CLIMATE-SMART Agriculture 2015

Global Science Conference

March 16-18, 2015
Le Corum, Montpellier France

A modelling framework to assess climate change and adaptation impact on heterogeneous crop-livestock farming communities

Descheemaeker K., Masikati P., Homann-Kee Tui S., Chibwana G.A., Crespo O., Claessens L., Walker S.

AgMIP The Agricultural Model Intercomparison and Improvement Project

UKaid from the British people

WAGENINGEN UR For quality of life

ICRISAT Science with a human face

CSAG Climate System Analysis Group

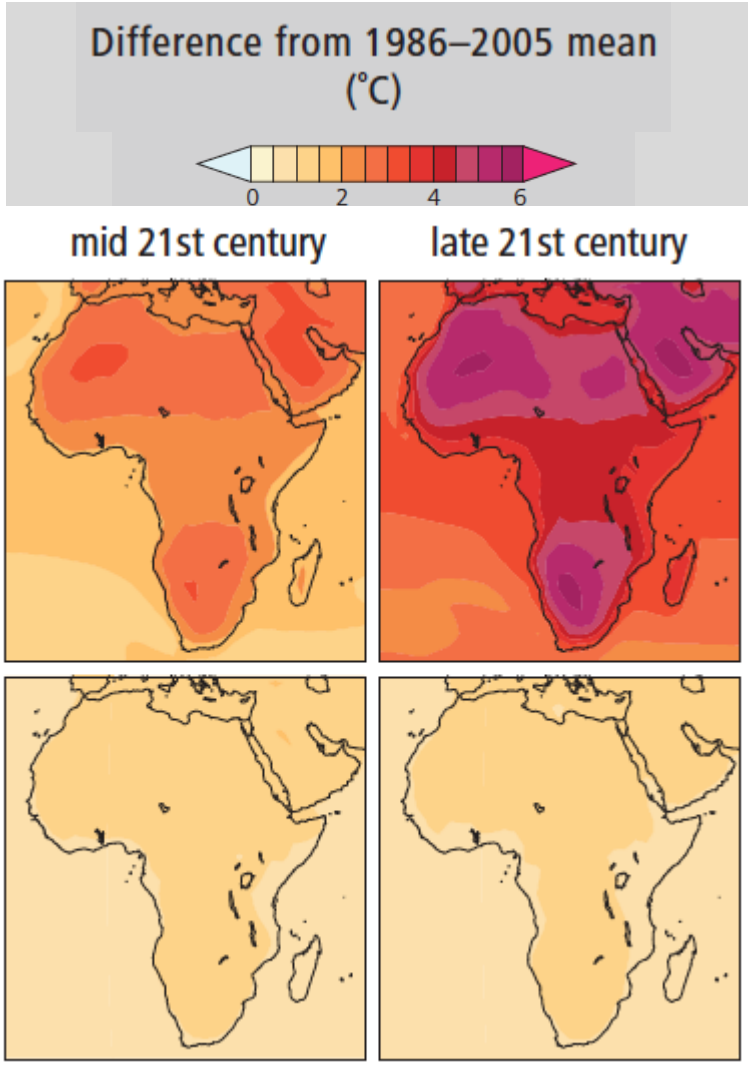
