Implementing HELP on the Jequetpeque Watershed, Peru
A Report to the IHP

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INTRODUCTION

Purpose

This report presents findings of an evaluation of the Jequetepeque Watershed in Peru with respect to its suitability as a HELP Basin and suggests a preliminary strategy for implementing HELP on the watershed. Specifically, I was asked to

1. Undertake a mission to Peru to discuss with Dr. Hector Cisneros, Director of CONDESAN, whether the HELP project would be appropriate for the Jequetepeque Watershed and, if so, the best ways and means to implement it.

   I spent a week in Peru for this purpose (August 8–15). Activities conducted during that time are briefly outlined in Appendix I of this report.

2. Research and examine data bases to obtain information about various research, technical, and environmental initiatives currently being carried out in the basin.

   While in Peru, I held meetings and discussions with representatives of a large number of stakeholder organizations interested in watershed management—in particular, management of the Jequetepeque Watershed. I also reviewed the various hydrology-related initiatives that have been or are being carried out on the watershed. The findings of my investigations are detailed in this report.

3. Compile and submit to UNESCO, in hard copy and digitized format, a document outlining the best strategy for implementing HELP within the Jequetepeque Watershed.

   In this report I outline a strategy for implementing HELP on the Jequetepeque Watershed. In addition, I provide a brief description of the watershed and outline opportunities and challenges.

Jequetepeque Watershed and HELP

The Jequetepeque Watershed could be a valuable addition to the HELP network, but if its inclusion is to be a truly meaningful one, focused (and probably full time) coordination will be required. Factors that would argue for making the Jequetepeque Watershed a part of the HELP network include

1. *Pressing watershed-management issues.* A component of HELP is designed to address urgent water-management issues in the developing world. The Jequetepeque Watershed is the site of many very serious water-related issues—

issues that quite literally are matters of life and death. Examples are scarcity of water, contamination of water by sewage, soil erosion, sedimentation, soil salinization, and a decrepit irrigation system. All of these are contributing to the poverty and suffering of the population. An issue of particular importance is management of a large reservoir (Gallito Ciego) that is rapidly filling with sediment.

2. *Representative of high mountain watersheds.* The Jequetepeque would be the sole watershed in the HELP network representative of high-elevation tropical mountains such as the Andes or the Himalayas.
3. *Extreme spatial and temporal climate variability.* The effects of El Niño are strongly felt in this region. During El Niño years precipitation, runoff, and sediment movement can be extreme.
4. *A new political climate in the country.* With the passing of the Fujimori regime and a new, more democratic government in place, a burgeoning democracy movement is empowering local populations.
5. *An active and dedicated stakeholder community.* Led by CONDESAN (Consortium for the Sustainable Development of the Andean Ecoregion), a group of interested organizations and individuals is working hard to create sustainable water and watershed-management policies for the Jequetepeque Watershed. This group is well organized, has in broad terms adopted the watershed approach for managing and coordinating resources, and would be supportive of complementary hydrologic research. In other words, the situation is an almost ideal one in that the science community could immediately "plug into" and connect with the human-dimensions/policy-making community.

Figure 1. Jequetepeque stakeholders meet at the Gallito Ciego Reservoir to discuss the HELP initiative.

6. *High level of local, regional and national scientific interest.* The hydrologic research community within Peru is supportive and excited about collaborative research under the HELP umbrella.
7. *An existing management framework.* CONDESAN, whose sole purpose is to organize regional consortiums of stakeholder groups for jointly achieving sustainable development is an ideal framework for coordination of a HELP project in this area. The sole purpose of CONDESAN is to organize regional

consortiums of stakeholder groups for jointly achieving sustainable development. In addition there is strong support within the parent organization of CONDESAN, which is the International Potato Center (CIP).

8. *Baseline data:* By developing-world standards, and especially for the Andes, a respectable amount of information is available on climate (from 15 stations), soils, vegetation cover, and land use in the Jequetepeque Watershed. Two sub-swatershed within the Jequetepeque have received considerable analysis. The existing baseline information provide a foundation for further and more detailed hydrologic analysis. That said, basis information is still quite limited. A major thrust of a HELP initiative should be that of improving baseline water and climate information.

