

TRIP REPORT

Prepared By:
Daene McKinney and Caryn McKinney



Moon over the Huayhuash

Huaraz, Peru
July 23 - August 14, 2011

1. Introduction

1.1 The Project

Background

Only 2% of Peru's natural water resources are stored in the country's Western Andes, where approximately 70% of the population resides. This natural disparity is coupled with extreme vulnerability to climate variability due to reliance on tropical glacial melt and seasonal precipitation, and has forced ~12 million poor, indigenous communities in rural Peru to address water quality and availability issues in the region. Five communities (~18,000 people) located in the Santa River basin, a main river fed by the central Andean glaciers, have taken a proactive approach to addressing water and climate issues by forming a common entity, the Tres Cuencas Commonwealth. In a collaborative effort with the locally run non-profit The Mountain Institute (TMI), EWB-Greater Austin (EWB-AUS) will partner with the Tres Cuencas Commonwealth to implement new technologies and conservation practices that address the water challenges facing the area and that help communities adapt to climate variability.

The Need

Approximately 18,000 residents of the Tres Cuencas Commonwealth are struggling to provide food for their families as a result of climate variations affecting their agricultural productivity. It has been well documented that the climate variability in this area has led to shorter and less reliable rainy seasons, resulting in significant water shortages during the dry seasons. These communities need technical solutions through which they can store water and utilize it more efficiently. In addition, natural heavy metal contamination in the rocks of Santa River tributaries prevents the use of stream water for agriculture or potable use for downstream communities. Tres Cuencas is also seeking low-cost solutions for treating this water to use for irrigation and land maintenance.

The EWB-USA Response Assessment I

In August of 2011, EWB-AUS will traveled to the Central Andes' Santa River basin to formalize collaboration with TMI and the Tres Cuencas Commonwealth, as well as conduct a technical assessment to identify the range of available small-scale projects that serve the most pressing water needs outlined by the Commonwealth. With community and TMI input we will establish stakeholder roles and a shared vision for the lifespan of the program.

1.2 This Report

This report details the activities of Daene McKinney (Mentor) and Caryn McKinney (Health and Safety Officer) on the Assessment I trip. This travel covered the period July 23 to August 14, 2011.

2. Information on Activities

Saturday, 23 July 2011 Austin - Lima, Peru

Travel by air to Lima via Atlanta. Arrive in hotel at 1:00 am July 24.

Sunday, 24 July 2011 Lima, Peru

Spent this day in Lima to get bus tickets and prepare to travel to Huaraz.

Monday, 25 July 2011 Lima - Huaraz, Peru

Traveled by bus to Huaraz (starting at 9:30 am for 9 hours).

Tuesday, 26 July 2011 Huaraz, Peru

First day in Huaraz. Purchased Cell Phone sim card, number is: 972 - 879 - 144.

Met with The Mountain Institute: Doris Chavez (TMI staff) and Daniel Constable (TMI intern).

Canrey Chico - The current schedule is to go to Canrey Chico on Aug 4 and spend 4, 5, and 6 there. TMI is arranging transport (4x4 truck) and taxi. Doris is in Canrey today and tomorrow and then to Huasta making arrangements. We will camp Aug 4 at the water source above the community. TMI has tents, but we need to supply sleeping bags and pads. TMI is arranging a cook (Joel and he's great!) with food. We will stay Aug 5-6 either in individual homes in the community, or all stay in a community building.

