Reframing sustainability?
Climate change and North-South Dynamics

Local and global drivers of land use changes: a case study of the Makonde Plateau, South-Eastern Tanzania

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***Authors*:**

A. K. Kabanza*, J.J.Tenga, S. Dondeyne, D.N. Kimaro, J. Poesen, E. Kafiriti, and J. Deckers

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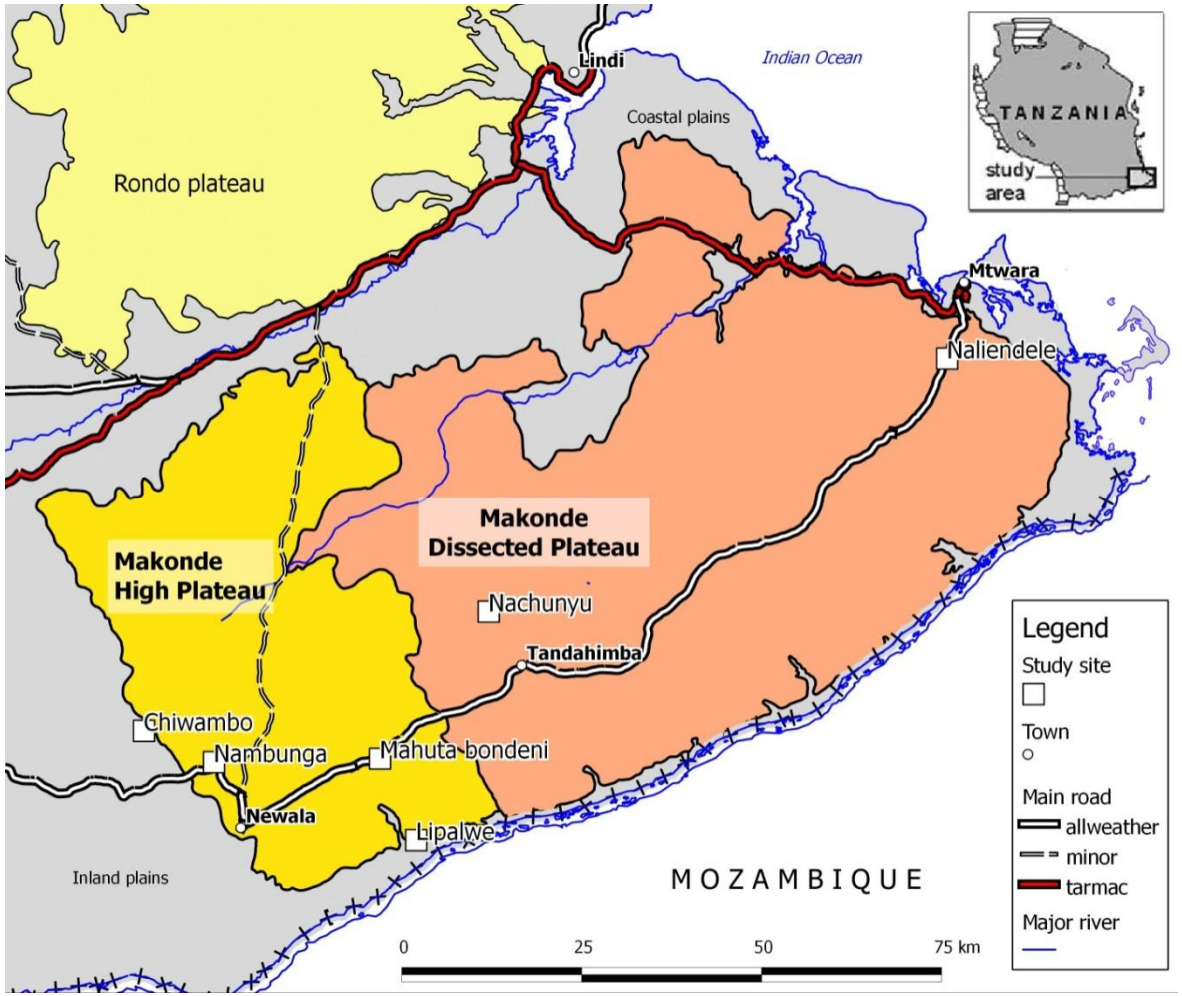
INTRODUCTION

- SE Tanzania -Mtwara
- Area 16,707 km^2
- Population 1,128,523
- > 75% live in rural areas
- > 90% engaged in agriculture
- Main producer of **cashew nut**, roots and tubers & oil seeds
- 2 landscape units



South-eastern Tanzania

INTRODUCTION cont....

