **Ni Importante ni No Importante** (Indiferente)
4 = **Importante**
5 = **Muy Importante**

[MARQUE SÓLO SI EL ENTREVISTADO LO MANIFIESTA]
NS = No sabe

[ENTREVISTADORA: RECUERDE LEER LA LISTA COMENZANDO CON UN LITERAL DIFERENTE EN CADA ENTREVISTA. MARQUE CON UNA "X" A LA PAR DEL LITERAL CON EL QUE COMENZÓ A LEER. SIEMPRE LEA EN EL ORDEN LISTADO (POR EJEMPLO: C, D, E, F, G, A, B).]

a. **Dar más información y educación para la gente de la comunidad sobre como colaborar con la protección de las fuentes de agua, ¿diría usted que esta sugerencia es** [LEA CADA NUMERAL DE LA ESCALA]?	1	2	3	4	5		NS
b. **Mejorar la participación de los hogares de la comunidad para la conservación del agua, ¿diría usted que esta sugerencia es** [LEA LA ESCALA SI ES NECESARIO] ?	1	2	3	4	5		NS
c. **Mejorar la organización comunal, ¿diría usted que esta sugerencia es** [LEA LA ESCALA SI ES NECESARIO] **que se debe hacer para proteger las fuentes de agua potable en el área?**	1	2	3	4	5		NS
d. **Mejorar la comunicación y participación entre la gente de la comunidad y las instituciones del gobierno.** [USE LA MISMA ESCALA E INSTRUCCIONES PREVIAS]	1	2	3	4	5		NS
e. **Mejorar el mantenimiento del sistema por parte del Comité del Acueducto.** [USE LA MISMA ESCALA E INSTRUCCIONES PREVIAS]	1	2	3	4	5		NS

[USE LA MISMA ESCALA E INSTRUCCIONES PREVIAS]

[CONTINUE LA LECTURA DE LA SECUENCIA]

f. **Mejorar la administración por parte del Comité del Acueducto**	1	2	3	4	5		NS
g. **Llevar a cabo un estudio para localizar una naciente alternativa**	1	2	3	4	5		NS
h. **Proteger la tierra alrededor de la naciente**	1	2	3	4	5		NS
[USE SÓLO SI EL ENTREVISTADO PROVEE INFORMACIÓN DE MANERA VOLUNTARIA] i. **Otro**_____							

SECCIÓN V – Información Demográfica

Tengo algunas preguntas generales acerca de usted y su familia.
[ENTREVISTADORA: MARQUE EL GÉNERO DEL ENTREVISTADO]

Hombre / Mujer

29. ¿Cuál es su edad? _____

30. a. ¿Cuántas personas mayores de 18 años viven en esta casa? _____

b. ¿Cuántas personas menores de 18 años viven en esta casa? _____

31. ¿Cuánto tiempo ha vivido usted en esta comunidad?
_____Años

32. ¿Tiene usted planeado mudarse de esta comunidad en el siguiente año? Si
No

33. ¿Cuál es el nivel de educación más alto que usted completó?
[ENCIERRE EL LITERAL QUE COINCIDA CON LA RESPUESTA DEL ENTREVISTADO]

a.	Primaria Incompleta ó Nada	e.	Universidad Incompleta
b.	Primaria Completa	f.	Bachillerato Universitario
c.	Secundaria Incompleta	g.	Licenciatura
d.	Secundaria Completa	h.	Postgrado

34. ¿Cuál es su estado civil?

a.	Casado	[CONTINUE CON LA PREGUNTA 35]
b.	En unión libre	[CONTINUE CON LA PREGUNTA 35]
c.	Divorciado/Separado	[CONTINUE CON LA PREGUNTA 36]
d.	Soltero	[CONTINUE CON LA PREGUNTA 36]
e.	Viudo	[CONTINUE CON LA PREGUNTA 36]

