Design Project – SIE 2024

Estimating the growth of woody biomass in Guinea using remote sensing.

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Company: Arborise, Philippe Nicod

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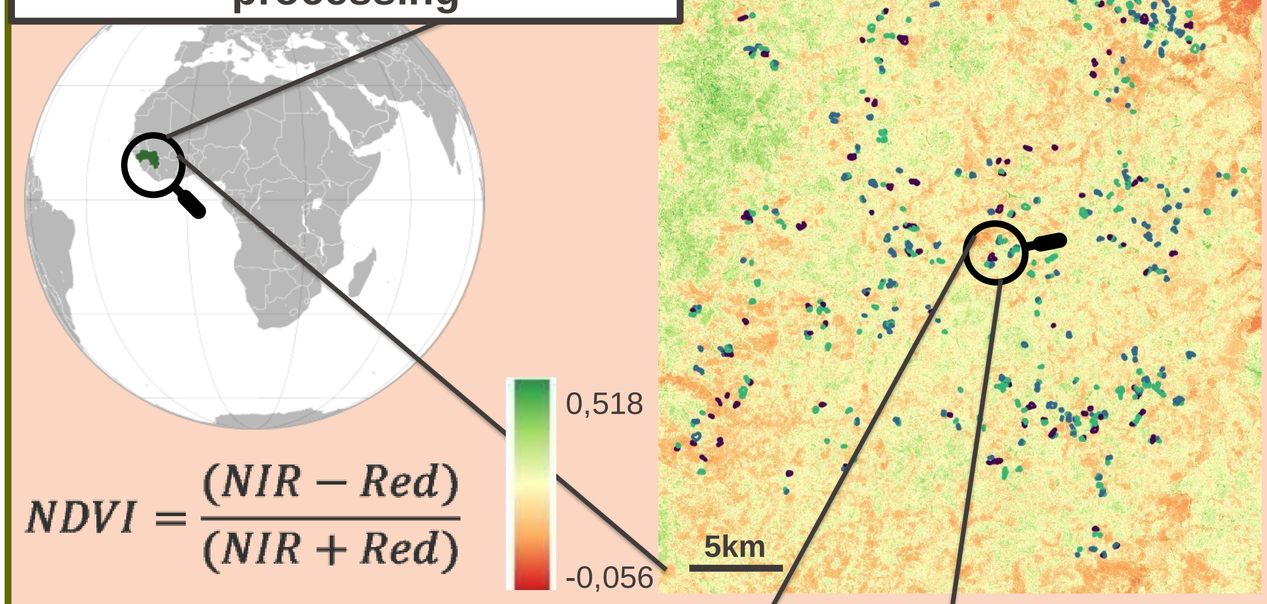
Context: Arborise aims to monitor 616 reforestation fields, each covering 2 hectares, within a 30 km by 30 km region. Using remote sensing technology, the NGO intends to evaluate the growth of these fields and understand the factors influencing their development.

Objectives

Estimating the growth

Data selection and pre-processing



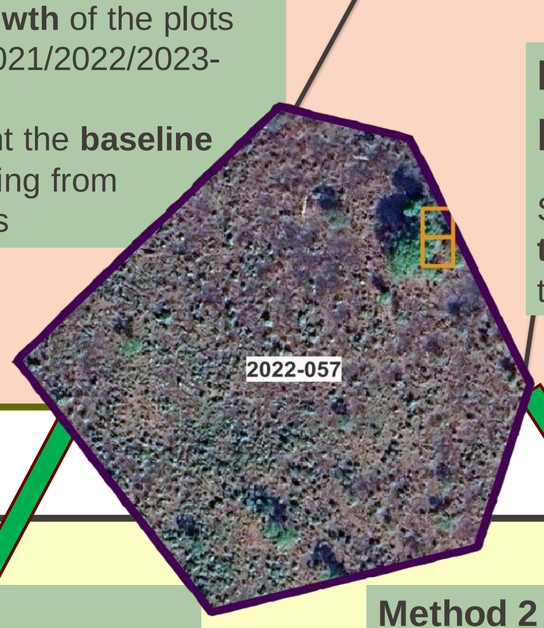
$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Process

- Estimating the **growth** of the plots over the period (2021/2022/2023-2024)
- Taking into account the **baseline**
- **Classifiying** growing from none growing plots

Data pre-processing:

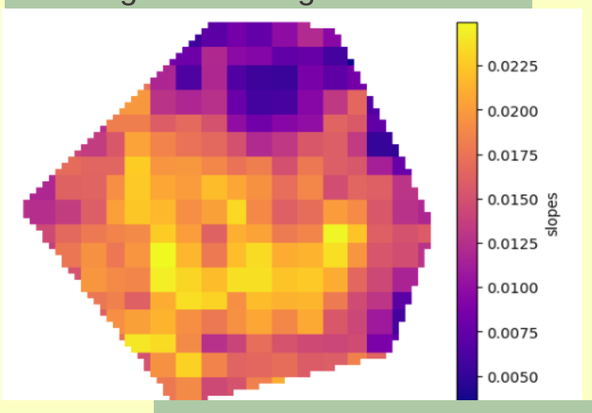
Suppression of **mature trees** based on a threshold of NDVI



Methodology

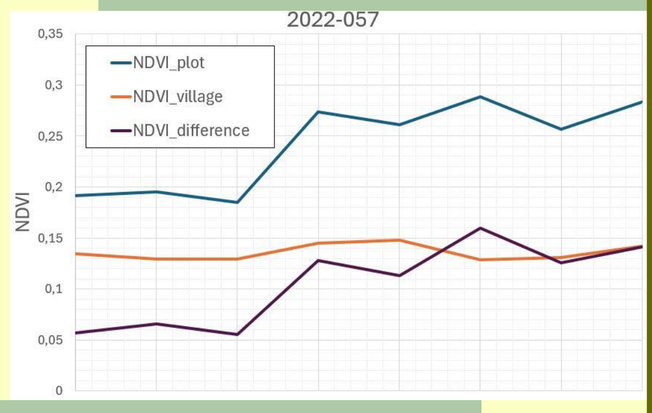
Method 1

- Take the **time serie of each pixel**
- Compute the **slope per pixel** using a linear regression



Method 2

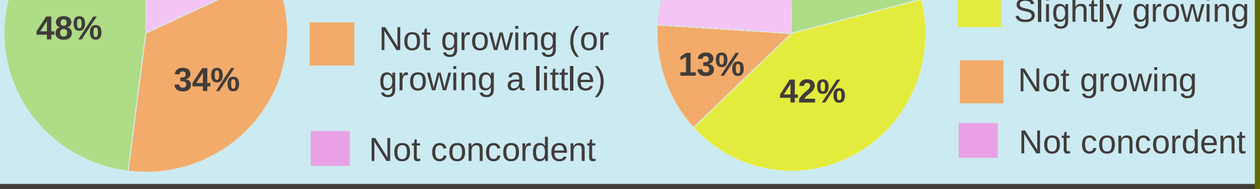
- Take the **difference** between mean NDVI of the **plot** and mean NDVI of **neighbor village** for each date



Classify the plot in growing/not growing

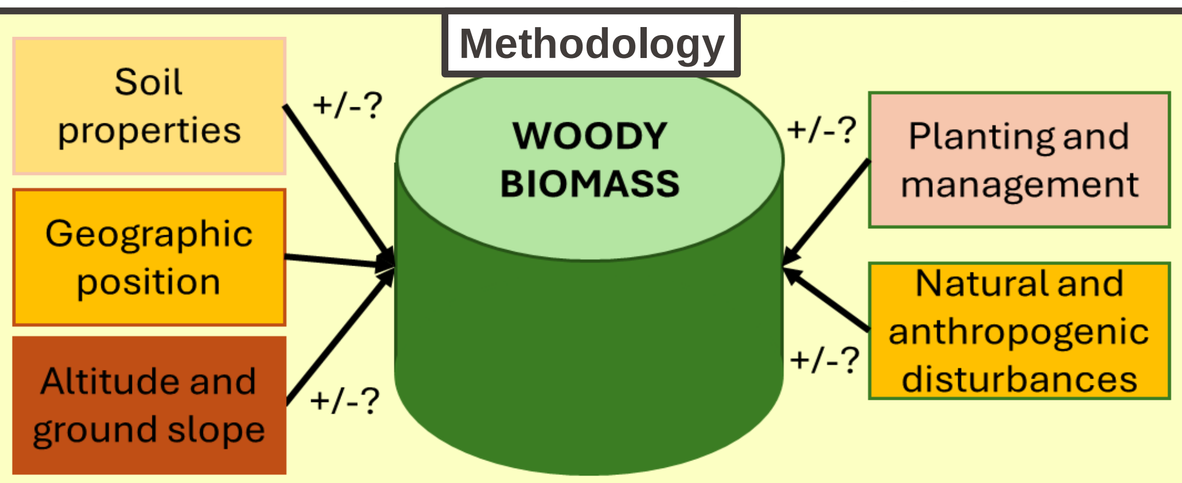
- Use of **k-means**
- **Comparison** of the two methods
- Keeping the plots that are **concordent** for both methods

