4th World Congress on Agroforestry | 20-22 May 2019 | Le Corum Conference Centre Montpellier, France

# Comparing methods for detecting and mapping tree parkland dynamics on large areas in Burkina Faso

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## Background and objectives

Parklands are a widespread agroforestry practice in West Africa, subject to the risk of aging and threatened by increasing mechanized agricultural practices. The ecological regional diagnosis of parkland by Leapagri Ramses Project is based on a landscape analysis and a systematic quantitative characterization over large areas.

It involves identifying the description variables of parklands at different scales, and comparing results by taking into account the associated uncertainty. The photo-interpretation of archive aerial images is limited by their resolution, but remains irreplaceable in terms of temporal depth.

**Ecological regional diagnosis (maps, inventory)**

**Drivers monitoring (practices and production of agriculture, forestry, cattle, fire, soils, climate, socio-economics) by survey (household, community, regional drivers)**

**Ecosystem services inventory and valuing**
**Scientific evidences, Local and expert knowledges**

**Exploring scenarios with participatory tools for parklands management**

*The global methodology of Leapagri Ramses*

## Methodological approach

The pilot approach of characterization of a sudanian park is carried out at a local scale (village Lofing, Comm. Dano, Prov. Ioba) by comparing 4 methods: field transect on 100m wide circles, photo-interpretation of archive and online imagery, and satellite image processing. The dry season inventory by transect carried out by trained peasants provides basic information and serves as ground truth. The photointerpretation uses Google earth and archived airborne pictures of Geographical Institut of Burkina Faso( IGB).

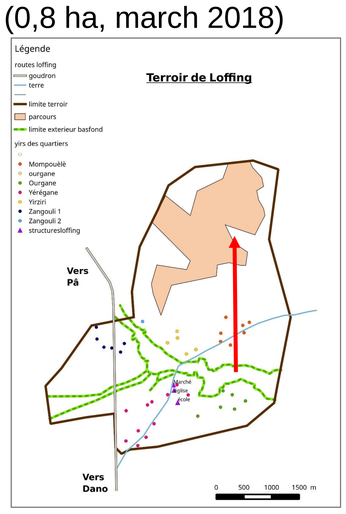
Satellite images processing uses dry season Sentinel 2 pictures (pixels 10m, NDVI neo-channel). Geomatics with Quantum-GIS software.

*The difficulties of detection : phenology, soil and species diversity, saisonality, phytopractices*

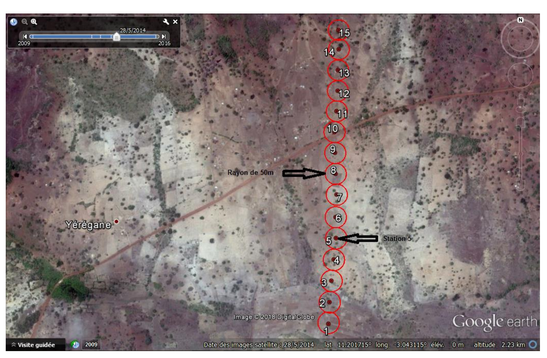
## Processing

1. Training inventory transect on 15 circles

(0,8 ha, march 2018)

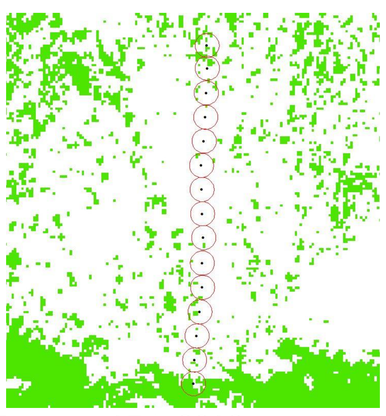



2. Photo-interpretation




(Google earth, 1/20000 or 1/50000 airborne photos)

3. Remote sensing Sentinel 2
NDVI thresholding (on histogram)



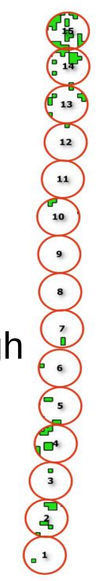
January 15th 2018,
Confusing trees with green grassy lowlands, wrong date

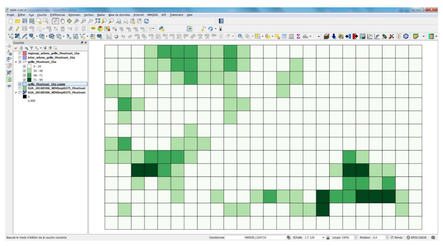
March 11th 2018
only trees, best date

4. Counting tree cover

- NDVI thresholded, coding 0-1
- Georeferencing ground circles
- Cuting-off raster with circles
- Vectorial conversion in polygones
- Cumulating tree area of polygons
- Coverage %

