# INVESTMENTS IN WATERSHED SERVICES FOR THE JEQUETEPEQUE WATERSHED IN NORTHWESTERN PERU, DEPARTMENTS OF CAJAMARCA AND LA LIBERTAD

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## About Peru's Incubadora de Mecanismos de Retribución por Servicios Ecosistémicos (Ecosystem Services Incubator)

Recognizing the need to provide national leadership, capacity-building, and coordination to the many local and regional mechanisms facilitating investments in ecosystem services throughout Peru, the Ministry of Environment of Peru (MINAM) partnered with Forest Trends to establish the Peru Ecosystem Services Incubator in 2012. The Incubator aims to enhance investments in nature by society through providing technical, financial, and economic expertise; building capacity; and contributing to the development of national policy. To do this, the Incubator works with a range of non-governmental organizations, development agencies, national authorities, and local and regional governments throughout the country who have worked for years to advance investments in ecosystems. Guided by the national prioritization of improving integrated water management, investment mechanisms linked to watershed services are the first focus of the Incubator.

The following institutions play critical roles in the design and implementation of the Incubator:

### Ministry of Environment of Peru (MINAM)

MINAM's mission is to preserve the quality of the environment and ensure that present and future generations will be able to enjoy their right to a healthy environment for the development of life. As the host and leader of the Incubator, MINAM is responsible for the planning, execution, tracking, and monitoring of activities in the technical, economic, and financial arenas.

### Forest Trends and EcoDecisión

Forest Trends works to maintain, restore, and enhance forests and connected natural ecosystems, which provide life-sustaining processes, by promoting incentives stemming from a broad range of ecosystem services and products. Forest Trends is a founding partner of the Incubator and serves as a technical, economic, and financial advisor. Forest Trends fulfills this role in a strategic alliance with EcoDecisión, a social enterprise specializing in ecosystem services and funding for nature conservation.

### Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN)

CONDESAN is a nonprofit organization aimed at strengthening rational and sustainable management of natural resources and promoting productive and institutional innovations that overcome poverty, exclusion, and inequality. CONDESAN provides technical, economic, and financial advice and provides support to enable the implementation, monitoring, and evaluation of the Incubator's activities.

### Swiss Agency for Development and Cooperation (SDC)

An organization that invests in the fight against poverty in developing countries, SDC has contributed significantly to economic integration and poverty reduction in Peru by working with the Peruvian government, civil society organizations, and the private sector. As part of its efforts to provide greater access to basic water and sanitation services, SDC is providing significant support for the Incubator's activities, through a global project with Forest Trends aimed at scaling up investments in watershed services to address the global water crisis.

The following institutions are key partners in the design and implementation of the Jequetepeque project: **World Wildlife Fund (WWF), CARE, the regional government of Cajamarca (GORESAM Cajamarca), and the government's Special Project for Jequetepeque and Zaña (PEJEZA).**

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## 1. Project Characteristics

The Jequetepeque watershed in northern Peru provides water for agriculture and grazing, domestic needs, mining, and the production of hydroelectricity. The Gallito Ciego reservoir stores water from the Andean headwaters to supply it for extensive agricultural use in the valleys and large urban centers on the coast. Extreme rainfall events, particularly during El Niño years, have produced increased erosion and silt loads in the reservoir, with extensive deforestation of the upper watershed for agriculture and mining contributing to these increases. The objective of this Investments in Watershed Services (IWS) project is to ensure natural resource management and better farming practices on the upper watershed through an incentive paid to farmers implementing those practices. The incentive is paid by downstream water users who benefit from the improved services of water flow regulation and reduced sedimentation.

