

## More agricultural intensification, more deforestation? Recognising the risk of profitability-driven expansion of cropland in Zambia

Increasing agricultural production and productivity through intensification is the first objective of Zambia's Second National Agricultural Policy – but will intensification prevent further deforestation? This briefing explores the risks that it could bring about the opposite.

### Zambia's natural forests are shrinking

Agricultural expansion in Zambia has resulted in significant loss of natural habitats, including forests, over time. Zambia lost 3.82Mha (or 6.3%) of tree cover (with a canopy density of more than 10%) between 2001 and 2021, with shifting agriculture and forest fires being major drivers<sup>3</sup> – in addition to charcoal production and mining. Whilst this tree cover constitutes a relatively small proportion of Zambia's forests, it is very large in absolute terms and has affected human livelihoods in many ways. Worryingly, deforestation rates are on the increase. Despite an array of relevant national policies and strategies, there is currently no effective prioritisation of forests for conservation (outside formally protected areas) based on the extent and value of the ecosystem services they provide.

### Agriculture as a major driver of deforestation

Agricultural expansion in Zambia is driven by the ever-increasing demand for commodities, in particular cereals (maize) and meat for the domestic and export markets. Cereal demand is predicted to grow by a factor of 3.4 over the period 2010-2050,<sup>4</sup> thus further increasing the pressure on forests. The main reason for the initial cutting of trees may well be charcoal production, but the cleared land is then used for crop and livestock production. Whether or not farmers choose to expand their farms into forests and woodlands depends on a range of factors,<sup>5</sup> including the effectiveness of local governance mechanisms, the presence or absence of alternative income-generating opportunities, and the productivity and profitability of agriculture.

### Key lessons

Agricultural intensification programmes operating near biodiversity hotspots need to carefully monitor changes in agricultural land use to identify and address risks associated with intensification-driven expansion.

Investment in livelihood opportunities other than farming is needed for both poorer and better-off farmers to reduce the risk of profitability-driven expansion of farmland.

Inclusive and effective forest governance is necessary to prevent agricultural expansion into forests with a high ecosystem value, ideally as part of a land use planning process.

### Background

With Zambia's population expected to double between 2020 and 2050,<sup>1</sup> significant increases in the production of staple food crops are needed. So far, much of this increase has come from expanding areas under cultivation, at the expense of natural forests. Agricultural intensification could enable Zambia to achieve future food self-sufficiency without further area expansion,<sup>2</sup> but this depends on farmers' decisions to intensify and/or expand.



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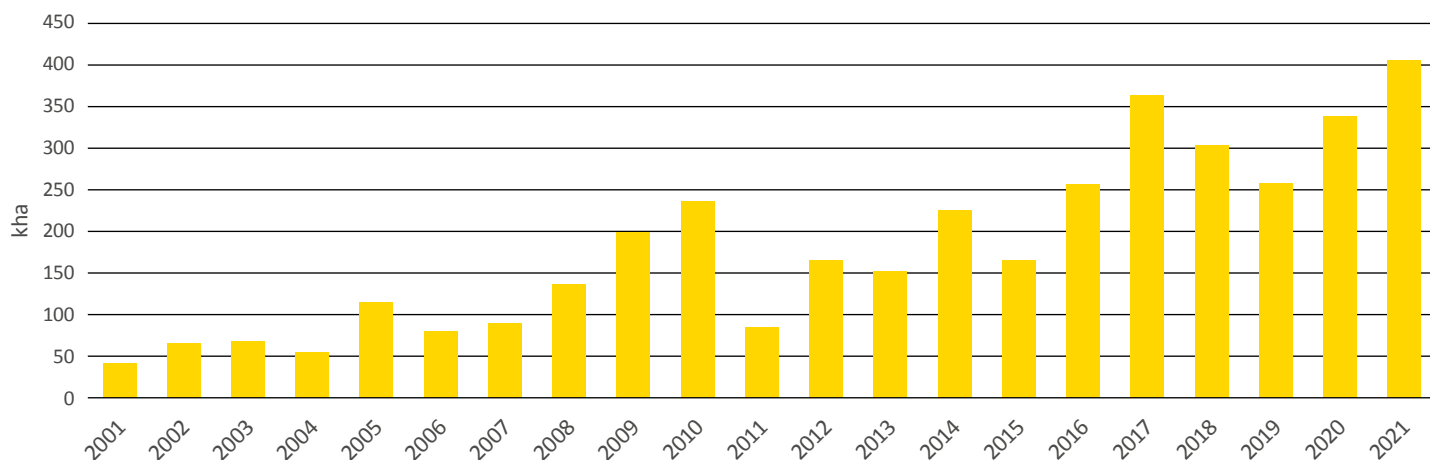


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# More agricultural intensification, more deforestation?

