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Can Agricultural Intensification Stop Cropland Expansion in sub-Saharan Africa?

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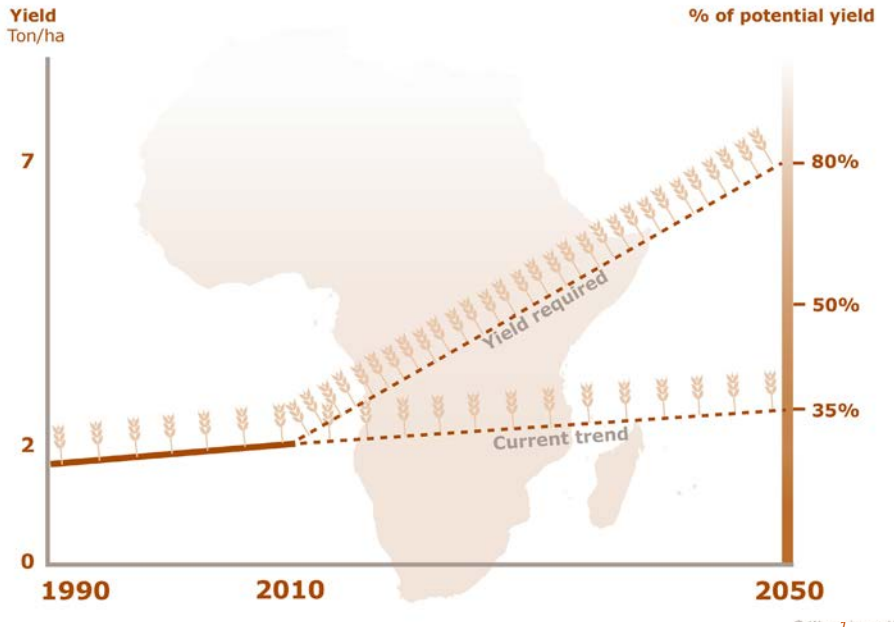
This document challenges the assumption that agricultural intensification will enable sub-Saharan Africa to achieve food self-sufficiency. Using a land-use focus, it argues that future increases in the region's food demand will lead to further deforestation, as cropland expands into natural habitats. It points out several risks related to cropland expansion and proposes strategies to mitigate these risks in food security programs.

Introduction

Sub-Saharan Africa's population and food demand are increasing rapidly. Agricultural production needs to increase to enable access to food for all, without relying heavily on food imports. The two strategies for increasing agricultural production are intensification—leading to increased productivity or yields—and expansion of farmland. Both entail the risk of unwanted negative socio-economic or environmental impacts.

This paper will first outline some of the issues and challenges related to agricultural intensification and cropland expansion. It will discuss their relevance to food security interventions, analyze the associated risks, and propose strategies to mitigate them.

Figure 1: Actual and potential cereal yields in Africa, 1990 to 2050 (simplified)



Source: https://www.wur.nl/en/newsarticle/can-africa-feed-itself.htm [1]

What are the issues?

Sub-Saharan Africa faces high levels of food insecurity and large increases in food demand. According to the United Nations (UN) Food and Agriculture Organization (FAO),[2] Africa currently has the highest proportion of people affected by hunger—20.2 percent of the population in 2021, or a total of 278 million people in Africa, as compared to 425 million in Asia (9.1 percent) and 56.5 million in Latin America and the Caribbean (8.6 percent). Sub-Saharan Africa's (SSA) food demand is expected to approximately triple[3] between 2010 and 2050 as a result of population growth, increased per capita food consumption, and dietary shift. While much of Africa's population will continue consuming a diet that is high in starch and low in protein, the demand for animal products by a growing number of better-off consumers will increase, requiring more crops to feed livestock.

A growing urban population requires both domestic food production and imports. An increasing proportion of Africa's population lives in cities,[4] relying on domestic surplus production and food imports for its food needs. But food

1 This graph was released by Wageningen University and Research (WUR) as part of a study conducted by a team of researchers from WUR, several African institutes, and the University of Nebraska. The findings were published in the journal PNAS (van Ittersum et al 2014).
2 FAO et al (2022)
3 Global food demand is expected to increase by 35% to 56% between 2010 and 2050 under different scenarios (van Dijk et al 2021). However, the increase in sub-Saharan Africa is expected to be significantly higher (FAO 2009, Franks et al 2017), as population growth in most of the continent will continue until the turn of the century, and dietary habits are rapidly changing from a largely plant-based diet to one that includes more animal protein (Noort et al 2022). Cereal demand alone is expected to rise, by 2050, to between 237% of 2010 levels (Ethiopia) and 519% (Zambia). See van Ittersum et al. (2016) for details.
4 OECD / SWAC (2020)

imports are a risky way of feeding a country, and African governments are increasingly seeking to be self-sufficient,[5] at least for staple food crops (cereals, roots, and tubers). For example, in West Africa, the Economic Community of West African States (ECOWAS) launched the Rice Offensive in 2014 with the aim of achieving rice self-sufficiency in the region by 2025.[6] The COVID pandemic and the war in Ukraine have disrupted supply routes, triggering an even stronger focus on domestic production in many African countries.[7]

Agricultural production increase is achieved through expansion and intensification of farmland. There is no doubt that food production in SSA will need to increase to feed its growing population. Increases in food production in SSA have in the past been the result of both expansion of farmland (often into natural habitats such as forests and wetlands, as well as into hilly areas prone to soil erosion), and increasing agricultural productivity. Yet despite a wide range of policies, programs and investments in agricultural intensification, a significant yield gap (between potential and actual yields) persists,[8] and consequently, cropland expansion is continuing in much of sub-Saharan Africa.

