Briefing

Climate change, food and agriculture

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Policy pointers

Linking local knowledge and external foresight can support pre-emptive action and leapfrog less-effective incremental changes.

Complex problems do not always need complex solutions; low-cost, high-impact measures can accelerate adaptation.

Addressing root causes of vulnerability may require a fundamental, sector-wide shift in policy and grassroots collective action.

'Silver bullet' investments that benefit all people everywhere are wishful thinking: policymakers need to recognise winners and losers in different contexts.

Radical adaptation in agriculture: tackling the roots of climate vulnerability

As climate change pushes livestock, crop and tree production systems towards new realities, societies may seek more comprehensive solutions. Examples of truly radical adaptation — pre-emptive actions at scale that address the root causes of climate risks and reduce climatic footprint — are still to emerge in agriculture globally. Yet there is much to learn from countries, communities and industries that are transforming agricultural livelihoods. Case studies show that local experience, combined with external knowledge, provide the platform for positive change. From these examples, we present nine lessons on how to shift towards a more radical pathway for adaptation. The levers for new behaviours can be surprisingly simple, although addressing root causes may require more fundamental reforms. Looking ahead, radical adaptation can guide practical actions towards a well-adjusted future for food and farming.

Changing the rules of the game

Much climate change adaptation focuses on current and near-term climatic challenges. Improving technologies and institutions, for example, can help vulnerable groups manage short-term risks and opportunities more effectively; in agriculture, increasing access to crop and livestock insurance or drought-resistant maize varieties have successfully helped poor smallholder farmers cope with current climate variability.[1]

But the climate stakes are rising for crop producers and livestock keepers (Box 1). Once climatic conditions pass a certain threshold — such as number of frost days, length of growing season or water availability in the dry season — farmers may no longer be able to grow the same crops or keep the same animals. Adaptations to maintain current systems may no longer be enough for them, let alone for larger challenges faced by future generations. Current trends in farming systems, such as replacement of migratory livestock production with sedentary crop production, may reduce flexibility in livelihoods and food security in the face of growing climatic variability. Worse still, stubborn investment in maintaining current systems may discourage the more radical changes that are really needed — to other crops, diets and livelihoods.

Radical adaptation is an emerging concept that responds to high climate stakes and thresholds in conditions. It sits on a spectrum of adaptation (Figure 1) and embraces the notion of transformative adaptation — that is, planned, pre-emptive, large-scale transitions in food and farming systems. Added to this, radical adaptation aims to address the root causes of climate change risks for as wide a population as possible.

Radical adaptation may need a fundamental, sector-wide re-think of policy

In so doing, it tries to change the 'rules of the game' that make some groups more vulnerable to climate change. And it takes the question of equity between generations seriously — radical adaptation aspires not only to carbon-neutrality, but to make a net reduction in emissions from food and agriculture, for global future benefit.

A mean global temperature increase of just 2°C will be enough to necessitate radical adaptation in agriculture. We use a number of case studies (Box 2), achieving varying levels of success, to pull out successes and best practices, and distil these into nine key lessons to lay the foundations for better investments towards a radically adapted future agriculture.

On the path to radical adaptation

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and IIED collected 28 cases of adaptation. Of these, 12 were transformative, 14 systemic and 2 incremental, but none met the definition of radical adaptation: they did not deliberately address either the root causes of climate risk or net emission reductions. Even among case studies large-scale enough to count as transformative (Box 2), many were reactive rather than pre-emptive, responding to a wide range of stresses beyond climate change. Nonetheless, they provide nine valuable lessons on how to shift towards a more radical approach.

Box 1. What's special about agriculture and food under climate change?

Food security is vulnerable to climate change for two reasons. First, agriculture is highly sensitive to climate, especially in rain-fed systems. Second, a large proportion of poor people depend on agricultural incomes to buy food and to secure nutrition.

Agriculture drives about one-quarter of global greenhouse gas emissions, including through land-use change. Yet the sector can also bring about net reductions in emissions through carbon sequestration in biomass and soils.

Practitioners and policymakers have recognised the importance of acting simultaneously on food security, adaptation and mitigation, a strategy known as 'climate-smart agriculture'.