**Figure 1: Tree cover loss in Zambia [canopy density >10%]**



Source of data: Global Forest Watch, [www.globalforestwatch.org/dashboards/country/ZMB](https://www.globalforestwatch.org/dashboards/country/ZMB)

## Reducing agricultural expansion through agricultural intensification – the answer?

Zambia's Second National Agricultural Policy<sup>6</sup> emphasises the need to increase agricultural production and productivity through intensification. This includes the use of improved crop varieties and livestock breeds, as well as fertiliser, irrigation, mechanisation, and market development. Together these are expected to increase the productivity, efficiency, and profitability of agriculture. The policy does not explicitly mention agricultural expansion, but it promotes sustainable land management technologies, afforestation, community woodlots and agroforestry.

Agricultural intensification is expected to reduce the expansion of farmland – an assumption shared by many of those researching sustainable intensification in Africa.<sup>7</sup> If only farmers were able to produce more on their existing land, they would not need to expand their farms, goes the saying. Hence, productivity-enhancing technologies – using either agroecological or agro-industrial approaches, or a combination of both – are expected to reduce, or even halt agricultural expansion, and help protect existing forests and natural habitats.<sup>8</sup> However, it is difficult to

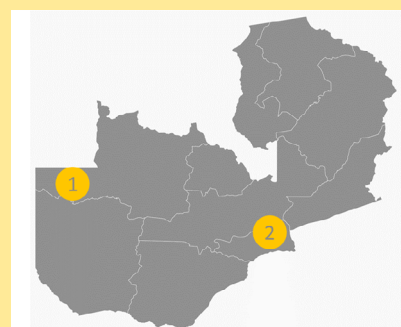
know whether this strategy would work as expected in a specific context, as farmers' decision-making processes are complex.

## Understanding household level choices: using 'serious gaming' to understand 'what-if?'

We wanted to know how increasing agricultural productivity would potentially influence the land use decisions of smallholder farmers in Zambezi and Katete districts. Would the assumption that increased productivity will result in reduced expansion hold? When we asked this question during a socioeconomic survey in 2019, we found that conventional socioeconomic research methods, such as questionnaire surveys or semi-structured interviews, which ask farmers directly about their past or potential future choices, have limitations. First, farmers were reluctant to discuss their own (or their household's) decisions related to agricultural expansion into forests or protected areas for fear of reprisals or sanctions – as farming in these areas is often illegal (even though governance mechanisms are not very effective, and sanctions are not necessarily enforced). Second, the extent of agricultural intensification in these communities was relatively low, with most farmers using relatively small quantities of

### Box 1: The study sites

This research was carried out in two locations: a community in Zambezi district of Northwestern province (1) and one in Katete district of Eastern province (2). In Zambezi, the main crops are cassava, maize and beans, grown under a slash and burn cultivation system. In Katete, maize is the main food crop, whilst groundnuts and (more recently) soya beans are grown for cash. In both locations, livestock production (cattle and goats) is an important source of income for better-off farmers.



# More agricultural intensification, more deforestation?

external inputs (improved seed, fertiliser, or agrochemicals) or agroecological practices (compost, integrated pest management, integrated soil fertility management, agroforestry, etc). It was therefore difficult for them to respond to a question such as “if you were able to increase your agricultural productivity and profitability, would you continue expanding your farmland?”.

To overcome these challenges, we used a ‘serious gaming’ approach. A serious game is an application (computerised or not) that combines serious aspects (teaching, learning, communication, research, marketing, etc) and playful aspects.<sup>9</sup> Serious gaming methods have been used by social researchers to explore real-life problems in a playful manner, with an emphasis on experiential learning (learning by doing). We selected this approach to de-personalise the land use decisions, with farmers playing a fictional

household in a fictional (but plausible) future world. This enabled farmers to ‘experience’ (in the game) a scenario that they have not experienced before, and to react to it without fear of sanctions. The game involved a highly simplified simulation of the farming system to enable focusing on key decisions related to expansion.

Box 2 explains the game design, which was also used in a similar way in the Sentinel research sites in Ghana and Ethiopia.<sup>10</sup> The insights gained from the game go beyond the actual choices made by farmers (such as expanding or not expanding, adopting certain intensification options or not) and included an understanding of their motivations and influencing factors. We were able to observe and record conversations to capture motivations and influencing factors between players from the same fictional household during the game.