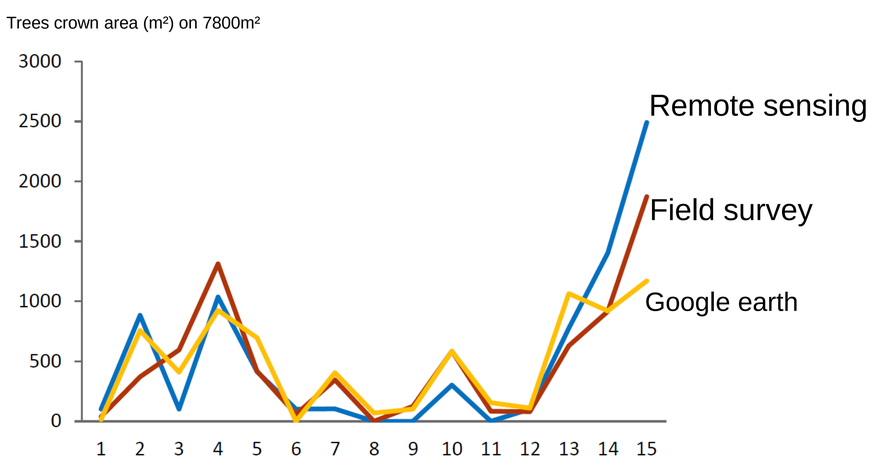
5. Mapping cover rate (%) through a 100 x 100m grid then thresholding tree cover%





## Results

1 . Good fitting between methods

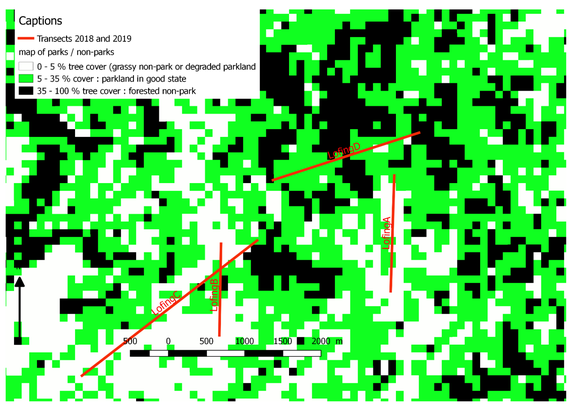



*Variations of park density in march 2018 along the transect Lofing A*

Comparison of tree crown area (in sq. m.)
on 15 stations (defined by circles of 50 m. radius)
according to 3 methods

2.Mapping, validation

Slight overestimation by remote sensing in lowland (plot 2) and in case of high tree cover (plots 14, 15)
Slight underestimation on low-tree plots

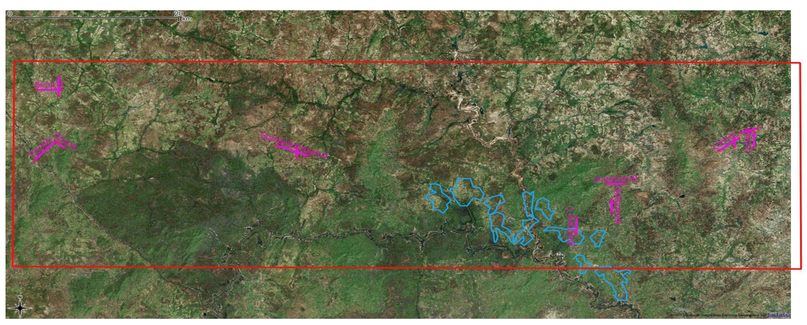



*Mapping tree cover % on Lofing Territory*

.Large white zones of degraded parkland.. The green areas (parkland in good state) are decreasing
Red : New transects in 2019 for validation

3. Spatial generalization (in progress)

Raw application to larger areas impossible without new transects and stratifying Imagery ( in progress in 2019)



*New transects 2019 on the Koumbia-Dano zone of Ramses Project*

## Conclusion

Sentinel 2 image processing is used to map and assess the park's cover rate with an acceptable uncertainty for the characterization of spatial variations of parkland density. But the statistical tests for validation and generalization at a larger area than the village scale are in progress.

The photo-interpretation of online images from Google Earth or Bing Maps allows to estimate the area and number of tree elements and to identify certain recognizable species to study issues related to elimination over a few years.