Annex 2 to Award Letter

PROJECT PROPOSAL Andes 2: CIAT

Assessing and anticipating the consequences of introducing benefit sharing mechanisms

Basin Development Challenges of the CPWF

To improve livelihoods, increase water access, and reduce water-related conflict through benefit sharing

July 2009
1. Basin Development Challenge:
Andes: To improve rural livelihoods, increase water access, and reduce water-related conflict through benefit-sharing in selected basins

2. Project:
Andes Project 2: On assessing and anticipating the consequences of introducing benefit-sharing mechanisms

3. Project Data

<table>
<thead>
<tr>
<th>Duration:</th>
<th>4 years</th>
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<tbody>
<tr>
<td>Target start date:</td>
<td>November 2009</td>
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<tr>
<td>Finish date:</td>
<td>November 2013</td>
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<tr>
<td>Maximum budget requested from CPWF:</td>
<td>US$1.5 million</td>
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<tr>
<td>Any matching funds offered (provide brief explanation):</td>
<td>GTZ will cover the salaries of its staff to be involved in the project as some operational funds for field visits and coordination work in Ecuador. The University of Florida member salary is covered by them. FUNDESOT will contribute with part of its staff time for training, administration and dissemination of project advances with local actors. CIAT offers time of an administration staff and a secretary for supporting project operation as well as a part of a GIS support and senior staff.</td>
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4. Project Deliverable

- Analysis and quantification of the extent to which changes in land and water management in catchments contribute to improved downstream water quality and quantity
- Recommendations on how the design of benefit and cost sharing mechanisms can be improved under different circumstances

5. BDC Goals to which the Project will contribute

If this BDC is successfully addressed, basin stakeholders will have new opportunities to care for and reap the advantages of their local water and soil resources, leading to improvement in their livelihoods. Conflict between water and land users will have been diminished through the development and implementation of fair and equitable water and land reallocation mechanisms and rights. The resolution of such land-water use conflicts will contribute to improving the livelihoods of stakeholders. Local and regional governance will also benefit because resources and efforts can be redirected to other urgent problems. Social organization will become more inclusive and focused to deal with peoples’ demands in closer contact with policy-makers at local scales. Finally, downstream water users will have a more abundant and reliable supply of clean water while upstream communities will benefit from investments that improve the productivity of their agroecosystems. In return, upstream communities will agree to cease the unsustainable exploitation of catchment areas key to downstream water supply.
6. Links with other projects in the Basin Development Challenge:

The project will need to work with other projects in the BDC to contribute to a coherent research program that is lead by a Basin Leader.

7. Project Summary

This project is about showing whether BSM are effective. It seeks to quantify the consequences of BSM-driven changes in land and water management for livelihoods in upstream rural communities, and for water supplies for downstream water consumers. It will develop methods to anticipate ex ante the likely consequences of introducing BSM as well as monitoring and measuring these consequences ex post. Finally, it will introduce methods for adaptive management in BSM design and planning, so that new instances of BSM can benefit from lessons already learned – for example, so that BSM design is more likely to result in benefits to the upstream rural poor, and to the environment, as well as for downstream water consumers.

8. Links to previous and ongoing work

8.1 Previous and on-going work

In the Andes it is recognized the causal relationship between upstream land use and management and the water quality and quantity downstream. Specifically instability of dry-season streamflow and sedimentation are two of the main negative effects caused by inappropriate land use and management in upstream areas and affecting downstream water users. In consequence desired watershed services (WS) in the Andes are mostly related to enhanced dry-season stream flow and sediment retention (Celleri, 2009). This causal relationship has stimulated the creation of BSms that aim to promote ecosystem conservation or restoration in upstream areas and Payment for Environmental Services is one of these mechanisms in the Andes (Asquith and Wunder, 2008) that through direct payments compensate land users providing (WS). The resources came from parties benefited from the environmental service and also from donor support as a strategy to start up the mechanism.

Although, PES schemes are popular in Latin America, few possess all stylized ‘ideal’ PES criteria of conditionality, voluntariness, transactions between at least one buyer and one seller, and an adequate definition of the services being paid for (Wunder, 2005). Instead, most of the existing BSms correspond to financial or economic mechanisms that are differentiated from other conservation-oriented mechanisms because they attempt to influence directly land users' decisions likely to secure the service (or, in other words, to address the externality) (Quintero, 2009). Therefore what it is found in the Andes is different types of BSms that give monetary or non-monetary compensations and by being not “pure” PES schemes are called PES-like schemes (Wunder et al. 2008).
Most of these mechanisms have emerged without following any legal framework to guiding their creation and even, have been developed without sound hydrological analysis about the provision of the service (Quintero, 2009). Instead, providers of WS are paid for changes to their land management practices or use that are believed to have a high probability of resulting in the desired impact on WS (Porras et al 2008), but the land use-WS linkage is often uncertain (Wunder et al 2008). Furthermore, few studies have been conducted to determine the effects of these schemes on livelihoods and poverty (i.e. Wunder, 2008; Pagiola et al., 2005; Landell-Mills, N. y Porras, T. I., 2002).

This situation is encouraging practitioners and scientists to find or propose approaches for investigating if the service is actually delivered and to policy-makers to revise, in some countries, their legal framework to orient the implementation of these schemes. This situation encouraged some researchers part of the CPWF-first phase to develop and propose a methodological approach for ex-ante assessment of impacts on the watershed services when new land use/management alternatives are promoted in Andean watersheds. This effort was accompanied in some cases with the design of a BSM in parallel as a strategy to be able to conduct ex-post analysis and contrast it with the initial ex-ante results (see section 10.8).

However few efforts such as this in the Andes exist. Garzon (2009) found that of 14 BSM cases already implemented in the Andes and oriented to provide WS, only 3 cases have conducted in some extent this type of analysis, and anyone have tried to monitor the effects of these BSM on livelihoods. Also, most of the projects are quite recent and are focused on protection measures appealing to a precautionary principle where the conversion of conserved natural is prevented (Wunder et al 2008). The existing BSMs have appealed to different management options to compensate the positive modification of the provision of ES and can be classified as enablement strategies, incentives and direct measures. Enabling involves environmental training and campaigns and implementation of agricultural technologies or better management practices likely to impact positively the services; incentives includes direct payments or soft credits to land users providing or conserving the services; and direct measures are in most cases land acquisition and improvement of surveillance in protected natural areas. In most cases, more than one management option is used (Quintero, 2009). This shows that BSM can not only compromise monetary compensations such us direct payments and that the strategy to promote BSMs depends on opportunity costs, local context, upstream socioeconomic needs, land tenure status, etc.

