



Land use in developing countries: The triple exposure of local livelihoods

The issues of climate change, globalization and population pressure

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Presentation to the 13th Swiss Global Change Day, April 4th 2012, Bern



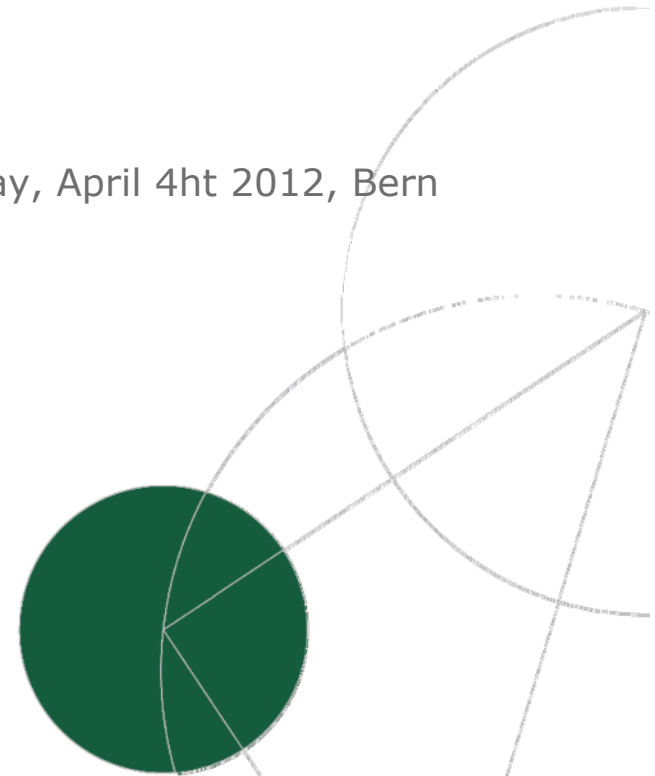
LaSyRe Sahel, research project (Danida)



Waterworlds, ERC-project (Dep of Anthropology)



Global Land Project, IGBP/IHDP



My entrance points – and conclusions

- Climate change and food security is high on the agenda LDC
- Agricultural and pastoral land uses are still the backbone of many LDC economies
- Land is an increasingly scarce resource – hence, land use changes in response to pressures is an important theme for global sustainability (climate adaptation, climate resilience, food for 9 billion in 2050, land grab movements, etc)
- Land use changes are results of complex interactions between man and the environment – and in some places 'beyond climate'
- Global change is much more than climate change



The roadmap for this presentation:

- A short introduction to the Sahel in West Africa
- A few words about the shifting focus of Sahelian research efforts
- The triple exposure: climate, population and globalization
- Examples from local studies in Burkina Faso and Niger



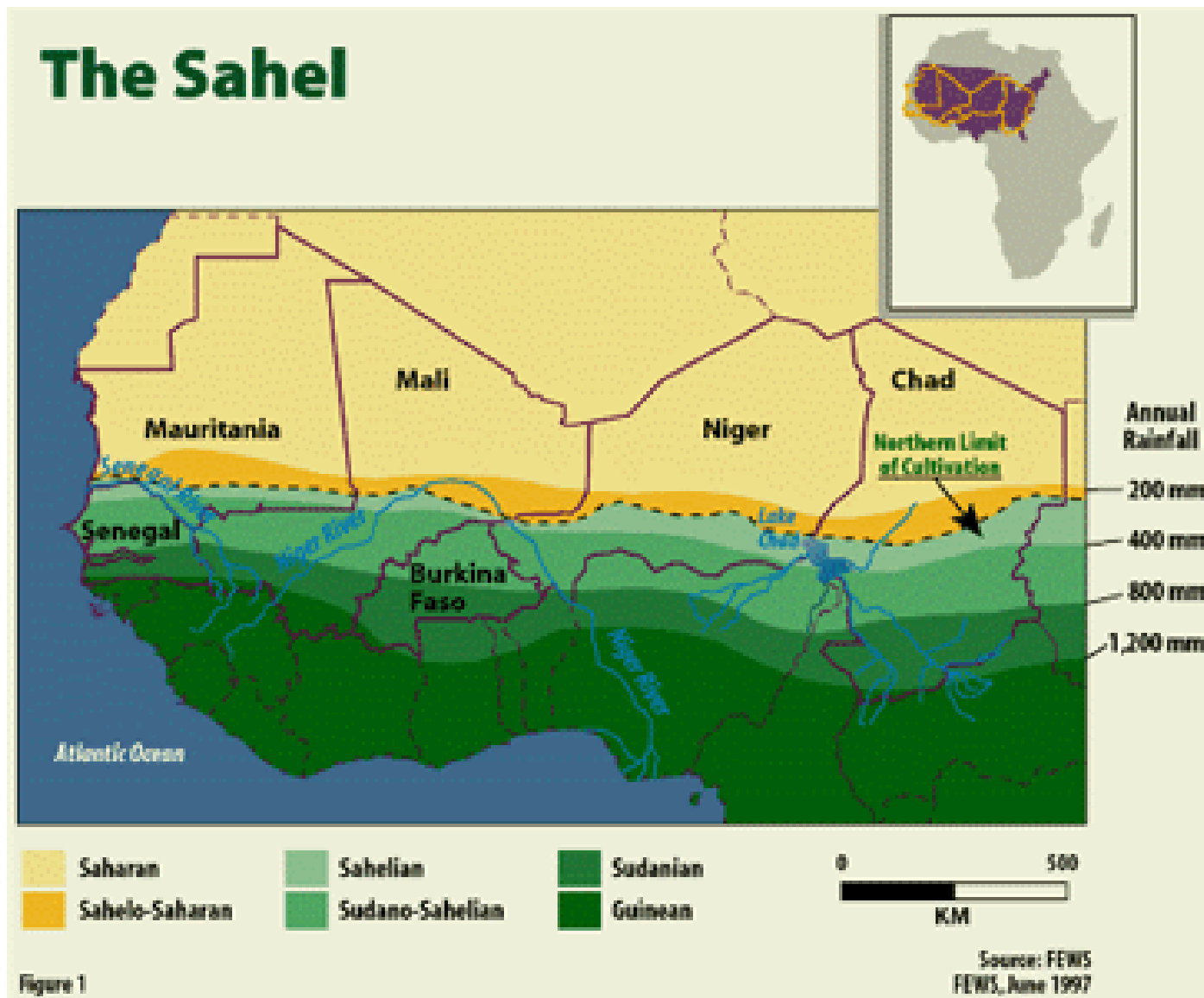


Figure 1



Sahel – images



Sahel images



Major land use practices

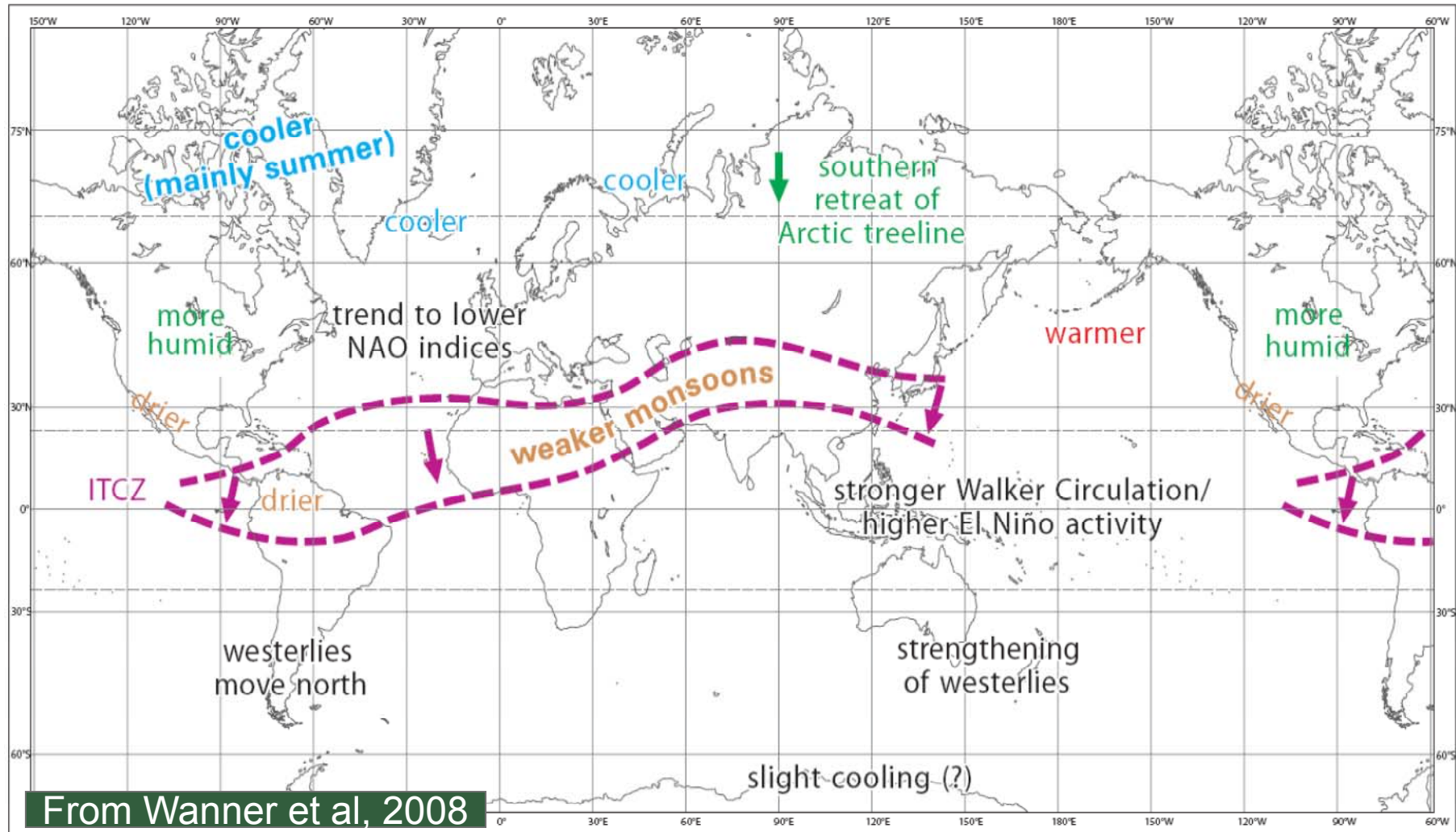
Rainfall yearly	Agroecology Zone	Pastoral activities	Agriculture Main crops
<100 mm	Sahara	Nomadism	No cultivation
200-600 mm	Sahel	Transhumance	Millet Cowpeas Sorghum Peanuts
> 600 mm	Soudano-Sahel	Sedentary	

