



Land use and socio-economic trends in Mozambique and importance of Integrated approaches in addressing these trends

Results from an integrated land use simulation model



1. Introduction

The WB has been supporting during the last 4 years the Government of Mozambique in the development of information about current conditions of land/ landscape degradation, provide a better understanding of how land degradation may evolve in the future, and generate insights into how future trends in land degradation might affect the achievement of the Government's development outcomes. Two main resources have been made available:

1. Baseline on land degradation and drivers for the period 2000-2016
2. A prototype model and platform for simulating and evaluating land use and land use change processes (**LANDSIM-P**)

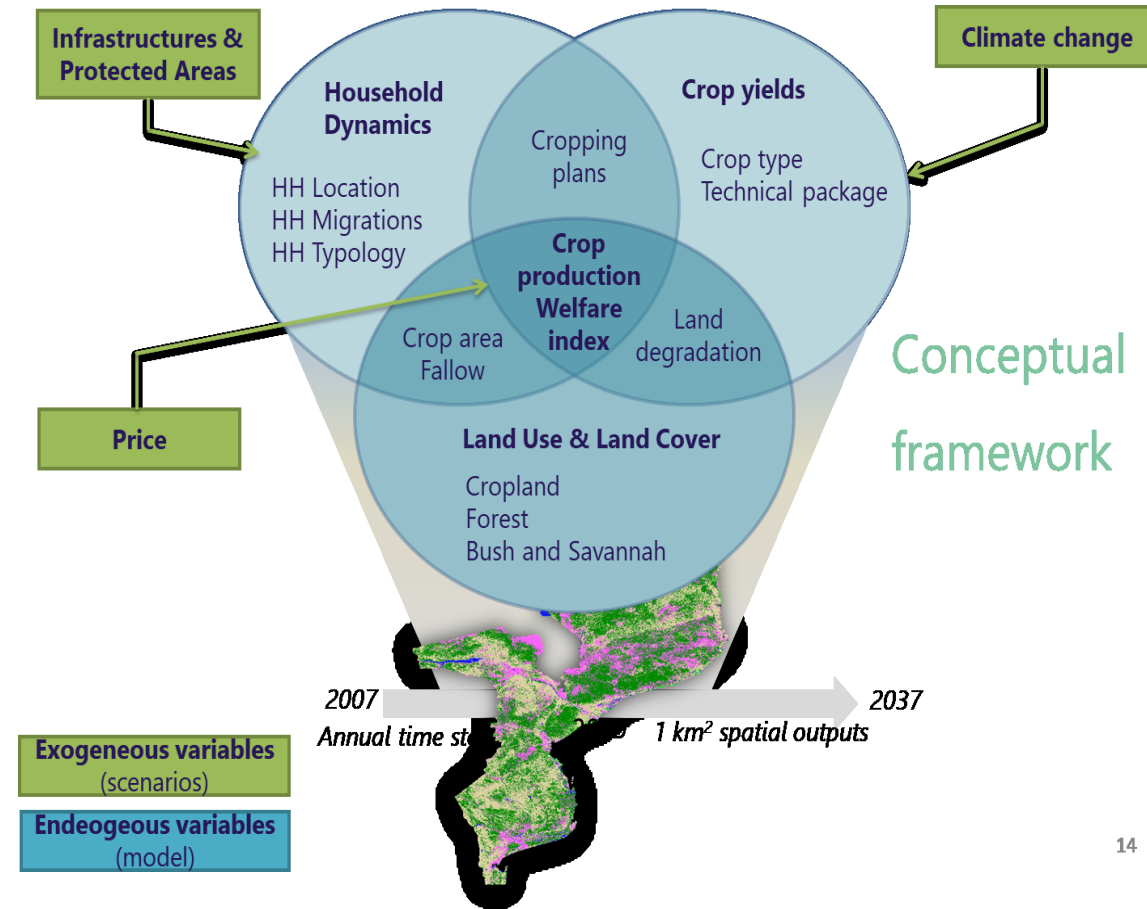
2. LANDSIM-P and scenarios simulated

LANDSIM-P enables the simulation of future household dynamics, crop yields, land use and household income in a number of scenarios which consider climate change, crop prices and interventions.

LANDSIM-P has been applied to model three different scenarios under a climate change scenario RCP 2.6:

- Business As Usual scenario (**BAU**)
- Agriculture intensification scenario (**AI**)
- AI + Forest Management (**AI+FM**)

Results of these scenarios are provided in the following slides.



3. Business as usual scenario



2019-2030

Mozambique

BAU

- Population growth continues as per historical levels (Birth rate 3.8%, Mortality rate 1.2%)
- No improved agriculture intensification or livestock improved feeding beyond observed levels
- Accessibility in protected area restricted at same level as historical
- Forest management of forests out of protected areas at historical levels
- Results are presented for the period 2019-2030 for the whole country

2019-2030

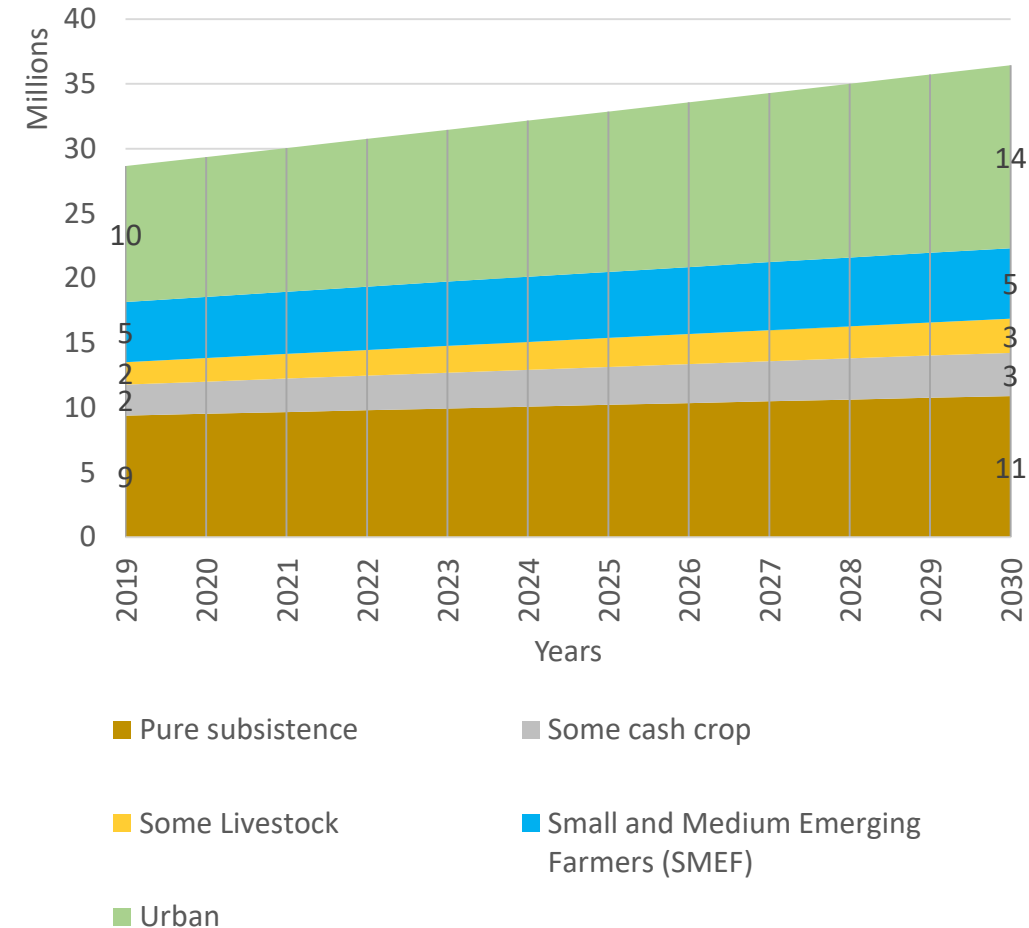
Mozambique

BAU

Population

- Mozambique's **population** would **increase by 34% to 36 million**
- Share of rural population would decrease due to migration to cities
- However, **rural population** would still **increase by 29% or 5 million**
- Population relying on pure **subsistence farming** would **increase by 20% or 1.8 million**
- This **increase in rural population** relying on farming will increase a **pressure over natural resources**

Population per household type



2019-2030

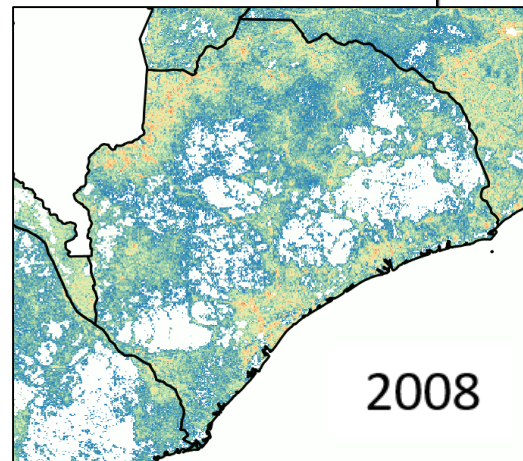
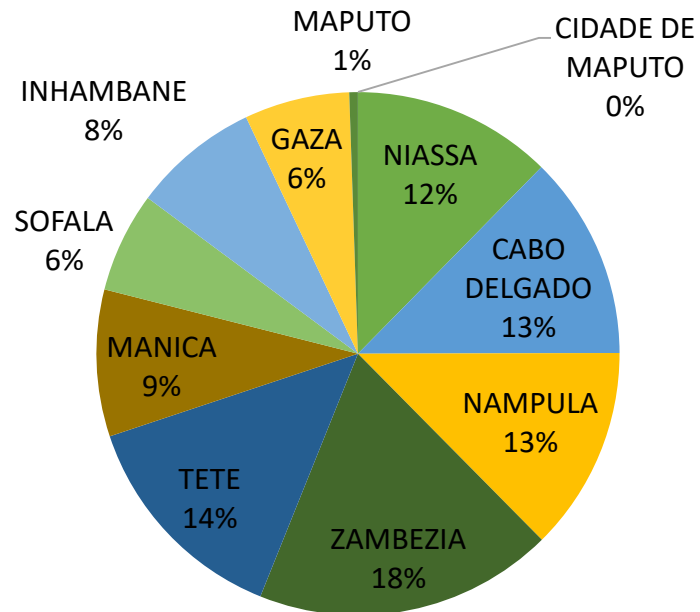
Mozambique