The PN22-CPWF-first phase had to resort to hydrological modeling and optimization models. The first to anticipate the hydrological effects of different management practices or land uses in Andean watersheds and the later, to determine economic and social benefits of different management and land use alternatives as of shadow prices for environmental services. The PN22 found that a very exact and precise price of the service and magnitude of the hydrological impact is difficult to obtain in the Andes due
to lack of hydrological information and models developed for this region (Quintero et al. 2009). However, although all models are wrong, some can be useful (Box and Norman, 1987), to setting a compensation amount closer enough “right” to channel decisions toward seeing nature as essential for sustaining human well-being (Daily et al., 1997). So, this project served to identify the most sensitive variables that affect the quantification of WS in the Andes and also realized the need to measure more carefully the socioeconomic benefits beyond the farm scale to be able to design BSM beyond the renowned PES schemes.

Apart from developing a methodological approach, the PN22 and other CPWF in the Andes measured the impacts of new technological alternatives (i.e. conservation agriculture, agroforestry systems) in soil and water-related characteristics. However, only on-site impacts have been documented and still and in many cases explicit connection with the impact on WS (off-site impacts) need to be addressed in order to be able to promote BSM between water users and upstream inhabitants.

8.2 Lessons learned

○ Few of the BSM cases are supported by research activities evidencing a weak relation between PES-like schemes researchers and practitioners. However some practitioners are interested in conducting studies to document their environmental impacts and to target spatially spending to ensure that highest value of benefits is get per every dollar spent. This currently poses an opportunity to enhance research-practitioner interaction.

○ BSM for ensuring better WS can not be strictly PES schemes and the type of scheme depends on opportunity costs, local context, upstream socioeconomic needs, etc. Thus other arrangements for sharing upstream-downstream costs and benefits are required (e.g. trust funds, revolving funds, endowments, among others)

○ There are many BSM cases for improving water quantity and quality in watersheds where any monitoring (at least on on-site impacts) is conducted and its design relayed on widely accepted but not always correct assumptions (i.e. forests have always a positive impact on water quantity) (Quintero 2009)

○ Neither commonly accepted standards, nor indicators nor guidelines related to BSM for providing watershed services exist

○ BSM impact assessment need to include benefits derived from impacts:
  a. On the environmental services (externality);
  b. On socioeconomic conditions of service providers (upstream land users) which include marginal changes on income, employment and competitiveness (especially when new productive alternatives are promoted),
  c. On Socioeconomic conditions of downstream beneficiaries including marginal changes in income and employment and changes in competitiveness (when an economic activity depends on the service) and livelihood impacts,

All this will permit to i) Design fair and equitable BSM derived based on the benefits from WS. This will facilitate an agreement on the distribution of monetary and non-
monetary benefits between a provider and a recipient of the services. Moreover, this will permit to avoid unbalances when WS beneficiaries are whether under-paying or over-paying for a service. ii) To determine the time frame for which these benefits can be shared (short, medium and long term). iii) To determine the kind of benefits to be distributed according to the type and needs of actors involved.

9. Research questions

- How can the consequences of implementing BSM be anticipated (ex-ante) and measured (ex-post)? What methods are appropriate under different circumstances? Regarding:
  - Quantity, reliability, quality of water for consumers
  - Major land use (forest, pasture, agriculture, fallow)
  - Ecosystem services (broadly defined)
  - Water allocation, access to water, and water-related conflict
  - Land and water use practices in agriculture (including livestock, farm-level adoption of resource conserving practices, farm-level use of irrigation)
  - Water, land and labor productivity
  - Rural livelihoods and resilience
- How can the contribution of BSM to the above kinds of changes be assessed relative to the contributions of other factors?
- How can research on BSM performance be used to further improve BSM design? (Adaptive management)

*How will your research address these research questions?*

With respect to methods to quantifying impacts (ex-ante and ex-post) of land use/management changes driven by BSM, changes on water for consumers will be assessed through hydrological modeling as a first hand approximation during ex-ante analysis and refined with ex-post measurements of on-site and off-site biophysical impacts (soils, streamflows, soil loss rates, etc.). When feasible these changes will be linked with changes (positive or negative) in other ecosystem services such as soil carbon sequestration and biodiversity. Changes on land and water use will necessarily be documented when assessing not only environmental impacts but socioeconomic ones, which involves modeling of the land use systems to be proposed (this includes documentation of changes in inputs and outputs, including labor, land and water use among other resources and goods). The livelihood resilience will be analyzed by using a methodology called Multidimensional Poverty Assessment (MPA) (unpublished) recently developed by IFAD. One of the dimensions is “resilience to shocks” which is a methodological component that measures the household’s exposure to natural and socioeconomic shocks and their ability to cope and recover from such shocks. This is based on surveys developed by panel of experts where a team member of this project participated. This methodology has been recently tested in China and India. For more details about methods see section 10.5. On the other hand, recommendations for BSM (Output 3) will include principles to adapt BSM when its performance indicators show low efficiency, this will ensure adaptive management but maintaining agreements about
the distribution of benefits and costs based on results from output 2. The project expects that during M&E, impact pathways methodologies will be used to guide the project to understand what factors have contributed to changes on water for consumers and socioeconomic conditions for upstream and downstream land and water users.

10. Research Outputs, Methods and Uptake Pathways

10.1 Project research outputs

- Analysis and quantification of the extent to which changes in land and water management in catchments contribute to improved downstream water quality and quantity
- Analysis and quantification of the economic and social benefits derived from changes in land and water management in catchments
- Recommendations on how the design of benefit and cost sharing mechanisms can be improved under different circumstances

What additional research outputs should the project produce, if any? What does the output(s) add to the BDC?

The additional research output the project will produce is:

- Output 2: Analysis and quantification of the economic and social benefits derived from changes in land and water management in catchments

This additional output will permit to explore at what extent proposed changes in land and water management will affect socioeconomic conditions of upstream land users and downstream water consumers. This is important because BSM design should take into account not only the environmental benefits but the socioeconomic implications of it. In that way truly fair and equitable BSM can be developed and negotiated. In another hand, changes on water, labor and land productivity will be included in this analysis as an indicator of the economic efficiency of the BSM. In addition a BSM can have impacts on rural livelihoods, but one of them is on their resilience capacity to recover from environmental and socioeconomic shocks. BSM by changing socioeconomic and environmental conditions to both, upstream and downstream land and water users can therefore, modify this capacity. The project will explore how this will be modified. This also contributes to questions arisen in section 9.

