Defeating Dryland Risk

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It is commonly said that drylands are the riskiest environments for agriculture. But if dryland agriculture is so risky, why do so many engage in it? The simple answer — that they have no choice — is not enough. By understanding how they became entangled in risk, we might find ways to get past it.

Getting from there to here

Traditionally, dryland agriculturalists managed drought risk by avoiding it. If they could not bring rain to their farms, they brought their 'farms' to the rain — by herding their livestock to greener areas. This nomadic pastoralist strategy required vast areas of land, occupied by relatively few human beings.

As human populations increased, dryland inhabitants evolved agro-pastoralism, a combination of crop farming and animal herding that is still common today. Crops provide additional food and income in good years, while the mobile herds provide resilience in drought years. Income is earned from sales of small surpluses of food to growing towns, which provide specialty goods and services that increase the quality of rural life.

As populations increase further, towns grow into urban areas and lands become privatized. Agriculturalists can no longer escape drought risk through fallowing or livestock mobility. Some dodge drought by taking up dry-season urban occupations or by leaving the farm entirely. Others invest urban-market income into irrigation, fertilizer and other inputs, reducing drought vulnerability.

Stuck in a risky rut

Those are the happy endings. Unfortunately, many are not able to clear away the risks that block their pathways to prosperity. When they get back onto the path, drought knocks them off again into the rut of poverty. They cannot afford to irrigate, fertilize, or educate their children to help them overcome drought risk. Instead, they lose their animals, their crops fail, and they go hungry. And as the new IPCC report tells us, climate change will likely make things worse, especially for the drylands of Africa and Asia.

Village-level responses to drought in two States in India (446 households in six villages surveyed)

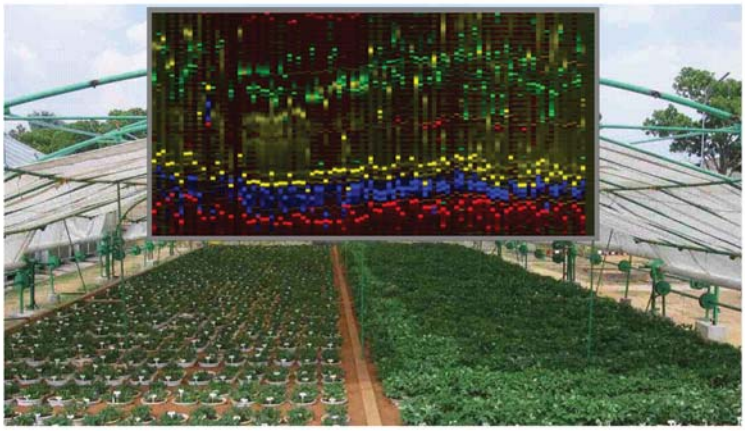
Parameter/strategy	Average, Andhra Pradesh	Average, Maha-rastra
Number of drought years in last ten	5	3
Average income shortfall from drought (%)	50	23
Percentage of farmers coping, by:	82	36
Borrowing money (%)	38	15
Selling assets (%)	9	2
Shifting to nonfarm work (%)	29	37
Reducing expenditures (%)	6	27
Migration (%)	15	2
Reducing input use (%)	4	10

How can research-for-development practitioners help those who are trapped to find *sustainable development pathways* that lead either to sustainable agricultural intensification, or to exit from agriculture?

Each step must be clearly attainable, and must provide incentives to take the next step, with risk management controls in place. One size does not fit all; multiple options are needed for different environments and socio-economic settings. Some examples are below.

Stepping stones to secure futures

Weak plants and animals are more susceptible to drought, and thus impart high risk to farmers. Plants and animals can be drought-hardened **by correcting soil and animal nutrient deficiencies, breeding resistance to diseases, and matching genetic adaptation to the environment.** Research has found affordable ways to do all these things.



ICRISAT scientists compare plant performance under glasshouse-controlled drought, to gene patterns visualized from high-throughput molecular genomics data (inset), mapping stress-resistance genes for more effective drought resistance breeding

Shortages of water and nutrients can be eased by **tightening natural resource cycles through tree-crop-livestock synergies**. Tree roots ensure that early and late-season nutrient surges are captured and water tables are tapped, and recycled through root biomass and leaf litter. Crops capture nutrient surges triggered by early rains, and stem biomass is recycled through livestock manure. Livestock graze biomass beyond the farm gate and deposit it at home to raise crop yields.

Livestock recycle crop residues through manure in Western Kenya, reducing risk

Integrated water-soil-nutrient management holds particular potential. **Low-cost land-forming interventions such as small basins and ridges for on-farm water harvesting** retain and concentrate scarce water to reduce risk when the high costs of conventional irrigation development are not affordable. **Watersheds** are natural concentrators of water and nutrients, and their **integrated management by communities** is reducing risk on a large scale in Asia, and is likely to spread to Africa in the future.

More diverse crops and livestock reduce the risks associated with failure of any single component. Similarly, **more diverse livelihood options, such as off-farm work** help farmers protect themselves against farming failures. Such off-farm linkages also help them (or, equally important, their children) **transition into possible full-time urban employment**, reducing population pressure on the fragile drylands.

