WATER WORKS

The crucial issue of water management in India is illustrating how ACIAR's 'cluster' approach to research can tackle social and economic issues along with the science.

(Main photo) Farmers' club meeting in Nemmani village, Bangladesh.

(Inset) Project research fellow Rajender Kulla conducts an interview with a farmer in Gorita village, Andhra Pradesh.

KEY POINTS:

- **Water management in India is inextricably linked to social and economic issues.**
- **ACIAR's 'cluster' approach to water management considers socioeconomic and equity issues alongside technical considerations.**
- **Crop modelling will help vulnerable smallholder farmers mitigate risks from climate variability.**

BY MELISSA MARINO

The combination of rising demand for water, lack of clarity on who owns this resource, and a changing climate altering rainfall patterns are colliding in India, and smallholder farmers are most at risk. And this is only part of the complex environment of water management.

Exacerbating this situation is the need to implement agreed institutional arrangements for water management across Indian states, while still ensuring those farmers at risk have access to water.

Balancing these diverse viewpoints, needs and rules cannot be done in isolation. The ability to mitigate climate-related risk will not be successful if broader approaches to water resource management do not address associated issues, such as ground water depletion.

ACIAR's approach in India bases its projects around linked clusters: advanced wheat breeding; crop management and cropping systems; land and water resources; and policy.

"This multidisciplinary approach—clusters, if you like—represents a significant improvement by combining research disciplines within projects to create a synergy that allows for real results on the ground," says ACIAR's principal adviser Dr Simon Hearn.

The clustering of ACIAR's water projects in India echoes the systems science approach utilised in Australia. Importantly, it allows for issues of socioeconomics and equity in relation to water to be studied alongside the applied scientific research, including consideration of current and alternative regulatory frameworks.

Perhaps nowhere do these issues intersect to create so many possibilities as in the area of climate change. The shifting rainfall patterns that have helped shape patterns of life and farming, common across generations, are now uncertain.

PARTNER PRIORITIES

Climate change is already a key issue on the radar of the Indian Government. This is evidenced by its target of reducing its greenhouse gas emissions by 20–25% of 2005 levels by 2020.

That ACIAR is involved in this aspiration is in no small part due to the links between policy settings and farmers' lives. "We don't do projects unless they meet the priorities of our partner countries," Dr Hearn says.

"It's an absolute prerequisite, and one of the reasons for that is you won't achieve adoption of results unless you've got people on board in your partnerships and actively collaborating across the research spectrum."

The approach allows for various issues relevant to a clustered research theme to be examined by several projects and links forged between them. Groundwater depletion, for

example, creates issues of access and social equity; improved watershed development affects users downstream.

Viewed this way, water, Dr Hearn says, is one of the world's biggest challenges in agriculture. This is reflected by the increasing tendency for farmers and researchers to talk about yield per litre or megalitre in addition to the traditional measure of yield per acre.

And with water one of the resources most affected by climate change, farmers' yields per acre and per litre become a focal point beyond the field.

WEATHERING RISK

Managing risk is a major preoccupation of farmers worldwide. As climate change brings increasing variability to farming conditions, those risks become more pronounced.

Often it is those farmers with the least resources who are most at risk. They work in more vulnerable areas. They are at the end of water supply lines. Their food security is tenuous in good times.

A project developing climate-change adaptation strategies aims to modify crop-modelling systems used in Australia to Andhra Pradesh—a state in central India where agriculture is largely centred on small, rainfed, rice-based farms.

The modelling system is based on the online tool Yield Prophet, developed by CSIRO and BCG (formerly the Birchip Cropping Group). Indian partner organisations using the system can generate information that can help farmers adjust their cropping regimes in line with water and nitrogen availability, both before and during the growing season.

"Ultimately we want farmers to be able to track the season as it goes, more or less in real time, to make decisions more tightly linked to how the season is progressing," says project leader Dr Christian Roth, from CSIRO's Climate Adaptation Flagship.