### Project at a Glance

| | |
|---|---|
| **Location** | Jequetepeque watershed, Departments of Cajamarca and La Libertad, Peru |
| **Project type** | Watershed services: Water flow regulation and reduced sedimentation; and Social benefits: Improved livelihoods of the rural poor. |
| **Size of watershed & project area** | • Jequetepeque watershed: 4372.5 $km^2$<br>• Pilot project area: 2047 ha (La Succha, Ayambla and Ahijadero subwatersheds) |
| **Key institutional partners** | World Wildlife Fund (WWF), CARE, the Regional Government of Cajamarca (GORE Cajamarca) and the government's Special Project for Jequetepeque and Zaña (PEJEZA). |
| **Water users** | 389,859 inhabitants, SN Power (Gallito Ciego hydroelectric plant), and the 15,072 members of the Water Users' Commission of the Jequetepeque Regulated Irrigation District (JUSDRRJ). |
| **Watershed service providers** | 1338 people (317 families) living on three subwatersheds |
| **Project status** | Phase I. Project design & preparation (2006-2007); Phase II. Work in the pilot area on three subwatersheds (2008-2012); these two phases have been completed. |
| **Project funding & payment mechanism** | Donors: International cooperation from DANIDA (Denmark), DGIS (Netherlands), GIZ (Germany) and the Challenge Program for Water and Food; resources for implementation in the pilot area from SN Power, Junta de Usuarios de Jequetepeque (JUSDRRJ), Regional Government of Cajamarca, and PEJEZA. |
| **Level of investment** | Over US$1,700,000 from donors, government agencies, and diverse water users. |
| **Scalability** | Eight subwatersheds have been selected to scale up the project and more will potentially be added in the future; this is a multi-stakeholder retribution model applicable to other watersheds. |

### Project History and Key Developing Institutions

The preparatory first phase of the project began in June 2006 and continued over 1.5 years until December 2007, during which time baseline hydrological studies were carried out to determine water flow of the Jequetepeque River at monthly intervals throughout the year and the volume of sedimentation in the Gallito Ciego reservoir that results in decreased water storage capacity of the reservoir (CESAH 2012). The Challenge Program for Water & Food provided support for some of the hydrological studies.

Since 2008, a pilot project (Phase II) has been underway with farming communities on three priority subwatersheds with a high degree of environmental degradation – La Succha, Ayambla and Ahijadera – to reforest and improve

farming practices on the upper Jequetepeque. This work has been financed primarily by DANIDA in a grant to CARE-WWF Peru and its local partners. The project involves the following principal streams of work:

- Reforestation;
- Development of agroforestry and woodland pasture systems in upper watershed;
- Reduction of pollution from urban and mine effluents; and
- Retribution or payment by the water users in the agricultural coastal regions.

As well as initiating ecological recovery of the upper watershed, first steps have been taken towards a future fair payment scheme for environmental services such that the upper watershed population receives fair compensation from downstream water users for implementing land use practices that result in improved water collection and regulation[1]. This project description provides the context for the interaction with the *IWS Incubator of Peru*, led by the Ministry of the Environment (MINAM) and Forest Trends, with financing from the Swiss Agency for Development and Cooperation (SDC), towards scaling up investments in watershed services in the country.

## Project Location and Description of the Problem

The Jequetepeque watershed is located on the western Andean slopes of northern Peru, running from east to west over a distance of 150 km from its origin at a small high altitude lake at 4188 m elev. (Cajamarca Department) to the Pacific Ocean (La Libertad Department) (Map 1). The principal rivers that feed the Jequetepeque are the Pallac, San Miguel (or Puclush) and the Magdalena, as well as more than 30 secondary rivers and streams (PRCA 2006).

