



Development
Progress

A GREENER BURKINA

Sustainable farming techniques, land reclamation and improved livelihoods

Amanda Lenhardt, Jonathan Glennie, Nicholas Intscher and Ahmed Ali,
with Gabriel Morin



Mother farming with child in Northern Region, Burkina Faso. Photo: © Amanda Lenhardt

Case Study Summary

Environment

- In Burkina Faso, between 1989 and 2004 some 200,000 to 300,000 hectares (ha) of once degraded land was reclaimed through the adoption of innovative techniques based on traditional farming practices.
- An additional 80,000 tons of food crops produced each year has enhanced food security for around 500,000 people and most families have halved their hunger gap.
- Short-term impacts on agricultural yields range from increases of between 30% and 350%, particularly if the improved techniques are used in combination. This avoids long lags between farmers' investment and increased returns.
- Strong social and community networks aided the dissemination and adoption of new techniques, and financial support from donors and NGOs helped poorer farmers to adopt them.
- While Burkina Faso has made advances in soil and water conservation, more needs to be done to address persistent food security and nutritional challenges.

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Why explore sustainable agriculture in Burkina Faso?

From the 1960s to the 1980s, Burkina Faso was a prime example of the impacts of unsustainable agriculture on land and on the people who depended on it. Successive decades of over-farming and overgrazing have gradually turned once fertile lands into desert, with up to 65% of land degraded in some areas (Ouédraogo, 2002).

In recent decades, however, a range of simple but effective sustainable agricultural techniques has driven a ‘re-greening’ of large parts of Burkina Faso, one of the world’s poorest countries. This, in turn, has led to higher agricultural outputs for the farmers who have adopted them.

As global population growth, urbanisation and rising wealth create new patterns of consumption – including a surging demand for food, raw materials and energy (ERD, 2011) – Burkina Faso’s progress, in the most trying of circumstances, could hold key lessons for other countries. The achievements of smallholder farmers in the Central Plateau of Burkina Faso are examples of the kind of water and soil conservation that is possible even in adverse circumstances, a lesson that will become all the more relevant in the face of increasing climate variability and desertification brought about by climate change.

What progress has been achieved?

1. Initial situation

In the 1960s and 1970s, Burkina Faso’s Central Plateau experienced a vicious agro-ecological cycle driven by both human and ecological changes. First, population pressures led farmers to expand their cropland in order to meet rising food needs, placing great strain on land resources. There was also a large expansion in the head of livestock, triggering further demands on the land (Ickowitz et al., 2012). Farmers responded by trying to get more out of their land without increasing inputs, for example by not returning fields to fallow. As a result, there was widespread soil degradation.

By the 1970s, the situation in the Central Plateau began to spiral out of control as rainfall decreased and became significantly more sporadic. The region faced severe droughts between 1968 and 1973 and again over the 1982–1984 period, causing severe food crises in a context in which the high population pressures and low soil fertility had already combined to reduce the population’s resilience to such challenges.

Perhaps even more damaging than the overall decline in precipitation levels in the Central Plateau has been the growing irregularity of rain patterns. Not only has total rainfall varied from year to year but even within a single growing season, and variations in the dispersion and timing of the rains caused severe damage to crops (Reij et al., 2005; Critchley, 1991).

By the end of the 1970s, the Central Plateau was home to a rapidly growing population without enough land or water to sustain it. As more territory was cultivated to replace

the land that had been degraded through unsustainable agricultural practices and the population’s growing needs, the vicious cycle continued. It was a situation described by one interviewee for the study as ‘change or die’.

In the face of these deepening problems, farmers began to adopt a range of techniques to stem the land loss and recuperate land that had become degraded. Three simple techniques – *zai*, contour stone bunds and *demi-lunes* – are considered to have been crucial in halting desertification and reclaiming land for agricultural use (see Box 1).

2. Soil and water conservation

The adoption of sustainable agricultural practices appears to have turned a vicious chain of events into a virtuous one. The situation in the Central Plateau has dramatically improved, with land once thought lost now being used for agriculture and forestry. Estimates for the total land reclaimed across the region range from 200,000 ha to more than 300,000 ha (Kaboré and Reij, 2004; Ouédraogo, 2005).