Crops for the Future Research Centre

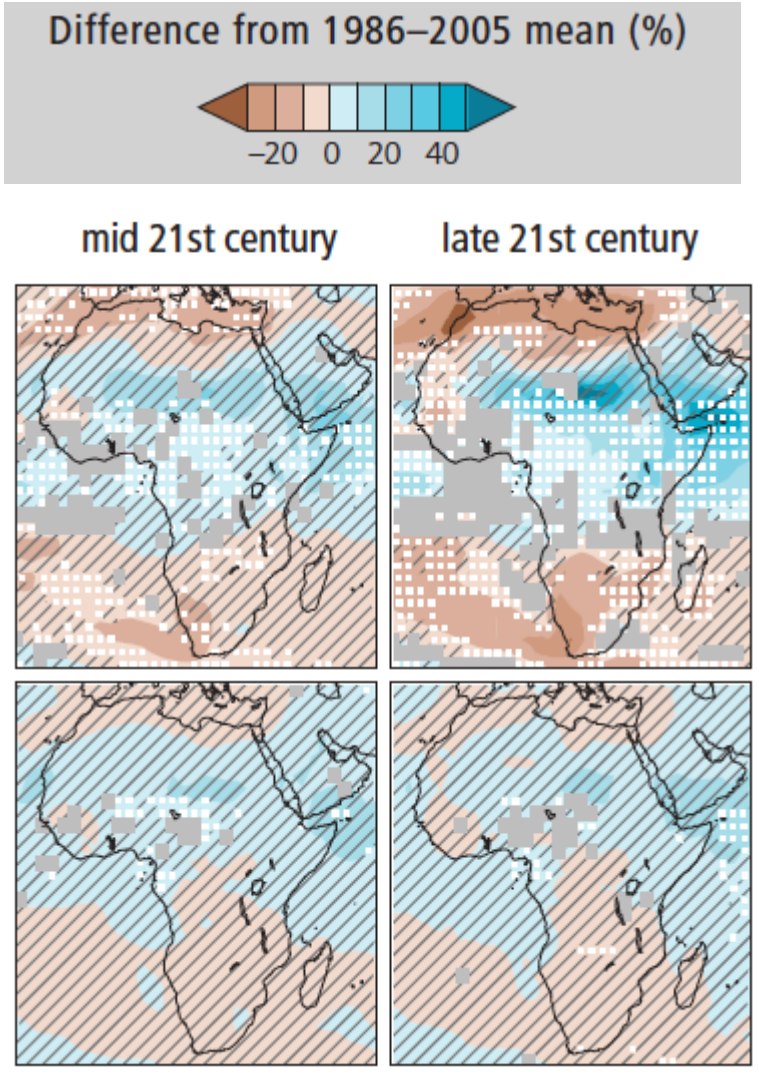
Montpellier

March 16-18, 2015

Introduction

- Climate change in Africa



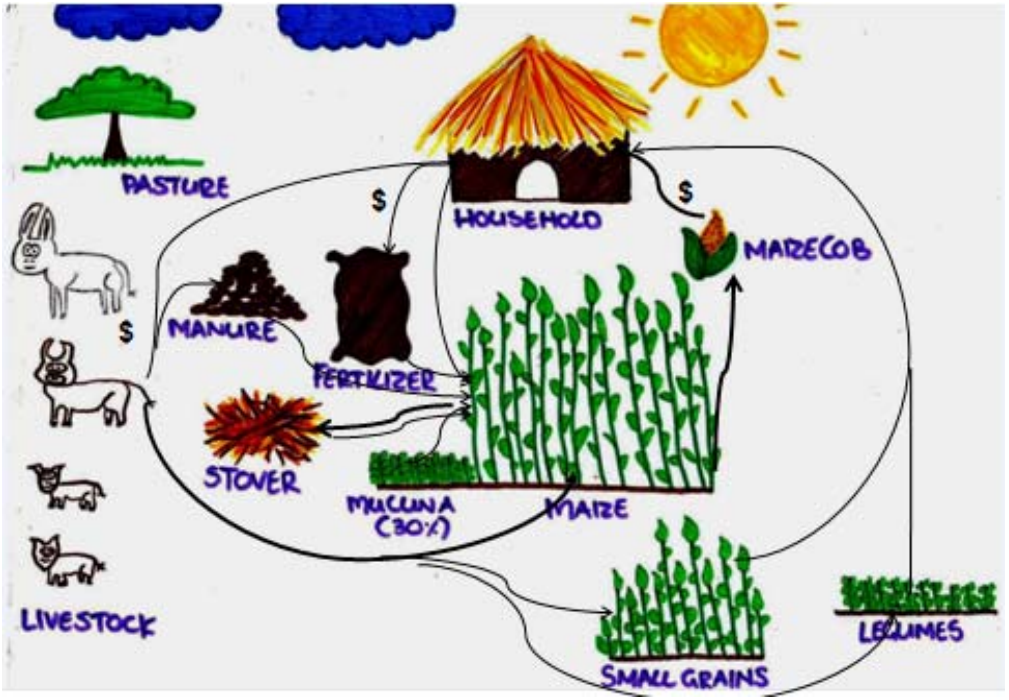


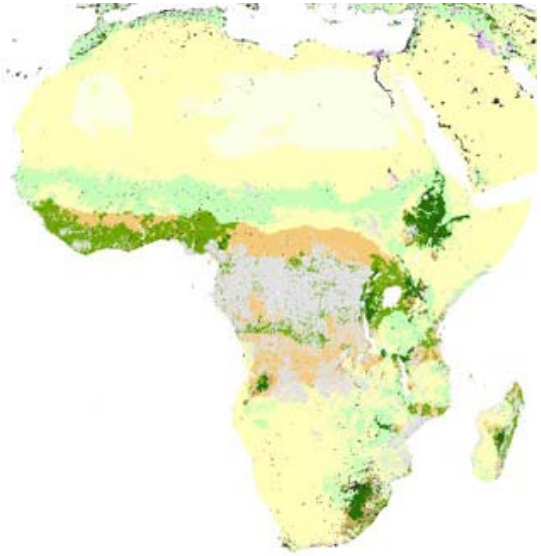
C

IPCC, AR 5

Introduction

- Climate change in Africa
- Crop livestock farming systems





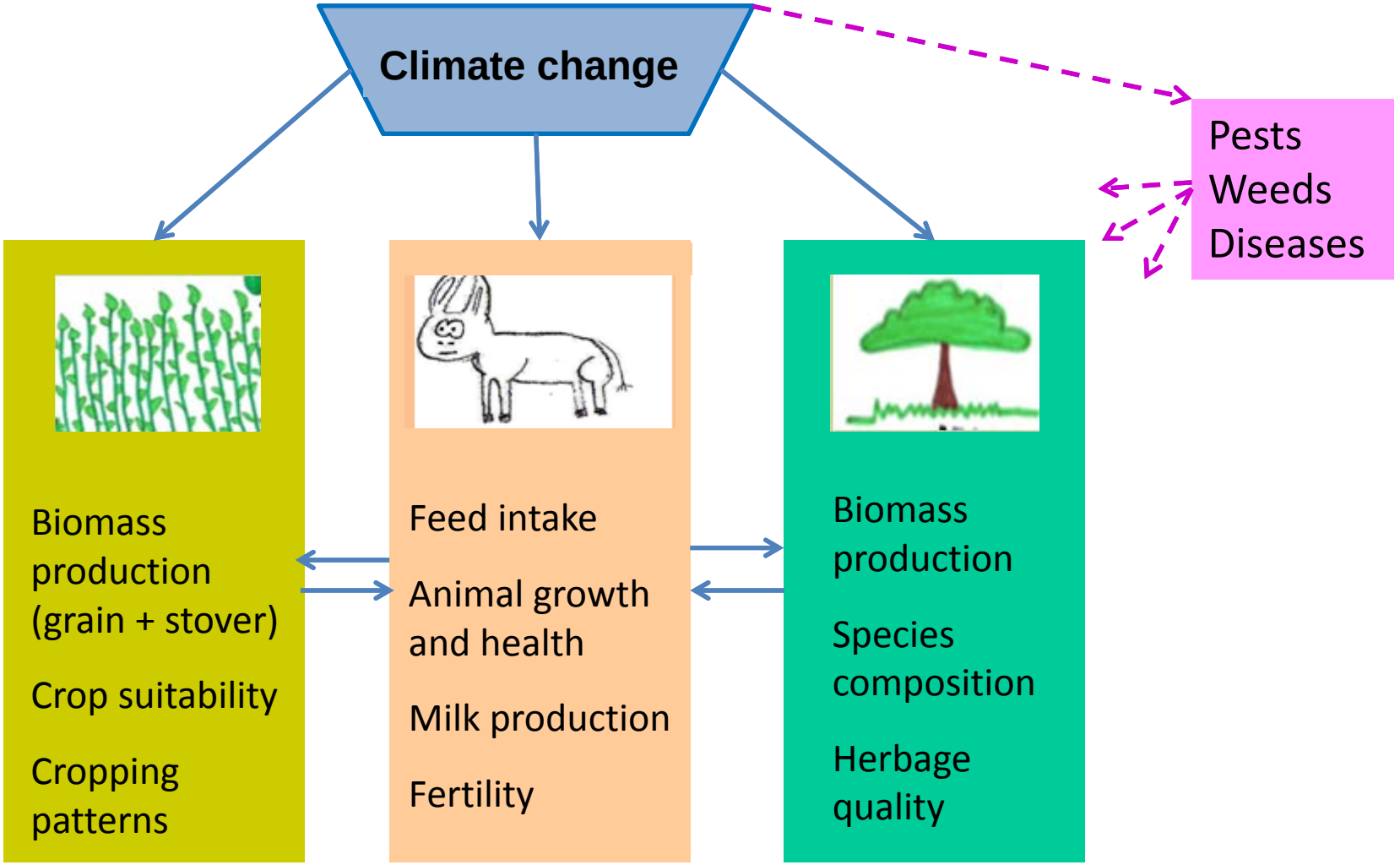
	Rangeland-based	Mixed rainfed
Hyperarid	LGY	MRY
Arid/Semi-arid	LGA	MRA
Humid/Subhumid	LGH	MRH
Temperate/tropical highlands	LGT	MRT

Global Livestock Production Systems v.5 (FAO/ILRI)

