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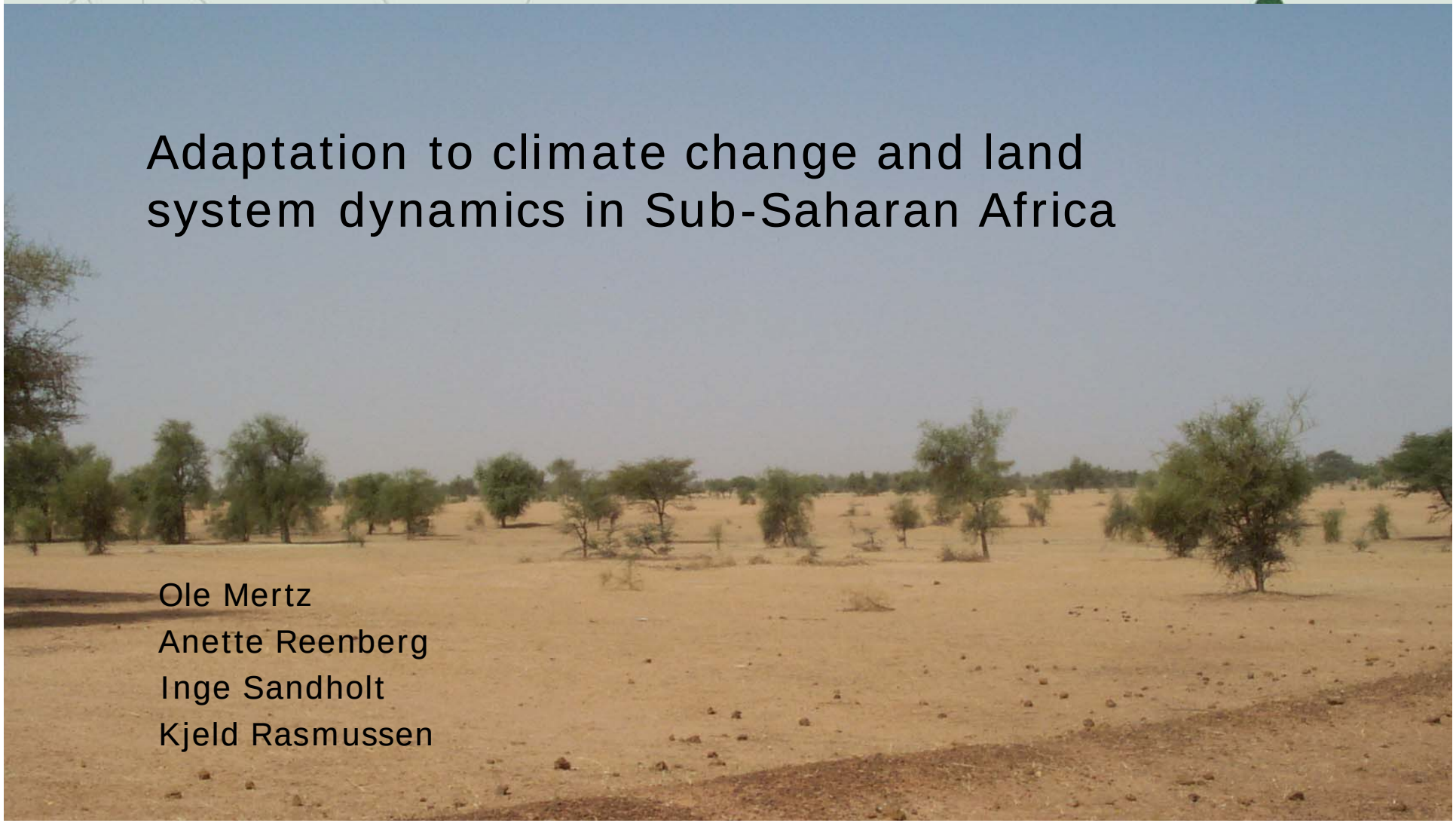
Adaptation to climate change and land system dynamics in Sub-Saharan Africa