**Box 2: A game to understand farmers’ agricultural expansion choices**

The game was designed to simulate a situation whereby farmers were able to intensify their crop production, and if they did, to see whether they would continue expanding their farms. Participating farmers played several rounds of the game by allocating resources on a fictional farm. Each game round was equivalent to one main cropping season. The game focused on the main food and cash crops grown by all farmers in the area (maize and soyabeans in Katete, cassava and maize in Zambezi). The declared aim of the game was for a farm household to feed all its family members and meet basic household cash needs. Maximising household income was not a declared game objective, as the facilitators did not want to explicitly incentivise market-driven expansion.

There were twelve participants (farmers) participating in each game, working in pairs of two, resulting in six pairs. Each pair of participants formed one fictional farm households (a ‘player’ in the game). Each player was given a specific amount of land and family labour (household members) at the start of the first round. Players sat around a large table, with each having a board in front of them with all game materials (see photo below). All game parameters (these include the amount

of land per household for different types of household, the household size, the required food and cash per family member to ensure household food security and meeting of basic needs, types and size of farmland, the level of production per unit area on different types of land – both existing farmland and newly cultivated land in the forest – under low and high levels of intensification, the crop prices at the time of harvesting and later in the season, the costs of inputs (intensification ‘packages’, labour costs) were kept as close as possible to the actual situation in the location. This process of ‘calibration’ was carried out with local key informants (agricultural extension workers, local government) before the game.

To ensure that different types of households (in terms of wealth category) were included in the game, the six players received different resources (number and types of plots, family members) at the start, with two each representing poor, medium and better-off households, respectively. Players were given names corresponding to the colour of their farm / household and these names were used throughout (eg below the farm of the ‘blue farmer’) to emphasise anonymisation.

Players were asked to allocate their land, labour and financial resources (the latter obtained from crop sales or wage labour during previous rounds) during each round in the way they thought would best help them achieve their objectives. This included the option to expand their farms into the forest (an area in the middle of the table, accessible to all players), subject to certain risks or sanctions. The ‘rules’ for each round are shown in Table 1.

During each round, farmers’ choices and discussions were recorded. After the game, all players discussed the game outcome and insights with the facilitators. In addition, a separate debriefing was held with each player (pair of participants) to discuss their specific choices and the motivations behind them.





# More agricultural intensification, more deforestation?

**Table 1: Game rounds**

	Narrative	Purpose
1	Everything is like the <b>current situation</b> in terms of production, yields, prices, forest protection, etc – but there are no options to intensify production.	This is the warm-up round – for everyone to familiarise themselves with the game and for final calibration of parameters.
2	<b>Intensification:</b> Introduction of an attractive ‘intensification package’ for the main crops that requires additional capital and labour (as compared to traditional management) but increases yields significantly.	This is designed to enable / incentivise farmers to intensify and increase the profitability of their farming activities.
3	<b>Introduction of soya beans</b> (Katete only): Farmers could now choose to grow maize and / or soya, using traditional methods or intensification. <b>Increase in the price for maize and cassava</b> (Zambezi only) because of an increase in the demand.	As soya had emerged as a main crop in Katete, we had to include it in the game.
4	‘Jump to the future’ (Katete only): It is now five years later, and family sizes have increased, but the farm size has remained the same. Both crop and input prices have increased (but in a way that is advantageous for farmers) and marketing has become easier, with good access to markets for farmers.  ‘Ban on expansion into the forest’ (Zambezi only): The government has observed a significant reduction in the forest cover due to increased agricultural expansion into the forest. It has introduced a ban on expansion and punishment for non-compliance.	This is intended to generate a situation whereby farmers need to decide whether to invest income from intensified agriculture in expansion or in other activities.  To see whether forest protection will reduce expansion.

## Game outcomes

Farmers understood the game very quickly and played it enthusiastically – they told us at the end that they learnt a lot from it. Table 2 shows the main decisions and outcomes in terms of: (a) whether farmers expanded or intensified their farms; and (b) what result they achieved in terms of income from crop/livestock sales or hiring out labour at the end of each round. Red numbers indicate deficits.

During the first ‘business as usual’ round, most players were only just able to meet their household’s food needs, with poor farmers in Katete ending up with a net deficit at the end of the round. Once the intensification option was introduced in round two, all farmers intensified production on at least part of their land and all farmers in Katete started growing soyabeans.

In both sites, some players expanded their farms in rounds two to four. In Katete, these players explained their decision as being motivated by an opportunity to increase income by investing profits from agriculture in the only opportunity they considered viable in their location: increasing their agricultural production. In Zambezi, all farmers expanded in round three, when prices increased – adopting intensification **and** expanding farms were effective strategies to increase incomes. This is an indication that, besides the well-documented ‘poverty-driven expansion’ to meet basic household needs, intensification (leading to increased profitability) can also incentivise expansion. This only stopped

in round four, when forest protection increased, and expansion became riskier.