10.2 Project partners

Output 1:
International Center for Tropical Agriculture (CIAT)
Marcela Quintero (Ecologist – Soil and Water Scientist)
Natalia Uribe (GIS specialist, hydrological modeling)
Ruben Dario Estrada (Agronomist and Economist. Agroecosystem modeler)

University of Florida
David Wright (Agronomist)
Output 2:
RIMISP - The Latin American Center for Rural Development
German Escobar – (Sociologist and Agricultural Economist)
International Center for Tropical Agriculture (CIAT)
Jeimar Tapasco (Agronomist and Environmental Economist), Ruben D. Estrada, Marcela Quintero
GTZ – German Technical Cooperation
Alonso Moreno (Agronomist)
FUNDESOT (Foundation for Sustainable Development)
Wilson Otero – (Agrologist, Extension Agent and Land Use Planner)

Output 3
International Center for Tropical Agriculture (CIAT)
Ruben Dario Estrada, Marcela Quintero, Jeimar Tapasco
University of Florida
David Wright
RIMISP - The Latin American Center for Rural Development
German Escobar
GTZ – German Technical Cooperation
Alonso Moreno
FUNDESOT (Foundation for Sustainable Development)
Wilson Otero

10.3 Next users

Output 1:
- The following actors will use directly results from the analysis of impacts on downstream water quality and quantity to target spending in watersheds from BSM and promote better land and water use/management alternatives
  - Regional environmental authority (CAR): (Fuquene watershed -Colombia)
  - Regional environmental authority (CORPOGUAVIO), EMGESA (Hydropower company), EAAB (Bogota Water supply company): (Tomein watershed-Colombia)
  - GTZ (Quijos watershed – Ecuador)
  - Municipalities of El Chaco and Quijos (Ecuador)
  - FONAG (Water Conservation Fund of Quito) (Quijos watershed –Ecuador)
  - Ministry of Environment and National Water Authority (Canete watershed - Peru)
- Identified and tested land uses and management practices to improve watershed services will be used directly by farmers (CORPOMORTINO and ASOAGROALISAL in Fuquene, livestock farmers of Tomine and El Quijos watersheds, farmers of Canete).
• CIAT and other research centers and universities working on hydrological research will use modeling results and adjustments to the model for assessing impacts on WS in Andean watersheds

**Output 2:**
The following actors will use this output in order to discuss the design of the most appropriate and suitable BSM based on the expected economic, environmental, social and livelihoods impacts

- **Fuquene (Colombia):** CAR, FUNDESOT (Fuquene -Colombia)
- **Tomine (Colombia):** CORPOGUAVIO, FUNDESOT, EMGESA. EAAB
- **El Quijos watershed (Ecuador):** GTZ, FONAG, municipalities
- **Canete watershed (Peru):** Ministry of Environment, National Water Authority
- And any other organization interested in participating in the creation and operation of this kind of mechanisms in the study sites

**Output 3:**
All next users mentioned in output 2 plus land users and other organizations and persons interested in BSM in the Andes to improving water quality and quantity in watersheds and softening water-related conflicts.

### 10.4 Learning required by next users

**Output 1:**
Technicians from the abovementioned organizations (next users) will need to understand the principles and rationale behind hydrological modeling and its ability to determine the contribution of different areas to stable streamflow for downstream users. This will be important for understanding the resultant targeting of areas to be included in the BSM design.

Farmers will need probably to develop new skills and knowledge about the principles and management of new land uses/management practices proposed for improving WS.

Other research and academic institutions interested in using SWAT will need to understand the reasons behind adjustments to be made to the model for obtaining more accurate results in the Andes. In the same way CIAT is developing a collaboration with the University of Texas who have developed SWAT model, to ensure that probable adjustment to algorithms are made correctly by the CIAT modeling team.

**Output 2:**
All organizations to be part of a BSM for improving WS will need to understand the assumptions, source of information and results of these output in order to be able to validate results and design, negotiate and agree about the most appropriate, fair and equitable BSM for the study site. This will include the understanding of results about the
economic benefits for farmers, downstream water consumers, and the social benefits in terms of labor use and resilience capacity.

**Output 3:**
Next users will need a clear understanding of concepts related to WS and BSM, land use-WS interdependencies, the socioeconomic context and the approach to quantify the impacts of a BSM in the study site. Once certain BSM options are recommended it will be necessary that all users understand the conditions and rules behind it.

**10.5 Research methods**

**Output 1: Analysis and quantification of the extent to which changes in land and water management in catchments contribute to improved downstream water quality and quantity**

This output requires an analysis at the watershed level. To quantify the impacts on downstream water quality and quantity hydrological modeling will be needed in ex-ante and ex-post analysis. Through the simulation of the different scenarios of land use and management it will be possible to determine the areas at which these changes need to be promoted by a BSM as not all areas in a watershed have the potential to impact equally downstream water quality and quantity. For the *ex-ante* analysis the most accurate and available secondary data (rainfall, soil types, land uses, climate, topography, water consumers location, streamflow and sediment measurements, expected changes of land uses/management practices on soil characteristics based on previous research, and experts knowledge) will be used to anticipate the hydrological impacts. For the *ex-post* analysis two approaches will be adopted: i) hydrological modeling updating input values with on-site ex-post measurements of characteristics that are known to affect hydrological processes at the watershed scale (i.e. new soil values after implementing new land use/management practices). This approach is based on hydrological processes knowledge. ii) By proposing a protocol to directly measure ex-post off-site impacts on streamflow stability, quantity and quality (this is based on a direct measurement approach of off-site impacts). For hydrological modeling a distributed and process-based model will need to be used (e.g. SWAT) as this will permit to determine the minimum amount of area for land use changes to reach the level of desired impact on water quality and quantity and to enable *ex-post* evaluation of how changes on on-site characteristics will affect the hydrological processes at the watershed level. Similar applications of this model can be found at Quintero et al. (2009). This project will permit to improve the performance of hydrological modeling in the Andes by working closely with the University of Texas where SWAT model was developed. The SWAT team of UT has expressed his interest on providing advice to modify the model in order to adjust it to the very special conditions in the Andes. The past experience of the project team with the model has encouraged the UT to provide this support.
The application of SWAT in previous experiences (e.g. CPWF-Phase 1 PN22) has provided results that fit well with measurements (good correlation factors) and although it is not 100% accurate in absolute terms, it has contributed to determine the relative importance of different land uses/practices, soils and topography combinations in the magnitude of the total sediment and water yield. This is crucial for targeting investments or payments to retain sediments or improve streamflows. However we do not ignore that having an USLE equation (Universal Soil Loss Equation) adjusted for the Andes will be the optimal alternative and will contribute to improve modeling exercises. For this reason, we want to attempt at least in few sites, field measurements and try to find out how feasible the proposed methodological approach can work to adjust the equation (see attached file). There are many efforts to measure erosion in the field in the Andes, but any has systematically tried to adjust the coefficients. To have a unique USLE equation adapted for the whole Andes may need an enormous effort, however before embarking on such a task we may prove this at some specific sites, and this is what we want to do in this project. All this will contribute to discard or select methods for proposing and refining ex-ante methods and this should be reflected in output 3 (recommendations). Now the project will always look for expert's advice in the topic and for this will work count with the advice of experts from the University of Texas. To do this, the team will embark on field experimentation that will provide insights about new coefficients to be modified in the model. The objective of this is to measure the soil losses occurring in different land uses/management practices in selected study sites by using the structure of the USLE, but determining the erodability and erosivity factors locally. This will be achieved by measuring the soil permeability, soil structure, organic matter and texture, which are the variables that determine the erodability factor of a given soil. The value of this factor will be incorporated into the USLE to calculate the soil loss. In addition, rainfall intensity will be used to adjust the erosivity factor of each plot. The erodability and erosivity factors will be combined with the land cover and slope characteristics in order to estimate the soil losses in each treatment. This result will be compared with the soil losses obtained with a field rain simulator or runoff plots (see attached file for more details). At the same time the project team will consider other models for addressing the same objectives of this output (e.g. those models to be used by the CPWF project 1 in the Andes) in order to have a comparative basis for selecting better modeling results and be able to do further recommendations on methodological issues for anticipating impacts of land use/management practices scenarios on WS. This comparison will be made based on modeling performance coefficients and results of uncertainty analysis for simulations results.