35. ¿Cuál fue el nivel de educación más alto que su pareja ha completado?
[ENCIERRE EL LITERAL QUE COINCIDA CON LA RESPUESTA DEL ENTREVISTADO]

a.	Primaria Incompleta ó Nada	e.	Universidad Incompleta
b.	Primaria Completa	f.	Bachillerato Universitario
c.	Secundaria Incompleta	g.	Licenciatura
d.	Secundaria Completa	h.	Postgrado

36. ¿La casa en que usted vive es [LEA LAS OPCIONES]?

a. Propia
b. Alquilada
c. Cuida la propiedad
d. Prestada
e. No sabe
f. Otro_____

37. ¿Se dedica usted a la agricultura? Si No

38. Incluyendo a todos los que viven en su casa, ¿Cuál es aproximadamente el ingreso mensual en su hogar?

¢_____ [REGISTRE EL MONTO]

[SI EL ENTREVISTADO RECHAZA RESPONDER, PREGUNTE LO SIGUIENTE]

a. ¿Podría solo decirme si el ingreso total por mes de su casa es menor que 150,000 colones?
a) Si
i. Si es así, ¿puede usted decirme si el ingreso total por mes de su casa es menor que 75,000 colones?
01. Si
02. No
b) No
i. Si es así, ¿puede usted decirme si es menor que 240,000 colones?
01. Si
02. No

39. Vota usted en alguna de las siguientes elecciones [LEA LAS OPCIONES] [MARQUE LA OPCIÓN INDICADA]

a.	**A nivel comunitario, para Comité de Desarrollo por ejemplo**	Si	No
b.	**A nivel local, para Alcalde o Regidor por ejemplo**	Si	No
c.	**A nivel cantonal, para Diputados por ejemplo**	Si	No
d.	**A nivel nacional, para Presidente**	Si	No

40. ¿Confía usted en la administración de su actual servicio de agua para manejar el acueducto?

a. Si
b. No **Dígame brevemente ¿por qué?**
c. No Sabe **Dígame brevemente ¿por qué?**

_____

41. Programas como el presentado en esta entrevista tienden a requerir la participación de los miembros de la comunidad en un comité.

a. ¿Estaría Usted dispuesto a participar en este Comité del Acueducto de Agua?

Si No

b. ¿Estaría algún otro miembro de su hogar mayor de 18 años dispuesto a participar?

Si No

[LEA LA PREGUNTA 42 SÓLO SI EL ENTREVISTADO RESPONDE "NO" A LA PREGUNTA 41, SI RESPONDE SI FINALIZE LA ENTREVISTA]

42. En un comentario muy corto, díganos por favor, ¿cuál es la razón principal que evita que Usted participe en el Comité del Acueducto?

_____

_____

_____

_____

_____

Bueno, esa fue la última pregunta. Muchas gracias por su tiempo. De verdad aprecio mucho su disposición de compartir con nosotros sus opiniones sobre estos temas. Si en el futuro usted tiene preguntas o comentarios, por favor no dude en contactarnos. Nuestra información de contacto está en la página que le entregamos al inicio de esta entrevista.

TERMINE LA ENTREVISTA

SECCIÓN VI - <u>Para el entrevistador solamente</u>

43. ¿Piensa Usted que la persona entrevistada se notó contrariada (ej. irritada, nerviosa, molesta) durante la entrevista?

    a. Si
    b. No

44. ¿Piensa usted que la persona entrevistada hizo un esfuerzo por responder con la verdad?

a. Sobre sus percepciones	Si	No
b. Sobre sus ingresos	Si	No
c. Sobre su votación	Si	No

45. En términos generales, ¿cómo calificaría la calidad general de la entrevista?

    a. Muy Buena
    b. Buena
    c. Ni Buena ni Mala
    d. Mala
    e. Muy Mala

Si usted tiene algún comentario que quisiera hacer sobre las respuestas del entrevistado o sobre el propio cuestionario, por favor regístrelo en este espacio.

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