Agriculture: millet, sorghum, ground nuts, cowpeas, dry season vegetables
Pastoralism: cattle, camels, goats and sheep

Note:
 Crop-livestock interactions are important



PAGES – CLIVAR – AIMES collaboration: Climate change 6 kyr BP - present



Long term fluctuation of agro-ecological zones in Sahel

10.000 BP intensified monsoon (lakes, open woodland)

5.000 BP final collapse of monsoon (after periods of abrupt arid crises) – cattle herders migrated to the Sahel

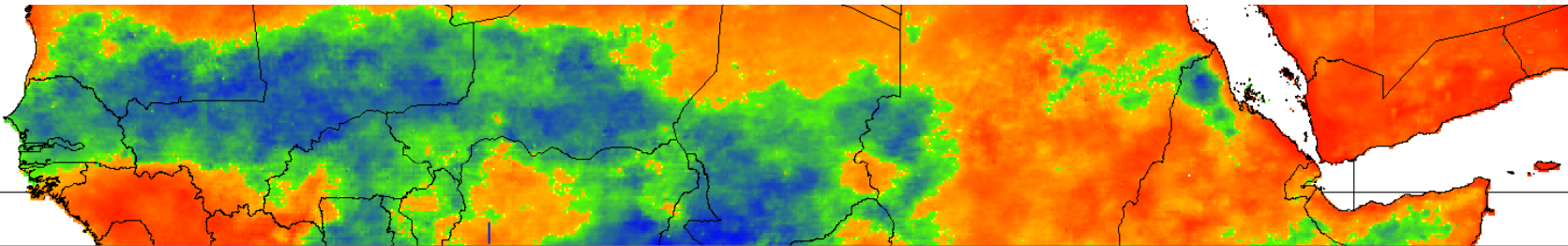
Unlike e.g. Asia, Sahel pastoralism was not from the outset linked with sedentary agriculture

Lack of water (rivers for irrigation) was the main cause of the lacking development of urban civilizations

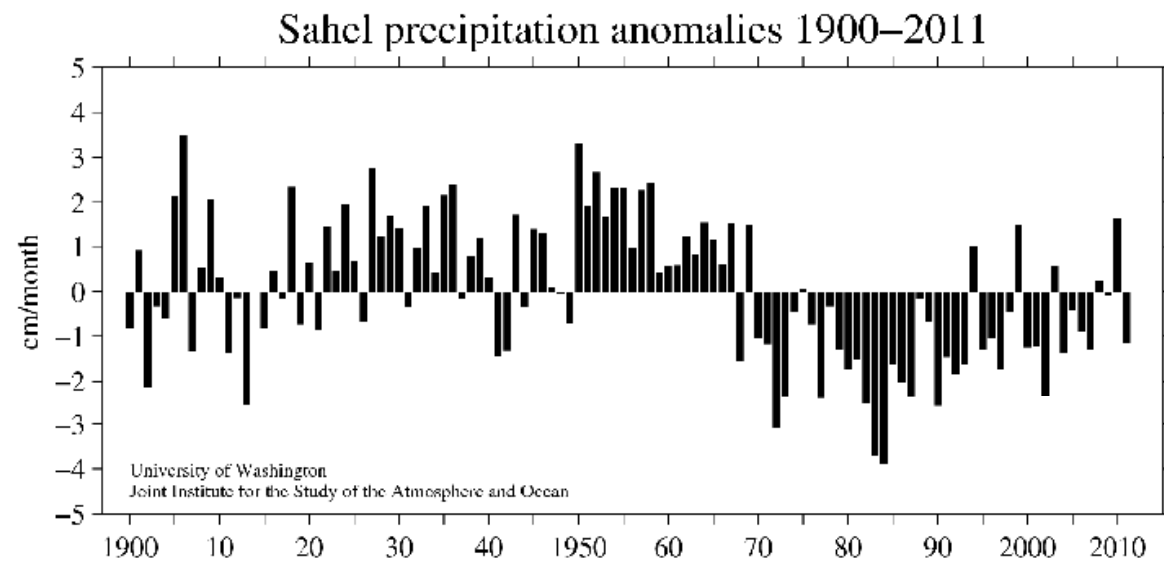
Recently, the Sahel experienced an unusual high rainfall in 1950-60's (coincident with independence => large incentive to expand cultivation into marginal land => profound implications for vulnerability)

Brooks, 2006

Recent rainfall trends in the Sahel



Trends in the development of rainfall in the period 1996 – 2006, derived from the CHARM data-set. Green colours denote a positive trend, red colours a negative trend. (Funk & Verdin, 2003)



June through October averages over 20–10N, 20W–10E. 1900–2011 climatology
NOAA NCDC Global Historical Climatology Network data



COP 15 statement



Dr Hubert N'DJAFA OUAGA,
Regional Coordinator
Climate Change Project CILSS,
AGRHYMET Regional Centre
Clément OUEDRAOGO,
Coordinator – Water Supply Programme,
CILSS

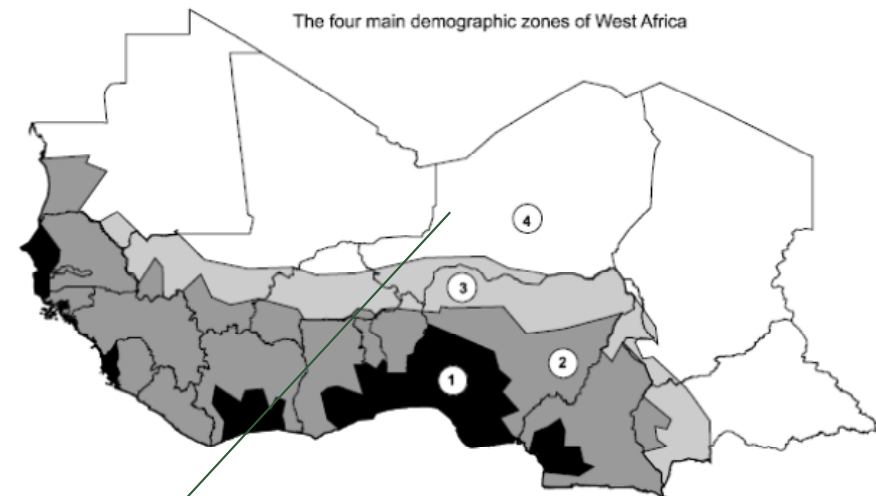
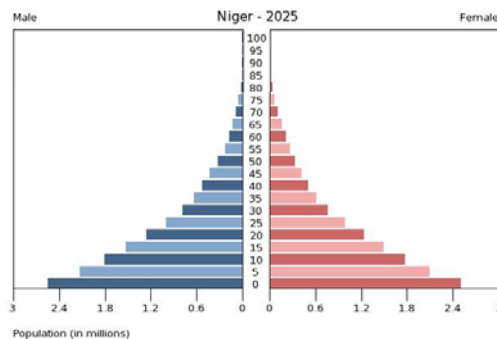
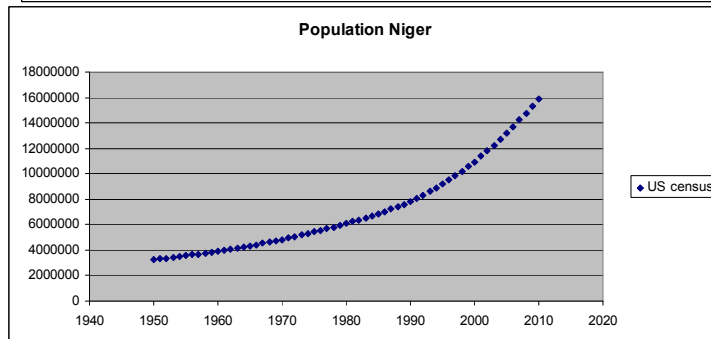
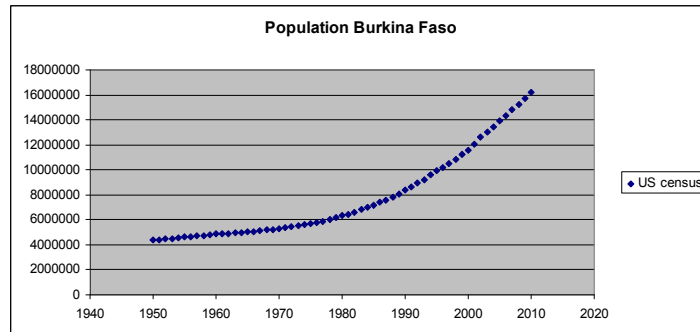
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According to the United Nations, **the population in the Sahel should double again by 2030 and exceed 193 million inhabitants in 2050, i.e. 12 times more than it was in 1950 (16 million)**. In Niger, for example, the Government stated in 2007 that if the demographic growth keeps up, the cereal production required to cover population needs would move from about 3 million tons in 2005 to 4.2 tons in 2015 and to over 13 million tons in 2050.



