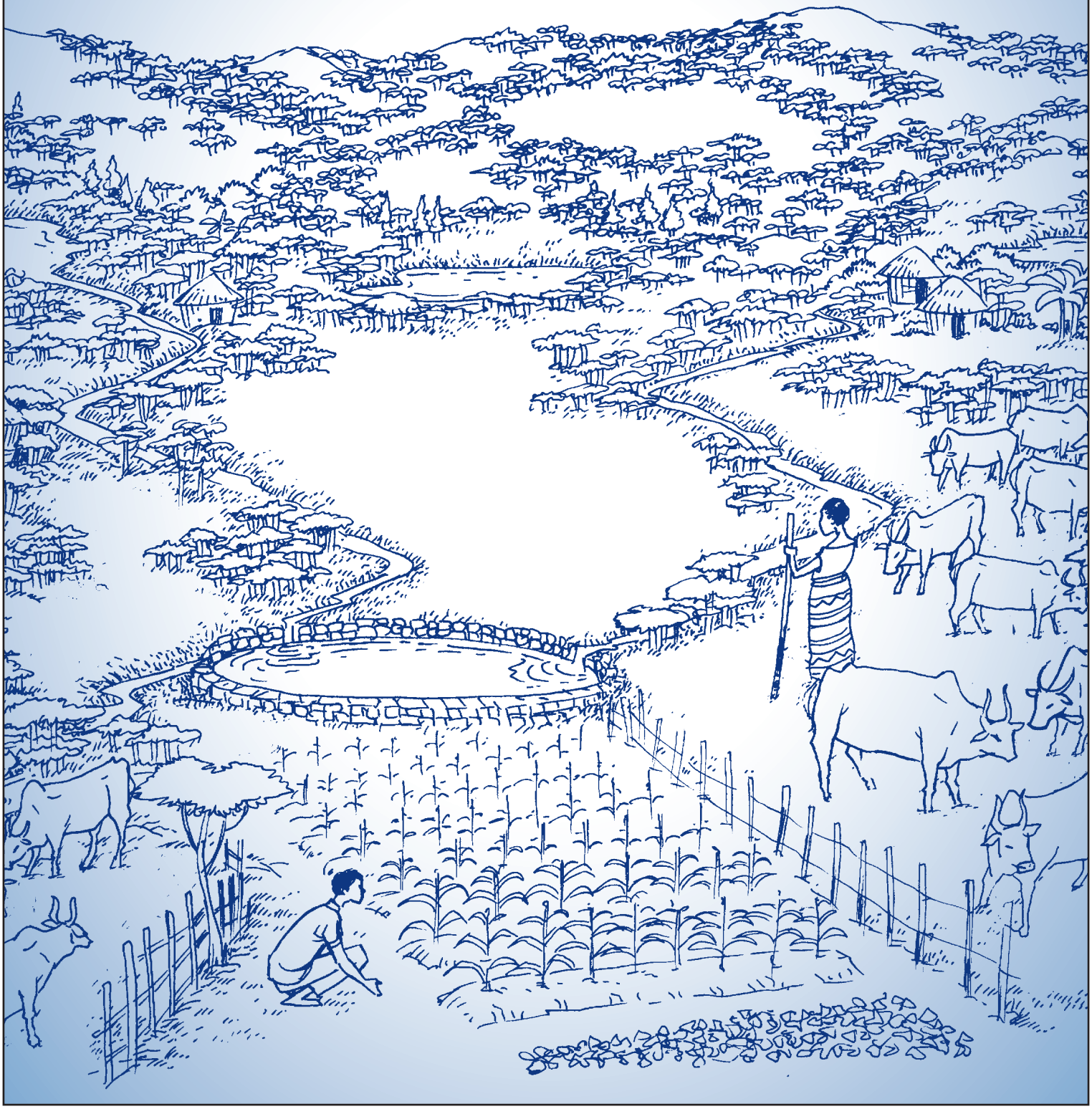
Sustaining Landscapes 2



Improving Land and Water Management

The world's food production systems face enormous challenges. Millions of farmers in developing countries are struggling to feed their families as they contend with land degradation, land use pressures, and climate change. Many smallholder farmers must deal with low and unpredictable crop yields and incomes, as well as chronic food insecurity. These challenges are particularly acute in sub-Saharan Africa's drylands, where land degradation, depleted soil fertility, water stress, and high costs of fertilizers contribute to low crop yields and associated poverty and hunger.

