# DETAILED FINAL REPORT

Conserving degraded natural habitats in the Trois-Rivières Forest Reserve, a biodiversity hotspot threatened by human pressure in northern Benin

By

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## Introduction

Trois-rivières Forest is one of the largest forest reserves in Benin. It constitutes a hotspot of threatened species and provides important ecological services for biodiversity conservation and the subsistence of local communities (Neuenschwander et al. 2011). For example, the forest is a corridor for species dispersal as it is contiguous to the W National Park, a transboundary biosphere reserve. However, the conversion of forests into agricultural lands, especially for cash crop production such as soybeans and cotton followed by unsustainable cultivation practices and the selective logging of the commercially important timber trees have led to a severe fragmentation of this ecosystem (Sinsin et Kapmann, 2010). Indeed, the neighbouring communes of the region represent the cotton basin of Benin with an estimated production of 342948.29 tons in 2021 and 357672.66 tons in 2022, which is an increase of 14725.33 tons between 2021 and 2022 (AIC, 2022). Despite this situation, basic information relevant to planning the conservation of the Trois-rivières Forest is still lacking. In particular, the following important questions remain unanswered: where are the remnant forests to be conserved? Does the current floristic composition of these patches of the forest allow the maintenance of the ecosystem services provided by this forest? What are the motivations of the local populations in deforesting this habitat? What is their perception and how do they feel they should be involved in the conservation of this habitat? The answer to these questions is a step towards preserving biodiversity in North Benin, particularly in the Trois-Rivières Forest. To achieve this remote sensing techniques combined with social surveys and livelihood strategies can help by detecting changes in Land Use, providing insight into drivers of habitat conversion, and people's perception of their conservation (Desalegn et al. 2014; Biaou et al., 2021). We use the traditional knowledge, to design culturally appropriate and compatible management solutions therefore more likely to be accepted and successful.

## 1 Methodologies

### 1.1 Data collection and analysis

#### 1.1.1 Analyze the LULCC from 1990 to 2022

We used Landsat imagery obtained from the United States Geological Survey in September 1990 and 2006, alongside Sentinel-2 imagery acquired by the European Space Agency in 2022. To mitigate the impact of cloud cover in the images, our selection process focused on Landsat and Sentinel acquisitions during the dry season, commencing in mid-September. Furthermore, diverse ancillary data sources were integrated, including 1:50,000 scale topographic map sheets of Benin, the road network, watercourses, and boundaries delineating reserve forests. In addition to these datasets, field reconnaissance mission data collected between November 15 and December 20, 2022, and validation data gathered from December 17 to 23, 2023, were taken into account. These control and reconnaissance points, totaling 450 sample points were meticulously acquired using a Garmin 78 GPS. Before classification, the images underwent pre-processing tasks such as layer stacking, color composite, and sub-setting. Geometric corrections and color enhancements were also applied. To ensure precise alignment, a cubic transformation due to the varied resolutions of the images was done. For instance, Lansats images with 30 m x 30 m pixels were adjusted to 10 m x 10 m to ensure uniform pixel size. The supervised classification of homogeneous occupation units utilized the maximum likelihood algorithm. To ease the discrimination between different classes, all images were converted into false-color compositions. Each forest was classified into eleven LULC classes such as agriculture and fallow land, dense forest, gallery forest, swamp forest, woodland, Tree and shrub land, waterbody, plantation, bare soil, rocky surface and Residence Area. To enhance image classification and mitigate spectral confusion, a visual interpretation was performed based on the background of pre-processed images. Land cover classes were identified and digitized, considering the color, tone, structure, texture, shape, and location of objects using QGIS 2.18.16 software. The accuracy of the classification and visual interpretation of these images were validated using a confusion matrix. Each land-use class areas were computed, and their intersection across two dates formed the basis for generating the transition matrix. The spatiotemporal evolution of the various land-use classes within the forest reserve was primarily analyzed by comparing the areas between two specific dates. The conversion rate, deforestation and degradation rates were calculated.

**Figure 1:** The photos from left to right show the collection of field verification points.

### 1.1.2 Forest inventory in the permanent plot in 2007 and 2023

Permanent plots were established in 2007 as part of the National Forest Inventory (NFI). The NFI conducted a systematic inventory using terrestrial statistical sampling. A 15 km x 15 km grid based on the "UTM 31 N" projection of the WGS 1984 reference ellipsoid was used throughout the Republic of Benin, indicating that each plot was 15 km apart. A permanent sampling unit is located at each vertex of this square grid. The sampling units are circular plots with a radius of 18 m, i.e., approximately 1018 $m^2$. The coordinates of the centre of the sampling units were recorded and marked. The entire 18 m radius plot was surveyed. Trees in the main stand were those with a diameter at breast height (DBH) greater than or equal to 10 cm. There were three types of data in the main stand. These were the scientific names of the species found, its diameter at 1.30 m above ground, and its total height. In the understory, a circular sampling unit of 4 m radius was used to count all sample trees and shrubs between 3 and 10 cm in diameter. This was followed by four circular subplots of a 1 m radius for regeneration i.e., all trees/shrubs with a diameter of less than 3 cm and a height of 1.3 m or more. In 2023, the 58 plots established in 2007 during the NFI in Benin within the Trois – Rivières forest reserves were revisited to collect the floristic (floristic composition), structural (DBH; total height) and regeneration count data using the same approach as the NFI (2007) (Figure 2).

