CONVENTION SUR LE COMMERCE INTERNATIONAL DES ESPECES
DE FAUNE ET DE FLORE SAUVAGES MENACEES D'EXTINCTION

Soixante-dix-septième session du Comité permanent
Genève (Suisse), 6–10 novembre 2023

Respect de la Convention

Respect de la Convention

Procédure accélérée d'application de l'Article XIII en ce qui concerne le bois de rose d'Afrique de l'Ouest *Pterocarpus erinaceus* pour tous les États de l'aire de répartition

MISE À JOUR DU RAPPORT SUR L'AVIS DE COMMERCE NON PRÉJUDICIABLE (ACNP) DE L'AVIS D'ACQUISITION LÉGALE (AAL) POUR *PTEROCARPUS ERINACEUS* EN SIERRA LEONE ET UNE DEMANDE D'AUTORISATION SPÉCIALE POUR L'EXPORTATION DES STOCKS DE *PTEROCARPUS ERINACEUS* PRÉLEVÉS AVANT LE QUOTA D'EXPORTATION ZÉRO

1. Le présent document a été soumis par la Sierra Leone.*

2. Le Gouvernement sierra-léonais a le plaisir d'informer le Secrétariat de la CITES, le Comité permanent et le Comité pour les plantes qu'il s'est beaucoup investi dans le processus d'avis de commerce non préjudiciable (ACNP) et présente ici une mise à jour de l'ACNP pour *Pterocarpus erinaceus* en Sierra Leone.

3. Par ailleurs, la Sierra Leone a également investi des ressources considérables pour finaliser l'avis d'acquisition légale (AAL) pour *Pterocarpus erinaceus* et documenter la légalité et la durabilité des grumes prélevées avant la notification aux parties N° 2022/021.

4. Le projet de rapport sur l'ACNP soumis au Secrétariat en mars 2023 a servi de base à la mobilisation d'experts internationaux chargés de l'examen du rapport sur l'ACNP et l'AAL, et sur la traçabilité en Sierra Leone. **Afin d'en faciliter la consultation, le rapport actualisé sur l'ACNP et l'AAL pour *Pterocarpus erinaceus* en Sierra Leone est joint au présent document**. L'ACNP actualisé est présenté dans le format en neuf étapes avec les données de la mission menée sur le terrain en août 2023 par des experts internationaux du cabinet de conseil Forest-Source, LLC (FS) et les partenaires Code4Nature et Forest Design. La mission de terrain avait pour objet de vérifier les données d'inventaire présentées par l'autorité scientifique de la Sierra-Leone et de repérer l'existence de lacunes dans l'élaboration d'une analyse exhaustive du commerce et de la conservation de l'espèce.

5. En résumé, les experts internationaux ont pu constituer des parcelles au niveau du district pour vérifier la distribution, élaborer des méthodes pour mener à bien l'étude au niveau des concessions de district et finalement réaliser un inventaire national et, par ailleurs, créer un site pilote pour la création et la mise en œuvre d'un programme exhaustif de traçabilité numérique des bois à des fins de suivi de la chaîne de contrôle.

6. Les agents de l'organe de gestion et de l'autorité scientifique de la Sierra Leone ont reçu une formation sur la technologie Forest-Source et ont été directement impliqués dans le projet pilote initial de fixation d'un quota de prélèvements durable pour le rapport au Secrétariat CITES et aux présidents du Comité

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* *Les appellations géographiques employées dans ce document n'impliquent de la part du Secrétariat CITES (ou du Programme des Nations Unies pour l'environnement) aucune prise de position quant au statut juridique des pays, territoires ou zones, ni quant à leurs frontières ou limites. La responsabilité du contenu du document incombe exclusivement à son auteur.*

permanent et du Comité pour les plantes en vue de la levée du quota d'exportation zéro. La deuxième mission de renforcement des capacités est prévue pour octobre 2023.

7. Comme nous l'avons réitéré dans plusieurs lettres adressées au Secrétariat au sujet de l'investissement réel de la Sierra Leone dans l'élaboration d'un avis de commerce non préjudiciable (ACNP) et d'un avis d'acquisition légale (AAL) pour *Pterocarpus erinaceus*, nous restons attachés à ce processus et avons augmenté notre capacité à mettre en place les principaux systèmes de suivi et de traçabilité nécessaires à la mise en œuvre des programmes de commerce légal et durable actuels et à long terme grâce à notre investissement dans l'ACNP et l'AAL.

8. Sur la base des évaluations d'experts réalisées en août 2023, au cours de la mission de terrain, la Sierra Leone souhaite informer le Secrétariat de la CITES, le Comité permanent et le Comité pour les plantes que nous avons redéfini les grumes récoltées avant la notification aux Parties n° 2022/021 que nous avions identifiées comme des « stocks » dans une lettre intitulée « Soumission du projet d'avis de commerce non préjudiciable (ACNP) pour le bois de rose d'Afrique de l'Ouest, *Pterocarpus erinaceus,* en Sierra Leone, et d'une demande d'autorisation spéciale pour l'exportation des stocks de *Pterocarpus erinaceus* » datée du 10 mars 223. Ils sont maintenant définis comme des « stocks prélevés avant le quota d'exportation zéro » ; ils appartiennent à des intérêts privés et ont été récoltés légalement.

9. En effet, le terme « stocks » sous-entend qu'ils ont été confisqués ou qu'ils sont détenus suite à une action de lutte contre la fraude engagée par le Gouvernement. Ils n'ont pas été confisqués, sont détenus par des intérêts privées et pourraient faire l'objet de demandes de permis d'exportation CITES une fois que le quota d'exportation zéro sera levé.

10. Notre objectif est de fournir un nombre total de grumes, un volume et un AAL pour ces stocks prélevés avant le quota d'exportation zéro en utilisant les nouveaux systèmes de traçabilité de l'ACNP pour prouver qu'ils pourraient être exportés. Soyez assurés que la Sierra Leone n'exportera **QUE** des stocks de *Pterocarpus erinaceus* prélevés légalement avant le quota d'exportation zéro, conformément aux dispositions de la Convention et aux recommandations du Comité permanent et du Comité pour les plantes.

11. Par ailleurs, il est interdit de prélever *Pterocarpus erinaceus* à des fins d'exportation tant que le Secrétariat et les présidents du Comité permanent et du Comité pour les plantes n'ont pas reconnu la crédibilité de l'avis de commerce non préjudiciable (ACNP) et de l'avis d'acquisition légale (AAL) pour *Pterocarpus erinaceus* et qu'un quota d'exportation n'a pas été fixé. Cela signifie que de nouveaux lots ne seront pas ajoutés aux stocks de *Pterocarpus erinaceus* déjà catalogués comme prélevés avant le quota d'exportation zéro.

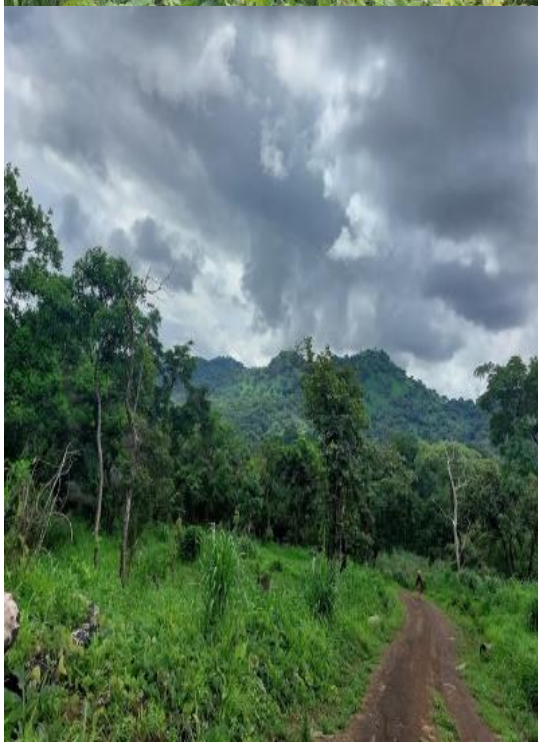
12. En conclusion, la Sierra Leone demande la levée du quota d'exportation zéro dans la mesure où les conditions déterminant l'ACNP et l'AAL pour la Sierra Leone ont été remplies. Le Gouvernement de la Sierra Leone continuera de vous assurer qu'il est pleinement attaché à la procédure de respect de la Convention pour *Pterocarpus erinaceus* fondée sur le document SC74 Sum. 13-11/13/2022, et qu'elle fera appliquer les mesures déjà en place et concevra de nouvelles méthodes pour l'organisation d'un commerce du bois correctement réglementé et légitime. Nous poursuivrons l'assainissement du commerce en fonction des conclusions des avis imposés.

Recommandations

13. Le Comité permanent est invité à :

    a) examiner la demande de la Sierra Leone de lever le quota d'exportation zéro ;

    b) examiner le rapport actualisé sur l'ACNP et l'AAL pour *Pterocarpus erinaceus* en Sierra Leone et formuler des recommandations supplémentaires à l'adresse de la Sierra Leone.



UPDATED NON-DETRIMENT FINDING (NDF) AND LEGAL ACQUISITION FINDING (LAF) REPORT FOR WEST AFRICAN ROSEWOOD *PTEROCARPUS ERINACEUS* IN SIERRA LEONE

CITES SCIENTIFIC AUTHORITY
SIERRA LEONE

AUGUST 2023

STEP 1 - REVIEW SPECIMEN IDENTIFICATION

Rationale

Proper identification of *Pterocarpus erinaceus* at the national and local levels is essential to its management, sustainable harvest, and trade of the species. It is also important in establishing sound data on its presence, density and standing volume to facilitate the setting up of harvestable volumes and ensure that such take-offs are sustainable and are within CITES compliance. The need for the species to be correctly identified in other areas of Sierra Leone where it is found is relevant to the various local approaches to its management and conservation. Although it is generally harvested for trade, the tree, or parts of it are used for other purposes such as medicinal, wood, charcoal and fodder for cattle.

Key Question

Has the plant/specimen been correctly identified, and is the scientific name used compliant with the appropriate CITES standard?

Pterocarpus erinaceus Poir, is often referred to as the African Rosewood tree. It is a medium sized, deciduous legumes tree of African savannas and dry forests, often with height ranging between 12-15m and poorly formed bole that is markedly fluted and gnarled, and with plank-like buttress. Its outer bark is finely scaly fissured, brown-blackish whereas its inner bark is thin that produces red exudate (sap) when cut. Its leaves, approximately 30 cm long, are alternate imparipinnate compound with small, linear or narrowly triangular shaped stipules and leaflets up to 11. Flowers are axillary, bisexual, irregular, golden yellow in colour with 5cm long calyx and 5 free petals that are glabrous or sparsely hairy outside. Fruit is compressed indehiscent, broad, and winged pod. The seed is kidney shaped.

The accepted English trade names of *Pterocarpus erinaceus* include African Barwood, African Kino tree, African Rosewood, Senegalese Rosewood. Other known vernacular names include Bois de vène, Kino de gambie, Santal rouge d'afrique, Teak africain (in French) and Gbenie in major Sierra Leonean local languages.

Flowers bisexual, papilionaceous; pedicel 4–8 mm long, hairy; calyx campanulate, c. 7 mm long, densely hairy, with 5 triangular teeth 1–2.5 mm long, upper 2 more or less connate; corolla with clawed petals, golden yellow, standard almost circular, up to 15 mm × 13 mm, wings up to 13 mm long, keel up to 10 mm long; stamens 10, fused into a sheath up to 8.5 mm long, the upper stamen sometimes free; ovary superior, stiped, hairy, style up to 5 mm long, almost glabrous.

The fruit a circular, flattened, indehiscent pod 4–7 cm in diameter, on a stipe up to 1 cm long and with a papery, finely veined wing with wavy or plaited margin, with prickles on the seed-bearing portion, straw-coloured, 1(–2)-seeded. The seed kidney-shaped, flat to slightly thickened, c. 10 mm × 5 mm, smooth, red to dark brown. Seedling with epigeal germination and the cotyledons are leafy.

In Sierra Leone the species is identified using various similar names by the different tribes in the Districts and Regions across its range, as follows:

Kono (Eastern Province) – *Gbenie*

Temne (Northern and Northwestern Provinces) – *Gbenie*

Limba (Northern Province) – *Gbene*

Koranko (Northern Province) – *Gbene*

Madingo (Northwestern Province) – *Bani-fere*

In general, based on field experience and observations, there is common understanding of the identity of the species even among local people in most villages and settlements in these Regions. In fact, among some of the local people and the Forest Rangers, there is a concept that there are two subspecies (or morphological varieties) which they refer to as the red one and the white one. This need to be verified by thorough field assessment and analysis of the phenotypic and genotypic features of these suspected varieties.

STEP 2 - REVIEW COMPLIANCE WITH REQUIREMENTS FOR ARTIFICIAL PROPAGATION

Rationale

The artificial propagation of Pterocarpus erinaceus assumes paramount significance due to its potential for yielding substantial, long-term economic, and ecological advantages. The species, known for its valuable timber and ecological contributions, warrants meticulous attention toward its sustained propagation. In past endeavors, attempts were made to establish nurseries within concession areas, albeit with limited success. This lack of accomplishment can be attributed, in part, to the ad hoc nature of these initiatives and the conspicuous absence of a well-structured scientific methodology and approach in conducting these trials.