Farmers and scientists have identified a wide range of land and water management practices that can address land degradation and increase long-term agricultural productivity. The benefits of these improved land and water management practices to farmers and rural economies include higher crop yields, increased supplies of other valuable goods such as firewood and fodder, increased income and employment opportunities, and increased resilience to climate change. These benefits can be brought about through the following improved land and water management practices:

- increased soil organic matter,
- improved soil structure,
- reduced soil erosion,
- increased water filtration,
- increased water-use efficiency,

- replenished soil nutrients, and
- increased nutrient uptake efficiency.

Four of the most promising improved land and water management practices that are particularly relevant to the drylands of sub-Saharan Africa are:

1. Agroforestry—the deliberate integration of woody perennial plants—trees and shrubs—with crops or livestock on the same tract of land.
2. Conservation agriculture—a combination of reduced tillage, retention of crop residues or maintenance of cover crops, and crop rotation or diversification.
3. Rainwater harvesting—low-cost practices—such as planting pits, stone bunds, and earthen trenches along slopes—that capture and collect rainfall before it runs off farm fields.
4. Integrated soil fertility management—the combined use of judicious amounts of mineral fertilizers and soil amendments such as manure, crop residues, compost, leaf litter, lime, or phosphate rock.

The benefits of these four practices and their observed impacts on crop yields and other measurable benefits to farmers and rural communities are considerable. For example,

1. Agroforestry. In Malawi, maize yields increased by about 50% when nitrogen-fixing *Faidherbia albida* trees were planted in farms. In Senegal, the presence of *Piliostigma reticulatum* and *Guiera senegalensis* shrubs in fields has increased nutrient use efficiency over sole crop systems and has helped to create "islands of fertility" that have greater soil organic matter, nitrogen, and phosphorus concentrations under their canopies than in open areas.
2. Conservation agriculture. In Zambia, maize yields in conservation agriculture systems with crop rotation can be more than 50% higher than yields under conventionally tilled maize.
3. Rainwater harvesting. Farmers in Burkina Faso have doubled grain yields using multiple water-harvesting techniques, including stone bunds and planting pits.
4. Integrated soil fertility management. In West Africa, adoption of integrated soil fertility management across more than 200,000 ha resulted in yield increases of 33–58% over a 4-year period and revenue increases of 179% from maize and 50% from cassava and cowpea.

Farmers have realized even greater benefits when combining these practices and have further enhanced yields when combining them with conventional agricultural technology solutions such as fertilizers and improved seed varieties. An example of a cost-effective, complementary practice is "micro-dosing," the targeted application of small quantities of fertilizer—often just a cupful—directly to crop seeds or young shoots at planting time or when the rains fall. Nearly 500,000 smallholder farmers in Mali, Burkina Faso, and Niger have learned the micro-dosing technique and have experienced increases in sorghum and millet yields of 44–120%, along with an increase in family incomes of 50–130%.

These four improved land and water management practices can help smallholders boost crop yields and provide other benefits on individual farms. However, in many situations, sustaining or improving agricultural productivity will require coordination between resource users situated in different parts of the larger landscape, including in nonfarmed lands, wetlands, forests, and rangelands. Integrated landscape approaches bring sectors and stakeholders together to jointly plan, design, and manage their landscapes for improved agricultural production, ecosystem conservation, and sustainable livelihoods.

In spite of the multiple benefits of improved land and water management, adoption by smallholders remains limited in most regions. Some of the commonly cited barriers include a lack of awareness of the appropriate practices and their benefits, as well as low levels of investment in knowledge dissemination. In many cases, national policies and legislation do not provide sufficient incentives—such as secure land tenure and property rights—to stimulate farmers to invest in improved land and water management. Many smallholder farmers are not reached by extension agents at all. And where extension does exist, too often agroforestry, conservation agriculture, and other improved land and water management practices are insufficiently integrated.

Still, there is vast potential to scale up the improved management of land and water resources as an integral component of agricultural development strategies. In sub-Saharan Africa, conditions are

ripe for investing in agroforestry and other improved practices on croplands covering more than 300 million ha. If improved land and water management practices were implemented on just 25% of this cropland to increase crop yields by an average of 50%, farmers would produce 22 million more tons of food per year. Such a scale-up could potentially provide 285 million people living in Africa's drylands with an additional 615 kcal per person per day.