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Inge Sandholt
Kjeld Rasmussen

AMMA

African Monsoon Multidisciplinary Analysis (AMMA)

- EU-funded with more than 50 partner institutions
- AMMA-US
- Extension with more African partners

AMMA Work Package 3.2 on adaptation to CC in the Sahel:

- Principal Investigator: Inge Sandholt
- Participants DGUC: Anette Reenberg, Kjeld Rasmussen, Ole Mertz
- Other principal partners in WP 3.2: Université Cheikh Anta Diop de Dakar; Centre de Suivi Ecologique, Senegal; Université de Ouagadougou; EIER-ETSHER, Burkina Faso; Université Catholique de Louvain, Belgium; IBIMET, Italy

Definitions of adaptation

Adaptation to climate change takes place through adjustments to enhance resilience or reduce vulnerability to current climate variability or expected changes in climate

Adapting vs. coping:

- *Adaptation* is an adjustment in practices, processes or structures aimed at long term change
- *Coping* refers to actions responding to short term climatic stress or shocks after which the systems reverts to its previous state

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Adaptation in developing countries

Developing countries have:

- lower resilience and are more vulnerable
- lower adaptive and institutional capacity
- diverse regions with different adaptive capacity

Projected changes in cereal production as a result of climate impacts (base year 2060, doubling of CO_2):

Developed countries:

- without adaptation: -3.5 to 11.3%
- with adaptation: 4.0 to 14.0%

Developing countries:

- without adaptation: -10.8 to -11.0%
- with adaptation: -9.0 to -12.0%

Terms of trade will have to be changed!

Challenges to studying adaptation of land use in DCs (1)

Response options – adapting to what?

- food demand (population growth)
- labour supply (migration, education, health, ...)
- availability of inputs and land
- soil fertility
- development projects and subsidies
- market opportunities
- tax incentives
- land tenure and conflicts
- ...

Levels of scale

- levels of analysis
- extrapolation between scales
- incompatibility of ecological-agricultural scales
- incompatibility of institutions affecting land use at different scales

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Challenges to studying adaptation of land use in DCs (2)

Porous boundaries

- resource management units do not always comply with set boundaries
- land use change as a response to CC may not follow modelled prediction within agreed boundaries

Conceptual levels of human choices

- formal rules and regulations often replaced by political or operational decisions to fit reality – at all levels

Sahel – wetter or drier?

- Decline in rainfall since 1970s in the Sahel likely to have been caused by change in sea surface temperatures – not land use change
- Most models predict higher precipitation in the Sahel with climate change, but...
- increased rainfall partly predicted in dry season or as more intensive rainfall events
- recent modelling point to a significant drying of the Sahel...