But Dr Roth says perhaps the biggest risk to rainfed farming is brought about by climate variability.

Crop-simulation models such as Yield Prophet—which provide yield predictions based on climate data, soil moisture and nutrient levels—can help mitigate those risks by helping farmers decide if they should invest further in their crop or cut their losses.

"As the season progresses, you can model changed weather conditions to come up with more rigorous predictions and recommendations," Dr Roth says.

Developing a more strategic approach to managing water when it is available becomes more important, says Dr Roth. "So one of the questions we will assess in our project is, 'If you had access to a little bit of irrigation, when is the best time to use that water?' And if you don't have access to irrigation water, this is where seasonal forecasting can really make a difference. Farmers can adjust their management according to better knowledge about the season ahead."

(Above) CSIRO's Dr Zvi Hochman (right) and G. Srinivas (left) from the Acharya N.G. Ranga Agricultural University using soil augurs for moisture and nitrogen content measurement in a farmer's field.

(Left) Farmers in Nemmani village in Bangladesh study weather forecast information.

Initially the focus is understanding farmers and their livelihoods, and collaboration with farmer groups to discuss climate variability and the resources they have—or need—to deal with it. This will help inform options related to seasonal recommendations. On-farm research experiments in the next season will then be established and monitored.

TAILORED INFORMATION

In India, much work has centred on improving the dissemination of information contained in advisories already being generated in rainfed areas of Andhra Pradesh by the Indian Meteorology Department and distributed by the Agro-Met cell of the Acharya N.G. Ranga Agricultural University.

Understanding farmers' needs and the viability of associated options can ensure the agro-advisories are even better tailored. This will be enhanced by the work of a social anthropologist associated with the project, who spent four months on the ground interviewing farmers about their enterprises and livelihood strategies.

Three villages in Andhra Pradesh's Warangal, Nalgonda and Mahabubnagar districts now receive twice-weekly medium-range forecasts customised to weather scenarios. Farmer groups meet twice a month to discuss the seasonal effects on crops and provide feedback on the advisories and accuracy of the weather forecasts. These activities are facilitated by a collaborating non-government organisation, WASSAN.

Already the information has been used to fine-tune the timing of sowing, paddy harvest and the application of insecticide to control sucking pests.

Dr Zvi Hochman, a CSIRO team member who helped establish Yield Prophet in Australia, plans for the agro-advisories to eventually be underpinned by Yield Prophet-type modelling. That will mean that the impact of a changing weather situation on crop prospects can be modelled to deliver predictions on management options.

"We see an opportunity to value-add to the agro-advisories," he says. "We want to make them more systematic and effective."

THE CLUSTER APPROACH AND POLICY

The linking of advisories to farmers must also operate within the broader policy environment.

It is this type of synergy, Dr Hearn says, that is critical to a project's success. For example, to achieve uptake, the research not only needs to be relevant to growers, but also in step with the regulatory framework and realistic socioeconomic contexts.

"If the policy framework is not conducive to people adapting the science in a practical sense, it may never happen," he says. "And after all, beneficial adoption of the research results is the driving objective of such undertakings."

While this is true for all countries, in India there are specific socioeconomic issues that need to be considered alongside the science to ensure implementation is realistic—for example, the cost of water and electricity.

ACIAR Land and Water Resources (LWR) program

The LWR program is spread across four key areas:

- **Management of soil and water salinity—for example, tsunami-affected soil management, developing baseline data for soil salinity in Iraq**
- **Water management at the farm scale (including improving cropping systems)—for example, laser levelling, permanent raised beds, conservation agriculture, drainage modification**
- **Basin-level water management and water policy—for example, monitoring sediment flows, water security across basins, village groundwater recharge, institutional performance of watersheds**
- **Climate-change adaptation and mitigation—for example, climate change adaptation strategies, assessment of impacts of climate change.**

Activities range from systems modelling at a basin scale and government policy options, to interacting with farmers on water management, salt-tolerant varieties and more efficient cropping systems.

