Process Analysis in Western African Coastal Regions based on Remote Sensing and Socio-economic Surveys – Case of Benin

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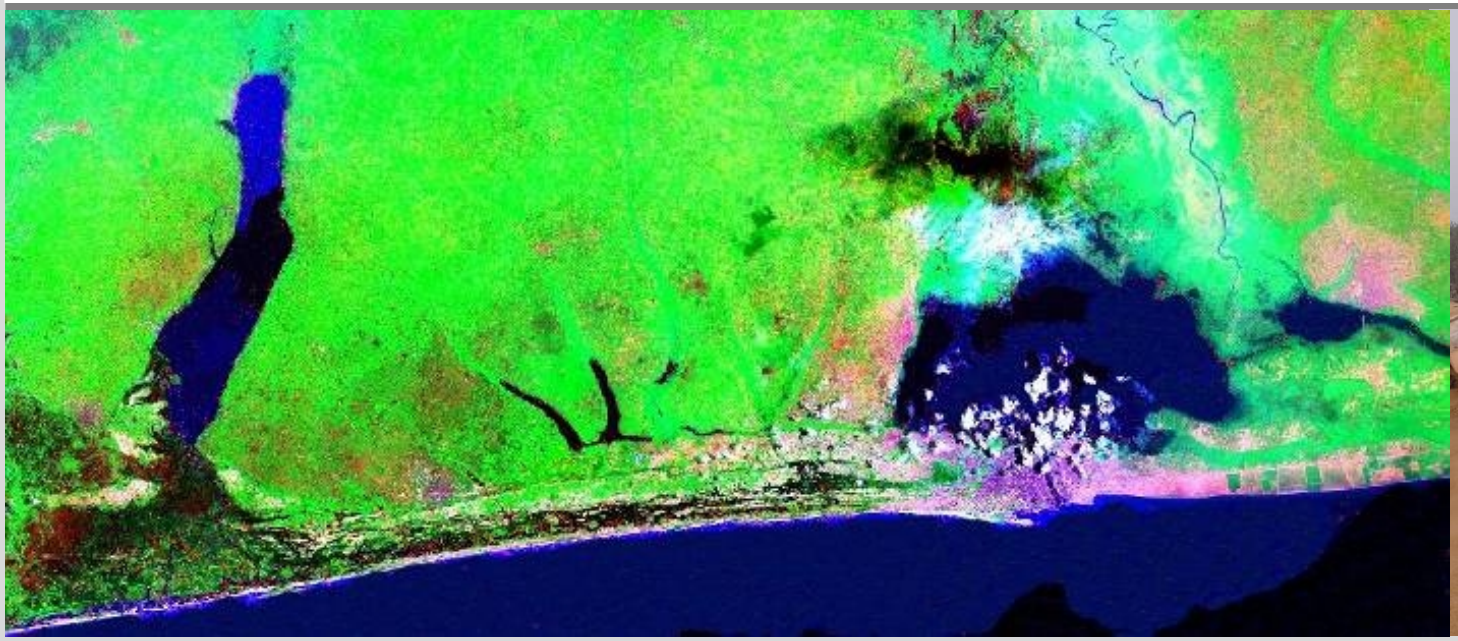
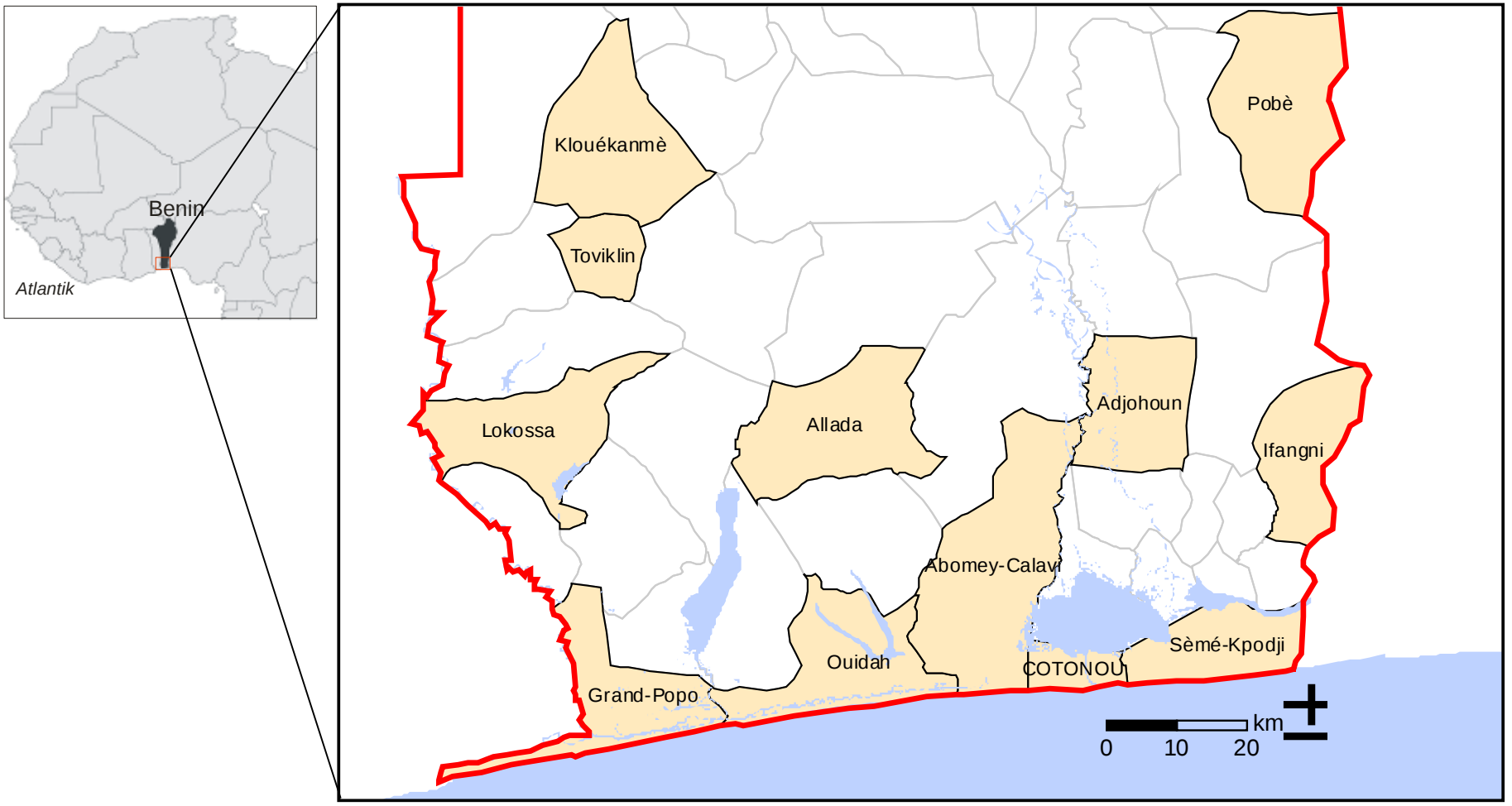