BAU

Population

- **Zambezia, Tete and Nampula: 45% of share to increase in total rural population**
- **Zambezia** would see a significant increase of over a **1 million**

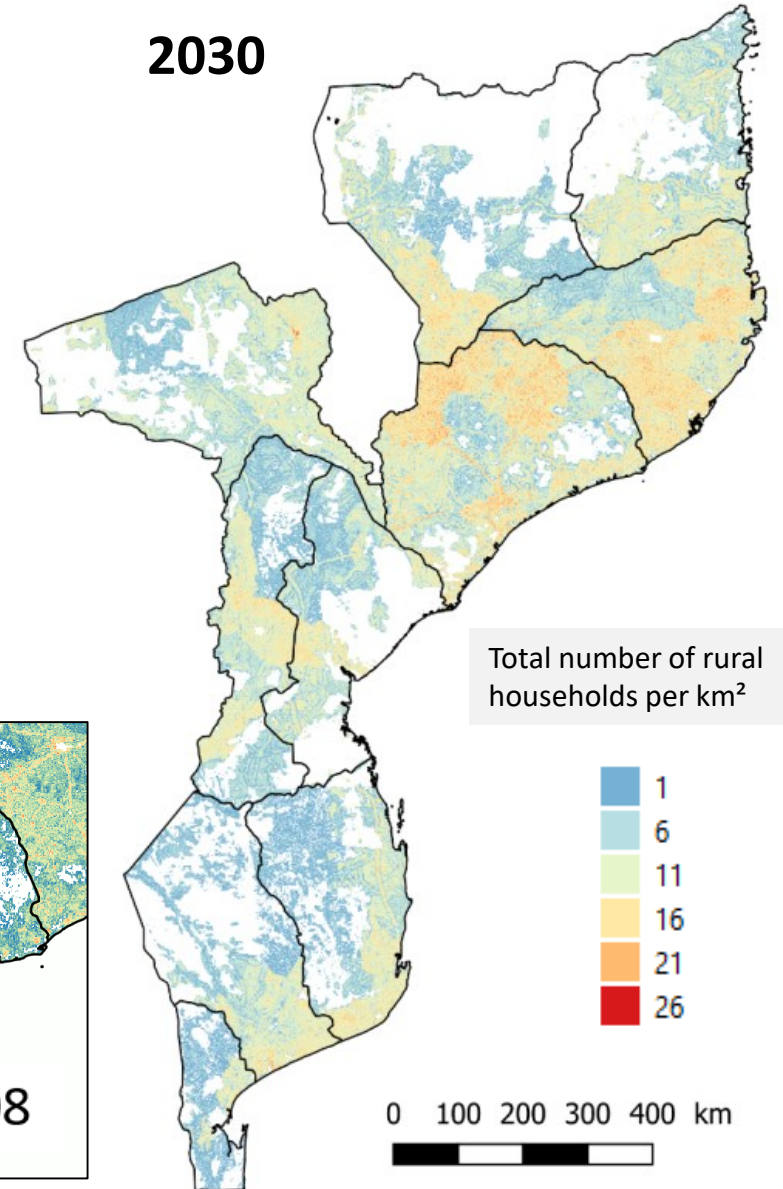
% contribution to increase in rural population



2008

Animated map

2030



0 100 200 300 400 km

2019-2030

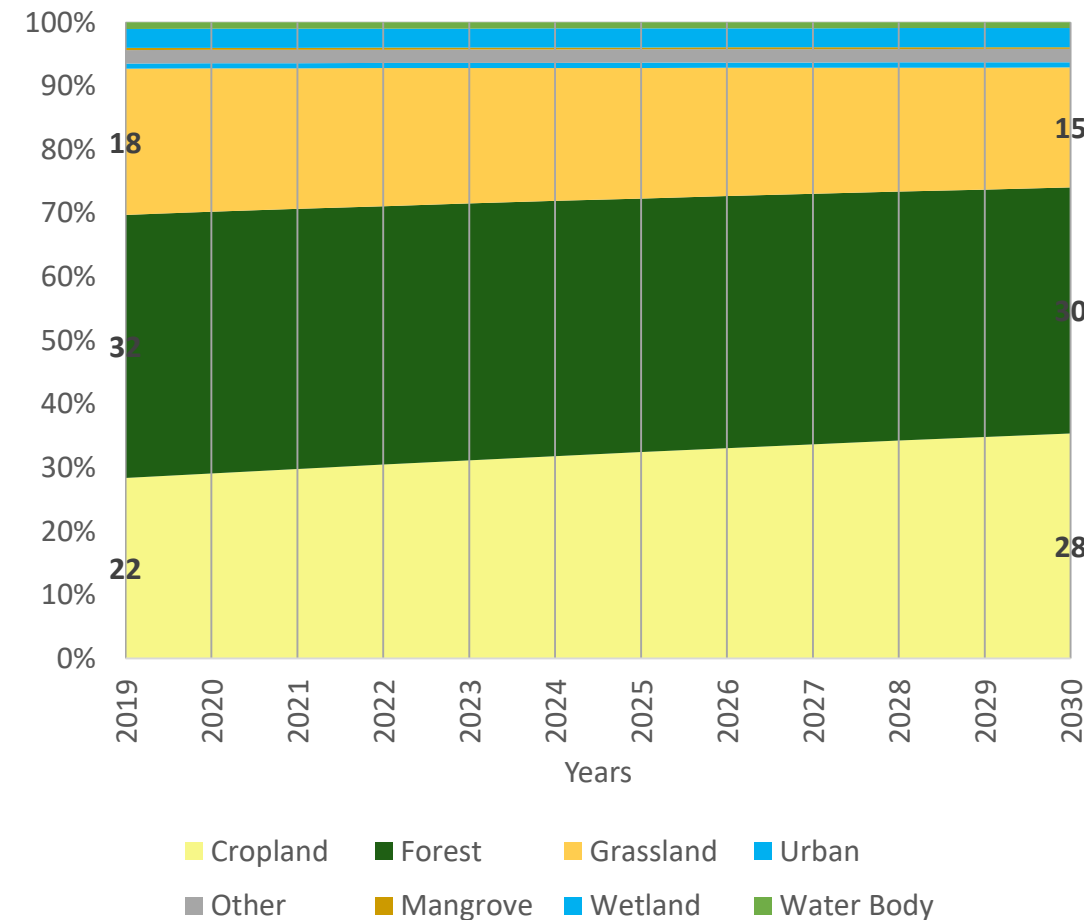
Mozambique

BAU

Land Use

- **Demand for agricultural land would increase cropland area, including fallows, by 6.4 million hectares, from 22% to 28% of total land**
- Cropland would mainly replace grasslands, including shrubland
- However, cropland expansion would also occur at the expense of **forests** that will be **reduced by 2.3 million ha, passing from 32% to 30% of the total land**