Efforts to propagate Pterocarpus erinaceus artificially represent a significant stride in forest management practices, particularly in regions where this species holds ecological and economic prominence. To fully unlock the benefits of artificial propagation, it is imperative to address the historical inadequacies in prior nursery establishment initiatives. By adopting a scientifically rigorous approach, one that incorporates a systematic methodology and adheres to established protocols, the success rate of nurseries within concession areas can be substantially enhanced.

Moreover, such a meticulous approach can encompass various facets of propagation, including the selection of appropriate germplasm, precise nursery management techniques, consideration of ecological and silvicultural factors, and rigorous monitoring and evaluation protocols. In this regard, scientific rigor is indispensable in ensuring that artificial propagation initiatives not only bolster the economic potential of Pterocarpus erinaceus but also contribute to its conservation and sustainable management within concession areas.

The prospects of artificial propagation of Pterocarpus erinaceus are both promising and imperative for long-term economic and ecological benefits. To navigate toward success in this endeavor, a well-structured, scientifically grounded methodology is of paramount importance. By rectifying the shortcomings of past initiatives and embracing a systematic approach, the propagation of Pterocarpus erinaceus can emerge as a cornerstone in the sustainable management of this invaluable species within concession areas.

Key Questions

Is the permit application for artificially propagated specimens?
Answer - No.

Is export of the artificially propagated specimens of this species permitted by national or relevant sub-national legislation?
Answer – Yes, but no successful artificial propagation is evident now.

If specified as artificially propagated, do timber specimens meet all requirements for artificial propagation?
Answer – Not applicable, because none exists now.

STEP 3 - REVIEW OF RELEVANT EXCLUSIONS AND PREVIOUSLY MADE NDFS

Rationale

There is need to understand whether the specimen is excluded from regulation by an annotation to the species listing in the CITES Appendices; if harvest or export is prohibited by national legislation; or if the export permit application is consistent with previous science-based findings. Since no previous NDF has been carried out, none of these conditions would apply for the species in Sierra Leone. However, in response to the Notification to the Parties N^{o} 2022/021, Sierra Leone requested the Standing Committee, Plants Committee and the CITES Secretariat to accept a **Zero Export Quota** for commercial trade in specimens of *Pterocarpus erinaceus* in accordance with Resolution Conf 14.7 (Rev. CoP15) in a letter titled "Submission of Zero Export Quota for Pterocarpus erinaceus" dated 6 April 2022. The Zero Export Quota was chosen as the preferred option rather than the submission of a Non-Detriment Finding (NDF) and a Legal Acquisition Finding (LAF) for *Pterocarpus erinaceus* in Sierra Leone because it was very difficult to conduct such a scientifically based Non-Detriment Finding that will be accepted as credible by the Standing Committee in advance of the 27th of April 2022 deadline indicated in the Notification. The Zero Export Quota was accepted, and publication has been made on the national export quota section of the CITES website.

Key Questions

Are the timber specimens applied for covered by CITES Appendix II?

Yes, *Pterocarpus erinaceus* is covered by CITES Appendix II. This includes all products obtained from the plant, whether alive or dead, such as logs, sawn wood, veneer sheets, plywood and transformed wood, specified in the provisions of the Convention.

Is the harvest or the export of wild-harvested specimens of this species permitted by national or relevant sub-national legislation or regulation?

Yes, the harvest and export of the species is permitted by national and relevant sub-national legislation and regulation. Based on the provision in the Forestry Act of 1988 (Amended in 2022), the harvest and export of Pterocarpus erinaceus is permitted nationally and at subnational levels. The legislations and regulations also make provision for the prohibition of harvest and export whenever the need arise, particularly in situations where exploitation may need to be curtailed as options for the management and conservation measures for the species.

Has the Scientific Authority previously made a science-based NDF for this species that is still valid and is sufficient to evaluate the specimens for the current export permit application?

No previously made science-based NDF was made by the Scientific Authority. However, during the preparation of the NDF that is currently being reviewed, District and Chiefdom level data were obtained, and the analysis and assessment showed that logs were harvested through a legal permit and licensing process instituted by the Forestry Department of the Ministry of Environment and Climate Change, Government of Sierra Leone.

STEP 4 - EVALUATE CONSERVATION CONCERNS

Rationale

The most important conservation concern for *Pterocarpus erinaceus* in Sierra Leone is the harvest of the species for the purpose of export of semi-processed logs or transformed wood. Thus, the need to prepare an NDF for *Pterocarpus erinaceus* in Sierra Leone is justifiable because its harvest and export contributes significantly to the foreign exchange earnings and thus the economy of the country. Therefore, its continued viability and sustainable management is a must if the country should continue to benefit from the harvesting of the species.

Key Question

Considering conservation status assessments, what is the indicated severity of conservation concern?

In Sierra Leone, the severity of conservation concern was evaluated through the study, and it is assessed to be "Medium". Considering the plentitude of *Pterocarpus erinaceus* woodlands in the Districts of the Northern latitudes in Sierra Leone, the species was the most logged timber in the country. There are several uses and benefits from *Pterocarpus* timber, which have been outlined for each of the Districts, including fencing, construction work, firewood, charcoal, medicine, and fodder. According to local sources, the durability, thickness, and robustness of the wood is the main reason for its choice of use, among other timber species.
In most of the remote areas, it was observed that *Pterocarpus erinaceus* wood are used for the construction of roads and local bridges. The logs are laid across trenches and drainages to connect roads and accesses to communities and houses, for the easy movement of people, vehicles, cattle, and goods. The wood of *Pterocarpus erinaceus* is also used in the construction of houses in most Chiefdoms and Villages across the Districts.

Farmers also use *Pterocarpus erinaceus* to fence their crops and livestock. The trees are extensively cut down into many pieces of equal height (4-5 ft), which are braced together around the farmland and stable. The fence serves the purpose for protecting crops against pest and theft and to restrict the movement of cattle and other livestock to prevent loss and control their destructive potentials. Charcoal production is the growing alternative profitable use of the wood in Kono, Bombali, Tonkolili, Kambia and Karene Districts and there is evidence that this activity has started in some other Districts.

The market for *Pterocarpus erinaceus* timber provides a source of income for everyone along the supply chain. Therefore, there is need for a coordinated approach from the Concession holders, entire supply chain actors, Factory owners, the Government Regulatory Agencies and the Local Authorities. Proof of legality should always be made transparent from source, transport, stockpiling and finally to the retail market or for exportation.

It is critical to understand the impact of harvesting on the survival of the species based on its biological characteristics.

STEP 5 - EVALUATE POTENTIAL BIOLOGICAL RISKS OF PTEROCARPUS ERINACEUS

Rationale

Understanding the potential biological risks associated with the wild harvest of Pterocarpus erinaceus is crucial for assessing the impact on its survival. Certain biological characteristics can make a species more susceptible to detrimental effects of harvesting and trade. The objective of Step 5 is to evaluate the potential biological risks associated with the wild harvest of Pterocarpus erinaceus. This assessment will help us understand the impact of harvesting on the survival of the species based on its biological characteristics.

Action

In this step, we focused on analyzing key factors that contribute to the potential risk of harvesting on the species' survival. By considering these biological attributes, we aim to determine the severity of risk associated with the harvest. Considering the factors related to the species distribution, population, and habitat that influence the potential risk of harvest on the survival of Pterocarpus erinaceus populations we will determine whether the severity of risk for each factor is "Low," "Medium," "High," or "Unknown."

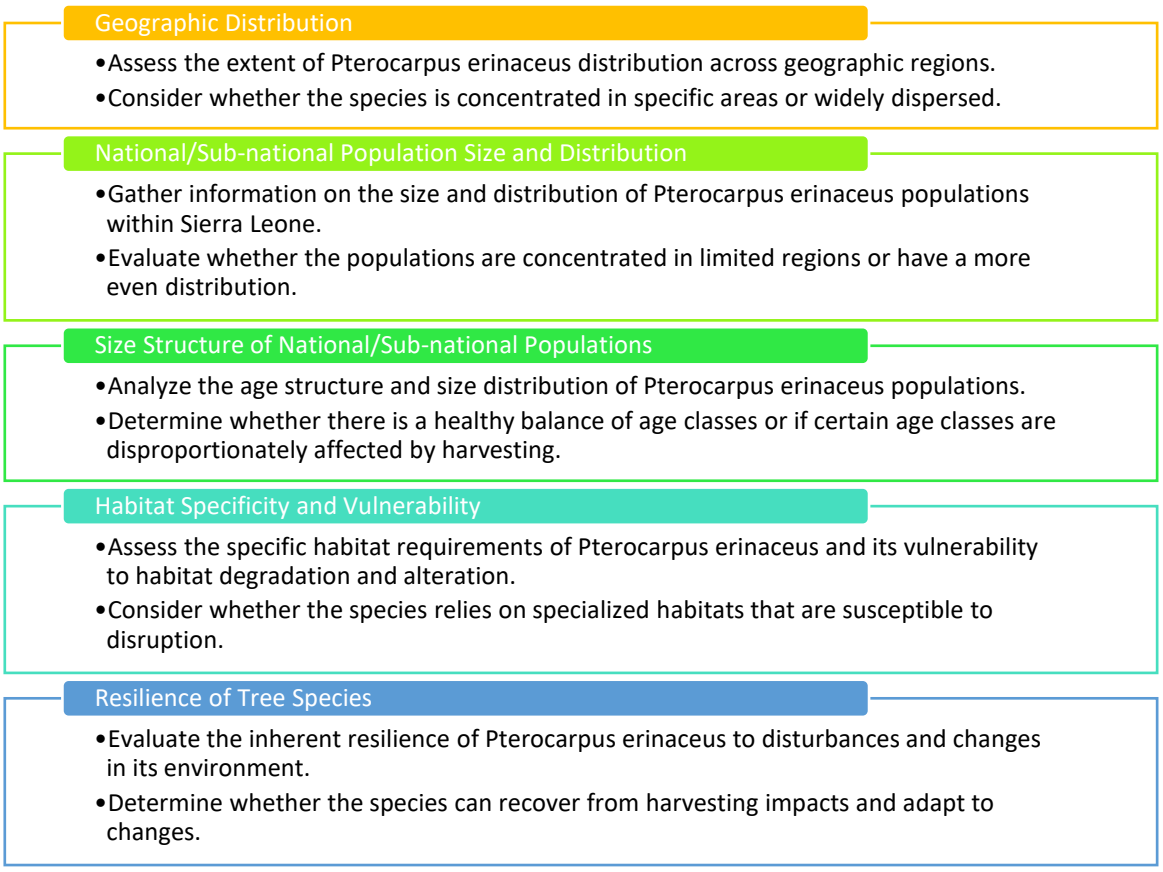


Fig.5.1. Workflow for evaluating the biological risks

1. Geographic Distribution

In order to comprehensively assess the geographic distribution of Pterocarpus erinaceus, we turned to a synthesis of regional studies that collectively provide insights into the species' range across different countries. These studies, cited below, have contributed crucial data that form the foundation of our understanding of the species' distribution patterns:-

Dimobe, Kangbéni et al. (2022):

- This study focuses on the impact of climate change on Pterocarpus erinaceus in Burkina Faso.
- The research provides valuable insights into the distribution of the species within Burkina Faso and highlights the anthropogenic threats it faces.

Biaou, Séverin et al. (2023):

- This study enhances our understanding of the species by incorporating intraspecific variation into distribution models.
- By considering genetic variability, the study provides a refined perspective on how Pterocarpus erinaceus responds to climate change across West Africa.

Adjonou, Kossi et al. (2020):

- This research assesses the vulnerability of African Rosewood, including its distribution and response to climate change in West Africa.
- The study's findings contribute to our understanding of how the distribution of Pterocarpus erinaceus may be influenced by changing climatic conditions.

Segla, N. K. et al. (2016):

- Focusing on population structure and minimum felling diameter, this study provides insights into the species' distribution and its exploitation potential in arid and semi-arid climates of West Africa.
- The research aids in characterizing the species' range and its suitability for sustainable management.

GBIF Database:

- The Global Biodiversity Information Facility (GBIF) serves as a valuable resource for species distribution data.
- The data available in this database further contributes to our understanding of the geographic range of Pterocarpus erinaceus.

By synthesizing data from these studies and cross-referencing them with the GBIF database, we have gained a more comprehensive and accurate understanding of the geographic distribution of Pterocarpus erinaceus. The collective insights from these sources offer a holistic view of the species' presence and range across the region.

Our commitment to assessing the geographic distribution of Pterocarpus erinaceus has led us to compile, analyze, and synthesize data from multiple credible sources. This integrated approach ensures that our understanding of the species' range is robust and well-informed, serving as a critical foundation for subsequent stages of the Non-Detriment Finding process.

