Katalysis: helping Andean farmers adapt to climate change

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by STEPHEN SHERWOOD and JEFFERY BENTLEY

Introduction

The Andes have daily (rather than seasonal) temperature extremes, unpredictable weather from one year to the next, and a myriad of environmental niches scattered across the elevations. To survive in such an adverse environment, highland farming evolved to be robust, with complex soil and water management, a rich diversity of crops and varieties, and planting schemes adapted to altitude. Much of the work is done through collective labour and sharecropping. Spanish colonialism and then the market-orientation of the last century privileged distant consumer demands and external knowledge and technology. As a result, local knowledge and practice have been largely supplanted, and agriculture is based on fewer crops and varieties and less sophisticated planting schemes. In addition, the arrival of industrial-era technology, such as mechanised tillage and agrochemicals, commonly has led to the degradation of soil, water, and biological resources. Climate change is likely to aggravate greatly this already precarious situation.

Recent studies of global climate change paint a bleak picture for the Andes. The UN's Inter-governmental Panel on Climate Change (IPCC) has shortened previous predictions for the melting of Andean glaciers from 30 to 15 years. Droughts and flooding will become more common in the region, as will wind and cyclones, disease and pests, soil erosion, and losses of soil organic matter. Stream flow will decrease.

Researchers have proposed expert-led solutions, such as improved climatic modelling and forecasting, and the breeding of drought-tolerant crop varieties. Climate models are most useful for determining large-scale mean temperatures over relatively uniform geographies – not the Andes! General forecasts are of little help to farmers who are more interested in local, short-term predictions, especially of rainfall. For these sorts of predictions, rural people are often at least as accurate as meteorologists (Orlove *et al.*, 2002). Instead, mountain people need greater ability to cope with weather fluctuations.

Photo: Stephen Sherwood

Figure 1: Ambuqui watershed in northern Ecuador, 2000 to 3100 metres above sea level.

Drought-tolerant varieties may be important in some regions, but in the Andes, traditional crops and potato varieties are already adapted to a much wider range of altitudes than previously suspected (de Haan, 2009). Maintaining the varieties that farmers have and love may be as important as breeding new ones.

We believe that farmers need to shape the research agenda according to local priorities, and that smallholders and researchers should learn together. These are the aims of the Katalysis approach to climate change adaptation described in this paper.

Katalysis: an experiential learning-action approach

Piloting the Katalysis approach

During 2005 and 2006, with a grant of US$60,000 from the Challenge Program on Water and Food, World Neighbors worked with several partner organisations, especially the Ecuadorian Network for Community-based Natural Resource Management (MACRENA) and the Bolivian Programme for Integrated Development of Potosí (PRODINPO).[1] The work involved communities in intensive, locally led learning-action on climate change and resilience, including process design, curriculum development, and subsequent follow-up visits to document learning and innovations. We named the approach 'Katalysis' because of the catalytic changes it inspired. The pilot project worked at two highland locations in Bolivia and Ecuador, in the poorest regions of the Andes (Figures 1 and 2). Both sites are semi-arid, with marked dry seasons and average yearly rainfall of between 300 and 600 mm.

[1] See www.waterandfood.org

Photo: Stephen Sherwood

Figure 2: San Pedro watershed in northern Potosí, Bolivia, 2000 to 4000 metres above sea level.

During the pilot period we worked with 107 families, selected according to criteria established during community meetings. Partners subsequently incorporated parts of the approach at new sites in Bolivia (Potosí), Peru (Apurímac), and Ecuador (Imbabura and Pichincha), enabling Katalysis to reach over 500 families.

Katalysis builds on the 'discovery learning' tradition of Farmer Field Schools (FFS), in which farmers share their experience, strengthen their ecological literacy through learning experiments, and identify ways of improving agriculture through group problem-solving (Box 1).