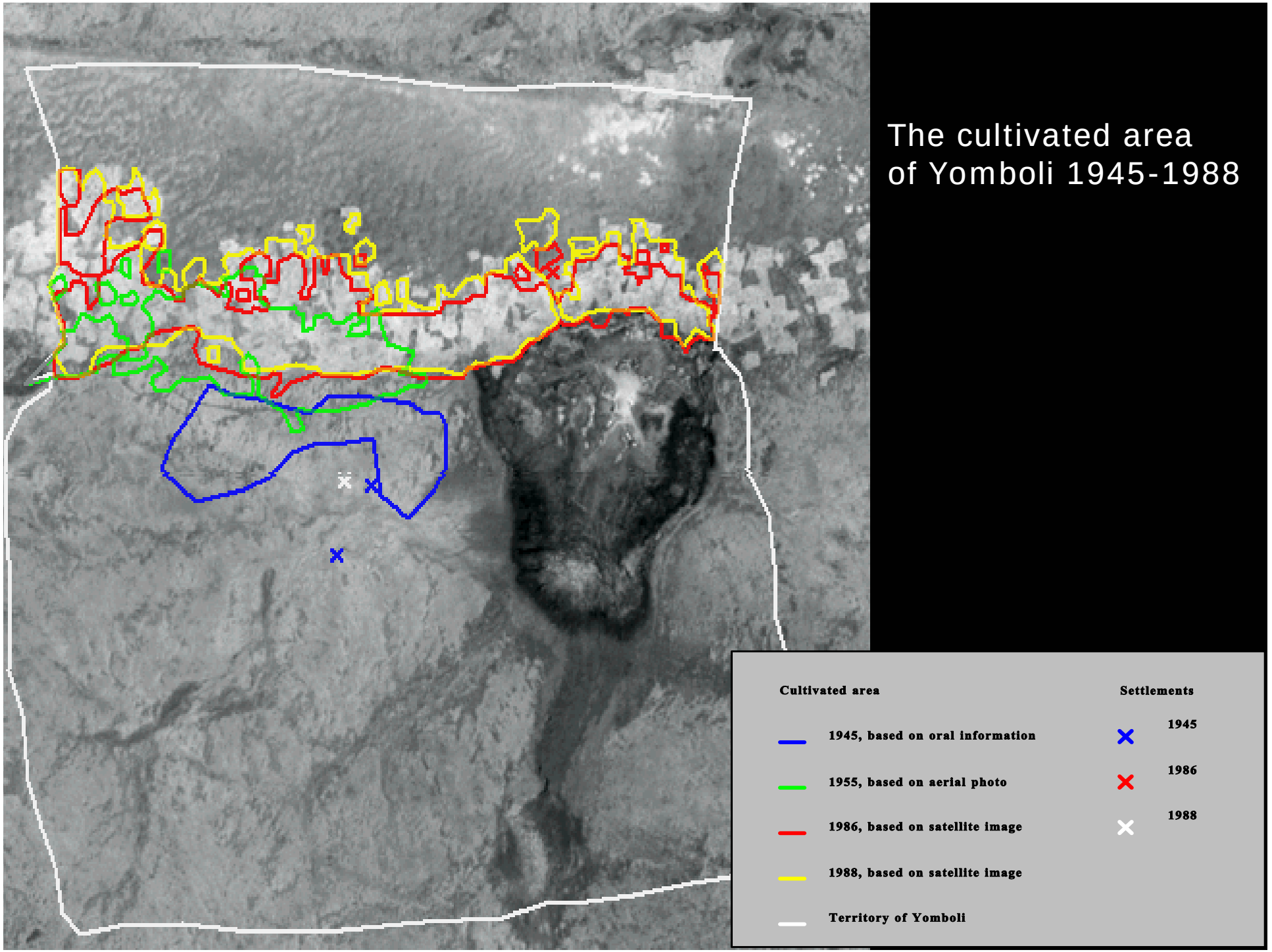
Which scenario should farmers adapt to?