The expansion of smallholder agriculture is a key driver of deforestation. According to Global Forest Watch, cropland expansion is the main driver of deforestation in most countries in SSA.[9] For example, in the Democratic Republic of the Congo, 17.1 million hectares (Mha) of tree cover were lost between 2001 and 2021, largely due to shifting cultivation. Elsewhere, such as in Zambia, most deforestation happens initially for timber extraction and charcoal production—but the cleared land is then used for farming. Cropland expansion is predominantly driven by smallholder farmers who need to increase production to feed their families and generate some income from crop sales.[10] According to FAO, nearly 4 Mha of African forests are cut down each year, at almost double the speed of the world's deforestation average.[11]

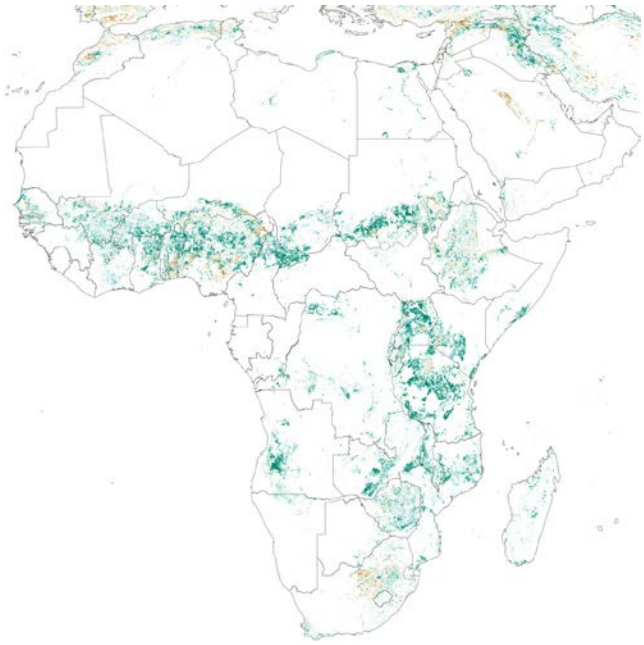
Photo credit: Ezra Millstein / Mercy Corps

5 For example, Ghana, Ethiopia and Zambia all aim to be self-sufficient in staple foods (Jeary et al. forthcoming).
6 ECOWAS Commission (2020)
7 Gakpo (2020)
8 van Ittersum et al. (2016). In this paper, it is argued that even if yield gaps were closed to 80%, six out of the ten countries included in the analysis (Ghana, Niger, Nigeria, Kenya, Tanzania and Uganda) would not be able to produce enough cereals to be self-sufficient in 2050 with current area under cereal cultivation—an expansion of cropland would be inevitable, unless the deficit can be covered by imports. Only four countries (Burkina Faso, Mali, Ethiopia, and Zambia) would produce enough cereals without cropland expansion. In the Sahel, in particular, a closing of the yield gap by 80% appears highly unlikely considering climate change impacts and political instabilities.
9 https://www.globalforestwatch.org/blog/data-and-research/agriculture-drove-recent-record-breaking-tree-cover-loss/
10 Rudel TK (2013)
11 FAO and AUC (2021a)

Losing forests affects rural livelihoods. Forests, woodlands and wetlands provide important ecosystem services[12] to rural (and urban) households: they regulate water flows and microclimates, provide a habitat for pollinators and other animals directly benefitting agriculture, and supply vital off-farm livelihood opportunities (e.g., honey making, medicinal plants, building and thatching materials, fruits and nuts). They also sequester carbon and hence contribute to climate change mitigation.
In this way, loss of these natural habitats impacts rural communities directly and the global population indirectly.

Agriculture is not the only threat to forests and other natural habitats. Other drivers include urban expansion, mining, logging, and charcoal production. Currently, many countries in SSA do not have coherent policy frameworks that balance the land needs of different sectors and uses, such as urban development and infrastructure, industry, different types of agriculture, habitat and wildlife conservation and climate change mitigation. Even within sector policies, conflicts are frequent between various land use policy objectives, which makes policy implication on the ground even more difficult. A recent analysis of policy coherence (with regards to land use) in Ethiopia, Ghana and Zambia shows major policy disconnects between policies for agriculture and food, environmental conservation and forestry, climate change adaptation and mitigation, and other key objectives.[13]

Figure 2: Cropland expansion in Africa, 2003–2019



Source: https://earthobservatory.nasa.gov/images/149624/crop-expansion-accelerates-in-africa

What does this have to do with food security programs?

Food security programs, such as the Resilience Food Security Activities (RFSAs) funded by USAID's Bureau for Humanitarian Assistance (BHA), typically include aims related to increasing food production. Increasing resilience and food security are key objectives of the policies and programs of African governments, civil society organizations, research institutes and donor agencies, including USAID. Food availability is only one component of food security, but a crucial one in a context where even rural households are often net food buyers[14] —as in much of SSA.

Influencing food demand is difficult. Reducing post-harvest losses and food waste is urgently needed but it is technically and economically challenging,[15] and would on its own not produce the additional food needed to feed Africa's growing population. Similarly, there is limited political support in many parts of SSA for measures to reduce

12 Wangai et al (2016), Igini (2022)
13 Jeary et al. (forthcoming)
14 Gatune (2022)
15 FAO (2011), Sheahan and Barrett (2017)

population growth. Even where there is support, the resources and institutions needed to mainstream girls' education, increase women's economic empowerment and improve reproductive health services—all of which are required to reduce birth rates—are insufficient, and hence changes in reproductive behavior will take some time to materialize. Any attempt to reduce food demand also raises substantial ethical and justice concerns, in a context where average food consumption levels[16] in SSA (both in terms of quantity and quality) are lagging far behind what is needed for a healthy life.[17]

Are Sustainable Intensification and 'land sparing' the answer? Increasing agricultural production by increasing productivity is expected to enhance the food security and incomes of smallholder farmers, while also ensuring the production of sufficient surplus to feed the urban population. Agricultural intensification is widely considered to be the key strategy to increase food availability in SSA, and Sustainable Intensification (SI) has been hailed as a win-win approach that increases yields without having negative environmental impacts.[18] Promotors of the 'land sparing' paradigm suggest that the only way of protecting natural habitats (and living up to commitments on habitat conservation and climate change mitigation made by governments globally and in SSA) is to increase agricultural productivity in areas with a high potential for agriculture, but low biodiversity value. This argument was summarized by Benton and Harwatt (2022) as follows: *"Food production must increase to satisfy growing demand. Efficiency gains—primarily through the use of technology—will allow biodiversity-rich land to be protected from agricultural expansion, and ecosystems to be restored on unused land."*

Increasing agricultural productivity is difficult. Productivity increases in SSA have been lower than population growth, with a yield gap persisting in much of the continent for several reasons[19] including poor access to and use of appropriate knowledge and technology, and climate change impacts. Calls for increasing agricultural productivity in Africa are numerous,[20] but the political, economic, and environmental challenges associated with such a transformation are numerous as well. The Alliance for a Green Revolution in Africa (AGRA) has supported agricultural intensification in about a dozen SSA countries since 2006—with mixed results. The success stories on AGRA's website[21] report significant increases in yield, but the approach has been criticized for its negative socio-economic impacts (dependency on purchased inputs and reduction in diversity of food crops) and poor environmental outcomes (acidification of soils under monoculture cultivation with fossil fuel based synthetic fertilizers, erosion of agrobiodiversity).[22]