Proportion of land cover by Land Use



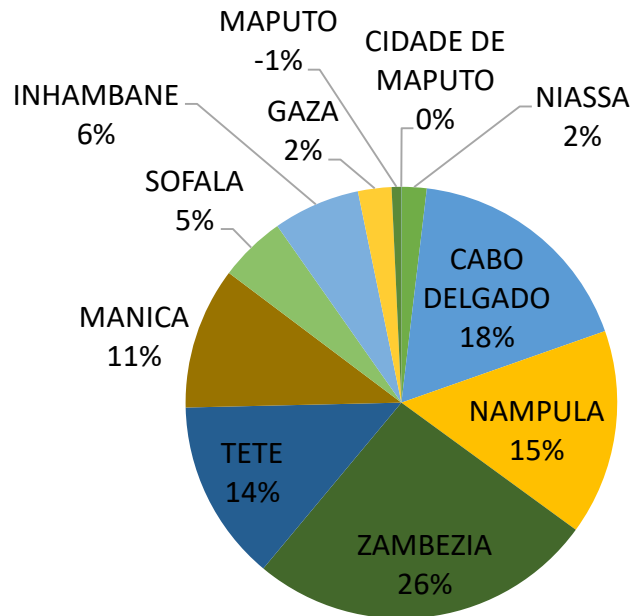
2019-2030

Mozambique

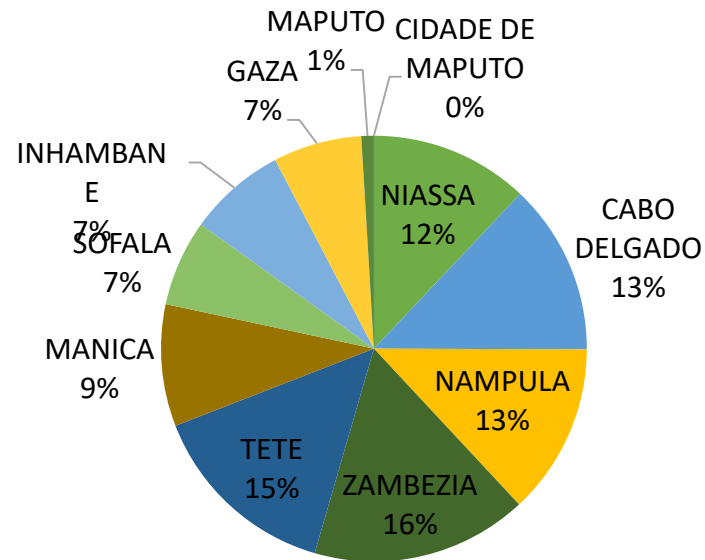
BAU

Land Use

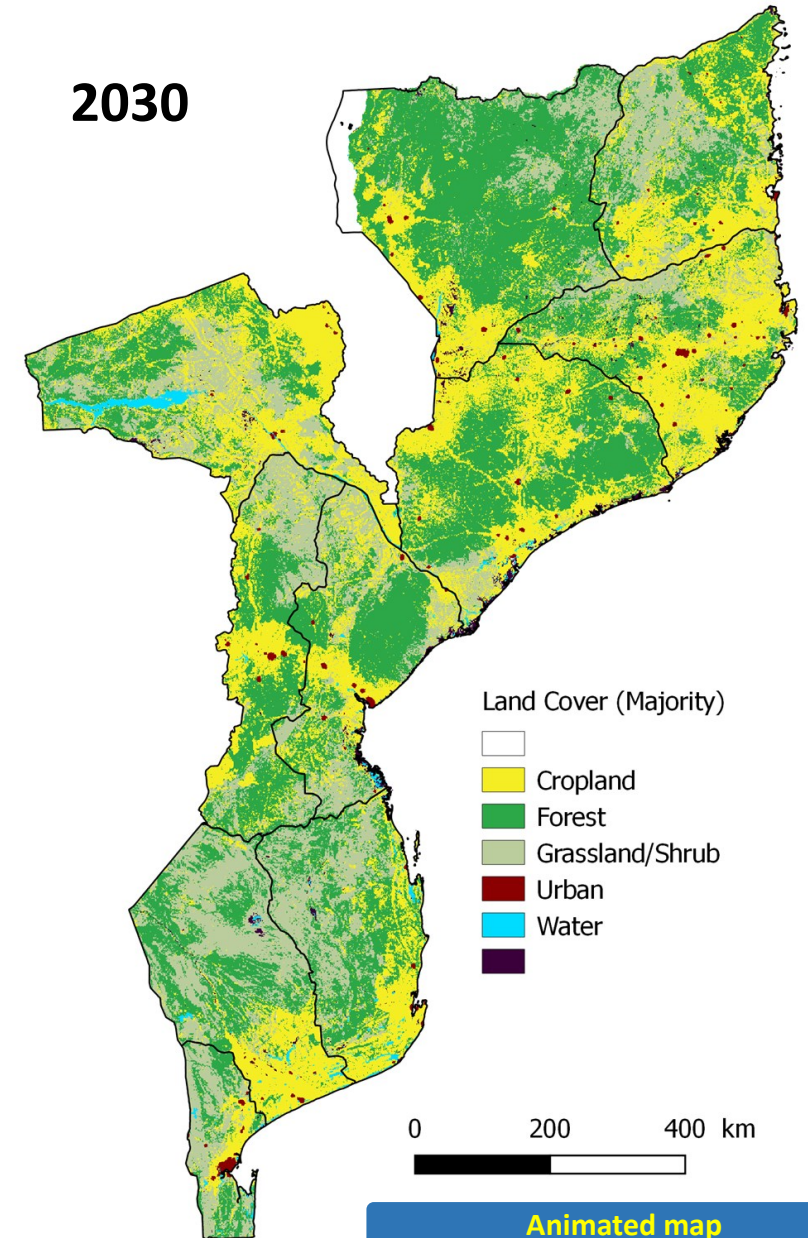
- 57 % of cropland expansion and 73% of deforestation concentrated in Zambezia, Cabo Delgado, Nampula and Tete
- Nampula will see the most drastic reduction in forest cover (-22%)



% contribution to deforestation



Contribution to cropland expansion



2019-2030

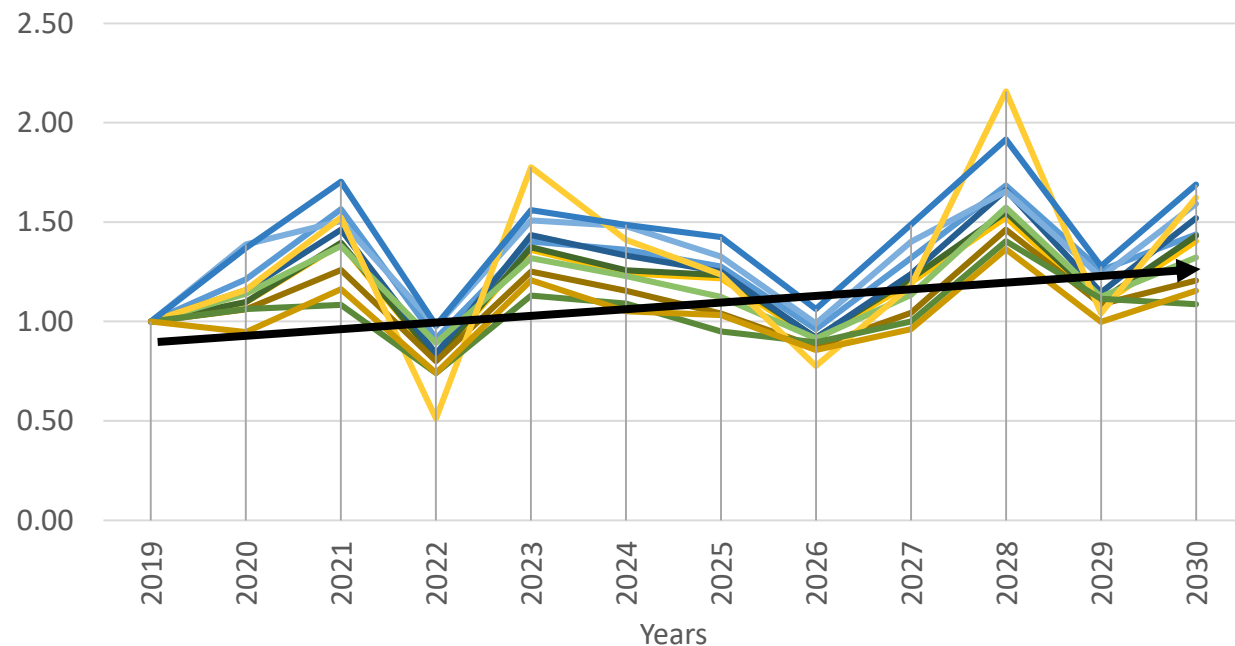
Mozambique

BAU

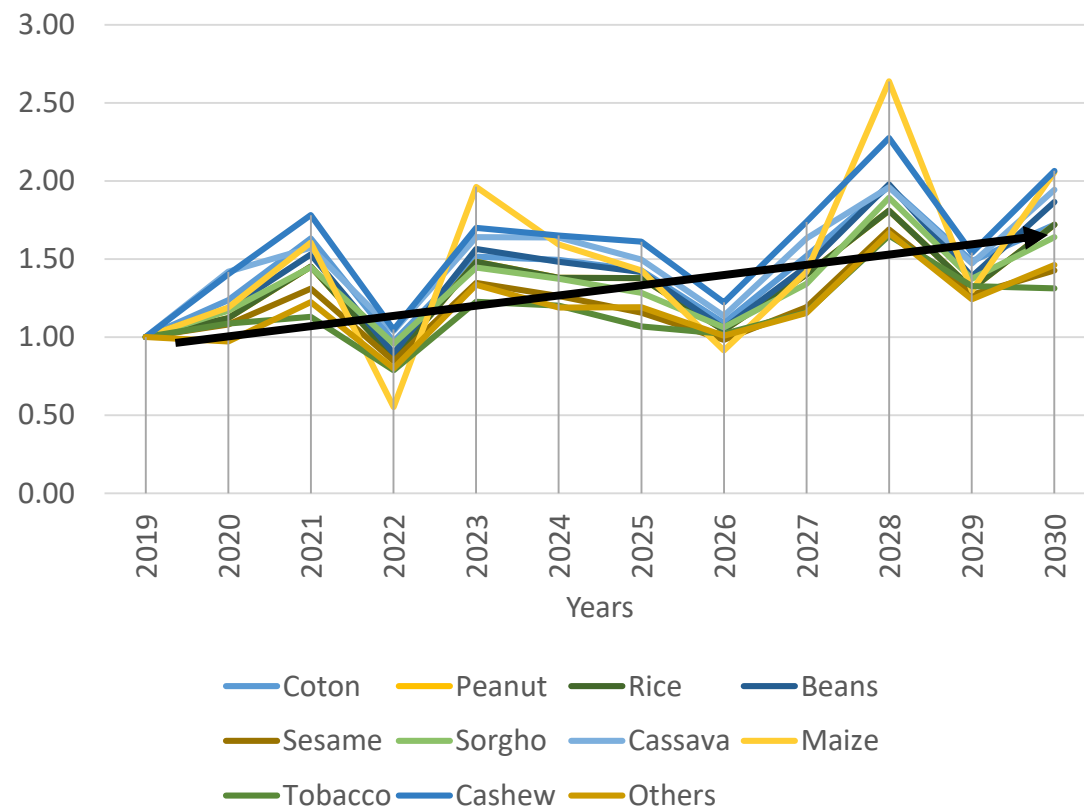
Agriculture
production

- **Agriculture output** would increase **50-100%** as a result of increased rural population
- **Yields** would increase by 10%-50%
- **Annual variations** remain **high**

Variation of annual yield per crop (base year 2019)