The human dimension

Population: Regional distribution and growth

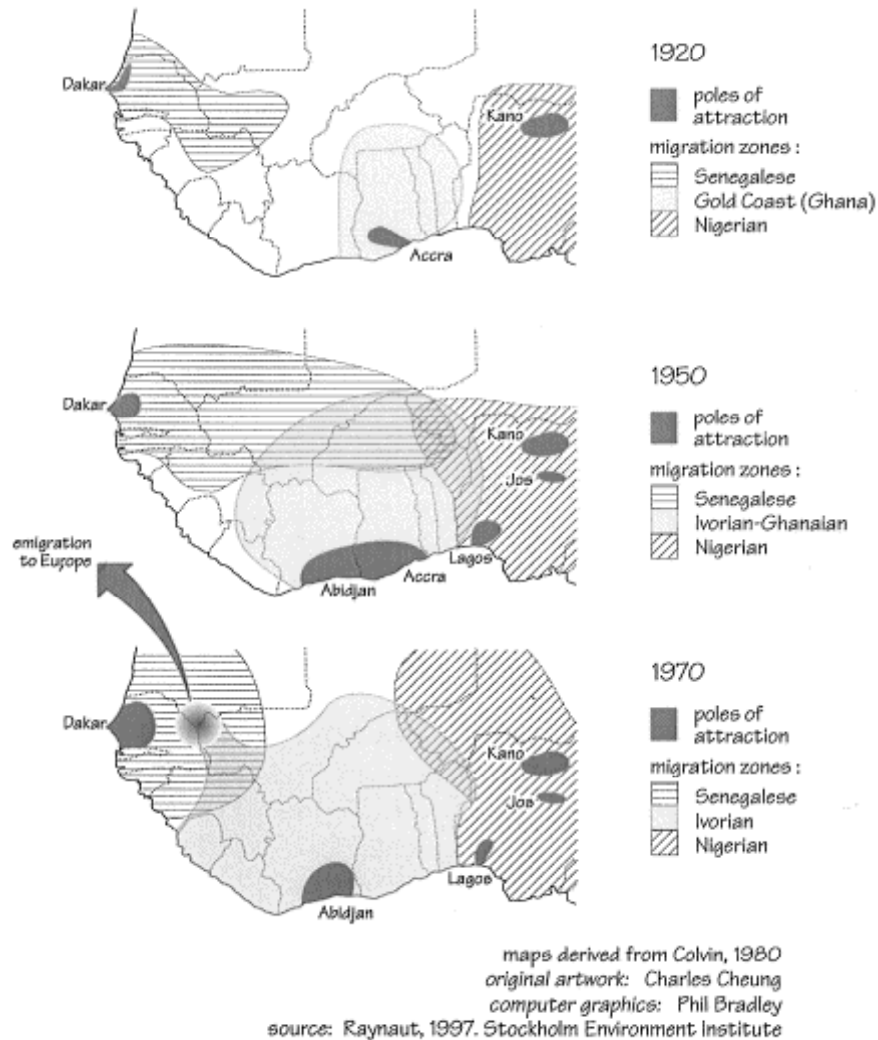


PAST AND PROJECTED GROWTH OF POPULATION BY AREA
in million inhabitants and % of regional total

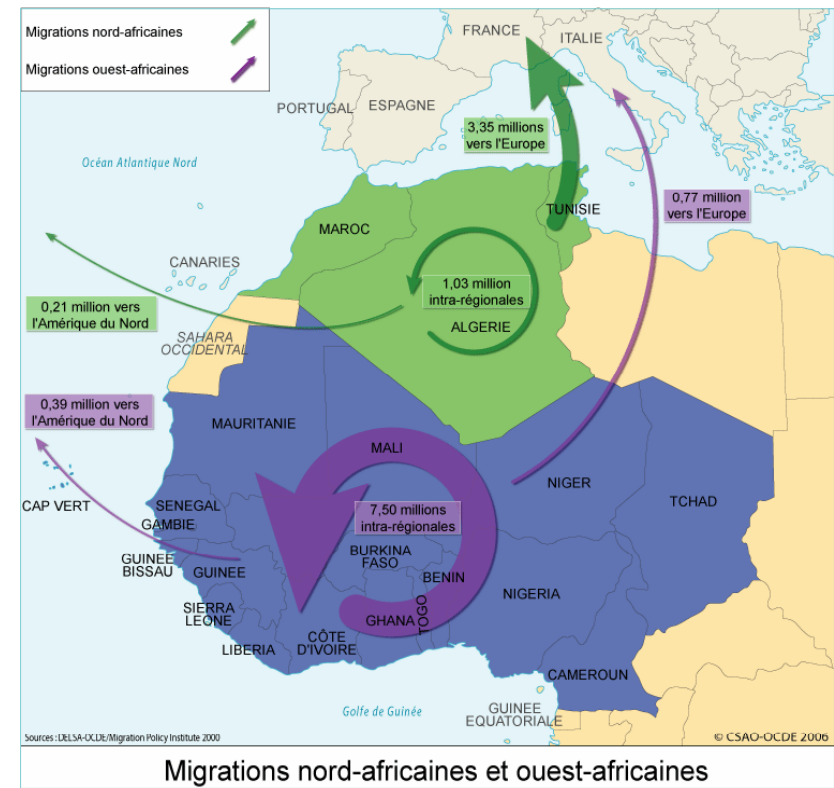
ZONE	YEAR	POPULATION				PERCENT of total			
		1930	1960	1990	2020	1930	1960	1990	2020
Zone 1	Coastal growth poles	14	31	79	174	31%	37%	41%	40%
Zone 2	Coastal hinterland	13	25	54	137	29%	30%	28%	32%
Zone 3	Sahelian growth poles	13	21	50	101	29%	25%	26%	23%
Zone 4	Sahelian fringes	5	7	12	20	11%	8%	6%	5%
Total	West Africa	45	84	195	432	100%	100%	100%	100%

Source: Club du Sahel, 1995

Migration well established in the livelihood portfolio



That is why population pressure
In local places is hard to quantify



Shifting narratives – the moving perspective for land use system research in Sahel:

1970's desertification

- How fast is Sahara expanding
- Biophysical or human explanations?