- **Characteristics of cashew cropping system**
  - Fallow system
  - After slash and burning of fallow bush land , fields are cultivated for four years with maize, sesame, upland rice, sorghum and cassava
  - Mono cropping of polyclonal seeds or seedlings of cashew nut
  - Or the annual crops are intercropped with the young cashew trees
  - In the escarpment (Ruvuma flood plains) crops can be grown twice a year, maize and vegetables taking advantage of residual moisture in the valley in the dry season

INTRODUCTION cont….

Overview of shifting cultivation on Makonde plateaux Mtwara, Tanzania

INTRODUCTION cont….


Fallow bush land


Bush clearing


Use of fire


'Chingondola'


Seed bed

Land preparation on Makonde plateaux Mtwara, Tanzania

INTRODUCTION cont….

INTRODUCTION cont….

- **Why study land use/cover**
  - Land use/cover transformation influence climate change
  - Global trends show a **decrease** in world's forests, grasslands and woodlands
  - Cropped areas expanding
  - What are the factors causing these land use/cover changes? Is it a single factor or multiple interacting factors?

INTRODUCTION cont….

- **JUSTIFICATION** (why the study)

- SE Tanzania considered as ‘periphery’ but principal cashew nut production area
- Through cashew nuts trade SE Tanzania is imbedded into the global economy
- Concerns: cashew groves and global climate change and local water cycle influencing runoff, infiltration and soil degradation
- **decrease** in area under **fallow bush land** and **increase** in area under **cashew groves**
- The **driving forces** for this changes are not known

WHAT DID WE DO?

- **Materials**

  -Land use changes assessment on six villages:

  -Aerial photographs of 1965 and Landsat TM satellite of 2002

- **Methods**

  -Land cover maps were made based on aerial photographs of 1965 and compared with land cover maps based on Landsat TM satellite from 2002

  -Ground truthing was done in 2004 during field survey to verify land use categories

  -Land use changes were assessed from the overlays from the two periods using Arc View

WHAT DID WE DO? Cont…

- **Methods** cont..

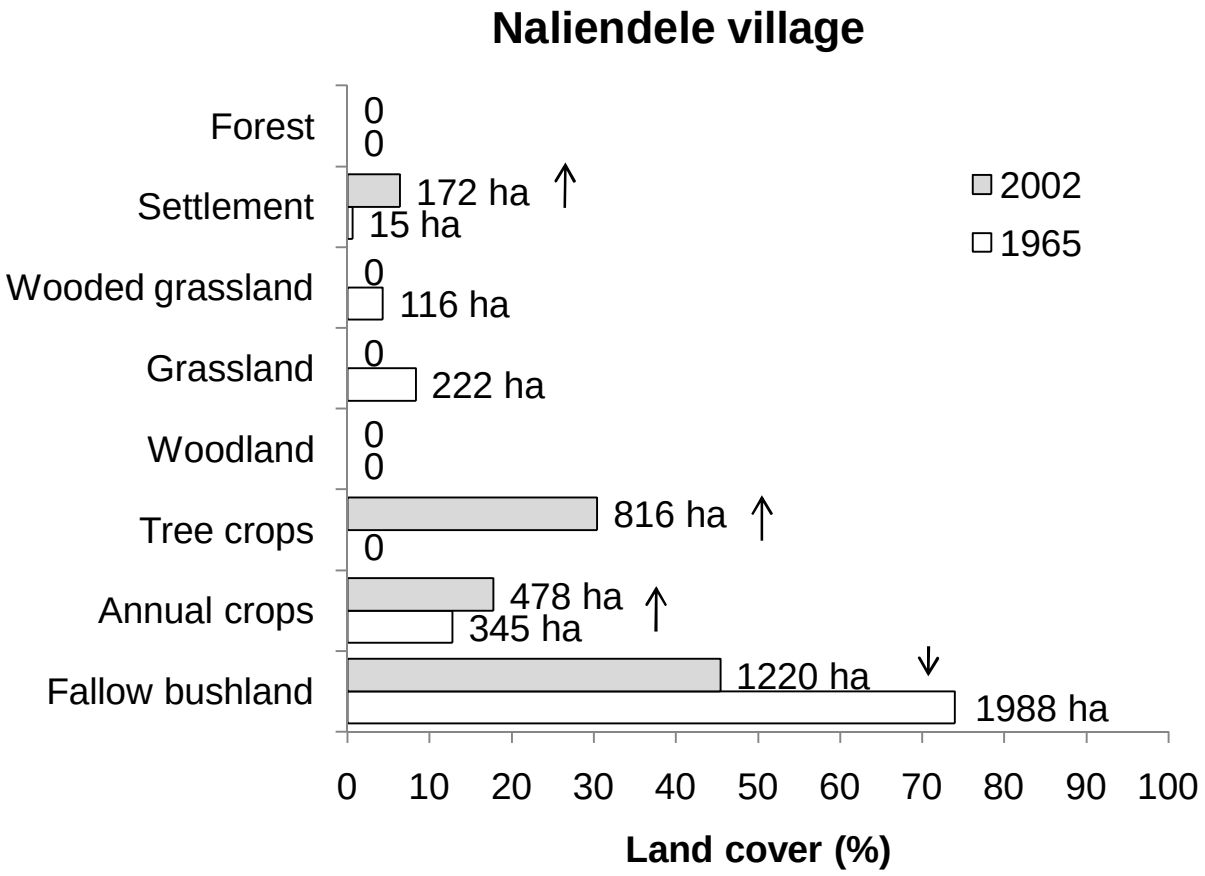
  -Semi-structured questionnaire used, 125 farmers interviewed on current farm size, land tenure, household income and degree of information on market prices