OVERVIEW

The Jequetepeque Watershed is located in the Andes Mountains of Northern Peru (Figure 2) and drains into the Pacific Ocean. As is typical of Andean watersheds, its extreme elevation gradient gives rise to strong variations in climate and vegetation. Because the Andes are a young mountain chain and geologically very active, with landslides, debris flows, and other forms of mass movement being common, the Jequetepeque is different from most watersheds being considered for the HELP network. Not only are the problems of this watershed more acute, but the resources needed to address them are scarce. Population pressures, poverty, and low education levels, among other factors, have led to extensive degradation of the watershed, which in turn is greatly affecting both the quality and quantity of the water. Understanding of the fundamental hydrologic processes at work within the watershed is limited, as is the ability to quantify the extent of the problems, because of the lack of basic hydrologic data. Climate data are also limited, as discussed below. However, considerable progress has been made in the compilation and analysis of spatial information—such as vegetation cover, elevation, land use, and soils— because of the adoption of spatial analysis technology.

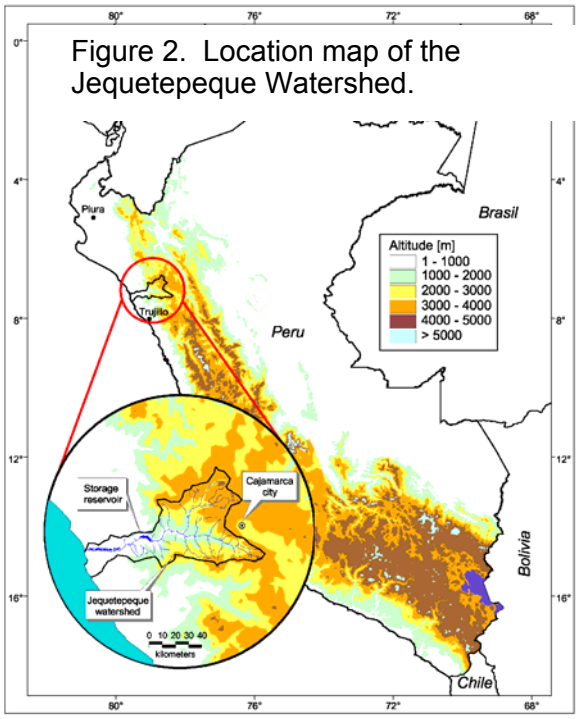

Figure 2. Location map of the Jequetepeque Watershed.

Although the problems are acute and resources very limited, there are exciting opportunities. A very active and collaborative network of producers, local authorities, national institutions, and NGOs are working on management issues for the Jequetepeque Watershed—all related to exploring and developing sustainable economic, social, and agricultural systems. Concurrently, recent political events (primarily the departure of President Alberto Fujimori) have resulted in a real movement to empower local organizations, making it an opportune time to re-activate and invigorate organizations within the watershed. Most people are also optimistic that government agencies will be more active and effective under the new regime.

In addition, since 1998 watershed stakeholders have been working with the CG-Centers Andean Ecoregional program CONDESAN. Linking the local watershed group to the consortium has been very beneficial in promoting a freer flow of information. It appears that working together, stakeholders and CONDESAN are well positioned and prepared to be catalysts for both establishing a broad-based coalition of stakeholders and renewing watershed research in the Jequetepeque. The Jequetepeque could be a model for the other nine Peruvian Pacific watersheds that have a similar set of problems.

DESCRIPTION

Like other watersheds along the Peruvian Pacific coast, the Jequetepeque is a narrow valley with very abrupt slopes and a short, intense rainy season. The area of the watershed is almost 5000 km^2 and the elevation gradient is extreme (0–4200 m), with correspondingly extreme gradients of climate and vegetation (Figure 3). The three primary tributaries are the Rio Pallac (250 km^2); San Miguel or Puclush (1,065 km^2); and the Magdalena (1,500 km^2). An upper and a lower watershed are distinguishable, both in terms of physical and demographic characteristics (see Table 1); the upper watershed is mountainous and the lower watershed consists of the depositional delta below. At the juncture of the upper and lower watersheds is a massive dam, Gallito Ciego, that was completed in 1988 at a cost of over $250 million. It provides critical irrigation water and hydroelectric power for the lower watershed. However, rates of sedimentation have far exceeded what was projected; at the current rate, the dam has a functioning life of only 12 more years.

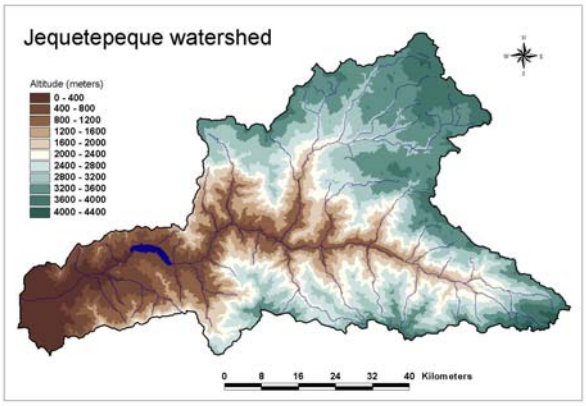

Figure 3. Digital Elevation Map of the Watershed. Note Reservoir Gallito Ciego at the lower end of the watershed.