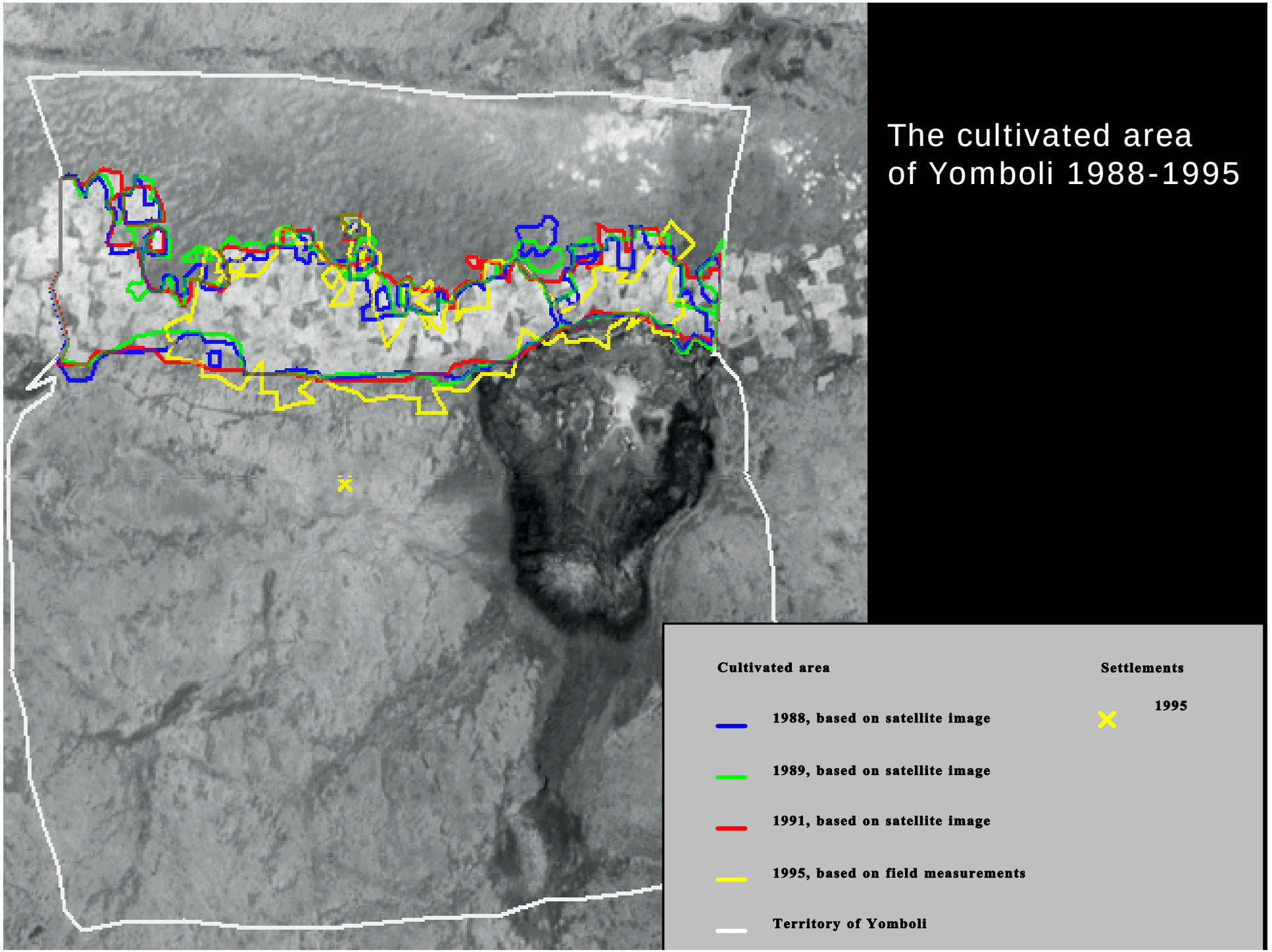
Sahel – coping and adaptation experiences

- Sahel farmers and pastoralists have always been adapting/coping
  - seasonal forecasting using signs in nature
  - labour flexibility – migration
  - use of alternative resources in poor years
  - flexible land resources – dunes vs. river beds
  - animal-crop flexibility
  - transhumance – annual and emergency

- Shocks like the droughts in the 1970s and 1980s caused set backs

- … but farmers are still 'in business'


The cultivated area
of Yomboli 1945-1988
Cultivated area
1945, based on oral information
1955, based on aerial photo
1986, based on satellite image
1988, based on satellite image
Territory of Yomboli
Settlements
1945
1986
1988


The cultivated area
of Yomboli 1988-1995
Cultivated area
1988, based on satellite image
1989, based on satellite image
1991, based on satellite image
1995, based on field measurements
Territory of Yomboli
Settlements
1995

Objectives of research in Sahel

Based on empirical studies at multiple levels, how will development trends in the Sahel such as:

- urbanization – migration, off-farm activities
- land tenure changes and capital investment
- trade – diversification of production and new technologies
- government policies and macroeconomic trends/changes
- land and resource degradation/restoration

affect, positively or negatively, the vulnerability of households, communities and Sahelian countries at seasonal to decadal time-scales?

How is their relative weight compared to impacts of climate change and variability (CCV) and how do the trends interact with CCV?

Which coping and adaptation strategies are adopted in the face of these changes or trends and to what extent are these strategies specifically a response to CCV?