1) Work together. Collective action was beneficial for several reasons. In Niger, it increased social capital, decreased costs and helped share knowledge in farmer-managed natural regeneration. In Ethiopia, it enabled communities to conduct labour-intensive monitoring. In Nicaragua, it empowered a newly formed association of small coffee producer co-operatives to meet common economic and environmental challenges. Ultimately, collective action helps farmers overcome economic, social, technical and capacity barriers. It also helps achieve thresholds of scale and equitable outcomes for producers. It follows that adaptation programmes should strengthen local organisations rather than focus purely on technological innovation.

2) Draw on first-hand experience. In each of the cases in Box 2, first-hand experience of environmental degradation and change triggered action. In Niger, farmers experienced famine and drought. In Kenya, drought reduced pastoralists' herds of cattle, goats and sheep. In Australia, drought brought destructive bushfires and cut wine grape production by more than 45,000 tonnes per year. Since they had first-hand experience of climate change, local people bought in readily to adaptation programmes.

3) Leapfrog the learning curve. Relevant, reliable and timely knowledge is essential to inform the design of appropriate adaptation. Downscaling climate change models to local level can help identify likely future climate risks, allowing communities to change farming practices before climate change renders them inappropriate. In Nicaragua research has identified future risks to coffee production ahead of farmers' experience. Research and institutional capacity to forecast climate impacts, together with awareness-raising efforts, can enable the first steps of adaptation to 'leapfrog' ahead of local experience.

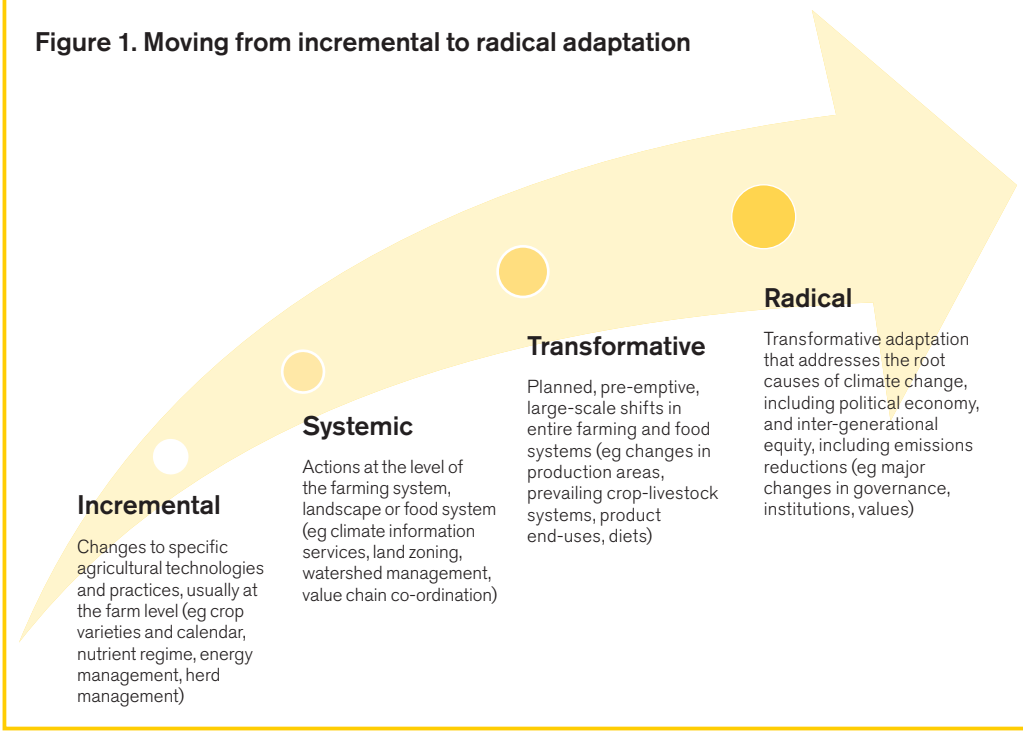
4) Share knowledge. Incremental adaptation relies on local innovation but larger-scale measures can benefit from external insights. For example, combining community-generated weather observations with seasonal forecasts from national services can enhance climate risk management. External knowledge can also fine-tune local adaptation or introduce new options. In Egypt, for example, resettlement proved less effective when social realities and local perceptions were ignored. One successful way to share knowledge is a learning platform, based either on geography and themes (as has been done with conservation agriculture in Zambia) or on commodities and value chains (see 'Coffee in Nicaragua', Box 2).

