



## USAID ISSUE BRIEF

# LAND TENURE & CLIMATE-SMART AGRICULTURE

### BACKGROUND

Projections based on population growth and food consumption patterns indicate that by 2050 agricultural production will need to increase by at least 60–70 percent to meet demand (FAO, 2013; World Bank, 2013). In sub-Saharan Africa, where growth in agricultural productivity has been slow, meeting these production goals is even more daunting given that an increase in production must occur during a period of climate change that is expected to significantly impact food production. Because climate change is likely to increase the variability of production and farm incomes (Smith et. al., 2007), urgent solutions are needed to raise production and strengthen the resilience of farmers so they are less susceptible to extreme events and better able to adapt to climate change. USAID's [Climate Change and](#)

[Development Strategy](#) calls for all agriculture programs to be climate resilient and, when possible, curb carbon emissions.

#### BOX 1. THE GLOBAL ALLIANCE FOR CLIMATE-SMART AGRICULTURE

The United States is a founding member of the Global Alliance for Climate-Smart Agriculture. The Alliance brings together governments, businesses, farmers' organizations, civil society groups, research bodies, and intergovernmental entities to address food security in the face of climate change. The United States will bring its existing food security and climate programs to this multi-stakeholder effort.

*(Source: The White House, 2014)*

To help meet future demand, climate-smart agriculture (CSA) may provide one environmentally sustainable strategy. As defined by the FAO (2013), CSA is based on three main pillars: 1) sustainably increasing agricultural productivity and incomes; 2) adapting and building resilience to climate change; and 3) reducing and/or removing greenhouse gas emissions where appropriate. Given that CSA focuses on practices that achieve these objectives simultaneously, it is often referred to as a 'triple win.'<sup>1</sup>

Unfortunately, small farmers have not widely adopted CSA because of key barriers, including: a lack of access to inputs and materials; non-existent or unclear incentives and credits for providing environmental services; inadequate training and education; poor access to markets; limited research; and—the focus of this brief—insecure land tenure and resource rights (FAO, 2001, 2013; Liniger, Rima, Hauert, & Gurtner, 2011). As a result, the extent to which CSA benefits have been realized and rural development outcomes improved is limited (FAO, 2013).

<sup>1</sup> USAID's policy and program guidance on resilience aligns closely with the first two pillars on productivity and adaptation in meeting development objectives, including poverty reduction.

Secure land tenure means that people in a given environment, as individuals or as groups, recognize and respect the land rights of others over time. Land tenure and property rights (LTPR) institutions and rules create incentives that either encourage or discourage the adoption of CSA practices, such as climate-smart crop, agroforestry, and livestock production. This brief considers a variety of CSA practices and explores how different aspects of LTPR are tied to farmers' and herders' decisions to adopt (or not) a particular practice. With a clearer understanding of these linkages, the brief then provides recommendations to strengthen land tenure and resource rights to incentivize the uptake of CSA.

## INVESTING IN CSA

Although the potential benefits associated with CSA—higher yields and farm income, greater resilience, and climate change mitigation—apply broadly, the types of practices and the investments required vary considerably. Table 1 illustrates this by presenting a number of CSA practices under crop, agroforestry, and livestock/pastoral production systems, along with the initial investment costs and recurrent seasonal (maintenance) costs of these practices.

**TABLE 1. INITIAL INVESTMENT AND MAINTENANCE COSTS FOR SELECT CSA PRACTICES (\$USD PER HECTARE)**

Type of Production Activity	CSA Practice (Country)	Initial Investment				Maintenance Cost
		Labor	Equipment	Ag. Inputs	Total	Total
Crop	Seed priming and micro-fertilization (Mali)	0	0	0	0	3
	Precision conservation agriculture (Zimbabwe)	0	0	0	0	184
	Small-scale conservation tillage (Kenya)	0	0	0	0	93
	Large-scale conservation tillage (Kenya)	0	208	0	208	105
	Tassa planting pits (Niger)	150	5	5	160	32.5
	Runoff and floodwater farming (Ethiopia)	253	24	106	383	814
	Grassed <i>Fanya Juu</i> Terraces (Kenya)	270	20	90	380	30
	Shelterbelts agroforestry (Togo)	200	86	90	376	162
	<i>Grevillea</i> agroforestry system (Kenya)	25	10	125	160	90
	Farmer managed natural regeneration agroforestry (Niger)	6	0	0	6	4
Livestock	Night corralling (Niger)	0	15	0	15	8
	Rotational fertilization (Niger)	150	200	0	350	15
	Grazing land improvement (Ethiopia)	320	22	710	1054	126
	Smallstock manure production (Togo)	200	182	0	382	150

Note: Shading of select cells in this table have been added by the authors to emphasize CSA initial investments that are: 1) in excess of \$100/ha; and 2) tend to be highly site-specific in the sense that once made, these investments cannot be easily re-assigned other land.