**Figure 2:** Forest inventory on IFN 2007 plots

### 1.1.3 Assessment of the local perception of the factors and motivations driving the land use land cover change

Data was collected in the districts of Gogounou, Segbana, Bembereke and Kallalé in the areas of the TRF where the degradation is more intense. We chose three villages per commune (12 villages in all) and interviewed at least 64 and at most 79 households. The choice of villages was based on their proximity to the forest reserve. A total of 297 heads of household were interviewed. The surveys aimed to gather information on the perception of the local community. Thus, the structured questionnaire was used to collect information on i) the socio-demographic data (Age, household size, length of residence, marital status, ethnicity, profession and level of education), ii) the trend of natural formations and iii) the perception of the LULCC drivers, motivations for occupying the reserve forest and practices adopted for biodiversity conservation. A two-tailed test showed the relationship between local perception of the trend of forest vegetation and professional and ethnic groups. A principal component analysis was performed to understand the relationship between occupation and ethnicity with motivation and conservation strategies. A linear regression analysis was used to determine the degree of association between socio-demographic factors and awareness of a) trends in vegetation change, b) LULCC drivers and c) local conservation practices. Piecewise SEM was performed to assess the direct and indirect effects of predictors (socio-demographic, socioeconomic, sociocultural and motivation level) influencing the conservation, forest valorization and the perception of forest trends. The overall fit of the piecewise Structural Equation Model (SEM) was assessed using Fisher's C statistic, P-value ($p > 0.05$ indicated a good fit), and AIC (Lefcheck, 2016). The values of R square were also calculated to determine the variance explained by each group of predictors. statistical analyses were performed with R4.3.3.

**Figure 3:** Survey of the local community on the motivation and factors for land-use change in the Three Rivers Forest.

## 2 Results

### 3.1. Mapping and quality assessment of the 2022 image classification

Ten (10) land cover classes were finally mapped following a classification process of the 1990, 2006 and 2022 images (Figure 4). These include natural formations (dense forest, gallery forest, woodland, shrub and wooded savannah), plantations, agricultural and fallow land, water bodies, built-up areas, rocky surfaces and bare soil. The results of the classification performance analysis give an overall accuracy of 96% for the 2022 classified image, with a Kappa coefficient of 0.95. These statistics suggest significant discrimination between the various land cover classes. They also confirm the reliability of the image classification.