'Land sharing' has been promoted as an alternative paradigm. Supporters propose using environmentally sustainable farming methods so that land can provide provisioning, regulating and supporting ecosystem services at the same time.[23] This involves farming based on agroecological and regenerative principles, such as agroforestry and biological control of pests and diseases, so that agricultural land can maintain many of its important environmental benefits. Others propose that a systems perspective, which includes shifting food demand through changes in consumption patterns, in particular amongst the wealthier, can reduce food demand and hence the pressure on natural resources (e.g., by reducing the consumption of meat).[24] Benton and Harwatt (2022) summarize the underlying logic as follows: *"Changing consumption patterns can improve public health and reduce demand. This reduces pressure on land, allowing for the widespread adoption of agroecological farming to make the food system sustainable."*

16 However, there are significant differences in nutritional status within countries. WHO found that one in five adults and one in ten children and teenagers are projected to be obese by December 2023 in ten high-burden African countries, if no robust measures are taken to reverse the trends. The causes are dietary habits such as consuming energy-dense foods, sedentary lifestyles and lack of physical activity associated with rising urbanization or changing modes of transport in many countries. https://www.afro.who.int/news/obesity-rising-africa-who-analysis-finds, accessed 2 November 2022.
17 FAO, ECA and AUC (2021)
18 Pretty and Bharucha (2014)
19 van Ittersum et al. (2016), Hillocks (2014), Jayne and Sanchez (2021)
20 See e.g., Jayne and Sanchez (2021)
21 https://agra.org/success-stories/, accessed 1 November 2022.
22 Biodiversity and Biosafety Association of Kenya et al (2020)
23 See https://www.fao.org/ecosystem-services-biodiversity/en/ (accessed 27 November 2022) for an explanation of the different types of ecosystem services (from an agricultural and food systems perspective).
24 See Willet et al. 2019. The EAT-Lancet commission concluded that current dietary trends, combined with projected population growth to about 10 billion by 2050, will exacerbate risks to people and planet. They advocate for healthy diets that consist of a diversity of plant-based foods, low amounts of animal source foods, unsaturated rather than saturated fats, and small amounts of refined grains, highly processed foods, and added sugars. However, the report explicitly acknowledges the low per-capita consumption of animal source foods in SSA, which has decreased in the past few decades. Based on projections by FAO, the availability of animal source protein across SSA will only be 13 g/person per day in 2050, which is less than half of the world average of animal source protein availability in 2011 and less than the recommended quantity in their healthy reference diet.

Photo credit: Sasha Myers / Save the Children

The landscapes resulting from 'land sharing' cannot replace intact habitats. There is ample evidence that agroecological, regenerative farming practices have significant environmental benefits, as compared to external input dependent systems.[25] But from a natural habitat protection perspective, even the most ecologically managed farmland is not a substitute for an intact forest or wetland, with its own unique ecology and biodiversity.

Land use changes and their impacts are not on the radar of many donors and implementers in the food security community, including RFSA stakeholders. Whilst interdisciplinary teams have been researching the pros and cons of 'land sparing' and 'land sharing' in different contexts,[26] there has been limited awareness of the 'bigger picture' related to land use change, food demand and food security amongst development practitioners and those funding their work. Traditionally, agricultural and rural livelihood interventions are designed, implemented and evaluated by different line departments in government and different sections of development and funding organizations. RFSAs, for example, focus on resilience and food security from various angles, including an environmental perspective—but they do not necessarily consider the impacts of agriculture on the wider landscape.

Consequently, RFSAs tend not to track land use changes. As the immediate objectives of RFSAs are related to socioeconomic improvements of the target population, longer term land use changes may well go unnoticed. USAID/BHA encourages RFSAs to address agricultural productivity challenges, using both agroecological strategies and external inputs (improved crop varieties, fertilizer, and mechanization). However, there is no clear guidance on how to track or potentially mitigate the impacts of agricultural expansion on natural habitats. The list of indicators for RFSAs[27] includes "area under improved management practices or technologies with US government assistance," but without any reference to land use changes in the intervention area overall. Similarly, the USAID-funded Feed the Future initiative (under the Bureau for Resilience and Food Security (RFS)) aims to increase agricultural production to overcome hunger, working in fifteen SSA countries via a range of government, NGO and research partners. However, land use changes associated with agricultural development are not currently included in the 78 performance indicators of the Feed the Future initiative.[28] While USAID's Initial Environmental Examination (IEE) template[29] could help with monitoring land use changes, project teams would need to be aware of the potential for adverse land use to use it in this way—and for most teams this issue is not on their radar.

25 IPES-Food (2016)
26 E.g., Sidemo-Holm et al. (2021)
27 USAID (2021b)
28 See https://www.feedthefuture.gov/resource/feed-the-future-performance-indicators-under-the-global-food-security-strategy/ for a list of the 78 Feed the Future indicators.
29 USAID (2019c) https://www.usaid.gov/environmental-procedures/environmental-compliance-esdm-program-cycle/environmental-documentation/initial-environmental-examination-iee/pdf

Agricultural intensification is expected to enable 'land sparing.' The USAID/RFS Food systems conceptual framework[30] considers "land and water resources" as part of the food supply system, and "environmental sustainability" as an overall development outcome. The Sector Environmental Guidelines for Crop Production (USAID 2019b) explicitly include the risk of "land conversion, change of landscapes and loss of vegetation" as an adverse impact of crop production, and subscribe to the 'land sparing' paradigm by suggesting to "Minimize Agricultural Land Expansion by Intensifying Production using inputs and improved techniques to increase productivity and reduce losses per unit of land, therefore reducing the pressures for land conversion." To "conserve and manage high-priority natural land, marine, and coastal area" is also a key priority area of USAID's work on natural resource management, and the USAID Environmental and Natural Resource Management Framework[31] states "USAID is a global leader in biodiversity and the conservation of forests primarily through our work with biodiversity and sustainable landscapes funding. We do this by financing and assisting local stakeholders to address local threats to biodiversity and the drivers of deforestation and poor use of land. Globally, the top threat to natural land areas is agriculture and the production of timber [...]. USAID strives to address these threats while advancing economic development and social well-being. For example, USAID can help improve national and local capacity to protect and manage natural forests and other ecosystems to conserve critical biodiversity and globally important forests, while improving efficiencies and sustainable productivity in established agricultural areas."