Variation of annual total production per crop
(base year 2019)



2019-2030

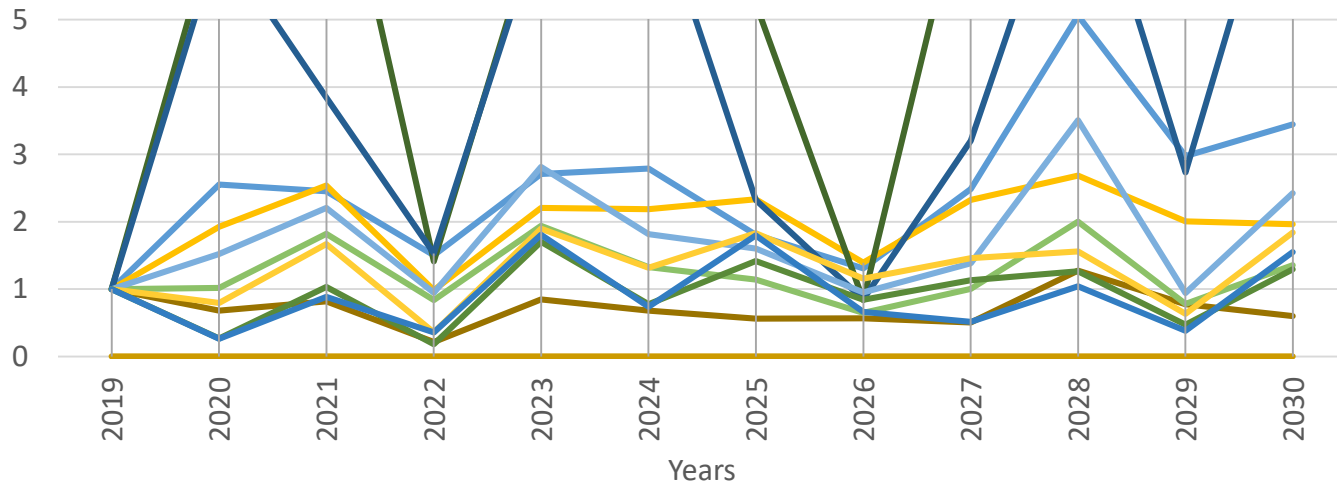
Mozambique

BAU

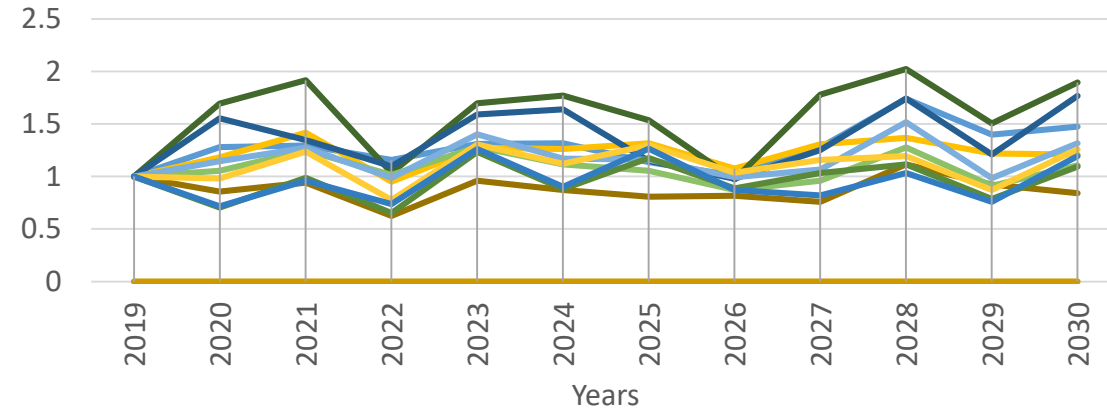
Agriculture production

- **Nampula and Zambezia: Highest increase in yields of cassava (80%), cashew (100%) and maize (400%)**
- **Maputo, Tete and Gaza: decrease in yields of around 10-20%**
- Annual variations remain high

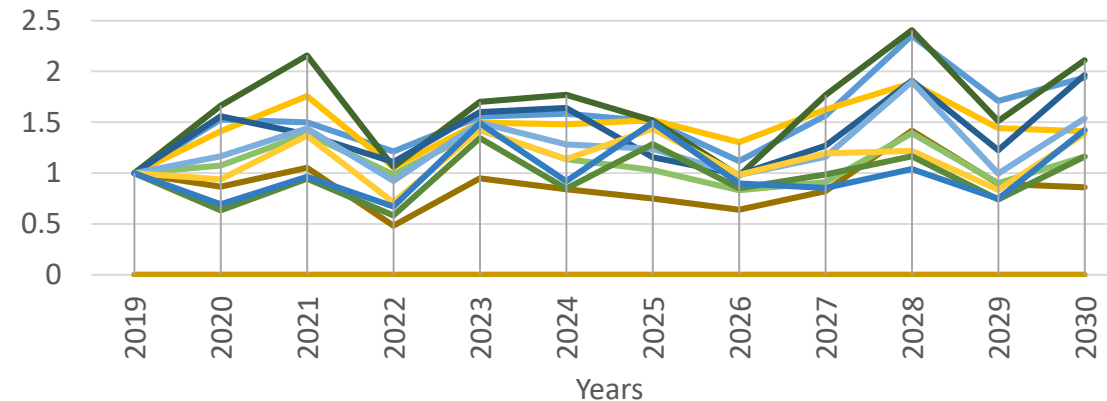
Variation of yield of MAIZE per province (base year 2019)



Variation of yield of CASSAVA per province (base year 2019)



Variation of yield of CASHEW per province (base year 2019)



— NIASSA
— ZAMBEZIA
— SOFALA
— MAPUTO
— CABO DELGADO
— TETE
— INHAMBANE
— CIDADE DE MAPUTO
— NAMPULA
— MANICA
— GAZA

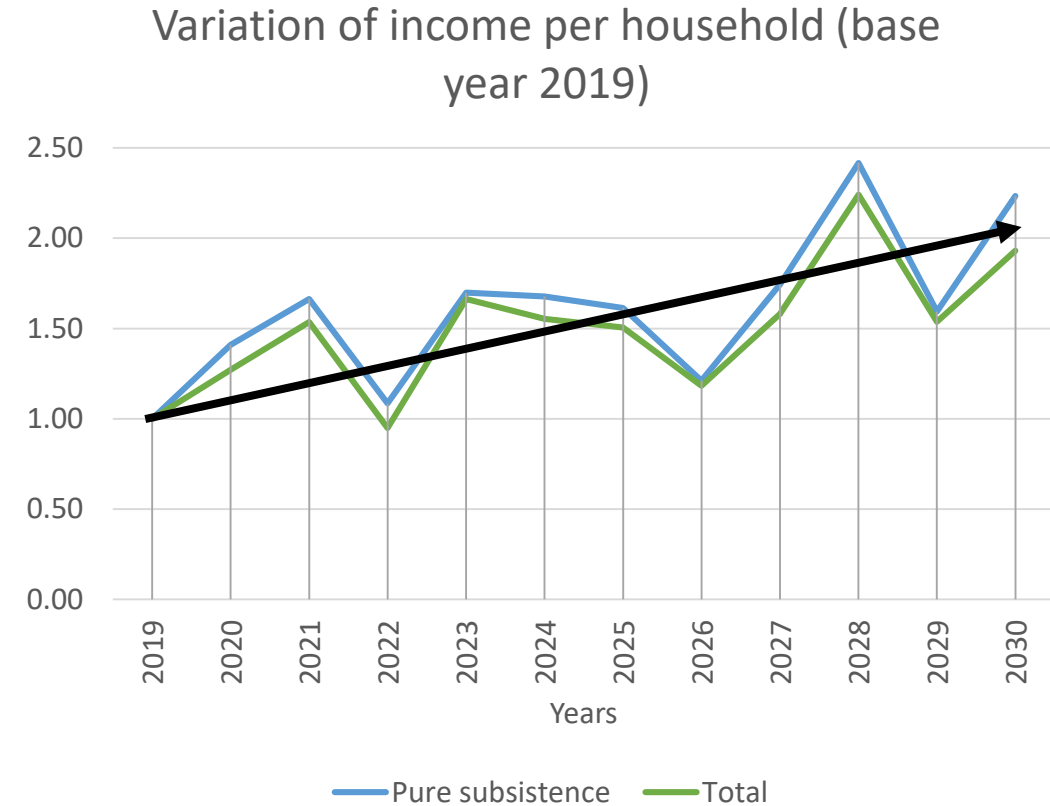
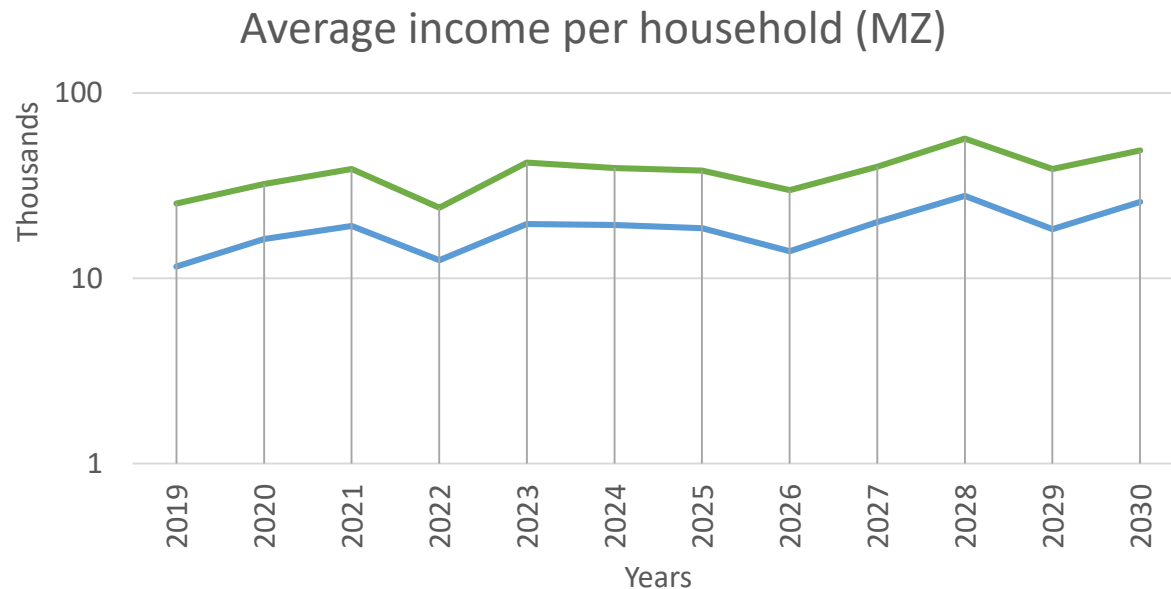
2019-2030