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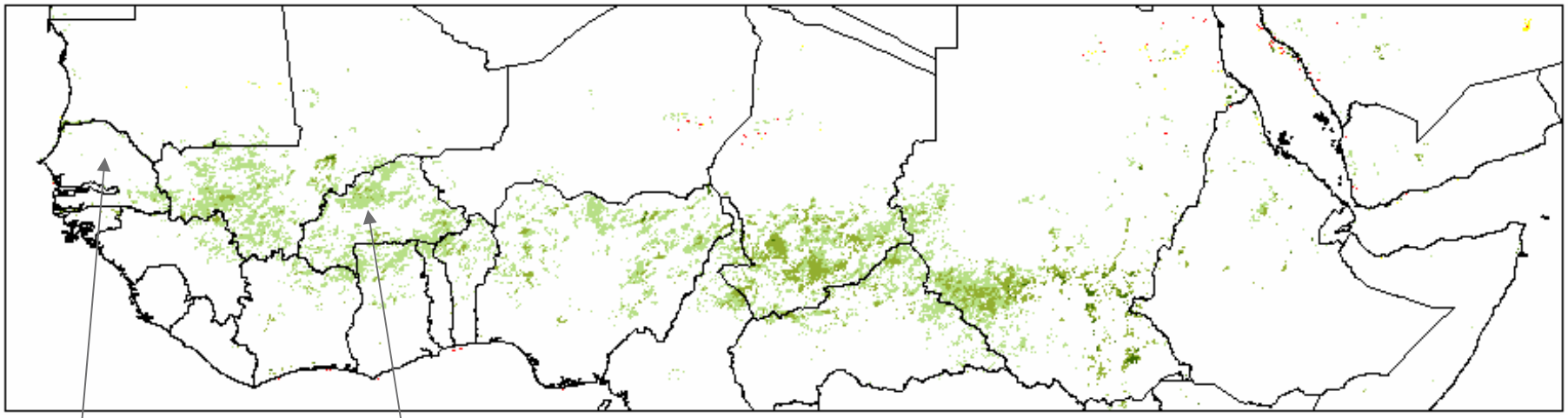
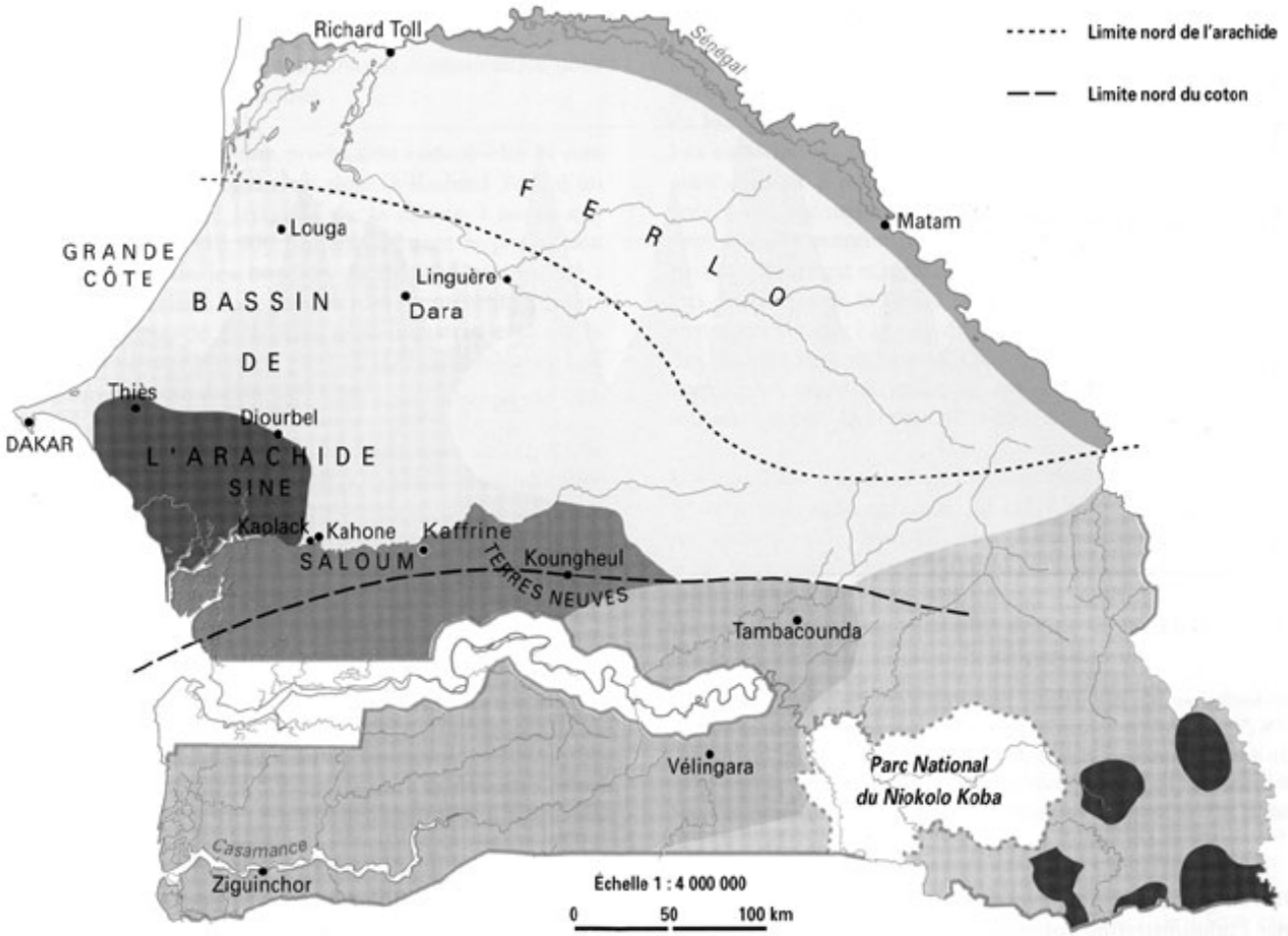
The Sahel cases