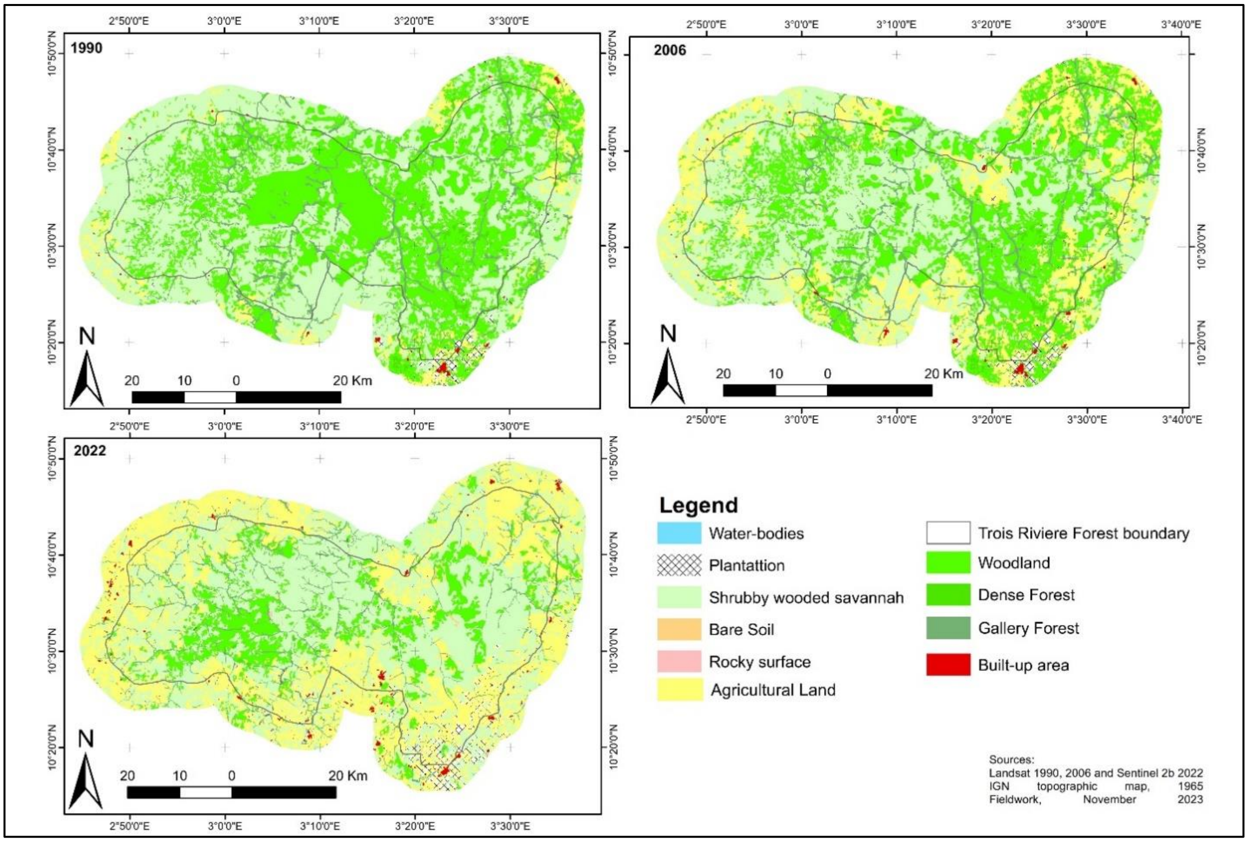



**Figure 4:** Map of Land use and cover changes in TRF for the three study periods.

Historically, in 1990, the landscape of the study area was dominated by two classes of natural formations, namely shrub and wooded savannah and woodland respectively (Table 1). Between 2006 and 2022, there was a significant change in the area of dense forest, and woodland (Table 1). Finally, there was also a significant increase in the agricultural and fallow land in the forest area between 1990 and 2022.

Table 1: LULC changes in percentage for the TRF and its buffer (5km) from 1990 to 2022.

| **LULC** | 1990-2006 (%) | 2006-2022 (%) | 1990-2022 (%) |
|---|---|---|---|
| Dense forest | -65.24 | -89.70 | -96.37 |
| Gallery forest | 0.06 | -9.77 | -9.70 |
| Woodland | -15.44 | -63.81 | -69.39 |
| Forest and savannah swamp | 0.00 | 0.00 | 0.00 |
| Shrubby wooded savannah | -19.68 | 12.32 | 4180.16 |
| Plantation | 6.29 | 89.09 | -66.77 |
| Agricultural land | 283.32 | 68.22 | 208 223.74 |
| Waterbody | 0.00 | -59.09 | -96.40 |
| Build-up area | 40.29 | 90.66 | 2355.48 |
| Rocky surface | 0.00 | 0.00 | 00 |
| Bare soil | 215.16 | 338.69 | 401.64 |

## 2.1 Degradation and Deforestation Levels in the Trois-Rivières Forest

Analysis of the results for deforestation and degradation of vegetation (Table 2) shows a higher annual rate of net deforestation (1.15) from 2006 to 2022 and an estimated annual rate of degradation of 0.1 (48.6 ha). Between 1990 and 2020, the annual deforestation rate is 1.15, while the rate of degradation is 1.12 (Table 2).

**Table 3:** Species diversity of plots in the Trois-Rivières Forest

| 1990 to 2006 | Total (ha) | Annual rate (ha) | Rate of change (%) | Annual rate (%) |
|---|---|---|---|---|
| Global deforestation | 74004.84 | 4625.30 | 18.44 | 1.15 |
| Natural recovery | 0.00 | 0.00 | 0.00 | 0.00 |
| Global degradation | 25617.16 | 1601.07 | 6.38 | 0.40 |
| Improvement | 29.20 | 1.83 | 0.01 | 0.00 |
| Net deforestation | 74004.84 | 4625.30 | 18.44 | 1.15 |
| Net degradation | 25587.96 | 1599.25 | 6.38 | 0.40 |
| 2006 to 2022 | | | | |
| Global deforestation | 104745.76 | 6546.61 | 32.04 | 2.00 |
| Natural recovery | 34068.63 | 2129.29 | 10.42 | 0.65 |
| Global degradation | 74064.53 | 4629.03 | 22.65 | 1.42 |
| Improvement | 31749.27 | 1984.33 | 9.71 | 0.61 |
| Deforestation nette | 70677.13 | 4417.32 | 21.62 | 1.35 |
| Degradation nette | 42315.26 | 2644.70 | 12.94 | 0.81 |
| 1990 to 2022 | | | | |
| Global deforestation | 154299.79 | 4821.87 | 38.06 | 1.19 |
| Natural recovery | 9230.68 | 288.46 | 2.28 | 0.07 |
| Global degradation | 179349.22 | 5604.66 | 44.23 | 1.38 |
| Improvement | 30456.56 | 951.77 | 7.51 | 0.23 |
| Net deforestation | 145069.12 | 4533.41 | 35.78 | 1.12 |
| Net degradation | 148892.65 | 4652.90 | 36.72 | 1.15 |

**Dynamics of species diversity in the Trois-Rivières Forest between 2007 and 2023**

In addition, the Shannon diversity index (1± 0.00 in 2007 and 1± 0.00 in 2023) and the mean Pielou equitability (1.5± 0.3 in 2007 and 7.8 ± 5.1 in 2023) increased (Table 3). The same trend was observed for the Chao1 index (Table 3).