Mozambique

BAU

Income

- **Total income per household would double** as a result of increased yields and expected increase in prices
- However, **average income per household would remain low** due to the high proportion of subsistence farmers



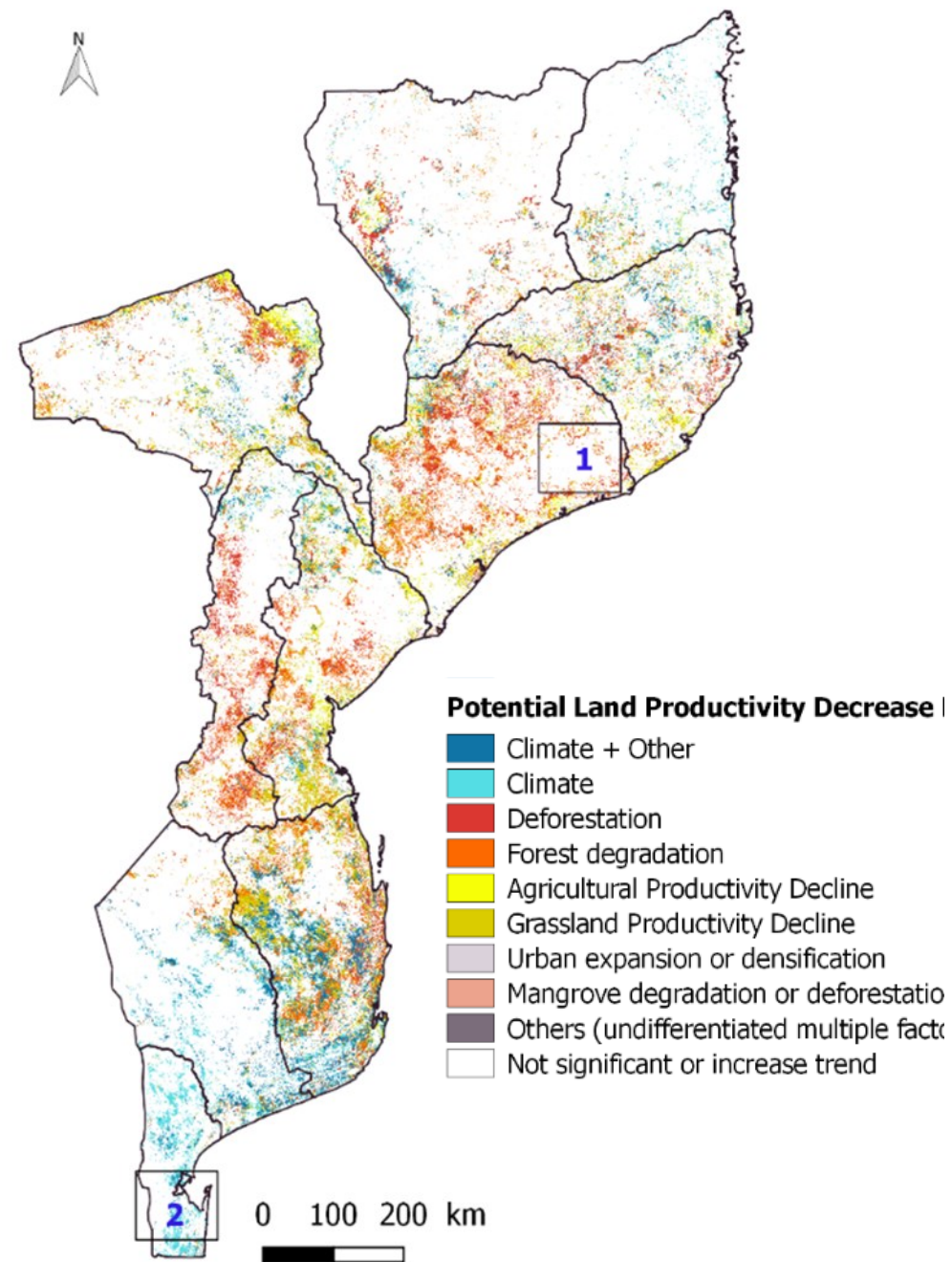
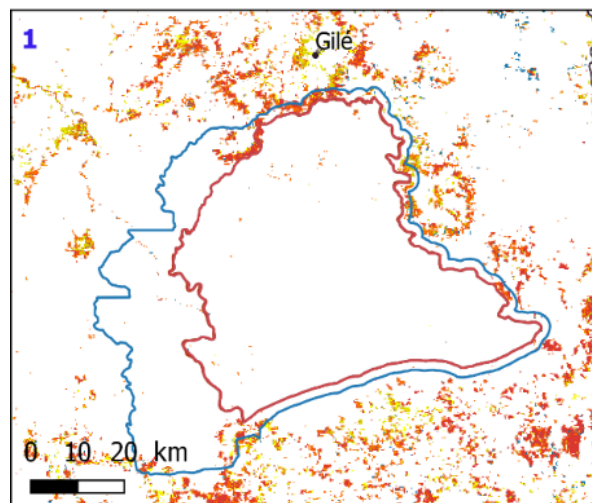
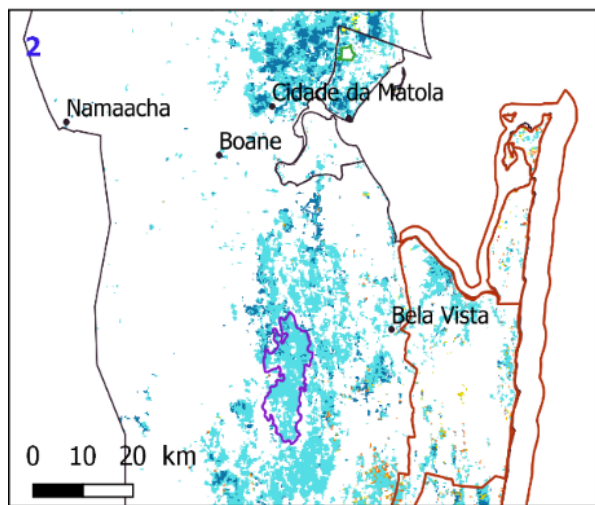
2019-2030

Mozambique

BAU

Climate Change*

- **4.6 million ha, 6% of national territory, have seen a decline in productivity due to climate related drivers**
- **Loss of productivity due to climate reasons mainly concentrated in Maputo, Tete and Gaza, precisely the regions where a decrease in yields is expected**



*Modelling of climate change not sensitive for such a short period. This analysis relies on historical data

Some conclusions

- Growth of rural population (5 million expected) is resulting in a high demand of agricultural land, specially in Zambezia, Tete and Nampula (45% of total increase)
- Cropland will increase (6.4 million ha including fallows) and forestland will decrease (2.3 million ha)
- Yields would increase in average (25-50%) as a result of higher rainfall and temperature due to climate change, except for Maputo, Tete and Gaza yields will be reduced (- 10-20%)
- Variability in yields will remain high
- Income per household will increase, but it will still be low due to a large share of pure subsistence households

5. Intervention scenarios

LANDSIM-P has been used to model the following intervention scenarios for the period of 2019-2025 in the area of the ZILMP

2019-2025

ZILMP

BAU

- Continuation of the historical trends
- Explained in the previous slides

2019-2025

ZILMP

Agriculture
intensification

- Technology is forest-friendly, i.e. does not increase the ability to convert forest areas
- Intensification occurs in all types of households in order to meet the targets of yield specified in MADER's Agriculture Development Plan 2019-2025
- Although SUSTENTA concentrates on SMEF, it is assumed that all household types benefit

2019-2025

ZILMP

AI + Forest
Management

- Same agriculture intensification as above
- Improved forest management and land use planning in areas under forest concession and simple licenses areas
- Forest concession and simple licenses areas have a permeability of double and triple of that observed in the protected area of Gilé