(Source: adapted from Liniger et al., 2011)

Table I helps highlight several important points about investing in CSA in general. The first is that some (but not all) CSA practices involve little or no explicit initial investment. Second, where significant initial investments are required, in many cases they are tied to the land itself. For example, unlike investments in tractors, planters, and other machinery that can be easily moved from one location to another, many CSA practices require investments that are not movable. For example, once the initial investment has been made (e.g., establishing *tassa* planting pits, water diversion ditches, land terraces, or improved grass and fodder and fruit trees, and building fences to improve grazing land to support livestock production) these cannot be applied or moved to land elsewhere—at least not without incurring significant costs. Third, as implied by the names categorizing production, different types of CSA practices entail using the land in different ways (e.g., to produce field crops, raise livestock, plant trees, or some combination) and may involve exploiting other resources on the land (e.g., water, in the case of irrigation). A farmer's decision to adopt a particular practice and undertake the necessary investments is directly linked to the potential stream of benefits that may result. Thus, the composition of a farmers' land tenure and resource rights and how secure these are play a critical role in defining the stream of benefits that he or she can capture.

## **TENURE SECURITY: IMPROVING THE GROUNDS FOR INVESTMENT**

If the rules governing the allocation, use, control, and transfer of land and other resources, such as trees, are clear and enforced impartially, people are likely to feel secure, whether their rights are recognized by formal or informal law. This is important because when tenure is secure, rights holders are able to benefit from their investments—both labor and capital—in the land. If farmers are also able to securely transfer their land use rights or expected long-term benefits to another person or group, they are more likely to make larger investments (Place, Roth, & Hazell, 1994). In the developing world, the level of tenure security varies widely from very secure to highly insecure, and the rights people hold may vary over time. These constraints in the land tenure environment may impact a farmers' willingness to adopt particular CSA practices.

The LTPR framework can affect a farmer's underlying incentives, especially where CSA investments are long-term in nature and are land-specific (i.e., tied to a specific parcel). In cases where relatively little upfront investment is needed, or where the investment is not parcel-specific, farmers may not need strong land tenure security to adopt the CSA practice. However, some CSA practices require significant up-front investments in machinery (e.g., large-scale conservation tillage), while others require significant labor investment (e.g., terracing), or capital investment (e.g., purchasing seedlings to start agroforestry). Unlike machinery, which is mobile, these other types of investments are not. The amount of time required before starting to realize benefits from any CSA practice, and how long these persist into the future, also affects the decision of whether or not to adopt that practice. For example, a farmer wishing to adopt agroforestry practices to promote crop production may need to wait upwards of five years before he or she starts to realize benefits. As noted, different types of CSA may rely on different resources (water, trees, pastures), and the extent to which farmers and other resource users can effectively exercise rights over each of these resources may differ, potentially resulting in different adoption choices. Farmers may be less likely to adopt certain CSA practices if the set of rights they hold over land is insufficient to generate the incentives necessary or limits opportunities to directly benefit from their efforts.

It is useful to conceptualize the role of LTPR in incentivizing investments in CSA along two separate but highly complementary dimensions: the extent and type of rights enjoyed by the land owner or user and

the landholders' perceived security and assurances of those rights. From an investment perspective, the types of rights determine the potential streams of benefits associated with alternative investments, while assurance captures risk and uncertainty. These concepts are discussed in more detail below, including how they relate to the incentives underlying decisions on whether or not to adopt.