**Table 3:** Species diversity of plots in the Trois-Rivières Forest

| | Shannon Diversity | | Richness | | Pielou's Evenness Index (J) | | S. chao1 | |
|---|---|---|---|---|---|---|---|---|
| | 2007 | 2023 | 2007 | 2023 | 2007 | 2023 | 2023 | 2007 |
| Mean | 1.0 | 1.0 | 5.6 | 5.9 | 1.5 | 7.8 | 8.5 | 2.3 |
| SD | 0.0 | 0.0 | 1.8 | 3.5 | 0.3 | 5.1 | 3.7 | 1.7 |

#### *2.1.1* Changes in *Trois-Rivière* plots composition through time

Analysis of temporal beta diversity from 2007 to 2023 shows that, of the 56 study sites, only 19 plots, or 33.92%, show a significant gain in species and high abundance (Figure 5). On the other hand, 33 plots showed a significant loss in terms of abundance and species, i.e. 58.92%, while 7.14% of plots remained stable between 2007 and 2023.

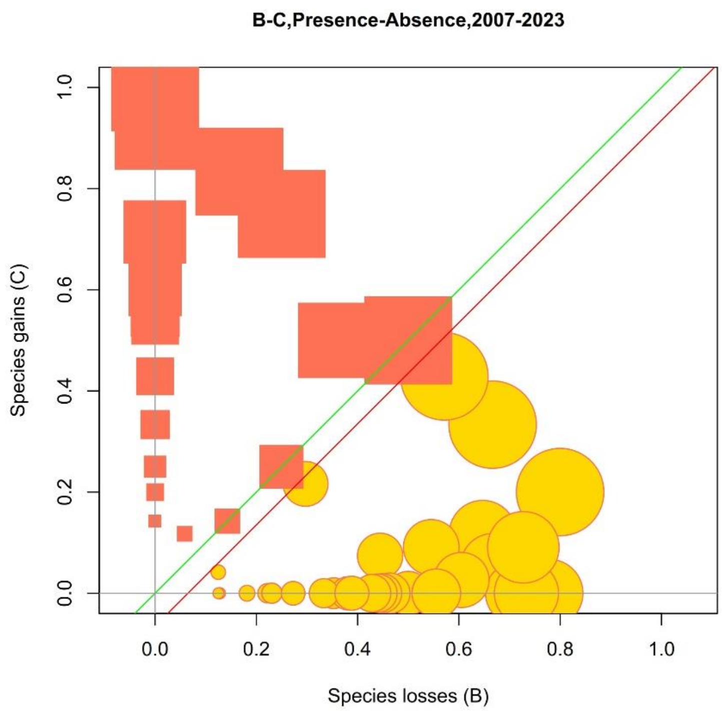



**Figure 5:** B-C Plots for abundances-per-species data from 2007 to 2023. The green line (slope 1) represents the line where losses equal gains, and the red line positioned parallel below the green line indicates that, on average, the losses of abundances-per-species dominate the changes in the entire woodlands in the time step under consideration. From 2007 to 2023, Species gains, losses and stabilities are listed in Table 4.

Table 4: Species (with DBH ≥ 10 cm) that changed significantly in abundance in the plots from 2007 (T1) to 2023 (T2)

| Species name | Family | Abundance | | Difference |
|---|---|---|---|---|
| | | T (1) 2007 | T (2) 2023 | T2-T1 |
| | (a) Species whose abundance has increased significantly | | | |
| *Detarium microcarpum* Guill. & Perr. | Fabaceae | 16 | 105 | 89 |
| *Crossopteryx febrifuga* Benth. | Rubiaceae | 30 | 82 | 52 |
| *Vitellaria paradoxa* C.F Gaertn. | Sapotaceae | 101 | 135 | 34 |
| *Burkea africana* Hook. | Fabaceae | 63 | 96 | 33 |
| *Anacardium occidentale* L. | Anacardiaceae | 0 | 27 | 27 |
| *Monotes kerstingii* Gilg | Dipterocarpaceae | 8 | 29 | 21 |
| *Acacia nilotica* (L.) Delile | Fabaceae | 2 | 16 | 14 |
| *Terminalia glaucescens* Planch. ex Benth. | Combretaceae | 5 | 18 | 13 |
| *Isoberlinia doka Craib & Stapf.* | Fabaceae | 26 | 37 | 11 |
| *PIliostigma thonningii (Schumach.) Milne-Redh.* | Fabaceae | 3 | 13 | 10 |
| *Maranthes polyandra (Benth.)* | Chrysobalanaceae | 3 | 10 | 7 |
| *Ficus exasperate Vahl.* | Moraceae | 0 | 6 | 6 |
| *Terminalia avicennioides Guill. & Perr.* | Combretaceae | 7 | 13 | 6 |
| *Parinari curatellifolia Planch. ex Benth.* | Chrysobalanaceae | 4 | 9 | 5 |
| *Daniellia oliveri (Rolfe) Hutch. & Dalziel* | Fabaceae | 15 | 19 | 4 |
| | (b) Species whose abundance has decreased significantly | | | |
| *Afzelia africana Pers.* | Fabaceae | 10 | 7 | -3 |
| *Erythrophleum suaveolens (Guill. & Perr.)* | Fabaceae | 3 | 0 | -3 |
| *Gardenia sp* | Rubiaceae | 3 | 0 | -3 |
| *Lannea acida A. Rich.* | Anacardiaceae | 18 | 15 | -3 |
| *Borassus aethiopum MART.* | Arecaceae | 8 | 4 | -4 |
| *Pteleopsis suberosa Engl. & Diels* | Combretaceae | 6 | 1 | -5 |
| *Prosopis africana Guill. & Perr.* | Fabaceae | 13 | 3 | -10 |
| The total number of tree stems counted | | 344 | 645 | - |