It is worth mentioning that the project will not attempt to estimate all erosion sources with hydrological modeling but at least to improve the quantification of the one originated by land uses/practices that is something we can influence through an eventual BSM. Precisely this will provide insights to know at what extent this source is significant compared to the total sediment yield in the watershed. This will help to determine the potential of BSMs to improve the sediment retention in a watershed.
Output 2: *Analysis and quantification of the economic and social benefits derived from changes in land and water management in catchments*

Because BSM will benefit groups of individuals, this analysis will be done separately for upstream land users (who will implement changes in land and water management for delivering WS) and for downstream water consumers (who will be benefited from upstream land use changes). This will permit to understand the trade offs between benefits for upstream land users and downstream water consumers which is essential for designing an equitable BSM mechanism.

For upstream land users, agro-ecosystem modeling will be used to simulate how changes on productivity and labor use derived from proposed changes on water and land use affect net revenues and labor employment. This will permit to determine the difference between the highest-returning practice (business as usual scenario) and the practice that yields the most WS, or in other words it will permit to understand the opportunity costs. This will help to understand if from an economic perspective, a farmer will be willing to change its land use or practices. It will be assumed that a farmer will be willing to change if that opportunity costs is compensated or if the new alternative produces equal or higher net returns. Agroecosystem modeling and opportunity costs estimation will be conducted using an optimization model already developed during the CPWF phase 1 called ECOSAUT (Quintero et al. 2006), which permits to evaluate different land use systems throughout the time and by applying sensitive analysis permit to identify the most restrictive variable that may be constraining an optimal alternative from the economic and environmental perspective. The rationale behind this approach is that restrictions for adoption and opportunity costs will help to determine the more suitable BSM that requires to be promoted in order to stimulate or enable certain behavior upstream for delivering the desired environmental impact. For example, if it is found that a proposed land use or management change is a win-win option from the farmer and water consumer perspectives (the opportunity cost is negative and the environmental impact is positive) then the most suitable BSM will not be a PES scheme (as there is not any reduction on farmer income) but probably a cost-sharing scheme will be required to catalyze the technological adoption. In addition a competitiveness analysis will be conducted to determine if it improves with the new alternatives and at what extent benefit and/or cost sharing schemes are required for the technological change. This will be done based on the methodology proposed by (Masters, W. A. y A. Winter-Nelson. 1995) and applied in previous studies (i.e. Estrada 2007, Estrada et al. 2009). As a result the economic (net revenues and competitiveness) and social (labor use) benefits of land use/management alternatives likely to impact positively water quality and quantity downstream (from output 1) will be quantified. Also, with information used in the agroecosystem modeling, in the ex-ante analysis, cost and benefit marginal curves will be constructed to determine consumers and producers surpluses. This will permit to propose paretoian measures and cost-effectiveness analysis (including transaction costs vs. marginal prices
changes). Also the effect of prices on marginal costs and income curves will be analyzed in ex-ante and ex-post analysis. These economic analyses will be important for deliberating on the best alternatives for upstream and downstream actors. The agroecosystem modeling approach will be used for ex-post analysis but adjusting input data based on direct measurements on productivity, natural resources use, labor use, product prices, input prices, and compensations/contributions from BSM. At the end ex-ante measured benefits will be comparable to ex-post results providing this an opportunity to test accurateness of ex-ante approaches.

In addition with information from agro-ecosystem modeling it will be contrasted the amount of goods produced per system with the amount of water, labor and land resources use. This will be ex-ante and ex-post analyzed, for the upstream land user and the downstream water consumer (if a productive activity downstream is involved). As a result, water, labor and land productivity will be evaluated and used as an indicator of the eco-efficiency of the proposed productive alternatives and BSMs.

With respect to livelihoods impacts, a dimension of it related to the resilience capacity will be evaluated. Initial surveys will be conducted to determine the resilience capacity of upstream current farming systems when suffering financial or environmental shocks. This will permit to determine later if new land uses/management practices permit to overcome these shocks and how BSM can contribute to tackle financial ones. Also by knowing the main sources of weak resilience capacity –if any, the BSM can be designed to give compensations that tackle it directly. For downstream beneficiaries it will be explored with surveys how to tackle shocks that affect water availability in order to determine if better water quantity and quality derived from upstream land users, enhanced the resilience capacity. The surveys will be adapted from an IFAD methodology called Multidimensional Poverty Assessment (MPA) recently developed to determine resilience capacity of farmers in Asia (unpublished) and for which a project team member was part of the advisory committee.

Output 3. **Recommendations on how the design of benefit and cost sharing mechanisms can be improved under different circumstances**

With the results from the previous outputs it is expected to derive recommendations about the most appropriate design depending on the kind of externality imposing extra costs (or benefits) to downstream water users (e.g. sedimentation, reduction of stream flow regulation capacity, etc), the socioeconomic profiles of watershed services beneficiaries and providers, and the type of stakeholders involved in the creation and/or operation of the BSM (farmers, water supply companies, hydropower companies, water users, irrigation system users, international cooperation, conservation organizations, etc). Thus opportunity costs, watershed services value for beneficiaries, and socioeconomic capacity of beneficiaries will be contrasted among the four study sites and related to the agreed BSM between stakeholders. In that way, pre-conditions for
each kind of BSM created will be deduced and given as recommendations for setting up other BSM in the Andes.