Risk severity	Indicator
Medium	According to various regional studies (Figure 5.2 and 5.3) the distribution is restricted to a medium sized region comprising the following countries

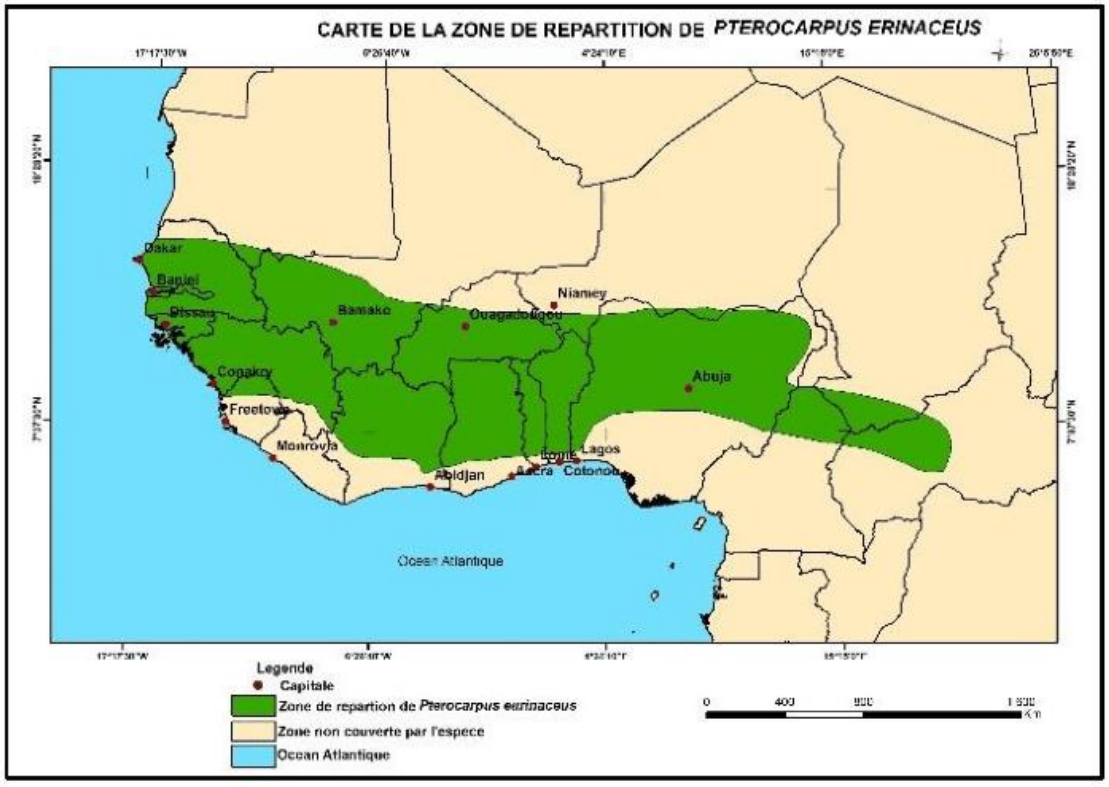


Figure 5.2. Distribution of Pterocarpus erinaceus (Adjonou et. al, 2020)

Figure 5.3. Distribution of Pterocarpus erinaceus based on https://www.gbif.org/species/5349317

Data sources and cross-validation:

Dimobe, Kangbéni, et al. "Climate change aggravates anthropogenic threats of the endangered savanna tree Pterocarpus erinaceus (Fabaceae) in Burkina Faso." *Journal for Nature Conservation* 70 (2022): 126299.

Biaou, Séverin, et al. "Incorporating intraspecific variation into species distribution models improves climate change analyses of a widespread West African tree species (Pterocarpus erinaceus Poir, Fabaceae)." *Global Ecology and Conservation* 45 (2023): e02538.

Adjonou, Kossi, et al. "Vulnerability of African Rosewood (Pterocarpus erinaceus, Fabaceae) natural stands to climate change and implications for silviculture in West Africa." *Heliyon* 6.6 (2020).

Segla, N. K., et al. "Population structure and minimum felling diameter of Pterocarpus erinaceus Poir in arid and semi-arid climate zones of West Africa." *South African Journal of Botany* 103 (2016): 17-24.

2. National /Sub-national Population Size and Distribution

To comprehensively assess the national and sub-national population size and distribution of Pterocarpus erinaceus, we employed a sophisticated approach that harnessed the power of modern technology and advanced data analysis techniques. Our commitment to accuracy and efficiency led us to utilize a regression analysis based on machine learning, a methodology that provided robust insights into the species' population dynamics.

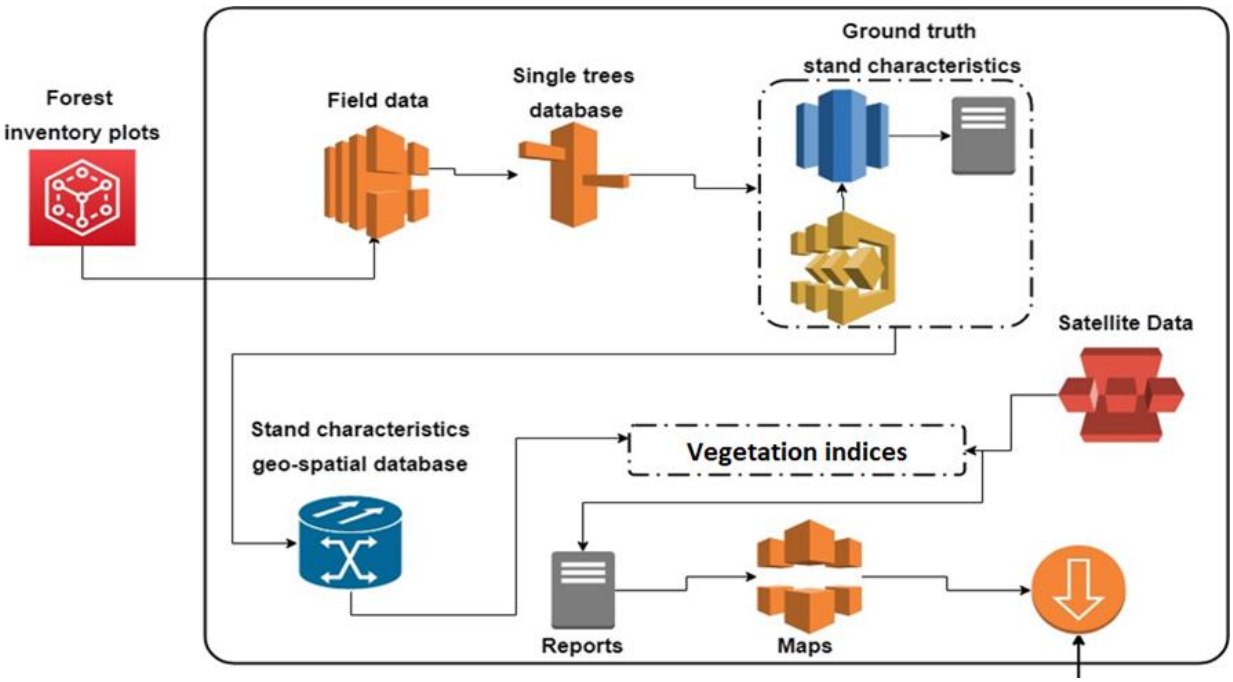


Fig 5.4. Machine learning workflow

Methodology:

- Data Compilation:

We compiled a rich dataset comprising various factors that could influence the population size and distribution of Pterocarpus erinaceus.
This dataset included vegetation indexes, climatic data, digital elevation models, and ground truth inventory data of Pterocarpus erinaceus across the nation.

- Supervised Random Forest Algorithm:

To analyze this complex dataset, we employed the supervised random forest (RF) machine learning algorithm.
RF is well-suited for handling multi-dimensional datasets and capturing complex relationships within them.
This algorithm was executed on the Google Earth Engine (GEE) cloud computing platform, allowing us to harness its immense processing power and scalability.

- Pixel-Based Analysis:

We adopted a pixel-based analysis approach, breaking down the study area into smaller units for in-depth analysis.
Each pixel was treated as a data point, and the algorithm learned patterns and relationships among the various input variables.

- Predictive Modeling:

Our analysis aimed to predict the population size and distribution of Pterocarpus erinaceus in different geographical areas.
The algorithm learned from the ground truth inventory data, utilizing known locations of Pterocarpus erinaceus to predict its presence in other areas.

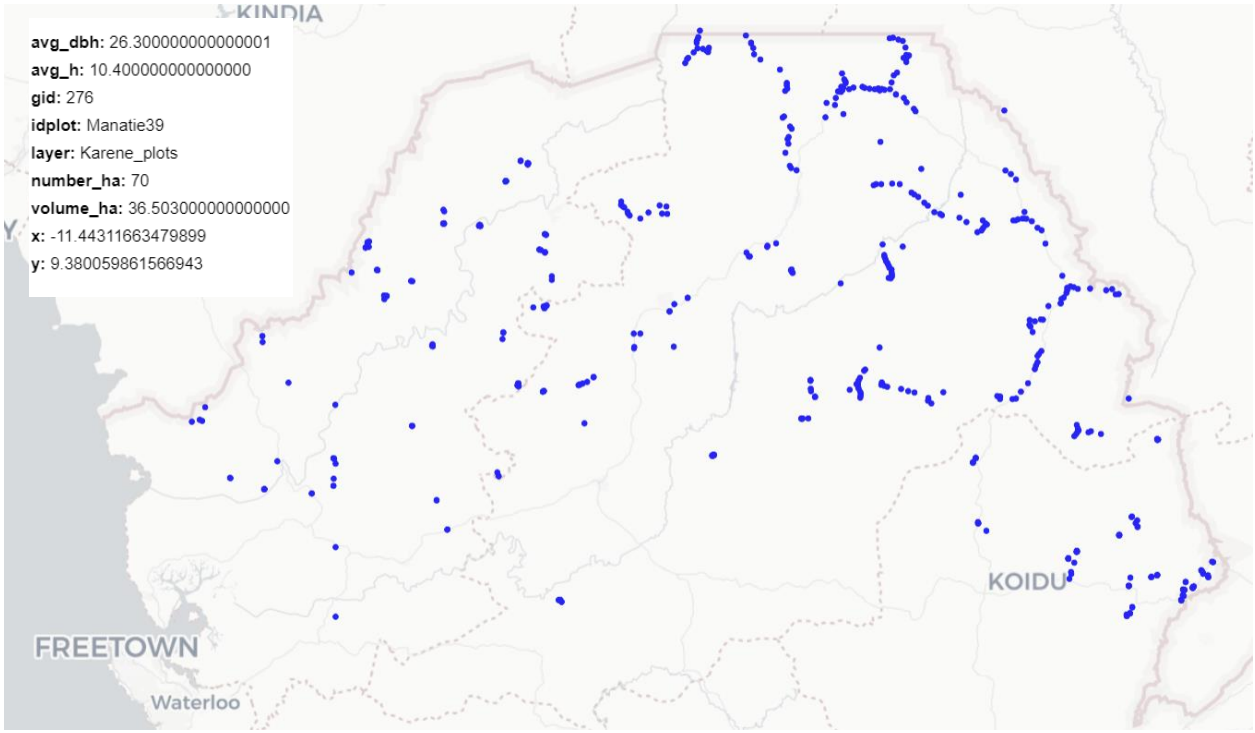
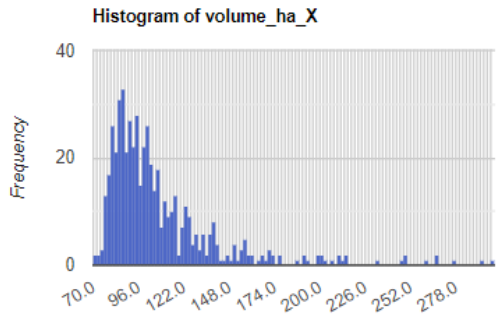
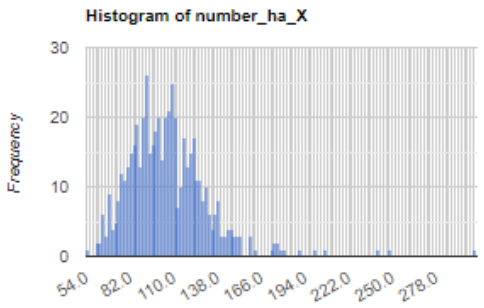


Fig 5.5. Distribution of plot and dependent variables inside each plot used for prediction

- Regression Analysis and Insights:

The machine learning model performed regression analysis, creating a predictive model that estimated the population size based on input variables.





RMSE
128.0876146305439

MAE
-39.26850178247583

RMSE
101.54238424428165

MAE
15.298453400727155

Fig.5.6. Histograms of validation data, Root Mean Square Error, Mean Absolute Error of the prediction made for volume and number of trees

By analyzing the model's outputs, we gained valuable insights into how various factors contribute to the species' distribution patterns.
Through our innovative utilization of advanced technology and machine learning, we have taken a significant step toward understanding the population dynamics of Pterocarpus erinaceus. This methodology sets a benchmark for data-driven conservation efforts and contributes to our commitment to sustainable resource management.