  -Demographic census to assess impact of population dynamics on land resources obtained from Tanzania Bureau of Statistics)

  -Cashew nut marketing data compiled from reports obtained from CBT and FAO

RESULTS cont….

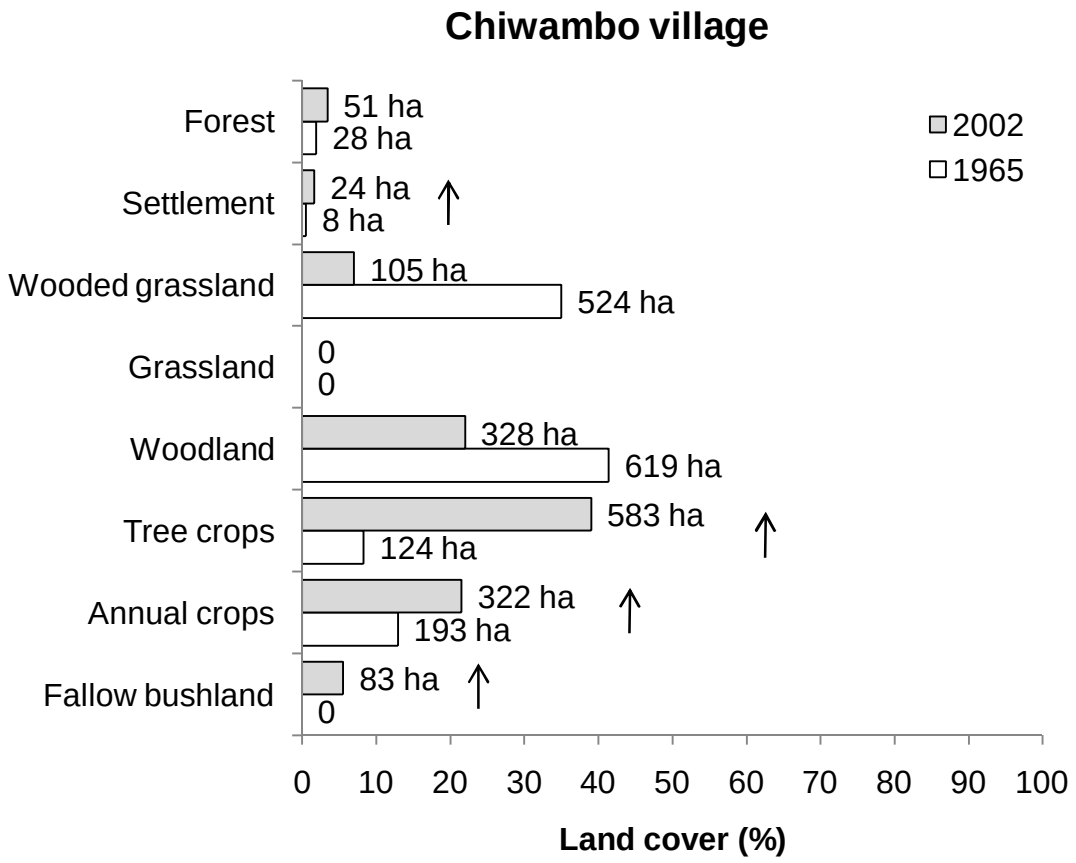
Makonde Plateau



Land cover distribution in the study villages

RESULTS cont….

