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ecosystem services
for poverty alleviation

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About this project

Name

A virtual observatory for ecosystem services and poverty alleviation.

Principal investigator

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Other partners

Nature and Culture International.

Time frame

November 2010 – September 2012.

Objective

This project experimented with new technologies to support 'citizen science' in the Andes, exploring how participatory data collection processes can be used to support adaptive governance of ecosystem services in remote, poverty stricken regions.

Summary

In remote mountainous regions such as the Andes, poverty and threats to ecosystems are often exacerbated by an insufficient knowledge of the state of the environment. In such a 'perfect storm' of conditions, the typical 'predict and control' approach to ecosystem management is not feasible. On the other hand, continuously monitoring the direction in which the ecosystem is heading and responding flexibly to observed changes is difficult in areas that are hard to access.

This project explored how new environmental monitoring technologies, data processing, and interactive visualisation might support adaptive governance of ecosystem services. In the Pacaipampa community in the Peruvian Andes, stream-flow was monitored by local farmers and an interactive hydrological model developed to support land-use planning and safeguard water supplies.

Remote control

Citizen science and the latest technologies are allowing once isolated mountain communities to monitor fragile local environments and ultimately shape their management.

On the western edge of the Andes, where the desert coast of Peru is a major agricultural hub, the main concern for lowland farmers is a lack of water.

Their land is irrigated by rivers originating in the mountains, which means water availability and quality depends on land management and soil conservation strategies implemented in highlands almost a hundred miles away, where poor farmers – such as those of the Pacaipampa community in northern Peru – struggle to make a living on the steep, infertile slopes. Implementing sustainable farming that generates enough income for poor montane farmers, yet also supports regional ecosystem services such as lowland irrigation, is a delicate balance – and one which is further complicated by the Andes' changing climate patterns.

In addition, land degradation, erosion, mining activities and agrochemical contamination all threaten the environment and so management needs to be based on optimal access to both existing and newly generated data. Yet in the hard to reach Pacaipampa, environmental data tend to be scarce given the scale of the challenges being faced.

'Citizen science', the process in which local people actively participate in the generation of new knowledge, is a promising way to generate the necessary evidence-base to make these well-informed choices about ecosystem management. And new technologies – such as cheap electronic sensors, cloud computing and visualization – can prove very useful in supporting citizen science. They make it possible to create interactive applications known as Environmental Virtual Observatories (EVOs) that allow data access and learning – based on openness, interaction and multidirectional knowledge exchange.

Testing the waters

This ESPA project experimented with the design of EVOs to support adaptation strategies for the farmers of Pacaipampa.

Together with a locally based NGO, Nature and Culture International, farmers in Pacaipampa installed rain and river gauges to monitor the fragile mountain wetlands ('páramos'), which act as water towers for much of the northern Andes. These same farmers also then collected the data from these monitoring stations, with the intention they would identify which ones were the most important water sources.

However, this was just the start. The path from any raw data to informed decision-making is traditionally very long. It usually involves storing data in different places, the use of various different software packages, and analysis and modeling by research groups at distant universities – not to mention the expensive travelling between the parties involved. Formerly, this will have added up to a potentially cumbersome and lengthy process prone to data loss, errors, delays and costs.

The team analysed how EVOs can smooth and accelerate this process. From both a technical and scientific perspective, this was quite a challenge. While new networking technologies and improved internet access make it easier to exchange data, they come in different formats and meanings. The teams showed how using open standards helps avoid misinterpretation and facilitates proper documentation.

Power to the people

There is still a need to process this raw data into a form that is useful to non-scientists, and to do that requires scenario analysis and simulation.

For instance, the farmers of Pacaipampa were concerned about the impact of exotic tree species on the water yield of their catchments. Hydrological models, calibrated with local data, were used to evaluate such scenarios. But, because scientific understanding about hydrological processes is still limited, such predictions have large uncertainties.

In this study, the use of interactive, web-based simulation tools proved to be very helpful in visualising and communicating such uncertainties. The scientists created the visualisations, and the farmers and NGO staff commented on them – producing a dialogue rather than the typical unidirectional flow of information – which in turn helped improve these simulations further.

But once this knowledge has been shared, it is only useful if it results in action. Decision making is a complex process, which depends strongly on the decision makers socio-cultural background. They may have high and unrealistic expectations from scientific knowledge and environmental models, and they might see them as clear-cut cases for particular actions. Or contrarily, they may lack confidence in scientific data and model predictions.

Involving local actors in data collection and analysis increased the credibility of the knowledge generated. Helping identify in which valleys agriculture would be least harmful has led the farmers to conserve the wetlands, lakes and valleys identified as their major water sources. In the short term this results in farmers actively participating in conservation projects for a reason they understand and value, rather than an action that is imposed upon them or alien to their way of life.

Next steps

In 2007 CONDESAN (Consortium for Sustainable Development of the Andean Ecoregion) launched an initiative to set up a local monitoring network in communities in Peru, Bolivia, Ecuador and Venezuela. The team is currently expanding the EVO technology to support this network, which has nine active sites but is growing quickly.

A new ESPA project (MOUNTAIN-EVO) intends to replicate this success in other, even poorer mountain regions, including Ethiopia and Kyrgyzstan. At the same time, it will further extend the observatories to incorporate mobile phones, tablet computers, and social networks. The hope is it stimulates South-South interaction and social learning that breaks the vicious circle of data scarcity in remote mountain regions.

New knowledge

- New developments in sensors technologies, ICT and data processing can effectively be used to support participatory environmental data collection in remote regions.
- Poor people in remote environments are eager adopters of new technologies to collect data about their environment. However, results of local monitoring (such as rainfall or river flow) should then be used to support local processes of ecosystem governance.
- Participatory monitoring of ecosystems can provide a basis for the co-generation of knowledge about the effect of land management scenarios. It empowers local people to make better-informed decisions that affect their livelihoods.

Creating impact

- Citizen science is a powerful tool for poverty alleviation. The availability of affordable and easy-to-use technologies for data collection removes barriers to knowledge generation and supports environmental education.
- The tools and insights developed in the project helped establish a long-term initiative on participatory hydrological monitoring, with nine sites already operating in Bolivia, Peru, Ecuador and Venezuela.
- The data collected on threats to waters and their degradation provide an evidence base that strengthens local communities' position during the negotiation of compensation for ecosystem services schemes, and helps influence local and international policy-making.

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