To summarize, the risks of cropland expansion into forests and natural habitats is recognized in key USAID documents, but no guidance for monitoring land use changes is provided, and agricultural productivity increase is expected to enable land sparing.

What are the specific risks?

Cropland expansion poses a risk to natural habitats—but there is a lack of understanding about the nature and extent of this risk in different contexts. Increasing the productivity and resilience of smallholder farms is rightly a high priority of international development support. But will it be enough to protect the remaining forests, woodlands, and wetlands of SSA from being converted into cropland? And, worse still, could activities that aim to increase agricultural productivity unintentionally accelerate land use changes and loss of forests and other natural habitats? And thereby undermine the food security and resilience outcomes they seek to achieve over the long-term? A key challenge lies in the assumptions that agricultural policy makers and agricultural practitioners make about smallholder farmer decision-making with regards to land use. These include an assumption that increasing productivity on existing cropland will result in less cropland expansion (and hence deforestation).[32] These assumptions have rarely been tested and may well not be in line with realities on the ground. There is an urgent need to recognize these risks (detailed below), test the underlying assumptions, and develop cross-sectoral strategies for risk mitigation.

1. **The risk of disconnected policies and programs due to a lack of understanding of the extent and nature of threats posed by agricultural expansion**
   Whilst there is now ample evidence for the likely future food demands of SSA and the land use implications of national and regional food self-sufficiency strategies, agricultural development initiatives still largely operate on the assumption that there is sufficient cropland available. This has been fueled by studies such as the World Bank's report on the Guinea Savannah zone of West Africa,[33] which claims that two thirds of the 600 Mha of Guinea Savannah could be used for agriculture—without giving much consideration to the socio-economic and environmental importance of this landscape for woodlands and grazing. At national level, disconnects between food and agricultural policies on the one hand, and climate change mitigation and environmental policies on the other, have been identified in several SSA countries,[34] but are mirrored by disconnects both within major development assistance donors and between agricultural and environmental programming. If these disconnects continue, with limited or no cross-sectoral analysis and joint-up planning, implementation gaps (between policy aspirations and the realities of their implementation on the ground) will likely continue.

30 USAID (2021a)
31 USAID (2019b)
32 See for example Schut and Giller (2020) or Mutabazi et al. (2014)
33 World Bank (2009)
34 Jeary et al (forthcoming)

2. **The risk of a rebound effect, whereby agricultural intensification incentivizes an expansion of farmland**

   Making farming more productive and efficient—through use of technologies such as mechanization, herbicides, or improved crop varieties—can enable farmers to make efficiency gains. For example, the savings from using herbicides instead of manual weeding can be significant, and the adoption of higher yielding and more pest resistant crop varieties can increase yields and gross margins. There is a risk that farmers will use the increased profits resulting from these efficiency gains to expand cropland and hence further increase profits. This phenomenon is known as a rebound effect or Jevon's paradox[35] and has been observed in Brazil and Indonesia, where efficiency gains have contributed to accelerated deforestation.[36] Research on the extent and context of such rebound effects in SSA is ongoing, but several studies have shown that farmers will expand their cropland even after achieving high levels of productivity, if there is a lack of off-farm livelihood opportunities and poor forest governance. Recent research in Zambia and Ethiopia[37] used 'serious gaming' to explore farmers' decisions related to agricultural intensification and expansion and confirmed that Jevon's paradox is a risk in certain contexts. A pre-requisite for Jevon's paradox is that the additional production entering the market due to the expansion will not significantly reduce crop prices. This is often the case in SSA, where both formal and informal cross-border trade of food commodities is common and explicitly encouraged by African Union (AU) agricultural policies,[38] resulting in a stabilization of prices.

3. **The risk of a market-driven expansion of farmland due to improved market access by smallholder farmers**

   Similar to Risk #2 above, cropland expansion can be accelerated by value chain development activities that increase the profitability of farming by reducing input prices, increasing output prices or improving access to markets. Programs, such as RFSAs, that support farmers in organizing themselves (to purchase inputs in bulk, negotiate better deals with traders, improve storage and processing, etc.) can incentivize farmers to expand their cropland. It can also attract new entrants to farming—something that is often explicitly encouraged to address the challenge of outmigration of youths from rural areas. Thus, while value chain development clearly has many benefits for rural producers and consumers alike, it can have unwanted impacts in terms of land use.

4. **The risk that a diversification of agriculture to improve nutrition will have an even larger land use footprint than traditional diets based on starchy staples**

   Shifting diets in Africa to address the double burden of malnutrition[39] (the coexistence of both under nutrition and over nutrition in the same population across the life course) calls for a diversification of agriculture to increase the production and consumption of vegetables, pulses and other nutritious crops. But these crops produce fewer calories per unit area than traditional staple food crops (cereals, roots and tubers), thus increasing the pressure to expand cropland. However, vegetables are often produced in kitchen gardens and then do not compete directly for land with field crops such as cereals, roots and tubers. Cereal-legume rotations are also important to maintain soil fertility via nitrogen fixation. Nevertheless, on a national and global scale, the differences in productivity (kcal per unit area) are significant. Similarly, an increase in the consumption of animal protein—an essential improvement in the diets of the poor—would require the diversion of some cereals and other food crops to be used for animal feed, thus requiring the expansion of cropland. Again, there is a strong counterargument, as much of SSA small-scale livestock production does not involve the use of feed that could also be used in human diets. Hence, the specific impacts depend on the context of the local food system.

5. **The risk that 'land sharing' strategies that replace natural habitats with sustainable, resilient farming systems will contribute to further cropland expansion**

   To meet growing food demand in sub-Saharan Africa, it is necessary to increase production in a sustainable way that reduces pressures on natural resources or even enhances these resources through "nature-based solutions" with multiple benefits. But if cropping strategies rely entirely on local resources (e.g., soil fertility management using only organic amendments), yields may stagnate or even decline under intensive use, if local resources (such as farmyard manure) are insufficient to compensate for nutrient losses from crop production. Low productivity could result in

35 Hertel (2012)
36 Byerlee et al. (2014)
37 Adolph et al. (2022a, 2022b)
38 FAO and AUC (2021)
39 Khonje et al. (2021)

the need to farm a larger area to produce the same output—at the expense of natural habitats.[40] On the other hand, rehabilitating degraded lands that have been abandoned due to soil fertility loss resulting from soil mining can reduce the pressure on natural habitats. See Case study 1.