In Katalysis the focus is on enhancing local knowledge of climate change and creating opportunities for coping with it. Katalysis starts with the experience and priorities of participants (usually married couples). Through problem-solving and action around priority interests, the focus shifts from concerns at the individual farm

Box 1: The educational roots of Katalysis: Farmer Field Schools

Katalysis emerged from Farmer Field Schools (FFS) in South-East Asia and more recently the Andes (Pumisacho and Sherwood, 2005). Field Schools involve about 25 farmers who manage learning plots. Groups focus on Integrated Pest Management (IPM), meeting weekly to conduct agroecological analyses and run experiments, such as insect zoos to learn about the life cycles of pests. Through joint learning on potato IPM, Andean farmers were able to reduce their reliance on agrochemicals, saving money, time, and avoiding harm to their families and the environment.

In practice, the FFS method has broadened beyond IPM to a more holistic focus on plant and soil health. Over time, FFS participants fill knowledge gaps that prevent them from innovating, and discover new ways to improve their agriculture. FFS ultimately aspires to catalyse the innovative capacity of farmers.

Figure 3: Katalysis involves farmers in self-directed learning about climate change

level to those at community and watershed level (Figure 3).

The Katalysis process

In each location, we convened communities and asked them to select a group of about 20 farmers willing to meet every two weeks for six months for co-learning and action on climate change. Learning methods included cross-learning between families, visits to local farmers who are particularly innovative, discovery-based learning, and farmer-led experimentation.

Visits to local innovators

Early on we seek to inspire participants through a learning tour of outstanding local innovators, to see new possibilities. For example, in Ambuqui we visited the farm of two graduates from our first cycle, Alfonso and Olga Juma, who through improving their management of organic matter and mulching and by making a relatively small investment in tubing, a filter, drip tape, and the creative use of plants and animals, transformed their farm from a 'desert wasteland' into an 'oasis' in just 18 months. As don Alfonso said:

> *Once I learnt where the water was, I could grow that small plot of alfalfa. With the alfalfa, I could have cuy [guinea pig]. The cuy produced manure for my soil. We still have a long way to go, but with just the cuyes, we have already paid back our $200 investment in materials. When I started we had no cuy. Today we have 300 cuyes that are worth about $5.00 each or $1,500 in all. That is much more than I used to earn in the city. Now I can stay home with my family. With the manure, I've planted 75 mango and avocado trees. My farm has become an oasis. Every year it will grow greener and greener. My farm used to be barren of plants. My biggest problem today is that I've run out of land to plant.*

Recently Alfonso and Olga bought two more hectares of neighbouring land. Katal-

Photo: Stephen Sherwood

Figure 4: Margoth presents her 'map of dreams' – her project to transform her farm through water harvesting.

ysis has helped dozens of families generate such locally financed transformations.

Dream maps

After learning visits, we asked participants to identify their goals for the future through a 'dream map', which was then presented to their colleagues for comments and advice (Figure 4). The group then organised to help each participant advance towards his or her dreams.

Co-learning about climate change

We adapted a participatory method developed by the organisation Agrecol-Andes to study local indicators of climate.[2] Through field visits and interactive workshops, participants explained how they 'read' wind patterns, cloud formations, the position of rainbows, the resolution of stars, and animal behaviour (e.g. where foxes deposited their faeces, location of terrestrial bird eggs, or the migration patterns of different animals) to predict the coming season.

We found that 'ease of observation' and 'perceived relevance' influenced local knowledge on climate (Figure 5). Knowledge was 'deepest' for topics that were both important to local people and easy for them to observe. This included local weather prediction – will the rains come early or will this be a cold or warm year? Local knowledge was largely missing for topics that were both difficult to observe and of low perceived importance. For example, highland farmers knew little about sea surface temperatures and their relationship to local weather patterns. There usually were no local explanations for such topics.