Makonde Escarpment



Land cover distribution in the study villages

RESULTS cont….

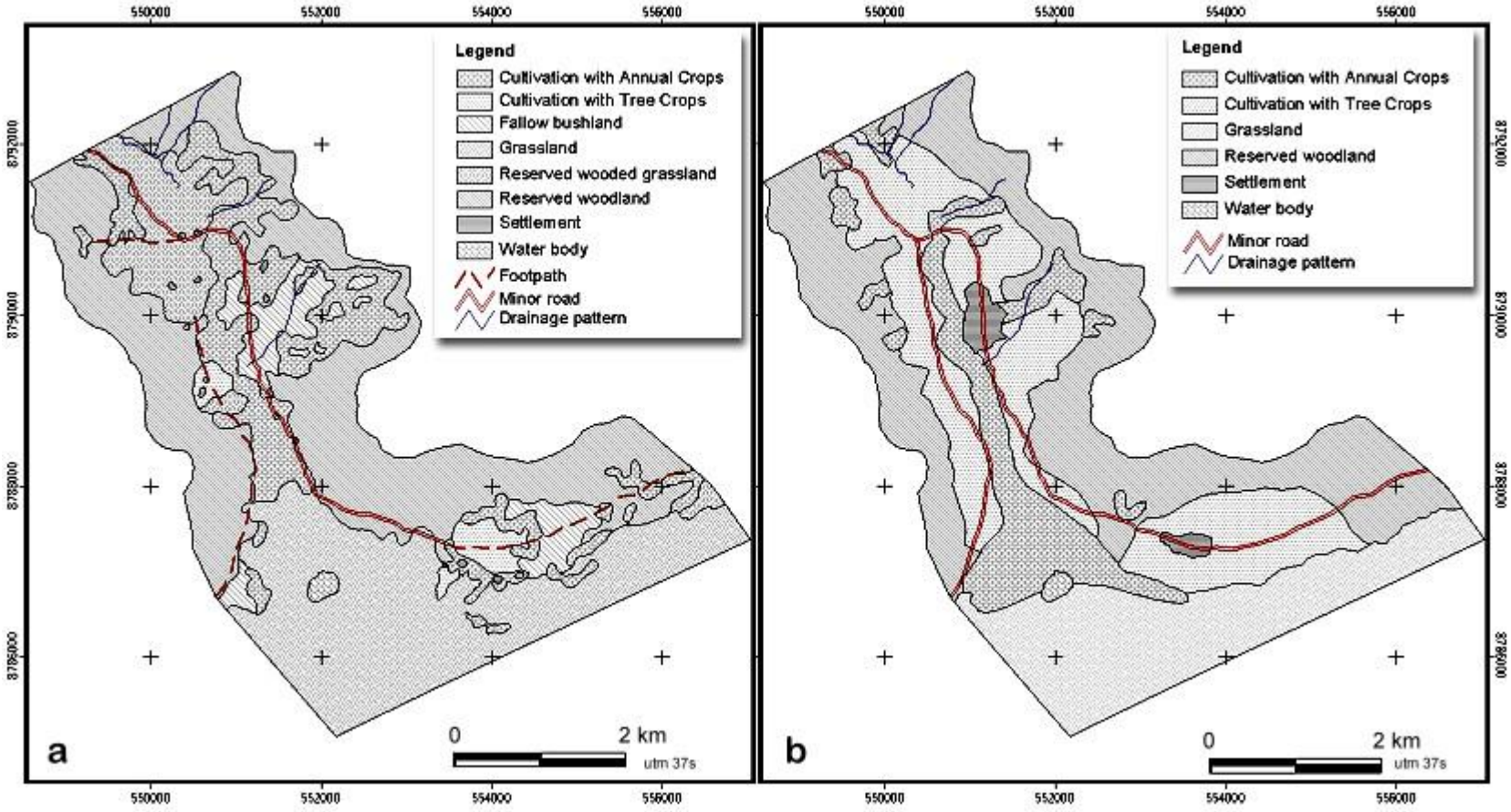
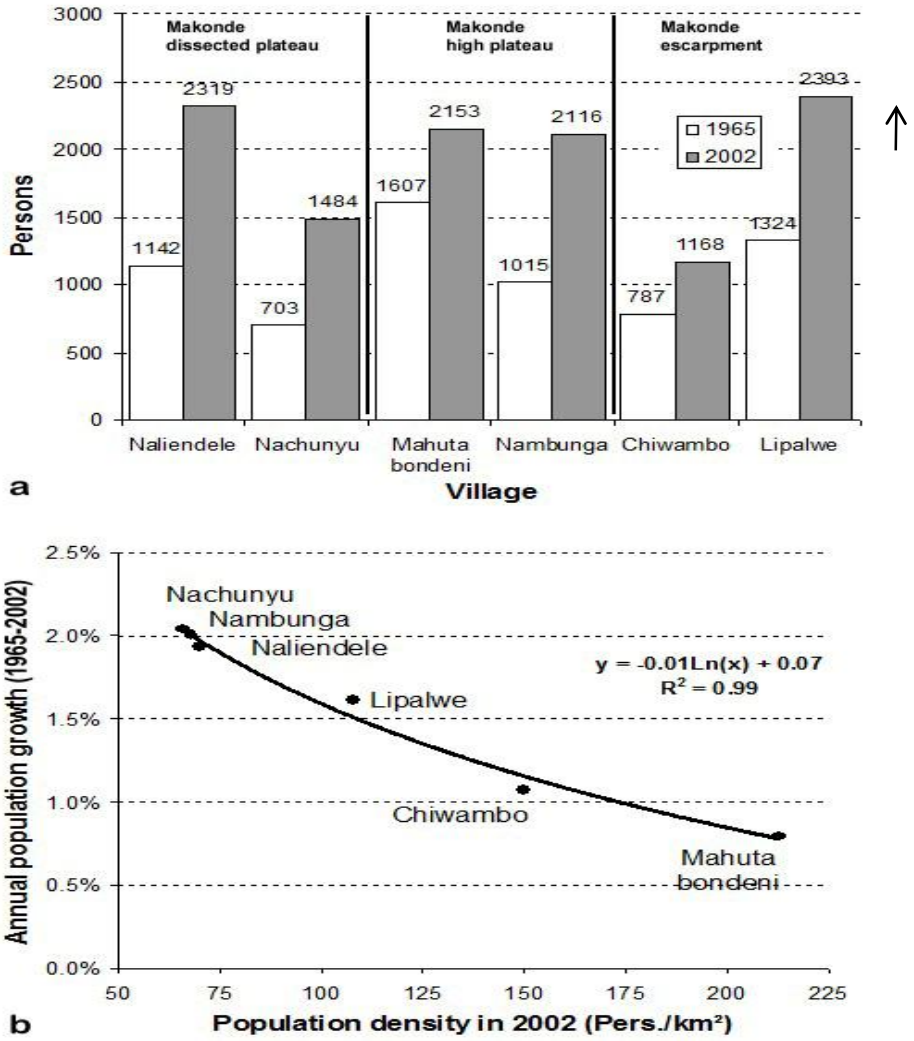