1980-90's arid land degradation

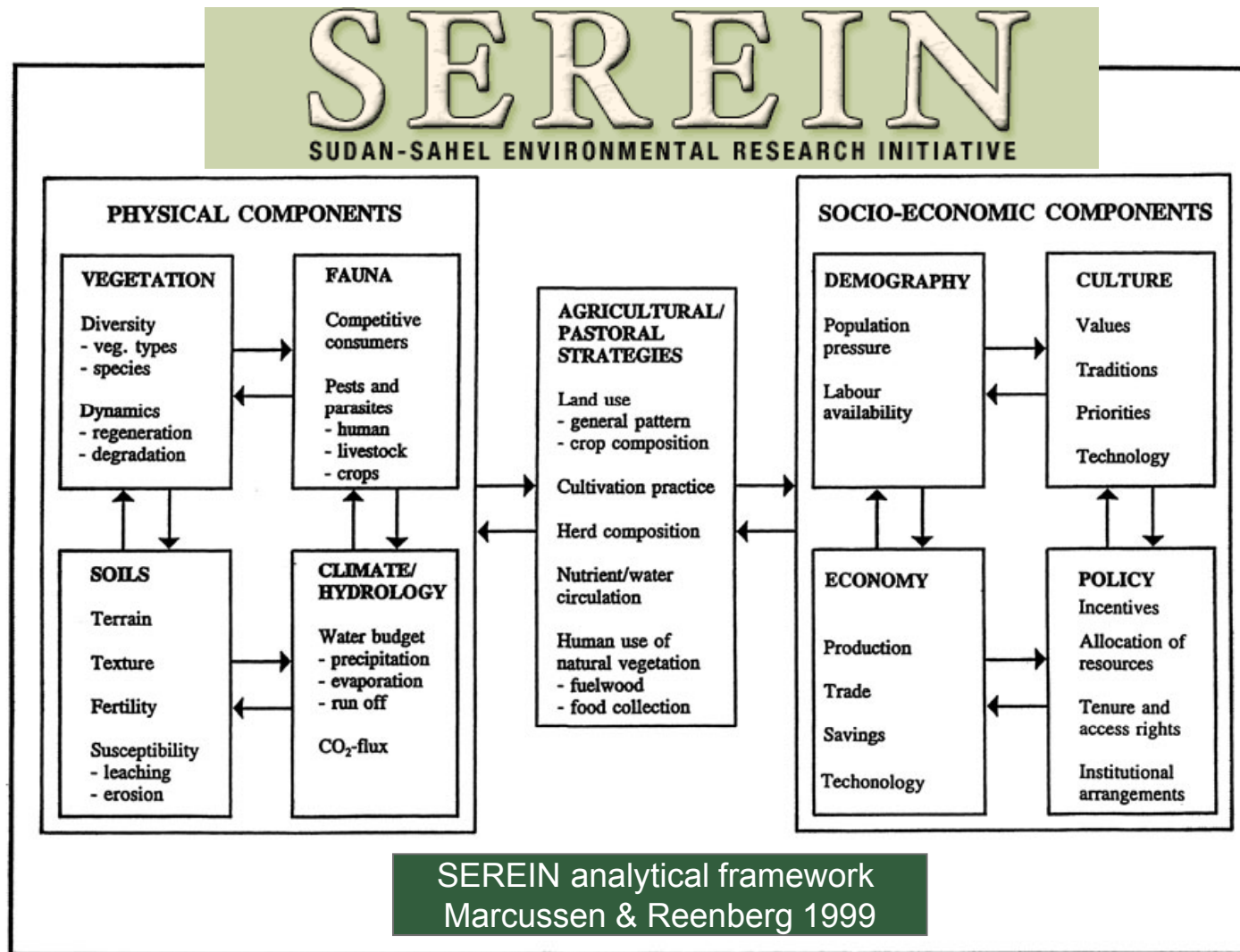
- Sustainable NRM in farming systems

2000's adaptation to climate

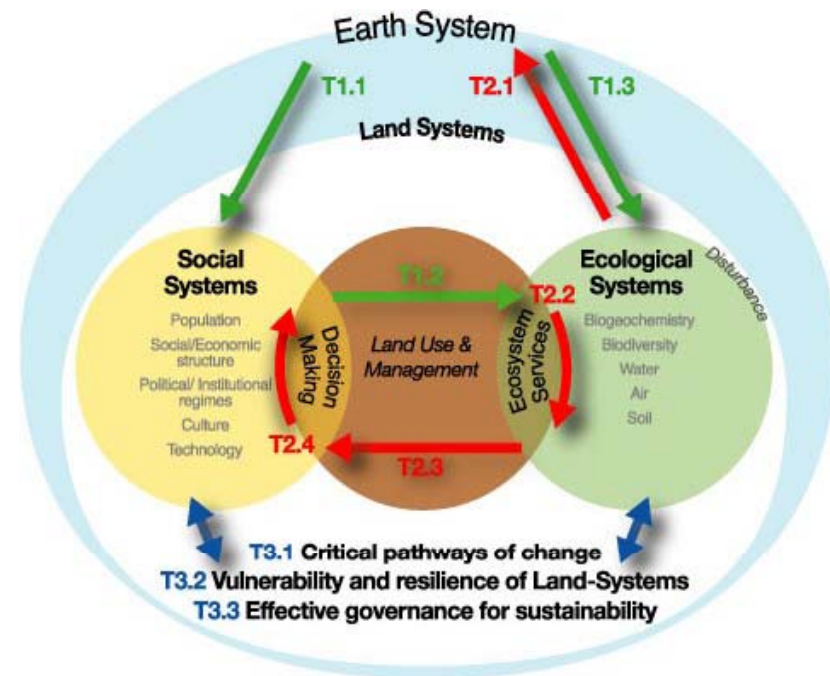
- Coping strategies
- Resilience and vulnerability



Coupled human-environment systems – a durable conceptualization



Land Change Science



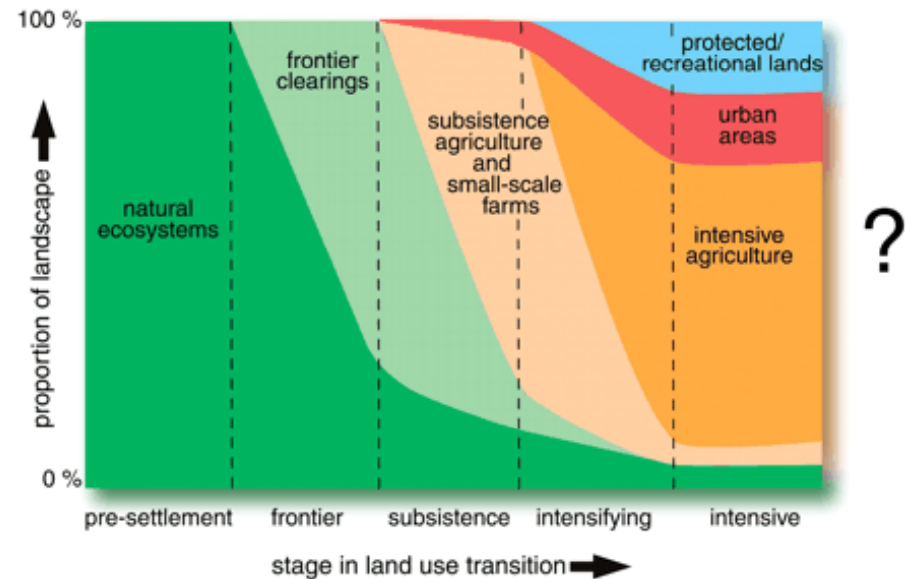
The conceptual framework specifically stresses that 1) land use decisions plays a pivotal role; 2) land use management impact ecosystem variables, 3) ecosystems services influence land use decision making, and 4) socio-economic-cultural-institutional variables influence land use decision making.



Towards a heterodox notion of land change process?

The 'classical land change narrative' builds on the notions of

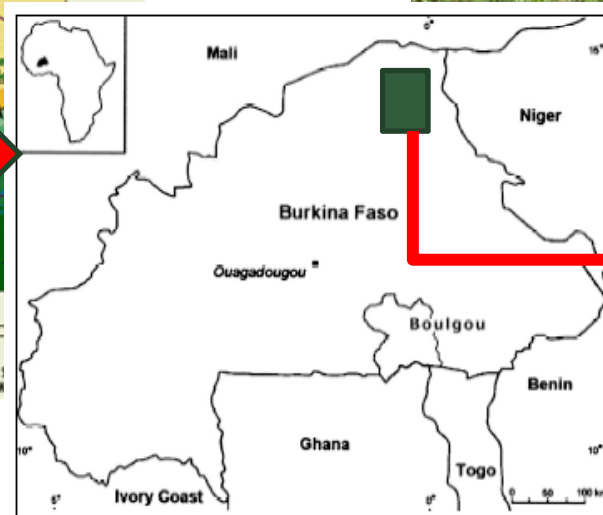
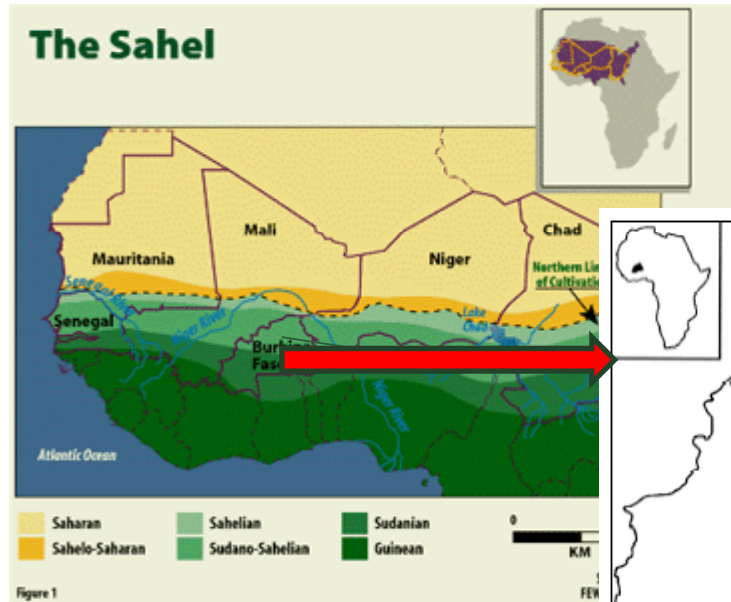
- a) land transition and
- b) 'vicious circle' (more people/less rain => more need for land => field expansion on marginal land => soil degradation => even more need for land etc.)