Research questions

- **Which spatial processes have been occurring in the coastal area of Benin and where?**
- **Can we combine socioeconomic findings with visible spatial processes observed by remote sensing?**
- **Which problems result or may in the future result caused by the ongoing processes?**
- **What has to be considered in spatial planning?**

Study Area

Study Area


Benin
Atlantik
Klouékanmè
Toviklin
Pobè
Lokossa
Allada
Adjohoun
Ifangni
Abomey-Calavi
Sèmé-Kpodji
Ouidah
COTONOU
Grand-Popo
km
0
10
20

Combination of Remote Sensing and socio-economic surveys

- two test areas (Avlékété in the municipality of Ouidah and Ekpè in the municipality of Sèmè),
  - PAN aerial photographies for March 1995,
  - multispectral QuickBird data from 2002 for Ekpè and 2006 for Avlékété
  - some Quicklooks from the 2007 aerial imagery.
  - multispectral ASTER data for larger areas or composite classes.
- → Very heterogeneous data of different spectral and geometric resolution for a timeline for process analysis.

Combination of Remote Sensing and socio-economic surveys

- **Surveys and expert interviews**
  - 262 women and 405 men in 7 ethnic groups
  - 32 authorities (experts, chiefs of the villages and notables)

- **Data analysis**
  - by ethnic group
  - by gender
  - by age
  - Multi- and monoparametric statistic analysis: e.g. PCA, Loglinear, Log (1+x) and ANOVA

1. Settlement densification and expansion

- **Ex. 1: Avlékété**
  - expansion especially along the coastal road and in the northern part
  - Already populated areas increasing density.
  - result of migration to coastal areas and the natural population growth (pop. growth 3 %, cf. INSAE 2002)
  - In the interviews, 82 % of the persons interviewed were migrants, only 18 % were born on site.

- **Ex. 2: Ekpè (village of Tchonvi)**
  - similar to Avlékété
  - e.g village Tchonvi is getting denser and spreads especially up north
  - spread along the road

positive migration saldo in municipalities of Ouidah and Sèmè

2. Agricultural changes

- In order to ensure their living, the population performs different activities.
- Agriculture is one with a special importance.

Avlékété

- with settlement expansion and densification, increase of cropland.
- mainly oil-palm plantations converted into cropland.

Ekpè

- increase of the exploitation of swampy areas at the expense of natural vegetation: swampy vegetation, that even falls under the Ramsar convention.

3. Coastal erosion – east of Cotonou


April 2007

- A first investigation made by NDVI-differencing from ASTER data from 2002 and 2007. Especially further east, a strong decrease of the NDVI can be stated - coastal erosion
- in high resolution data, coastline can be detected more exactly.
- In certain areas houses directly on the water front in 1995.
- In 2002 those houses vanished, the coastline had proceeded inland. New houses were built
- In 2007 again vanished. Again, new buildings emerged further north.
- At the same time we can see sand removal.

- several reasons for coastal erosion:
  - geomorphologic reasons (e.g. Kaki & Oyédé 2005),
  - global warming (IPCC 2007) and
  - anthropogenic reasons e.g. sand removal

3. Coastal erosion – perception

Two kinds of explanation

- Metaphysical
- Scientific-rational

Two typs of residence

- Urban area
- Rural area

Tab: Linkages between risks perception and milieu (Log linear-Analysis)

Notion	ΔG^2	Δdf	Probability (p)
Milieu	403.56	1	0.000
Group	280.60	21	0.000
Milieu*Perception	174.00	1	0.000

(i) There is a considerable influence of the type of housing and the respondents' risk perception ($p<0,001$);
(ii) there is a strong dependency between the affiliation to an ethnic group and the interviewees' risk perception ($p<0,001$)

Source: Teka, O. & Vogt, J. (2010): Social perception of natural risks by local residents in developing countries—The example of the coastal area of Benin The Social Science Journal 47 (2010) 215–224

Conclusions and outlook

- Spatially relevant processes observable in remotely sensed images
  - → Automatization for larger areas
  - → Need of multitemporal multispectral high resolution data
- Socioeconomic surveys give background information
- Qualitative synthesis helpful for deeper understanding of processes
  - → Quantitative combination to be developed
  - → Approprious spatial units

Problems faced

- Difficulties in data acquisition
  - E.g. high bureaucracy
  - Unclear responsibilities
- Lack of up to date topographic maps
- Problems with georeferences
- Lower resolutions inappropriate for coastal zones

Lessons learned

- Methods for working with data mixture necessary
- For future: data of same type necessary in order to study larger areas
- No sharp administrative boundaries in Benin → difficulties in demarcation of spatial units

  → We need to look for a combination of spatial units with unsharp boundaries and socioeconomic data

Wishlist

- Multitemporal multispectral high resolution data
- Integration of DEMs
- Integration of SAR-data analysis