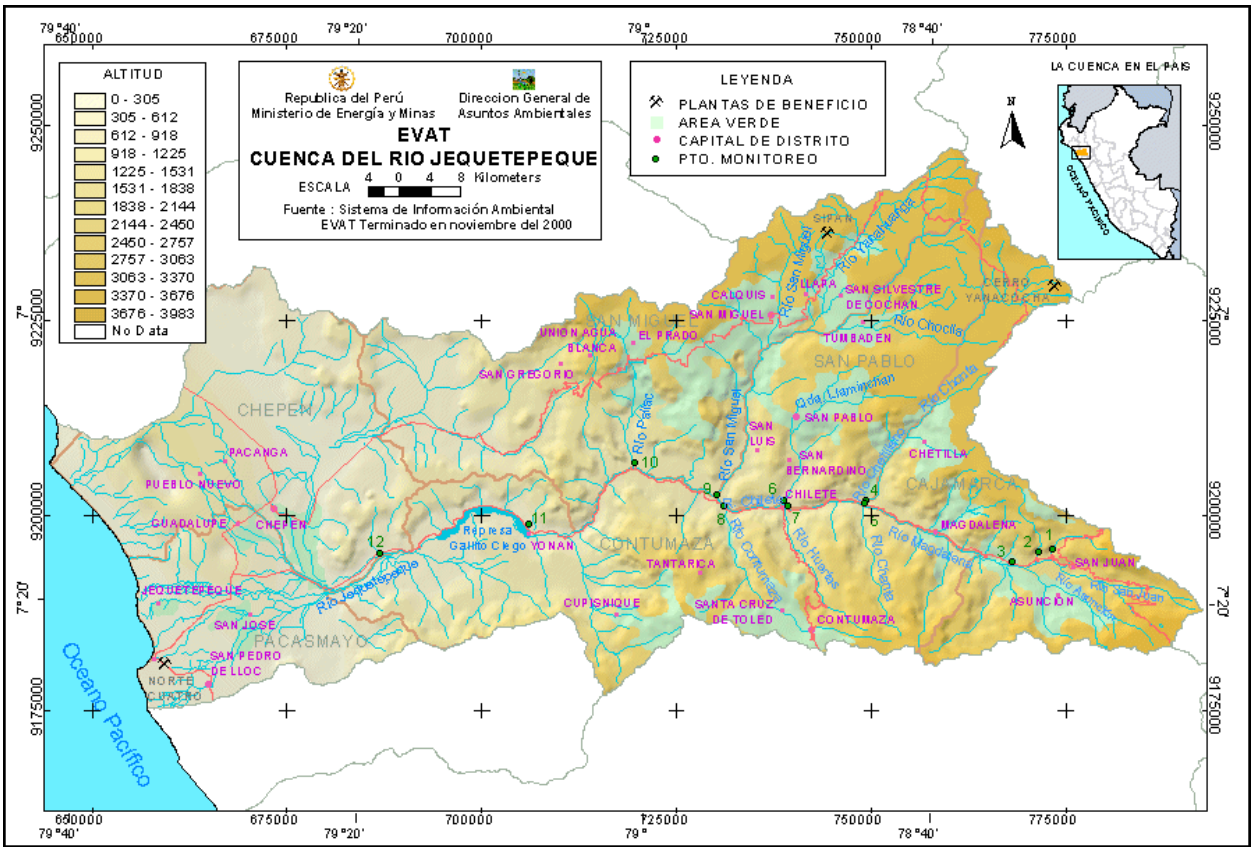
The main challenges in the watershed are (1) to reduce the amount of soil and dirt reaching the river and causing sedimentation and (2) to increase and regulate year-round availability of water. The watershed has undergone extensive deforestation for farming and cattle pastures. Erosion and run-off are the result of this land use conversion and other sources of environmental degradation, namely firewood collection, overgrazing and inappropriate agricultural practices.

On the uppermost part of the watershed (>3500 m elev.), about 36,000 ha of natural montane forests remain, often on the steepest slopes, along with pine and eucalyptus plantations. Below 3500 m elev., natural vegetation is scarce due to its overexploitation for domestic use (e.g. firewood collection) and deforestation for farming purposes. In the highlands, potatoes and other Andean tubers, grains, corn, and legumes are grown and cattle graze; sugar cane, rice, fruits and vegetables are grown in the lowlands (PRCA 2006).