There are also strong indications that sustainable practices have contributed to better management of water resources; Reij et al. (2009) calculated an average increase of five metres in groundwater levels in the Central Plateau. Access to improved water sources in rural Burkina Faso has surpassed the average for low-income countries and is far higher than the sub-Saharan Africa average, as shown in Figure 1, which shows that it has almost doubled, from 38.6% of the population in 1990 to 74.1% in 2011.

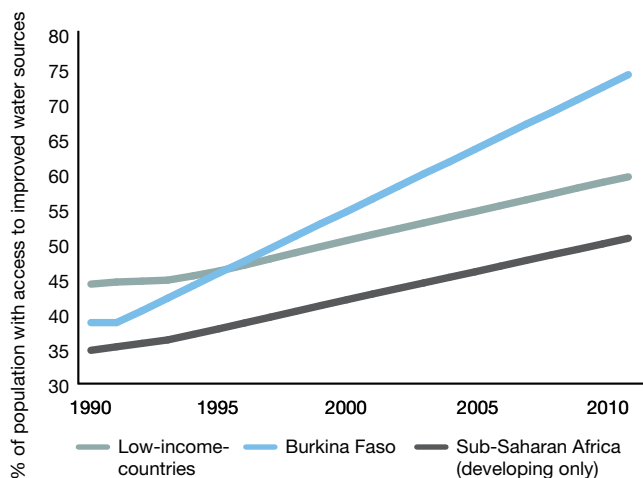
3. Increases in agricultural output

In addition to the reclamation of degraded land, the overall productivity of farmland has improved, leading to a significant increase in agricultural output. At the national level, Burkina Faso has increased its agricultural

Box 1: Three improved techniques for sustainable agriculture in Burkina Faso

- *Zai*: planting pits traditionally used on a small scale to rehabilitate hard, barren land. Innovations included widening the dimensions of the pits and the application of manure and other organic waste.
- Contour stone bunds: semi-permeable barriers built by placing stones tightly together around and within fields. They trap rainwater and encourage its slow absorption into the soil, preventing run-off and reducing erosion by trapping soil particles and increasing soil moisture.
- *Demi-lunes*: ditches dug in a semi-circular shape and lined with cuttings. The hollowed portion collects water along its walls allowing crops planted in the ditch to receive much more rain. Like contour bunds, these follow the contour of slopes across fields to retain run-off.

Figure 1: Rural population with access to an improved water source



Source: World Bank Indicators, 2014

productivity, as shown in Figure 2. While yields were relatively static from the 1960s to the 1980s, the early 1990s saw Burkina Faso converge with – and momentarily surpass – the West African average.

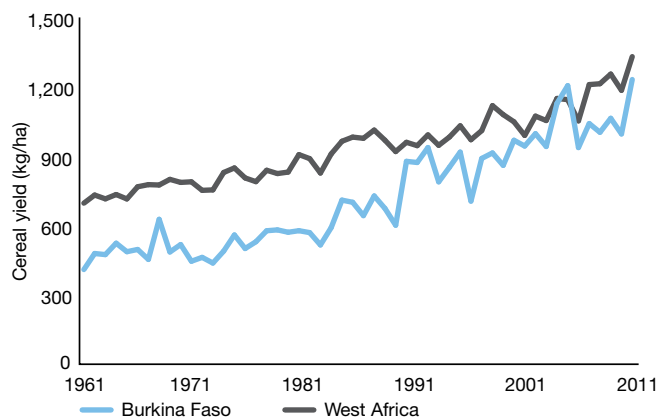
There is considerable evidence that the adoption of sustainable agricultural practices has played an important role in increasing productivity. Between 1995 and 2006, nine studies measured the impact of the new agricultural practices on yields in the Central Plateau under various conditions, and all recorded positive impacts – ranging from an increase of 40% to more than 100% (Reij et al., 2009).

This progress is even more noteworthy when compared to global trends in this area. The Food and Agriculture Organization (FAO) estimates that only 10% of the world’s land is experiencing improvements to its fertility, while more than three times that amount is experiencing degradation (FAO, 2011).