10.6 Participatory research approaches

Output 1: The project will be initiated by introducing technicians and professionals on the methods to be used for quantifying effects of land use/management practices on WS. The main purpose of this is to ensure that the hydrological processes and the way the model operates for quantifying this is understood and discussed. For example, it will be explained how hydrological response unit (that correspond in this case to service providing units) are defined in terms of biophysical heterogeneity.

When management practices or certain land uses are proposed and recommended, extension and consultation activities will be carry out for ensuring that the principles behind it are fully understood and accepted. Also dissemination material will be developed with the help of FUNDESOT who have ample experienced on this. In another hand initial workshops for presenting the project, objectives and concepts (PES schemes, BSM, WS, etc) will be held to ensure that all stakeholders understand the scope of this project and its purpose.

Output 2: The project will held a workshop with socioeconomic professionals from the expected next user’s organizations, to explain the approaches for quantifying socioeconomic benefits of land uses/management practices and to be stimulated by BSM.

Apart from this, if desired by the next users, the project will involve directly in the analysis socioeconomic and biophysical professionals that are willing to participate in the analysis. The project is interested on contributing to build capacities while doing the ex-ante and ex-post assessment.

Output 3: The project has in all sites a local partner that act as a liaison with all stakeholders interested on creating a BSM and that currently has initiated conversations about the potential creation of it. The project will continue supporting and facilitating periodical meetings to discuss project advances to start gradually shaping the BSM in a participatory and consultative manner.

10.7 Change in user practice

Output 1: It is expected that next users will use hydrological modeling results to target spending (part of a BSM) for improving water quality and quantity. Also it is expected that land users will implement proposed land uses or management practices stimulated by a BSM.

Output 2: It is expected that next users will negotiate with all important actors a BSM
based on the understanding of total economic and social benefits derived from implementing new land and water uses.

Output 3: The users will negotiate the more suitable and appropriate BSM using as a basis for negotiation and agreement the results of this output.

10.8 Suggested sites

This project has selected 4 sites (located in Colombia, Peru and Ecuador), one already part of the Andean System of Basins and three additional ones where partners already have started scoping activities and discussions with local stakeholders interested on developing BSM for impacting positively water quantity and quality downstream. Thus the project will be conducted in sites where there is an explicit interest of developing BSMs and this project will contribute significantly to this purpose. At the same time these sites offer diverse types of water consumers and therefore, different possible situations for which different BSM will need to be designed. However the project team recognized that this project needs to contribute to other projects of this BDC so it is flexible to change the site if convenient and recommended by the coordination project and the CPWF in general. Or similarly, the mentioned sites can be incorporated in the other projects.

_Tomine reservoir watershed (Colombia):_ Located 50Km away from Bogota (Colombia), the reservoir regulation capacity permit to: 1) Supply with water the Bogota supply company (EAAB); control flooding in the Bogota highplains; and produce hydropower for Bogota (EMGESA). Additionally, the landscape offers a space for ecoturistic and navigation activities. The main concern of the environmental authority (CORPOGUAVIO), EAAB and EMGESA is that the project is facing an advancing process of eutrophication. The conversion of native forests to agriculture and livestock activities, the increase of runoff in intensive agriculture systems, the livestock manure and the human waste from surrounding towns are related with this problematic. Under this context the mentioned organizations jointly with FUNDESOT are interested on promoting better land uses and management practices upstream to reduce the sources of eutrophication.

_Fuquene Lake watershed (Colombia):_ Located 100 Km away from Bogotá, Colombia. The lake has deteriorated extensively due to excessively high levels of phosphates and nitrates and the proliferation of aquatic plants, which have accelerated eutrophication. The surface covered by water has made navigation impossible. The downstream municipalities, whose aqueducts depend partially or totally on waters from the Suarez River, which begins at the outlet of the lake, are concerned about the future of their water-supply systems. GTZ and CAR started promoting some years ago conservation agriculture as a means to reduce the deposit of sediments, nitrates and phosphates in the lake. During CPWF-phase 1 a revolving fund was created to provide soft loans for small farmers willing to implement these practices. Nowadays the challenge is to increase this fund and to find other ways for cost and benefit sharing in order to reach
more farmers and to involved direct beneficiaries as contributors to the mechanism (aqueducts companies, municipalities, etc). For this a broader socioeconomic analysis is needed. Also, there is the expression of interest of some municipalities to allocate funds for compensate land users located close to water springs in upper catchments in order to avoid the conversion of those areas to agriculture.

**El Quijos River watershed (Ecuador).** It is part of the system of watersheds that supply with water to Quito, Ecuador. The upper part of this watershed is still covered by native cloud forests, habitat of the threatened Andean bears and tapirs. Due to the biodiversity and hydrological importance of these forests, GTZ has targeted this site to design a BSM able to hold the advance of low productivity agriculture and livestock to the forested areas. For this GTZ requires ex-ante analysis that help to understand what is the kind of incentive that works better to improve agricultural productivity in already disturbed areas as a means to disincentive its advance to pristine areas, to ensure the conservation of the cloud forest and to maintain the water quality and quantity for downstream users. Potential BSMs have been already discussed with the stakeholders (trust funds, pool funds, compensations, etc) but it has been decided to initiate as soon as possible the ex-ante quantification of the WS, and the socioeconomic baseline before designing a BSM. Later this site will offer an opportunity to measure the ex-post impacts based on the methodological approached explained in section 10.5.

**Canete watershed (Peru):** This watershed is located close to Lima city, capital of Peru. The watershed is of regional and national importance since agricultural activities produce is mostly exported, there is an important national natural reserve and the second largest reservoir in the country is being constructed for hydropower production (Pantanal reservoir). The Peruvian Ministry of Environment and the National Water Authority are concerned about the impacts that the reservoir construction may have on water supply for downstream agricultural lands and Canete town water users. At the same time it is recognized the importance that natural and agricultural upstream areas have for the regulation of water flows and the retention/production of sediments, ecosystem services on which the production of hydropower, potable water, and agricultural products relies on. Under this context, BSMs (e.g. PES) are considered by the Ministry of Environment as instruments to reach equity between the different land users and the water-related environmental services providers while stimulating the conservation of natural areas and the recuperation of degrading ones. Currently the WWF (World Wild Fund) has offered support for conducting in 2009 a general socioeconomic and environmental diagnostic to provide the basis for the design of the most adequate BSM in the watershed. This diagnostic will serve as the basis to carry out the proposed analysis in our research proposal which aim to provide specific guidelines for the creation of these mechanisms and its impacts monitoring. As such, the ministry of environment has received with enthusiasm our offer for contributing with these analyses. Currently we are already participating in the formulation of the ToR for the preliminary diagnostic to make sure that this will be complementary with our research
activities and both will truly contribute to the design, negotiation and implementation of the BSM.