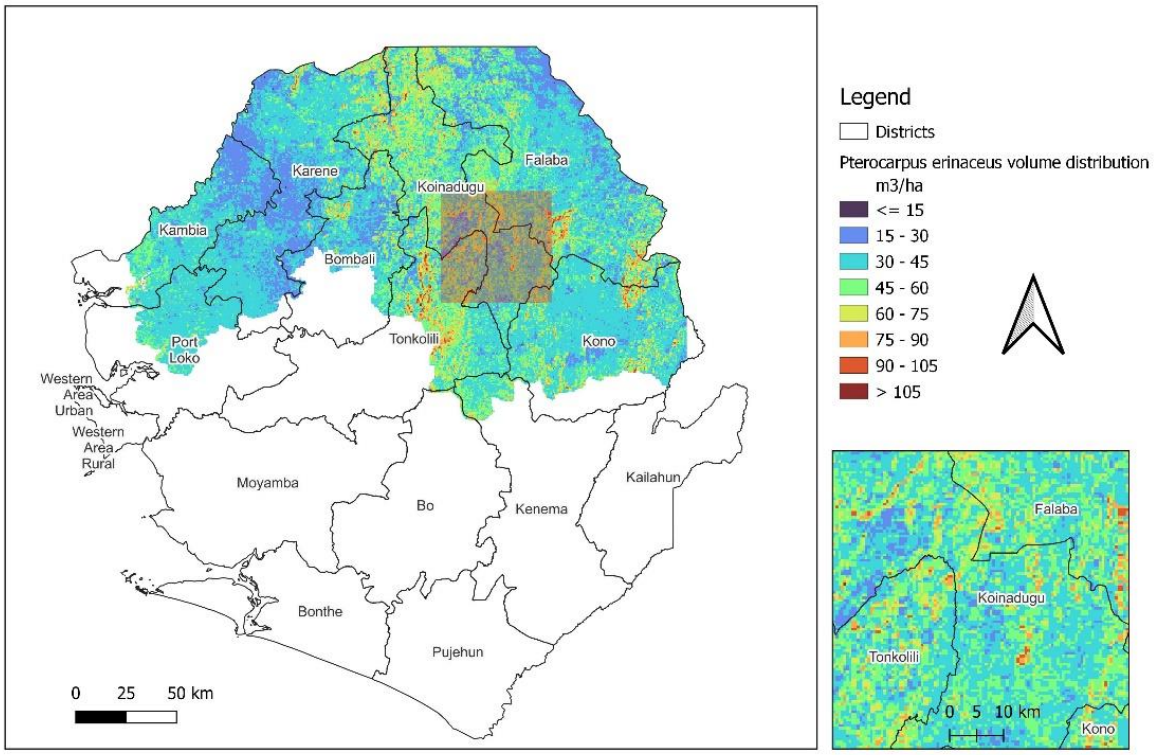


Figure 5.7. National distribution expressed in standing volume as m3/ha produced from machine learning regression based on field plots

Risk severity	Indicator
Medium	National population is medium-sized. Sub populations are unevenly distributed across the country. (Figure 5.7)

3. Size Structure of National / Sub-national Populations

The tree distribution at national level shows a reverse J-shaped curve, with a high number of small trees and a decreasing number of trees with increasing size. This is evident from the field plots, which show that the majority of trees have a DBH (diameter at breast height) of less than 24 cm. The R2 value of 0.9181 indicates that the reverse J-shaped curve is a good fit for the data, meaning that the majority of the trees are accurately represented by the curve.
The reverse J-shaped curve is a good sign for the health of the population because it indicates that there are many small trees, which are the most likely to reproduce. This means that the population is likely to be sustainable in the long term.

Risk severity	Indicator
Low	Size classes are distributed in a way that shows a high potential for recruitment and high levels of regeneration, which is in a reverse J-shaped curve. The reverse J-shaped curve describes a negative exponential distribution of numbers of individuals in size classes with high numbers of small trees and decreasing numbers of trees with increasing size of classes (Fig. 5.8 and Fig.5.9)

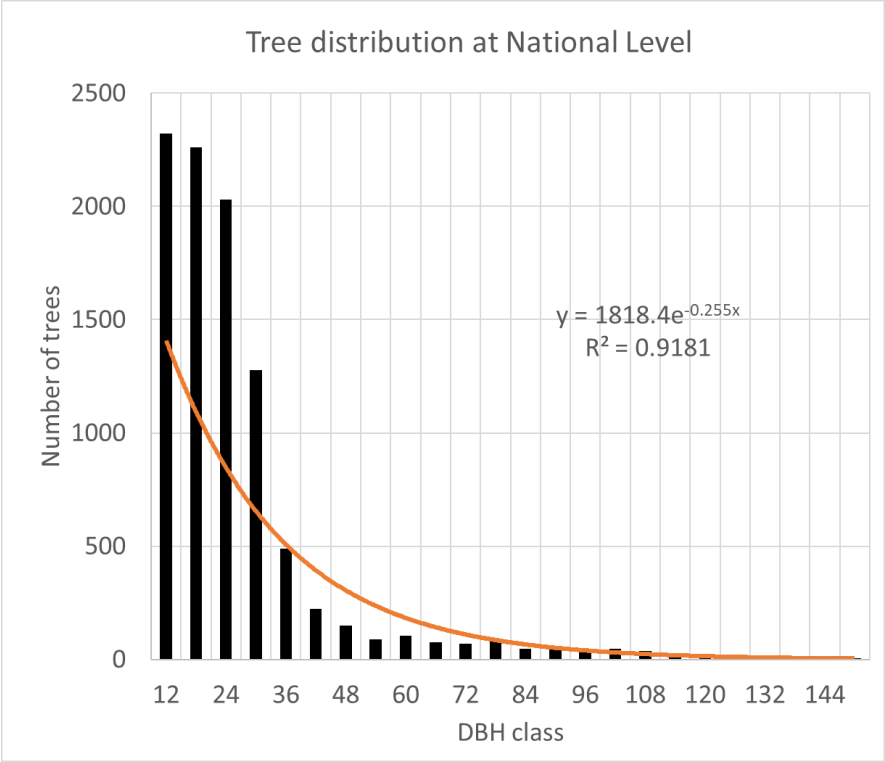


Fig. 5.8. Size structure of Pterocarpus erinaceus at national level

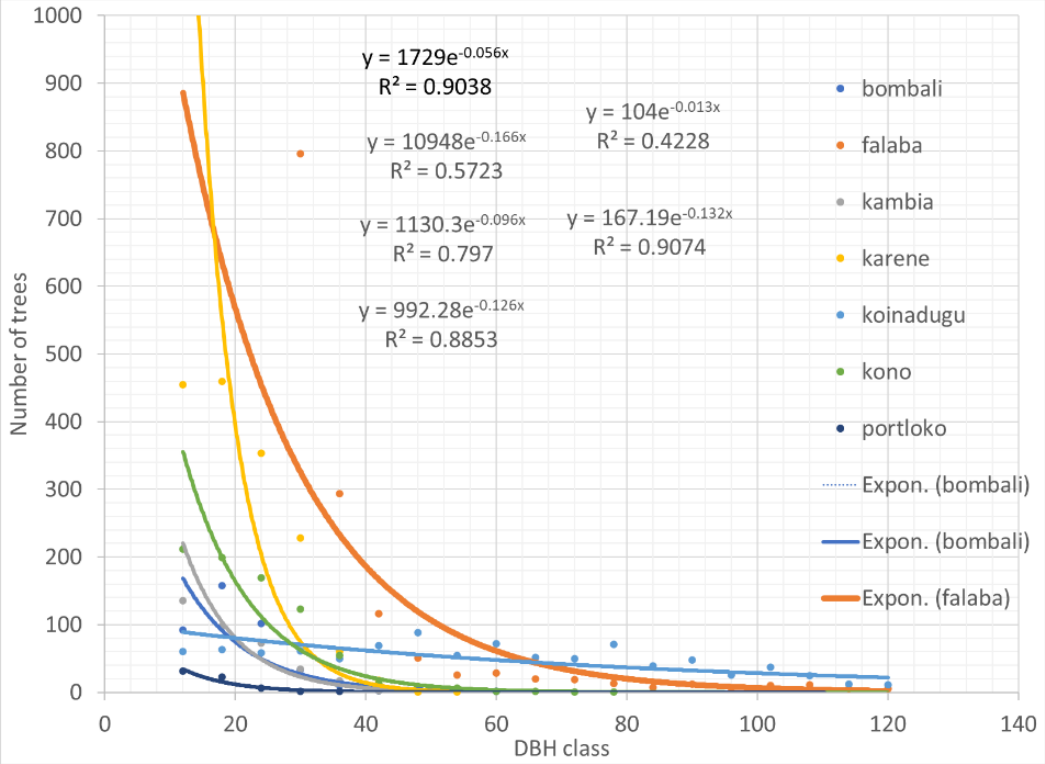


Fig.5.9. Size structure of Pterocarpus erinaceus at District level

4. Habitat Specificity and Vulnerability

Risk severity	Indicator
Medium	Species is adapted to a few stable habitat types, or ecological zones across its range not having a high proportion of the landscape cover, or it is adapted to a variety of habitat types that are declining in size and / or deteriorating in quality

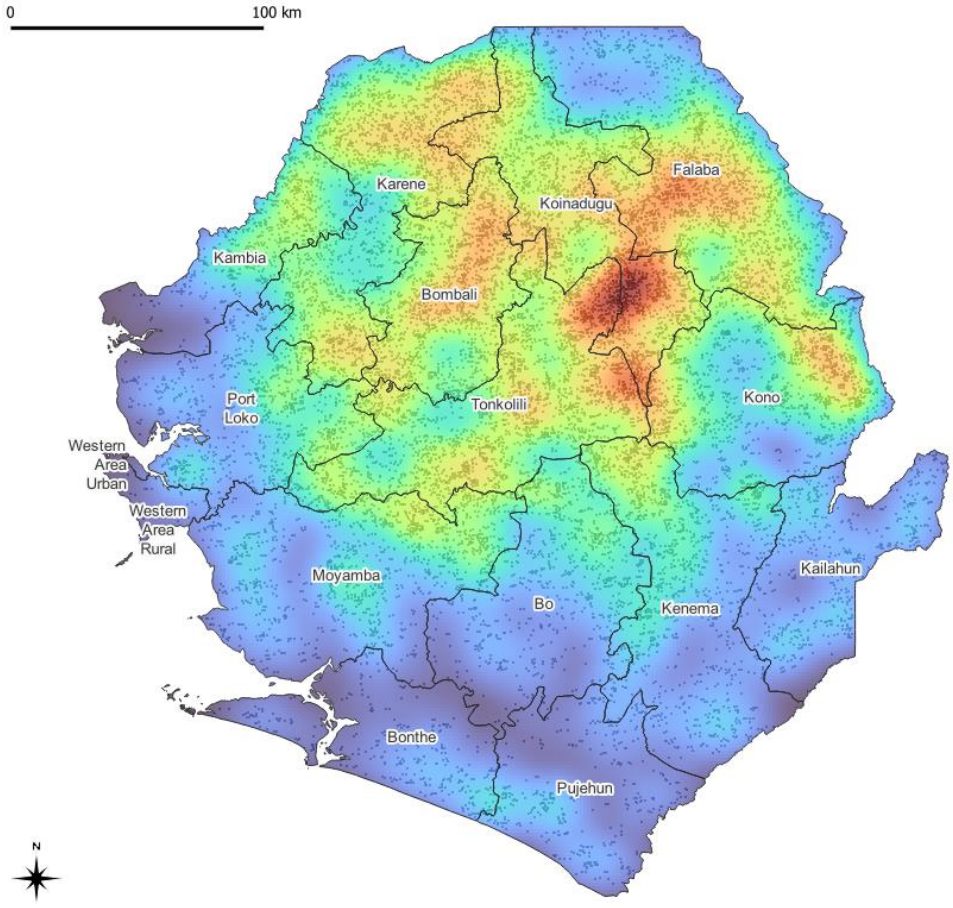


Figure 5.10. Detected fires by MODIS in 2022 the areal of Pterocarpus erinaceus at national level

5. Resilience of Tree Species

African padauk, in Sierra Leone is a subject of ecological and environmental significance. Pterocarpus erinaceus, a deciduous tree species native to various parts of Africa, including Sierra Leone, exhibits notable characteristics that contribute to its resilience in the face of various environmental challenges. Here are some key aspects of its resilience:-

- Drought Tolerance: Pterocarpus erinaceus has shown a remarkable ability to withstand periods of drought. Its deep-rooted system enables it to access water from deeper soil layers during dry spells, ensuring its survival even in arid conditions.
- Adaptability to Different Soils: This species demonstrates versatility in terms of soil adaptation. It can grow in a range of soil types, from sandy soils to clayey soils, which enhances its ability to thrive in various ecological niches.
- Natural Regeneration: Pterocarpus erinaceus exhibits effective natural regeneration mechanisms. The production of viable seeds and their dispersal by wind or animals contributes to the species' ability to colonize new areas and recover from disturbances.
- Resistant to Pests and Diseases: While not entirely immune, Pterocarpus erinaceus displays a degree of resistance to common pests and diseases. This attribute reduces its vulnerability to outbreaks that can decimate other tree species.
- Fire Resistance: The bark of Pterocarpus erinaceus possesses some fire-resistant qualities, which can protect the tree during periodic wildfires that are common in some ecosystems.

- Slow Growth and Longevity: Pterocarpus erinaceus tends to grow slowly but can reach significant sizes and ages. This slow growth rate, combined with its longevity, allows it to persist in landscapes over extended periods, even in the face of changing environmental conditions.
- Ecological Importance: This species often plays a keystone role in ecosystems by providing habitat and sustenance for various wildlife species. Its ecological significance contributes to its resilience by fostering mutualistic relationships within ecosystems.