4. Human impact

Over the last 20 years, some households have become fully food-secure in the Central Plateau region, and the high average food deficits witnessed in the early 1980s have been significantly reduced. While most families continue to experience food shortages, these have declined from six months to two or three months of each year – a halving of the hunger gap (Reij et al., 2009). The adoption of improved planting techniques also has the potential to raise households’ incomes. Barro et al. (2005) estimate that 1 CFA (West African CFA franc) invested in mechanised *zai* (using draft animals) yields a return of 14 CFA. They estimate that, on average, investments in mechanised *zai* planting can yield a return of 150, 000 CFA/ha per year. At the time of their study this amounted to approximately \$300, or around 75% of annual per capita income in Burkina Faso.

Figure 2: Cereal yields per hectare, comparing Burkina Faso with West Africa, 1961–2011



Source: World Development Indicators, 2013

While malnutrition and poverty persist in much of the Central Plateau and Burkina Faso more widely, we believe that the situation may well have been worse if sustainable farming techniques had not been adopted. Although the risk of famine lingers year-on-year, the catastrophic events of the 1973–1974 drought, which led to numerous deaths, have not been repeated (Sawadogo, 2007; Prevention Web, 2014). While the avoidance of widespread famine cannot be directly tied to the progress in land reclamation and the adoption of sustainable farming techniques, we do know that these innovations provide significant returns within one planting season, and that food production is estimated to increase by 25% to 75% (PATECORE & PLT, 2005). This suggests that their use can in indeed lessen the impact of crises at the household level.

What are the factors driving change?

1. Finding techniques that work

Perhaps the most important factor in the adoption of sustainable agricultural practices in the Central Plateau region has been the nature of the techniques themselves – namely the *zai*, stone bunds and *demi-lunes*. The three practices improved on traditional processes and techniques used in the region, and emerged from the ‘bottom-up’ participation of local communities and farming leaders. This is in some contrast to previous techniques that were imported from different contexts, implemented in a ‘top-down’ manner, and which are broadly considered to have failed.

In response to such failure, farmers and the organisations that supported them sought to develop techniques better suited to the prevailing environmental challenges. One of the most attractive features of these technologies is that benefits can be reaped within the first planting season, or in the dry season, thus avoiding a long lag between the farmer’s investment and the increased return to recuperate initial

costs. This is particularly important given the constraints faced by very poor farming households, which are the majority in northern Burkina Faso.

The short-term impact on agricultural yields can range from an increase of 30% to 350%, particularly if these techniques are combined (i.e. stone bunds as well as *zai* and manure). Positive outcomes are particularly evident on degraded land that was not previously cultivated (Sahel study, CILSS). Yields in the first year have increased by an estimated 40%, and when applied to barren fields, yields of 1,200 kg/ha have been achieved in the first year.

2. Diffusing knowledge

In the case of sustainable agriculture techniques in the Central Plateau, the diffusion and adaptation of successful techniques appears to have been fairly widespread and effective. Although impact studies have generally focused on limited village or sample plots, project reports corroborated by interviews with experts imply that sustainable agricultural practices are well known and widely shared in the Central Plateau.

Local organisations

Although it is not widely recognised internationally, Burkina Faso has one of the most active and diverse civil society networks in SSA. The Africa Capacity Index ranks Burkina Faso second after Ghana in SSA in terms of individual and organisational capacity as well as for its 'enabling environment' (after Ghana). Farmers' groups such as the National Federation of Farmers' Groups (FNGN) and national NGOs are recognised as having a significant impact on information diffusion, both about improved farming practices and also about marketing and credit.

These organisations and their broad community engagement have gone some way to mitigate the potentially inequitable sharing of information or benefits to the advantage of better connected or resourced farmers, and there has been an undeniable expansion of the skills and capacities of farmers' organisations for the dissemination and implementation of soil and water techniques.

Support from national and international organisations

As the benefits of sustainable agriculture became ever clearer, farmers and their organisations were able to attract support both from the government and from foreign donors for further dissemination. The FNGN mediated between farming communities, its core constituency, and other parts of the national and international apparatus. Along with other civil society organisations and NGOs, it championed and filled knowledge gaps in these techniques until they gained the attention of other interested parties, including international development agencies.