It is important to note that the existence of these risks does not mean that the various strategies to increase productivity, food security, and incomes, encourage youths to farm in a way that is profitable, and diversify diets, are inherently wrong. It just means there is a need to acknowledge, closely monitor, and mitigate these risks.

Figure 3: Factors increasing and decreasing the risk of cropland expansion

What can be done about these risks?

Clearly there are no easy answers! The availability of land for farming and other uses is limited and conflicts of interest are unavoidable. There are inherent trade-offs, at least in the short to medium term, between socioeconomic objectives (food security) and environmental objectives (forest and habitat protection). This means that RFSAs need to optimize, not maximize, food security impacts in a way that does the least damage to natural habitats.

Mitigating these risks requires first to acknowledge that they exist. This involves looking beyond the immediate objectives of RFSAs, considering the wider socioeconomic and environmental context, as well as interrogating the assumptions that inform development policies and actions. It also requires a cross-sectoral approach, whereby economic and environmental interests and objectives are considered in an integrated way. The USAID Environment and Natural Resource Management Framework[41] provides entry points for this—it is explicitly designed to provide *"a vision for integration of investments in environmental and natural resource management with economic growth and social development; a set of cross-sectoral environmental priorities in line with the National Security Strategy and the USAID Policy Framework; […] and a set of cross-cutting programmatic approaches to inform USAID programming and facilitate partner countries' Journeys to Self-Reliance."* Applying a cross-sectoral

40 Ritchie (2022)
41 USAID (2019a), op. cit.

lens to the design of RFSAs, Feed the Future initiatives and other USAID-funded programs, making use of the guidance available for agriculture and food security, climate change adaptation and mitigation, natural resource management and environment, would go a long way in identifying potential trade-offs that must be considered.

Assessing the risk of cropland expansion should be part of the design process of agricultural and food security interventions. Activities aiming to increase agricultural productivity need to consider the land use situation in the wider target zone, possibly even before selecting specific project sites. Are there natural habitats that are particularly vulnerable or that provide important ecosystem services? Are there biodiversity hotspots of particular importance? Is there a risk that these habitats could be converted into cropland if agriculture was developed? A large proportion of food security interventions takes place in locations where there is simply no natural habitat left that could be converted into farmland, and hence cropland expansion is not a risk. Rather, environmental considerations would focus on issues around land degradation, pollution from agrochemicals and other in-situ impacts of agricultural production. But where agricultural development is happening in proximity to natural habitats such as forests, woodlands, grasslands and wetlands, the risk of cropland expansion is real and needs to be reviewed. This could involve the following steps (see also Figure 5):

- Assessing the nature and extent of natural habitats in the location and the ecosystem services they provide to local communities and wider stakeholders. Working across sectors and line ministries, such as agricultural, forest and environment departments, as well as environmental NGOs and research institutes, could help collate and analyze relevant information. Participatory rural appraisal methods, such as natural resources mapping with members of local communities, could also be used.
- Assessing existing land use patterns and how these have changed over time, including identifying the main drivers of change. Similarly, this could be done through a participatory process involving local stakeholders. Drivers of change include market demand for agricultural produce as well as socioeconomic factors such as land tenure and access to land (in particular for women, youth and poorer households), and environmental drivers such as climate change.
- Assessing the institutions and governance mechanisms for natural habitats. Both formal and informal institutions are likely to exist that govern who can use what land for what purpose. It is key to understand how these institutions work and whether they are effective.

Monitoring land use changes and their causes should be integrated into project monitoring, evaluation and learning (MEL) systems. All projects with relevant land interventions should monitor the land use changes in their operational area, starting with a strong baseline evaluation that includes an environmental assessment of both natural habitats and farmland (crop land and pastures). There are many ways to do this—including using GPS, drones or satellite images, and crowd sourcing data with the help of farmers or local youth, using handheld devices such as mobile phone apps. Such monitoring also needs to track farmers' priorities and motivations, using basic qualitative research methods such as focus group discussions and participatory mapping. "Serious gaming" has shown to be an effective method to understand farmers' decision making processes,[42] and is a relatively low-cost tool to explore "what-if" questions—e.g., to understand how different types of farmers might act once specific project interventions have been implemented. Most food security interventions already use a range of quantitative and qualitative methods to track key performance indicators but as suggested earlier, these do not normally include land use changes.

If a risk of cropland expansion into natural habitats is identified, different types of safeguards should be developed to de-connect agricultural intensification from expansion. The concept of environmental and social safeguards in development interventions and investments is well established. USAID's 2016–2025 Food Assistance and Food Security Strategy (Bureau for Democracy, Conflict, and Humanitarian Assistance) emphasizes the need

42 See e.g. Ornetsmüller et al. (2018) for an example from Laos, and https://africa-rising.net/serious-gaming-offers-insights-into-land-use-decision-dynamics-in-northern-ghana/ for one from Ghana. Serious gaming was also used by the Sentinel project to assess the risk of agricultural expansion in Ethiopia and Zambia—see Adolph et al. (2022a and 2022b).

to recognize and manage environmental risks. Similarly, the World Bank published its Environmental and Social Framework in 2016,[43] which provides the conceptual backbone as well as guidance on how to assess and mitigate environmental and social risks. "Do no harm to local natural resources including land, air, water, and biodiversity" is the first of five top Goals of Environmental Safeguarding mentioned for USAID food assistance.[44] From a natural resources or habitat protection perspective, an obvious entry point is strengthening the governance of these habitats and increasing the benefits that local people receive from them, for example via eco-tourism.[45] However, safeguards for unintended land use changes triggered by agricultural development interventions are a 'new territory,' and so far, it appears that there is very limited experience, let alone guidance, available on how to design and implement such safeguards from an agricultural angle. Farmers who participated in the serious gaming exercises in Zambia[46] suggested that support to increase agricultural productivity (such as input subsidies and advisory services) could be made conditional to farmers not expanding their fields into natural habitats. However, the challenge here is how to enforce such a rule, in particular after the end of the intervention. More experience is needed with such safeguards, and USAID-funded food security interventions could contribute to this body of knowledge through careful monitoring of what works and what does not in different local contexts.