Table 1. Watershed Characteristics

	Upper Watershed	**Lower Watershed?**
Size (km^2)	3600	1000
Population	125,000	14,000
Elevation	400–4200	0–400
Precipitation	100–1100	0–100
Crop Area (ha)	69,675	33,000

Climate, Vegetation, and Land Use

Climate data for the watershed are limited. There are currently about 15 climate stations within the area, all of which are managed by the National Weather Service of Peru (SENAMHI). Information on precipitation, temperature, wind, and evaporation have been collected at these stations since 1958, but the quality and continuity of the data are uncertain; only three of these stations are automated and provide information on a regular basis. The information we do have indicates a climatic regime that is extremely variable, both spatially and temporally. Average annual precipitation varies from near zero at the coast to over 1100 mm at the higher elevations. The climate is strongly affected by the ENSO phenomenon. Precipitation can be extremely high throughout the catchment during El Niño years. Average annual temperatures vary from 23° on the coast to 3° in the higher elevations.

The different climatic and physiographic conditions define four broad vegetation zones within the watershed (Table 2). The highest-elevation zone, the Jalca, is dominated by native grasslands (which are predominantly overgrazed). Some cultivation takes place in this zone, and is in fact expanding, because of population pressures—and perhaps because of a changing climate. The zone of most active agricultural activity is the Quechua; what little native vegetation remains in this zone is mostly relict forests. The Yungas is a low, semiarid shrubland that has also been overgrazed and has little agricultural potential. The average annual precipitation in this zone is less than 500 mm, but during El Niño years the normally dry stream beds are transformed into torrents of water that transport tremendous amounts of sediment. The Chala zone is the lower watershed, which was formed by deposition from the mountains above; it is mostly irrigated agriculture.

Table 2. Vegetation Zones of the Watershed

	Jalca	**Quechua**	**Yungas**	**Chala**
Elevation (m)	>3500	2300–3500	500–2300	0–500
% of Total Area	13%	23%	32%	37%
Vegetation	native grasslands potatoes	potatoes wheat corn	semiarid shrublands fruit trees	rice corn sugar cane

Streamflow

Streamflow from the Rio Jequetepeque has been monitored continuously at the Ventanillas site since 1968, and streamflow has been measured manually near this site since 1948 (Figure 4). It is unclear to me whether streamflow measurements have been made on other tributaries of the basin. I have seen reports of there being as many as 5 gaging stations but all the streamflow analysis that I have seen seems to be based on the Ventanillas site. I suspect that continuous measurements are currently being made only at Ventanillas.

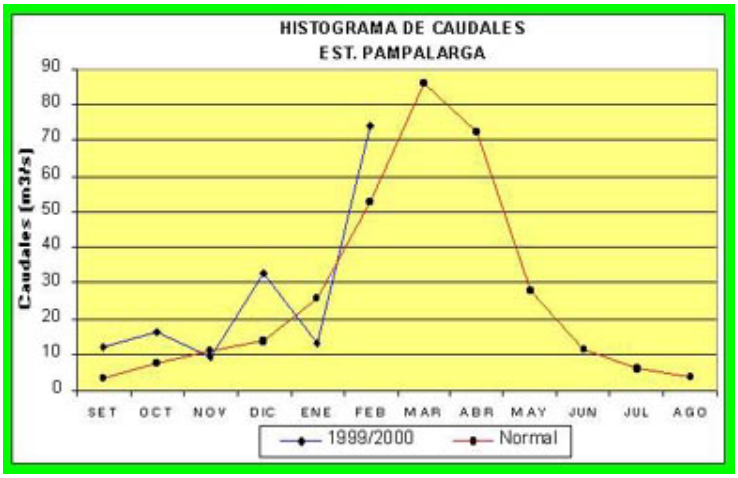

Figure 4. Longterm average streamflow compared to the first months of water year 2000. Streamflow is extremely seasonal with peak flows in February and March (SENHAM webpage).