Results



Which factors affect the growth

Methodology



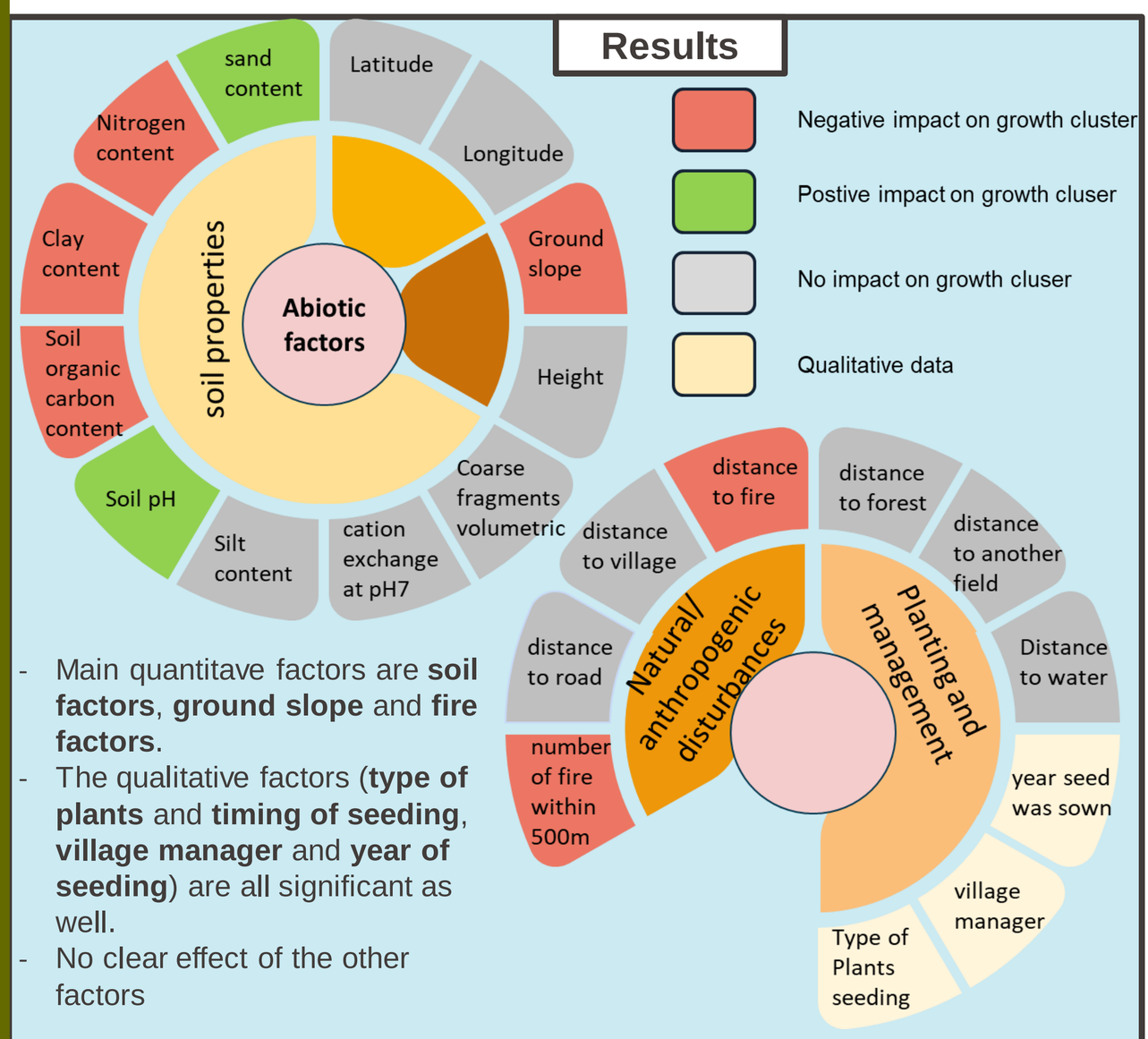
Process

- **Identifying** potential factors
- Determining whether or not each factor **affect growth?**
- (Finding **peculiar patterns**)

Method

- Use the analysis "Characterize a qualititave variable" on **concordent plots only** (Factoshiny, R)
- Filter only the **significant ones** (p-value < 0.05) and their **relative effect** (positve/negative) on growth.

Results



- Main quantitave factors are **soil factors**, **ground slope** and **fire factors**.
- The qualitative factors (**type of plants** and **timing of seeding**, **village manager** and **year of seeding**) are all significant as well.
- No clear effect of the other factors

Possible improvments

- **Improve the classification** with ground data
- Take **additionnal factors** into account (soil moisture, barriers to fires)

Conclusion

- We **assessed the growth** using 2 methods based on the **NDVI temporal series** of the plots
- We kept the **concordent plots**, which accounted for 76-81% of them, with a nearly even number of growing and non growing plots, for further analysis
- We analysed the impacts of each identified factor on the growth using a statistical method, and **8 factors were significantly associated with the growth**, mostly soil properties.

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