CLIMATE-SMART Agriculture 2015

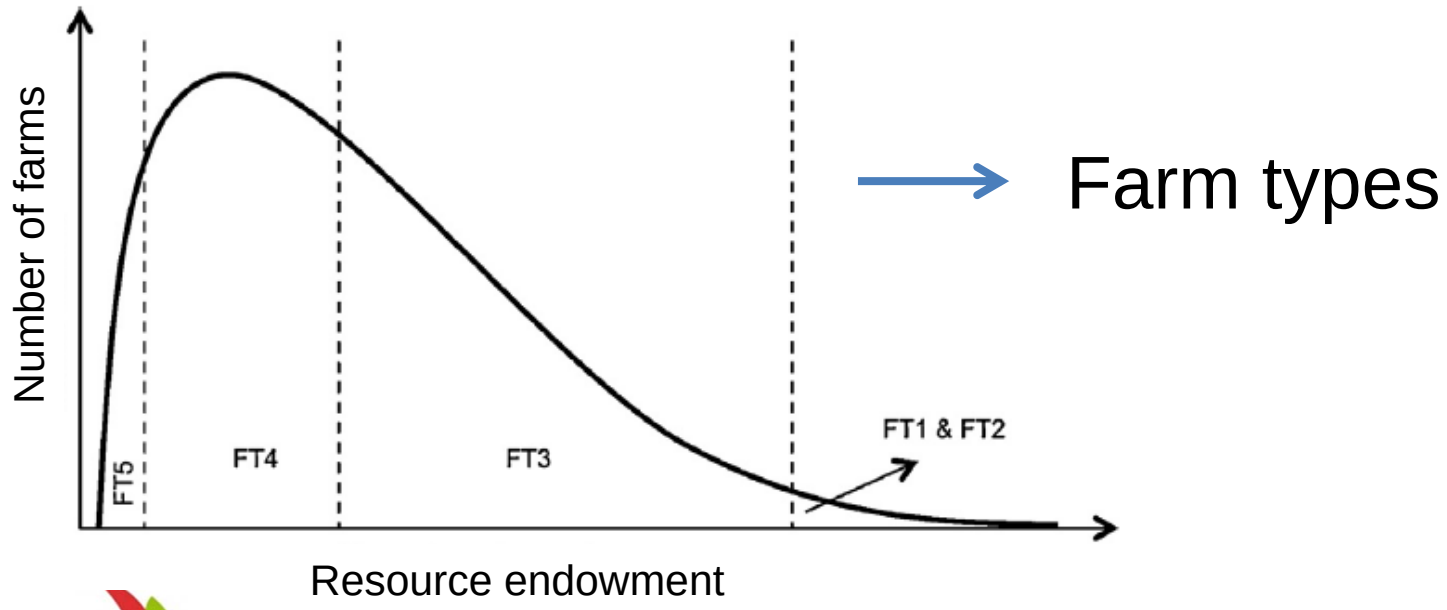
Introduction

- Climate change in Africa
- Crop livestock farming systems



Introduction

- Climate change in Africa
- Crop livestock farming systems
- Heterogeneous farming communities