The average annual rainfall in the watershed varies with elevation, from close to zero on the coast due to cold ocean temperatures to 1100 mm/yr in the highlands. Pronounced seasonality creates a highly irregular water flow on the Jequetepeque River that has an annual average volume of 816.49 million $m^3$: 65% of annual flow is produced between the three months of February and April resulting in erosion, run-off and sedimentation, but water flow during dry months can be below 1.0 $m^3/s$ (IBC 2006). Adding to this variability are precipitation changes during El Niño years when rainfall may be intense and more sediments are produced in comparison with "normal" years.

In an effort to regulate the water flow of the Jequetepeque, the Gallito Ciego Reservoir began operations in 1988. At 400 m elev., it separates the middle and upper parts of the watershed from the lower part. This dam provides water for irrigation to the agricultural area in the valley. Particularly large sediment volumes were deposited in the reservoir during the El Niño years of 1982-83 and 1997-98, unexpectedly exacerbating sediment accumulation (Jacobsen 2010). However, incremental improvements in water storage volume in the reservoir have been noted from recent measurements made by the Regional Government of La Libertad Department.[2] On January 31, 2012, water storage in the reservoir was at 49.25% of its maximum capacity, a 179.47% increase from the year before leading to the conjecture that this increase was the result of consistent precipitation in the headwaters of the Jequetepeque in Cajamarca, at slightly greater rates than the historical average (MINAG 2012), rather than the positive effect of land use improvements.

[1] http://m.peru.panda.org/en/our_work/in_peru/climate/services/
[2] www.pejeza.gob.pe




*Source:* Ministry of Energy and Mines (MINEM), 2000.

**Map 1. The Jequetepeque Watershed that Runs East-West from the High Andes to the Pacific**

## Water Users

The watershed service on the Jequetepeque has two basic components of interest to water users: reduction of the sediment load and regulation of water provision throughout the year. These two services will directly benefit users of the lower watershed, especially SN Power and its Gallito Ciego dam and the Jequetepeque irrigation districts comprised of 15,072 members (CSAH 2012).

The SN Power Company built a hydropower plant at Gallito Ciego in 1997 to utilize the dam's potential; it provides an average annual electricity output of 150 GWh to Peru's National Interconnected System[3]. Water storage in the reservoir is hampered by sediment accumulation that has occurred at faster-than-expected rates, especially following heavy rainfall in El Niño years (Yacob & Pérez-Foguet 2009). Other water users are mining and cement companies, as well as more than half a million people who live on the Jequetepeque watershed that spans 6 provinces and 30 districts: 389,859 people in the Dept. of Cajamarca (mid and highlands) and 165,927 people in the Dept. of La Libertad (lowlands) (2005 census data). Today's overall population figures are certainly higher, especially in the coastal urban areas.

## Present Water Supply and Demand

The watershed encompasses 437,250 ha (CESAH 2012) with its water being used for agriculture, domestic needs, industry and mining, animal husbandry and the production of hydroelectricity. Total water use is approximately 727 million $m^3$/yr (IBC 2006). On the lower Jequetepeque, agriculture – principally rice, with sugar cane and pasture grass to a lesser extent – creates by far the greatest demand for water, amounting to approximately 719 million $m^3$/yr or 98% of the total demand (IBC 2006).

[3] http://www.snpower.com/projects-and-plants/plants-in-operation/gallito-ciego/default.aspx

## 2. The Watershed Service

The proposed IWS scheme is based on the recognition that environmental services provide benefits to their users and that this benefit should be reciprocated or monetized so that it will be sustainable over time. Local farmers would consider changing or modifying their agricultural practices to improve watershed services under the following three conditions (Loyola 2012):

- That the proposed interventions would improve their standard of living, in other words, that new practices would result in greater earnings than current ones, thereby ensuring that the changes are sustainable over time;
- If the new agricultural practices employed did not produce increased income, then financial compensation for farmers' losses – as compared to previous practices - would be necessary; and
- That sufficient funding exists to guarantee support of the activities to be implemented under the project.