Serious dissemination efforts made by international NGOs began in the early 1980s and continue today, although are now largely supported by local NGOs. Oxfam GB supported an agroforestry project which used a participatory village-level approach to promote stone bunds. Pilot projects supported by the German Federal Enterprise for International Co-operation (GIZ), the



Gardening project in the Sahel. Photo: ©CE-ECHO/Anouk Delafortrie

Permanent Interstate Committee for Drought Control in the Sahel (CILSS) and others validated the bunds and *zai* techniques as the most attractive options for farmers. A project funded by the International Fund for Agricultural Development helped to promote *demi-lunes*, whose use is now growing (Reij et al., 2009). Further, as academics in the capital, Ouagadougou, heard reports of the successful techniques from field-based researchers, this in turn generated information dissemination and rigorous academic backing.

3. Encouraging adoption

Despite the broad appropriateness and effectiveness of the techniques developed in the Central Plateau, the dissemination of information about them sometimes proved necessary but insufficient to achieve significant uptake. In many cases, although communities and farmers were well aware of the techniques they were not using them, suggesting that access to information was not the only constraint.

Most farmers needed further incentives to adopt the techniques. The barriers for poorer farmers include inputs – the nutrients necessary to regenerate soil, which may be costly and/or in short supply – as well as the considerable labour costs associated with building bunds, *zai* and *demi-lunes* and the ongoing protection against straying ruminants, overgrazing or erosion.

The initial and ongoing input and labour costs, as well as the cost of simple tools, mean richer farmers can more easily rehabilitate land while poorer farmers can only do so incrementally. Ouédraogo (2005) confirmed that it was particularly difficult for low-income households to adopt these techniques, and in a two-village study (using household data from 1992 and 1994) he found that adoption ranged from 10% to 50%, increasing with income level.

The only way these techniques were going to be adopted more widely was with subsidies from government agencies and NGOs committed to their uptake. In the Central Plateau region, the German-funded PATECORE project

was crucial in alleviating some of the adoption constraints. One distinctive feature of this project, which differed from the failed donor-funded conservation techniques of earlier decades, was the inclusion of farmers in the planning and implementation phase, leveraging local knowledge of the types of techniques likely to work in these environments.

Our fieldwork suggests that poor farmers are more likely to adopt these agricultural techniques where there is assistance in reducing barriers to adoption, particularly in covering the cost of inputs, tools and labour. In the Central Plateau, adoption has spread beyond the wealthier minority of farmers thanks to significant external support, including study tours, tools, subsidised transport costs for stone bunds and food-for-work for the poorest.

In addition, research organisations such as the Environment and Agricultural Research Institute (INERA), the Agricultural Research Centre for International Development (CIRAD) and other action-research projects offered approaches to tackle the main obstacles to uptake. Where there was a need for labour-saving technologies, they have more recently offered mechanisation using donkeys and ploughs; where there was inadequate availability of organic matter, they suggested improved composting methods.

‘Preventing starvation is good, but even better is to give farmers the means to produce’ – Former senior government official in agriculture

What are the challenges?

1. Limited coordination slowing large-scale improvements

Several actors have been involved in the Central Plateau’s progress, from the farmers to major international donors, and a range of players in-between. These actors played different roles at different times in relation to the three factors of progress we have identified. A common finding from research interviews is that their lack of coordination has limited the scale of adoption of sustainable farming techniques.

Recent policy commitments and programmes suggest that the government of Burkina Faso is prepared to make a concerted effort and investment in sustainable agriculture, for example by meeting the Maputo Declaration to dedicate 10% of the national budget to agriculture. But interviewees pointed out the need for careful coordination across ministries and different levels of government in order to scale up outcomes and to ensure that the funds are allocated appropriately and efficiently.

While international agencies have played a crucial role in terms both of the financing and the implementation of projects over the past 30 years, coordination among

international and local NGOs, government ministries and local government has been described as highly unstructured (personal interview, donor representative, Ouagadougou, 2013). More strategic planning and coordination could significantly raise the impact of their interventions, particularly at the watershed level, which are now required to see genuinely transformative changes in land reclamation and water conservation (personal interview, donor representative, Ouagadougou, 2014).