Franke et al., 2014

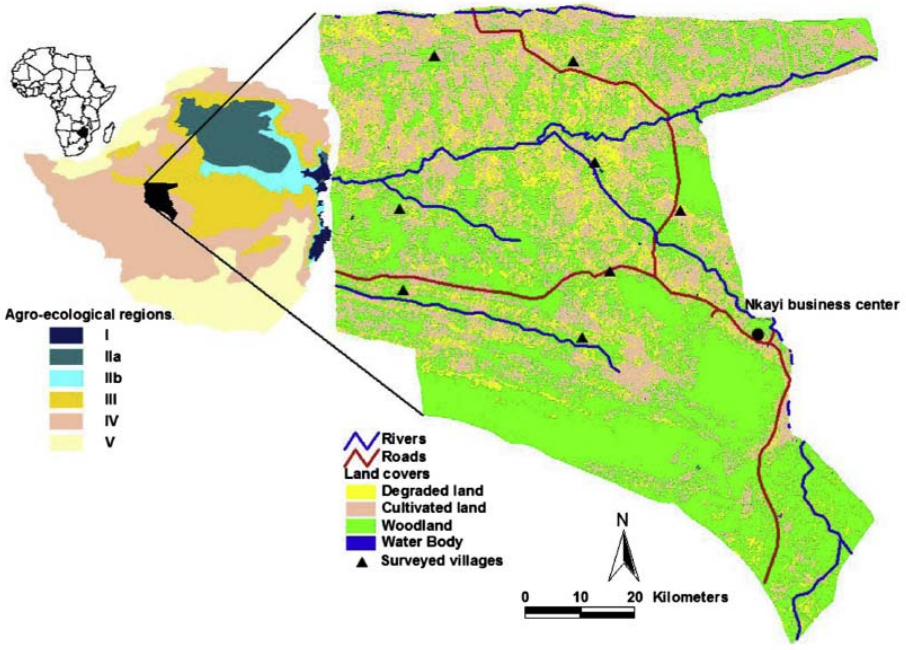
Objectives

1. Assess the vulnerability to climate change of smallholder crop livestock farmers

2. Assess potential effect of two options
   - Fertilizer applications on maize
   - Maize-Mucuna rotation

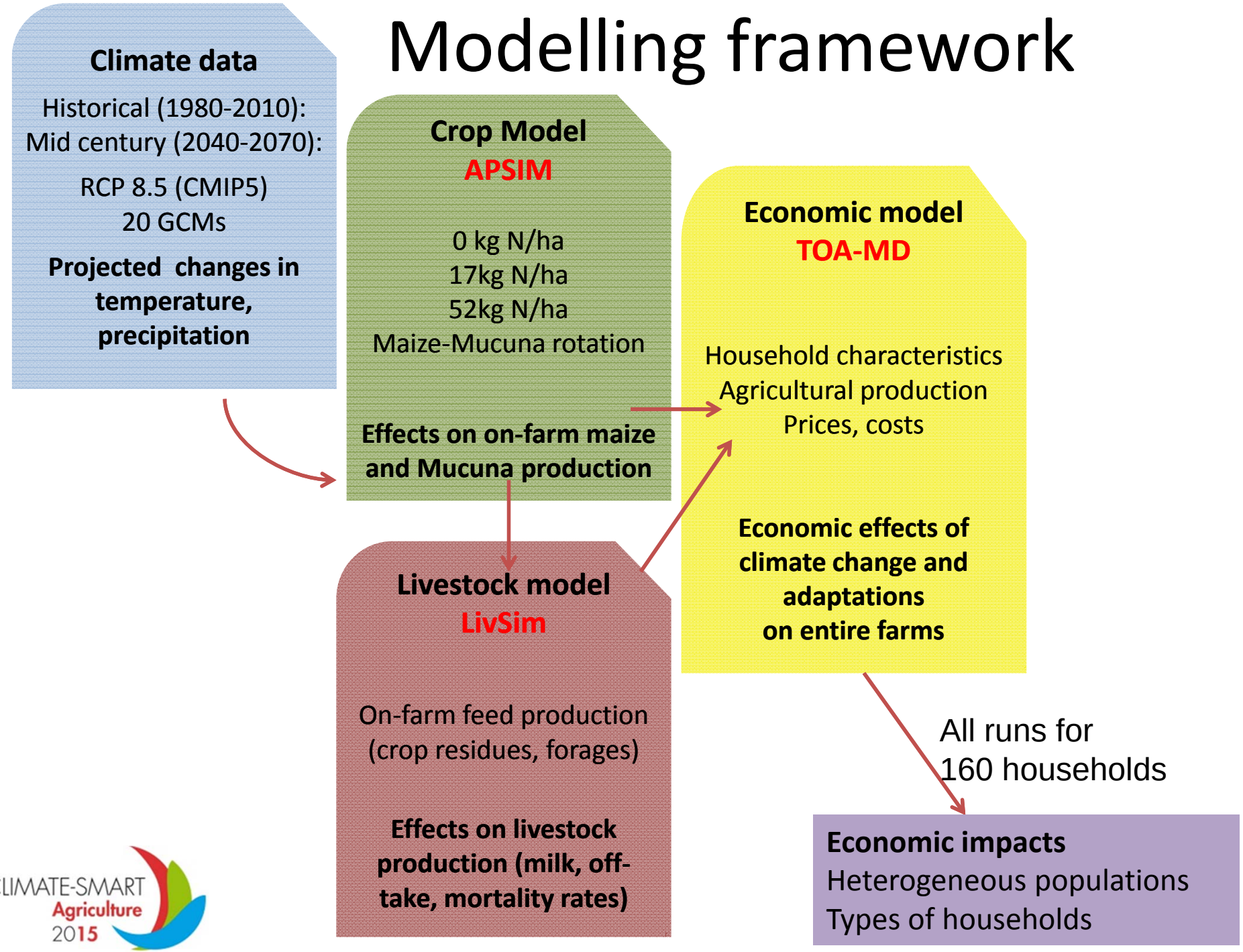
Study area

- Nkayi District in semi-arid Zimbabwe
- Annual rainfall: 450-650 mm ; high variability
- Poor soil fertility
- Limited input use
- Poor crop and livestock productivity



CLIMATE-SMART Agriculture 2015

Modelling framework



CLIMATE-SMART Agriculture 2015

Results - Climate

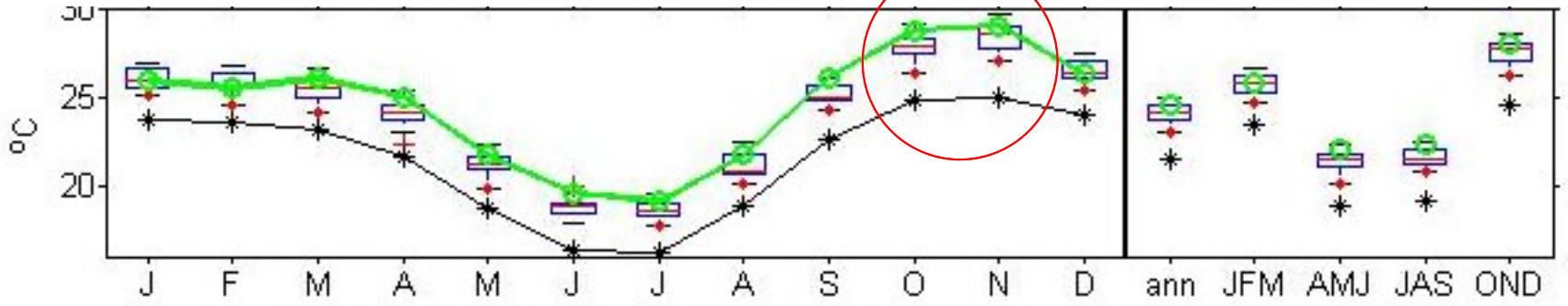
Temperature

- Strong signal: +2 to +3.3°C
- Increase strongest during the early growing season

Precipitation

- No strong signal: -0.7mm/day to +0.5mm/day
- Decrease strongest during earlier rainy season

RCP 8.5 mid century temperature scenarios for all GCMs in Nkayi, Zimbabwe

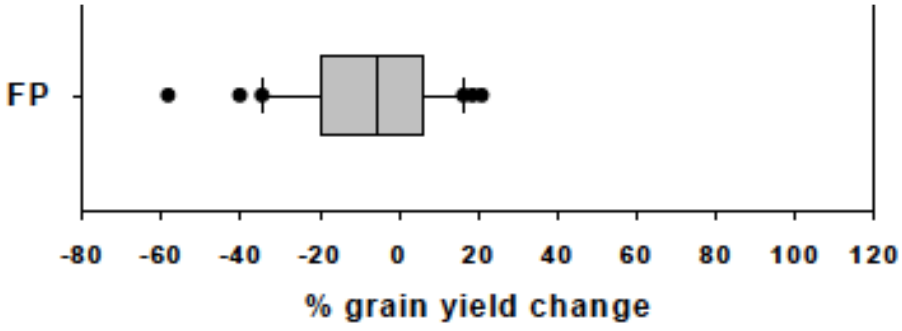


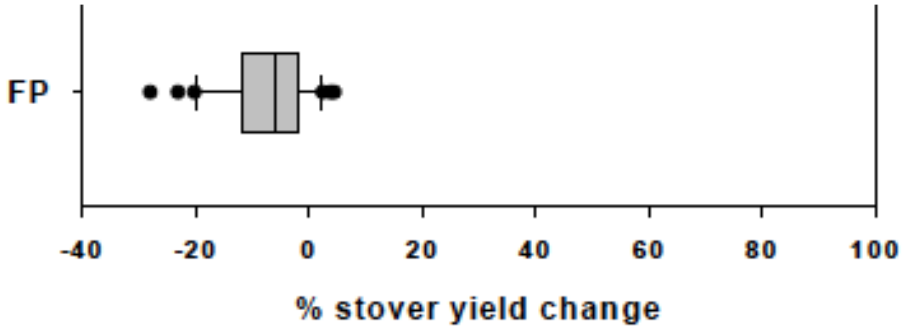
RCP 8.5 mid century precipitation scenarios for all GCMs in Nkayi, Zimbabwe

Results - Crops

Climate change impact:

- Grain yields and stover yields decline, but wide variability

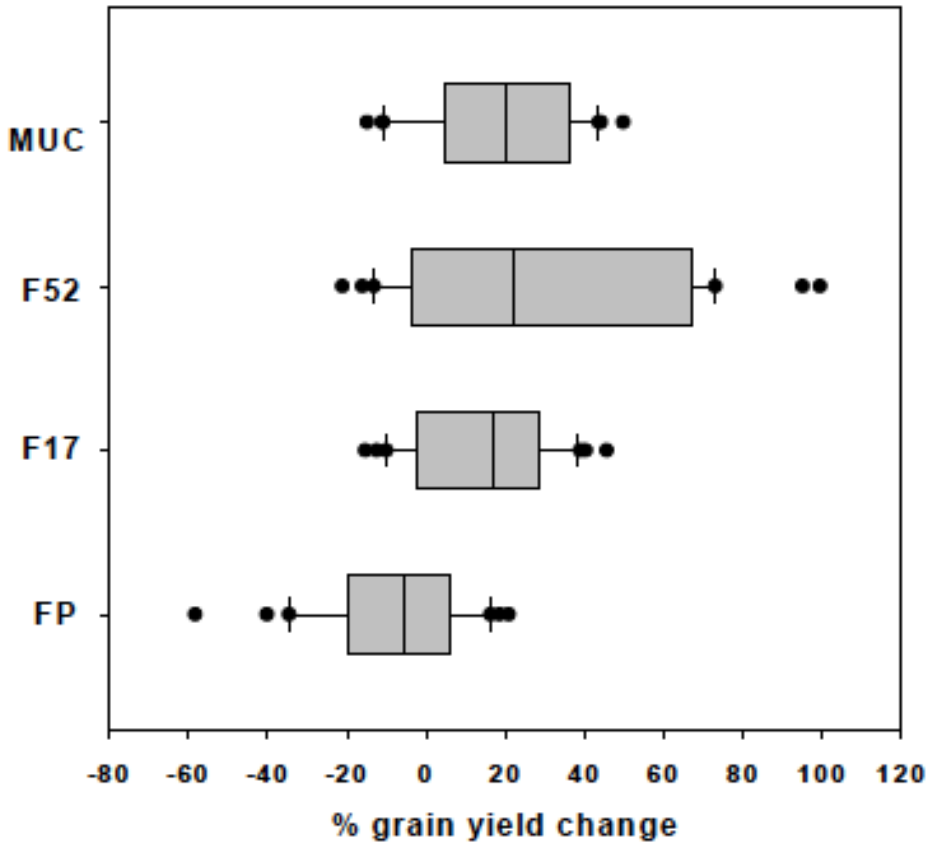


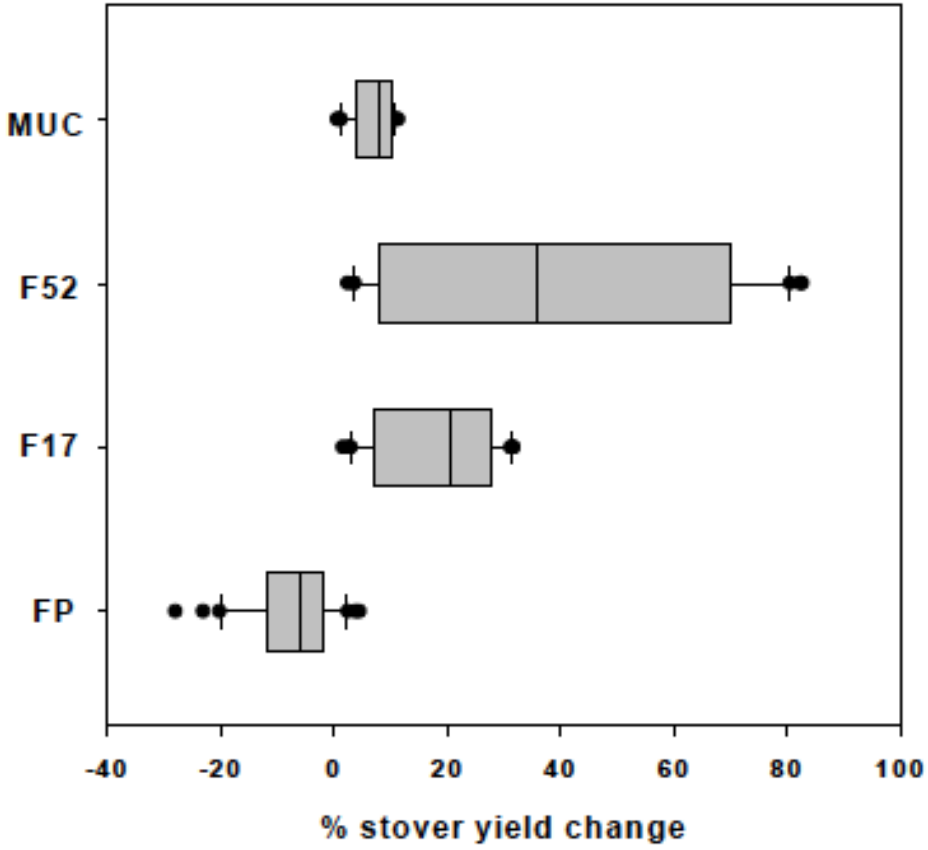


Results - Crops

Effect of adaptations

- Microdosing (17 kg N/ha) vs. recommended N rates (52 kg N/ha)
- Mucuna in the rotation: positive effect on maize yield + fodder