STEP 6 - EVALUATE IMPACTS OF HARVEST FOR PTEROCARPUS ERINACEUS

Rationale

Step 6 of the CITES Non-Detriment Finding (NDF) process is crucial as it focuses on evaluating the actual impacts of wild harvest on the harvested populations, referred to as the "target population." Understanding these impacts is essential because they represent the most significant effects of trade and assessment on the species. Moreover, the evaluation extends to determine whether the harvest practices negatively affect the national population of the species and the broader ecosystem in which it resides.

This step is used to identify and assess these impacts by considering available information about the harvest practices employed and their intensity. The severity of these impacts dictates the quality of information required, the level of management rigor, and the precautionary measures.

Action

Within this action plan, we follow a comprehensively evaluation of the impacts of harvest on the target population, the national population, and the ecosystem, ensuring that trade practices align with conservation goals.

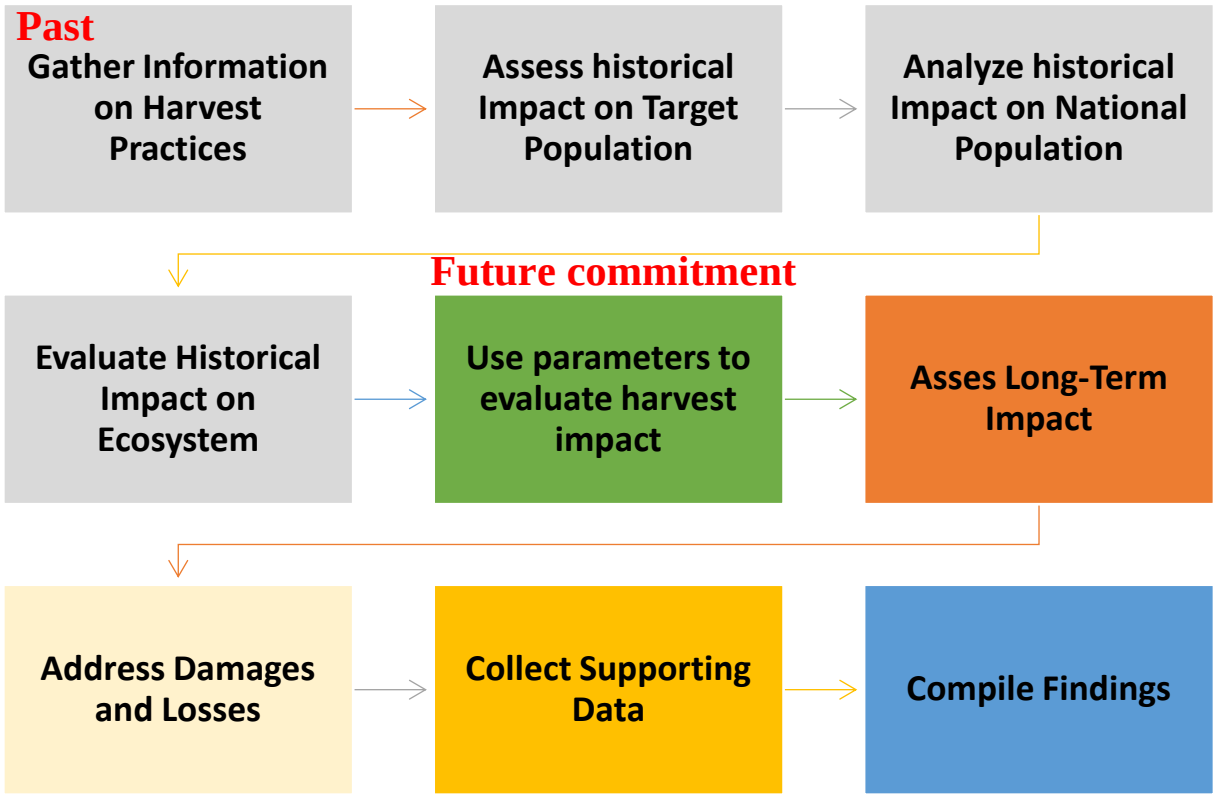


Fig.6.1. Workflow for evaluating the impact of harvest

Inside the workflow the following guiding principles and objectives will be set:-

- Gather Information on Harvest Practices:
    - Collect comprehensive data on the existing harvest practices for the species.
    - Include details on logging methods, cutting diameter thresholds, cutting/logging cycles, and annual allowable cut.
- Assess Impact on Target Population:
    - Evaluate how the harvest practices affect the target population.
    - Focus on whether the volume or number of trees harvested, along with other losses like mortality, exceed the recruitment rate.
    - Consider the recruitment by size classes to gauge regeneration capacity.
- Analyze Impact on National/Sub-national Population:
    - Examine the impact of harvest on the national/sub-national population of the species.
    - Consider the cumulative effects of all ongoing harvest activities, including legal and illegal logging.
- Evaluate Impact on Ecosystem:
    - Assess how the harvest practices impact the ecosystem in which the species is found.
    - Consider the broader ecological consequences, such as changes in habitat structure, effects on other species dependent on the same ecosystem, and alterations to ecosystem services.
- Use the objective parameters to evaluate harvest impact:
    - Area covered by the management plan, distinguishing between forest types.
    - Minimum cutting diameter, ensuring it complies with legal standards.
    - Cutting/logging/rotation cycle, understanding its implications for regeneration.
    - Annual allowable cut, considering its relation to growth rates.
    - Number of individuals and density of the species, examining distribution patterns.
    - Size distribution, analyzing age and size correlations.
    - Growing stock, accounting for the volume of timber.
    - Growth rate (increment), focusing on relevant size classes.
    - Mortality rate, including natural mortality.
    - Size class at maturity, comparing it to the minimum cutting diameter.
- Asses Long-Term Impact:
    - Emphasize the long-term impact of harvest operations.
    - Ensure that sustainable forestry practices are in place and that they do not constantly reduce the stock.
    - Verify that the volume of trees planned for harvest does not exceed the growth rate of the remaining stand.
- Address Damages and Losses:
    - Account for damages during harvesting, as well as losses during transport and stockpiling in the forest.
- Collect Supporting Data:
    - Ensure that the data collected for evaluating harvest impacts are robust and supported by sound inventory methods, monitoring, and data sources.
- Compile Findings:
    - Summarize the findings of the impact assessment.
    - Categorize the severity of harvest impacts as "Low," "Medium," "High," or "Unknown."

- Exercise caution and apply stricter requirements for information quality and management rigor if the severity of risks identified in previous steps (Steps 4 and 5) is higher.

Current Harvest Practices

While most conservation efforts in Sierra Leone are diligently concentrated on safeguarding traditional forests, it's crucial to acknowledge and address the often-neglected, woody savanna ecosystems. These expansive woodlands extend across northern Sierra Leone and, to a lesser extent, along the coastal regions. Within these densely wooded savannas, which were eloquently described in the "1975" monograph as "Woodland with fairly closed canopy; trees up to 15 m tall with an undergrowth of tall grasses up to 3 m tall," historical practices of unregulated Pterocarpus erinaceus harvesting for export have raised significant concerns. In the past, this valuable species was not formally recognized as a forest resource in Sierra Leone, leading to a simplified monitoring procedure of harvesting activities that posed a threat to the delicate equilibrium of these unique ecosystems. However, it's worth noting that the landscape has evolved, and there has been a notable shift in the approach to harvesting practices, as all the actors are committed to a sustainable management of Pterocarpus erinaceus resource.

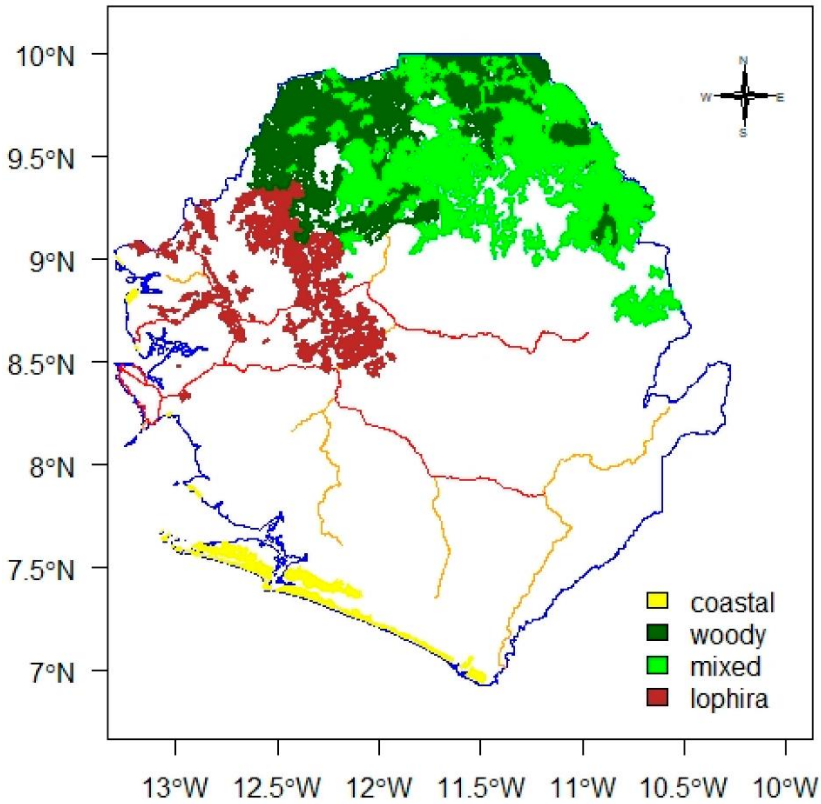


Fig. 6.2 The extent of the savanna woodlands in Sierra Leone (Wadsworth, R.A.; Lebbie, A.R. What Happened to the Forests of Sierra Leone? *Land* **2019**, *8*, 80. https://doi.org/10.3390/land8050080).

Presently, all harvesting activities have come to a halt, marking a pivotal moment in the sustainable resource management journey. The contemporary approach to harvesting Pterocarpus erinaceus in these woodlands is distinctly characterized by a commitment to sustainable practices. These practices encompass a comprehensive set of principles, including:-

- Deliberate delineation of areas under management plans, with due consideration to various forest types within these regions.
- Adherence to legally mandated minimum cutting diameters, ensuring full compliance with established standards.
- A profound understanding of the implications of cutting and rotation cycles on regeneration dynamics.
- Calculating the annual allowable cut while taking into account growth rates and sustainable management principles.
- Diligent examination of species distribution patterns, particularly density and dispersion.
- Comprehensive analysis of size and age correlations within the population, shedding light on regeneration prospects.
- Thorough accounting for the volume of timber resources available within these woodlands.
- A focus on relevant size classes when assessing growth rates, considering their influence on sustainable practices.
- Inclusion of natural mortality rates as a vital factor in sustainable forest management.
- Rigorous comparisons between size classes at maturity and the minimum cutting diameter to ensure responsible harvesting practices.

This transformative shift in approach signifies a collective commitment to the preservation of these woody savanna ecosystems and the invaluable Pterocarpus erinaceus species habitat. The transition from a simplified monitoring procedure of harvesting activities to sustainable practices is a statement to the evolving conservation ethos in Sierra Leone, setting a promising course for the future of these unique woodlands.

Historical Impact on Pterocarpus erinaceus Population

In Sierra Leone's past, the Pterocarpus erinaceus harvesting mechanism was based on a workflow adapted to the national context. District Forest Units, led by District Forest Officers (DFOs), oversaw forestry activities within districts. DFOs reported to the national Director of Forestry, ensuring alignment between district and national forestry programs.

Pterocarpus erinaceus was primarily found in Community Forests, and Timber Sales Agreements were established through collaboration between Paramount Chiefs, Local Authorities, and select companies. These agreements covered vital habitat areas. Monitoring and supervision occurred through Forest Management Units in districts. Periodic visits by the Assistant Director of the Commercial Unit at the Ministry of Environment and Climate Change ensured compliance with forestry regulations, allowing for necessary adjustments.