Source: *Science* 22 July 2005:
Vol. 309. no. 5734, pp. 570 - 574

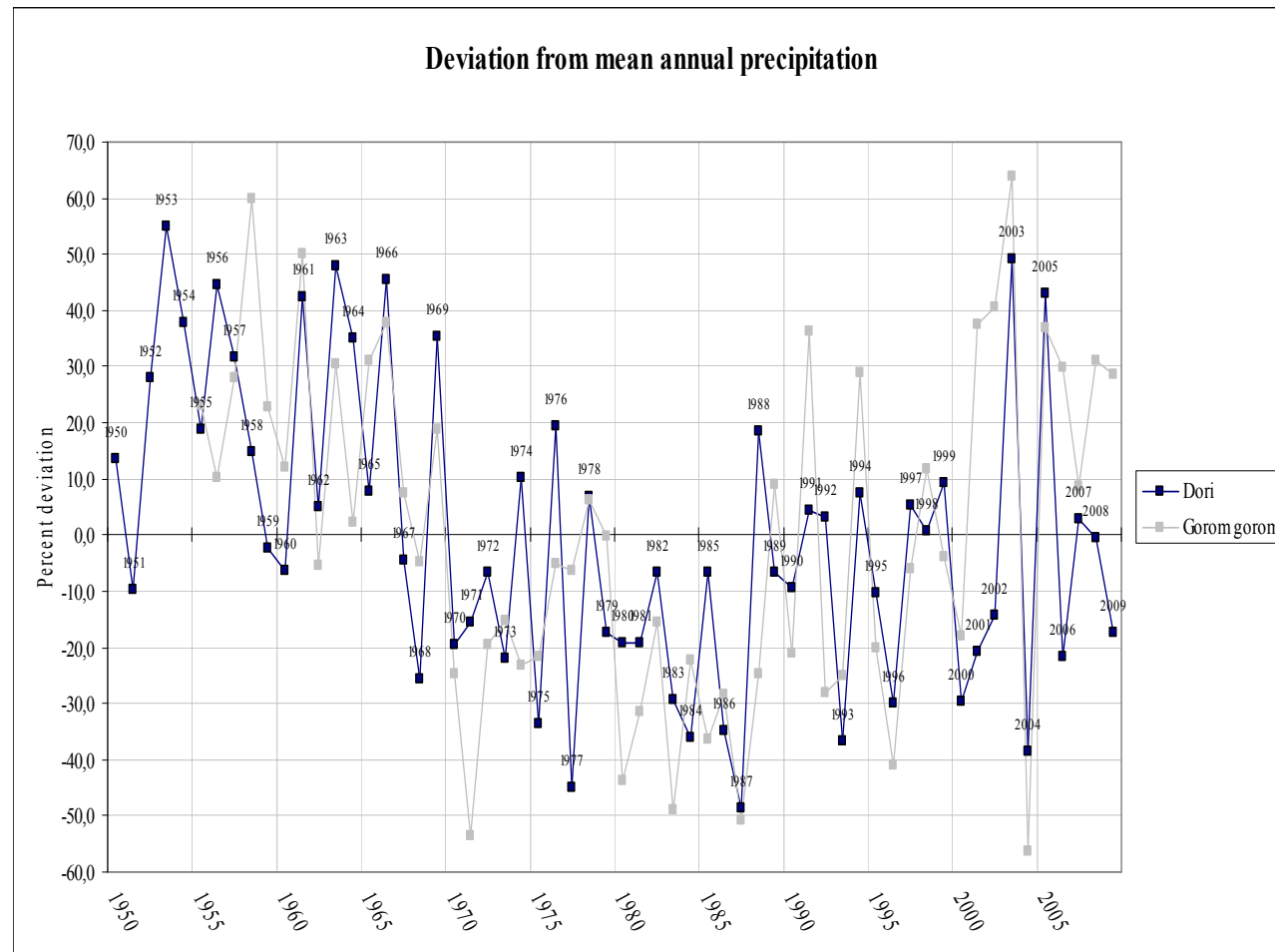


The empirical background



Two villages, Bidii-2 and Yomboli, studied intensively between 1995 and 2011

Exposures to climate variability and population pressure

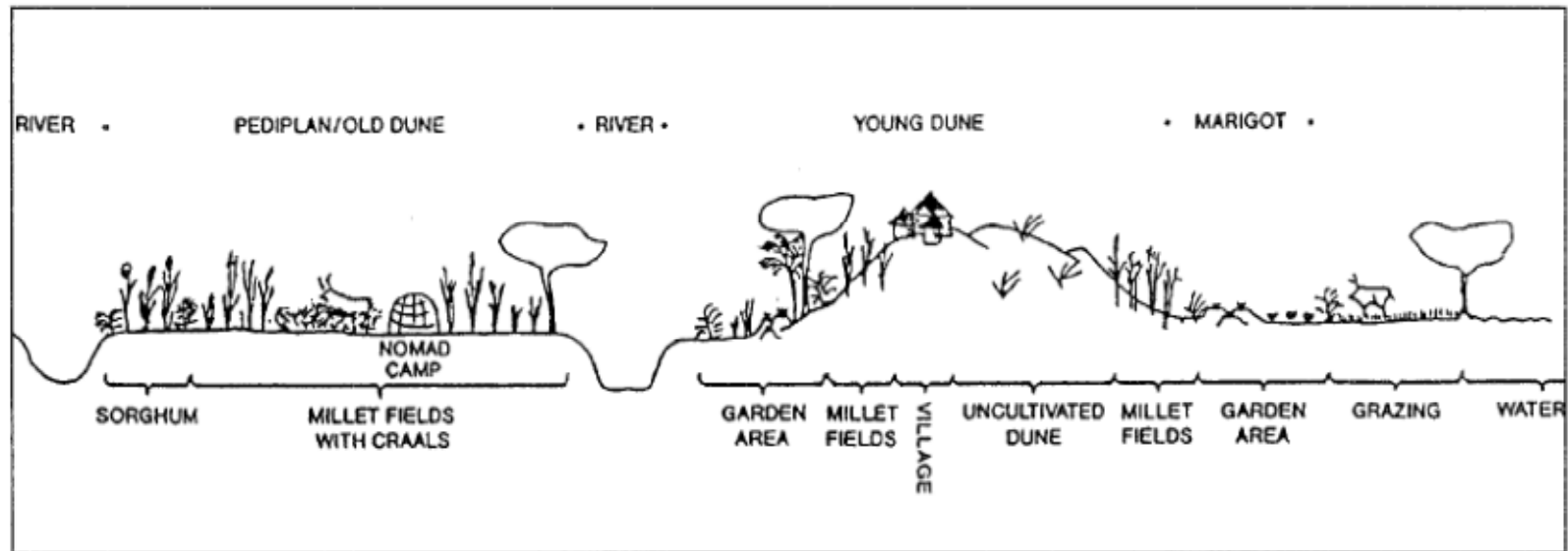


Population figures:

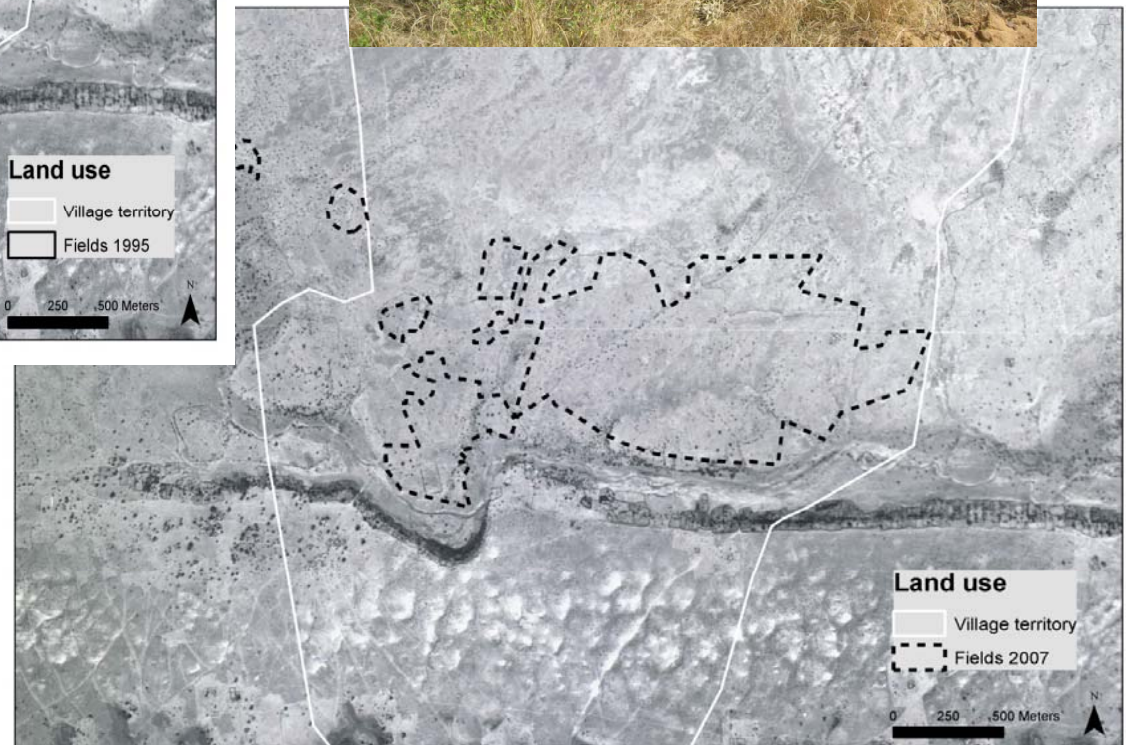
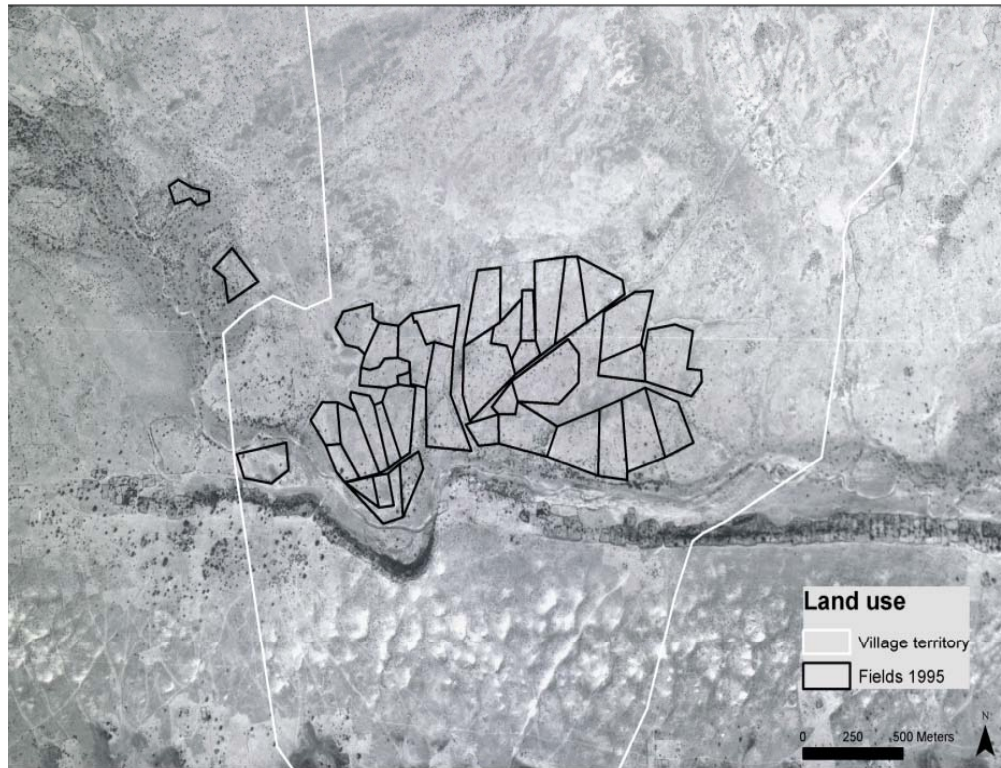
Bidii-2 1995: 346
Bidii-2 2011: 639

Yomboli 1995: 825
Yomboli 2011: 1040

The places – a pediplain/dune landscape

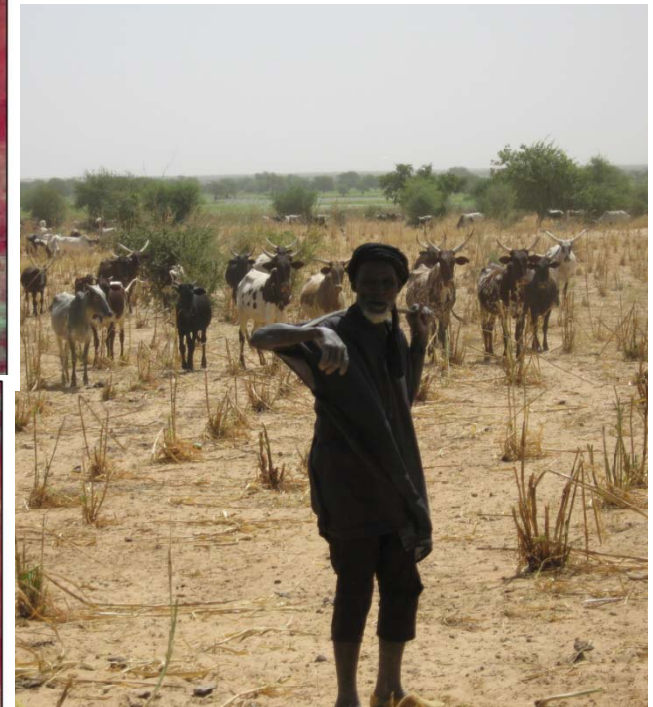
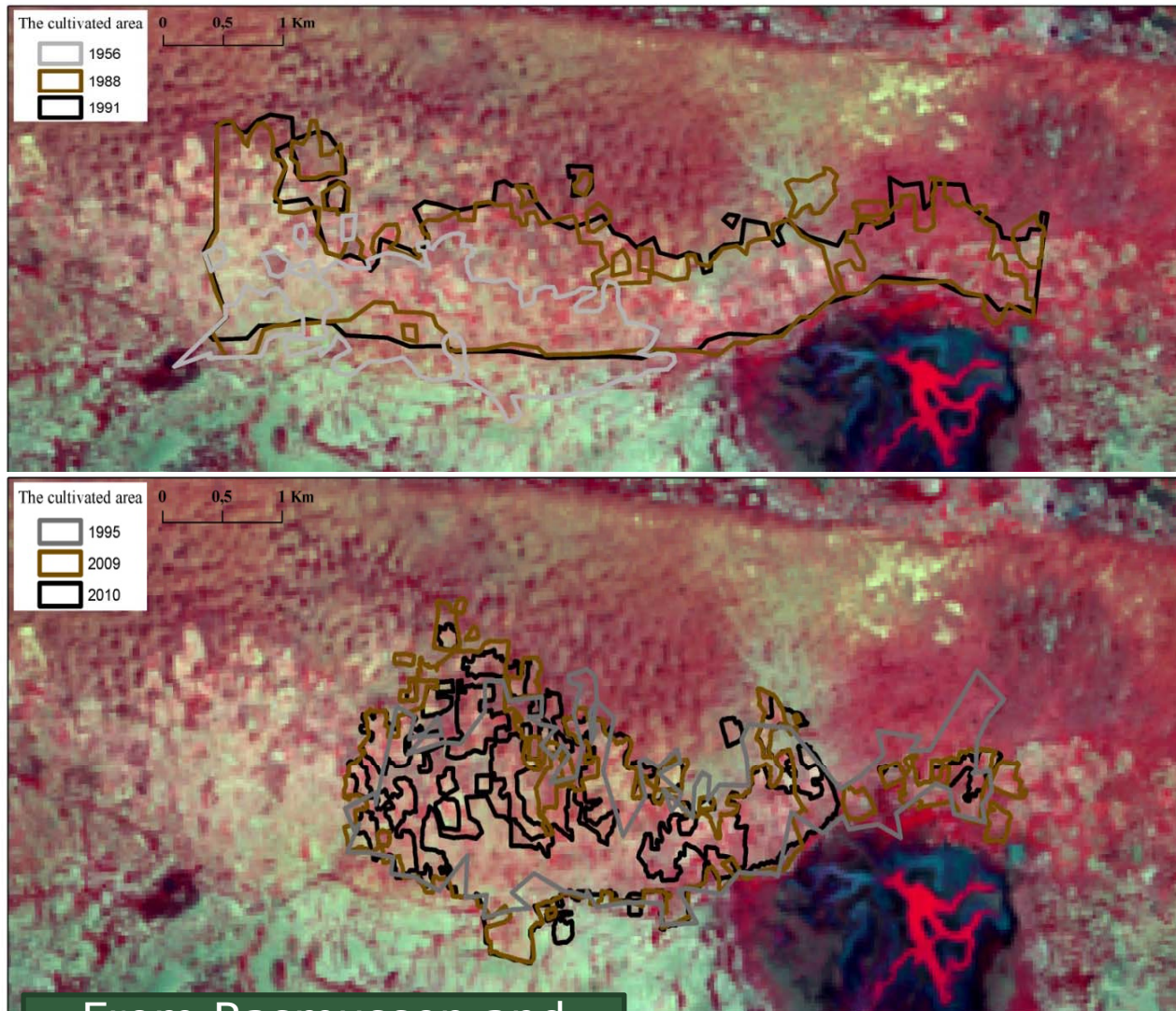