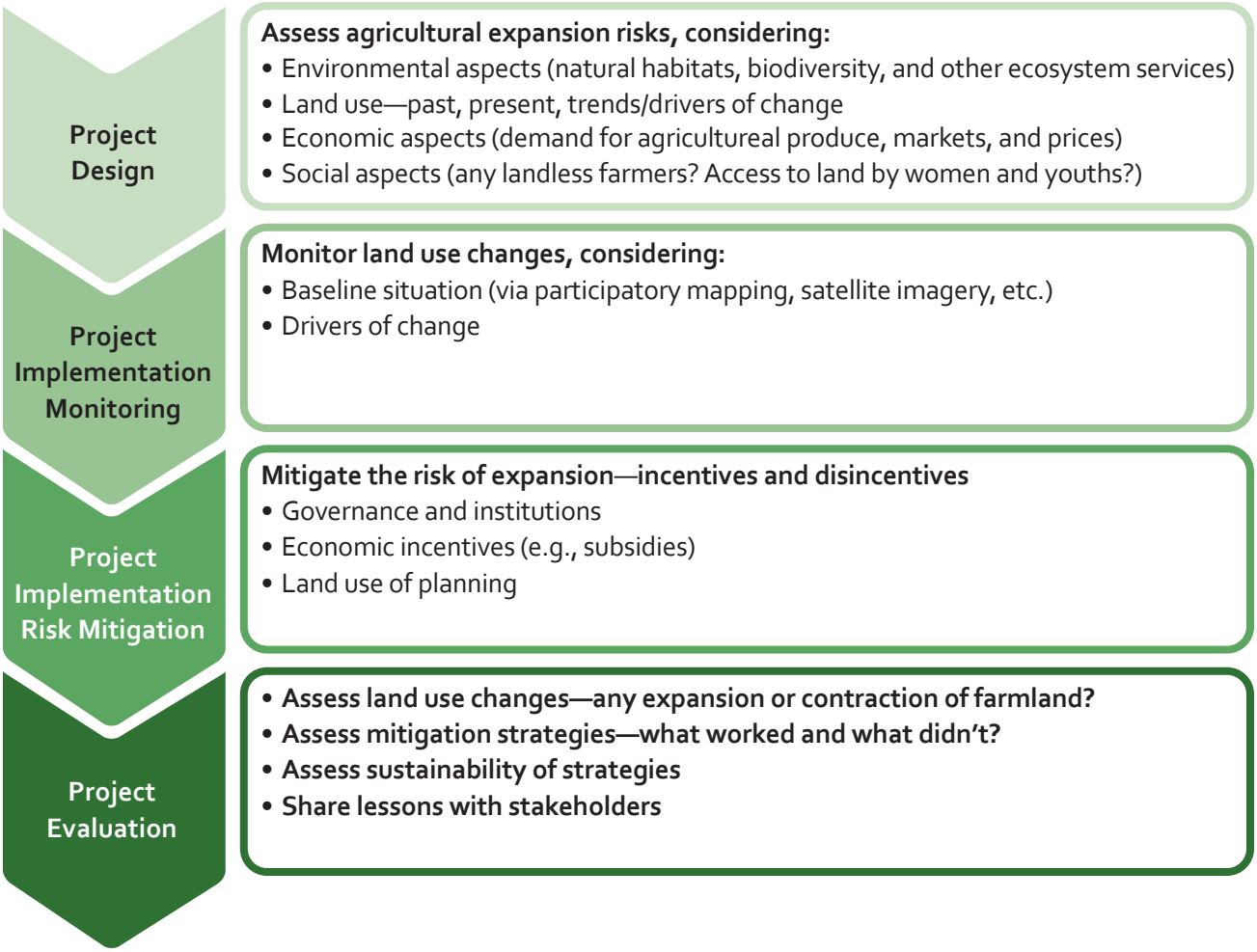
Photo credit: Sasha Myers / Save the Children

Managing agricultural expansion requires locally driven land use planning within a national land use strategy. Considering the drivers of cropland expansion in SSA outlined earlier, the conversion of more natural habitats into cropland seems almost inevitable. However, the decision on which habitats should be protected 'at all costs,' which may be suitable for a 'land sharing' approach to agriculture, and which can be converted to intensive cropland without significant losses of other ecosystem services, requires strategic considerations at national level—and perhaps even regionally. Most countries in SSA are still far from designing and implementing such a strategy, as land use strategies may lead to tensions between sectors and line ministries, given their development and implementation require substantial resources. Local level, bottom-up land use planning has been piloted in several countries, including in Ethiopia, with support from the International Water Management Institute (IWMI),[47]

43 World Bank (2016)
44 https://www.usaid.gov/food-assistance/partner-with-us/environmental-risk-management, accessed 2 November 2022.
45 Conservation Capital and Space for Giants (2019) argue that there is still a lot of untapped potential for nature-based tourism in Africa.
46 Adolph et al. (2022b)
47 Girma et al. (2020), https://siwi.org/ethiopia-water-and-landscape-governance-project/ (accessed 2 November 2022)

the German Federal Ministry for Economic Cooperation and Development (BMZ)[48] and the Swiss Development Cooperation (SDC).[49] Such locally led processes, within a supportive national policy framework, could result in a clearer and more transparent prioritization of land use which recognizes and negotiates trade-offs between different uses. The MEL data from agricultural and food security projects with regards to agricultural expansion could inform such strategies by contributing valuable local experiences and contexts. Food security projects could also liaise with national and local authorities to advocate and develop the capacity for inclusive land use planning processes that enable protecting areas of high ecosystem service value, while intensifying less vulnerable areas.

Figure 4: Identifying and addressing risks of cropland expansion in the project cycle



Conclusions

This paper has perhaps raised more questions than provided answers to the complex challenges surrounding agricultural expansion in sub-Saharan Africa. Agricultural expansion will continue—but steering it away from those habitats that are most valuable to people and planet, because they provide crucial ecosystem services, can perhaps prevent the worst damage. But even the decision on which ecosystem services are most important is a highly contested one, with different stakeholders likely to have different views.

Agricultural development is necessary, but it may have unintended consequences on natural habitats, in particular forests, that will affect both local communities and the planet overall. An awareness of the risks and monitoring their extent, whilst searching for appropriate 'safeguarding' strategies, is an important responsibility for agricultural interventions.