## 2.2 Socioeconomic determinants influencing respondents on perceived drivers of LULC changes

The local community of TRF identified enough factors that drove the LULCC and the motivation that induced them to change this forest (Figure 6). It highlights the massing of agricultural land, the best fertilisation of the soil in forest reserves, the collection of non-timber forest products, and the poorest, which are the main factors motivating the local community (Figure 6a). However, the Expansion of agricultural land and growing population were driven by LULCC (Figure 6b, 7).

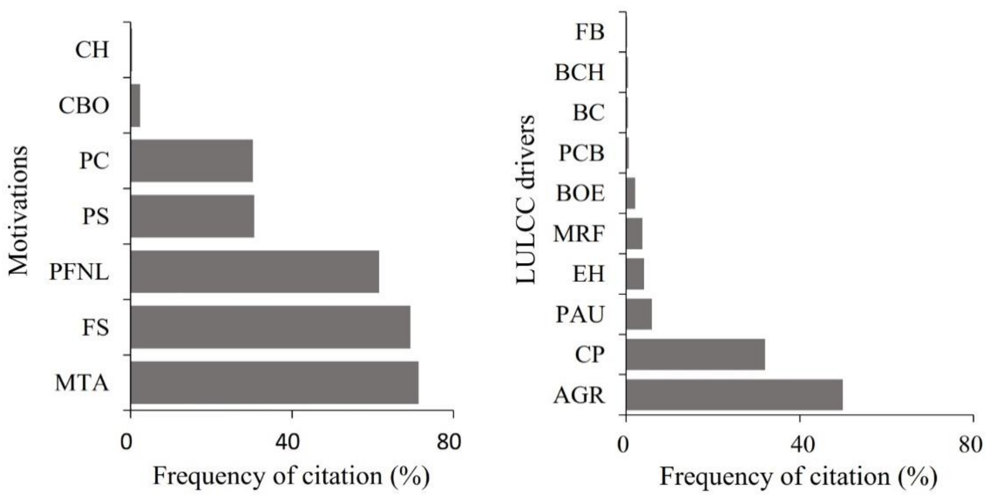
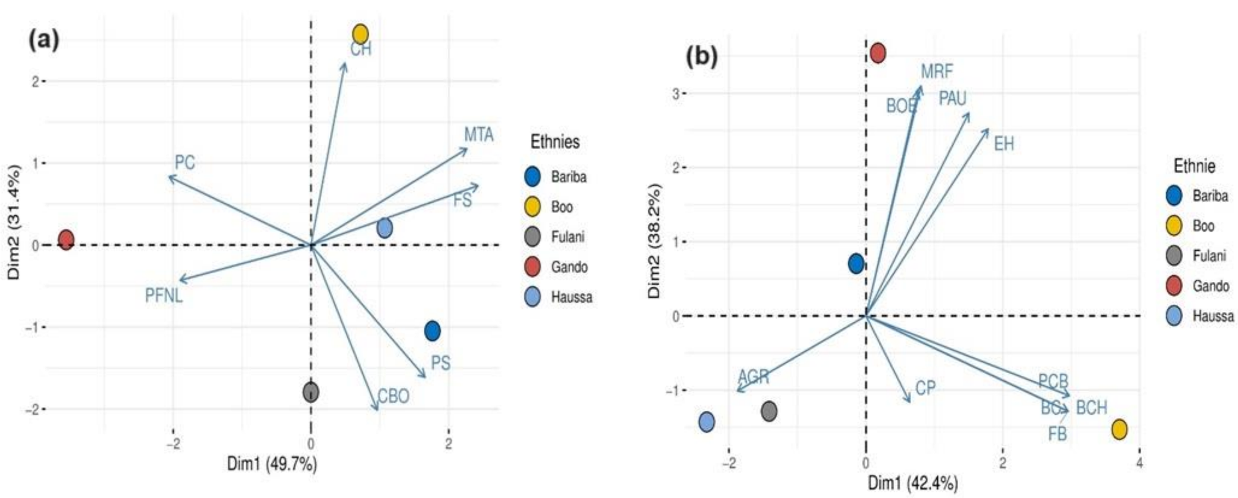



**Figure 6:** Drivers of land-use change in the Trois-Rivières forest reserves. PFNL: Non-timber forest product collection, FS: Soil fertility, MTA: Lack of land for agriculture, PC: Cultural practice, CH: Hunting, CBO: Timber collection, PS: Social heritage. BCH: Fuelwood, BC: Timber collection, CP: Population growth, BOE: Demand for timber, AGR: Agricultural land expansion, EH: Housing expansion, FB: Bushfire; MRF: Lack of financial resources, PAU: Poverty; PCB: Charcoal production.