## THE 'BUNDLE' OF RIGHTS

From an individual perspective, the decision to adopt a particular CSA practice is inherently a management issue. For purposes of this brief, we draw on the larger body of literature (Bruce, Migot-Adholla, & Atherton, 1994; Meinzen-Dick, Knox, Place, & Swallow, 2002; Ostrom, 2000; Place & Swallow, 2002; Schlager & Ostrom, 1992) but also adopt the perspective of a landholder faced with a set of possible investment choices. With this framing in mind, we classify the property rights according to:<sup>2</sup> i) use; ii) excludability; (iii) management and iv) transferability. Rights may be held separately or together as part of the 'bundle' of rights. The composition of the 'bundle,' as well as the breadth or scope of each stick within the bundle has important implications for the types of benefits a landholder can derive from their CSA investment. These are discussed in more detail below.

**Use:** The resources that can be harnessed and harvested (e.g., water, trees, minerals, etc.) on a landholder's parcel determines what types of activities can be pursued to generate benefits. Landholders will often have a choice about whether to adopt a particular type of production (e.g., field crops, trees, livestock, grazing, pastoralism, etc.) and whether to use different resources (e.g., water, carbon, etc.) based on the use rights they hold. Thus, the specific use rights held by each resource user has implications for the types of activities they can adopt and the stream of benefits they can obtain as a result of their decisions. For example, if a household does not hold rights to use a waterhole on or near their land, they may be less likely to invest in irrigation efforts.

**Excludability:** For effective land and natural resource management, it is important to be able to keep unwanted people and/or animals from accessing private resources, such as tree seedlings or crop residues. The ability to exclude others from using a given resource or parcel, or to place restrictions on how land can be used by others, plays an important role in determining the potential stream of benefits associated with a particular investment. Women and other vulnerable groups often are unable to exclude others from accessing their land. For example, in some contexts, contrary to their wishes, women's fields may be disproportionately used for communal grazing. In such situations, they would be less able to benefit directly from the investments they make in enhancing land productivity. When exclusion rights are weak, landholders—male and female alike—have fewer incentives to invest in CSA, since the actions of others place limitations on their current and future stream of benefits.

**Management:** Potential CSA adopters also need to have the autonomy to make decisions about how to use the land and resources they have rights to access and/or use. Management rights determine the kinds of production strategies available to landholders. For example, in many countries, it is not necessarily the case that female farmers and migrants who have the right to grow annual crops on a given parcel also hold the rights to manage and benefit from trees that are or could be grown there. Likewise, farmers or herders may depend on access to key water resources that they may not have the right to manage themselves, which could undermine their ability effectively adopt CSA practices.

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<sup>2</sup> In the context of the classification developed by Ostrom (2000), what we term as 'use' corresponds to a combination of withdrawal and management rights, excludability and transferability corresponds to exclusion and alienation respectively. Ostrom's 'access' classification is not covered here as this corresponds to non-rival benefits from land use which generally do not factor into individual decision making beyond their own benefit.

**Transferability:** The ability to transfer land and/or resource rights (whether permanently through sale or temporarily through lease or other mechanisms) in a relatively transparent market increases the likelihood that a property owner will make investments or improvements to the land, because they expect to capture any increased value of the land or resource in the sales or rental price. The ability to sell to a buyer who values land more highly can help individuals transition away from farming when they wish to do so. The ability to securely lease in lands allows competitive farmers to expand production. Conversely, leasing out land may also allow less productive farmers to benefit more from their resource rights—both parties gain from the trade of rights. Even when land cannot be sold or leased but can be inherited, a landholder can invest confidently knowing that he or she can transfer a future stream of benefits to his or her heirs. When laws and rules limit transferability, restrictions may have a variety of negative impacts: including reduce the market value of land, limiting access to credit, and reducing incentives to invest. Such restrictions may have a disproportionately negative impact on poor and vulnerable groups. For example, in the event the male head of household dies, his wife/wives and daughters may be disadvantaged if his land cannot be bequeathed to them. Similarly, in the event of divorce, if women are barred from receiving land as part of a property settlement, they will be disadvantaged and may be economically disempowered. Such limitations on transfers especially reduce women’s incentives to undertake costly or longer-term investments.

Finally, the duration or length of time that a landholder retains control and authority over his or her rights may have important consequences on their decision to adopt a particular CSA practice. Property rights can be short-term, such as a lease that lasts for the length of one growing season, or long-term, such as a 30-, 50-, or 99-year lease. Although there is no one “right” length, secure long-term rights create stronger incentives to invest in practices that produce benefits many years or decades into the future. Adopting new practices may involve significant upfront investments, but it may be years before benefits materialize or the investments “bear fruit.” In such cases, property rights need to be secure for a long enough period to create the appropriate investment incentives. In other cases, as with annual crop production, short-term rights may be sufficient to encourage CSA.

