Helping the world's poorest farmers adapt to a changing climate

Warren Page, Manager, Communications, Australian Centre for International Agricultural Research

Agriculture has a significant role to play in managing a changing climate. Farmers have a history of managing and adapting to seasonal variation. In Australia, agriculture produces enough food to feed some 60 million people worldwide, making the nation a net food exporter. This is achieved on the driest inhabited continent.

Australia's strong research and scientific base has led the way in delivering innovations that have helped our farmers adapt to and mitigate the extremes of climate. The majority of Australian farming is undertaken at the broad-acre level, yet the lessons learned can be delivered to different farming situations.

Developing countries are more likely to be affected by climate change because they rely more on agriculture for employment and to contribute to their economies. In many developing countries, agriculture employs and provides livelihoods for 40-70 per cent of the population. Half the world's poor, some 500 million people, rely on farming.

Many of these farmers are smallholders, farming small parcels of land in the hope of producing enough food to feed their families and grow a small surplus. The poorest farmers – who are often located on the more marginal land and production areas – could be expected to bear the brunt of climate change impacts first. They are also the first to feel the effects of seasonal climate variability.

Recent failures of monsoons in South Asia have demonstrated how tenuous life can become for poor farmers. Seasonal forecasts have not been able to predict the failures of the monsoons, so farmers have planted seed expecting rain to fall. In the worst case scenarios many of these farmers can lose half of their annual income and end up with significant or increased debts. Where these debts can only be repaid by selling land, farmers can end up with their only asset and hope for future income disappearing.

The story is similar in many countries, from Indonesia to China to Africa, where poor smallholders living on marginal lands lack the ability to adapt to, and mitigate, climate risk.

The Australian aid programme is working to address these issues, with engagement in agriculture led by the Australian Centre for International Agricultural Research (ACIAR). Agricultural research plays a central role in helping farmers, farmer communities and policymakers develop strategies focused on both adapting to climate change and lessening its effects. ACIAR funds projects that address seasonal variability, the reduction of carbon emissions and the ability of smallholders to adapt to climate change.

Seasonal forecasting

Many Australian and Asia-Pacific farmers grow their crops and raise their livestock in a climate of uncertainty, marked in particular by large variations in rainfall. Over the past 20 years scientists have gained a clearer understanding of the mechanism driving these seasonal swings. It is an ocean-atmosphere interaction in the tropics that gives rise to the El Niño Southern Oscillation (ENSO), a seesaw of climatic conditions near the equator in the Pacific Ocean. It leads to the El Niño effect, where every two to seven years the Pacific air pressure patterns reverse. During this phase, a high-pressure system predominates over Australia and a low-pressure system occurs in the eastern Pacific. This leads to droughts and bushfires in Australia, Indonesia and other South-East Asian countries.

Scientists have gained much from studying the El Niño phenomenon from both actual and historical perspectives, and they now have models on which to base predictions of changing weather and rainfall patterns associated with ENSO.

With global warming, the concern is that El Niño events could become more frequent and more intense. Thus the study of these seasonal fluctuations is important in the overall context of learning more about climate trends and developing practical tools for farmers.

A project in the late 1990s involving Australia, Indonesia, Zimbabwe and India adapted the RAINMAN software package (designed to help Australian farmers construct their individual seasonal forecasts) to produce an international version. This made the tools for seasonal forecasting available to help agriculture in developing countries. The challenge was to convince farmers of their worth.

ACIAR-funded work extended the use of seasonal forecasts to the Philippines, partnering with the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) to develop and implement strategies to better match forecasts with decision makers' needs. The project involved a series of farm-level and policy-level case studies to determine how the farmers integrate forecasts into their risk management strategies. The team found International RAINMAN a valuable tool to convey the times of the year and locations to expect a strong ENSO signal, and when to use climatology as the most appropriate guide to the approaching season.

PAGASA benefited from the collaboration, lifting its capacity to deliver seasonal climate forecasts (SCFs) for the regions in the case studies. PAGASA in turn part-

Image: Tesfaye Legesse

Women from the Liganwa farmers' group in Siaya, Western Kenya, celebrating their maize harvest

nered with the Philippine Institute for Development Studies and Visayas State University, to identify ways to better link the climate science with the community.

A typical case study in the Philippines involved corn farmers in the Visayas region. Team members compiled a brief description of dominant cropping patterns and corn production practices in the study area, then reviewed and presented a valuation framework for estimating the economic benefits of SCF information under various assumptions of risks and uncertainty. Their task was then to quantify the potential economic value of SCFs to corn farmers in Leyte. These data, along with the findings of another study of corn farmers in Isabela, helped them to draw up policy implications on the usefulness of SCFs to corn farmers throughout the Philippines.

Surveys showed that farmers had a high degree of concern about climate risk and were well aware of El Niño, but they only made moderate use of the information in decision-making. As part of the project, the team refined an Excel-based game that allows participants to work out the best decisions for their situations, based on forecasts that are more than guesswork, but fall short of perfect information.