Illustration of land use change in Lipalwe village 1965 and 2002

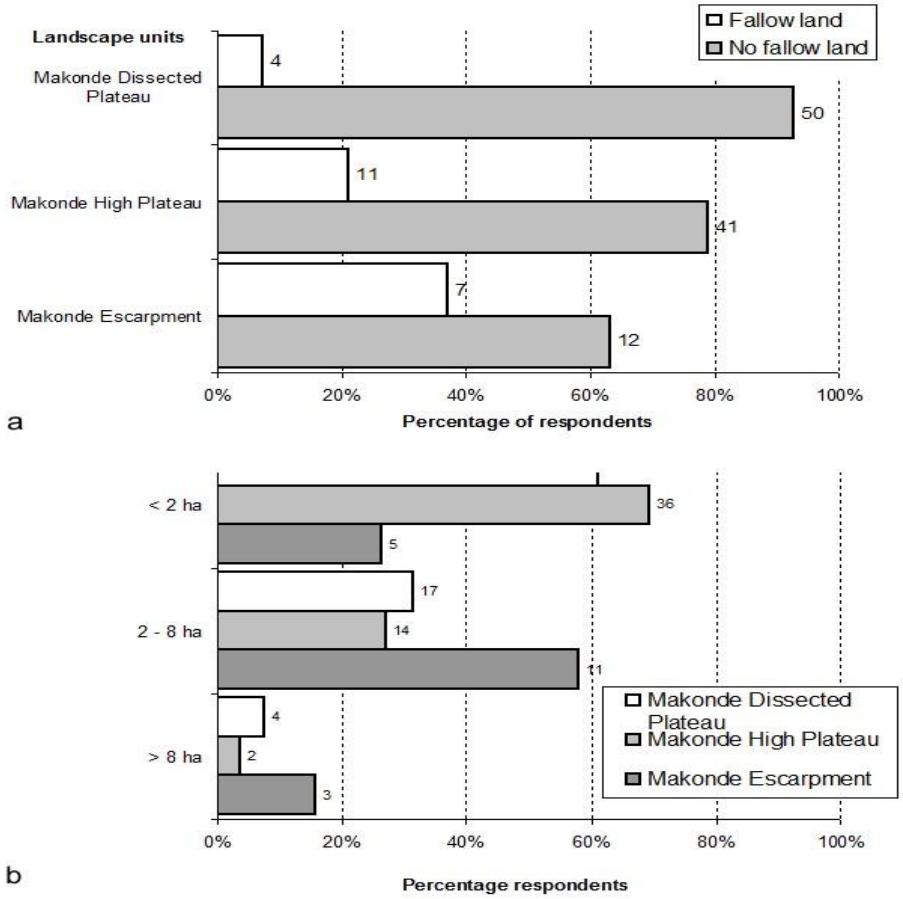
RESULTS cont….



(a) Population growth between 1965 and 2002 in six villages of SE Tanzania

(b) High average annual population growth rate in the Makonde Dissected plateau villages)

RESULTS cont....



(a) Percentage of respondents with fallow land and (b) general farm land size distribution per landscape unit (n=125)

RESULTS cont….

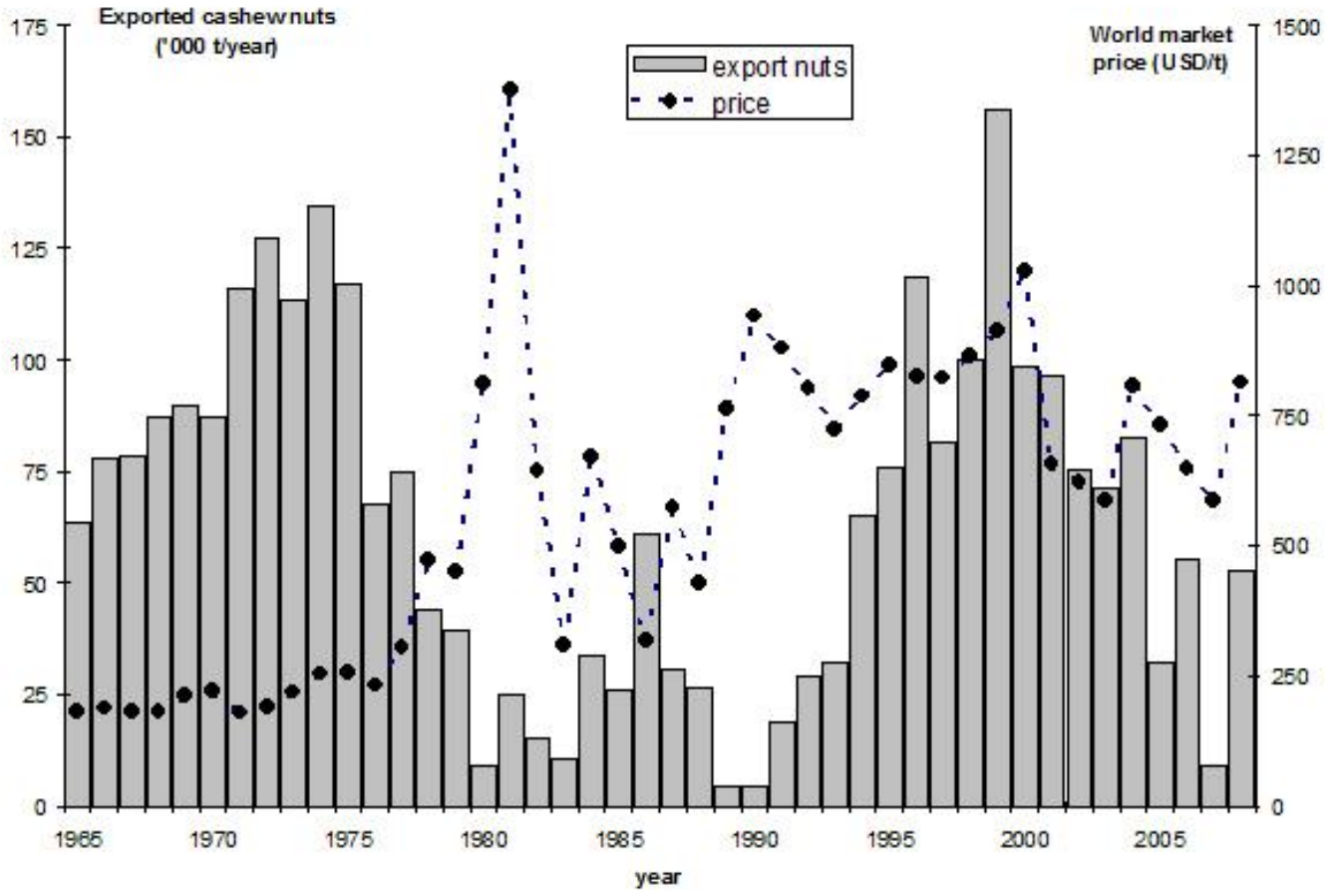
- Land use changes in relation to socio-economic characteristics