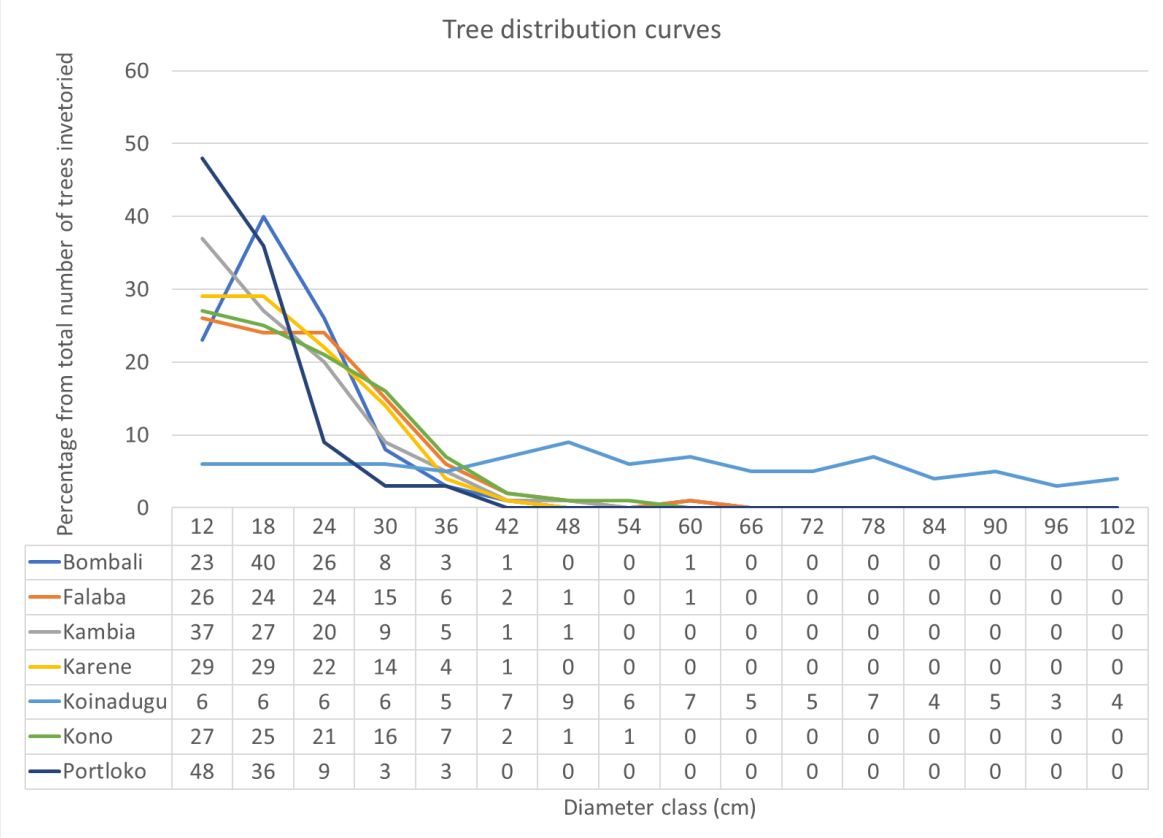
To regulate and oversee the trade, the government appointed a Sole Timber Agent in 2018, responsible for timber exports in collaboration with the CITES Management Authority. This agent ensured transparency and full revenue remittance.

In the past, Sierra Leone's Pterocarpus erinaceus harvesting system, while collaborative, did not employ key parameters to evaluate its impact comprehensively. Parameters like area covered by the management plan, distinctions between forest types, cutting/logging/rotation cycles, annual allowable cuts, species density, size distribution, growing stock, growth rates, mortality rates, and size class at maturity were not systematically used for impact evaluation, with the exception of the minimum cutting diameter, which was subject to legal standards.

Recognizing the need for a more holistic assessment of the harvest impact, a recent field survey was conducted at the district level. This survey aimed to capture the current situation, allowing for a more comprehensive evaluation of the species' harvesting practices. This proactive approach demonstrates

Sierra Leone's commitment to evolving and adopting contemporary conservation practices that consider the full spectrum of impact factors.

An insightful analysis of the Size Class Distribution of Pterocarpus erinaceus trees in various districts has revealed intriguing patterns. The data, represented as percentages of trees within specified DBH (Diameter at Breast Height) classes, shed light on the state of these woodlands. The DBH classes, starting from 12 cm and progressing at 6 cm intervals, provide a comprehensive view of the population's structure.



	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102
Bombali	23	40	26	8	3	1	0	0	1	0	0	0	0	0	0	0
Falaba	26	24	24	15	6	2	1	0	1	0	0	0	0	0	0	0
Kambia	37	27	20	9	5	1	1	0	0	0	0	0	0	0	0	0
Karene	29	29	22	14	4	1	0	0	0	0	0	0	0	0	0	0
Koinadugu	6	6	6	6	5	7	9	6	7	5	5	7	4	5	3	4
Kono	27	25	21	16	7	2	1	1	0	0	0	0	0	0	0	0
Portloko	48	36	9	3	3	0	0	0	0	0	0	0	0	0	0	0

Fig.6.3. Size class distribution of the trees showing different exponential curves , the numbers represent the DBH classes in cm.

One remarkable observation is the prevalence of a reverse J-shaped curve in most districts. This suggests that historical harvesting practices, alongside other activities such as burning and charcoal production, have not significantly impacted the natural structure of the inventoried Pterocarpus erinaceus. This is an encouraging sign, indicating a degree of resilience within the Pterocarpus erinaceus populations in these areas.

However, two districts stand out from this trend. In Koinadugu district, the distribution across DBH classes is relatively uniform, with less than 10% of trees in each class. This could signify a unique ecological context or previous management practices specific to this region.

Conversely, Bombali district displays a deficiency in the lower diameter classes, potentially indicating past harvesting practices that skewed the size distribution. Further investigation and monitoring are crucial to better understand these nuances and ensure sustainable management for Pterocarpus erinaceus across Sierra Leone.

Future developments in evaluating the impact of harvests in order to Asses Long-Term Impact, Address Damages and Losses and Collect Supporting Data

A. Setting up management plans on established concession areas

This future development will be based on the following steps:-

1. Resource Assessment: Assess Pterocarpus erinaceus availability, health, and ecological factors.
2. Legal Compliance: Ensure legal land tenure and regulatory compliance.
3. Stakeholder Engagement: Engage with stakeholders for input and local community involvement.
4. Concession Planning: Define boundaries and gather baseline data.
5. Sustainable Management Plan: Develop a plan for harvesting, regeneration, and conservation.
6. Environmental Impact Assessment: Evaluate and mitigate environmental and social impacts.
7. Monitoring and Adaptation: Implement a monitoring system and adapt strategies as needed.
8. Community Benefits and Certification: Support local communities, seek forest certification, and ensure compliance.

B. Setting up a exploratory inventory system at section level

Statistical grid sampling will be placed in order to determine at section level the following;-

- Number of individuals and density of the species, examining distribution patterns.
- Size distribution, analyzing age and size correlations.
- Growing stock, accounting for the volume of timber.
- Growth rate (increment), focusing on relevant size classes.
- Mortality rate, including natural mortality.

The current number of plot will be increased and established based on the natural distribution of Pteorcarpus erinaceus

C. Determination of Minimum Diameter of Exploitation (MDE), rotation cycle for Pterocarpus erinaceus at regional level

1. Introduction

The methodology outlines the process for determining the Minimum Diameter of Exploitation (MDE) for Pterocarpus erinaceus in Sierra Leone. The MDE is a critical parameter for regulating sustainable harvesting practices. The establishment of the Minimum Diameter of Exploitation (MDE) for harvesting is grounded in the principles of sustainable forest management. At its core, this practice aims to strike a harmonious balance between extracting forest resources and conserving the ecological health and vitality of the forest ecosystem.

It revolves around the idea of nurturing the forest ecosystem, safeguarding its biodiversity, and maintaining its natural processes. By defining an MDE, we ascertain that trees below a certain diameter threshold are spared from harvesting. This allows these younger trees and seedlings to thrive undisturbed, facilitating natural regeneration.

Furthermore, the MDE seeks to maintain the population structure of the tree species. It ensures that an adequate number of mature trees remain within the population to produce seeds, promote genetic diversity, and enable natural recruitment. This, in turn, sustains the population and supports the long-term health of the forest.

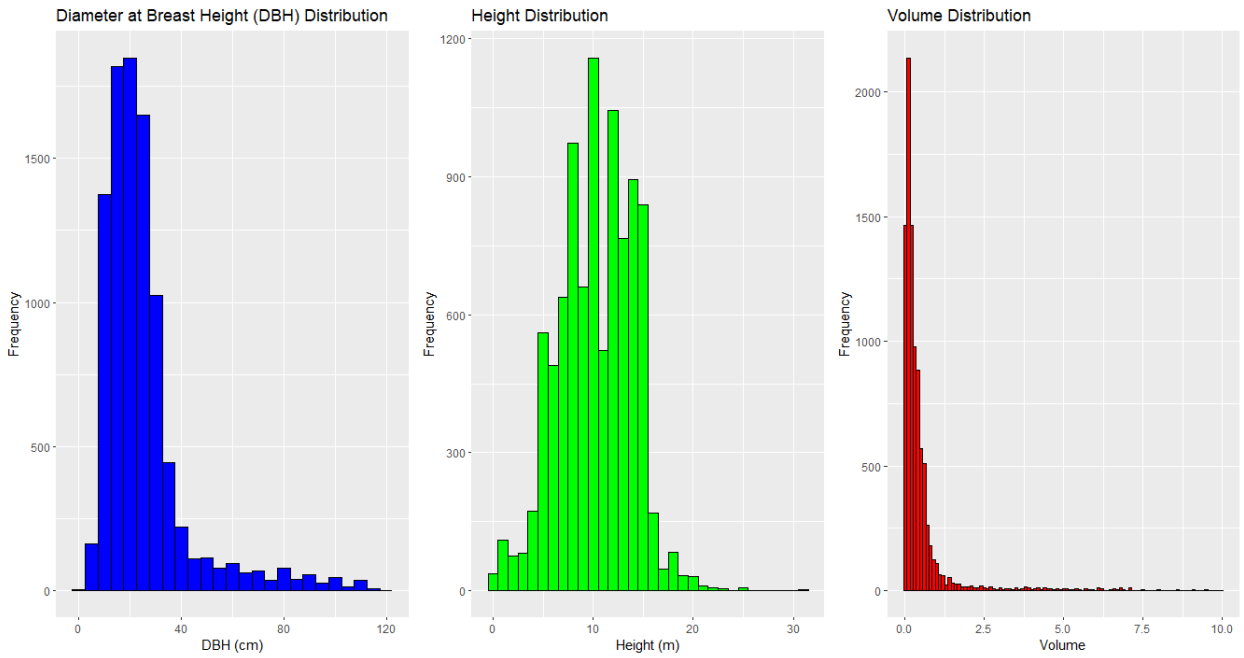
Crucially, the concept of MDE also acts as a bulwark against overharvesting. It prevents the excessive removal of trees, particularly the larger, older ones, which can lead to population declines and even local extinctions. Moreover, it aligns with the philosophy of sustained yield forestry, where the forest's capacity to provide resources is safeguarded for the future. By allowing trees to reach a specified maturity before harvest, the MDE ensures a consistent and sustainable supply of timber and other forest products.

The determination of MDE is not a one-size-fits-all approach. It takes into account the unique characteristics, growth rates, and ecological needs of the target species. It also considers the influence of environmental factors, such as climate, soil conditions, and local ecology, which may vary from one region to another.

Ultimately, establishing an MDE is a dynamic and adaptive process. It involves continuous monitoring, data analysis, and adjustments as ecological conditions evolve. This ensures that the forest remains resilient and capable of providing resources for generations to come while preserving its ecological integrity.

2. Data Collection and Preparation

Gather comprehensive data on Pterocarpus erinaceus populations, including Diameter at Breast Height (DBH), Height (H), and Volume. Ensure data quality and accuracy. Data from P. erinaceus populations in the study areas were collected by means of forest inventories. The sampling was based on the random method. The random method was based on 1000 m2 (40m×25m) sampling units at regular intervals of 200 m, randomly defined in populations dominated by P. erinaceus. In all cases the DBH ≥ 10 cm measurements were performed using a tree caliper for large diameters or a tape measure for medium and small stems. Forest characteristics were assessed by calculating the average diameter, the total average height. A total number of 9510 trees were samples in the field



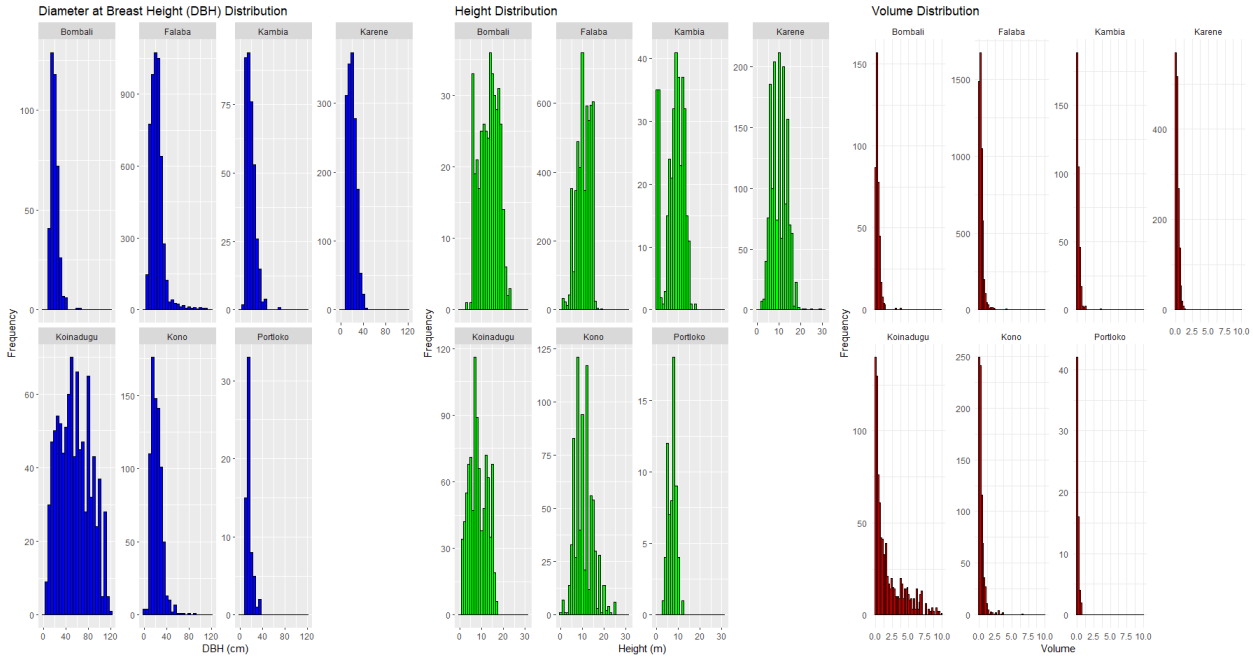


Fig. 6.4. DBH, Height and Volume histogram distribution at national and regional level

3. Basal Area Distribution Analysis

Analyze the basal area distribution per diameter class for Pterocarpus erinaceus. Identify the modal distribution and assess the ecological conditions in different districts of Sierra Leone.