## **SECURITY AND ASSURANCE OF RIGHTS**

Landholders and other users want to be sure that their rights are not only of sufficient duration to achieve their goals, but also that these rights are secured. Assurance creates incentives to make costly upfront investments with long time horizons. Assurance captures the degree of consistency and predictability with which rules and norms governing land are consistent (non-arbitrary) and predictable and when there is a reasonable expectation that the current framework will persist in the future. Uncertainty—whether it is over prices, policies, or rights—will have a dampening effect on investment, particularly where these investments involve large upfront irreversible or ‘sunk’ costs and where the benefits are realized in the future (Dixit & Pindyck, 1994). Uncertainty can arise where the institutional framework for enforcing property rights is comprised of multiple levels and sources of authority such as overlapping formal, customary, and religious laws, and even unwritten local norms that address rights and responsibilities related to natural resources (Meinzen-Dick et al., 2002). Where *de jure* (statutory) law is not aligned with *de facto* (locally practiced) rules, the potential for misalignment of perceptions pertaining to ownership and management of land often creates uncertainty and unpredictability. Few people, including small farmers, are comfortable making investments in uncertain and unpredictable environments.

## **LINKING CSA WITH LTPR: INCENTIVES AND BARRIERS**

The extent to which land tenure and property rights influence decisions to adopt (or not) CSA practices depends upon: 1) the make-up of the bundle of rights that farmers hold; 2) level of assurance of those rights; and 3) the type of practice under consideration, especially the types of investment this practice requires (Feder & Feeny, 1993). To spur investment by farmers in CSA practices that have high upfront costs, but whose benefits are realized years or even decades later, farmers need long-term tenure security and confidence in the institutions enforcing and protecting those rights (e.g., assurance of rights of appropriate duration) and opportunities to transfer rights. As well, farmers need to know what types of resources they can access and the types of production practices they can pursue (use), whether they can keep unwanted outsiders off their land in order to protect their investments (exclusion), and to what extent they (or their heirs) can capture part or all of any investments they make to the land or resource (transferability).

This section discusses how different elements of the ‘bundle’ of rights discussed above factor into decisions about whether to adopt CSA practices and, if so, the extent or scope of adoption. These examples are illustrative and based on stylized relationships. The household-level decision to adopt (or not) a given CSA strategy will, of course, be context-specific.

Investments that are tied to the land itself and cannot be easily or economically transferred to land in another location once made should be distinguished from other types of investments that are mobile and may be employed productively elsewhere. The degree to which investments are tied to the land itself, and the security of underlying land tenure and property rights of the parcel/s, may be critical to the success or failure of a particular CSA investment strategy. Given this, it is very helpful to ask the following questions during planning stages of a CSA project:

- Does the landholder have the right to make (and adjust) crop and management decisions on this parcel?
- Does the landholder have the right to access other key resources outside their land, such as water?
- How likely is it that the landholder making these investments will lose his or her rights to this land (in the near-, medium-, or far-term), particularly if more powerful people see the benefits of these investments (e.g., improved productivity and/or reduced climate vulnerability)?
- If the landholder does lose their rights, how much of their initial investment is likely to be recovered?

If the answers to these questions are “no,” “no,” “likely,” and “little or none,” respectively, then the landholder has few incentives to adopt CSA practices, and the project needs to consider supporting a stronger LTPR legal and policy environment.

## **BARRIERS TO ADOPTING CSA IN CROP PRODUCTION**

Unlike conventional agriculture, which relies heavily on tillage and synthetic fertilizers and pesticides, CSA practices improve soil conditions and result in higher and more stable yields by reducing the use of tillage and incorporating sustainable agronomic practices, such as planting more resilient (e.g., drought-tolerant) crop varieties and introducing crop rotations and cover crops. However, in comparison to conventional agriculture, the benefits of CSA take longer to realize. Soil conditions and productivity improve gradually through CSA practices, and, therefore, farmers are likely to need secure land tenure to switch practices and adopt CSA. As such, encouraging farmers to change their behavior and undertake these types of investments requires that their ‘bundle’ of rights gives them the flexibility to

make crop and production decisions (use), keep unwanted outsiders off their land (excludability), and capture the full benefit from those investments in the future (transferability).