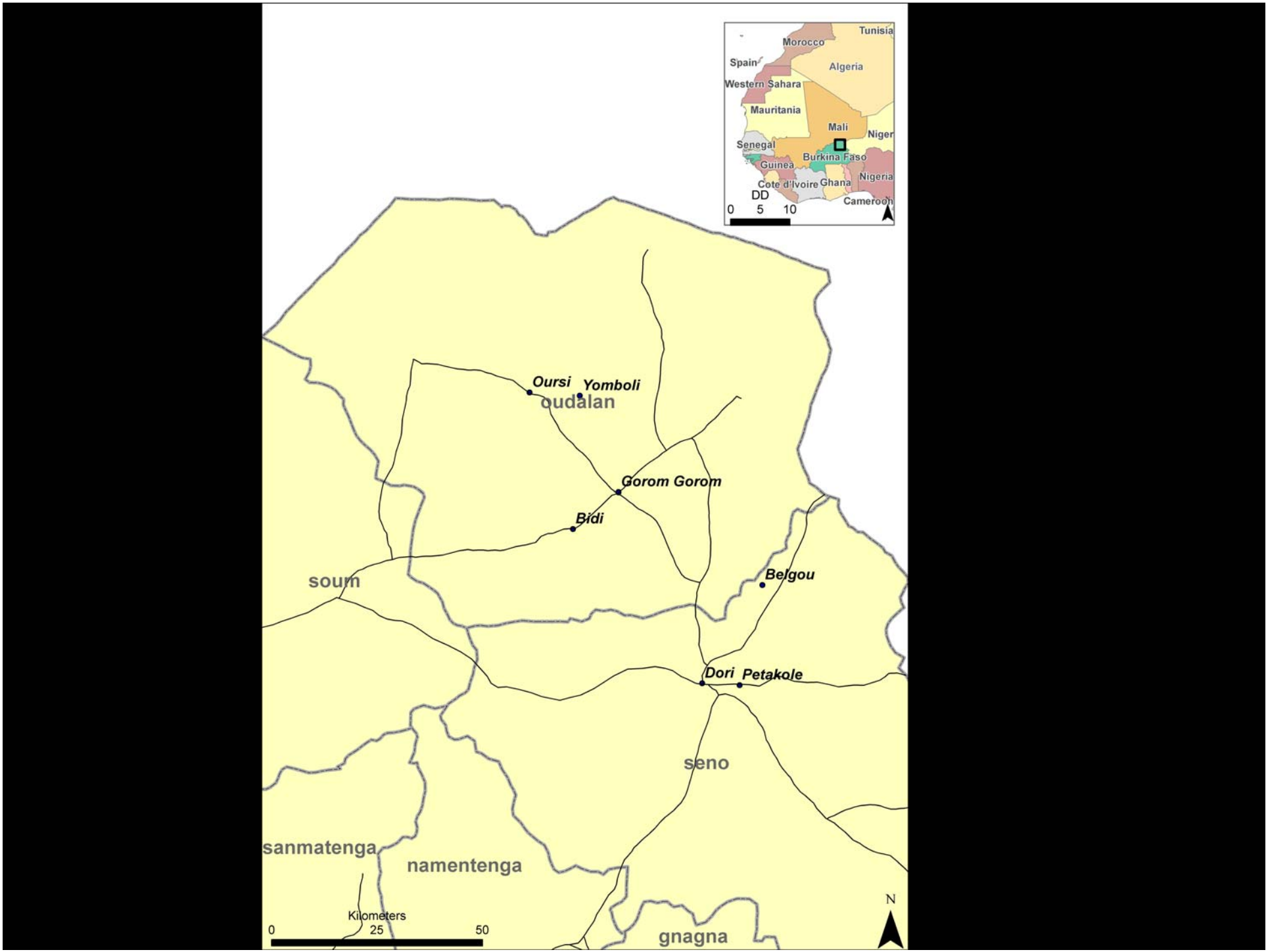
- Sahel: Ecological zone stretching east-west across Africa
- 200-400 mm annual precipitation
- Main crops: millet, sorghum, ground nuts, dry season vegetables
- Pastoralism with cattle, camels, goats and sheep