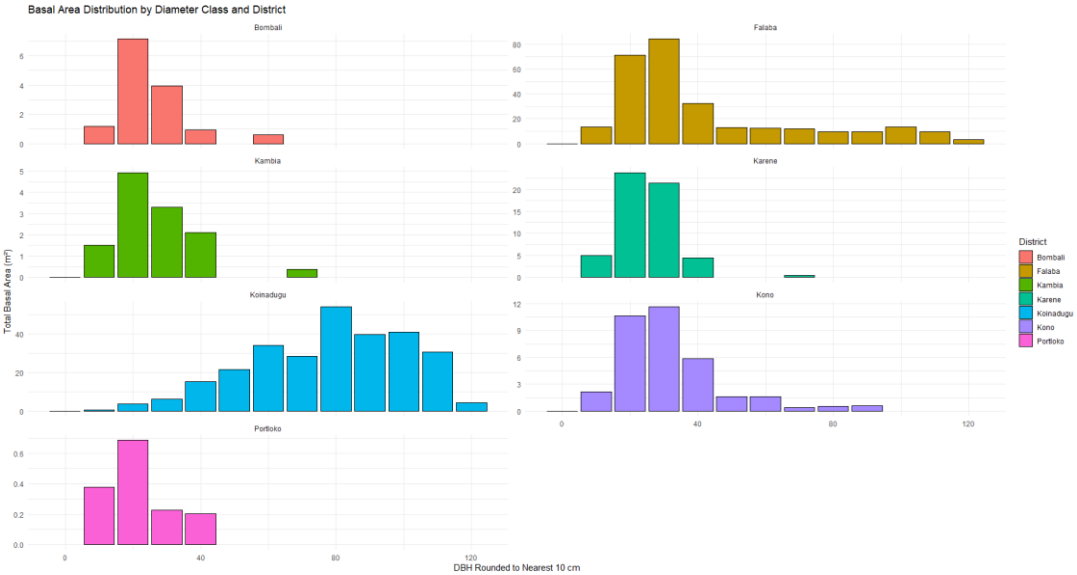


Fig. 6.5. Basal area distribution at District level

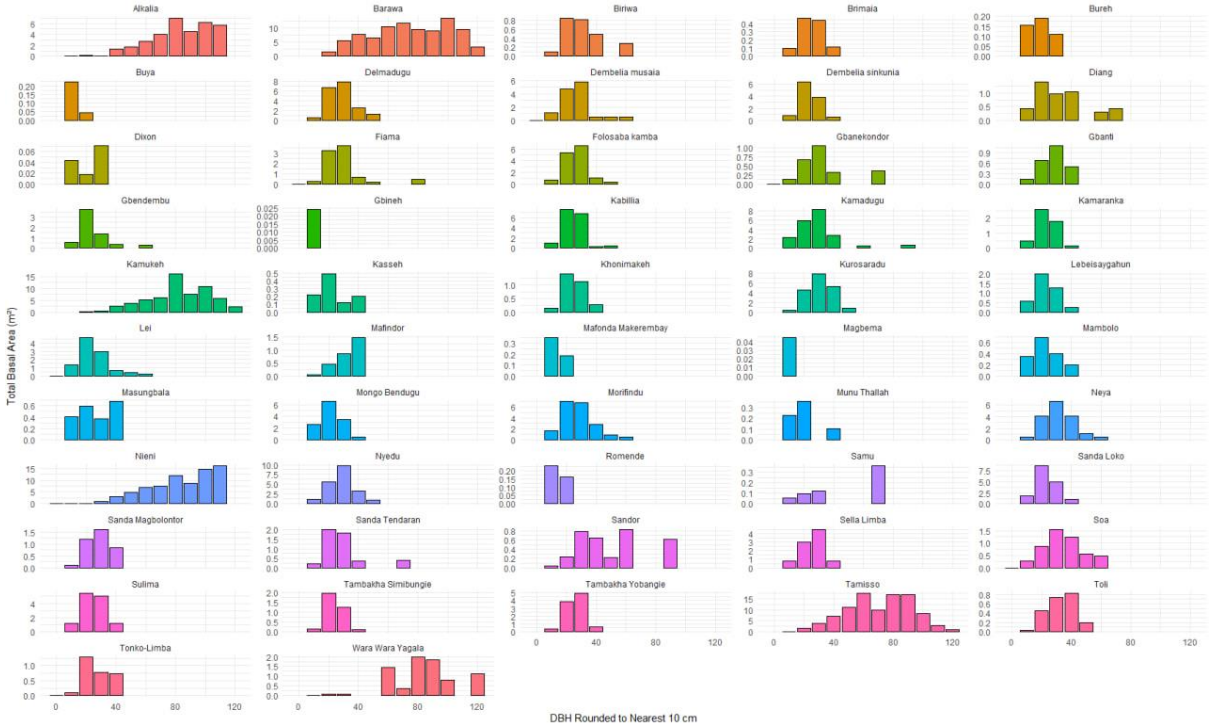


Fig.6.6. Basal area distribution at chiefdom level

4. Iterative MDE Calculation

The determination of the Minimum Diameter of Exploitation (MDE) for Pterocarpus erinaceus in Sierra Leone is based on a well-established methodology. This methodology draws from the work of Durrieu de Madron and Forni (1997) and has been adapted and refined by Sokpon and Biaou (2002), as well as Sokpon et al. (2006). The fundamental principle underlying this approach is to ensure sustainable harvesting practices that account for the growth rate and the diametric structure of the P. erinaceus species.
Here is a step-by-step explanation of how the MDE and rotation cycle are determined:-

- Initial Diameter Classes: The process begins with an assessment of various diameter classes, typically including classes such as 25 cm, 35 cm, 45 cm, and 55 cm. These classes serve as initial reference points.
- Restoration Percentage: To establish a sustainable rotation cycle, it is crucial to calculate the restoration percentage of the original exploitable basal area for the P. erinaceus species. This restoration percentage is informed by factors like the extent of exploitation damage, diameter growth of trees, and mortality of individual population members.
- Iterative MDE Testing: The MDE is not fixed but is determined iteratively. Initially, an MDE is selected, often based on the diameter classes mentioned earlier.
- Restoration Assessment: The restoration percentage is calculated based on the transition time or rotation. The transition time represents the duration required to move all individual trees in a specific diameter class to a diameter higher than the selected MDE.
- Restoration Percentage Evaluation: The restoration percentage is a critical parameter in this process. If the calculated restoration percentage falls below a certain threshold (typically less than 50%), it suggests that restoration efforts are insufficient, and the MDE needs adjustment.
- Iterative Refinement: To achieve sustainable exploitation, the MDE is adjusted upwards, and the restoration percentage is recalculated. This iterative process continues until an MDE is

identified that not only prevents over-exploitation but also facilitates the restoration of the P. erinaceus species to a healthy and viable state.

- Transition Time and Restoration Percentage Formulas: The formulas employed for determining the transition time and the restoration percentage are derived from the work of Durrieu de Madron and Forni (1997). Specifically, the transition time (T) is calculated as follows:

$$T = \frac{MDE - D_{bi}}{AAM}$$

Here, T represents the transition time in years, MDE is the Minimum Diameter of Exploitation, Dbi is the diameter of the lower bound of the relevant class, and AAM is the average annual growth.

- The restoration percentage (P) is computed using the formula:

$$P = \frac{[(G_0\ (1-\Delta)](1-\propto)^T}{G_p} \times 100$$

In this equation, P signifies the restoration percentage of the number of trees initially exploited. G0 is the basal area of the diameter classes immediately below the MDE, Gp is the exploitable basal area, alpha represents the annual mortality rate, and delta is the damage rate due to exploitation.

This methodology ensures that the rotation cycle for harvesting P. erinaceus trees takes into account not only the economic aspects of exploitation but also the ecological sustainability of the species. By iteratively adjusting the MDE based on restoration percentages, it strives to strike a balance between resource utilization and species preservation.

5. Restoration Percentage Calculation
Calculate the restoration percentage of the original exploitable basal area, considering factors such as exploitation damages, diameter growth, and mortality of population individuals.

6. Iterative Testing of Diameter Classes
Iterate through various diameter classes, including 25 cm, 35 cm, 45 cm, and 55 cm, to determine the MDE. Increase the MDE iteratively until a restoration percentage exceeding 50% is achieved.

7. Transition Time Calculation
Calculate the transition time ('T'), representing the time required to move all individuals in one diameter class to a diameter higher than the MDE.

8. Restoration Percentage Estimation
Estimate the restoration percentage ('P') of the number of trees initially exploited using the calculated values. This percentage provides insights into population restoration.

9. Final MDE Determination

When setting up a transition period of 50 years – optimal MDE is 35 cm in most of the districts, therefore the rotation cycle of 20 years and a MDE of 35 ensures the restoration percentage over 50% (values show in red in table below).

	MDE 20		MDE 25		MDE 30		MDE 35		MDE 40	
	P%	T	P%	T	P%	T	P%	T	P%	T
BOMBALI	7.34	12.8	30.7	22.8	90.8	32.8	221	42.8	420	52.8
FALABA	3.69	20	10	30	24	40	46.2	50	72.4	60
KAMBIA	10.4	20	26	30	57.2	40	108	50	194	60
KARENE	8.08	10	25.1	20	59.9	30	158	40	569	50
KOINADUGU	0.154	20	0.371	30	0.848	40	1.18	50	1.93	60
KONO	4.48	28	12.4	38	28.2	48	58.5	58	106	68
PORTLOKO	27.5	10	92.5	20	141	30	385	40	348	50

D. Establish quota of annual allowable cut

Establishing a quota for the annual allowable cut (AAC) of Pterocarpus erinaceus, commonly known as African rosewood or African padauk, involves determining the maximum sustainable level at which this valuable timber species can be harvested from a given forest or concession area while maintaining its population and ecosystem health. The AAC is a crucial component of sustainable forest management and conservation efforts. Here's a step-by-step definition of how to establish an AAC for Pterocarpus erinaceus:

- **Resource Assessment:**

Conduct a comprehensive assessment of the Pterocarpus erinaceus resource within the forest or concession area. This includes quantifying the population size, distribution, age structure, and health of the species.

- **Ecological Considerations:**

Evaluate the ecological characteristics of the forest ecosystem where Pterocarpus erinaceus occurs. Consider factors such as soil quality, hydrology, wildlife habitat, and biodiversity.

- **Legal and Regulatory Framework:**

Review and understand the relevant national and international laws, regulations, and agreements governing the harvest and trade of Pterocarpus erinaceus. Ensure compliance with CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) if applicable.

- **Harvest Impact Assessment:**

Assess the potential ecological impact of timber harvesting on Pterocarpus erinaceus and the broader ecosystem. Evaluate how various harvest scenarios may affect tree regeneration, biodiversity, and soil stability.

- **Define Sustainability Objectives:**

Establish clear sustainability objectives for Pterocarpus erinaceus. Determine the desired population size, age structure, and overall health of the species over time.

- **Calculation of AAC:**

Utilize scientific modeling and data analysis to calculate the AAC. This involves estimating the maximum volume or number of Pterocarpus erinaceus trees that can be sustainably harvested each year without depleting the population or causing ecological harm.

Consider factors such as:-

- Growth and recruitment rates of Pterocarpus erinaceus.
- Mortality rates due to natural causes and harvesting.
- Regeneration capacity and success.
- Desired stock levels (e.g., maintaining a certain population density or age distribution).
- Ecological resilience and recovery time.

- **Monitoring and Adaptive Management:**

Implement a robust monitoring and data collection program to track the status of Pterocarpus erinaceus populations, ecosystem health, and compliance with sustainability objectives.
Apply adaptive management principles, adjusting the AAC as new data and insights become available.

- **Stakeholder Engagement:**

Involve local communities, indigenous groups, conservation organizations, and relevant authorities in the AAC determination process. Consider their knowledge, interests, and concerns.

- **Periodic Review:**

Periodically review and update the AAC based on the latest research, monitoring results, and changes in ecological conditions or legal frameworks.

Indicator	Status	Explanation
Harvest impact severity on harvest population	Unknown	• The current inventory and monitoring data show that the amount of timber harvested is close or equal to annual re-growth, but needs to be expaned. The current data show that in most of the regions constant regeneration andre-growth into higher diameter classes should be a safe assumption. • Stand structure of accompanying species as potential competitors under altered conditions after harvest operations needs to be observed and possibly managed.
Harvest impact severity on national population	Unknown	• The current monitoring data is not in place show that the population(s) of the target species have been stable over the years, but the actual distribution revelead by the monitoring data is closer to a natural inverse J curve showing an indirect stability over the years. • Harvest operations may impact the viability of sub-populations e.g. the species' distribution is scattered and uneven in (partly) low numbers and interconnection between sub-populations is questionable.
Harvest impact severity on ecosystem	Unknown	• Target species may be confused with other species leading to their accidental harvest. • Harvest practices are occasionally disruptive to non-target species or ecosystem. • Harvest has a moderate effect on resources available for other species.

