Traditional knowledge improves water management in rural and urban Peru

Using inexpensive, replicable and ancient technologies to improve water management in the Peruvian highlands, an Ecosystem Services for Poverty Alleviation (ESPA) project has benefited both rural upstream communities and the downstream capital city, Lima.

Key messages

• In the Peruvian highlands, communities depend on water sources for their livelihoods and cattle, which can lead to overgrazing and jeopardise water flows due to sediment build-up. Downstream, Lima depends on these water sources to provide for its population and agriculture.

• Historically, data has not been sufficient regarding the environmental management of these highland regions and their role in securing fresh water flows downstream – making it difficult to plan interventions.

• This ESPA project found that overgrazing has a significant effect on the variability of river flows, due to sediment build-up.

• The team investigated and developed low-cost monitoring equipment, and tested and restored an ancient hydrological technique, mamanteo, as an example of an inexpensive way to manage water flows effectively.

• Using this research as a case study, Lima’s water utility is investing US$23 million in ‘green infrastructure’, with US$1 million allocated for mamanteo restoration.

Background

In the Peruvian highlands, communities like Huamantanga depend heavily on cattle for their livelihoods. However, overgrazing has compacted the soil so that water flows too quickly down the mountain, and downstream flows have been jeopardised due to the build up of sediments.

Downstream, the capital city of Lima is surrounded by desert. Rain water in the mountains feeds the rivers and irrigation systems that, in turn, provide for the high-value crops in the lower river basins, which are fundamental to the country’s economy.

Although river flow is abundant in the rainy season, during the dry season it is reduced to a trickle. In the coming years, Peru’s highlands will experience high temperatures more frequently, with
potentially disastrous consequences for their already stretched natural resources. Climate models do not show projections at a highly localised scale, especially at high elevations, and ecosystem monitoring is poor due to the difficulty in accessing these remote regions. Existing data tends to be geographically biased towards more populated regions.\footnote{Without more local data, it is difficult to assess the impact of Huamantanga’s agricultural practices on the downstream flow, or predict and plan for future changes to ecosystem services.} Recognising the need to improve Huamantanga’s water management, the local community, along with the non-governmental organisation Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (CONDESAN), investigated the impact of cattle grazing on streamflow. The ESPA-funded project developed low-cost monitoring equipment, and went on to test and restore an ancient hydrological technique.\footnote{By closing off one stream to all cattle, the project assessed the impact of grazing on the water quality and quantity, using technology employed by the local community. The team then analysed the different scenarios to find the ideal balance between cattle grazing and streamflow.}

A further investigation analysed the potential of mamanteo canals (derived from the word ‘breastfeeding’ in Spanish), an ancient technique that pre-dates the Incan Empire, which distribute water from the wet season throughout the dry period. The initiative refurbished an old canal and added dye to the water to understand its movement and the time it takes to re-emerge. These data were combined with a hydrological model to assess whether streamflow could be increased during the dry season.

Research

For a fair distribution and optimal use of scarce resources, it is essential to know how much you have. We found that participatory monitoring is a powerful way for small communities to get the most out of the ecosystem services that support their livelihoods.

Wouter Buytaert, Principal Investigator
Results

The results showed that overgrazing does not necessarily reduce the annual water yield, but it does have a huge effect on the river flow variability; after rainfall events, the water flow is initially very high in degraded catchments, causing sediment build-up, but the water flow then decreases rapidly.3 Meanwhile, the mamanteo experiment showed that small catchments above 4,000 metres could store around one third of the rainfall volume. The team found that the system delays water flow by between two weeks and eight months, which would effectively bridge the dry season.4

The research also determined that investment in community-driven restoration projects is a relatively cost-effective, socially responsible and environmentally friendly alternative to building reservoirs or transferring water.5,6

Impact and next steps

The findings have been adopted by the Huamantanga community, who have changed their approach to pasture management. At the national level, CONDESAN’s work has been instrumental in informing Peru’s ground-breaking 2014 Payments for Ecosystem Services Law, which draws directly on this project as a success story.

SEDAPAL (Lima’s water utility) has decided to invest US$23 million in ‘green infrastructure’, with US$1 million allocated for mamanteo restoration. The scheme intends to compensate communities such as Huamantanga for taking actions that improve ecosystem management and water availability and quality. Implementation is still in the early stages. A further 3.8% of tariffs (approximately US$89 million) will be used for climate change adaptation and disaster risk mitigation.

The project has obtained more than £2 million as follow-up funding from the UK’s Department for International Development (DFID) and the Natural Environment Research Council (NERC) to replicate community-based monitoring and citizen science in Africa and Asia.7 As in Peru, there has been local buy-in by communities, providing the work with a stronger legacy compared to traditional means of data gathering, and the team has received requests from other communities in Africa and Asia to support similar approaches. The original project in Huamantanga created tools that facilitated replication (such as manuals and a protocol) and offered training as part of these follow-on projects to ensure impact in the long term.

The UNESCO International Hydrology Programme has been inspired by the project’s work; the team presented their findings at the UNESCO knowledge forum in October 2017. The team has also received

“Comuneros in Huamantanga had sometimes said that problems occur because of their own lack of knowledge. This project looked exactly at bridging that gap, by not only generating new knowledge on the local water cycle but valuing local ancestral knowledge as well. Therefore, [the project] generates and rescues rural science, taking into account the characteristics, interests and needs of those people to whom we were delivering information.”

Katya Perez, CONDESAN
About the project
The project ‘Adaptive governance of mountain ecosystem services for poverty alleviation enabled by environmental virtual observatories – MOUNTAIN-EVO’ (NE/K010239/1) was implemented by a consortium of Imperial College London, CONDESAN, Wageningen University, LaMolina National Agrarian University, the Universities of Central Asia, Birmingham and Antwerp, SOHAM Nepal and the Social-ecological Systems Laboratory. The project, which ran from 2013 to 2017, aimed to understand the process of knowledge generation in remote mountain environments in Ethiopia, Kyrgyzstan, Nepal and Peru, and investigated how citizen science can be used to implement a negotiated, interactive model of polycentric governance of ecosystem services that alleviates poverty.

Credit
This briefing was written by the ESPA Directorate based on information provided by the MOUNTAIN-EVO team.

About the ESPA Programme
ESPA is a global development research programme established in 2009 with funding from the Department for International Development (DFID), the Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC). ESPA is one of the most comprehensive research programmes exploring the linkages between ecosystem services and human wellbeing. ESPA aims to provide new world-class research evidence demonstrating how ecosystem services can reduce poverty and enhance wellbeing for the world’s poor.

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invitations from the Chilean government to support citizen science activities in the context of flood and drought management.

The United States Agency for International Development (USAID) has committed US$15 million to support scaling up green infrastructure, using the participatory approach developed in Huamantanga as a cornerstone of the project’s methodology. Partners CONDESAN and Imperial College London are part of the collaboration, and will continue to share lessons learned.

Endnotes
1. http://paramo.cc.ic.ac.uk/espa/node/1
2. http://www.espa.ac.uk/projects/ne-k010239-1
7. This includes, in particular, the Landslide EVO project funded through under the UK Science for Humanitarian Emergencies and Resilience (SHEAR) programme (grant number NE/P000452/1). See http://paramo.cc.ic.ac.uk/landslide/

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