Thus, in practically all cases the water-related environmental externalities are related with the modification of the regulation capacity of the water flows and the sediments production. However, at the same time, the causes of the externality are different among the sites (deforestation, construction of mega-infrastructures, inappropriate land uses and practices, etc) having therefore, similar cases in terms of the watershed services but diverse in the required approach to be adopted for addressing its problematic. This poses an interesting situation to propose and test robust methodologies for ex-ante and ex-post analysis (for more details see attached file).

11. Activities and Implementation Plan

In the form of a Gantt chart, constructed as an Excel spreadsheet, as part of the project workbook.

12. Communications and alignment with CPWF Culture

12.1 Communications
The project is expected to contribute to the following communications products:

- A series of innovatively-designed products that communicate research findings to a range of stakeholders with a diversity of interests
- Policy recommendations for the successful implementation of the BSM considering different biophysical, socioeconomic and institutional environments.

The project will have a communication resource person familiar with environmental issues in order to periodically design a product to disseminate the objectives of the project, the involved partners and the research findings. The product will always frame the research findings into its final purpose (recommending and designing equitable and fair BSMs to improve WS). An additional product to disseminate policy recommendations will be produced periodically as there are advances on the discussion and creation of the BSM (e.g. policy briefs). The project will always take advantage of existing communications platforms of partners and any other regional communication platform for releasing these products (e.g. InfoAndina, RISAS -Network of interested parties in environmental services-, etc.). Also the researchers will be requested to produce scientific papers in order to disseminate it into the scientific community.

All these recommendations will be also delivered to the CPWF project 4 (the coordination project in the Andes). For this purpose, the project team is committed to ensure that the deliverables of output 3 will adequately feed into project 4 upon indications of how these results should be designed for this purpose.

12.2 Evaluative culture
The project team is committed to participate and provide the required information for these self-examination and self-reflection process. Also the project expects that these spaces will be propitious for encouraging an appropriate interaction between BDC projects to ensure periodical feedback and complementarity. Also this project expects guidance for self-reflection on gender and diversity issues and project communication strategy in order to ensure that this is correctly addressed by the project. When there is a research finding or approach that deserves to be discussed with other researchers from the other projects, the team will be available and open to encourage constructive debate as a validation strategy of findings and approaches among the BDC researchers. The project team expects that the coordination project will facilitate this interaction.

12.3 Alignment with CPWF core values

Since its formulation phase, this project is aligned with these core values. The proposed approach demand an interdisciplinary approach where biophysical and social sciences necessarily needs to interact to result at the end with BSM that not only aim to improve water quality and quantity downstream but expect to recommend the most sustainable, equitable and fair scheme to share the associated cost and benefits. Also the project has selected sites based on the clear potential and interest of multiple stakeholders to develop a BSM to improve an already identified environmental externality derived from inappropriate land and water management. This fact demands the creation of partnerships since the very beginning of the project. With respect to capacity building the project will support the creation of capacities at different levels. The project will trained interested technicians and professionals from local partners and next users organizations on the tools, approaches and conceptual framework that will guide the research activities of the project. Farmers will be trained in identified management alternatives proposed for improving WS and the exchange of experiences between farmers will be encouraged. Young researchers will be supported to develop their graduate studies while developing project research products. For this purpose the partnership with the University of Florida will be the basis for this and also as a strategy to learn and compare results and experiences overseas. It is worth noting that UF is currently researching on agriculture systems that minimize the impacts on water resources while improving water productivity, soil properties and net revenues. To finalize, the project team rejects any discrimination by gender or diversity during the research, participatory, negotiation and consultative (or other) activities to be held during the project.

13. Assumptions and Risks

The project demands ex-post assessment of impact of land use and management changes on water for downstream consumers, and aims to derived recommendations for improving the design of BSM. Being said this; the main risk to successfully accomplish these results has to be with the selected sites. There is the need to execute this project in sites where there is a high
probability of implementing land use and management changes to resolve a hydrological externality issue, and where there is interest of actors to develop a BSM but its main features, rules and design is not yet decided and therefore, project results will definitely add value to these processes. The project is minimizing this risk by screening carefully potential sites and selecting those where partnerships with local stakeholders are feasible, there is a clear hydrological externality that needs to be resolved, there is willingness of actors to share cost and benefits and interest to base the design of a BSM on ex-ante and ex-post hydrological and socioeconomic analysis. Now, the selection of the sites relies on the assumption that all the described interests and willingness will be kept during the project life time ensuring that favorable conditions for ex-ante and ex-post analysis will not change.

Also this kind of project requires transparent knowledge, information and interests sharing without which the project can have difficulties on anticipating and accessing the impacts of BSM. For this reason partnerships of this project relied on past successful partnerships and collaborations (e.g. CIAT, GTZ, FUNDESOT, CAR and University of Florida were partners during the CPWF-first phase); and respectful relationship with the rest of partners.
### 14. Project Team

