

## DESIGN PROJECT - SIE 2025

REMOTE SENSING OF BUSHFIRES  
IN THE REPUBLIC OF GUINEAStudent :  
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## 1 CONTEXT &amp; AIM

Arborise is a non-profit organization leading an **eco-participative reforestation project** in Guinea since 2021. The model relies on community involvement and is partly financed by external investors who receive **carbon credits** in return for supporting tree growth as a means to offset their emissions.

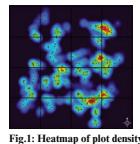
However, to ensure the long-term viability of the project, **young trees must be protected from a major threat: bushfires**. These fires, often uncontrolled and recurrent during the dry season, pose a serious risk to reforested plots.

While Arborise is currently subscribed to global satellite-based fire alert systems, these are often too slow or imprecise to trigger effective local responses. Local authorities and communities have expressed a clear need: they want **to be alerted as soon as a fire ignites**, so they can act rapidly and contain it before it spreads.

**OBJECTIVE:** To propose a remote sensing mechanism capable of detecting and locating fires in real time in order to improve containment efforts.

## 4 PRIORITY AREAS

Monitoring the entire set of plots appears unrealistic given the vast area they cover. A prioritization strategy is thus essential. To this end, data on plot density and historical fire recurrence were combined to target areas with both high plantation density and frequent fire events, ensuring a focused and efficient deployment of resources.

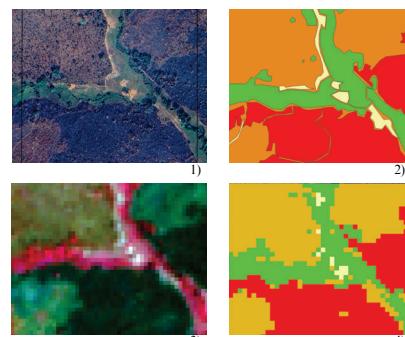


840 plots  
1'807 ha



## 5 IDENTIFICATION OF BURNT AREAS

A raster-based image classification was performed using false color filtering to train a model capable of distinguishing three land cover types. This allowed analyzing spatio-temporal fire trends and identifying priority zones where early fire detection efforts should be focused.



- 1) Ground-Truth Area Assessment
- 2) Manual Delineation of Ground-Truth Polygons
- 3) Reference Filter Application
- 4) Final Random Forest Classification

Classe	Precision	Rappel	F-mesure (F1)
1	0.824	0.275	0.412
2	0.750	0.653	0.698
3 et 4	0.921	0.973	0.946

Tab.1 : Performance indicators of the model for each class on the training zone B.

## 6 RESULTS

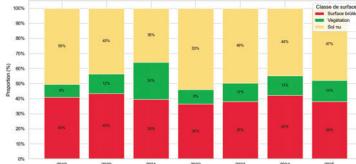


Fig.3: Histogram of land cover evolution

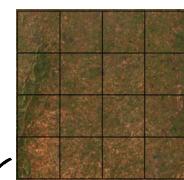


Fig.4: Research Area - True Color Raster Image

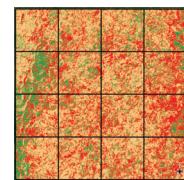


Fig.5: Research Area - Classified

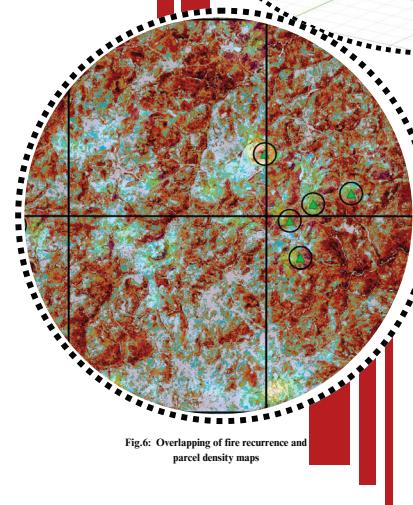
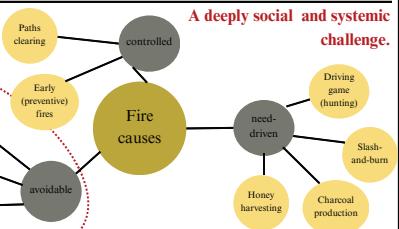


Fig.6: Overlapping of fire recurrence and parcel density maps

## 2 CAUSES OF FIRES

A deeply social and systemic challenge.



## 3 DESIGN CONSTRAINTS

**High Spatial Coverage**  
Monitor a wide area with minimal blind spots

**Continuous & Reactive Detection**  
Ensure near-real-time alerts with fire localization

**Local Integration & Autonomy**  
Deploy a non-intrusive, self-sustaining system

Respecting the annual budget of 10,000 CHF

## 7 SOLUTION

## AUTONOMOUS VISUAL FIRE DETECTION UNIT

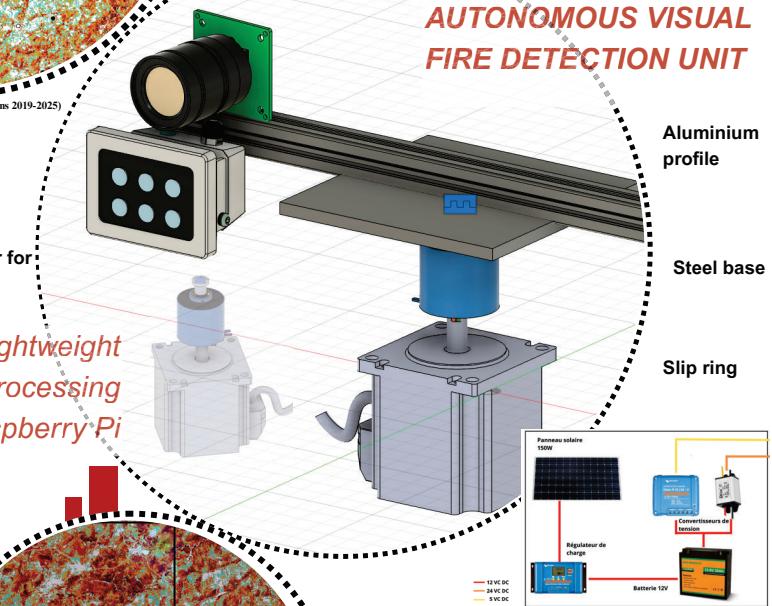


Fig.7: Power System Schematic

Stepper motor for rotation of the unit

Panneau solaire 50W

Régulateur de charge

Convertisseurs de tension

Batterie 12V

12 Vc DC

24 Vc DC

5 Vc DC

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