**Figure 7:** Land use land cover change driven in TRF

Analysis of the relationship between motivation, drivers of land-use change and socio-cultural groups reveals that perception and motivation, as well as the drivers of change, vary between ethnic groups. The Hausa and Boo socio-cultural groups consider that the lack of agricultural land, the search for fertile land and hunting are the main motivations that drive them to exploit the forest. For the Gando, on the other hand, the motivations are linked to cultural practices and the collection of non-timber forest products. The Fulani and Bariba consider that timber collection and the consideration of the forest as a heritage are their main sources of motivation (Figure 8a). About the drivers of land-use change, the Gando identify logging, poverty or lack of financial resources, and habitat expansion as the main factors behind LULCC. For the Boo, charcoal production, firewood, timber and vegetation fires are the predominant drivers. As for the Haussa, they mainly associate these changes with the expansion of agricultural land (Figure 8b).

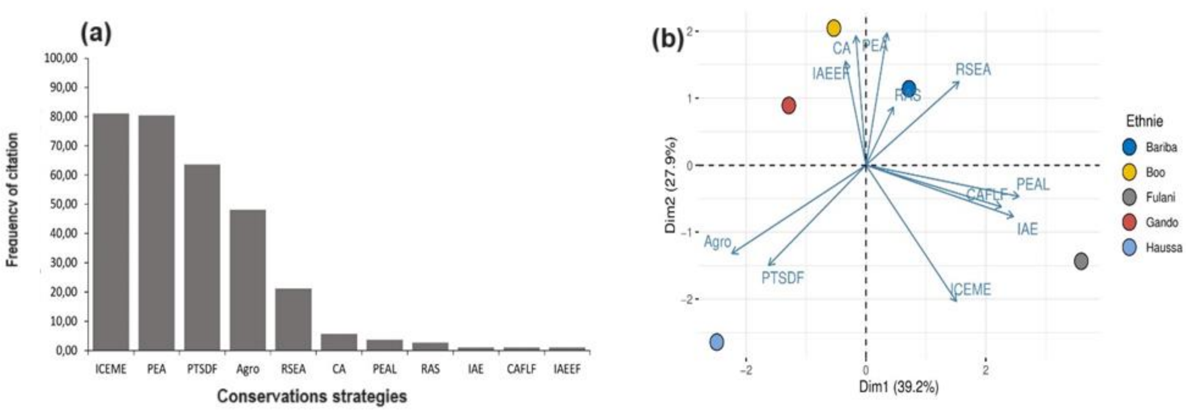



**Figures 8:** PCA of sociocultural (ethnicity) about local motivation (a) and conservations strategies (b) PFNL: Non-timber forest product collection, FS: Soil fertility, MTA: Lack of land for

agriculture, PC: Cultural practice, CH: Hunting, CBO: Timber collection, PS: Social heritage. BCH: Fuelwood, BC: Timber collection, CP: Population growth, BOE: Demand for timber, AGR: Agricultural land expansion, EH: Housing expansion, FB: Bushfire; MRF: Lack of financial resources, PAU: Poverty; PCB: Charcoal production.

## 2.3 Socio-cultural factors determining management strategies in the Trois-Rivières Forest reserve

Although the forest is disturbed, the local community has developed several conservation strategies. The most widely adopted practice is to prohibit the felling of certain species, followed by the planting of native species. The ban on agriculture in the forest reserve, however, is little recognised by the population (Figure 9a).  The adoption of conservation strategies varies between socio-cultural groups (Figure 9b). The Gando and Boo mainly practice conservation agriculture and recognize that it is strictly forbidden to practice agriculture, livestock rearing or logging within the reserve. In contrast, among the Fulani, the planting of non-native species, the ban on cutting endangered species and the integration of agriculture and livestock farming are the most common conservation practices (Figure 9b). The Bariba practice contrasts with that of the Haussa in that it regulates the area sown per farmer. The Haussa, on the other hand, practice agroforestry and pays tax on the area cleared in the forest (Figure 9b).




**Figures 9:** Frequency of citation (a) and variation in management strategies according to ethnic group. CA: Conservation Agriculture, IAE: Integration of Agriculture and Livestock, ICEME: Prohibition on cutting endangered species, RSEA: Regulation of the area sown per farmer, PTSDF: Payment of tax on the area cleared in the forest, Agro: Agroforestry, CAFLF: Collaboration with

forestry officers to limit access to the forest, IAEEF: Ban on agriculture, livestock farming and logging in the forest, PEA: Planting of indigenous species, PEAL: Planting of non-indigenous species, RAS: Nothing done in the village.