2. The need for further technical innovation

Despite being highly effective from an environmental perspective, the techniques still have room for improvement in order to become more viable for adoption, particularly for the poorest farmers. The main technical solutions that emerge from the literature, confirmed by our interviews, are aimed at removing household-level constraints:

Transport

Poorer households are unlikely to have access to donkey carts or trucks needed to transport stones for bunds, so innovations that minimise transport requirements will increase their ability to adopt sustainable techniques.

Labour

The use of small machines or animals for the construction of *zai* and *demi-lunes* and the regeneration of degraded soils is affordable and has a big impact, reducing the labour requirement from 300 hours/ha to just 50 hours (Barro et al., 2005).

Organic fertilisation

The increased production of biomass and compost will be essential to future improvements in agricultural production. Innovation in organic fertiliser is a key challenge to continued progress in the adoption of sustainable agriculture techniques nationwide.

3. Not just more investment but more strategic investment

While many farmers have adopted the techniques with little financial support, the relatively low adoption rates despite widespread awareness suggest the importance of financial barriers, a conclusion supported by the interviews we conducted. Several interviewees identified a targeting problem, i.e. the most vulnerable farmers are not able to support the upfront costs, with information and financial support largely benefiting the richest or those with some social and political power.

Another explanation could be that wealthier families are better educated and therefore better able to avail themselves of support provided by government and NGO schemes (Reij et al., 2005). Given the clear success of the bunds and *zai* techniques, among others, it seems likely that a significant increase in finance for such schemes would lead to a major increase in the amount of land recuperated annually. The rising interest in climate finance may be a way to increase international funding.

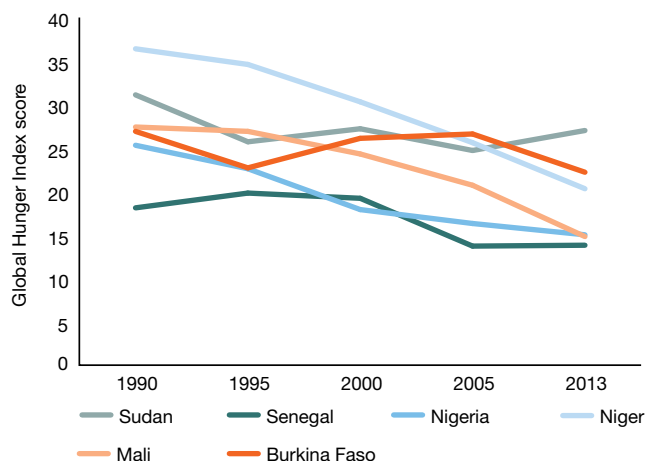
4. Lack of an integrated approach

There are two common but erroneous assumptions in natural resource policy: first, that ecosystem responses to human use are linear, predictable and controllable; and second, that human and natural systems can be treated independently (Folke et al., 2002). Discussions with farmers in the Central Plateau region suggest they are all too aware of the first error. The irregularity of rainfall patterns is now widely understood to be the norm (interview with FNGN, Ouahigouya, 2014). However, the discontinuity and short-termism of policies and programmes aimed at building resilient ecosystems and communities have not been aligned with the challenges of an unpredictable and uncontrollable climate. Only an integrated and long-term approach to the rehabilitation and maintenance of lands can address unpredictable natural challenges.

Furthermore, while higher yields in the Central Plateau have led to an increase in cereal production suggested to be enough to provide food security for between 0.4 and 0.6 million more people (Reij et al., 2009), nutritional status has not significantly improved over the period in the Central Plateau or across Burkina Faso more broadly (see Figure 3).

The relationships connecting food production with nutritional well-being are complex, and many factors may prevent improvements in one sphere from translating into gains in the other. Yet in the case of Burkina Faso, it is

Figure 3: IFPRI Global Hunger Index 1990–2013



Source: IFPRI, 2013

clear that more needs to be done. This disconnect between improved yields and continuing food insecurity suggests that poor distributional and market mechanisms are preventing greater gains from taking root in the country.