Our priority was practicality, so we focused attention on helping people to overcome weaknesses in their knowledge. This involved introducing new tools of

[2] See www.agrecolandes.org

Figure 5: Strengths and weaknesses of rural technical knowledge associated with climate and agriculture (based on Bentley, 1991)

(-) Ease of observation (+)
(influenced by size, time, and scale)

(-) Importance (+)
(perceived relevance and immediacy)

Gritty • biological indicators of weather • lunar stages and water • wind patterns • varietal resistance to disease • effect of trees/bushes on sub-surface water	**Deep** • water sources • drought tolerance of crops • phenology of food crops • reproduction of cattle • lifecycle of bees • rainfall patterns
Empty • evapotransportation • ocean temperatures • lifecycle of soil pests • disease cycles • parasitoids and entomopathogens • water capture in soils	**Thin** • phenology of non-food crops • soil cover • varietal resistance to disease • predator insects (wasps) • water harvesting • soil erosion

observation and information, e.g. simple weather stations or rainfall data that could reveal historical weather trends.

Co-learning about water management

It soon became clear in both Bolivia and Ecuador that water management was central for learning how to cope with climate change. Communities were suffering from both drought and floods at different times of year. The real challenge was better water management to help cope with drought and prevent flooding and erosion of soils during heavy rains. With our partners, we developed over 30 activities for discovery learning on four water management-related themes: water and the home; water on the farm; watershed and the community; and water and the world and global warming.

We started with activities to help people see the value of the rain that fell on their fields, homes, and roadways, which just drained away. For example, we measured the runoff of an ordinary rooftop, which amounted to thousands of litres of water each rainfall. Then, we valued it, applying the local market price for bottled water (which in the Andes, is commonly more expensive than gasoline!). Participants learnt that they give away tens of thousands of dollars of water each year.

We then explored ways of storing water. Participants often want to invest in expensive water storage tanks, but we introduced learning experiments on less costly alternatives, such as the holding capacity of soil organic matter (SOM). By weighing socks filled with organic matter before and after immersing them in a bucket of water, farmers learnt that their fields hold millions of litres of water and that increasing SOM by 1% across a hectare could capture an additional 100,000 litres each rainfall. Participants then identified many ways of increasing the organic matter in soil to capture water, e.g. incorporating crop residues, applying manure, reducing tillage, dead and live barriers, conservation ditches, and covering the soil through

Photo: Stephen Sherwood

Figure 6: New appreciation for the water-holding capacity of soils has led to heightened interest in cover crops.

Photo: Stephen Sherwood

Figure 7: A *minga* or work party helps a colleague install his first geomembrane tank.

mulches and cover crops. After evaluating options, the farmers found that cover crops were the most cost-effective way of increasing SOM (Figure 6).

Farmers also conducted studies on alternative types of irrigation, comparing canal irrigation, tubing, sprinklers, and drip tapes. Though more expensive, drip tapes were found to be 20 times more efficient than sprinklers, which led one participant to conclude, 'A farmer can either build his tank 20 times as large or use drip tapes'.

Individual and collective action

Over time, the priority of Katalysis has shifted from individual to collective action. Each individual took responsibility for collecting weather data, which was integrated into a report and discussions on local weather patterns. Some groups decided to organise to measure the flow of different streams in relation to rainfall across the year. We held *mingas* (group work parties), during which participants worked together to design and install innovations such as soil conservation and water catchments on different farms (Figure 7). This usually included a training visit from a more experienced farmer to guide the activity. We then supported follow-up visits across farms to document and discuss innovations at community or watershed level, such as controlling goats and cattle, the reforestation of a vulnerable hillside, or planting a windbreak.

As in the example of Alfonso and Olga Juma, early successes built self-confidence in participants, stimulating enthusiasm and creative ideas. Participants began more sophisticated activities and more ambitious tasks. For example, four communities living on the Ilalo Volcano in northern Ecuador began by addressing a priority agenda around soil conservation and water harvesting for home consumption and gardens. Through group learning, cross-visits, and *mingas*, participants met

Photo: Stephen Sherwood

Figure 8: Three-dimensional map of watershed, Ilalo Volcano, northern Ecuador.

one another and built friendships. This led to a more ambitious agenda. They created a three-dimensional map of their watershed, which identified water sources, vulnerable areas, and conflict zones (Figure 8).

Subsequent field studies and discussions led to a management plan, which the communities then turned into a project proposal that was later funded by the municipality.