Spatial Data

Craig Ficenec, of the University of Wisconsin is conducting watershed analysis of the Jequetepeque and the following is his assessment of availability of spatial data on the site. "There exists a wealth of spatial data for the Jequetepeque basin in digital format, with potential to be analyzed with the use of Geographic Information Systems (GIS) technologies. Data sets that have been created over several years by a variety of organizations and governmental agencies have recently been organized by INADE (*Instituto Nacional de Desarrollo*) and PEJEZA (*Proyecto Especial Jequetepeue-Zaña*) under a publication entitled *Diagnostico de la Gestion de la Oferta del Agua en la Cuenca Jequetepeque – Chaman*. This report includes 24 thematic maps of various biophysical and socio-economic variables. Additional studies are also being conducted in the basin to update and expand much of this information. While substantial resources have been invested in data collection and presentation, and several HELP partners possess skills and resources for geospatial analysis, there remains a lack of cooperation among owners and potential users of the data that must be overcome if integrated management of basin resources by all interests is to be achieved.

Regional NGOs within CONDESAN are also implementing geospatial studies of their own. GIS data sets have been created for selected sub-watersheds, and satellite imagery covering various dates from before the construction of Gallito Ciego to the present have been acquired. On the sub-watershed level, aerial photography and GIS data sets have been applied to participatory resource management exercises. Satellite imagery and digital elevation models are being explored for potential application to hydrologic studies in the basin."

WATER-RELATED ISSUES

The Gallito Ciego Reservoir

A major—if not the major—water-related issue for the Jequetepeque Watershed is the environmental and economic impact of the Gallito Ciego Reservoir. The reservoir was constructed at a cost of over $250 million and initially had a storage capacity of 400 million m^3. Sedimentation has already severely reduced that capacity. In fact, it is estimated that total sediment load is now more than 100 million m^3, which means that the dead zone, calculated to take 83

Figure 5. Sediment accumulation at the upstream end of Reservoir Gallito Ciego.

years to fill, is already full after only 14 years. Although it is tempting to claim otherwise, I am of the opinion that better watershed management will not appreciably slow this process. As noted earlier, natural erosion rates from these mountain slopes is very high; most of the sediment comes from the semiarid Yungas zone of the upper watershed, in El Niño years. At these rates, it is likely that the reservoir will fill within the next 1–2 decades. Anthropogenic provoked erosion is accentuating the process, and watershed management could lead to a slowing of the reservoir filling, but it will not prevent it.

In addition to the sedimentation problems, the dam has incurred other ecological costs. The habitat for fresh-water shrimp has been completely destroyed; the natural fertilization of the lower valley that occurred during annual flooding has been eliminated; and irrigation of the lower valley has brought on other problems, such as salinization from rice farming and raising of the water table.

Erosion

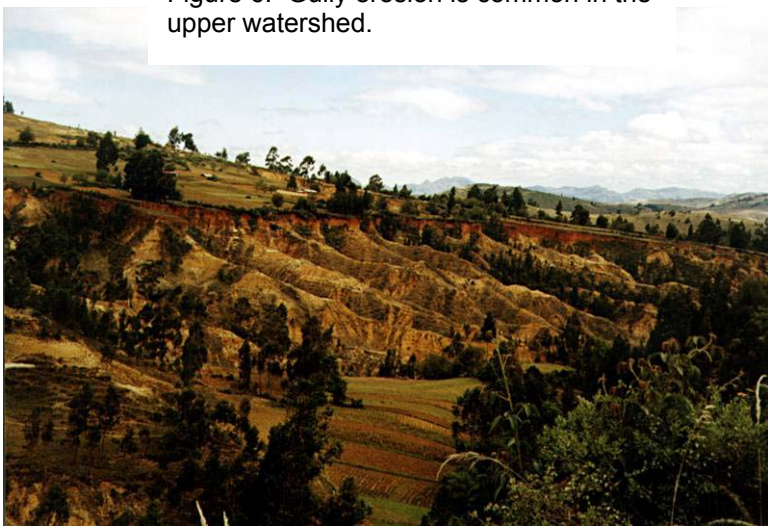

Figure 6. Gully erosion is common in the upper watershed.

Erosion is occurring on a massive scale in the upper watershed, as a result of both natural and anthropogenic processes. Erosion is occurring as sheet erosion, gully erosion, debris flows, mass wastage, and debris slumps. It is estimated that nearly 1000 hectares of cropland was lost to land slippage during the 1998 El Niño year. River measurements indicate that from an average silt load of 765,000 m^3/yr, in the El Niño year of 1982–83 the silt load increased 40-fold. By their very nature, these Andean watersheds have very high natural erosion. In the case of the Jequetepeque Watershed, erosion is especially high in the semiarid Yungas, the lowest of the three zones of the upper watershed. Land use in this desert-vegetation zone is not intensive. High-intensity and high-volume rainfall do occasionally occur, especially in El Niño years, and during such events huge amounts of sediment are moved downstream (as evidenced by the debris- and boulder-choked stream channels). In the two upper vegetation zones of the watershed, land use is very intensive and unquestionably has led to increased erosion. With population pressure forcing the use of marginal and very steep slopes for agriculture, the natural shrub cover has been removed, making these areas very susceptible to sheet erosion and, eventually, gully erosion.