Principaux systèmes de culture



- Agriculture de décrue en saison sèche, sorgho + cultures sous pluie sur les bordures de la vallée + casiers rizicoles irrigués
- Agriculture traditionnelle fondée sur l'alternance souna/arachide
- Agriculture intensive sous pluie avec petit mil/arachide/fumure animale
- Agriculture sous pluie diversifiée : petit mil et arachide dominants + sorgho, maïs, coton, riz (sur la côte)
- Agriculture sous pluie dominante avec petit mil, sorgho et coton + maïs + arachide + riziculture de bas-fond
- Agriculture sous pluie à longues jachères avec îlots intensifs sur les reliefs frontaliers
- Agriculture sous pluie avec petit mil + sorgho + maïs + arachide et riziculture de bas-fond
- Riziculture inondée dominante + mil et arachide sur plateaux
- Pastoralisme dominant : transhumance de saison sèche vers le nord, l'ouest et le sud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Approach – data needs

Key issues to be addressed:

- Past adaptation or coping strategies
- Current practices – the traditional system or a result of adaptation? The traditional system as an adaptive system
- Views on climate change and its impact on agriculture
- Assessment of scenarios of future climate change and the needs for adaptation
- Assessment of resources, capacity and political 'climate' for adaptation
- General analysis of drivers of change in agriculture to separate effects

Methods

Key methods used:

- Local historical land use data from earlier studies of agricultural change
- Remotely sensed data for local and regional land use/cover change
- Household and field surveys for an overview of current practices
- Focus group and key informant interviews:
  - retrospective questions
  - scenario assessment
- Climatic modelling used as continuous input as models improve

Points for discussion

- How to best understand decision-making processes that lead to adaptation?
- Will it be possible to separate responses to many different trends and events?
- The need for interdisciplinary and cross-sectoral approaches
- Climate change may be considered a minor issue in poor countries with plenty of other problems

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Thank you

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