The community has been monitoring the Rio Negro and upper tributaries for almost a year and we have good chemical data (analyzed in the Univ. of Huaraz lab). They have not tested for microbials, so it is good we are bringing those tests. The tributaries are very contaminated with several metals (iron, cadmium, mercury, lead, and arsenic). The community uses the river water for agriculture and they are very concerned that health effects are beginning to be a major problem for animals. Crops have also been affected (onions in particular). The community gets drinking water from several small springs in the area, but it has not been tested. They have discovered an old Inca canal that was used to deliver water to a community in the 1500's but has been abandoned since that time. The entire water system is inside the Huascarán National Park, but they have permission to renovate the canal if that seems like a good idea. There are some weather stations (6? Talk to Pablo Dourojeanni at TMI) in the vicinity and we can probably get the data. There are no active flow gages in the basin, but there used to be one at Olleros and Glaciology did some gauging above the water system in the 1990's (Rio Puma Huacanca); Cesar Portocarrero at the Glaciology Unit may have some data. TMI strongly encourages us to check out the basin and the upper tributaries, since this is where the community has identified some opportunities for improving the water system. It would be about a 4+ hour hike from the community up to the system, which is why they suggest that we camp up there (in the 'Puna') when doing the survey.

NOTE (Health and Safety): Canrey Chico is at 3400 m (11,154 ft) and the water system is at 4000 m (13,123 ft). Teams need to be acclimatized for this. Huaraz is at about 3100 m (or just over 10,000 ft). Team members pass over the Conococha pass at 13,400 ft on the bus and then stay in Huaraz for at least one day. One or two days should be planned in Huaraz to acclimatize before going to the communities and it is suggested to take day hikes up to 4000m after the 2nd day in Huaraz.

Huasta - Huasta will be visited Aug 8-10. Also, Caryn and Daene depart Huaraz on the day bus to Lima on the morning of Aug 12th. Huasta is experiencing a general lack of water supply as the community has developed and climate change has decreased high mountain glaciers.



Shopping in Huaraz. Yes, there are hardware stores and plenty of food.



Sunset from Olaza's B&B in Huaraz.

Wednesday, 27 July 2011 Huaraz, Peru

Hiked to Lake Churup (4500m) today for acclimatization.



Churup Lake (4500m, 14763ft)

Friday, 29 July 2011 Huaraz, Peru

Hiked to Lake Llaca (4600m) today for acclimatization. Llaca Lake provides a good example of a Peruvian lake safety system installed almost 30 years ago. It serves to keep the level of the lake below the safe level to avoid a Glacial Lake Outburst Flood (GLOF).



Llaca Lake flood safety system



Llaca Lake (4484 m, 14,712 ft) and (name?) glacier

Saturday, 30 July 2011 Huaraz, Peru

Hiked to Lake 69 (4500m) today for acclimatization.



Lake 69 (4500m)

Sunday, 31 July 2011 Huaraz, Peru

Hiked to Willkiwain ruins. They close at 2:00 pm. We only made it into the “small” ruin and missed the “big” one.



Willkiwain ruins

Monday, 1 August 2011 Huaraz, Peru

Rest day. Had a bit of a cold and took it easy. Met with James Seppi and Taylor Cook in Huaraz. Discussed trip schedule and details. They had taken altitude sickness medicine (Diamox) and it made them very tired. It is not recommended to take this medicine unless adverse reaction to altitude is noticed (say above 4000 m).

Tuesday, 2 August 2011 Huaraz, Peru

Hiked at Pastarouri Glacier (5000m) today for acclimatization. Be sure that you've been at altitude a few days before attempting this. It is very high and adverse reaction to altitude can occur in some people.



Pastarouri glacier (5000m, 16,404 ft). (add comparison to 2009)