### 2.4 Direct and indirect relations between factors driving the motivation, forest trends and the decision to conserve forest

Household heads' age, level of education and degree of knowledge about forest evolution negatively affect the adoption of conservation strategies. On the other hand, the motivation that drives the local community to interact with the forest is positively correlated with their willingness to adopt conservation strategies. Furthermore, income and level of education are also positively correlated with the community's ability to perceive the forest's regressive trend (Figure 10).

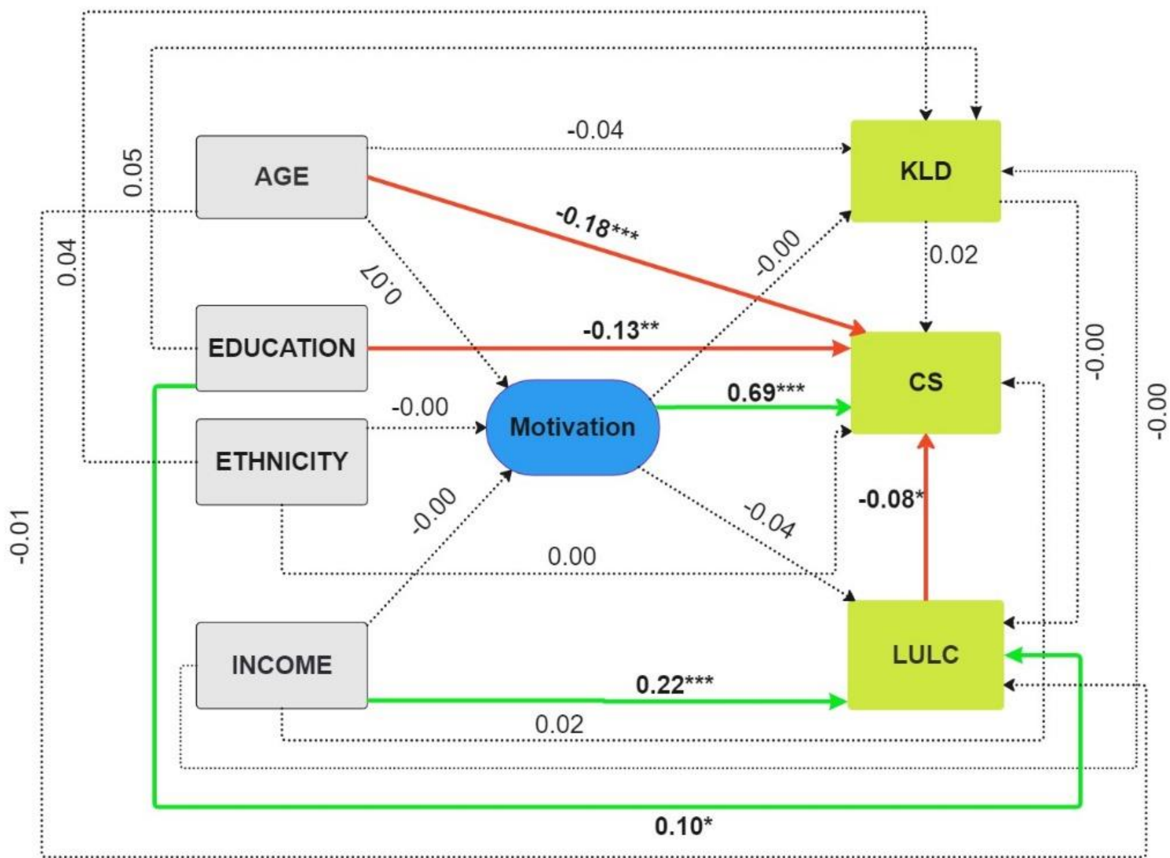



**Figure 10:** Equation structure showing the direct and indirect effects of socio-economic, cultural and demographic factors on motivation, perception of land-use changes and conservation strategies. KLD: Local knowledge of drivers of land-use dynamics, CS: Conservation strategy, LULC: Perception of land-use change trend.

## 2.5 Raising public awareness in the village surrounding the TRF

Before raising awareness in the local community about strategies for conserving and restoring degraded habitats, we organized a workshop to present the results to management and academic stakeholders and to gather their proposals (Figure 11). At this workshop, we discussed legislation and the threatened status of species on an international and national scale (Figure 11). Subsequently, posters were used to communicate the importance of safeguarding the Trois-Rivières Forest, the forest legislation and the consequences of activities carried out by the local community and the measures to be taken such as agroforestry and soil fertility conservation strategies in buffer zones to avoid encroachment of this forest (Figure 12). We also showed the community how pressure on this forest affects plant diversity. To reach a wider audience, a radio broadcast in the local language was produced, covering the points presented above.

