Assessing Mining Disturbance on Vegetation in Ouagadougou, Burkina Faso using Landsat Data

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Introduction & Methods

The rising mineral resource demand due to economic growth has boosted extraction activities, affecting ecosystems and human well-being. This study in Ouagadougou, Burkina Faso, assesses quarrying's impact on vegetation using Google Earth Engine for precise spatiotemporal analysis through binary classification and LandTrendr time series analysis.

This study aims to

Figure 1. Location of Ouagadougou city in Burkina Faso, in the West African region

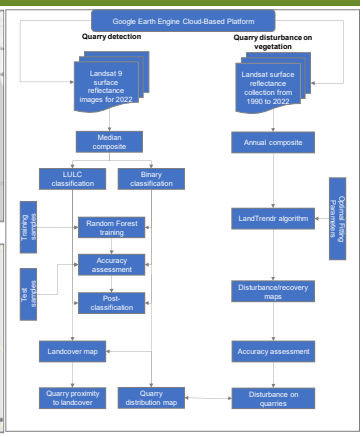

Figure 2. Methodology workflow implemented in Google Earth Engine (GEE)

Identify quarry extents → Analyze their spatial patterns → Assess spatio-temporal vegetation disturbance based on NDVI

Results & Discussion

1. Quarry detection

➢ LULC

- 95 % overall accuracy.
- Approximately 50% of the quarries are situated near vegetation, with an additional 40% located in built-up areas, particularly abandoned quarries.

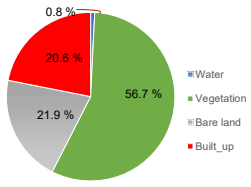

Figure 3. Landcover area proportions

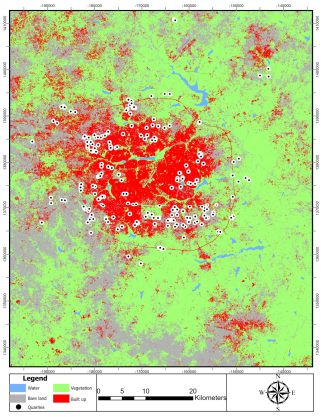

Figure 4. Landcover classification results for 2022

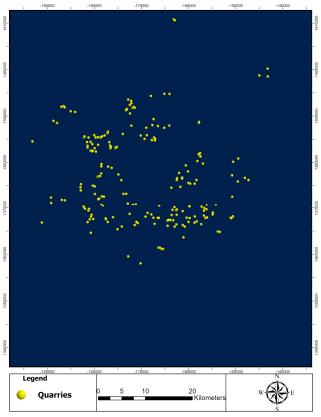

Figure 5. Quarry distribution in Ouagadougou

➢ Binary classification

- 95 % overall accuracy
- 218 out of 257 confirmed quarries by field survey with 87% accuracy
- Total area of 38.252 km^2

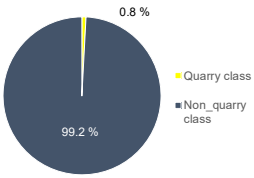

Figure 6. Quarry/non-quarry area proportion

2. Vegetation disturbance

➢ Observations

- 90 % accuracy related to year of disturbance, 87 % Kappa
- High density of quarrying activities before 1995 with an important increase from 2005

Explanation

A rapid planned and unplanned urban expansion and densification, as demonstrated by the high proximity of quarries to built-up areas

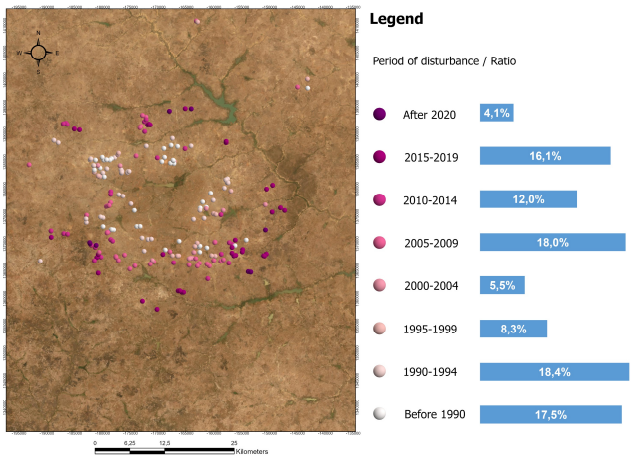

Figure 7. Years of disturbance grouped into 8 periods, with ratio of each period

➢ Limitations

- LandTrendr encounters difficulties in scenarios where there is a lack of vegetation growth or expansion

Solution

The focus on short vegetation, particularly during the rainy season in Ouagadougou, to mitigate the impact on the algorithm

Conclusions & Recommendations

The combination of binary classification and the LandTrendr algorithm based on Landsat data, presents a robust framework for quarry mapping and ecological impact assessment. These findings are invaluable for informing land management decisions, policy formulation, and environmental conservation efforts. As remote sensing technology continues to evolve, future research can build upon these methodologies to advance our understanding of landscape dynamics and promote more sustainable and ecologically conscious land management practices.

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