Bidii-2: Same amount of cropland – almost twice the population



From Reenberg 2009

Yomboli: almost the same story – about expansions and contractions

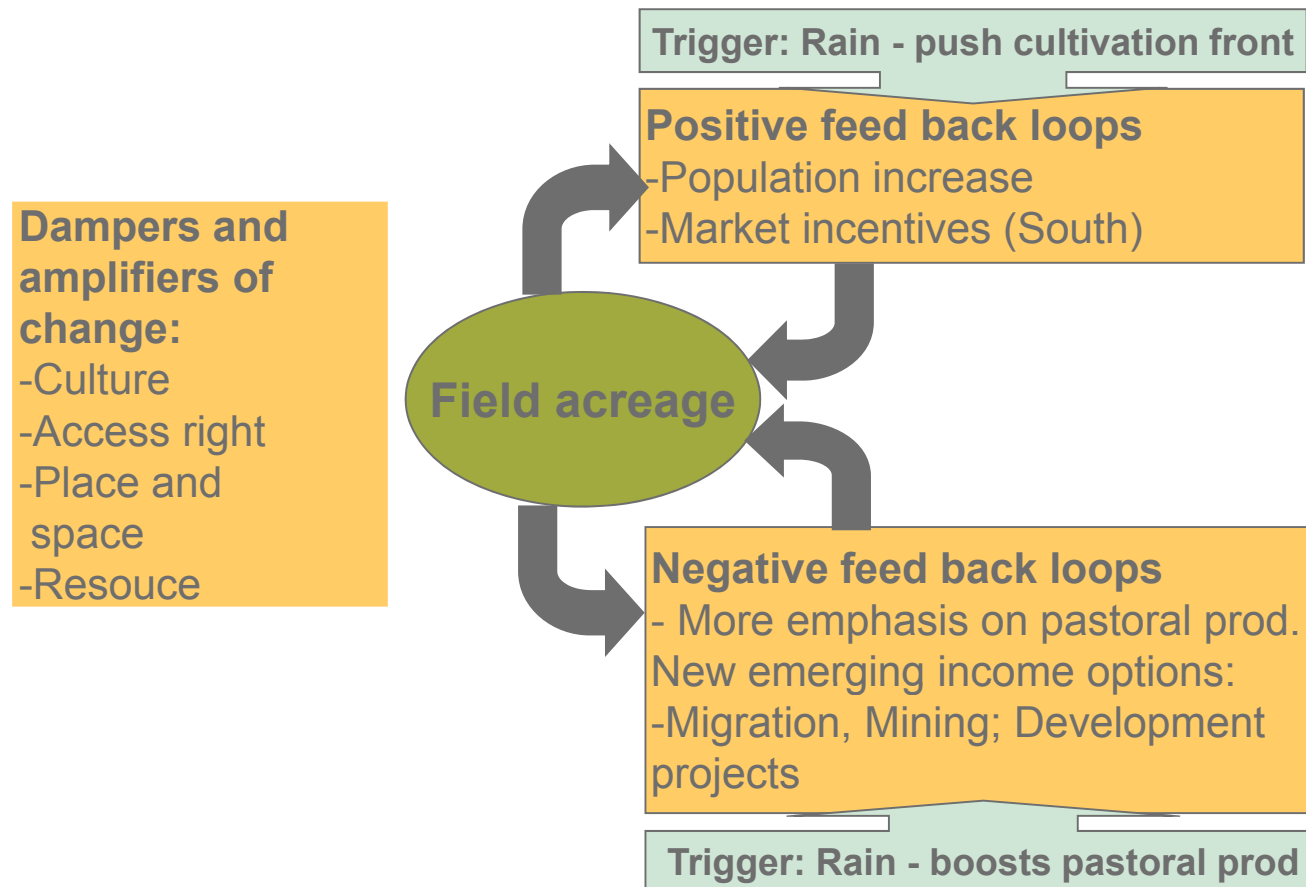


From Rasmussen and
Reenberg in prep



More rain: more or less fields?