2019-2025

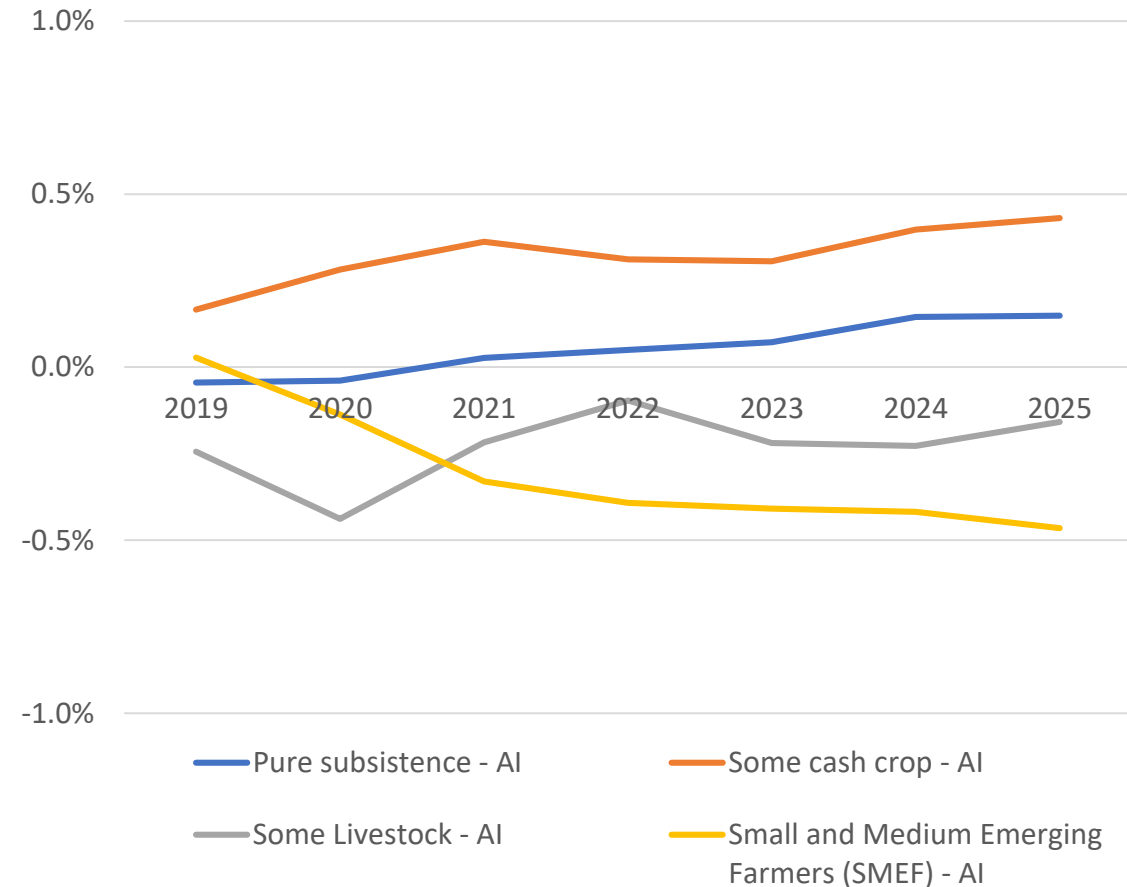
Zambezia
Program

Agriculture
intensification

Population

- **AI would increase the number people living in households with some cash crop**
- **Pure subsistence: Increased population** as a result of attractiveness of the area
- People under a household of **SMEF farmers** would be reduced (0.5%)
- Although these changes might be minor in terms of magnitude it is indicative of a trend

Relative difference in population per type between AI scenario and BAU



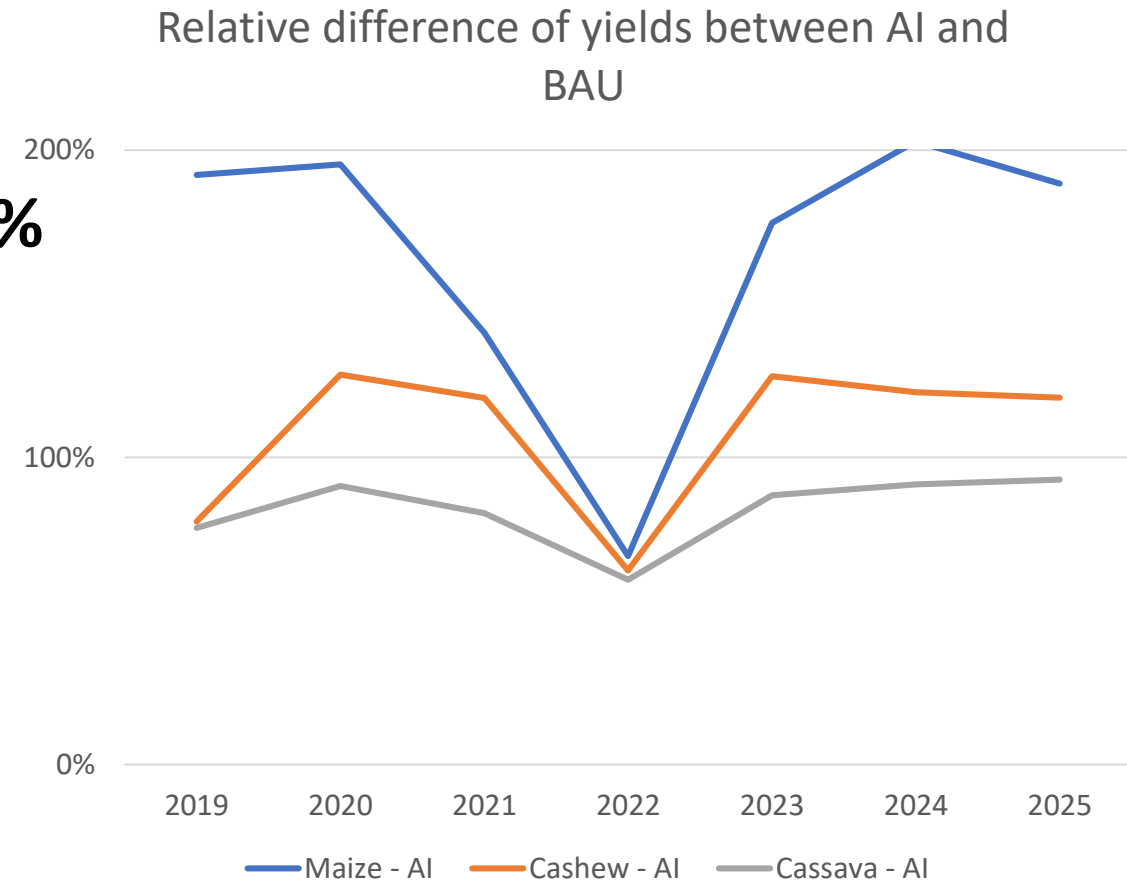
2019-2025

Zambezia
Program

Agriculture
intensification

Agriculture
production

- Total **production and yields would increase** for most crops
- **Yields of Maize** would increase **100 - 200%**
- **Yields of Cassava and Cashew** would increase by **70 -80 %** in average
- However, **large interannual variations**, specially in Maize



2019-2025

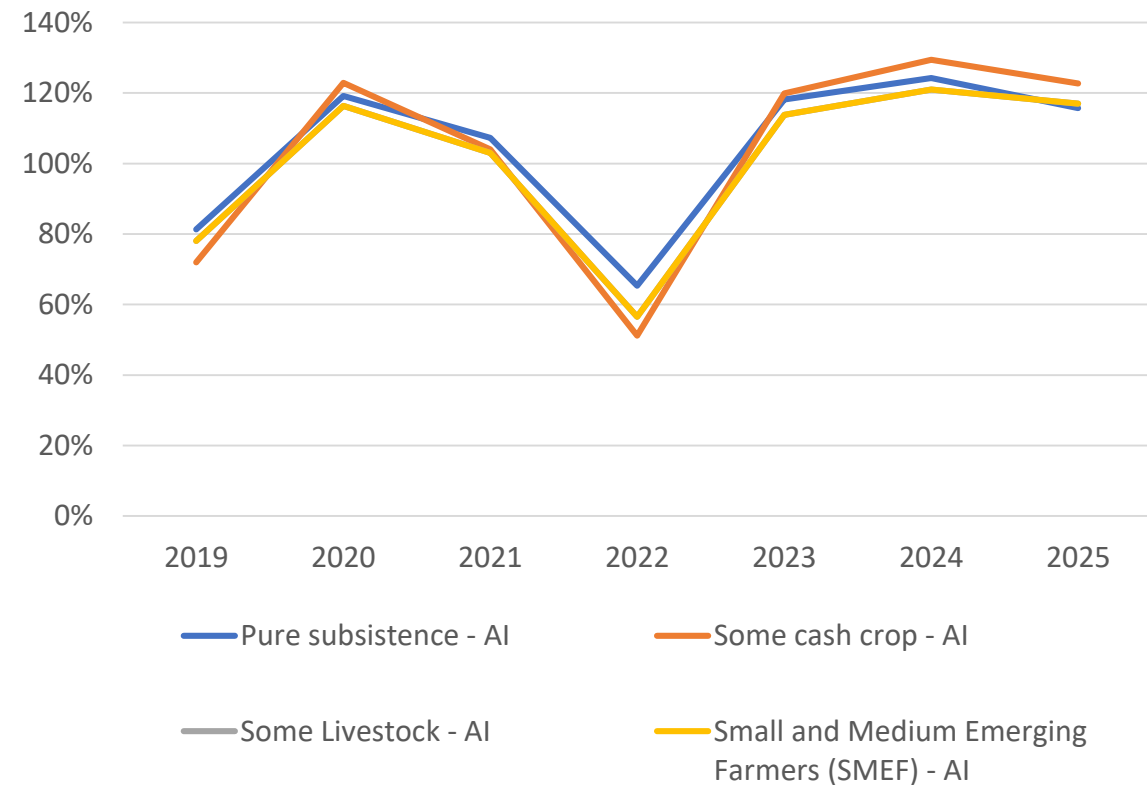
Zambezia
Program

Agriculture
intensification

Income

- **Increase in yield → Increase on income**
- **Income would double** in average
- It would **affect all household types**
- However, the latter is due to the assumption that IA covers subsistence drivers
- This might not be the case in some existing projects that target mainly SMEF (e.g. SUSTENTA)