Although the term agroforestry is typically used to refer to land use systems and practices in which woody perennials are integrated with agricultural crops or livestock (Liniger et. al., 2011), for the purposes of this brief, we will focus here on the aspects of tenure that are relevant to trees but distinct from crop and livestock (only) systems. Despite the potential for sustainably increasing agricultural production (and other benefits), adoption of agroforestry has also been slow (Blanco-Canqui & Lal, 2008). A 2003 meta-analysis of barriers to agroforestry adoption across a number of empirical case studies identified tenure security as one of the most important determinants of increased agroforestry uptake, with secure tenure being a key determinant of adoption in 72 percent of cases (Pattanayak, Mercer, Sills, & Yang, 2003). Rights to trees are often distinct from rights to land, rights to tree products are not necessarily the same as the rights to tree management and removal, and rights to own, inherit, and plant trees can vary (Fortmann & Bruce, 1988). As well, women's rights to land and trees tend to be less secure in comparison to men's rights, and women typically are less empowered to make decisions on managing trees and, as result, less likely to plant trees (Fortmann, Antinori, & Nabane, 1997; Meinzen-Dick et al., 2002). An additional complicating factor is that in many sub-Saharan African countries, improvements made to the land, particularly those involving planting trees, are often seen to strengthen tenure security and support one's claims to the land (Bruce & Migot-Adholla, 1994; Sjaastad & Bromley, 1997).<sup>3</sup> As such, those with weaker rights within a particular tenure system, such as women and pastoralists, may not be able to make and maintain such investments. In addition, the tenure systems governing land and trees may involve multiple institutions, potentially creating uncertainty over future rights (e.g., formal institutions may not be aligned informal rules governing land use and this may lead to conflicting claims in the future).

Establishing and maintaining trees requires substantial upfront effort and investment, but the potential future benefits are also high. The high investment costs associated with initial planting, the risk to seedlings and trees in the early years before they are established, and the fact that benefits are realized only after trees are established (often several years or more), require confidence and certainty of rights (assurance) for some defined duration, as well as excludability. For example, where livestock are part of local livelihood strategies, farmers need to be able to exclude or manage livestock access so that the trees can become established. This may require that farmers build fences to exclude animals—another expensive investment that farmers are less likely to make if their LTPR rights are insecure or of insufficient duration.

Restrictions on transfer rights—whether rental, long-term lease, sale, or inheritance—also limit a landholder's ability to benefit from land-based investments that enhance the land's productivity and value. In the case of agroforestry, transferability is particularly important for two main reasons. First, since agroforestry benefits are realized in the medium- and long-term, if landholders cannot trade or bequeath rights to these long-term investments, they may have fewer incentives to undertake agroforestry. Second, when a landholder is not willing or able to use their land, if they are not able to transfer the rights to the land and trees, they will have an incentive to “use or lose” the investment—by harvesting standing trees rather than maintaining them.

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<sup>3</sup> For example, in some countries, if you clear scrub and plant cacao trees you may create a new right over the parcel. Incidentally, this is one reason why some empirical research fails to find a relationship between stronger tenure and increased investments in land (Brasselle, Gaspard, & Platteau, 2002).

## BARRIERS TO ADOPTING CSA IN LIVESTOCK AND RANGELAND MANAGEMENT

Significant investments in the land are often required as part of climate-smart livestock and rangeland management. For example, increasing the productive capacity of grazing land so that it is resistant to erosion and less susceptible to drought may require establishing improved grass varieties and fodder trees. As these require significant upfront investments associated with preparing the land, in addition to explicit costs, such as for purchasing seeds and seedlings, adoption will be more likely where rights are secure and unlikely to be challenged (assurance) in the near- and medium-term (duration). As well, rights of exclusion may be necessary to deal with encroachment of cultivated lands (or other land uses, such as conservation areas) into pasture areas, and also other areas that impede livestock mobility in pastoral systems (Morton, 2007). Where fences or enclosures are required, these are costly investments that are highly site-specific. Again, undertaking the necessary initial investments requires certainty over land tenure and rights (assurance), as well as being secure in those rights for a sufficient amount of time to receive benefits and recoup those costs. Landholders must also have the rights to manage pasture lands. Adoption may be complicated where management rights are held in common or by someone other than the target CSA adopter, such as the state.