The areas selected for the pilot project were the most eroded and are La Succha, Ayambla and Ahijadero subwatersheds covering 2047 hectares in Cajamarca Department. The following types of projects are being implemented or planned in these subwatersheds:

a) Restoration of the ecological conditions associated with the watershed;
b) Restoration and construction of hydrological infrastructure to conserve and protect water resources (e.g. micro-reservoirs and pressurized irrigation systems); and
c) Compensation or payments for watershed services;

### Watershed Service Providers

The watershed service providers involved in the pilot project consist of 317 families from the communities of Ayambla (182 families), Ahijadero (82 families) and La Succha (53 families) (CESAH 2012). The rural population on the watershed is diverse; some communities are mestizo while others are indigenous. Forty percent of the indigenous community is comprised of people who speak only or predominantly Quechua and maintain their traditional Andean customs. In the highlands, most people (up to 92%) still depend on firewood for cooking, which contributes to deforestation or forest degradation (2005 census data). Socio-economic levels in the region are equally diverse. Some highland communities include very poor farmers who practice subsistence agriculture. There are also families that have a fair amount of cash and own more than six hectares of land with good quality forage, allowing them to raise meat or dairy cattle. Even these better-off families live in basic housing without services such as piped water, electricity, and a sewage system, and access to health and educational services is limited (Chunga 2006).

### Processes for Consultation and Participation

The participation of water service providers was essential for the design and implementation of the IWS, particularly to identify and prioritize conservation and development interventions. To this end, agreements were made with local governments and community authorities as well as with the families participating in the pilot project; their farm plots were geo-referenced; and timber, fruit and other commercially important native tree species were selected for reforestation, agroforestry and silvopastoral activities (CESAH 2012). Priority actions were agreed upon and estimates were made of economic benefits that would be obtained for the proposed interventions over the long term, based on profits from the future sale of annual crops (wheat, peas and potatoes) and fruit trees (Table 1). These values serve as a reference to determine opportunity costs to implement these systems (Loyola 2012). It is important to note that most of the interventions yielded positive economic estimates – and those with a greater quantity of commercially important trees yielded significant economic benefits – and were therefore of interest to farmers as a way to improve their present economic situation (Loyola 2012). Only natural forest protection had a negative net value (Table 1) since commercial tree species were not included, requiring that economic compensation be made on a permanent basis for areas of forest protection, at a price point determined by the opportunity cost of alternatives such as pea crop production (Loyola 2012).

**Table 1. Priority Actions and the Net Value of Benefits from their Implementation on a Single Hectare over a 30-Year Period**

| Type of Intervention | Net Value (1 ha/30 yrs) US$ |
|---|---|
| Agriculture with agroforestry | $4427 |
| Agroforestry with contour furrows | $4034 |
| Agroforestry with terraces | $704 |
| Woodland pastures with new crops | $19,060 |
| Woodland pastures with enrichment planting | $5287 |
| Reforestation | $46,248 |
| Protection of natural forest | -$1520 |

*Source:* Loyola 2012; currency exchange rate: 1 US$=2.5 Peruvian soles

## 3. Identification and Engagement of Investors

Consultation processes may be carried out efficiently through already existing organizations of water users and water service providers on the watershed. As per the Water Law, users are organized in *Irrigation Districts* that form commissions for each irrigation unit. At other locations on the watershed, there are organizations related to the specific activities or crops under cultivation.

For the pilot project, private investments were made by SN Power (Gallito Ciego hydroelectric plant) and water users who are organized in regional irrigation commissions on the Jequetepeque watershed. SN Power is a Norwegian Hydroelectric Corporation that operates six hydroelectric plants throughout Peru and prides itself in being socially and environmentally responsible, with claims that hydro operations contribute to sustainable development through the generation of clean and renewable energy.