Relative difference of total income per household type between AI and BAU



2019-2025

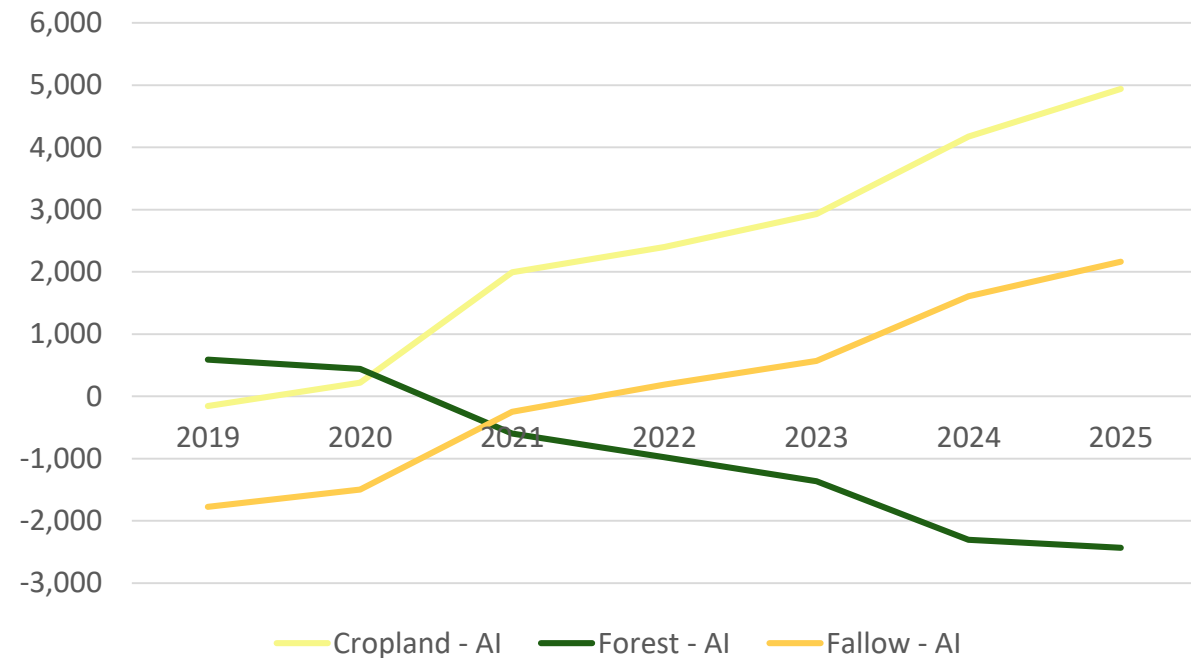
Zambezia
Program

Agriculture
intensification

Land Use

- **AI would cause an increase in cropland and fallow area over the BAU, i.e. 7,000 ha in total**
- In part this would impact **forest cover** which **would decrease by 2,000 ha**
- This effect would be explained by the attractiveness of the area to migration due to the increase in welfare
- This trend could be greater if technologies used were not “forest-friendly”, e.g. tractors

Absolute difference in land use area between AI and BAU (hectares)



2019-2025

Zambezia
Program

Agriculture
intensification

Some conclusions

- The greatest impact is the increase in yields and income of households that could be increased significantly as a result of interventions
- AI would increase the share of people in a household with some cash crop, but it would attract subsistence farmers from other areas
- Although an AI intervention is well formulated with forest-friendly technology, it would still cause an increase in deforestation

2019-2025

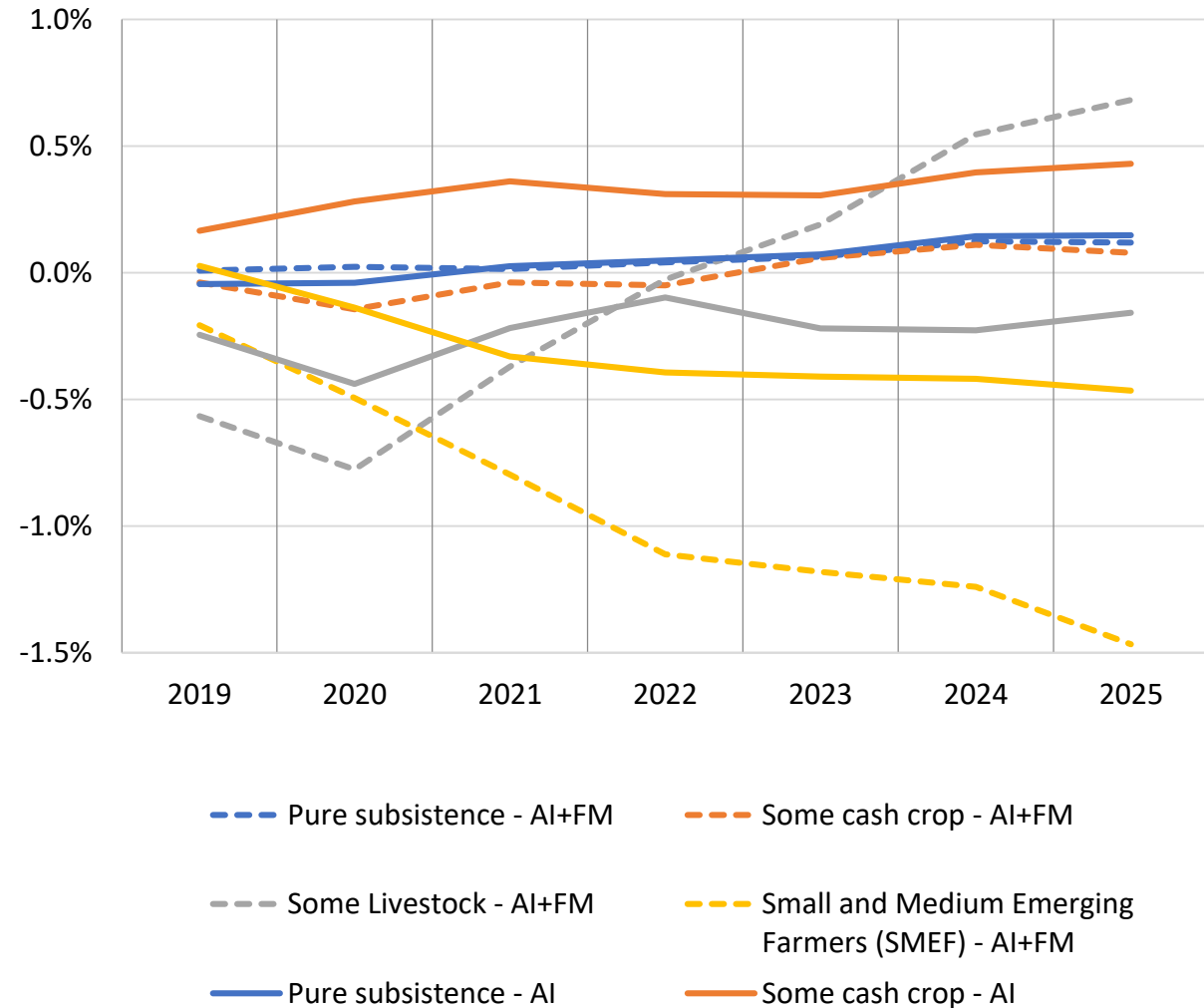
Zambezia
Program

AI + Forest
Management

Population

- **FM** would have an **impact on household dynamics** due to the restrictions to access to certain forest land
- **SMEF and “some cash” crop: Significant reduction over AI** due to constraints in territory
- “Some livestock”: **Significant increase over AI**
- Pure subsistence: No difference with AI as migration influx would still occur