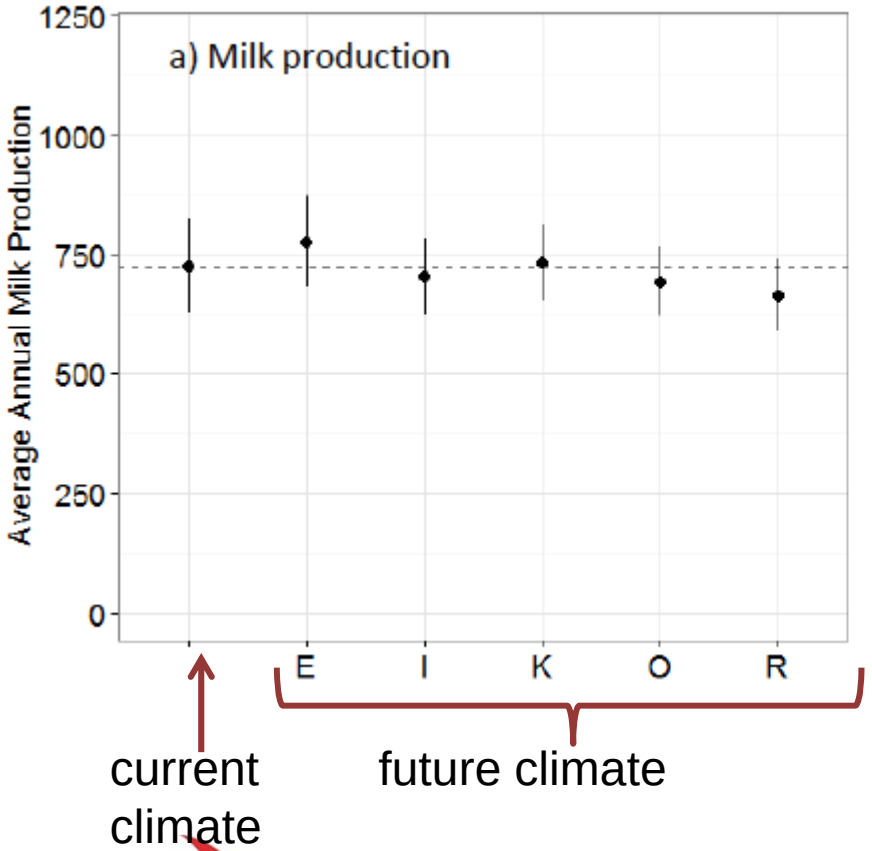


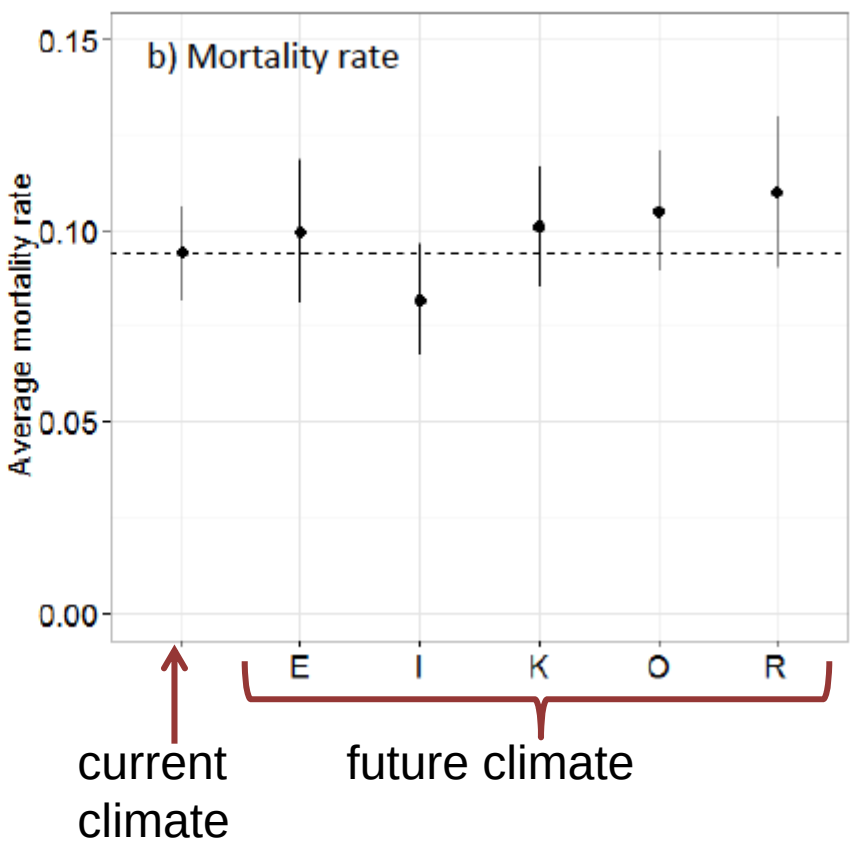


Results - Livestock

Climate change impact:

- Very small impact of climate change on livestock productivity



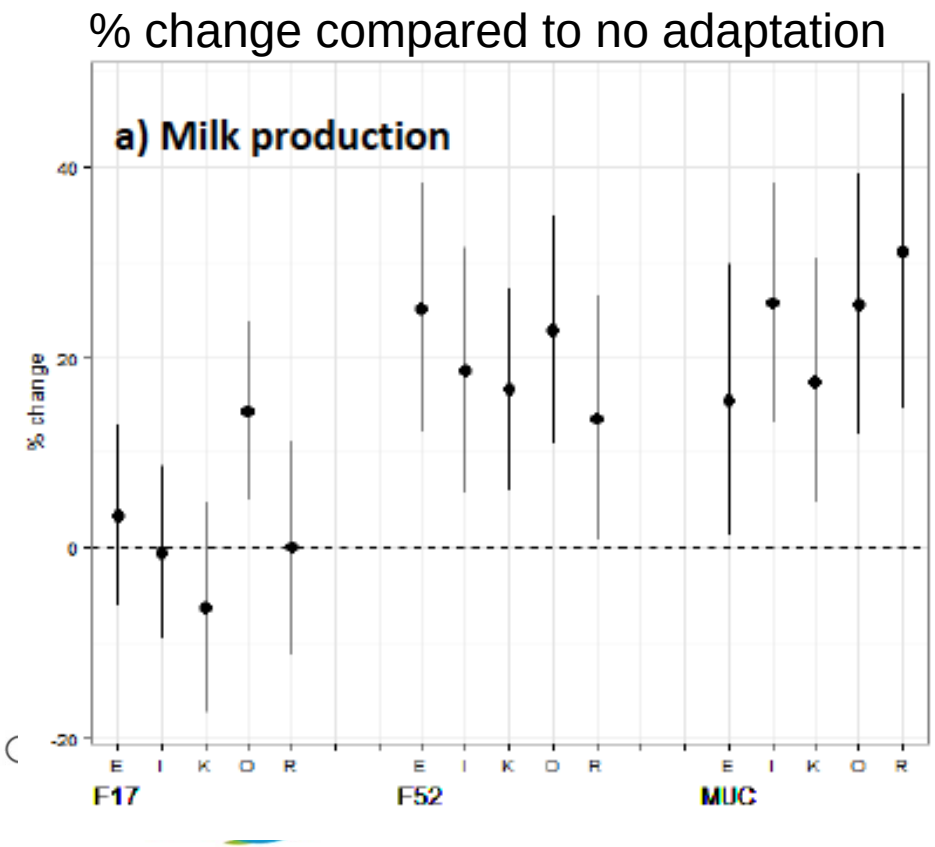


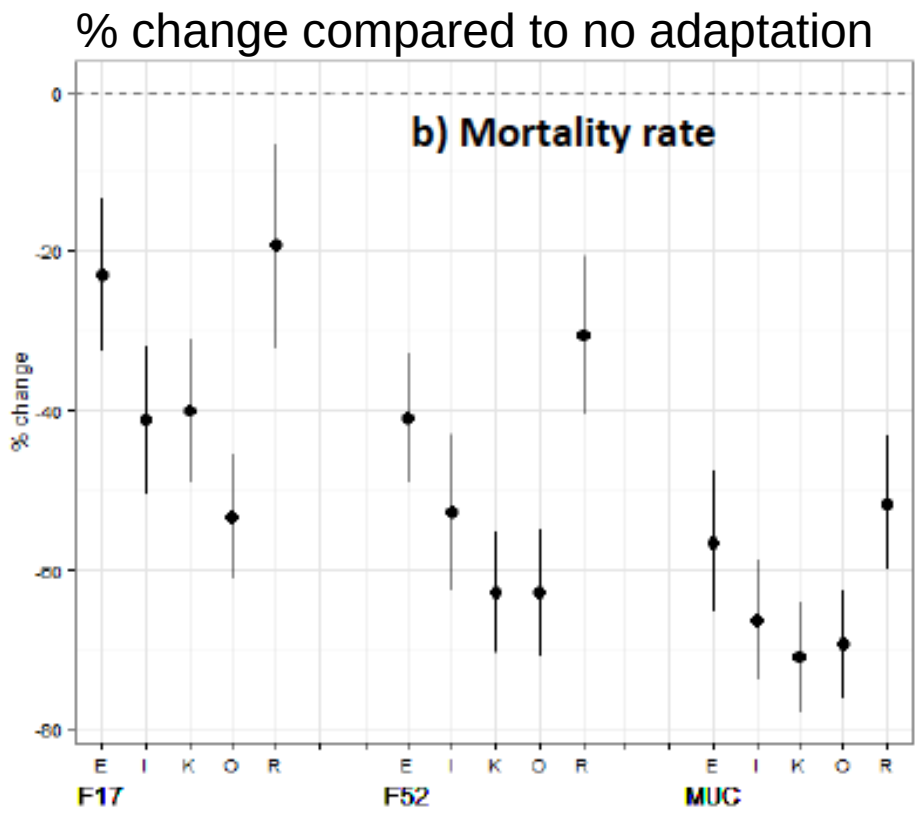
CLIMATE-SMART Agriculture 2015

Results - Livestock

Effect of adaptations

- High fertilizer rates and mucuna have positive effect on milk
- All options have positive effect on decreased mortality rates



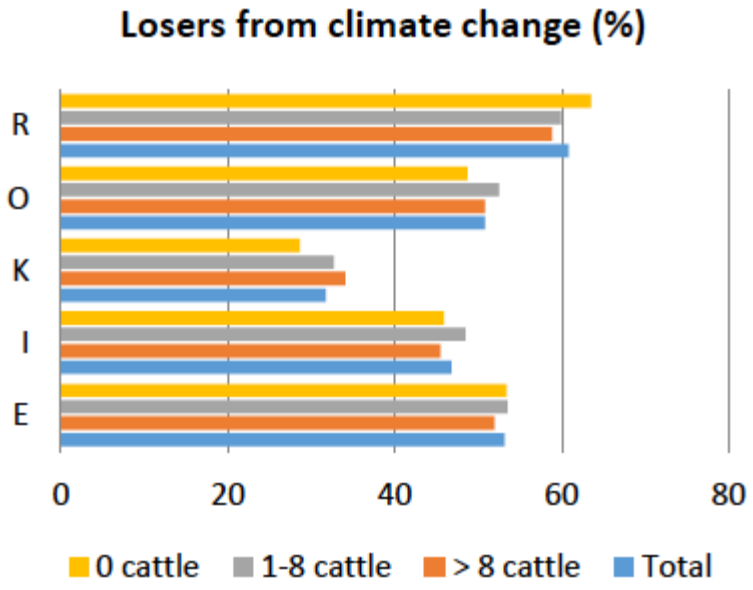


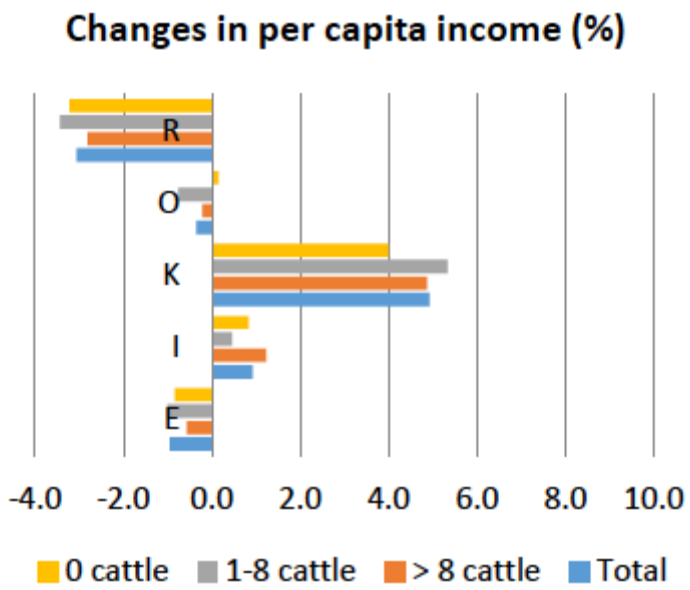
Results – Integrated analysis

Three farm types: 0 cattle, 0–8 cattle, >8 cattle

Climate change impact

- Percentage of losers varies with GCM and with farm type
- Per capita income changes are small: -3% to +7%