<table>
<thead>
<tr>
<th>Names of team members</th>
<th>Professional discipline</th>
<th>Institutional affiliation and address</th>
<th>Area of expertise important to this project.</th>
<th>Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.</th>
<th>Commitments</th>
</tr>
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<tbody>
<tr>
<td>Marcela Quintero [Leader]</td>
<td>Ecologist and Soil and Water Scientist (M.Sc.)</td>
<td>CIAT-International Center for Tropical Agriculture Km 17 Recta Cali-Palmira, Colombia</td>
<td>Hydrological modeling, soil sciences, ex-ante and ex-post evaluation of land use alternatives, valuation of ecosystem services, payment for environmental services</td>
<td>Hydrological modeling especially on the characterization of soil parameters and model calibration. Insertion of environmental impacts into socioeconomic analysis. Coordination of the project and participation in M&amp;E activities. Design and analysis of surveys to explore changes on resilience capacity</td>
<td>Coordinate the project during the 4 year-period; conducted mentioned analysis and publish its results; to ensure complementarity of capacities of partners. To conduct a doctoral dissertation with the University of Florida.</td>
</tr>
<tr>
<td>Alonso Moreno [Co-leader]</td>
<td>Agronomist (Ph.D)</td>
<td>German Society of Technical Cooperation (GTZ) Av. Amazonas y Eloy Alfaro, Edificio MAG, Piso 8 Quito, Ecuador</td>
<td>Planning and monitoring of natural resources projects; design of environmental finance mechanisms; mechanisms of payments for environmental services; planning, investment and financial mechanisms of development projects; formation and coordination of networks; promotion of political dialogue and institutions</td>
<td>Designing and advising on different benefit and cost sharing benefits taking into account results from Outputs 1 and 2. Facilitation of dialogue among partners to discuss possible BSM in the Ecuadorian sites Co-coordination of the project and participation in M&amp;E activities. Design of surveys to explore changes on resilience capacity</td>
<td>Co-coordination of the project during the 4-yr period; to support the creation of most and fair appropriate BSM; to participate actively in M&amp;E activities; to facilitate negotiation among local partners in Ecuador; to provide support and logistic support during field work in Ecuador and find complementarities between GTZ (and partners) in the selected sites with project activities and outputs to ensure</td>
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<tr>
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<tr>
<td>Chereen Ball</td>
<td>Economic Development</td>
<td>CIAT-International Center for Tropical Agriculture Km 17 Recta Cali-Palmira, Colombia</td>
<td>Dissemination of research findings, knowledge sharing, M&amp;E and gender issues. She participated in the Andean Basin Focal Project as communication assistant.</td>
<td>Creation of innovative products for sharing research findings and of policy recommendations. Interaction with other regional communication platforms to disseminate project information and with the communication office of the CPWF. Support on M&amp;E process of the project including gender and diversity issues.</td>
<td>She will be committed for the 4yr period of the project to support communication project activities, workshops organization and systematization, and M&amp;E activities.</td>
</tr>
<tr>
<td>Ruben D. Estrada</td>
<td>Agronomist and Economist (M.Sc.)</td>
<td>CIAT-International Center for Tropical Agriculture Km 17 Recta Cali-Palmira, Colombia</td>
<td>Studies of competitiveness, private profits, social benefits and distribution of benefits among different social sectors; trade offs between environmental and social benefits; hydrological modeling; estimation of shadow prices of non-market</td>
<td>Ex-ante and ex-post analysis of land use and management changes and analysis of competitiveness changes resultant from these changes and possible BSM (Output 2). Advise on hydrological modeling for ensuring good efficiency performance of the models (Output 1). Proposal of new land use and management</td>
<td>To participate as researcher during the project 4 yr-period, ensure integrity between biophysical and economic results to be able to evaluate trade offs between environmental and socioeconomic benefits. Will be involved in the work of all project sites (Colombia and Ecuador)</td>
</tr>
<tr>
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<tr>
<td>German Escobar</td>
<td>Sociologist and Agricultural Economist (Ph.D)</td>
<td>Casilla 228 Correo 22 Santiago. Chile</td>
<td>Rural development, rural poverty; non-farming opportunities for agricultural development; rural economical organizations, micro-financing, rural development project evaluation and systematization, institutional innovation and institutional learning.</td>
<td>Integral ex-ante and ex-post socio-economic analysis. To participate in the design of BSM according to nature of stakeholders, rural poverty and opportunities for improving livelihoods. Also will assist on the formulation and analysis of survey for exploring resilience capacity under different interventions.</td>
<td>To participate as researcher during the project 4 yr-period; to have availability for traveling to study sites and especial support to Ecuadorian sites while advising advances and findings of the team in the Colombian sites.</td>
</tr>
<tr>
<td>Wilson Otero</td>
<td>Agrologist and Natural Resource Management specialist (M.Sc.)</td>
<td>FUNDESOT Av. El Libertador, Conjunto Altos de Toledo, Casa No. 1 Cota,</td>
<td>Experience on land use planning, management of environmental projects; design of payment for environmental services schemes; soil and water conservation practices,</td>
<td>Application of participatory approaches for defining most appropriate land use and management changes in upstream catchments Organization of farmers for implementing changes,</td>
<td>To participate during a 4-yr period in the research and participatory processes of the project and to serve as main liason agent with next users in the Colombian sites. Since he is also familiar with Ecuadorian</td>
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<tr>
<td>Natalia Uribe</td>
<td>Topographic engineer, GIS and hydrological modeling specialist (Bs.C)</td>
<td>CIAT-International Center for Tropical Agriculture Km 17 Recta Cali-Palmira, Colombia</td>
<td>Watershed analysis using hydrological models; Geographic Information Systems – GIS; Photogrammetry and Remote Sensing; Digital image processing; Global Position Systems- GPS</td>
<td>Hydrological modeling and management of GIS databases</td>
<td>To participate as research assistant during the project 4 yr-period; to have availability for traveling to study sites for field verification of GIS data. Will assist Ecuadorian and Colombian sites. To develop a research thesis as part of a graduate program in the University of Florida.</td>
</tr>
<tr>
<td>Jeimar Tapasco</td>
<td>Agronomic Engineer and Environmental and Natural Resources Economist (Ph.D.)</td>
<td>CIAT-International Center for Tropical Agriculture Km 17 Recta Cali-Palmira, Colombia</td>
<td>Studies for internalization of environmental externalities in river catchment’s areas and its potential in the reduction of rural poverty; evaluation of conservation</td>
<td>Evaluation of land use and management alternatives and the valuation of externalities (watershed services). Comparison of opportunity costs with externalities value. Application and design of surveys to explore</td>
<td>To participate as researcher during the project 4 yr-period; to have availability for traveling to study sites and especial support to Colombian sites while advising advances and findings of the team in the</td>
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<tr>
<td>Candidate)</td>
<td>Colombia</td>
<td>policies for native forests; evaluation of the environmental assets belonging to and services derived from the water company’s activities; environmental management plans for water supply companies</td>
<td>changes on resilience capacity</td>
<td>Ecuadorian sites.</td>
<td></td>
</tr>
<tr>
<td>David Wright (Ph.D)</td>
<td>Agronomist</td>
<td>University of Florida North Florida Research and Education Center 155 Research Road Quincy Fl 32351-5677</td>
<td>Production and management of integrated livestock/row crop farming systems using conservation farming methods</td>
<td>Propose land use and management alternatives in upstream lands for improving socioeconomic conditions and water quantity and quality downstream. Especially for mixed crop/livestock rotations. Advise on designing soil and water sampling for ex-ante and ex-post analysis</td>
<td>To participate during a 4-yr period in research design and analysis of land use and management alternatives in the watersheds to ensure that appropriate indicators are chosen for ex-ante and ex-post evaluation of environmental impacts. To advice doctoral thesis.</td>
</tr>
</tbody>
</table>
Provide a brief text statement on why the lead institution is well-placed to lead the group.

CIAT is part of the Consultative Group on International Agricultural Research (CGIAR) and collaborates with multiple stakeholders, from farmers directly to farmer organizations, indigenous people and grassroots organizations, national agricultural research and extensions systems, Non-Governmental Organizations, universities in the south and north, and the private sector. CIAT’s mission is to reduce hunger and poverty, and improve human health in the tropics through research aimed at increasing the eco-efficiency of agriculture.

