Reading the logging scars in Congo Basin forest cover

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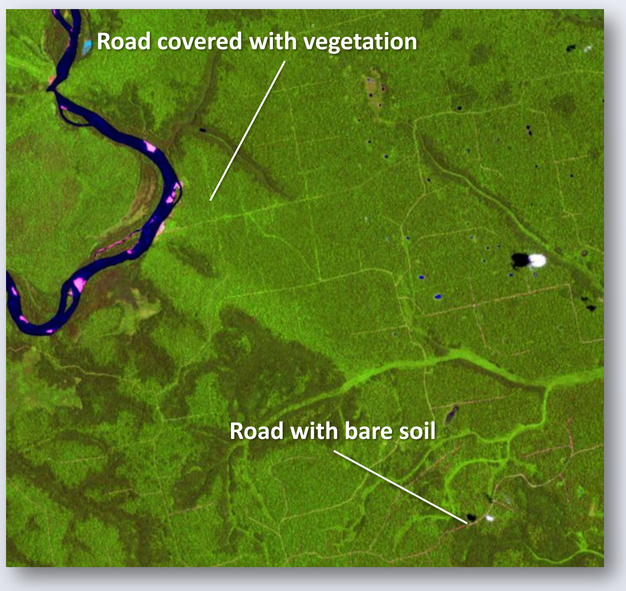
1. BACKGROUND

The Congo Basin harbours the world's second largest tropical moist forest. Here, logging mostly takes place in a **selective** way where only few commercial tree species are extracted.

The intensity of timber harvesting that can be sustained varies between forest ecosystems dependent on their resilience and productivity.

Geological substrate shapes functional diversity of tree communities: recovery from deforestation and degradation tends to be slower on sandy and resource-poor soils.



Detail (~20 x 20km) of LANDSAT 7 ETM+ scene 182/58, 12/03/2012, 30m pixel size

Logging road networks can be used as a proxy to assess the extent of selective logging disturbance. Their patterns are easily detectable on remote sensing imagery such as **LANDSAT**. Earlier studies focused merely on expansion of logging road networks.

2. STUDY AIM

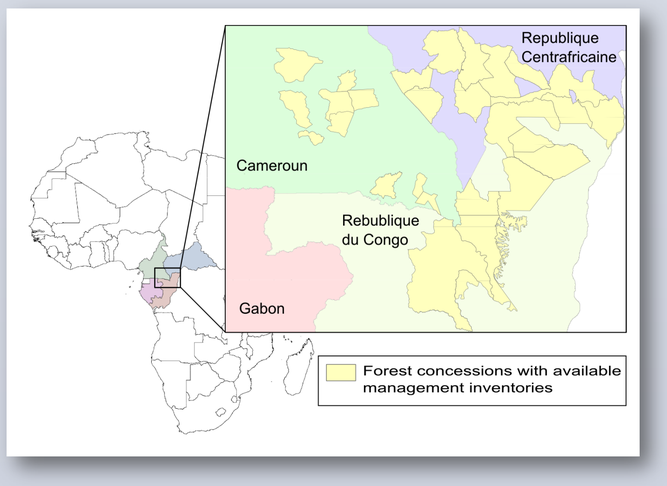
This study analyses forest recovery in the Congo Basin based on temporal and spatial dynamics of logging roads.

The objective is to evaluate the **resilience** of semi-deciduous rainforests to anthropogenic disturbance. To test the relative interaction of biotic and abiotic factors limiting forest recovery, we will compare the logging-road recovery patterns in environmentally contrasting forest areas.

3. MAIN RESEARCH QUESTION

What are the crucial roles of environmental factors such as geological substrate in speed and trajectory of successional forest recovery after selective logging?