The LWR program has been traditionally active in South Asia, with a particular focus on India (specifically the state of Andhra Pradesh), as well as Pakistan and Bangladesh. ACIAR has recently partnered with AusAID to undertake projects in the Middle East and Africa. There are also LWR projects underway in Laos, Cambodia and China.

Dr Hearn explains that in many parts of India water is almost free and the electricity used to pump it often heavily subsidised for smallholder farmers. While in social terms this serves its purpose, it is also detrimental to environmental conditions because collectively farmers are using electricity to pump groundwater at a rate that is depleting reserves in some provinces.

The sheer scale of this practice is illustrated by the statistic that 40% of energy produced in India is used to pump groundwater. On an environmental level, Dr Hearn says soil degradation is resulting from the rate of groundwater extraction partially driven by subsidised electricity.

But for pumping practices to change, Dr Hearn says social policy has to be considered alongside the scientific research. "If we can provide some policy options alongside the science, you can make better use of the science," he says.

"And this is just a small example of where a discipline cluster can work to bring together the economists and the policy researchers with the scientists, recognising, of course, that the final policy decisions rest with relevant Indian authorities."

SUPPORTING PARTNERS TO MAKE CHANGE

The issue of water ownership has particular relevance in India as there are no formal institutional mechanisms that encourage people to conserve the resource.

Nobody owns the water, so anyone who can dig a well can pump. While this accelerates the rate of environmental degradation, it also means there is less incentive for farmers to adopt new, more efficient water-management practices that researchers may recommend.

The issue is considered so significant that it cannot be left unaddressed. Professor Lin Crase from La Trobe University, Professor Vasant Gandhi from the Indian Institute of Management and Dr Madar Samad from the International Water Management Institute are collaborating on an ACIAR-funded project looking into the institutional arrangements around water. It complements a raft of research done by Indian organisations into the issue.

Another ACIAR project is looking at the equity issues surrounding groundwater access and watershed development in Andhra Pradesh. Led by Professor Geoff Syme from Edith Cowan University, this project addresses the uneven distribution of water access in the region where richer farmers have the resources to dig deeper tubewells to access more water than their poorer counterparts. This inequity is often compounded by the location of wealthier farmers, generally on richer soils with better access to groundwater in the first place.

Both projects are considering the question of accessing water resources to help create more equitable systems. They will influence policy settings that are needed to help projects implement advances in technical research that can have the desired impact in the region.

Dr Roth says the state of Andhra Pradesh is an ideal place for the water cluster to be centred because it has government supportive of research and development, and also because it is largely a poorer region suffering from depleted groundwater, which affects both its rainfed and irrigated farming systems fed by the Krishna Basin.

POSITIVE FEEDBACK

"We strived to set up a 'water program' rather than a water project or set of water projects," says Dr Kuhu Chatterjee, ACIAR's South Asia country manager.

This is a departure from the usual approach to research in India, where historically research has been confined within strong institutional boundaries, such as rice or livestock. ACIAR has been fortunate in its timing and has worked hard to capitalise on this to further changes heralding a new approach.

The emerging economies of India and China are accelerating towards a multidisciplinary approach to research, particularly at a senior level.

At the same time the linkages between projects ensure that smallholders are central to shaping policy that will affect them.

While the 'big picture' projects provide an insight into broad water-management issues, the climate-adaptation project led by Dr Roth hones in on where potential conflicts could arise around water access in a changing climate in such a way that helps farmers on an individual level improve their capacity to adapt.

"If we help establish systems and processes that enable farmers to access relevant climate information they will be better placed to manage whatever the climate turns out," Dr Roth says. "At the end of the day, you are addressing the key issues of how the individuals are going to cope." ■

PARTNER COUNTRY
INDIA

PROJECT: LWR/2010/033 Developing capacity in cropping systems modelling to promote food security and the sustainable use of water resources in South Asia
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