Some of the global regions particularly exposed to climate change—West and Southern Africa, inner-Asia, and the sub-Arctic—are inhabited by significant pastoral populations that contribute to developing economies in important ways (Behnke & Freudenberger, 2013). While in the past, pastoralism has been thought of as being unviable and ecologically harmful, it is increasingly being recognized as an economically viable, environmentally sustainable strategy that is compatible with development (Kipuri & Sorensen, 2008; Liniger et al., 2011). Adopting CSA approaches and practices for pastoral rangeland management can help achieve climate change and resiliency goals. However, strategies to improve rangeland conditions and achieve climate change and resilience benefits may require effective communal tenure and governance systems capable of managing livestock access to dry season grazing sites and water points (Liniger et al., 2011).

The stylized relationships described above, linking elements of the LTPR ‘bundle’ to the stream of benefits and the importance of having assured, secure rights associated with different types of CSA practices, are summarized in Table 2.

**TABLE 2. LTPR RELEVANCE TO ADOPTION OF CSA PRACTICES**

Type of Investment		LTPR Considerations			
Illustrative CSA practice	Security	Bundle of Rights - Stream of Benefits			
	Assurance	Use	Excludability	Transferability	
<b>Crop</b>					
Minimum tillage—minimal investment	+	+	+	+	
Minimum tillage—capital intensive	++	+	+	++	
Terracing	+++	+++	++	+++	
Irrigation and rainwater harvesting	+++	++++	++	+++	
<b>Livestock/Pastoral</b>					
Agro-livestock	+++	++	+++	+++	
Pastoral	++	++	++++	+	
<b>Agroforestry</b>					
Crop and Livestock systems	++++	+++	++++	++++	

+ = relative importance of different aspects of the LTPR bundle as they relate to different types of investments: ‘+’ limited; ‘++’ moderate; ‘+++’ very important, ‘++++’ critically important



## INCENTIVIZING CSA THROUGH SECURE LTPR

Even when required upfront investments of a CSA practice are small, LTPR can play an important role in encouraging the adoption of CSA. Targeting vulnerable women in Senegal, the USAID-supported Yaajeende conservation agriculture program works with communities to allocate degraded and abandoned land to women who receive training and extension services to return the land to a productive state. This program provides more security for women over their bundle of rights and training to help women use a package of conservation agriculture practices to reduce erosion, including planting low maintenance crops rich in micronutrients and crop rotations. As a result, women have increased incentives to restore the land's productivity and improve resilience (USAID, 2013a). After applying CSA for a few seasons, the productive capacity of soil has improved enough to support the production of more valuable crops.

In Morocco, water rights and rules governing the allocation and use of water resources for irrigating crops have evolved over many years to meet local needs (Fishbein et al., 2012). Water for irrigation is allocated among members of water users' groups by: 1) using flow-dividing structures to provide fixed volumes of water to each farmer along a canal; 2) delivering water to members' fields for a predetermined amount of time; or 3) a combination of both. Specific arrangements are tailored to adjust to the source of water and its variability (springs, perennial flows, flood waters, or groundwater). Arrangements reflect linkages between land rights and water rights; these linkages determine participants' contributions to the construction of the canal system and the distribution of lands among ethnic groups. This local system provides a flexible and evolved institutional structure that assures and secures rights to a critical resource: water. In a relatively secure LTPR environment like this, farmers are more likely to adopt cost-intensive irrigation efforts that support CSA (Feder, Onchan, Hongladarom, & Chalamwong, 1988).

Given the long-term planning horizon, the large upfront investments and maintenance costs in early years, and the risks posed by even a short-term period of insecurity, as noted, farmers need a relatively secure 'bundle' of rights over land and trees to have incentives to adopt agroforestry. One interesting example comes from the "Greening of the Sahel" success story: strengthening local rights to use and benefit from trees in Niger has played a key role in improving the livelihoods of millions. By reducing enforcement of regulations enacted during colonial times that made trees state property, locals had increased incentives to better manage soil and tree resources on their farms. When coupled with donor

### BOX 2. AGROFORESTRY IN ZAMBIA

Given its ability to increase productivity, increase resilience, and mitigate greenhouse gases by sequestering carbon, *Faidherbia albida* has been described as a miracle tree. A leguminous nitrogen-fixing tree species that is indigenous all over Africa, *Faidherbia* has a unique compatibility with cropping systems since it is dormant during the wet season, and thus does not compete with crops like maize and millet, and drops its leaves which provide fertilizer.

