Ecological agriculture for food security and climate resilience

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AGRICULTURE is the most important sector in many developing countries and is central to the survival of hundreds of millions of people. In most developing countries, agriculture, which provides the bulk of employment, is not a commercial activity per se, but a way of life. Most agricultural production in these countries involves small land holdings, mainly producing for self-consumption. Women are the key agricultural producers and providers. Hence agriculture is critical for food and livelihood security, and for the approximately 500 million smallholder households, totalling 1.5 billion people, living on smallholdings of two hectares of land or less (De Schutter, 2008). Smallholdings account for 85 percent of the world's farms.

The impacts of climate change will fall disproportionately on developing countries, despite the fact that they contributed least to the causes. Furthermore, the majority of the world's rural poor who live in areas that are resource-poor, highly heterogeneous and risk-prone will be hardest hit by climate change. Smallholder and subsistence farmers, pastoralists and artisanal fisherfolk will suffer complex, localized impacts of climate change and will be disproportionately affected by extreme climate events (Easterling et al., 2007). For these vulnerable groups, even minor changes in climate can have disastrous impacts on their livelihoods (Altieri and Koohafkan, 2008).

Ecological agriculture is essential to meet the climate challenge

CLIMATE change will require a range of adaptation approaches across many elements of agricultural production systems, from small changes in the crop varieties grown to decisions to abandon cropping completely. For example, in some rain-fed regions in Africa, there just will not be enough predictable moisture to continue to grow crops; in these areas, agriculturalists may change to livelihood strategies based entirely on pastoralism, or they may need to move to other regions or to cities. In other areas more animals may be integrated into the farming system to reduce dependency on crop production (Jones and Thornton, 2008).

In all areas, farmers working to adapt to climate change will need to adopt new practices that help to increase the resilience of their cropping systems -- through building healthier soils, increasing the biological diversity of the system and, particularly in rain-fed regions (where most poor farmers farm), incorporating more water harvesting and water management techniques.

Building healthy soils

By increasing the health of soils, farmers can increase the water-holding capacity of the soil and the infiltration capacity -- augmenting the speed at which water can percolate into soils and thus the ability to take more advantage of heavier rains that are expected under climate change (Tirado and Cotter, 2010). Moreover, by building healthier soils, farmers can increase productivity. Given that climatic changes will likely significantly reduce yields over time, any increase in productivity through better soil health and fertility will serve to moderate the productivity reduction expected.

Many well-established agroecological practices increase soil health and fertility, and with these, productivity. Prominent among these practices is the addition of manure or compost. At the same time that these additions bring necessary nutrients into the system, they also improve the structure of the soil, making it better able to hold onto both nutri-

ents and water. And with an improved soil structure, water is able to infiltrate better and more water is captured during periods of intense rainfall. Evidence from the Tigray region in Ethiopia shows that compost can increase crop yields significantly; on average, composted fields gave higher yields, sometimes double, than those treated with chemical fertilizers (Edwards et al., 2009).

Other ecological agriculture practices that can improve soil structure and increase fertility include growing green manures (crops that are tilled into the soil after they are grown to add nutrients and structure), cover cropping to add nutrients and keep soil covered during a fallow season, mulching and crop rotation (Magdoff, 1998). These are all standard practices in agroecological systems, which work to increase fertility naturally and use the diversity of the system to control pests and diseases, while increasing habitats for pollinators and other beneficial organisms.

Building resilience through diversity

System resilience can be built through increasing biological diversity (Altieri and Koohafkan, 2008). Practices that enhance biodiversity allow farms to mimic natural ecological processes, enabling them to better respond to change and reduce risk. Experience suggests that farmers who increase diversity suffer less damage during adverse weather events, compared to conventional farmers planting monocultures.

In cropping systems, diversity can be increased through increasing the variety of crops grown at one time on the parcel of land, and by adding trees and/or animals into the system. Farmers can also increase the diversity of the system by increasing crop diversity itself growing different varieties of the same crop that have different attributes, for example, shorter-season varieties that may be beneficial if the season is shortened by inadequate rainfall, or varieties that provide more nutritious forage for animals. Supporting soil health increases the diversity of organisms in the soil, which are responsible for benefits such as increased access to nutrients and reduction of overall disease burden.

It is important to note here the role of women, as they play a key role in managing biodiversity, and thus in adapting to climate change. For example, women in Rwanda produce more than 600 varieties of beans; in Peru, Aguaruna women plant more than 60 varieties of manioc (CBD, 2009).

Emphasizing water management and harvesting techniques

Adapting to climate change will require even more emphasis than is currently given to improving water management and water harvesting in rain-fed regions. Many traditional techniques already in use to improve rainwater use efficiency can be shared using farmer-to-farmer methods.

For example, the zaï techniques of the Sahel have received much attention: water pits used by farmers in Burkina Faso and Mali to reclaim thousands of hectares of degraded lands in the last decades. Farmers have become increasingly interested in the zaï as they observe that the pits efficiently collect and concentrate runoff water and function with small quantities of manure and compost. The practice of zaï allows farmers to expand their resource base and to increase household security. Yields obtained on fields

managed with zaï are consistently higher (ranging from 870 to 1,590 kg/ha) than those obtained on fields without zaï (average 500-800 kg/ha).

Increasing productivity in the face of climate change

Given the threats posed by climate change to crop yields, it is important that agriculture practices are able to maintain and even increase productivity. Fortunately, the practices that enhance climate resiliency that are found in ecological agriculture also work to raise productivity, primarily because they improve soil structure and increase fertility.

A roadmap towards ecological agriculture through climate resilience

ADAPTATION of agricultural systems to changing climates is an enormous challenge that will require the concerted effort of governments, researchers and farmers, working together and starting immediately. Because temperatures will continue to rise over the coming decades, we find ourselves in a race against time, to an unknown destination. The effort to create climate-resilient agricultural systems must be prioritized at all levels -- from the local to the global, with an important role for national governments to coordinate efforts. Lack of a well-coordinated and well-funded adaptation strategy threatens the lives and livelihoods of millions.

An essential component of climate-resilient agriculture, as explained above, is ecological agriculture. To move on the road to a climate-resilient agriculture, agricultural practices and policies, at the national and international levels, must be systematically and urgently redirected towards ecological agriculture, in order to ensure it can reach its full potential, especially in addressing this enormous challenge.

Farmers, in particular women who make up the majority of the world's small producers, must play a key role on the road to climate-resilient agricultural systems. To do so, they must be integrated into the research and development systems and given tools to do their own on-farm research and the capacity to share their knowledge with other farmers in farmer-to-farmer networks. The challenges facing agriculture are too great to ignore the important potential of farmers, their knowledge and their innovation skills to contribute to the creation of climate- resilient agricultures.

A roadmap towards climate resiliency contains five essential elements:

- Increasing investment in ecological agriculture
- Managing climate risks and reducing vulnerability
- Stopping climate-destructive agriculture by dismantling perverse incentives and subsidies that promote unsustainable and high-emissions agriculture
- Implementing a research agenda for climate-resilient ecological agriculture
- Building supportive international policy frameworks.

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