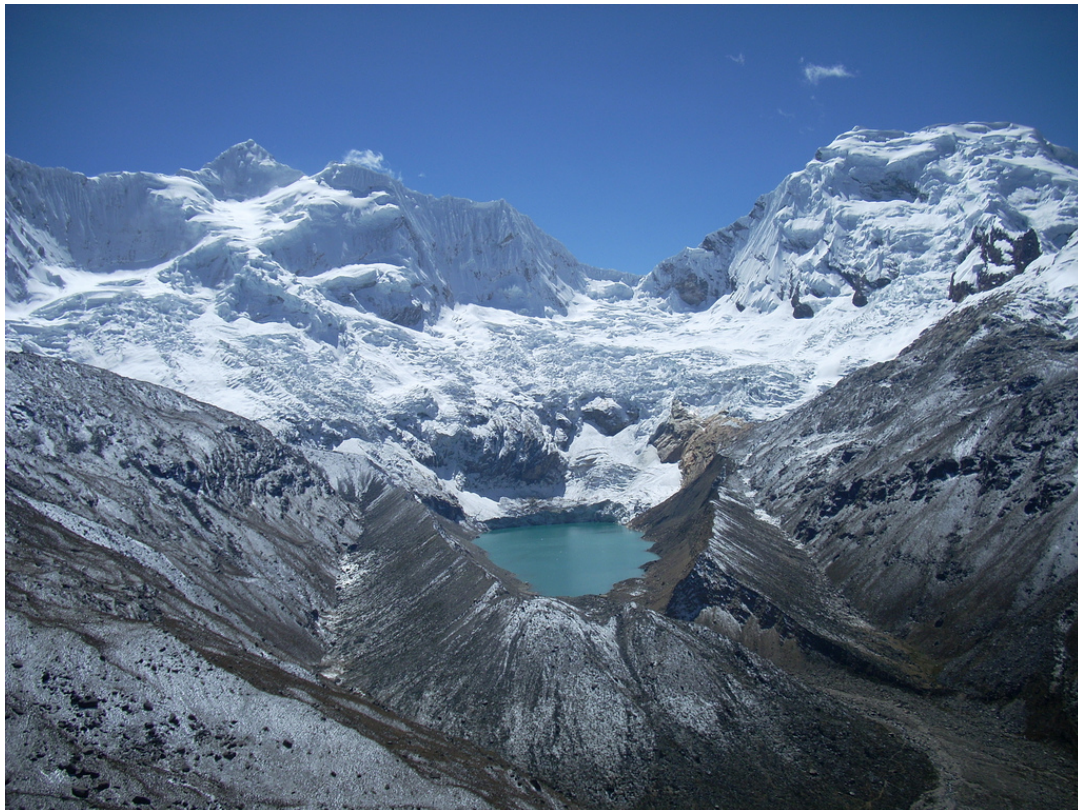


Ice at Pastarouri glacier.

Later in the evening we met Laura Read, James Seppi and Taylor Cook in Huaraz. Discussed trip schedule and details.

Wednesday, 3 August 2011 Huaraz, Peru

Met with Cesar Portocarrero, Director of the Glaciology Unit. We discussed Lake Palcacocha at length.



Palcacocha Lake (photo by Colette Simonds).

In 1941 when the lake contained 12 million m³ of water an avalanche fell into the lake and caused a Glacier Lake Outburst Flood (GLOF) that swept away a large portion of the city of Huaraz and killed about 5,000 people. In 1974 a lake safety system (main and secondary spillways) was installed and the lake was drained to 0.5 million m³. The lake currently contains 17 million m³ and the surface is 8 m below the spillway and rising. The Glaciology Unit has proposed draining 7 million m³ from the lake and lowering the surface 7 m. A new safety dam will be built (18-20 m high), but the regional government wants to delay the project for at least one year. A temporary siphon (5 pipes with 1 m³/s capacity each) is being installed at the lake to bring the lake level down over the next six months.

We also discussed other dangerous lakes: Lake 513 which had a GLOF in 2010 has a safety system that worked well for 18 years. It has 20 m of freeboard, but last year's wave was

over 20 m and caused the lake to overflow causing problems downstream. The Swiss government is supporting a project to install new safety systems at the lake.

Llaca Lake has increased in length to 400 m recently and will increase soon to 1 km.

Lake Tulparaju is dangerous. In 1974 it was drained to 1.5 million m³ and today it contains 12 million m³ of water. Steel pipes were used in the original safety system, but the mineralization of the water has destroyed these and it is necessary to change them to concrete.

We also discussed natural pollution of the streams which is increasing in the Rio Negro and other catchments as the glaciers recede. Many of the streams around the Huaraz area have increasing acidity (pH 3-4).