Smallholder-affordable inputs such as fertilizer microdosing (see “What ICRISAT Thinks about Niger’s Hunger Crisis”) that aim for economically-optimum responses can deliver large returns on small investments, rather than seeking biologically-maximum responses through unprofitably-high input use as advocated in the past. **Increased feed supplies through fodder banks and the sale of feed supplements, along with affordable animal health care** can fortify animals to withstand the stresses of drought.

Investing against risk

Financial risk reduction is also vital, but poor smallholders lack access to formal bank credit or insurance. Micro-credit facilities and loans, such as the 'warrantage' system that FAO is spreading in the Sahel that uses farmers' crop harvest itself as the collateral, enable the poor to act as investors, capturing higher grain prices and reducing interest costs.

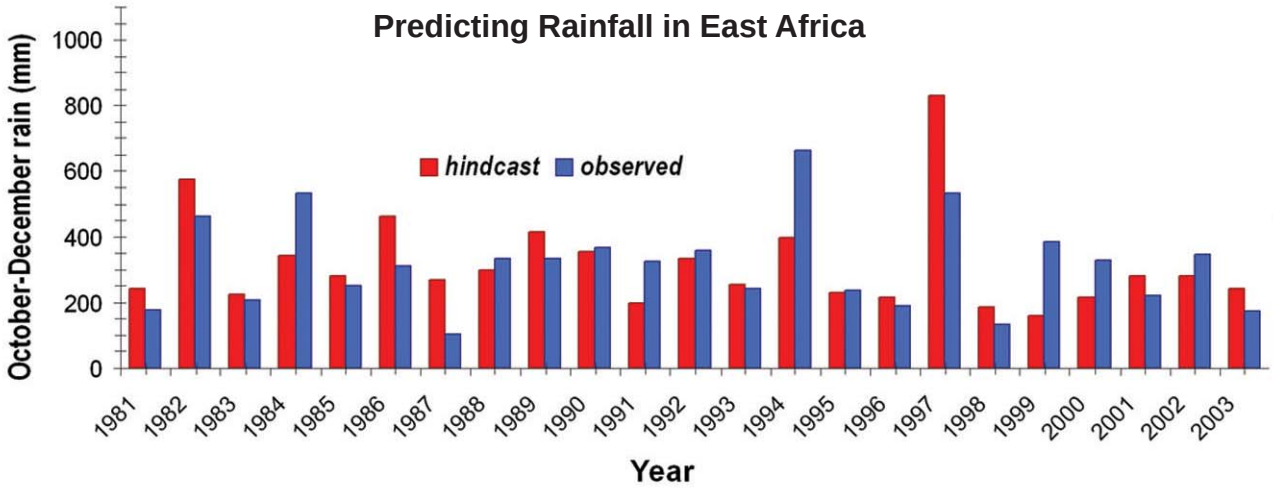
Rural retailers in southern Africa sell small fertilizer packs that reduce risk for small-scale farmers

Efficient, risk-controlled channels for inputs and outputs are essential to minimize input price inflations and output price collapses. Fertilizer and seed can be sold in small packets that fit the needs and financial means of poor smallholders. **Knowledge** also reduces risk and increases rewards; rural retailers are a vast ready-to-go network for information-sharing as well as for disseminating inputs and collecting outputs. Emergency grain reserves can reduce the risk of wild price swings that leave the poor unable to buy enough food to eat.

Research-for-development institutions, including policy and technical initiatives should **help agriculturalists capture higher-value markets that are emerging as the drylands join the global trend towards urbanization**. This raises rural incomes rather than ceding markets to foreign exporters or allowing them to remain unexploited.

Predict and prepare

Drought prediction and preparedness can greatly reduce risk. If herders knew when drought risk was high, they could sell some of their animals before prices collapse because too many are rushing to sell the animals that they cannot sustain. Farmers could reduce plantings that are likely not to pay off



Rainfall models can predict droughts or wet years in some areas, such as the October to December rainy period at Machakos, Kenya. Models are developed by testing past data (hindcasting) versus observed rainfall. Model developed by the International Research Institute for Climate and Society (IRI) at Columbia University, USA in collaboration with ICRISAT.

due to drought, focusing their efforts instead on their least-risky fields and lower-risk off-farm activities. Emergency relief agencies could better plan and prepare their assistance. New technologies in remote sensing, GIS, crop modelling and mapping are increasing forecasting and early-warning capabilities, as well as market supply and price forecasts, all of which can help take **affordable insurance against drought** from vision to reality.

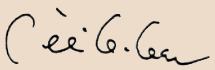
Potential predictability of seasonal forecasts in Africa

Region	Rainfall Period	Potential Predictability
West Africa	July to September	High
East Africa	October to December	High
East Africa	March to May	Low to Medium
Southern Africa	January to March	Medium
North Africa	December to March	Low

Surer paths to prosperity

Ultimately, pathways to less-risky futures must be traversed by farmers themselves. We can help remove some roadblocks, but we cannot make the journey for them. But neither should we construct a road that requires impossible leaps from one stepping stone to the next. By building achievable, rewarding steps, we can help the poor leave risk-induced poverty far behind.

Sincerely yours,



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About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Future Harvest Centers of the Consultative Group on International Agricultural Research (CGIAR).

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