The productivity of degraded agricultural land can be restored and crop yields boosted if tens of millions of smallholder farmers were motivated to invest their labor and their limited financial resources in these proven land and water management practices. This working paper proposes seven pathways to accelerate scale-up of these improved practices.

1. Strengthen knowledge management systems and access to information.
2. Increase communication and outreach in ways that amplify the voices of champions and leverage direct engagement with farmers.
3. Support institutional and policy reforms, particularly for strengthening property rights.
4. Support capacity building, particularly in community-based management of natural resources.
5. Increase support for integrated landscape management.
6. Reinforce economic incentives and private sector engagement.
7. Mainstream investments in improved land and water management to catalyze adoption of these practices as a strategic component of food security and climate change adaptation programs.

While smallholder farmers are the key actors, many other entities and organizations have a role to play in implementing these strategies. National governments should create enabling agricultural development policies—as well as land tenure and forestry legislation—that secure farmers' rights to their land and recognize their ownership of on-farm trees. Governments also should create enabling conditions for the private sector to invest in market-based approaches to strengthening agroforestry value chains. The public and private sector—working with local communities, international partners and development assistance organizations—can take these improved practices to scale by investing in knowledge management, communication, and outreach, which will help restore agricultural productivity, enhance rural livelihoods, and contribute to a sustainable food future.

Integrated landscape approaches

The four improved land and water management practices described above can help smallholders boost crop yields, sustain resources, and provide other benefits on individual farms. However, in many situations, sustaining or improving agricultural productivity will require coordination between resource users and managers situated in different parts of the larger landscape, including nonfarmed lands, wetlands, forests, and rangelands. As pressures increase on land, water, and biological resources—and as initiatives with multiple development objectives work in the same or adjacent and connected landscapes—a new set of approaches has also emerged to address and manage these pressures and sometimes conflicting objectives. Integrated landscape approaches bring sectors and stakeholders together to jointly plan, design, and manage their landscapes and institutional resources for improved agricultural production, biodiversity and ecosystem conservation, and sustainable livelihoods (Box 1).

Box 1. *Integrated landscape approach.*

Society has begun to recognize that farmland is important for more than just the production of food calories. Society values and benefits from a range of goods and services provided by healthy ecosystems that support agricultural production systems across rural landscapes (Ranganathan *et al.*, 2008). These include not only the production of grain, fodder, wood and other agricultural products, and ecosystem services that directly benefit farming (e.g., pollination, pest management, irrigation), but also other services such as source-water protection and the recharge of aquifers for diverse uses, nutrient cycling, regeneration of pastures and tree cover, conservation of wildlife habitat and biodiversity, and climate change mitigation and adaptation (Table 1).

Table 1. *Integrated landscape approaches take account of the importance of ecosystem services in managing agricultural landscapes.*

Provisioning	Regulating	Supporting	Cultural
♦ Crops and livestock ♦ Biomass fuel ♦ Wild food ♦ Genetic resources ♦ Natural medicine ♦ Fresh water ♦ Timber and other biological raw materials	♦ Erosion control ♦ Climate regulation ♦ Natural hazard mitigation (droughts, wildfire) ♦ Water flows and quality	♦ Soil formation ♦ Nutrient cycling ♦ Water cycling ♦ Habitat for biodiversity	♦ Local land races of agricultural crops ♦ Cultural landscapes ♦ Traditional agricultural practices ♦ Sacred groves

Sources: Adapted from Millennium Ecosystem Assessment (2005); Wood, Sebastian and Scherr (2000).

Landscape-level coordination, therefore, is especially important in maintaining ecosystem services that operate at geographic scales larger than individual farms. Landscape management helps to manage the dynamics of land use change—mitigating impacts of agricultural development on forests and other native vegetation—while also ensuring that other uses of land—such as pasture lands or forests—complement agriculture (Bailey and Buck, 2013; Sayer, 2013; Scherr and McNeely 2008).

Integrated landscape management involves long-term collaboration and negotiation among different groups of land managers—farmers, pastoralists, forest and other resource user groups—and other stakeholders—local communities, government representatives, businesses—to achieve their multiple objectives within the landscape. Stakeholders seek complementary solutions to common problems and pursue new opportunities through technical, ecological, market, social, or policy means that reduce trade-offs and strengthen synergies among their varied objectives.