48 https://www.giz.de/en/worldwide/80804.html (accessed 2 November 2022)
49 https://cgspace.cgiar.org/handle/10568/99457 (accessed 2 November 2022)

Case Study 1: Cropland Expansion in South Kivu, DRC

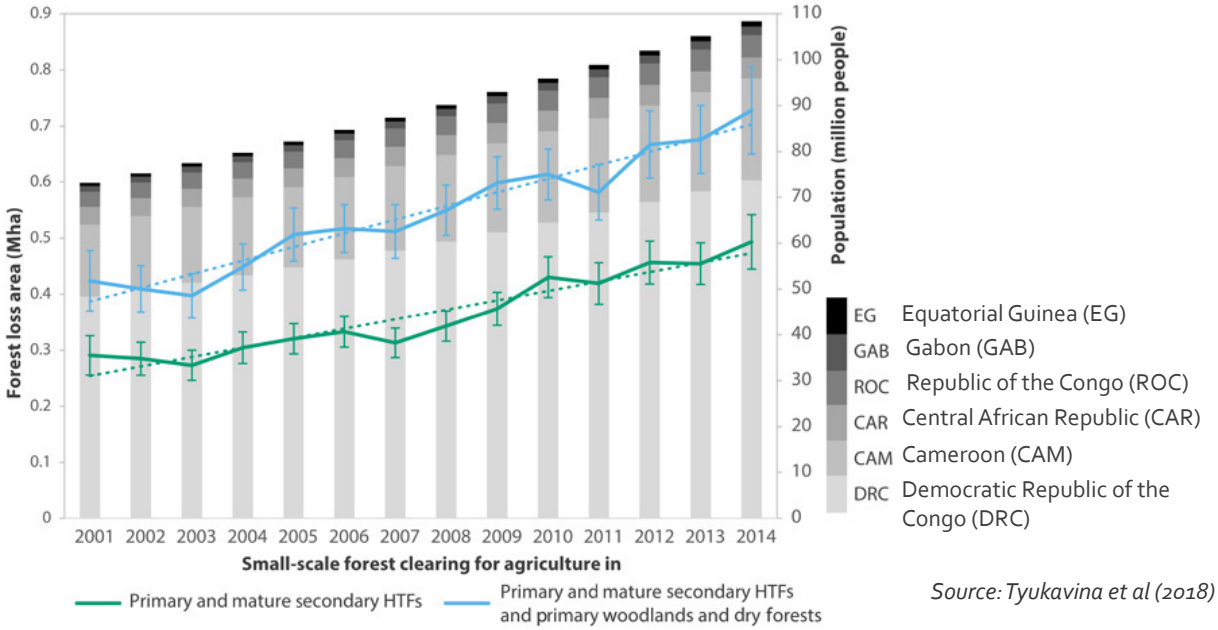
The Democratic Republic of the Congo (DRC) has one of the highest rates of deforestation in Africa. Most of the forest disturbance is caused by small-scale agricultural activities, mostly via shifting cultivation.[50] Cropland expansion, together with a growth of rural settlements and infrastructure, is resulting in an expansion of the "rural complex" (a characteristic land cover mosaic of roads, villages, active and fallow fields, and secondary forest), which contributes to fragmentation of forests. South and North Kivu provinces of DRC have the highest rate of growth of the rural complex in the whole of the country,[51] as well as high rates of food insecurity and conflict. A sample survey carried out by the South Kivu office of the World Food Programme (WFP) in 2019 found that 80.2% of households in Kalehe territory and 79.1% of households in Kabare territory were moderately or severely food insecure.[52]

USAID's Country Development Cooperation Strategy[53] therefore includes amongst its three development objectives "Inclusive, Broad-Based, and Sustainable Economic Growth Increased," via "sustainable management of forests and wildlife" and "improved agricultural productivity and profitability of selected value chains," amongst others.

The BHA-funded RFSA known as the South Kivu Food Security Project (FSP) operates in Kabare and Kalehe territories of South Kivu. An FSP scoping study[54] showed that the demand for farmland is very high in this area, fueled by population growth (including via influx of internally displaced people) and land degradation. There are frequent conflicts around land. According to Global Forest Watch, between 2000 and 2020 Kabare lost 2.67kha (or 1.7%) of tree cover, whilst Kalehe lost 18.4kha (or 5.5%).

Farmland degradation in the DRC. Photo credit: Barbara Adolph

Figure 4: Expansion of small-scale agriculture into recently undisturbed forests and woodlands and population growth in the Congo Basin by country



Source: Tyukavina et al (2018)

50 Shapiro et al (2021), Tyukavina et al (2018)
51 Molinario et al (2015)
52 WFP (2019)
53 USAID (2020)
54 Mercy Corps and APC (2017)

To address the challenges of land degradation, low agricultural productivity, and insecure land tenure in Kabare and Kalehe, FSP piloted between 2017 and 2022 the "Hill Approach." A recent review of the approach showed that it succeeded in rehabilitating degraded land and increasing agricultural productivity through soil and water conservation, improved farming practices, and negotiating longer-term, more secure tenure contracts for smallholder farmers.[55] By bringing degraded land back into cultivation, the Hill Approach may have reduced pressure on forests and other natural habitats in the project's intervention zones.

However, increasing the productivity and profitability of farming—by introducing / promoting improved farming methods and connecting farmers to markets—may have incentivized expansion of farmland overall. The project's MEL system tracked a range of BHA indicators but did not assess land use changes in the intervention zone. Could it be that the project was so successful in making farming more productive and profitable that it brought about further land use changes in the area?

Research in other parts of DRC showed that a "rebound effect" can occur where agricultural intensification has been supported along forest frontiers, even when coupled with initiatives to create awareness about forest protection.[56] It is therefore important to include land use change in the MEL frameworks of agricultural development projects, so that mitigating measures can be taken by the implementing organizations. Measuring both productivity changes due to intensification and land use changes due to expansion would enable more effective adaptive management of interventions.

Farmland rehabilitation using resilience design principles. *Photo credit: Barbara Adolph*

55 Adolph (2022)
56 Nackoney et al (2022)

Case Study 2: Land Sharing and Land Sparing in the Ethiopian Highlands

Most of the remaining forest in Ethiopia is located in two regions of Ethiopia, which represented in 2010 71% of tree cover (Oromia with 5.45 Mha and the Southern Nations, Nationalities and Peoples (SNNP) region with 1.12 Mha). These two regions together experienced tree cover loss of 366 kha between 2001 and 2021—over 80% of the total tree cover loss in the country. The main driver of this loss has been shifting agriculture.[57]

Ethiopia's National Agricultural Investment Plan (NAIP) 2021–2030[58] continues the focus of earlier policies and strategies to increase staple food production through intensification and value chain development, whilst also putting a strong emphasis on export commodities (coffee, red meat, some horticultural commodities). A recent analysis of Ethiopia's agricultural, environmental and climate change policies[59] suggests a lack of coherence between policy objectives, with targets to develop land for commercial livestock farming and horticultural production at odds with targets to halve habitat conversion due to agricultural expansion.