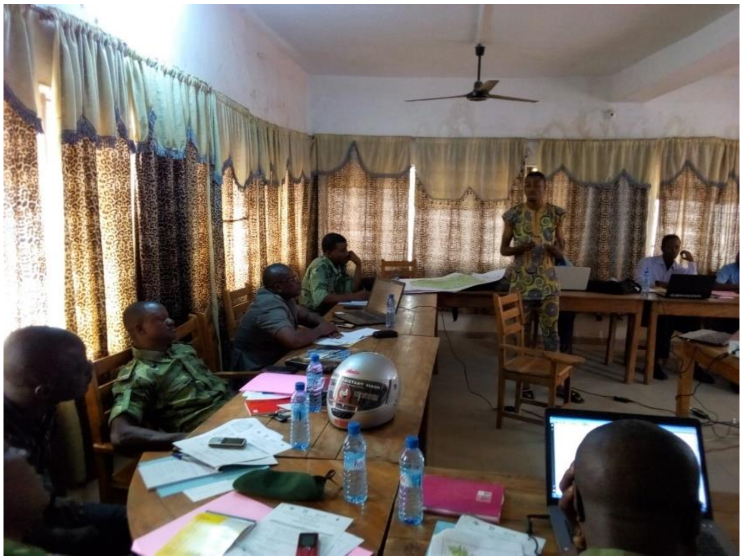


**Figure 11:** workshop to present the results to management and academic stakeholders and to gather their proposals


**Figure 12:** Raising awareness in the local community about restoration practices in degraded and deforested areas of the reserve forest.

## 3 Discussion

A diachronic analysis of land use between 1990 and 2022 in the Trois-Rivières forest reserve, based on satellite images, reveals that the landscape, once dominated by natural formations such as shrub and wooded savannahs, and woodland, is now highly anthropized. A sharp increase in cultivated areas was observed over the study period. These results corroborate those of Ahononga et al (2020b) and Biaou et al (2019), who highlighted the decline in the area of natural formations at the expense of agricultural and fallow land, respectively over the period 1990 to 2006 and 2006 to 2022. This increase in cultivated areas is seen as the result of several factors, driven by agricultural policy and the transition from a self-subsistence economy to a market economy (Mama et al., 2013). In addition to its role as a granary for food crops, the study area is known as Benin's cotton-growing basin (Biaou et al., 2019; Chirwa et al., 2014; Hountondji et al., 2013), and very recently as its soya-growing basin. The local community is aware of the drivers of land-use change, but their perception is strongly influenced by socio-cultural factors such as ethnicity. This suggests that targeted awareness-raising among stakeholders is needed to ensure forest conservation. This landscape dynamic is not without consequences for the structure of the forests and their floristic composition.

Analysis of the fifty-six (56) periodic forest inventory surveys carried out over sixteen (16) years, i.e. from 2007 to 2023 on permanent forest plots based on the beta temporal diversity index, indicates that significant changes have occurred in the floristic composition of open forest stands over time. There are two distinct phases. In the first phase, the plots studied were characterised by relative stability in the structure and floristic composition of their stands. The stability of the stand structure here implies that losses in species abundance were offset by gains in abundance and that the floristic composition of the plots remained similar to that surveyed in 2007. On the other hand, the same plots clearly showed a gradual and marked deterioration in the structure of the stands and a profound change in their floristic composition. This deterioration in stand structure has resulted in a loss in the abundance of the predominant species characteristic of savannah and woodland. During this period, and thanks to the recruitment process, new species emerged in the woody stand. It is known that most of these species are common to the tropical savannas of West Africa because of their ecology (Akoègninou et al., 2006; Arbonnier, 2009).

The fertility of the soils under open forests makes them a permanent focus for agricultural expansion, which contributes to the savannisation process (Mama et al., 2014; Silvério et al., 2013; Stark et al., 2020). According to Moonlight et al. (2020). Degradation of woodland is likely to worsen in the future as a result of market-oriented agricultural policy, with the consequent alteration of the regeneration capacity of woodland and a potential impact on local biodiversity. To limit this degradation and the loss of biodiversity, it is important to strengthen forestry policy, taking into account all stakeholders, to define sustainable management strategies. To this end, a study assessing the impact of degradation on the income of local communities is essential to develop a strategy for reducing emissions linked to degradation and deforestation (REDD+). Our results show that the adoption of conservation strategies is influenced by various socio-cultural and economic factors. Older and less educated heads of household, with little knowledge of forest evolution, are less inclined to adopt conservation practices. On the other hand, a strong motivation to interact with the forest encourages the adoption of these strategies. In addition, higher income and education levels improve the perception of threats to the forest. This underlines the importance of increased awareness and economic support to strengthen forest conservation.

## 5. Conclusion

Our findings from landscape analysis show a strong expansion of field and fallow areas to the detriment of natural forest formations. This landscape dynamic is contributing to the degradation of natural forest formations. The extent of this degradation was evident between 2006 and 2022, with major changes in the structure and species diversity of the stands. These structural changes are associated with changes in the floristic composition of open forest stands, particularly with the recruitment of savannah species, which could compromise the forest's regeneration capacity. It therefore seems important to develop sustainable management strategies in the current context of climatic variations. However, it is vital to understand the effect of exploiting these ecosystems on the income of local communities. Given that income directly influences the community's ability to perceive changes in the ecosystem, it is crucial to train farmers and nurserymen in the production and silviculture of endogenous species. Such training would not only ensure the preservation of these species, but also the success of initiatives to actively restore the Trois-Rivières Forest.

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**Annexes**

Photos from a series of activities


TECNO
CAMON


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Rufford