Water harvesting

In India, research has helped communities to harvest water and use this harvest to produce better returns. Farmers working land on the East India Plateau are among the poorest in India. Traditional farming practices are based around the annual monsoon, with rice crops planted to coincide with those rains. The rice is harvested from farms less than 1 hectare in size on low-lying land.

Most families are faced with not growing enough food, and it is common practice for men to emigrate in search of seasonal work to supplement meagre incomes. Women are left to undertake the roles done by men, but they lack support and resources, especially labour and access to technical know-how.

One place where technical know-how exists is the rural development organization, Professional Assistance for Development Action (PRADAN), which had trialled water-harvesting technology to capture run-off and tap shallow underground water sources. Such technology can be very effective in areas with high seasonal rainfall, such as those that experience the monsoon season.

The difficulty for farmers of the East India Plateau is that enough rain falls for two rice crops, but almost all that rain falls in one concentrated period. Water-harvesting technologies present an opportunity to extend the benefits of that rainfall across a much longer period of the year.

ACIAR developed a project linking scientists from the University of Western Sydney and the Australian National University with the Indian Council for Agricultural Research's Research Complex for Eastern Region and PRADAN.

The aim of the project was to test the PRADAN water-harvesting technology – a network of storage pits in the uplands with channels to funnel water to those pits, allowing increased infiltration of monsoonal rain that could be accessed later using seepage tanks in low-lying areas near villages. PRADAN also worked with villagers to ensure local participation, using participatory methods to ask farmers, particularly women, to identify research questions and carry out field trials.

In the village of Pogro a village core committee (VCC), comprising self-help group representatives, was established to improve project implementation and build social capacity, shifting ownership, responsibility and control to the villagers. The model helped women in the village lead changes, such as managing weeds through planting techniques, to support the water-harvesting network. The VCC oversaw (with project support) the initial implementation of the watershed development plan, along with the introduction of improved rice varieties that mature faster, allowing a second crop, such as mustard or wheat, to be planted in rice paddies.

The results have included dietary improvements and additional income. This has allowed some Pogro villagers to own houses and livestock for the first time and to spend money on educational materials and books for their children. Perhaps the most important change is the strengthening of family units, as the ability to generate income in the village is helping prevent the seasonal exodus of men in search of work.

Farmers and project team inspecting a newly dug seepage pit in a Pogro village watershed, West Bengal

Adapting to change

In Eastern Africa the impacts of climate change are threatening smallholder farmers, many of whom farm on marginal land with large variations in rainfall patterns. Maize and beans are staple crops in these areas, as is the case across most of Africa. People depend on these crops for their daily food and for cash income, but many farmers are facing low yields because of declining soil fertility, erosion and drought.

Helping these farmers adapt to reduced rainfall and drought involves introducing a new system for growing staple crops. The 'Sustainable Intensification of Maize-Legume cropping systems for food security in Eastern and Southern Africa' programme, funded by ACIAR and led by the International Maize and Wheat Improvement Center, is helping farmers test a system change encompassing conservation agriculture, and intercropping improved varieties of maize and legumes.

Crops are sown without ploughing and straw is kept in the field to retain soil moisture and build soil fertility. Increasing the yields of maize and legumes provides more food and gives farmers cash for family needs.

The Liganwa Women's Group in Western Kenya has been testing the new approach to maize and bean farming for three seasons. They have more than tripled their yield using the improved techniques. Rather than ploughing their land, they have been spraying herbicide and planting seeds directly into their fields. They maintain the stover (remnants of harvested crops) on the ground as mulch to improve the soil. The farmers no longer hand plough or weed their crops.

In mid-2011, the farmers celebrated the success of their maize and legume crop. They were keen to share their experiences with other farmers at a field day attended by hundreds of people who came to hear how they are growing more and saving time.

Jane Jahenda Nyonje said the maize grew very well, that she didn't have any problems with pests and disease, and that the yields increased. "The benefits of conservation agriculture are that we don't spend time and money on ploughing and it's very effective on the weeds such as striga," she said.

John Achieng of the Kenya Agricultural Research Institute, who has been assisting the farmers with the on-farm trials, said that while farmers in the areas usually get a yield of two to three bags of maize (90 kilograms) per acre, with conservation agriculture they have found farmers can get up to 20 bags of maize grain. "In the case of beans, farmers are boosting their yields from about 50 kilograms of grain per acre to up to 160 kilograms of grain per acre," he said.

In a season where drought has affected many parts of Kenya and the region, boosting yields this much is making a huge difference to these women, providing food for their families. Grain prices have rocketed up, so they could also make handsome profits if they chose to sell their grain.

Food security remains a challenge for many of the world's poorest farmers. The ability to adapt to climate change is a vital component in their hopes for a better future. ACIAR's research is helping to scale the successes of Australian agriculture to allow smallholder farmers to adapt new ideas, systems and crops, in the face of climate change.