We met with Jorge Recharte, Director of TMI Andes Program at the TMI office in Huaraz. TMI is implementing several projects: Peaks to Coast Project (USAID funded), Research Project on Water Resources and Climate Change, Punas-Agua Project, and Twin Watersheds Project.

The Twin Watersheds Project is studying the impact of current agricultural and livestock management practices on water retention in high rangelands (called 'puna') in two basins located next to each other. The basins are very near Canrey Chico and have different land-use practices, but similar soils and climate.

The communities in the Tres Cuencas Commonwealth area have been shrinking in recent years. Canrey Chico occupies the left hand side of the Rio Negro watershed and Canrey Grande occupies the right hand side. In the past they were one community, but then they were split. Municipalities are the lowest government level in Peru. However, communities (part of the municipalities) make most of the decisions. Canrey Chico and Canrey Grande are part of the District of Recuay, which, in turn, is part of the Recuay Province. Canrey Chico is actually a sub-community of the Cordillera Blanca community. Huasta is in the Huasta District in the Province of Bolognesi.

Tres Cuencas Commonwealth covers three river basins (Rio Santa, Rio Patavilca and Rio Forteleza). It includes two provinces, eight districts and 14 communities. The members are the districts and provinces. The Commonwealth has a ten member Board of Directors made up of the district and province mayors. The purpose of the Commonwealth is to manage high mountain ecosystems for sustainable development and climate change adaptation. The Commonwealth can propose projects to the regional government for funding. EWB projects can serve as pilot projects and the successful ones can be proposed to the regional government for replication in other communities. The Tres Cuencas (three basins) come together at Lake Conococha. The Commonwealth office is in Chiquain and the President is the Mayor of Bolognesi Province.

In Canrey Chico and Huasta, farming is mostly for local consumption (low value crops). Livestock activities are increasing since they are higher value and can be sold in the

markets. Tourism is becoming more important in the Canrey Chico area due to the Olleros – Chavin trekking trail (10-20% of Canrey Chico families participate in this activity (about 80 families).

Huasta is in the Rio Patavilca watershed. There are many springs in this watershed and the community gets its drinking water from springs. There is some concern in the community that the springs may be drying up. The water system for agricultural purposes is made up of small canals (~ 160 L/s flow) and small reservoirs (~ 40 – 70 m³) for farming and livestock. There has been some experiment with drip irrigation, but this has not worked out well due to water scarcity. The community is interested in new and more efficient irrigation techniques. Women in the community are very interested in medicinal plant production. Huasta does not have a community water research committee like Canrey Chico does, so their water problems are not as well identified and prioritized. There is a need to study the flow of the springs to determine if they are declining. Water quality of the delivered spring water should also be tested. The canals carrying water from the springs could be improved.

The community has reported perceptions of climate change, such as: crop productivity decrease, problems with trees, water shortages, changes in meteorology (e.g., solar radiation and temperature) all resulting in increased shortage of water. Water demand data may be available from the ALA office in Huaraz.

The communities sometimes see outsiders as patronizing and this can be a risk in project implementation. The message to the communities needs to be that EWB is looking for communities that are interested in EWB help.

Thursday, 4 August 2011 Canrey Chico, Peru

What animals are most valuable? Cows are valuable because of milk and cheese production. Corn and wheat are the main crops grown in the area along with some potatoes. The water quality problem has been diminishing crop yields in recent years and increasing the move from crops to livestock production. The area cultivated in the community is about 0.5 ha per family. The canals are used mostly for irrigating pastures. A small amount of domestic water is delivered from canals, but mostly it is piped from springs.

We met with the President and several members of Canrey Chico local water research committee to discuss water problems in the basin and community.



Members of Canrey Chico local research committee.

