Detecting environmental change using time series, high resolution imagery and field work - a case study in the Sahel of Mali

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Introduction & Study Area:
Climatic changes and population pressure have caused major environmental change in the Sahel during the last fifty years. Many studies use coarse resolution NDVI time series such as GIMMS to detect environmental trends; however explanations for these trends remain largely unknown. We suggest a five-step methodology for the validation of trends with a case study on the Dogon Plateau, Mali.

Long term time series

The first step is to monitor long-term trends with coarse scale time series. We use a smoothed combination of LTDR (derived from AVHRR) and SPOT VGT NDVI data, covering the period from 1988-today with a temporal resolution of 10 days and a spatial resolution of 5.6 km, which has proven to be of superior quality than GIMMS.

High resolution time series

Areas with significant trends are further analysed in a second step. Here we use a smoothed and decomposed MODIS time series from 2000-today with a spatial resolution of 250 m. Due to the large scaled MODIS dataset, trends can be identified at a local scale / village level. Though we can detect environmental trends; however explanations for these trends can only be speculated and hypothesized.

Very high resolution imagery

Using very high resolution imagery (e.g. SPOT, Quickbird) areas of interest can be compared with pre-drought Corona imagery from 1967. This offers a detailed overview of the environmental change at tree-level. A comparison of high resolution imagery with the Corona images show major land use changes over the past fifty years. What used to be dense bush cover has partially been converted to farmer managed agro-forestry and a significant proportion is now degraded land. Furthermore, an increase of tree cover on the fields can be detected. These different trends can also be observed in figure 3.

Ground truthing

On-site field work provides information on the land use systems, vegetation composition and the current environmental condition. An initial field trip validated the suspected soil erosion and ongoing loss of trees and shrubs outside the fields used for farming purposes. On the fields surrounding the village many useful trees of all ages were identified. Still many explanations for change can only be speculated and hypothesized.

Conclusion & Outlook:

This example demonstrates the importance of land use and how an integrative and qualitative approach as well as input of local inhabitants expands knowledge and understanding of environmental change in the Sahel. Greening and degradation have many reasons which need to be varified by field work. Our example demonstrates, that climatic factors are important drivers of environmental changes. But land use concepts lead to oppositional results in vegetation development and therefore heterogenous landscape patterns.

A further publication in progress will present many more examples using similar techniques and will include several examples of greening with a variety of explanations including a complete change of biodiversity. Study areas are the Dogon Plateau, the Sèno Plains (Mali) and the Ferlo region around Linguère (Senegal).