Water Scarcity and Water Conflicts

Ironically, there is not enough water to meet demand, mainly because of poor water management—including inefficient irrigation, poorly maintained infrastructure, and inability to prevent pollution. It is estimated that above the dam there are over 620 small

irrigation systems serving around 15,000 hectares and 3,000 families. Many of these systems are poorly maintained and considerable amounts of water are wasted. In addition, there is little incentive to improve water management, since in most places in the valley water sells for less than $50/hectare per cropping season (and as low as $5.00 in some places). For the same reason, there is little money for canal maintenance. Below the dam, poor water management and inadequate drainage systems are resulting in serious salinization problems. It is estimated that since 1994, the area affected by this problem has grown from 6,000 to 13,000 hectares.

Water Contamination

Figure 7. Laundry being washed in an already polluted stream.

Because of sediment from erosion and poor management of effluent, most running water is contaminated and not able to support healthy aquatic communities (biodiversity). Most of the villages in the watershed have their "backs" to the river and use it for disposal of sewage water and urban wastes. Few if any of the communities have adequate sewage-disposal systems. Other sources of contamination include high levels nutrients and pesticides. The poor quality of the water has created very serious health issues on the watershed.

Sustainable Agriculture

Agriculture that is essentially unsustainable is being practiced throughout the Jequetepeque Watershed. In the lower watershed, large areas are devoted to rice and sugar cane, both of which consume a lot of water and are not very profitable. Farmers have neither the training nor the resources to make changes to more profitable and environment-friendly crops. The semiarid lowest zoneof the upper watershed also suffers from serious overgrazing, and agro-silvo-pastoral systems need to be developed. In the two higher zones of the upper watershed, low-input / low-output systems lock producers into a cycle of depletion of their natural resource base.

Limited Hydrologic and Climatologic Information

In light of the severity of the water-related problems described, it is striking that very little is known about the hydrologic, water quality, or erosion regimes of rivers and tributaries in this watershed. The infrastructure for obtaining such information is clearly inadequate. Some types of data are badly collected, other types are not collected at all. The Rio Jequetepeque is reliably measured in only one location, and precipitation is continuously monitored in only 8-15 locations. (I am unclear as to the number of climate stations that are currently functioning.) In addition, financially strapped government

agencies are reluctant to share information, even though it should be in the public domain. As a result, water management decisions are generally made in an information vacuum.

Climate Variability
The region in which the Jequetepeque Watershed is situated is strongly affected by El Niño-induced climate variability, which influences precipitation, runoff, and erosion dynamics. Although El Niño is obviously a natural phenomenon, it presents problems if it is not taken into account by humans when they put infrastructures in place. During the one or two El Niño years that occur each decade, runoff and associated sediment loads are many times greater than in other years. For example, 70% of the sedimentation behind the Gallito Ciego dam accumulated during the El Nino year of 1998.

ORGANIZATIONS AND INITIATIVES

Regional Organizations

- **Consortium for the Sustainable Development of the Andean Ecoregion** (CONDESAN) http://www.condesan.org. CONDESAN is a consortium of regional institutions and partners dedicated to sustainable development of the Andes and is the lead organization in the HELP-Peru effort. Their mission is to organize and mobilize stakeholder groups within affected areas, with the objective of developing and implementing solutions for natural resource management problems. The Jequetepeque watershed is a major focal point of CONDESAN's work in Peru.

International Organizations

- **International Potato Center** (CIP) http://www.cipotato.org/index2.asp . The International Potato Center (known worldwide by its Spanish acronym, CIP) seeks to reduce poverty and achieve food security in developing countries through scientific research and related work on potato, sweet potato, and other root and tuber crops. It also seeks to improve the management of natural resources in the Andes and other mountain areas. In addition to being a major collaborator with and supporter of the HELP project on the Jequetepeque in Peru, CIP houses CONDESAN. The Natural Resource Management group within CIP is currently planning research for the next 5–10 years and hopes to make Jequetepeque a key research site.