Table: Correlation coefficients between land-use changes and socio-economic variable-cashew price

Changes in land use	**Price of cashew**
Annual crops	-0.80*
Tree crops	0.86**
Fallow bushland	0.09
Wooded grassland	0.12
Settlement	0.18

* P < 0.1; ** P < 0.05

RESULTS cont….



Evolution of exported raw cashew nuts from Tanzania in relation to the world market price, note the very low export in the 1980s (Source: FAO 2011)

RESULTS cont….

- **Discussion**

-Population has increased substantially in the study area.

- In all (except Chiwambo village) at the base of the Makonde escarpment land under fallow bush land decreased-converted either to annual crops and/or tree crops

-price strongly (R= 0.86, $p<0.05$) influenced the area attributed to tree crops and annual crops land

-Mahuta bondeni annual crops area decreased . Soils and climate are very suitable for cashew nut production, many farmers seem to specialize in cashew nut production

RESULTS cont….

- **Discussion cont..**

-The arguments by Geist and Lambin (2002) and Lambin et al (2003) that land use/cover changes are driven by a complex of underlying causes well support the case in the Makonde plateau

- Demography – high population density eg in Mahuta bondeni , cashew nut trees increased.

-Economic factor: cashew nut prices strongly correlated with changes in both the area under annual crops and cashew groves. Globalization makes the Makonde plateau integrated into the world cashew nut marketing thus determine land use of the area

RESULTS cont….

- **Discussion cont..**

-Technological factors: introduction of new cashew varieties, pests and diseases control

- Land use and agricultural policies: villagisation policy affected people distribution and land use. In the Makonde escarpment land abandoned and reverted to woodland and forests. No fallowing any more

-Sustainability of cashew nut production calls for: concerns about sensitivity of the Makonde plateau soils for acidification and gully erosion-as a function of cashew groves on the local hydrology

CONCLUSION

- Between 1965 and 2002 the Makonde Plateau has undergone major changes in land use/cover

- The driving forces are population increase, villagization policy, technological factors and economic factor- increase in cashew nut price in the world market through global trade may move people to reduce their land under annual food crops in favour of cashew groves.

- **HOW SUSTAINABLE WILL LAND USE BE UNDER DOMINANCE OF CASHEW NUT TREES? IS STILL UNRESOLVED QUESTION!**

THANK YOU FOR YOUR ATTENTION

kkaggwa@yahoo.co.uk