Relative difference in population per household type between AI/AI+FM and BAU



2019-2025

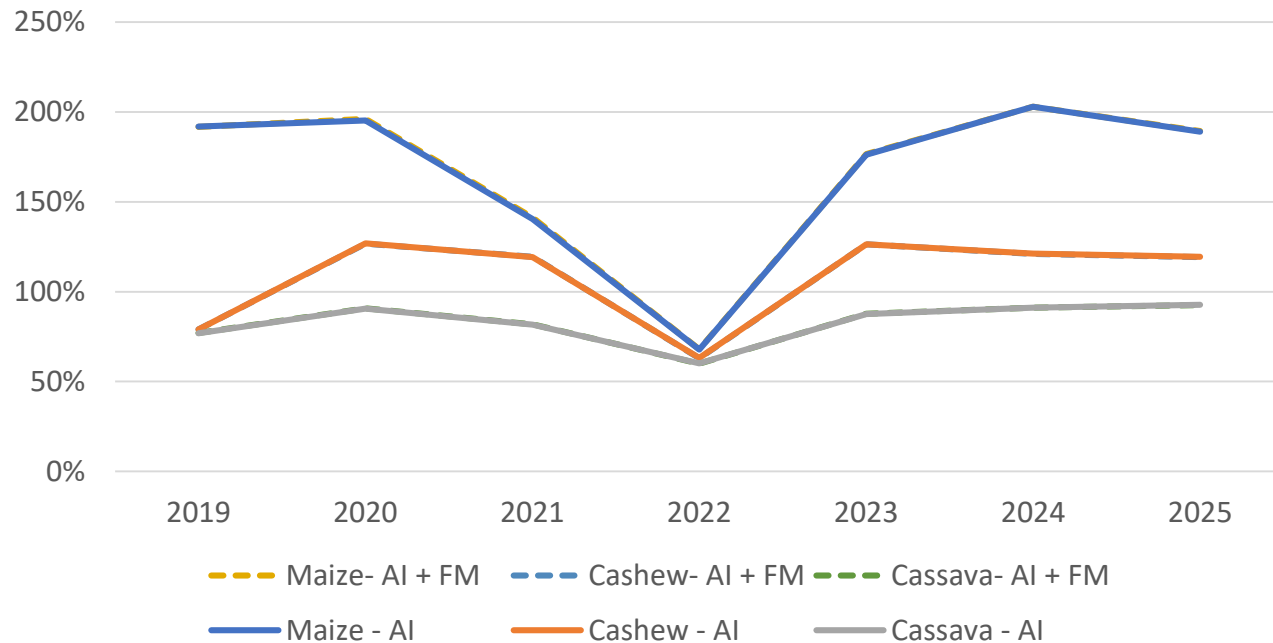
Zambezia Program

AI + Forest Management

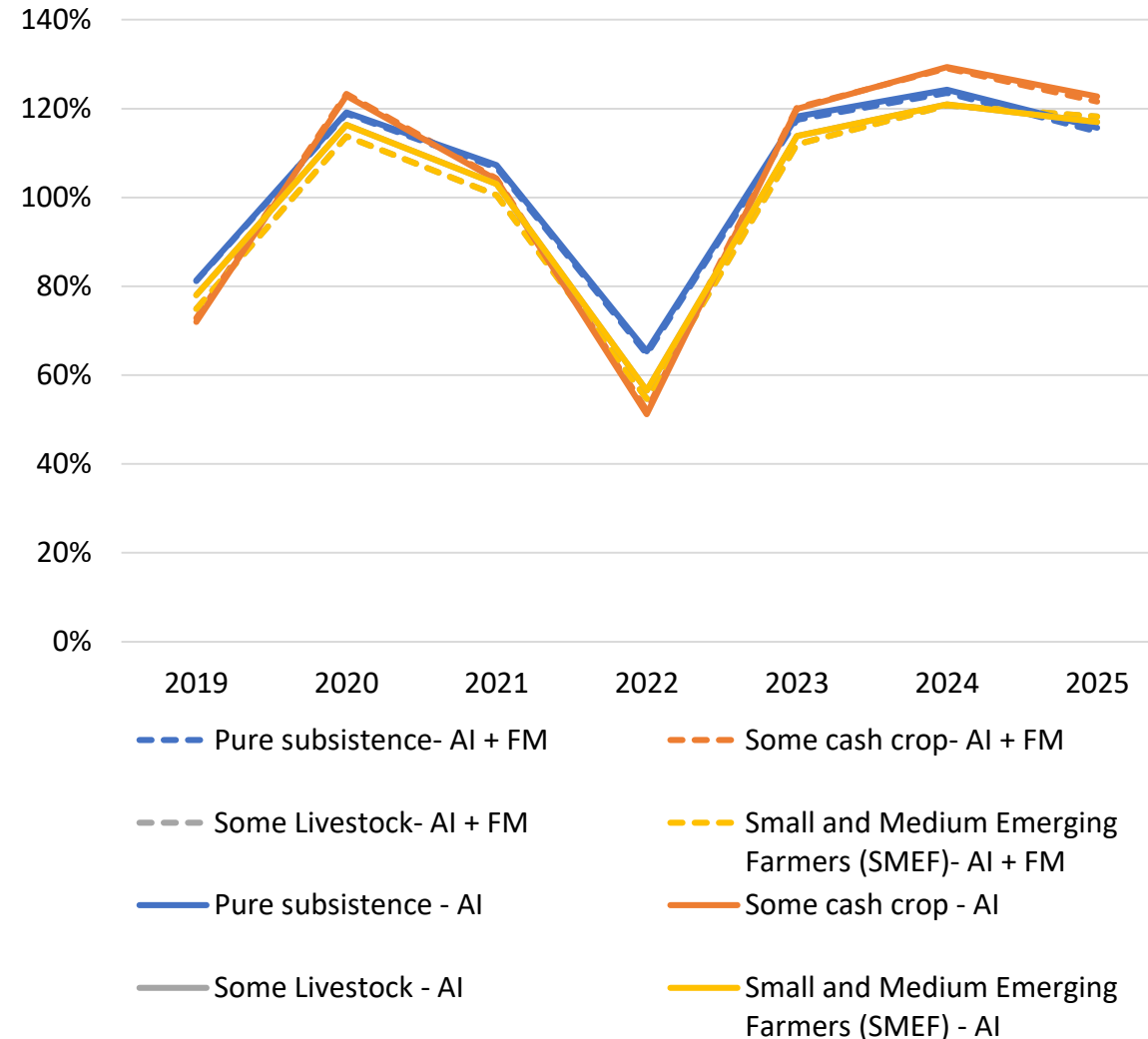
Production and income

- Yield and income would be the same as stand-alone agriculture intensification

Relative difference of yield between AI/AI+FM and BAU



Relative difference of total income per household type between AI/AI+FM and BAU



2019-2025

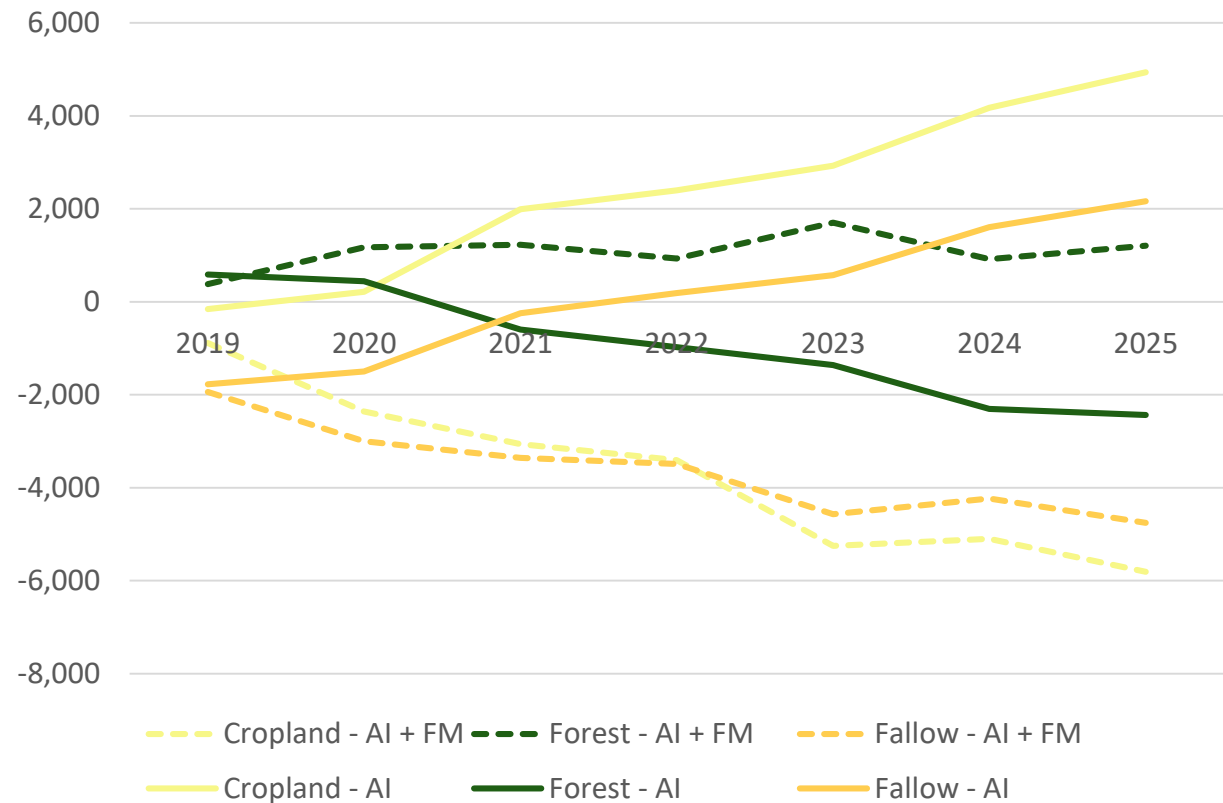
Zambezia
Program

AI + Forest
Management

Land use

- **FM would mitigate and revert the effect that AI would have on forest cover**
- Cropland and fallow areas would decrease over BAU
- There would be a more efficient use of resources and land allocation generating the same level of output

Difference in land use area between AI/AI+FM and BAU (hectares)



2019-2025

Zambezia
Program

AI + Forest
Management

Some conclusions

- Forest management intervention, as formulated here, would mitigate and revert the impact of agriculture intensification on forest cover
- This would happen without an impact on income and yield, which would increase the efficiency in the allocation of land
- However, restriction of land induced by land use planning may have an impact on household dynamics and they need to be well formulated

6. Conclusions

- The main driver of change is population growth, with a net rate of $>3\%$ the demand for land and resulting degradation of natural resources would dwarf the impacts of any intervention
- Large-scale agriculture-intensification-interventions would have a substantial impact on yields and wealth, yet it is important that these interventions consider the impacts of targeting different household types and the attractiveness to migrants that is generated
- AI, even if well formulated, will have a negative effect on forest cover
- However, this may be mitigated with forest management interventions which will induce a more efficient allocation of land and use of natural resources without causing impacts on the level of output

6. Conclusions

- An Integrated landscape approach addressing poverty and food security while at the same time ensuring the sustainable management of natural resources and conservation of high natural values is the most efficient intervention



Integrated Landscape Management
M O Z A M B I Q U E

Thank you!

<http://www.worldbank.org/mozambique/ilm/>

RCP scenarios

- LANDSIM-P enables land use simulation of two different climate change scenarios:
 - RCP 2.6 (Paris Agreements)
 - RCP 8.5 (worst-case scenario)
- Overall impacts in Mozambique remain unclear. Although it has been confirmed that there would be less rainfall in the south, there is evidence that it could cause an increase of rainfall in average, yet more variability