5) Maximise mitigation co-benefits. Several cases may have positive benefits for both adaptation and mitigation, such as the increase in biomass due to re-greening in the Tigray region of Ethiopia and farmer-generated natural regeneration in Niger. On the one hand, reducing emissions may be inappropriate in smallholder agriculture settings, for both equity and value-for-money reasons. On the other, adaptation can also benefit mitigation in ways that directly benefit farmers — veterinary care, for example, that increases milk yields in camels. Adaptation interventions should maximise co-benefits to mitigation where possible.

6) Address root causes of vulnerability. Agricultural producers' capacity to adapt greatly depends on public policy, market forces and cultural norms that shape access to resources

and economic opportunities. In Niger, for example, the transfer of tenure over trees from the state to farmers was a critical success factor. Past government policies can also alter the sensitivity of agricultural systems to climate change. In Ethiopia, promotion of large-scale monocultures, such as sugarcane and cotton, may have inadvertently increased the climate risks to agricultural livelihoods. Radical adaptation may need a fundamental, sector-wide re-think of policy to address the root causes of climate change in an inclusive, non-competitive way, which maximises benefits to the general public.

Figure 1. Moving from incremental to radical adaptation



7) Bridge the gap between short- and long-term. Significant changes in farming practices and institutions require clear rights and incentives. Adaptation that only brings economic benefits in the long term (eg additional firewood from regenerated tree cover) may not be attractive to farmers. For poorer farmers, even short-term losses to livelihoods are not an option. Strategies are needed to bridge the gap between initial investments and longer-term benefits. In Niger food-for-work programmes initially supported natural regeneration; in Kenya, improving markets for camel hides enhanced the transition from cattle to camels. An economic analysis can help determine whether interventions are likely to be sustainable rather than requiring constant subsidy.

8) Spell out the trade-offs. Adaptation spreads costs and benefits differently. In Nicaragua, for instance, pushing coffee production to higher altitudes would come at the expense of biodiversity reserves and watershed protection. Men and women may also value different outcomes. In Ethiopia, men may support pastoralism, but women tend to favour settlement and irrigated crops to allow their children better access to education. Rather than betting on a few large 'silver bullet' investments that seem to apply equally everywhere and to everyone, policymakers may need to spell out the trade-offs in different contexts.

9) Assess different possible futures. Effective development planning will assess alternative development pathways against the range of possible climate futures. For example, decisions to relocate production areas for wine in Australia and coffee in Central America make sense, even at low levels of climate change. Planners could consider the more radical dimensions of the future food system. For example, does an industry like wine or coffee have a viable role in future national food security? How do alternative pathways, such as irrigated cash crops versus pastoralism, compare in terms of gender equity or mitigation potentials?

A radical re-think

Radical adaptation is a big idea with big implications. It requires a re-thinking of adaptation strategies so they address underlying causes of inequalities and vulnerabilities, rather than reinforce them. The principles of transformation, being pre-emptive, addressing root causes, and equity for current and future generations apply equally across scales to adaptation measures at local, national, regional and global levels. However, achieving net positive benefits for mitigation makes more sense in high emission contexts. Low-emitting smallholder farmers and pastoralists are among those most severely affected by climate change and so adaptation is a more suitable response. A shared global vision for radical adaptation will need to reduce differences in climate vulnerability to have any real impact on current and future poverty.

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Please see overleaf for **Box 2. Case studies of agricultural adaptation**

Box 2. Case studies of agricultural adaptation[2]

Farmer-managed natural regeneration in Niger. Desertification and soil degradation had reduced yields and the availability of fuel wood, threatening livelihoods. Over the past 30 years, with support from nongovernmental organisations (NGOs) and researchers, communities have rehabilitated over 200,000 hectares of degraded land through natural regeneration and agricultural intensification. These interventions built on farmers' indigenous practices, as well as researchers' inputs. A favourable policy environment, including the Niger government's formal recognition of farmer-led regeneration, supported the spread of practices.

'Greening' in Ethiopia. Responding to experienced climate risks in northern Ethiopia — including desertification, soil degradation and reduced access to water — the community of Abrha Weatsbha reclaimed large tracts of land through reforestation and sustainable land management. A newly formed community initiative took over the project from the Ministry of Agriculture and Rural Development. The resulting environmental recovery permitted the community, which was on the brink of resettlement, to remain in the area and improve local livelihoods.