In both sites, farmers were aware of the negative impacts of agricultural expansion on the environment and on human livelihoods,<sup>11</sup> but emphasised that they have few other options. In particular, in Zambezi, only a minority of farmers benefited from the Farmer Input Support Programme (FISP), and inputs were unaffordable and inaccessible for most farmers, thus hampering intensification of existing farmland and favouring extensive production of cassava in the forest, given that cassava is cultivated in newly opened fields. In Katete, inputs (improved seeds, inorganic fertilisers, herbicides and pesticides) are more readily available and used on both soya and maize, making cultivation less labour intensive (in particular the use of herbicides) and therefore potentially fuelling expansion.

During the discussions following the games, farmers in both sites suggested that making benefits from FISP and other support programmes conditional to not expanding farms could reduce expansion, whilst allowing farmers to increase the production on their existing plots. In Zambezi, farmers are keen to improve the processing and marketing of cassava, which is currently mostly grown as a food crop for home consumption. Making cassava production more profitable would increase the incentive to intensify it, but could also trigger further expansion. In Katete, farmers explained how the absence of alternative investment opportunities influences their decisions. Expanding agricultural

# More agricultural intensification, more deforestation?

**Table 2: Farmers' choices and outcomes**

Game round	Decision / outcome	Better-off households		Medium households		Poor households	
		Player 1	Player 2	Player 3	Player 4	Player 5	Player 6
Katete / Eastern province							
1	Expand or not?	No	No	No	Expand	No	No
	Cash left	5	4	3	3	-5	-2
2	Expand or intensify?	Intensify	Intensify	Both	Intensify	Intensify	Intensify
	Cash left	2	12	1	12	0	2
3	Expand or intensify?	Intensify	Intensify	Intensify	Intensify	Intensify	Both
	Cash left	65	66	68	62	13	68
4	Expand or intensify?	Intensify	Both	Both	Both	Intensify	Intensify
	Cash left	134	134	104	79	45	112
Zambezi / Northwestern province							
1	Expand or not?	No	No	No	No	No	No
	Cash left	1	3	1	3	5	16
2	Expand or intensify?	Both	Intensify	Both	Both	Intensify	Intensify
	Cash left	5	0	18	7	21	12
3	Expand or intensify?	Both	Both	Both	Both	Both	Both
	Cash left	136	69	121	52	66	124
4	Expand or intensify?	Intensify	Intensify	Intensify	Intensify	Intensify	Intensify
	Cash left	261	89	117	124	172	167

operations (both by intensifying and expanding farms) is often the only viable economic activity, whereas many farmers, in particular younger ones, would prefer to invest in off-farm businesses. Besides a lack of capital, a lack of access to electricity also hampers the development of such businesses.

## Discussion and way forward

The findings confirm that farmland expansion happens when farmers are unable to meet their growing household food requirements from farming small plots of degraded land. However, the results show that the increased productivity and profitability of crop farming that results from intensification can

also incentivise some farmers to expand their farms, under certain conditions. These include poor forest governance without law enforcement and a lack of alternative income- generation and investment opportunities. The findings suggest that intensification strategies to promote increased agricultural productivity may need companion strategies to protect forest ecosystems from expansion at the agricultural frontier.

Farmers in both sites considered the game to be a 'training exercise' that encouraged them to think through their resource allocation decisions in a more systematic way. For the researchers, the gaming methodology provided an entry point to discuss alternative scenarios with farmers, and how different factors (internal to the farm and external) affect farmers' motivations

# More agricultural intensification, more deforestation?

and decisions. The great strength of ‘serious gaming’ is that it creates a ‘safe space’, where researchers and farmers can discuss factors that influence the success or failure of interventions to reduce expansion, and their likely impacts on different types of households. It enables testing and discussing farmers’ own assumptions, such as making input subsidy conditional on zero deforestation could help reduce expansion into forests. Unlike in a standardised choice experiment, the actual game outcomes / farmers’ choices cannot be used to make quantitative predictions, for example about the proportion of farmers who would expand after intensification.

There is great potential for using ‘serious gaming’ to inform and help better manage trade-offs between competing land use objectives and thereby enhance the coherence and effectiveness of REDD+, forest conservation, land use planning, and food and agriculture strategies. Gaming could be used by local and national government actors to challenge their own assumptions about the effects of different policies and strategies on farmers’ land use choices. It could inform the design of programmes such as FISP that incentivise intensification, and that may require safeguards to prevent them from fuelling expansion.

There is clearly scope for improving the methodology, for example by playing it over several days to introduce more variations in subsequent rounds, or by introducing more game elements, such as different crop and livestock enterprises (and not only the main food crop). However, there are likely to be diminishing returns to farmers’ and researchers’ time investments.

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