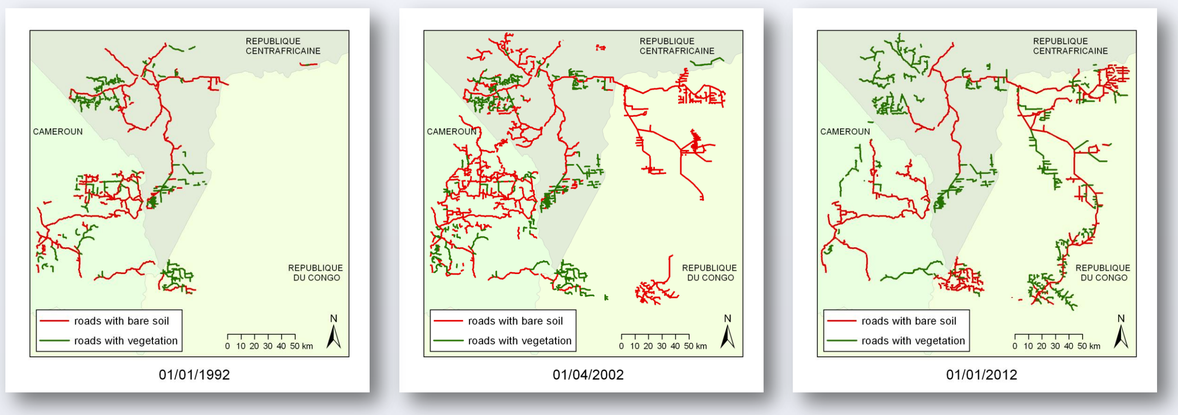
4. STUDY AREA



- Sangha river basin
- Area of 213'000 km^2
- Partially under logging concessions
- Forest management inventories with stand measures of commercial timber trees

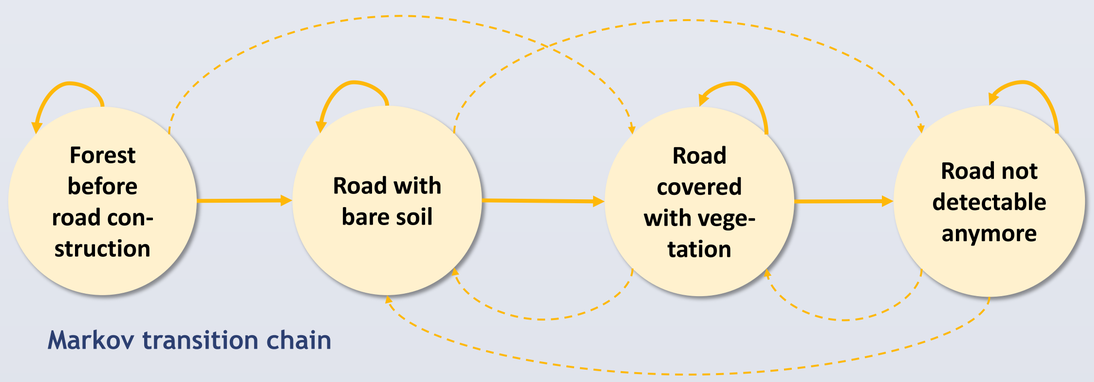
5. METHODOLOGY

i) Analysis of road network dynamics based on maps extracted in 2-5 year steps from **time series** of LANDSAT images from 1984 until today.



3 steps of road development in LANDSAT scene 182/58

Three disturbance states can be distinguished: **Bare soil, Vegetation in early successional states, Vegetation in later successional states** (making it undetectable). In a GIS we will overlay the sequence to produce a matrix (road segment x road state), that can be treated as a Markov transition chain. The Probability of a road remaining in the same state or shifting to another is interpreted as a measure of duration of disturbance and speed of recovery.

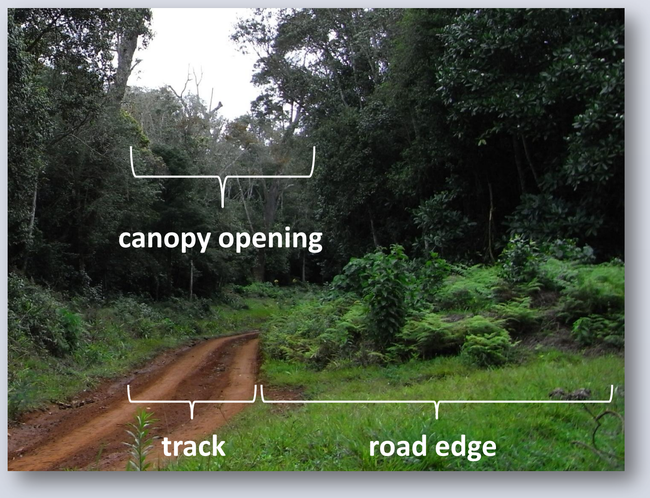


Markov transition chain

ii) Spatially explicit **environmental and vegetation variables** derived from existing maps will be included in the model. Environmental variables are topography and geology, vegetation variables are forest type and biomass.

iii) Selection of **contrasting areas** regarding geology and forest type. Control for degradation in the adjacent forest with SPOT-images (10m pixel size).

iv) Field-based sampling will extend the results of forest recovery on roads by including **successional trajectory**. Measurements include: width of road, road edge, percentage of canopy cover over road and soil compaction on the track.



We will measure **functional vegetation traits** in subplots in different microhabitats: road track, road edge and adjacent forest. Variables are height, abundance and coverage of different functional groups of trees (e.g. pioneer and old growth species) and dominant herbaceous plants that may be important in the succession trajectory.

6. EXPECTED OUTCOME

This study will draw conclusions on the influence of combined logging intensity, forest structure and geological substrate on **forest recovery capacity**.

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