Several tributaries of the Rio Negro contribute metals to the water:

- *Rio Ururash* - a major source of lead, aluminum and iron. From the confluence of the Rio Ururash and Rio Negro it is 4 km to the base of the glacier (which is receding rapidly).
- *Rio Araranca* - relatively clean.
- *Rio Pumahuacanca* - has not been tested much so it is difficult to tell if it is clean or not.
- *Rio Killock* - source of Cadmium. Research committee believes that Cadmium tends to be filtered out and adsorbs to sediments.

The flow in all the tributaries is unknown and needs to be measured in the wet and dry seasons. There are flow gauges across the mountain in the TMI Twin Basins project and these might be useful to estimate flow in the Rio Negro basin based on area ratios.

There are several canals that take water from the Rio Negro. Most of these were built more than 200 years ago. Killock and Araranca Canals have not been used since the 1920's.

Some children in the community have been getting sick from water problems (diarrhea and some discussion of mental development problems). There are no medical services in Canrey Chico, but there are in Recuay. Many children go to the doctor due to malnutrition, but the doctors tell them it is because of the water. The kids do not seem to have appetitewhich makes the malnutrition problem. Women suffer from malnutrition also.



Camp in the Puna of Rio Negro near Canrey Chico

Camping in the upper Rio Negro watershed was very cold and future teams should be sure to bring long underwear and good parkas.

We hiked around the Rio Negro source water area and saw all of the smaller tributaries, including Rio Killock, Rio Araranca, Rio Ururash, and Rio Pumahuacanca.



Old Inca Canal in the Puna at Canrey Chico



Confluence of Rio Pumahuacanca (left) and Rio Ururash to form the Rio Negro.



Rio Negro showing heavy iron content.

Friday, 5 August 2011 Canrey Chico, Peru

Saturday, 6 August 2011 Canrey Chico, Peru

We met with Mr. Alejandro (last name?) the President of the Canrey Chico Community. In summary, he told us that it is OK for EWB to work in the Community. They have a place for the team to camp. Then we visited his house in Canrey Chico and the spring box up the hill from there. This spring feeds the sub-community of Soledad (Cordillera Blanca Community is made up of 3 sub-communities: Canrey Chico, Soledad and Achic). The spring box system is 2 years old and is comprised of two spring boxes (one (higher one) is 2x2x1.5 m and the second (higher one) is 2x2x1 m). There is supposed to be an aggregate (sand?) filter in the

pipe somewhere. The quality of water coming from the spring has not been tested and it should be. The spring system here serves about 10 families or about 30 people.



Confluence of Rios Uruash and Pumahuacanca

Some Points in the Rio Negro Puna Where Water Quality Sampling Has Been Done.

Name	Latitude	Longitude
Rio Negro Bajo (lower)	9° 38' 36.35" S	77° 20' 54.35" W
Rio Chuelo	9° 38' 50.325" S	77° 20' 25.48" W
Rodeo Quto	9° 38' 48.08" S	77° 19' 58.27" W
Pampa Hahi	9° 38' 38.15" S	77° 19' 44.53" W
Rio Araranca	9° 38' 39.68" S	77° 19' 50.65" W
Confluence (union)	9° 38' 14.43" S	77° 19' 48.49" W
Rio Uruhuash	9° 38' 12.61" S	77° 19' 48.14" W
Rio Pumahuacanca	9° 38' 13.86" S	77° 19' 48.09" W

We met with the Mayor of the Cordillera Blanca Community. The community is comprised of three sub-communities: Canrey Chico (60 families), Soledad (90 families), and Achic (40 families). We introduced the EWB program and the relationships to TMI and Tres Cuencas Commonwealth. The mayor seemed to like the program. There was a lot of discussion about the spring water. These systems may be 70-90 years old. There is great concern about children's health in the community. The priority problem is water for agriculture – mostly livestock pastures and not so much for cultivated crops. The community irrigates about 300 ha and grows potatoes, wheat, quinoa, and sevada. The livestock seem to be getting sick from the water or the pastures after being watered. A decade ago there was more cultivated crops and not as many livestock. This has changed over the past decade

since livestock (milk and cheese production) have increased greatly. The community has enough water, but the pollution is a problem.