Despite widespread adoption in countries like Niger and Burkina Faso and elsewhere in the Sahel, farmers in Zambia have been slow to adopt *Faidherbia albida*, known locally as *msangu*. One potential reason is their lack of tenure security. Under the customary system of land tenure governing the majority of smallholder farmers in Zambia, an individual farmer cannot exclude cattle from grazing in their fields in the dry season. Since it can take 8–12 years before a farmer starts to realize benefits and upwards of 15 years to reach their full potential, farmers will be reluctant to plant *msangu* unless they are sure to enjoy the benefits. Grazing may also reduce crop residues available for enhancing soil fertility, another important CSA practice.

The USAID Tenure and Global Climate Change program is piloting a program in Zambia that combines agroforestry extension with tenure strengthening interventions to increase adoption of CSA practices, including agroforestry.

(Source: USAID, 2013b; World Agroforestry Center, 2010)

support promoting adoption of low-cost soil and water conservation techniques, these efforts have led to the revitalization of five million hectares of land,<sup>4</sup> resulting in improved productivity and income generating opportunities to the benefit of millions of smallholders (Stickler, 2012).

To promote the adoption of CSA practices by pastoralists, countries may need to introduce measures to strengthen the bundle of rights that herders hold. For example, the USAID Land Administration to Nurture Development (LAND) project in Ethiopia is designed to support legal and regulatory reforms, as well as pilot activities in pastoral areas, to improve governance at the local level by providing communities with enhanced management, exclusion, and transferability rights over their natural assets, especially grazing land and water (USAID, 2014).

## UNINTENDED CONSEQUENCES

As the benefits from adopting CSA tend to increase over time, so, too, does the land's productive capacity, which also tends to make it more valuable. As land becomes more valuable, people have increased incentives to capture that value (Box 3). Because CSA practices may increase the economic value of the land, it is important to clarify the rights of legitimate owners at early stages of a project. This will help to limit the potential for conflict arising from multiple claims and other rent-seeking behavior. If CSA programs are not attentive to the likelihood of these problems, landholders whose land rights were secured by *de facto* ownership may find their claims threatened over time as improvements are made, new technologies are adopted, and the productivity of the land and its income generating potential are increased. One example of the unintended negative consequences of agricultural programming comes from the Gambia (Box 4), where women who had been using land for high-value horticulture production were displaced by men who leveraged a tree planting program to reclaim the land that had been set aside for the women (Schroeder, 1997). As well, as the inherent value and productive capacity of land increases, this tends to encourage a shift from communal to more individualized holdings, and this process can lead to conflict (Fortman, 1985). Programs supporting CSA applications to communal resources, such as improving management of common-use rangelands, need to be attentive to these concerns and not inadvertently create new challenges.

### BOX 3. SHADY PRACTICES— AGROFORESTRY AND GENDER POLITICS IN THE GAMBIA

Between 1975 and 1985, Gambian women farmers succeeded in establishing hundreds of lucrative communal market gardens. In less than a decade, the women's incomes began outstripping their husbands' in many areas, until a shift in development policy away from gender equity and toward environmental concerns threatened the social and economic gains of the garden boom. Openings created by environmental policy reforms along The Gambia River Basin gave rise to strategies and tactics being adopted by rural Gambians to manipulate these policies for personal gain. Male lineage heads and community leaders claimed land that had been improved by women through donor-generated agroforestry and soil and water management projects.

(Source: Schroeder, 1997, 1999)

## RECOMMENDATIONS

CSA holds the promise of achieving important development objectives—particularly goals related to reducing extreme poverty, improving resilience, and increasing adaptation to climate change. The limited uptake of CSA practices to date is at least partly the result of institutional environments that do not provide sufficient incentives to farmers to adopt them. Particularly in situations where upfront investment costs

<sup>4</sup> Although more information is needed to better understand the impact of land tenure reforms vis-à-vis improved water availability in this dramatic “greening,” it is clear that strong LTPR are a key part of the story.

are high and benefits are expected only in the medium to long term, farmers may view CSA practices as too risky. LTPR interventions that increase security over land and resources by strengthening the bundle of rights that farmers and herders hold can help reduce some of the risks by increasing the likelihood that farmers will be able to successfully adopt CSA practices and capture future streams of income and other benefits. As a result, programming designed to support CSA can be strengthened by building in activities that address underlying tenure weaknesses.

