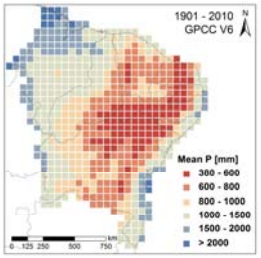
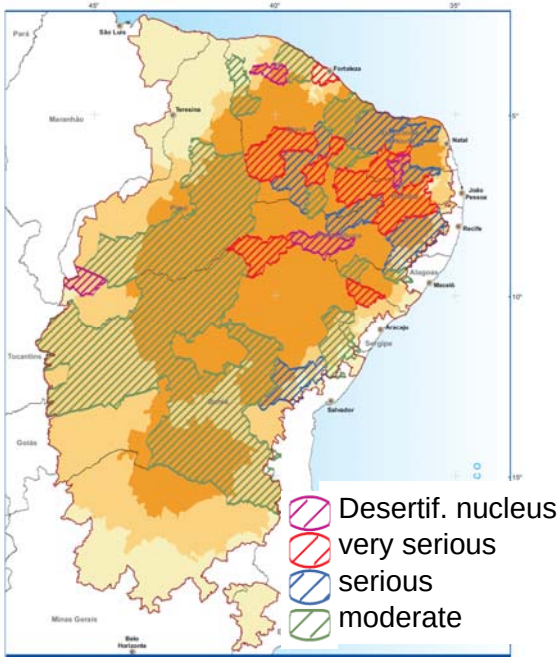
Vegetation, Land-Use, Desertification and Climate change

in North-Eastern Brazil



The Challenge

Semi-arid North-Eastern Brazil (NEB) is highly vulnerable to land degradation and desertification. This vulnerability is based on regional physical preconditions (geology, soil, climate) as well as on human-induced factors (e.g., population growth, land-use changes, resource use and management). Episodic extended dry periods (ENSO) and the partly over-exploitation of natural resources increase risks of desertification, soil salinization and loss of the very low soil fertility.



*Desertification risks in the region (*1)*

Any development and adaptation of concepts and strategies for sustainable land-use management in the region demand a) a reliable documentation of the spatial extent of vulnerable areas and b) the analysis of seasonal and inter-annual variability's of land surface responses to climatological conditions and anthropogenic impacts.

The Approach

VeLuDeClim-NEB thus investigates the following key scientific questions:

1) What are the most important direct and indirect parameters driving land-use and climate change in the region?
2) What are the specific characteristics of regional hot spots of desertification and land degradation within the study area?
3) How can remote sensing data be used to objectively map and monitor long-term as well as short-term indicators and parameters of land degradation including desertification in the study area?
4) Do specific potentials exist in the region to sequester carbon (soil and plant reservoir)?

The total study area is bordered by the nine regional states of the Brazilian Northeast (NEB). A focus area within the Northeast is delineated by the states Rio Grande do Norte and Paraíba, relating to i) sensitivity of the area, and ii) knowledge and experience of both the Brazilian and German partners. Within this focus area, we build on a well-documented land degradation and desertification hot spot that is located at the border between the two states (the Seridó Region).

C A P E S

DAAD Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

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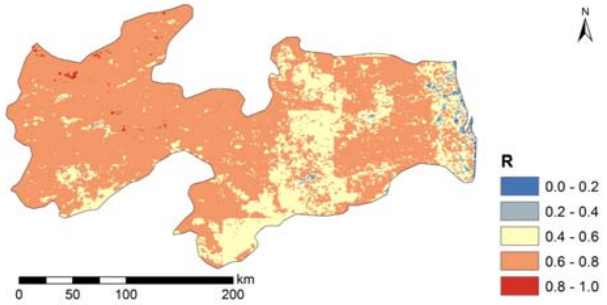
Results obtained so far

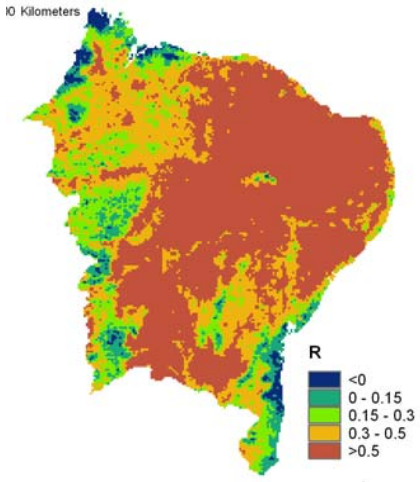
- Vegetation greenness follows spatial and temporal precipitation pattern with 1–2 month time lag
- intense droughts in Northeast Brazil are always related to ENSO periods but not every ENSO period evolves into a severe drought in Northeast Brazil

- High spatial and temporal variability within a climate normal

- no unanimous desertification signal
- no unanimous climate change signals



*Vegetation index and precipitation for Paraíba (above) and for NEB (below) *2*



*3

The results are based on satellite time-series (1982–2006, 2001–2010) of vegetation indices (VI), and on ground-truthing, including soil and vegetation studies in 2008.

In essence, more work is needed to both differentiate with reliable and robust accuracy between true climate change signals and land-use changes – mostly population-pressure and development-related.

Future climate response for the NEB region is currently neither reliable nor univocal; instead, fully contradictory.

Thus a sound base for adaptation is lacking.

- Soils in NEB are extremely nutrient-poor and have very limited water-retention capacity

This result (*4) corroborates the general vulnerability and demands appropriate adaptation response.

Additional activities

While NEB has been attracting increasing attention, knowledge and reliable data are still in high demand. Thus, apart from scientific endeavour, educational activities are needed – and addressed by the Brazilian partners.

*Example of educational activities, enabled by MMA (*5)*

Apart from scientific publications, workshops and the development of outreach materials are part of this ProBral-project VeLuDeClim-NEB.

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Sources

If not stated otherwise, the pictures are from the Freiberg group.

*1: MMA (2007) Atlas das areas susceptiveis à desertifição do Brasil. Ministério do Meio Ambiente, Brasilia

*2: Schucknecht A (2012)

*3: Erasmi S, Maurer F, Petta RA, Gerold G, Barbosa MP (2009) Inter-annual variability of the Normalized Difference Vegettaion Index over Northeast Brazil and its relation to rainfall and El Nino Suthern Oscillation. Geo-Öko 30: 185-206

*4 Schucknecht A, Matschullat J, de Caritat P, da Silva J, Melo Jr G, Pleßow A, Mello JMV (2012) Pedogeochemistry in NE-Brazil – Compared to Australia and Europe. Sci Total Environ 438: 342-356

*5 http://www.iicadesertification.org.br/lendo.php?id=NDc0