Agreed collaborative actions typically involve the farm-level improved land and water management practices described in the sections above, along with strategies that are spatially targeted, to ensure impacts in parts of the landscape that have the greatest aggregate effect. Landscape-level strategies can also mobilize investment from stakeholders who benefit from farmers' improved resource management or are engaged in complementary activities in nonfarmed areas. Strategies may be implemented through market mechanisms (such as payments for ecosystem services); strengthened social organization (such as community-based institutions); policy and institutional reforms (to empower landscape planning units); and other forms of capacity building, knowledge management, and technical support for integrated land use planning and collaborative management.

There are many different approaches to integrated landscape management, with different entry points, processes, and institutional arrangements. However, most share features of broad stakeholder participation, negotiation around common objectives and strategies, and adaptive management based on shared learning. Key features of integrated landscape approaches include

1. Agreement among key stakeholders on landscape objectives
2. Management of ecological, social, and economic synergies and trade-offs among different land and resource uses in the landscape;
3. Land-use practices that contribute to multiple landscape objectives
4. Development of supportive markets, policies, and investments
5. Establishment of collaborative processes for multi-stakeholder governance

While documentation of impacts from landscape initiatives remains generally poor, data are beginning to emerge.

Box 2. *Success in scaling up improved land and water management practices requires attention to gender.*

In assessing, designing, implementing, and monitoring activities to address the opportunities to scale up improved land and water management practices, it is essential to take account of gender. Addressing gender is important because women have been marginalized in the past and inequities need to be corrected. And experience shows that making progress on gender equity and the empowerment of women leads to better development outcomes.

In rural areas of sub-Saharan Africa, 95% of external resources and technical assistance (access to information and to inputs such as improved seeds and tools) are channeled through men, although women are responsible for 80% of agricultural work and their labor inputs into food production exceed those of men by 10–12 h a week (Reyes, 2011). Studies in sub-Saharan Africa indicate that agricultural productivity would increase by more than 20% if the gap in capital and inputs between men and women were reduced (Quisumbing, 2003). Women are also among those most affected by unchecked land degradation and associated shortages of fuelwood, fodder, food, and clean water (de Sarkar, 2011).

Women and men are both primary stakeholders in the adoption and scaling up of improved land and water management practices, yet they have different perspectives on the use of natural resources and the importance, feasibility, and cost-effectiveness of various practices. Women often do not have the same rights and management authority as men. Both customary and statutory provisions governing land tenure and resource rights need to be reviewed through a gender lens. Potential barriers to the adoption of improved land and water management practices that may be related to these differences in rights and security of tenure should be assessed and strategies developed to overcome these barriers.

Women and other marginalized stakeholders should be included in meetings and decisionmaking and should be represented in community-based institutions governing resource use. Women need to have direct access to information, training, and other assistance mobilized to scale up improved land and water management practices. Greater progress and success in mainstreaming these improved practices in agricultural development can be achieved by incorporating goals of gender equality and women's empowerment into agricultural program strategies and investments (Kanesathasan, 2012).

It will be important to address the gender dimensions to fully capitalize on the opportunities to ensure that investments in agricultural development and improved land and water management contribute to gender equality and women's empowerment (Box 2).

Source

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References

Bailey, I., Buck, L.E. 2013. Managing for resilience: exploring a landscape approach for improving food and livelihood security. Discussion Paper. Washington, D.C.: EcoAgriculture Partners.

De Sarkar, S. 2011. Gendering joint forest management. IUCN Arbor Vitae 43: 10.

Kanesathasan, A. 2012. Cultivating women's participation: strategies for gender-responsive agricultural programming. Technical Brief. Washington, D.C.: International Center for Research on Women.

Quisumbing, A.R. 2003. Household decisions, gender and development: a synthesis of recent research. Washington, D.C.: International Food Policy Research Institute.

Ranganathan, J., *et al.* 2008. Ecosystem services: a guide for decision makers. Washington, D.C.: World Resources Institute.

Reyes, T. 2011. Gender and farming in Tanzania. IUCN Arbor Vitae 43: 7.

Sayer, J., *et al*. 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. Proc. Natl. Acad. Sci. 110 (21): 8349–8356.

Scherr, S.J., McNeely. J.A. 2008. Biodiversity conservation and agricultural sustainability: towards a new paradigm of 'ecoagriculture' landscapes. Phil. Trans. Royal Soc. Biol. Sci. 363: 477–494.

Wood, S., Sebastian, K., Scherr, S.J. 2000. Pilot Assessment of Global Ecosystems: Agroecosystems. IFPRI and WRI: Washington, D.C.