Spring boxes on hillside above Soledad President's house



Water supply at Soledad President's house.

We visited the main canal serving the Canrey Chico community. The research committee members noted several plants that can help to clean the water of minerals: Cincanco, otutillo, and pampas grass. The canals are also cleaned each May when 10-20 cm of sediment is removed from the canals.

We visited the Achic community spring-fed water system. The system serves 25-30 families (75-90 people) from two spring boxes and a reservoir.

Sunday, 7 August 2011 Canrey Chico, Peru

Returned to Huaraz.

Monday, 8 August 2011 Huasta, Peru

Tuesday, 9 August 2011 Huasta, Peru

Traveled to Huasta. Huasta has a “community” that is made up of 120-150 members. Not all residents are members of the community. Met with Edmundo, the president of the community forestry committee. He noted that lack of water is the main problem for the community. They have been thinking about bringing water from the high mountain area (Jupaimarka) where there are many lakes. The distance seems to be about 25 km of pipeline or canal. There are five reservoirs in Huasta that supply water to pastures for livestock.



Looking over at the town of Huasta.

We met Alfredo Velasquez, the president of the Huasta community. He noted that the main problem for the community is that they have fertile fields, but not enough water for them. In the higher areas there is abundance of water, but it is difficult to deliver it. Water demand for irrigation is high. They irrigate once or twice during the dry season. This seems to be sufficient for a good alfalfa crop. Drip and sprinkler irrigation systems have not been used in the community, but there is interest in improving the efficiency of irrigation. The systems that we saw were in various states of repair and operation and maintenance seems to be a big problem. 800- to 900 ha of land is irrigated and this has not

changed in many decades. The rainy season used to be six months long, but has now reduced to three or four months. About six years ago the community needed more reservoirs to store and redistribute water and five were built. Now, more reservoirs are needed. The springs used for domestic water seem to have water all year long and there is not a shortage. However, the quality of the spring water has not been tested and it should be tested. Flow in the canals and piped systems are not measured or know. Demand for water is not known, so it is difficult to estimate the need for additional supplies.

There is a main spring in the center of town that feeds a concrete reservoir (20 x 10 x 3 m³ constructed in 2009 and delivers about 600 m³/day). The reservoir fills and empties each night as the water is delivered to pastures for irrigation. There are about 4 of these reservoirs in the community. We also visited an unlined reservoir that seemed to be about half the size of the concrete one.



Huasta main spring and reservoir



Unlined reservoir in Huasta

The community would like to reuse wastewater from the community's treatment plant. The community has a sewer and wastewater is delivered to a primary (physical) wastewater treatment plant. We visited the plant and it is in a state of disrepair and barely functioning. The plant is somewhere between five and eight years old. The mayor of the municipality is in charge of the plant.



Huasta wastewater treatment plant



Field, hacienda and Huayhuash



Hillside leading from wastewater treatment plant to fields and hacienda.



Main hacienda building

Wednesday, 10 August 2011 Chiquain, Peru

Meeting of Tres Cuencas Commonwealth Board of Directors. We met with the TCC Board to present EWB and the program idea to them. We also reviewed a Memorandum of Understanding that had been drafted for EWB, TMI and the Commonwealth to cooperate in carrying out the program. The MOU was signed at the end of the meeting!



Signing the MOU

Thursday, 11 August 2011 Huaraz, Peru

We met with Cesar Portocarrero at the Glaciology Unit and received a lot of information in the emerging glacial lakes in the Cordillera Blanca. He also introduced us to the staff member working on the Rio Negro basin and we will get data from him later.

Friday, 12 August 2011 Lima, Peru

Took the bus from Huaraz to Lima in preparation for departure to the US.

Saturday, 13 August 2011 Lima, Peru

Day in Lima. Went to the airport in the evening to fly to US.

Sunday, 14 August 2011 Lima, Peru - Austin