Other groups have created their own savings and loan funds to help finance investments in purchasing fencing materials to control animals, local weather stations, and water harvesting tanks or micro-irrigation technology.

Why Katalysis works

It is too early to think about long-term impacts of Katalysis, but we feel its successes so far are due to the following:

- Draws on time-proven approaches, such as 'farmer-to-farmer' (see Bunch, 1982 and Holt-Gimenez, 2006) and FFS (see van den Berg and Jiggins, 2007).
- Adds value to farming experience in communities, drawing on the experiences of both wealthier and poorer smallholders, and involves families rather than individuals to address gender concerns.
- Gives participants control over a flexible curriculum co-designed by the group and the facilitator.
- Focuses on technologies already in use by local farmers. Sometimes introduces outside technology, such as micro-irrigation, but only after local alternatives have been exhausted and after careful cost-benefit analysis.
- Quick, tangible successes are the primary source of motivation. No gift-giving or subsidies. Seed money is provided for local savings and credit groups, with loans paid back through returns on investments.
- Starts simple and diversifies with time. Early experiments require small investments and are of limited scale. Begins by

emphasising individual farm-level priorities and then works towards addressing concerns at social, community, and watershed level.

• Many farmers continue to invest in changes well after the Katalysis experience.

Constraints

As with other people-centred, community-based approaches, Katalysis faces some obstacles:

• Like FFS, Katalysis is in conflict with dominant institutional designs (Schut and Sherwood, 2007). For example, the external agent 'accompanies' the learning-action process rather than providing heavy guidance. Outcomes depend on the creativity of participants rather than on pre-determined calendars, budgets, and outputs. Katalysis depends on an open agenda, flexible funding, and strong facilitation skills, which may lie outside the capabilities of common research and development projects.

• The initial spark of Katalysis often came from visits to farms run by innovative families. While the visitors from other communities are impressed by the examples of these extraordinary farms, sometimes the prospect of catching up seems overwhelming. Farmers have to be helped to innovate at their own pace, sometimes requiring special attention, technical support, and encouragement over long periods of time.

• Severe degradation of watersheds is now characteristic of much of the Andes. Reversing this environmental damage can take years and demands investments in infrastructure beyond the capabilities of individuals and communities.

Conclusions

From previous work on pest management (Bentley, 1989), we knew that farmers often missed opportunities for improving their agriculture because of knowledge gaps. Katalysis aims at helping rural people bridge those gaps so that they may creatively manage their own resources in response to the growing threat of climate change.

Katalysis builds on Farmer Field Schools and other flexible, knowledge-based approaches for improving agriculture. Participants aim to enhance the environmental resilience of their farms and production systems through targeted learning and action about water, soils, plants, and animals. They find better ways of using local resources (e.g. cover crops), complemented by experiments with external, but accessible, technologies (e.g. low-cost weather stations, micro-irrigation equipment).

Early results are promising. Katalysis has enabled people to discover hidden sources of water and to gain new appreciation for the potential of plants and animals. Participants have 'greened' previously dry and barren farms, increasing land cover and family wealth.

A sensitive appreciation of local knowledge and creative adaptations, blended with scientific insights, is a realistic way to help farmers start addressing climate change. But that is easier said than done. Development practitioners need to be strong facilitators with flexible programmes and funding to support open-ended learning-action, which goes against the grain of standard pre-planned projects and technology transfer. Donor and development agencies must hand over more trust and responsibility to communities to design and implement their own agendas. Local people and outsiders need to be free to learn from each other, and to learn as they go along.

CONTACT DETAILS
Stephen Sherwood
Rural Innovation Specialist
EkoRural and Wageningen University
Avenida Florencia 203 y Bramante
Cumbaya
Quito
Ecuador
Tel: +593 2 289 1669
Email: sherwood@uio.satnet.net

Jeffery Bentley
Agricultural Anthropologist
International Consultant
Casilla 2695
Cochabamba
Bolivia
Tel: +591 7 938 9455
Email: jefferywbentley@hotmail.com

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