Choosing camels in Kenya. After herds of cattle, goats and sheep fell by 70 per cent across northern Kenya during the drought of 2005/06, the widespread adaptation response from pastoralists was a switch from cattle to camels. Camels need less water than other livestock, eat a diet of arid shrubs, and generate six times more milk than indigenous cattle. Poor markets for camel products, especially hides, are a problem. But government is increasingly supporting the new camel keepers with restocking programmes, extension services, veterinary care and infrastructure.

Irrigation projects in Ethiopia. Irrigation is widely promoted in Ethiopia as a response to increasingly variable rainfall. The government has a large-scale agricultural development project in the Awash Valley to replace mobile pastoralism with irrigated commercial cotton and sugar production. However, studies suggest that irrigated farming may not offer higher incomes or environmental sustainability. For example, the returns from sugar cane production roughly equalled those from livestock in just one out of four years — it falls short in three out of four years. Forests standing between land and water sources have been bulldozed, yet many fields are now abandoned despite the improved access, damaged by salt in the soil.

Diversification in Nicaragua. About 66 per cent of land 800 metres above sea level used for coffee growing in Nicaragua will no longer be suitable in a changing climate. Shifting to higher altitudes is not an option as these lands are often protected areas or owned by other farmers. A number of programmes aim to help existing farms diversify by adopting more climate-resilient crops.

Adapting practices in Australia. Temperatures in Australia's wine regions are projected to rise by between 0.3 and 1.7 °C by 2030. This could reduce grape quality in some areas by 12 to 57 per cent. In response, the wine industry is adopting incremental adaptation such as canopy management, irrigation management and mulching. In addition, it is also undertaking transformative changes like moving locations, developing alternate enterprises and leaving the industry altogether. Greater emphasis on collaboration along the value chain may be required.

Resettlement in Egypt. When local adaptation is impractical, planned migration offers one of the few options. In the Nile delta, projected sea level rise threatens the livelihoods of millions. The Egyptian government has resettled thousands from the outskirts of Cairo to areas further inland, providing people with land. But the scheme has largely failed; half of the migrants have left, citing problems with water supplies contaminated by salt, conflict with original inhabitants and poor provision of services.

Notes

[1] Greatrex, H *et al.* (2015) Scaling Up Index Insurance for Smallholder Farmers: Recent Evidence and Insights. CCAFS Report No.14. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen. See www.ccafs.cgiar.org. La Rovere, R *et al.* (2014) Economic, production and poverty impacts of investing in maize tolerant to drought in Africa: An ex ante assessment. *Journal of Developing Areas* 48(1) 199–225. / [2] References for case studies: Niger (Farmer-managed natural regeneration): Reij, C *et al.* (2009) Agroenvironmental Transformation in the Sahel - Another Kind of Green Revolution. Discussion Paper 00914, International Food Policy Research Institute, Washington, DC. See http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/15847; Kenya (Camels): Kagunyu, A W and Wanjohi, J (2014) Camel rearing replacing cattle production among the Borana community in Isiolo County of Northern Kenya, as climate variability bites. *Pastoralism: Research, Policy and Practice* 4(1) 13. See www.pastoralismjournal.com/content/4/1/13; Ethiopia (Greening): United Nations Development Programme (2013) Abrha Weatsbha Community, Ethiopia. Equator Initiative Case Study Series. New York. See http://equatorinitiative.org/images/stories/winners/13/casestudy/case_1370354707.pdf; Ethiopia (Irrigation projects): Behnke, R and Kerven, C (2013) Counting the Costs: Replacing Pastoralism with Irrigated Agriculture in the Awash Valley, North-eastern Ethiopia. Climate Change Working Paper No 4. IIED. See http://pubs.iied.org/10035IIED; Egypt (Resettlement): Ullah, A (2012) Climate change and climate refugee in Egypt: An overview from policy perspectives. *The TMC Academic Journal* 7(1) 56-70. See http://www.ubd.edu.bn/academic/faculty/FASS/staff/docs/AU/journals/Ullah-2012-climate.pdf; Nicaragua (Coffee): Baca, M *et al.* (2014) An integrated framework for assessing vulnerability to climate change and developing adaptation strategies for coffee growing families in Mesoamerica. PLoS ONE 9(2): e88463. doi:10.1371/journal; one.0088463; Australia (Wine): Fleming, A *et al.* (2015) Enhancing adaptation outcomes for transformation: Climate change in the Australian wine industry. Journal of Wine Research 26(2):99–114. See: www.tandfonline.com/doi/abs/10.1080/09571264.2015.1031883.

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