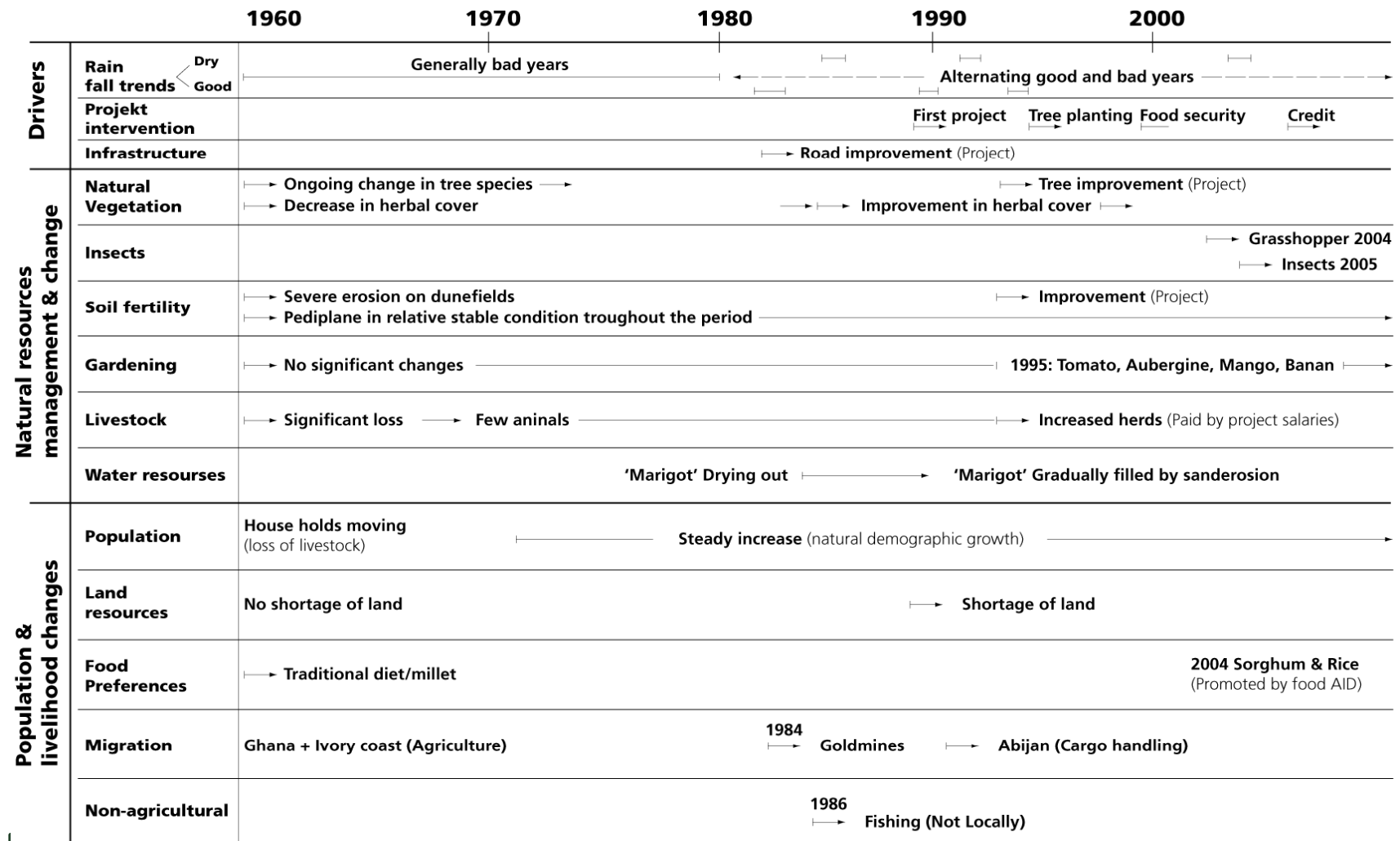
Bi-directional feed back loops



Source: Reenberg 2009



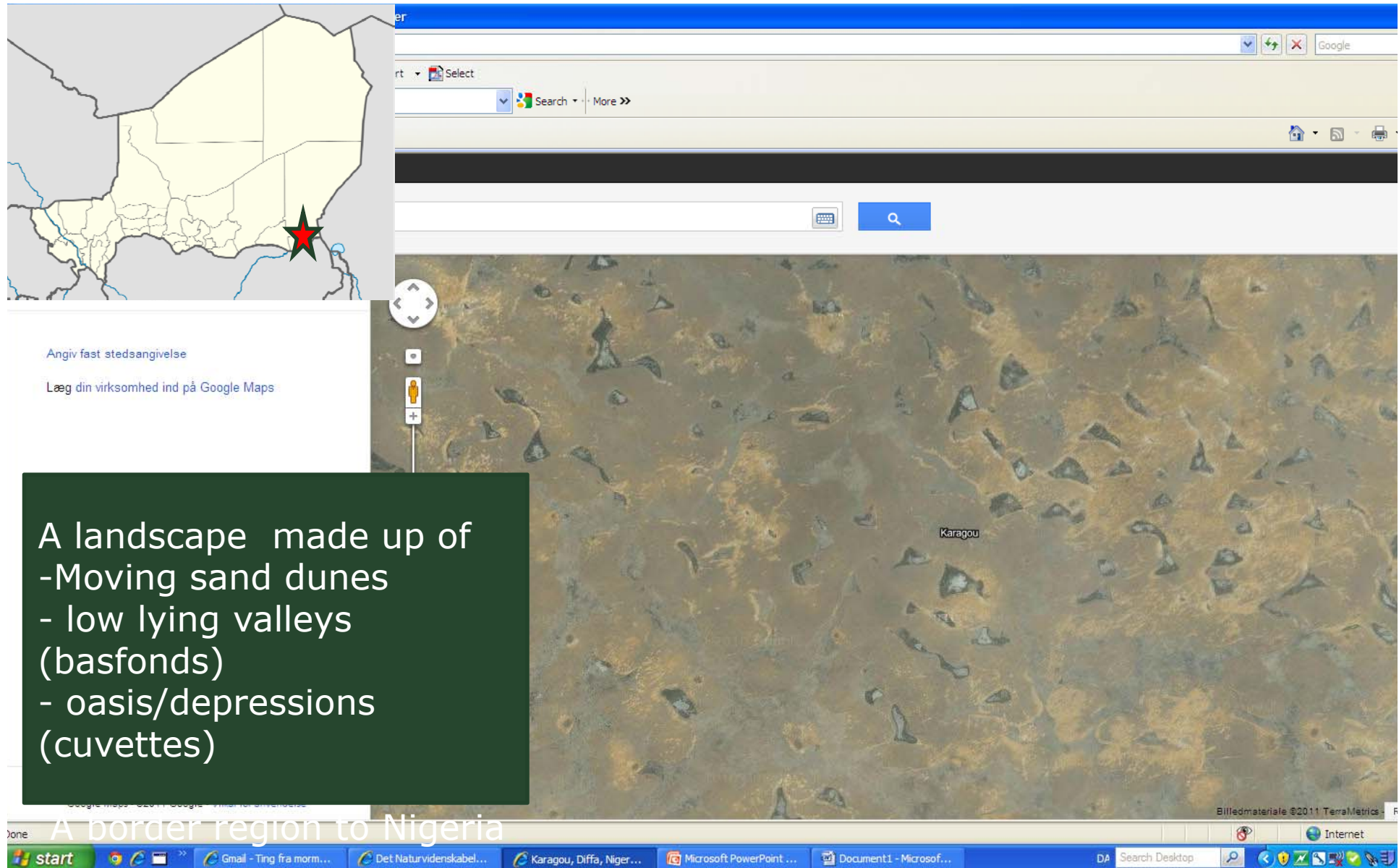
Human-environmental timelines



Although merely a simple heuristic, coupled human-environmental timelines have proven to be a useful tool to illustrate the co-evolution of a) environmental conditions and -events, b) resource management options and c) livelihoods (example from Bidii-2; Reenberg 2009)



Another example – the same story about dynamic and complex human-environment systems



Most of the region is dominated by **dunes** – and scattered shrubs – e.g. *Leptadenia*
Dunes are used by pastoralist – and for cropping in drier years



Bas-fonds are valleys formed during previous humid tropical conditions – most suitable for cultivation in wetter years



The dune landscape hosts small **lakes/oases – cuvettes** - a unique resource – suitable for cultivation (Fr.: 'culture contre saison'), dates, salt and natron – yet, depending on the ground water level



Cuvettes: a rich garden, and a source for natron excavation - but under threath because of lowering water table



Livehood: ranking exercise



Theme	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-
Rainfall	Good rains	From 1972 lack of rain	Mixed rain, good years in 1985 and in 1987	Generally bad – 1997 is a good year	Generally bad	2010 is a good year – otherwise average
Basfond vs dune cultivation	Only basfonds are cultivated – land is abundant	Only dune landscape is cultivated – basfonds given up because of lacking water	Basfonds are re-cultivated in the good years 1985 and 1987	Primarily dune landscape is cultivated, basfonds not completely abandoned (fringes are cultivated – possible because the drought was not as severe as in 1970's).	Primarily dune landscape is cultivated, basfonds not completely abandoned (fringes are cultivated – possible because the drought was not as severe as in 1970's).	All basfond fields are cultivated
Population and food sufficiency	Small population – all remained in the village. Immigration of workers to the natron and salt extraction (some permanent, others for 5 months only)	Significant emigration in 1973. Not many immigrants. Food was scarce – primary source of food was the production from horticulture in the cuvettes.	Population estimated to be 500 persons. Peopled stayed – food production was sufficient.		Many people have left on a permanent basis to Nigeria (ca. 40 individuals). Food production on millet/sorghum fields only sufficient to cover demands in 3 months.	2010 the production was sufficient to cover the demand for the year
Livestock		Significant loss of animals in 1973	Significant loss of animals in 1988			
Migration		Emigrations to Nigeria and Chad	Since 1984 short term migration (4 months) to Nigeria (agriculture, fishery, bricks)	Since 1984 short term migration (4 months) to Nigeria (agriculture, fishery, bricks)	Since 2004 emigrations to Libya (duration 2-4 years, employment in agriculture and brick construction)	
Trade	Important commodities: Wheat (to Nigeria) natron Salt Some animals dates	Important commodities: Wheat natron Salt Animals (most important in this era) dates	Sweet potatoes, sugar cane and manioc become Important dates	natron is more prominent because of the CFA devaluation Some horticulture products Animals dates	Cassava most important garden product natron animals dates	



Continuity – climate preparedness – emerging 'human-dimension of global change' challenges

The Sahelian livelihood is generically taking climate variations into account (e.g. use of different landscape units in the face of different rainfall regimes)

However, the land use portfolio has remained remarkably stable. Peoples' decision making follows the same rationales, addressing the enabling and constraining conditions determined first and foremost by the climate variability; yet, people unanimous stress that live has become very difficult and poverty more pronounced in recent years

Other sources have become more important to sustain the family – exposures to population pressure and globalization (market prices; migration) may need more attention by policymakers, than climate only

In fact – they are 'beyond climate'
More worried about projects,
health, poverty, Al-Queda



A final reflection

The examples portray a contemporary situation where the human-environmental system is resilient (in the meaning of stable), but maybe also lack ability to enable a transformation from the current type of system to some other kind of system.

Sustainable development may entail changing the ways people make a living, developing new 'goods and services' and operating at different scales. Hence, transformation and transformability are emerging as critical areas of concern in the global change research

'we have good opportunities here - we do not need projects - we need investments'



Recent publications

Marcussen, H.S. and Reenberg, A., 1999. On scale and disciplinarity in the study of natural resource use in the Sahel - lessons from the SEREIN research program. Danish Journal of Geography, Special Issue 2:1-14.

Mertz, O., Mbow, C., Reenberg, A. and Diouf, A., 2008. Farmer's perceptions of climate change and agricultural adaptation strategies in rural Sahel. Environmental Management 43:804-816.

Mertz, O., Mbow, C., Reenberg, A., Diouf, A. I (2009). Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel. Environmental Management 43(5):804-816

Nielsen, J. Ø. and Reenberg, A. (2010). Temporality and the problem with singling out climate as a current driver of change in a small West African village. Journal of Arid Environment, 74: 464-474

Nielsen, J. Ø. and Reenberg, A. (2009). Cultural barriers to climate change adaptation: a case study from Northern Burkina Faso. Global Environmental Change 20: 142-152.

Mertz, O., Mbow, C., Nielsen, J., Maiga, A., Diallo, D., Reenberg, A., Diouf, A., Barbier, B., Moussa, I., Zorom, M., Ouattara, I., and Dabi, D., 2010. Climate factors play a limited role for past adaptation strategies in West Africa. Ecology and Society 15(4): 25.

Nielsen, J. Ø., D'haen, S. and Reenberg, A. (2012). Adaptation to climate change as a development project: A case study from Northern Burkina Faso. Climate and Development.

Reenberg, A. (in press). Insistent dryland narratives: Portraits of knowledge about human-environmental interactions in Sahelian environment policy documents. West African Journal of Applied Ecology.

Rasmussen, L.V., Rasmussen, K., Reenberg, A. & Proud, S.R. (2012). A system dynamics approach to land use changes in agro-pastoral systems on the desert margins of Sahel. Agricultural Systems 107C, 56-64

Rasmussen, L.V. & Reenberg, A. (2012). Collapse and recovery in Sahelian agro-pastoral systems: Rethinking trajectories of change. Ecology and Society 17(1):14



Thanks for your attention



Links:

www.globallandproject.org

www.waterworld.ku.dk

www.lasyre.dk

www.geo.ku.dk