There is a need for an innovative financing mechanism to continue to provide up-front cash to support restoration and natural resource management efforts. Potentially, payments could be performance-based, thus rewarding to a greater degree those farmers and communities that make the greatest strides towards reversing environmental degradation in their area. Future investment in this project may come from present user sources as well as from companies with social and environmental responsibility programs that are interested in the conservation and restoration of the watershed.

### Current Investment

Project interventions thus far (Phases I & II) have been financed by donations from the Dutch Directorate-General for International Cooperation (DGIS) (about 50%) and local contributions (about 50%) from the regional government, local governments, the Water Users Association, Reservoir Managers and SN Power Corporation. Specifically, during the second phase of the project (2008-2012), the Regional Government of Cajamarca approved a public sector project of US$450,000 to protect natural forest on the three subwatersheds and to provide technical assistance for reforestation activities. Additionally, SN Power provided US$100,000 and the JUSDRRJ US$58,000 towards further conservation efforts (reforestation, agroforestry and silvopastoral improvements). To improve living conditions, local governments provided US$12,520 for efficient wood burning stoves and construction of micro-reservoirs with pressurized irrigation and PEJEZA contributed US$30,000 to purchase seedlings for cultivation (CESAH 2012). This range of contributions totals more than US$1,700,000, including transaction costs, such as baseline and program design studies and management paid by international cooperation.

### Institutional Structure and Use of Proceeds

An inter-institutional committee that has been active since the beginning of the project serves to provide advice and facilitate interaction and information flow between watershed users and watershed service providers, as illustrated in the project governance flow diagram. The water users involved in the IWS, presently comprised of a hydroelectric

company and irrigation commissions, may unilaterally invest in land use improvements through economic compensation to watershed service providers to improve their farming practices to reduce the amount of sediments that reach the river. The users in the lower watershed are the direct beneficiaries of those changes.


As a next step supported by the MINAM Incubator, the project proponents aim to create a water users council – as dictated by Peru's Water Law– as the new inter-institutional forum to serve as a link with watershed service providers for the development of the IWS financial mechanism. Project proponents also hope to create a US$1 million endowment, funded by a Global Environment Facility (IFAD-GEF) grant[4] to support the IWS project. This is still under negotiation.

## 4. Project Preparation and Monitoring

Initially, a hydrological model of the Jequetepeque River was developed to evaluate the effect of precipitation on water volume throughout the year, to assess the degree of sedimentation in the Gallito Ciego reservoir, and to identify specific areas and anthropogenic activities that produce the greatest quantity of sediments that flow into the river (CESAH 2012). The Soil and Water Assessment Tool (SWAT) was used to calculate water flow, sediment load, water quality, and chemical contamination in the watershed (López & Girón 2007). Some important results of this study were:

- On the nine sub-watersheds that exhibit the highest levels of erosion, land use is conventional farming and grazing;
- In priority sub-watersheds, land use change is necessary to convert conventional farming to agroforestry and woodland pasture systems; and
- The rainy season in the headwater region of the Jequetepeque River is normally compressed within a short period such that for 60% of the year, the river has a mean flow rate of only 1.2 $m^3/s$, clearly indicating the need for water flow regulation.

The resulting tangible benefits of these actions, as reported in the CARE- WWF Report (2012), are summarized below in Table 2:

**Table 2. Results of Improved Farming Practices in the Pilot Project Area: Beneficiaries and Measurable Short-Term Benefits**

| Direct Beneficiaries of Interventions in the Pilot Project Area | Tangible Benefits |
|---|---|
| **Water users associations** | • Annual water volume increased to 1.22 million cubic meters ($Mm^3$) in the three subwatersheds and to 187.92 $Mm^3$ in the entire watershed;<br>• Sediments (11,468 metric tons) were retained in three subwatersheds instead of reaching the Gallito Ciego Reservoir. [Note: Scaling this up to the entire Jequetepeque watershed is the equivalent of 2,154,237 metric tons of sediments potentially retained].<br>• Increase in the useful life of the reservoir; and<br>• More employment opportunities in the downstream valley. |
| **SN Power Corporation** | • Reduction of high volume of installed unused capacity at the hydroelectric |