AGAINST THE ODDS:

Farmers in Burkina Faso create a mosaic of green, arable land in the arid desert of the Central Plateau



PRESSURES

- Population density
- Encroaching Sahel desert
- Climate change affecting rain variability

SOLUTIONS

- Innovative farming methods, mixing traditional practices with new ideas
- Dissemination of information through locally-led initiatives, via strong social networks
- Demonstration of benefits and support with costs and labour - incentivising adoption

RESULTS

OVER THE PAST 3 DECADES

200k to 300k
hectares of degraded land turned into productive land

80,000 tons
of additional food per year produced

Providing food security for an additional

500,000 people

WORK TO BE DONE

- More and better targeted finance (domestic and international)
- More collaboration to scale-up progress
- Continued research to grow success

PROGRESS IS SIGNIFICANT, BUT ALSO FRAGILE

Innovative farming techniques can, in the short-term, increase agricultural yields by as much as:

30% → 350%

Source: Reij, Tappan and Smale (2009) 'Re-greening the Sahel: Farmer-led innovation in Burkina Faso and Niger' in Spielman and Pandya-Lorch *Millions Fed: Proven Successes in Agricultural Development*.

Lessons learned

Burkina Faso is seldom turned to for clues on how to respond to the challenges of development. Indeed, in most ways it is not a typical development success story. The country ranks 183 out of 187 countries in the Human Development Index, and it remains one of the world's poorest countries with 45% of the population living on less than \$1.25 a day (UNDP, 2013; World Bank, 2011). In one particular area, however – sustainable agriculture, specifically in soil and water conservation – Burkina Faso has made tremendous progress in the face of adverse circumstances, and its achievement holds important lessons on how to increase agricultural production while conserving natural resources such as soil and water, and even adapting to environmental and climatic changes.

- **Low-cost and effective technologies are fundamental, with bottom-up participation of local communities and farming leaders needed to ensure they are appropriate to local conditions.** The tremendous progress in sustainable agriculture made in Burkina Faso would not have been possible if the appropriate technology had not been developed, no matter the levels of support given to it. It took many years to develop the most appropriate and effective technology in this case, but when it came, the impacts were significant. It does appear, however, that in some circumstances locally developed solutions, building on traditional practices, may have a higher chance of adoption than foreign techniques.
- **Engaging existing organisations and local networks to disseminate information on new technologies and to channel support for their uptake can be an effective strategy for farmer extension.** The existence of strong social and community networks and organisations made diffusion and adoption of the appropriate techniques much more successful. Building as far as possible on existing networks, even if they are weaker than in Burkina Faso, should be a core strategy in dissemination and adoption of appropriate technology. Existing networks can mobilise people to work

together, to invest time or resources in community-wide projects, or to share collectively in the benefits.

- **More financing is needed to support smallholder farmers in the adoption of improved sustainable techniques, and what the available funds need to be targeted appropriately.** Despite the apparently low cost of introducing the sustainable agricultural techniques described, adoption has been more limited than might have been hoped. Poorer farmers' lack of resources is a major constraint on progress. More and better targeted financing would almost certainly lead to greater adoption. Coordination among funders could link up projects and so reap greater collective rewards, encouraging learning from successful interventions and avoiding unnecessary duplication.
- **International agencies have a vested interest in supporting the development of sustainable farming techniques and land reclamation.** While the problem of unsustainable agriculture needs to be dealt with at the national level, it may be hard to make progress in some contexts without international financial and technical support. At the dawn of the Sustainable Development Goals that are likely to succeed the Millennium Development Goals after 2015, donors should be even more interested in directing attention and funding to land reclamation, given its nature as a global public good, as well as being part of an anti-poverty strategy. There are emerging opportunities for climate finance to play a role in supporting farmers in mitigating climate change, but the low demand for these credits, high transaction costs in obtaining them, and the potential conflict between mitigation and development objectives are significant in preventing these funding sources from working effectively (Lipper et al., 2011). Resolving these issues and unlocking the potential of climate finance initiatives to reach the front lines of the fight against climate changes could have tremendous returns.

This summary is an abridged version of a research report and one of a series of Development Progress case studies being released at developmentprogress.org

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Overseas Development Institute

203 Blackfriars Road
London SE1 8NJ

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Contact us

developmentprogress.org
developmentprogress@odi.org.uk
T: +44 (0)20 7922 0300

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