CIAT researchers were involved in the first phase of the CPWF through the “Payment for Environmental Services-PES” project in the Andes (PN22) and from there approaches were refined, new research challenges identified. This team worked with a variety of partnerships in the Andean countries from which some of them are still active through punctual collaborations. This project team is highly recognized in the Andes for its contribution to novel schemes for BSM beyond pure PES schemes and for integrating agricultural productivity, hydrological and climatic criteria, and socioeconomic aspects in their proposals. The team has facility to interact with whether other researchers or farmers, extension and development agencies. Their proposed approaches for the quantification of environmental services and its economic valuation has been pioneer in the region encouraging PES practitioners and researchers to apply improve or modify it for other PES schemes in the region. Currently CIAT staff is directly involved in a Payment for Environmental Services project for Colombia with the Biocarbon Fund of the World Bank, is following up schemes created under the PN22 and actively participate in regional discussions about BSM for providing hydrological environmental services. Apart from its recognized experience in project-related topics has the capacity to manage the financial resources, proceed efficiently with contracting; and offer multiple facilities to undertake the research activities (soil labs, GIS facilities, world data bases, communication facilities, travel logistics, etc). CIAT has previously worked successfully with the other project partners.

Provide brief text statements on why the proposed institutions are qualified to carry out the proposed research.

Institution 1: GTZ (Ecuador)- Sustainable Management of Natural Resources Program
The German Technical Cooperation as part of its Sustainable Management of Natural Resources Program in Ecuador aims to promote novel mechanisms for the conservation of natural resources while improving the quality of life of rural inhabitants and distributing benefits in an equitable manner. Under this it is creating, assessing and promoting schemes for benefit and cost sharing for obtaining changes towards sustainable natural resources management. Part of its current staff participated jointly with CIAT and CONDESAN in a CPWF for developing approaches to analyze the feasibility of PES schemes. From this experience, GTZ has continued its interest on applying ex-ante environmental and socioeconomic analysis for implementing PES schemes or other types of economic mechanisms that can compensate rural farmers providing ecosystem services and also encourage the transfer of resources from different society sectors to rural sector. In this sense the GTZ has developed capacities to establish local partnerships for designing this kind of schemes, has a capacity to negotiate with interested stakeholders and is involved in technical activities related to hydrological assessments and land use planning.

Institution 2: RIMISP- The Latin American Center for Rural Development
Rimisp is a non-profit regional organization in Latin America that since 1986 promotes innovations that contribute to improve the quality of life of rural societies and strength the
capacities of their inhabitants. Since then identify, adapt and share those innovations with a diverse range of actors, from individuals to public, private, national and international organizations. Their priority themes are: the development and application of the Territorial Rural Development approach to alleviate rural poverty; access of small and poor farmers and rural entrepreneurs to dynamic markets; formation of new social movements and local governance; new sources of income and employment not necessarily related to agriculture productivity that may imply an incentive for rural poor to take advantage of new opportunities; and social learning for rural change and policy incidence. Under these themes, RIMISP has substantial experience on rural economical organizations, technical assistance services for small farmers, rural financial systems, agricultural production systems and food security. Thus they have capacities for promoting social and cultural innovations that favor rural livelihoods, from technological to organizational and institutional innovations. RIMISP have developed many approaches and methodologies to accomplish these purposes and is highly recognized by its knowledge on the rural development processes happening in Latin America. Due to its interest on rural financial systems, new sources of income for rural poor and technological innovations, RIMISP has expressed its interest in applying sharing their approaches and methods for assessing the socioeconomic impacts of new BSM that aim to improve water resources management in the Andes in an equitable and fair manner.

Institution 3: University of Florida - North Florida Research and Education Center – Agronomy Department – Soil and Water Department

The University of Florida in its Agronomy Department has focused part of its research to design, test and disseminate production systems with management practices that integrate livestock/row crop farming systems using conservation farming methods. Since then have researched on the effects of diverse land use and management practices on not only agronomic aspects such us productivity and pest incidence but on soil characteristics linked to the functions of the agro ecosystems that provide ecosystem services. In parallel, UF is interested on valuing these off site impacts derived from conservation farming systems in order to leverage more investment for small farmers. As part of these off-site impacts the water-related ecosystem services are highly recognized and since then is trying to develop and apply approaches for quantifying these impacts and determine the economic benefits of them. Sod-based rotations are an example of a practice that have increased land and water productivity, and such as this UF is interested on researching alternatives for other countries based on the principles behind conservation farming. In addition is very interested on establishing partnerships that can contribute to value the economic benefits of these alternatives as a way to encourage BSM from different society sectors and to promote north-south experience exchange.

Institution 4: FUNDESOT – Foundation for the Sustainable Development

FUNDESOT is a non-profit organization since 2005 that promotes, formulates, executes and stimulates integral actions, projects, plans and programs for integral rural development based on community participatory approaches, sustainable use of natural resources and equitable distribution of benefits in the rural sector. FUNDESOT staff has been involved in environmental, agricultural and rural development projects commissioned for diverse organizations from which some may be next users and collaborators in this project such as Ministry of Agriculture, Regional Agricultural Secretaries, environmental authorities, hydropower supply companies, water supply companies, GTZ, CIAT, CONDESAN and FAO. Professionals of FUNDESOT are recognized in the region for their work on soil conservation practices, adaptation of conservation agriculture to the Andean biophysical conditions, and extension activities.
Nowadays are involved in the formulation of rural development plans and in the promotion of compensation schemes for environmental services that may help to promote new conservation farming practices in intensive and non-sustainable systems in the Andes. In this way have developed and implement with farmers technological alternatives for sustainable livestock and crop production.

15. Indicative break down of budget

This is part of the project workbook.

16. Bibliography

Please list references and key documents


Estrada, R.D., Uribe, N. and Quintero M. 2009. Costo-beneficio privado y social de las inversiones realizadas en la represa de riego en la zona de Tungurahua. GTZ-GESOREN. Internal report.

Garzon A. 2009. State of the action on financial mechanisms for protection or rehabilitating hydrological environmental services generated in the Andes [In Spanish]. CONDESAN. http://www.infoandina.org/site.shtm?x=26621; accessed on February 14 2009


Quintero, M., Estrada, R.D., Garcia, J., 2006. Modelo de optimización para evaluación ex ante de alternativas productivas y cuantificación de externalidades ambientales en cuencas andinas: ECOSAUT. Centro Internacional de la Papa (CIP), Lima, Peru.


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1This project is one of several that together constitute a research program to tackle the basin development challenge (BDC). Please read the description of the BDC that can be found in the Medium Term plan. If you are successful you will be expected to work as part of a coherent research program, led by the Basin Leader responsible for program coordination and coherence.

2Project linkages and project contribution are shown in the BDC impact logic model in the Medium Term Plan

3The quality and experience of your project team will help ensure the delivery of quality outputs.