[4] IFAD, an executing agency of the GEF, established an IFAD-GEF Unit to play a catalytic role in addressing the links between poverty and global environmental degradation.

| Direct Beneficiaries of Interventions in the Pilot Project Area | Tangible Benefits |
|---|---|
| | plant during the dry season;<br>• Cumulative increment in the production of energy (ca. 73,260 megawatt hours); and<br>• Reduction of marginal costs during the dry season. |
| **Watershed service providers** | • Increased yields of wheat, corn, and pea crops; and<br>• Return on investments for these crops increased from 50% to 400%. |

Source: CARE-WWF 2012

### Project Monitoring

Hydrological monitoring is underway to determine changes in superficial runoff and sedimentation rates. Hydrological and environmental measurements are made by local outreach promoters, both male and female, in the pilot subwatersheds. Results of comparisons between erosion plots in areas with no intervention (control) versus those where the seven types of intervention are being implemented (treatments) indicate reduced superficial runoff and sedimentation rates in all treatment categories (CESAH 2012).

## 5. Next Steps for Defining the IWS Scenario

The MINAM Incubator aims to ensure that all projects address each of these four different facets of project development: hydrological, institutional, social and economic at different stages of design and implementation.

The items (or procedural steps) completed and the next steps to be taken on the Jequetepeque IWS project are provided in the following list that is based on actions described in CARE's *Equitable Payments for Watershed Services: Phase 1, Making the Business Case*[5] (Phases 1 & 2), and actions proposed for Phase 3 are from a recent (Oct 2012) WWF-CARE report.

| | |
|---|---|
| ✓ | Items are in process or have been completed |
| ☐ | Items are required as next steps in the process |

Phase 1:

- ✓ Baseline studies of the Jequetepeque watershed;
- ✓ Identification of key players, goals and interests;
- ✓ Promotion of economic values of watershed services with potential buyers and sellers;
- ✓ Agreements reached between watershed service providers and water users;
- ✓ Identification and assessment of strengths and weaknesses in the institutional framework and the capacity of participating organizations;
- ✓ Selection of indicators to measure project progress.

Phase 2:

- ✓ Implementation of IWS mechanism in selected communities on three subwatersheds;
- ☐ Development and implementation of the financial incentive system.

Phase 3:

- ☐ Scale-up the intervention to eight additional subwatersheds based on plans with the Regional Government;
- ☐ Discussions with MINAM to replicate interventions in additional watersheds in other parts of the country.

[5] http://www.care.org/careswork/projects/PER117.asp

## 6. Conclusions

The Jequetepeque IWS project has identified the environmental services that are the nexus between the interests of the water users and the watershed service providers; these are a reduction in the sediment load reaching the river and a better provision of water throughout the year, particularly during the extended dry season. At the scale of a pilot case study, water users and watershed service providers were identified as SN Power and Irrigation Commissions, and 317 farming families on three subwatersheds, respectively. An inter-institutional committee comprised of public and private entities was established to facilitate conversation and cooperation among users and providers through voluntary agreements. Improved land use practices that were estimated to provide economic gains and reduce negative environmental impact were identified, as well as a series of requirements that were accepted by providers and users to ensure financial compensation when opportunity costs were not met.

As the next steps for the IWS project, and in terms of engagement of the *Incubator*, technical and financial support is needed to develop details of a financial scheme that is sustainable over the long-term and an efficient way to collect and distribute agreed upon funds, identify and include new private investors and funding opportunities, as well as to decide on investments for 2013 and future years of the project.

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