- **UN Food and Agriculture Organization** (FAO). The FAO is now working with PEJEZA (dam administrator) on an erosion control study in the watershed. The project, which is funded to a level of about $30,000, will focus on abating the Rio Contumzá sub-watershed. According to the director of PEJEZA, the FAO may invest $7 million in the Jequetepeque for watershed development activities.

Government Agencies

- **Instituto Nacional de Desarrollo** (INADE). The major development agency in Peru.
- **Proyecto Especial Jequetepeque-Zaña** (PEJEZA). An autonomous and independent government agency, PEJEZA is the most powerful and influential government organization on the watershed and is responsible for maintenance and

operation of the large Gallito Ciego reservoir. PEJEZA has erosion control experts on its own staff and is actively collaborating with FAO in an effort to control erosion.

- **Instituto Nacional de Recursos Naturales** (INRENA). The Peruvian national institute for the management of natural resources. INRENA has a special office that deals with watersheds.
- **Servicio Nacional de Hidrología y Meteorología** (SENHAMI) www.senamhi.gob.pe The Peruvian weather service, which is responsible for the collection and analysis of climate and hydrologic information.
- **Proyecto Nacional de Manejo de Cuencas Hidrográficas y Conservación del Suelo** (PRONAMACHES). The soil and water conservation branch of the Peruvian government. They have been ineffective in the past because of politicization of the organization.

User Associations

- **Junta de Usuarios del Valle Jequetepeque**. The organization of users of irrigation water in the lower watershed, below the dam, who are reasonably well organized. Their major concerns are the continuing functionality of the dam and the maintaining of low water costs.
- **Junta de Usuarios del Alto Jequetepeque**. The organization of users of irrigation water in the upper watershed. This organization seems to be very weak, showing little accountability or effort to control water use. These users lack the incentive to contribute to canal upkeep because they have little confidence that money contributed will be well managed.
- **Cooperativa Agraria de Trabajadores Atahualpa – Jerusalén.** The organization of owners of the Porcon, a large area in the upper basin that has been converted from native grasslands to pine forests.

NGOs

Within the Jequetepeque, NGO organizations are powerful and effective organizations for social change. Several are actively working at capacity-building and developing sustainable ways of earning income.

- **Centro Ecumenico de Promoción y Acción Social** (CEDEPAS). This group, which is supported by the Lutheran church, focuses on economic development, marketing, and helping producers make money. CEDEPAS is supporting some work through the Ford Foundation.
- **Asociación Civil para la Investigación y Desarrollo Forestal** (ADEFOR). http://www.adefor.org This group deals with the creation and management of high-elevation forests.
- **Asociación para el Desarrollo Rural de Cajamarca** (ASPADERUC). An association that focuses on forest creation, municipal development, watershed management, agro-forestry, and farm management.
- **Servicio Holandes para la Cooperación al Desarrollo** (SNV). An agency that focuses on capacity-building for local governments and institutions; marketing; water management; and irrigation.

Municipal Governments

- Provincial Government of San Pablo
- Provincial Government of Contumaza
- Provincial Government of Pacasmayo
- Provincial Government of Chepén
- Municipal Government of Tembladera
- Municipal Government of Asunción
- Municipal Government of Chilete
- Municipal Government of San Juan
- Municipal Government of Magdalena
- Municipal Government of San Luis

Research and Technical Assistance

- **International Center for Tropical Agriculture** (CIAT). A sister CGIAR center based in Colombia. The CIAT staff have expertise in agronomic systems that are important in the upper watershed, stakeholder analysis, and expert systems.
- **International Center for Agro-Forestry** (ICRAF-Lima). Another sister CGIAR center specializing in agro-forestry.
- **Universidad Nacional Agraria La Molina** (Lima). The major agrarian university in Peru. Several researchers from this university are interested in becoming involved in HELP-Jequetepeque.
- **Catholic University of Peru**. Has expertise in law and water rights.
- **University of Wisconsin**. Craig Ficenic and Josh Posner are conducting a watershed analysis using available spatial data.
- **Texas A&M University**. Brad Wilcox, (associate professor and hydrologist), has an interest supporting a graduate program focusing on runoff and erosion studies should support be found.