The following recommendations to strengthen LTPR may help increase adoption or uptake of CSA:

- Support programs that allow farmers to register and record land rights in a more cost-effective, participatory manner, drawing on local knowledge of legitimate land rights to increase assurance.
- Support efforts to proactively register and record the land rights of women and other vulnerable groups, such as migrants, who participate in CSA programs to increase assurance and prevent elite capture.
- Allow for greater flexibility in the transfer of rights—including those governing temporary (e.g., rental) and permanent (e.g., sale) transfers—to increase opportunities for landholders to capture the full value of their investments.
- Support needed regulatory reforms and the development of policies that clarify rights related to trees, forest products, water, and carbon, with special attention to the rights of women and indigenous groups to these resources.
- Support efforts that devolve management rights over forests and other common resources, such as rangelands, to local communities.
- In cases where communities or local people maintain control of, or hold ownership rights over trees, support policies that restrict outsiders' rights to access—or provide for negotiated access—to allow seedlings to become established and increase assurance.
- Expand use of participatory mapping of pastures, water sources, and migratory routes of pastoralists as a step in the process of identifying legitimate rights to increase assurance.
- Support legislative and regulatory reforms and the development of policies that clarify rights of pastoralists to use and move across lands as a means to increase assurance, reduce conflict, and promote the development of economically robust and climate-smart livestock value chains.
- Support efforts to enhance women's rights with attention to how productive assets are divided upon divorce or death of husband, fathers, or brothers in order to increase their ability to capture future benefits necessary to incentivize investments in and adoption of CSA.

## CONCLUSIONS

Not all CSA practices require the same level of tenure security in order to encourage productivity-enhancing investment by farmers and herders. As compared with some conventional agricultural practices, many CSA investments require greater assurance and duration of rights. Strengthening LTPR rights is most important for those CSA practices that require significant upfront investments but that have medium- to long-term payoffs. Given the potentially devastating effect that a one-off event (short-term displacement or temporary revocation of rights) can have on a stand of trees (e.g., trampled by cattle or cut down), assurance and excludability are critically important components of a bundle of rights that will incentivize the adoption of agroforestry. Agroforestry also requires that farmers have a sufficient bundle of rights to allow for the beneficial use of trees and associated products. CSA practices that focus on improving soil conditions for annual crop production may, on the other hand, be successful even in areas where tenure is not as secure because of the relatively low upfront costs and

relatively quick payoffs. However, even relatively low-cost investments in soil and water conservation may have unintended consequences if the beneficiaries do not have sufficient rights to exclude others and/or recoup the value of their investments through lease, sale, or inheritance. Clarifying and enforcing rights related to exclusion and improving transferability play an important role in incentivizing CSA generally. As a result, there is no one particular ‘bundle’ of rights that applies broadly to all production systems and CSA practices.

It is important to note that securing and clarifying land tenure and property rights is not a silver bullet. Rather, it is an extremely important factor in a farmer’s or herder’s decision to adopt or not adopt a particular CSA practice.<sup>5</sup> To maximize the effectiveness of programming designed to increase CSA uptake, policy makers and development practitioners need to consider land tenure and property rights issues and concerns in addition to other constraints. A more holistic approach to CSA programming is more likely to lead to sustainable outcomes that help to address extreme poverty, improve resilience, and increase adaptability to climate change.

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<sup>5</sup> There are a host of other context-specific factors that influence individual decisions on whether or not to adopt CSA (FAO, 2013; Liniger et al., 2011; McCarthy & Brubaker, 2014). Additional factors identified as limiting the extent to which innovative CSA technologies can be adopted include: confidence in government support programs, spouse education, rainfall and plot-level disturbances, household wealth, social capital and networks, labor availability during periods of high demand such as for weeding, market access, lack of access to inputs, inadequate infrastructure and information, environmental and price risk, price policies, and cultural norms (Giller, Witter, Corbeels, & Tiftonell, 2009; Knox, Meinzen-Dick, & Hazell, 2002; Teklewold, Kassie, & Shiferaw, 2013).

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