To reduce the risk of losing the remaining forests to expansion of crop and livestock production, several development agencies have been working with local government and communities on these forest frontiers to support the development of alternative livelihoods. For example, Frankfurt Zoological Society is working in Bale Mountains National Park of Oromia regional state to protect this unique habitat from grazing, crop farming, and firewood extraction. Their interventions combine improving forest governance (via community-based organizations and rangers) with alternative livelihoods (sustainable tourism, beekeeping) and agricultural intensification (climate smart agriculture and livestock intensification in the area surrounding the park).[60] Whilst the forest governance component has been very successful, there are concerns that crop and livestock intensification is leading to a rebound effect, with some farmers increasing their livestock numbers, having experienced the benefits of higher productivity.[61]

In Kafa biosphere reserve, located in SNNP, the Nature and Biodiversity Conservation Union (NABU) used a different approach to reduce agricultural expansion. Arabia coffee originates from Kafa and the best quality coffee is grown in home gardens under natural forest trees. NABU worked with farmers and other value chain actors on local self-sustaining and environmentally friendly business models around the commercialized garden coffee value chain by developing new products, including organic Kafa garden coffee, organic cascara and coffee husk briquettes.[62] This 'land sharing' model, together with forest governance, has reduced, but not stopped cropland expansion in the area.

A garden coffee farmer in Adiyo woreda, SNNP, Ethiopia

Photo credit: Barbara Adolph

57 https://www.globalforestwatch.org/dashboards/country/ETH/, accessed 4 November 2022
58 Government of Ethiopia (2021)
59 Jeary et al. (2022)
60 https://fzs.org/en/projects/ethiopia/bale-mountains-national-park/, accessed 4 November 2022
61 Personal communication with project staff, October 2021.
62 https://en.nabu.de/topics/regional-development/coffee-novation/, accessed 4 November 2022

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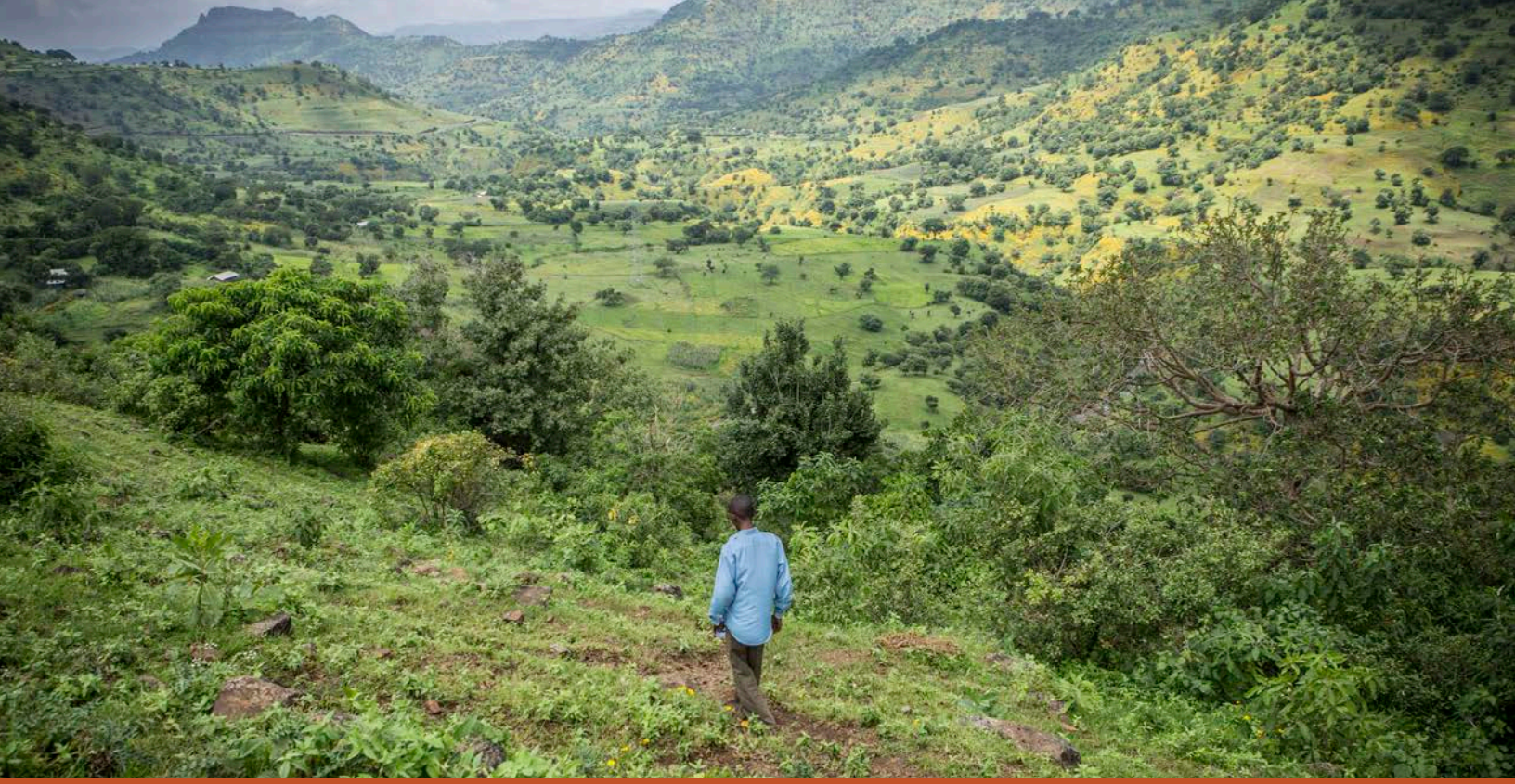

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Covers: Front cover photo by Barbara Adolph. Taken in October 2022 in Adiyo woreda, part of the Southern Nations, Nationalities, and Peoples' Region (SNNP) of Ethiopia, this picture shows recent agricultural expansion for cereal production in the forest of the Kafa Biosphere Reserve. Back cover photo by Colin Crowley/Save the Children.

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