Potential Donors

- **Swiss Development Agency**. Members of this agency are currently working in Cajamarca on issues of agrobusiness and chains of production.
- **USAID-Lima** (Economic Corridors Project). At this point, USAID is not involved, but CONDESAN is working to renew contacts with this agency.
- **Global Environmental Fund** (GEF). CONDESAN has a grant from the GEF for researching sustainable development in the Andes. Some of this work will be conducted in the Jequetepeque.
- **German Ministry for International Cooperation and Technical Assistance Agency** (BMZ/GTZ) The BMZ/GTZ is providing $2 million for economic development in selected watersheds in Colombia, Ecuador, Peru, and possibly Bolivia. This work will include large-scale watershed-analysis, watershed management, and watershed policy. Jequetepeque will be part of this network

IMPLEMENTING HELP

The Jequetepeque Watershed would make a valuable addition to the HELP network. If HELP is to be a truly global program, it will need to include watersheds in the

developing world. The inclusion of Jequetepeque now could pave the way for more developing-country participation in the HELP network. I believe that a well-implemented and active HELP program within the Jequetepeque Watershed could make a lasting contribution not only to management of the watershed but also to our overall understanding of tropical watershed management. And, many of the components for a successful program are already in place in Peru—although a strong science component is missing. In the remainder of this document, I discuss strategies for beginning the process of implementing HELP. A true implementation plan and vision for a future HELP program has to be developed with the full and active participation of the stakeholder community in Peru.

Potential Role/Products of HELP

The primary benefit of implementing HELP in Peru would be the building of a hydrologic science base on the watershed that would serve as a basis for developing a sustainable-management plan. The stakeholder community within the watershed is reasonably well organized and very receptive to any science initiatives. Contributions would include

1. *Building a strong science foundation.* A key role of HELP should be that of developing a solid science foundation on the basis of which a sustainable management plan for the watershed can be devised.
2. *Technical support.* It would be desirable at some point for the HELP program to be sufficiently developed to directly support a core group of technical people who could address a variety of hydrological issues on the watershed.

Hydrologic Science Questions

The Jequetepeque Watershed, as part of the HELP network, presents opportunities for addressing key hydrologic questions that have a direct bearing on management of Andean ecosystems and policies related to them. HELP should be organized with the idea of advancing several main issues. These will need to be identified and defined by the Jequetepeque HELP community, but some potential issues/actions that are important are the following:

1. **Quantify the hydrologic budget of the watershed.** At the moment, basic information—such as the contributions of different parts of the watershed to downstream flow, the role of the water table in pacing the release of water, and the nature of competition for water among upstream and downstream users—is not available. This basic information must be obtained if we are to develop a sense of "watershed commonwealth" in the region. A first step would be that of compiling and analyzing all of the available data.

2. **Quantify the sediment budget.** As with the hydrologic budget, the watershed team must have a clear idea of the current rates of erosion, where the sediment is coming from, and how much accumulated material is already in the riverbeds and moving in the direction of the dam. This information will be crucial for justifying investment in soil-conserving activities.

3. **Determine current land-use patterns and the impact of potential land-use changes on basin hydrology.** An updated picture of land-use patterns is needed, as is the development of good predictive models on the impacts of changes in land use. Clearly, one of the objectives of the team will be to identify the externalities associated with development of the upper watershed.

4. **Formulate optimal restoration strategies.** Better and more effective restoration techniques are required to reverse the dramatic deterioration of the landscape that is taking place.

5. **Monitor water quality near urban centers**. This is a new theme for Peru, but it is very important that point source (e.g., urban) pollution be abated. Stream monitoring and data collection will be necessary in order to develop improved urban waste management plans.

Recommended Actions for Creating a HELP Network

Some steps that I believe need to be taken for HELP to become a reality on the Jequetepeque are the following:

1. **CONDESAN should exercise strong leadership.** A viable HELP program in the Peruvian Andes is viewed as a "win-win" situation. All the components for a successful program are in place, but actually implementing it will require strong, sustained, and centralized leadership. CONSESAN is capable of providing that leadership and coordination.
2. **Strategic alliances should be developed***.* Many beneficial alliances have already been formed. When a stakeholder meeting was convened to discuss the HELP initiative, 40 people attended and support was enthusiastic and unanimous. As discussed in this meeting, a board has been created to coordinate watershed activities within the Jequetepeque.
3. **HELP should have a full-time program coordinator***.* Although CONDESAN is seriously committed and willing to serve, I do not believe that they have in place the staff needed to effectively implement HELP. If HELP is to be a viable program, not one in name only, a full-time coordinator will be required. The coordinator would need to have the training and experience to interact with and motivate (1) the stakeholder community, (2) the Peruvian science community, and (3) the international science community. At present, funding for the support of a HELP coordinator are not available. A number of possibilities could be explored to obtain the needed funds, for example: (1) send out proposals to donors; (2) use funds from other CONDESAN programs, such as the Paramos Project or the GEF project, for partial support; (3) inquire about collaboration from entities within the UN system; and (4) recruit someone who would be willing to devote a sabbatical year to coordinating HELP in Peru. No doubt there are other possibilities.
4. **CIP/HELP/UNESCO partnerships should be developed.** Both the administrative and scientific leadership of CIP are well aware that hydrologic expertise is sorely needed for accomplishing the research and development objectives of the institution. Because this kind of expertise is not available within the CGIAR system, CIP is seeking partners who can provide it and thus is very