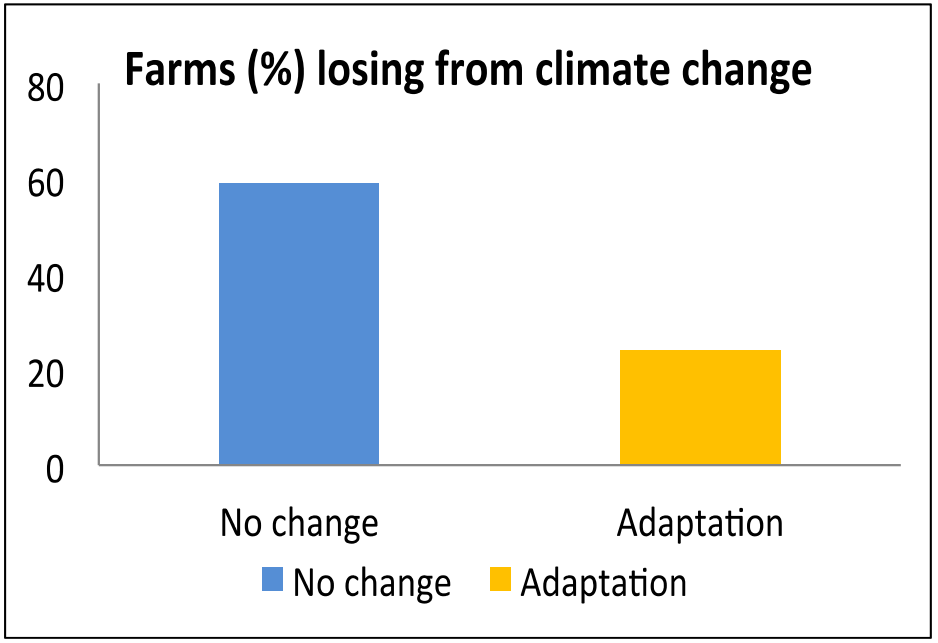


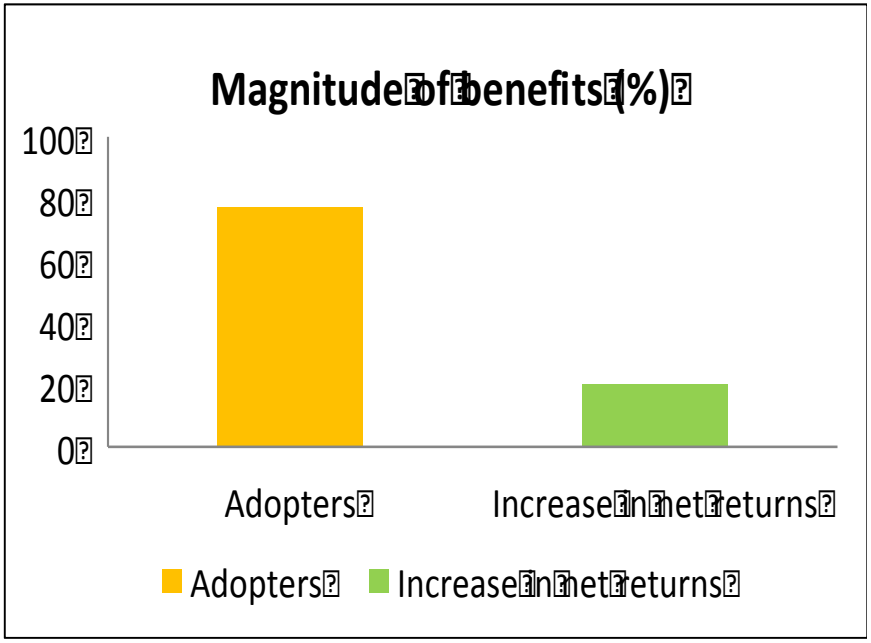
CLIMATE-SMART Agriculture 2015

Results – Integrated analysis

Effect of adaptation:

- Package of micro-dosing and maize-mucuna rotation



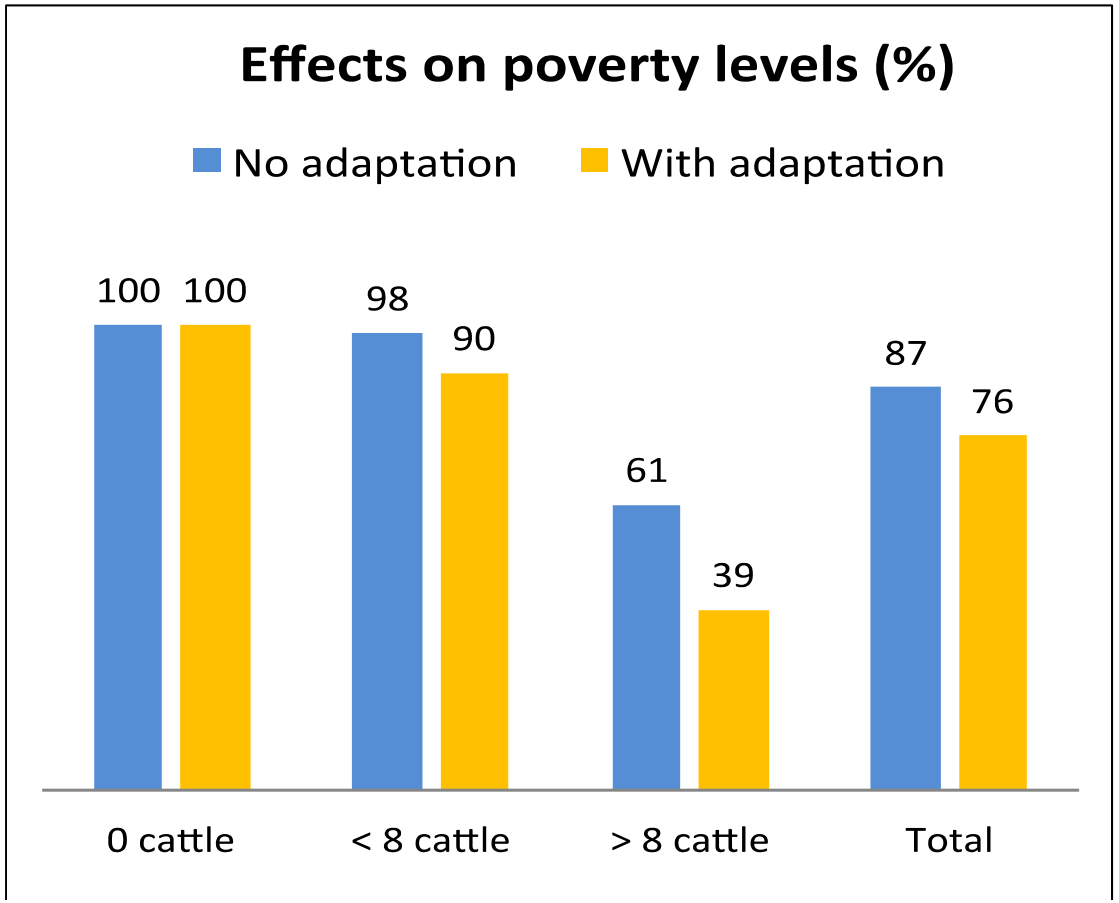


CLIMATE-SMART Agriculture 2015

Results – Integrated analysis

Effect of adaptation:

- Small and medium farms: benefit of 200-500 US$ per farm -> remain poor
- Better-off farms: benefit of 1200 US$ per farm -> higher welfare



CLIMATE-SMART Agriculture 2015

Conclusions

Integrated modelling framework to

- Assess effects on both crops and livestock, whole-farm economics
- Take into account farm heterogeneity

Most farmers in semi-arid Zimbabwe will loose from climate change

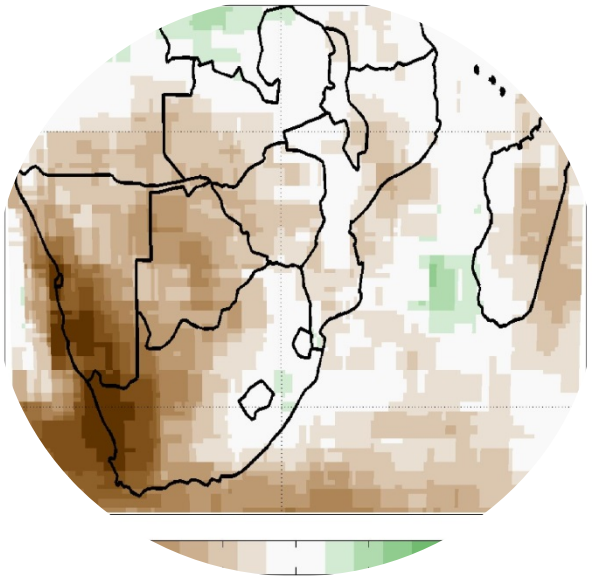
Most farmers benefit from adaptation options, but

- Benefits are small overall
- Small and medium farms will remain below the poverty line

Need for transformative changes and opportunities outside agriculture

CLIMATE-SMART Agriculture 2015

Thank you!



WAGENINGEN UR
For quality of life

ICRISAT
Science with a human face

AgMIP
The Agricultural Model Intercomparison and Improvement Project