interested in developing a strong relationship with HELP. In other words, the CIP leadership perceive HELP as an opportunity for strengthening their science base in a critical area. They are currently developing several large proposals, the success of which are crucial for the institution. Linking with HELP could provide a competitive advantage in winning these grants. I suggest that the IHP initiate direct contact with CIP to explore what mutually beneficial relationships might be developed.

Specific Actions

1. Letter from Mike Bonell/HELP in support of the CIP Challenge Grant, which if successful would provide support for hydrologic research within the Jequetepeque.
2. Preparation of a concept note by CONDESAN outlining role and qualifications of a HELP coordinator for Peru. In addition the note would develop ideas for funding such a program.
3. Identify ways in which CONDESAN projects, in particular those funded by GEF and the German development agency may complement HELP.
4. Enter into an agreement between CONESAN, HELP and SEHNAMI for making climate, hydrology and other data openly available.
5. Create a "data information system" , perhaps managed by INFOANDENA, whereby all available data are made centrally available.

Acknowledgements: Preparation of this report was assisted by personnel of CIP, CONDESAN, and the University of Wisconsin. In particular, ideas and information contributed by Hector Cisneros, Elias Mujica, Coen Bussink, Craig Ficenic, and Josh Posner are appreciated. Some material was taken from the original Jequetepeque proposal submitted to HELP.

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APPENDIX – TRAVEL REPORT

Thursday, August 8, 2002: Depart College Station at 1:00 pm. Arrive in Lima at midnight.

Friday, August 9, 2002:

- 8:00 am: Meet with Hector Cisneros and Elias Muiica, the Director and Associate Director of CONDESAN. Discuss strategy for upcoming meeting with members of Lima-based hydrologic community concerning the HELP initiative.
- 9:00 am: Meeting with Lima-based HELP partners. Participants include staff members from two universities (UNALM and PUCP), the International Potato Center (CIP), the National Meteorological Service (SENAMHI), and an NGO active in water management (IPROGRA). There are opportunities for collaboration among these various organizations. The meeting enabled the participants to brainstorm concerning the feasibility of implementing a HELP program in Peru.
- Afternoon: Strategy sessions with CONDESAN personnel on implementing HELP.

Saturday, August 10, 2002: Travel to the Chiclayo by plane and then by car to Gallito Ciego, the large reservoir in the center of the Jequetepeque Watershed, to attend a stakeholders meeting. Forty people representing a variety of interests on the watershed attended this meeting, including mayors from three cities, representatives from nine NGOs, several government organizations, irrigation user groups, and operators of the dam. The meeting was an all-day affair, with many lively discussions of how to best manage the water resource on the watershed and deal with the pressing water issues.

Sunday, August 11, 2002: Return to Lima

Monday, August 12, 2002:

- Meet with Teressa Velasquez, who will be attending the HELP meeting in Sweden, to discuss ways of collaboration and strategies for presenting material.
- Help design the poster for the HELP meeting.
- Meet with Dr. Roberto Quiroz, coordinator of the Natural Resource Program at CIP. Dr. Quiroz is very interested in the HELP initiative and is willing to shift some of his work to the Jequetepeque Watershed.
- Meet with Pamela Anderson, CIP Research Director. She is supportive of the HELP concept and would like to see HELP applied in the Andes.

Tuesday, August 13, 2002:

- Meetings with Roberto Quiroz, Research Leader-Natural Resource Program, and his team to discuss strategies for incorporating HELP concepts into the Challenge Grants, a new initiative in the CGIAR system.

- Meeting with Dr. Hugo Lipun, Deputy Administrator of CIP. He is particularly interested in HELP as a way of bringing hydrologic expertise into the CGIAR system.

Wednesday, August 14, 2002:

- Compile and process available information on the Jequetepeque Watershed.
- Meet with Hubert Zanstrum, Director General of CIP. He is very interested and supportive of the HELP concept and is eager to build stronger collaborations between the CGIAR centers and the hydrologic community.
- Depart Lima.