STEP 7 - EVALUATE IMPACTS OF TRADE FOR *PTEROCARPUS ERINACEUS*

Rationale

Impacts of wild harvest to the harvested populations ("target population") has been considered in Step 6.

Step 7 of the CITES Non-detriment Findings (NDF) process is crucial as it focuses on evaluating the actual impacts of trade on the harvested populations.

Understanding these impacts is essential because it allows the Scientific Authority and the Management Authority a data set to evaluate trends and adjust management strategies for legal and sustainable trade of the species. Moreover, the evaluation extends to determine the impact from illegal harvest practices that can negatively affect population of the species and the broader ecosystem in which it resides.

This step is used to identify and assess these impacts by considering available information about the trade for international export and the national uses. The severity of these impacts dictates the quality of information required, the level of management rigor, and the precautionary measures necessary to identify and curtail unsustainable trade volumes.

Action

Within this action plan, we use statistics from CITES permit allocations and the volumes of export from 2016, when Pterocarpus erinaceus was uplisted to CITES Appendix II with no annotation, up to the imposition of the zero-quota export in 2022 to indicate trends in trade. Local and domestic trade is considered based on traditional and historical uses. Impacts of Illegal logging and trade are evaluated based on areas of harvest, logistics and access to export.

International Trade: Export

Until recently, wood of *Pterocarpus erinaceus* was virtually unknown in commerce outside of its native range (Winrock, 1999). However, in recent years there has been a dramatic increase in trade of the species to Asia for rosewood furniture manufacturing. The species is formally recognized as one of the thirty-three "Hongmu" (literally "red wood" in Chinese) species included in China's National Hongmu Standard (2010), and from 2010 onwards, the high prices and limited supplies of more traditional Southeast Asian rosewood species led to dramatic growth in imports of rosewood from West Africa (Forest Trends, 2013).

Due to the trends of "Hongmu" and the 2016 listing of the Dalbergia genus, the international trade of *Pterocarpus erinaceus* increased significantly across all range states. International exports increased exponentially from Sierra Leone.

The impact of trade on the species in Sierra Leone can be considered HIGH.
International trade far exceeds all other national and traditional demands for the species.

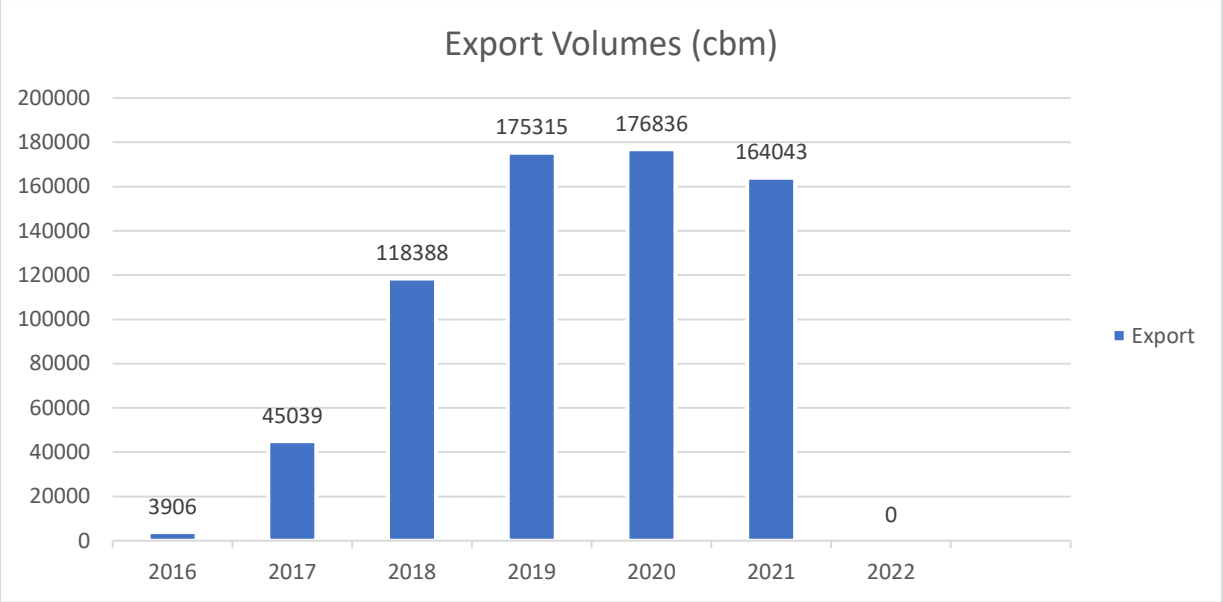


Fig.7.1. Export volumes for the period 2016-2022

National Trade and Traditional Demand

As outlined in the Annex of specific uses at the District level, *Pterocarpus* timber is in demand for fencing, construction work – houses and roads, firewood, charcoal, medicine, and fodder.

The impact on the species from the national trade is unknown and will be analyzed further as management plans and traceability systems are instituted for establishing harvestable volumes for export through the NDF and CITES Appendix II regulations.

There is a growing trend for charcoal, and this can be considered one of the key impacts from national trade that needs further analysis. It is unclear whether the trends for domestic demand, such as charcoal, should be considered trade or subsistence threats that are apparent from slash and burn and woodland clearance for agriculture.

Illegal Trade

The impact of illegal trade on the species is UNKOWN and in need of analysis through traceability systems and based on the German Nine Step questions. There is no clear data on the impacts of illegal trade.

Historically, there are only four companies that were issued licenses to harvest *Pterocarpus erinaceus*. Each was allocated a license in a different region of distribution of the species and had sole contracts with the Chiefdoms in each region. These areas are monitored at the local level.

Based on the volumes of export through the issuance of CITES Permits from 2016-2021, it is apparent that the large volumes of wood were exported through the official channel of the Management Authority.
There are potential border crossings that are porous towards Guinea where illegal trade could occur, but this would be a low impact in comparison with direct exports for international trade.

The completion of this NDF and institution of the traceability system will be a key deterrent for mitigating illegal trade.

Future developments in evaluating the impact of trade in order to Asses Long-Term Impact, Address Damages and Losses and Collect Supporting Data

E. Standardizing sustainable management plans and instituting traceability system

Trade impacts will be managed through the following processes currently under development from completing this NDF.

- Concession areas will be demarcated through grids and rotations that are based on the species harvest impacts and measures for improving regeneration and conservation.

- Sierra Leone has invested and is committed to implement a comprehensive traceability system that will be used to complete inventories and establish a sustainable harvestable quota.

- Management system standards will include mechanisms for monitoring forests for international trade as well as local trade use and demand.

F. Establish quota of annual allowable cut

The digital traceability system will be used for inventory management and establishment of Minimum Diameter of Exploatation (MDE) and the district and national level.

G. Institute Legal Acquisition Findings (LAF) Procedures for All Trade

Trade impacts will be mitigated through the implementation of the Management Authority LAF procedures. All data will be collected in the Management Authorities data base and centralized for access and analysis.

Indicator		
International trade impact severity on harvest population	High	Target species is in high demand for export level trade.
Trade impact from national demand	Unknown	Target species has multiple uses domestically but the actual national trade impact needs to analyzed.
Impact from Ilegal trade	Unknown	Target species is vulnerable to illgeal trade but impact is unknown.
Trade impact severity on national population	Unknown	Target species has a wide range of distribution in Sierra Leone. Even in harvested areas population is present.
Trade impact severity on ecosystem	Unknown	Target species may be confused with other species leading to their accidental harvest. • Harvest practices are occasionally disruptive to non-target species or ecosystem. • Harvest has a moderate effect on resources available for other species.

STEP 8 - EVALUATE APPROPRIATE RIGOUR OF EXISTING MANAGEMENT MEASURES

Rationale

In order to assess the status of *Pterocarpus erinaceus* in Sierra Leone and whether conservation and biological risks are mitigated, as well as harvesting and trade impacts assessed and identified in the previous steps of this NDF assessment process, there is a need to assess the rigour of current management measures and make recommendations on their improvement.

Key Questions to Answer

The evaluation of the existing management measures and their rigour has only been made after having gone through steps 4 and 7, assessing the conservation concern, intrinsic biological risk, exploitation impact and commercial impact of *Pterocarpus erinaceus*.

Information Sources

All Species / Specimens Requiring a Detailed NDF	**Species with Medium, High, and Unknown Severity of Concern, Risk, or Impact Identified in Steps 4-7**	**Species with High and Unknown Severity of Concern, Risk, or Impact Identified in Steps 4-7**
Routine verifications: • Export permit application • Conservation status assessments specifying existing management • Information on existing quotas (and the basis for setting them), monitoring of harvest and trade levels and impacts, enforcement • National legislation (conservation, harvest, trade of species concerned)	**Existing qualitative information:** • Approved local / national / state / provincial management plan(s) • Interviews with harvesters, traders, resource managers, enforcement officers, and other stakeholders along the supply chain • Harvester instructions, including harvest practices, impact mitigation measures, volume and quality controls	**Existing quantitative information:** • GIS layers of harvesting areas and land tenure • Quantitative monitoring in protected and harvest areas • Quantitative monitoring of domestic and export trade • Quantitative off-take thresholds (e.g., estimates of maximum sustainable yield, minimum viable - population)

As recommended by the 9-step NDF assessment Guidelines for *Pterocarpus erinaceus* in Sirerra Leone the following actions were carried out to collect quality information from various sources:

- Routine checks on export permit applications and verification of the volumes mentioned in the permits and comparison with the quotas established for extraction in the management plans, as well as the harvesting and marketing levels reported by three companies that

extracted *Pterocarpus erinaceus* in community forests from Karene District (Samaya Chiefdom) Kono District (Toli Chiefdom) and Falaba District (Dembelia Musaia Chiefdom), between 2018 and 2021.

- Review of existing legislation in Sierra Leone, namely the Forestry Act of 1989 and the Forestry Regulations of 1990, following the sections and sub-sections referring to forest management measures relevant to this assessment. Annex Xxx centralizes a list of observations based on the current legislation, but also a series of measures that the Government of Sierra Leone is undertaking to improve it, by adding provisions that will considerably contribute to the sustainable management of forest resources and help adapt the rigour of management measures to the current context of Pterocarpus erinaceus species and other CITES-listed species. The future legal provisions will also define the framework for the development and implementation of a National Forest Traceability System, which will help to collect data to support appropriate management measures and sustainable forest policies.

- Verification of local management plans and monitoring practices, required by legislation for the exploitation of areas under concession to companies, were also checked, while national plans, although mentioned in the Forestry Act, have not yet been carried out. Management plans for Samaya (Karene), Toli (Kono) and Dembelia Musaia (Falaba) community forests were reviewed to identify the current level of rigour of management measures stipulated there.

- Harvest practices were assessed through verification of the above-mentioned management plans and contracts, where harvesting methods and operations were described per each of the three companies that harvested in Karene, Kono and Falaba Districts.

- Interviews with stakeholders in all Districts and Chiefdoms where *Pterocarpus erinaceus* is distributed were also conducted and the results presented in this NDF report. This allowed to collect anecdotal information on the local knowledge regarding the target species, on informal management and protection measures, which differ from one Chiefdom or District to another.

- Review of basic GIS layers (kmz. Formats) and raster maps generated in three harvested areas in Karene, Kono and Falaba Districts, representing community forests from the Chiefdoms of Samaya, Toli and Dembelia Musaia, harvesting sections/compartments and harvesting areas (point formats). GIS layers of Districts, Chiefdoms and Sections at national level are also available from different governmental sources.

- Review of Excel spreadsheets with quantitative information regarding harvested trees and generated logs, as well as export trade for the three companies that harvested in Karene, Kono and Falaba Districts – ERA, LLI and GLS - between 2018 and 2021.

- Compiled a synthesis of regional studies providing insights into the species' range and distribution patterns across the neighboring countries.

- Used the Global Biodiversity Information Facility (GBIF) as a valuable resource for species distribution data.

- Compiled a rich dataset of various factors that influence the population size and distribution of *Pterocarpus erinaceus*, such as vegetation indexes, climatic data, digital elevation models and ground truth inventory data.

- Employed various advanced analysis technologies to create distribution models in Sierra Leone, such as Supervised Random Forest Algorithm (RF) machine learning algorithm to handle the multi-dimensional datasets and their complex relationships; Pixel-Based Analysis; Predictive Modeling and Regression Analysis to predict population size and distribution and a methodology for determining Minimum Diameter of Exploitation (MDE).

Information on how the quotas and minimum exploitable diameters have previously been established in each harvest areas, monitoring of harvest levels and impacts, as well as quantitative monitoring of harvest, estimates of maximum sustainable yields and minimum viable populations is missing or incomplete.

KEY FINDINGS FROM STEPS 4-7

Following the completion of steps 4-7 of the 9-step process, the findings related to each step are briefly presented below to serve as a context for the assessment of step 8 of the management measures for *Pterocarpus erinaceus*.

Step 4. Evaluation of Conservation Concern

Internationally, the severity of conservation concern for *Pterocarpus erinaceus* is considered **HIGH** (Adjonou *et al.*, 2020).

Locally, there are differences among countries, as well as within a country. For example, within Sierra Leone differences in distribution, tree densities per ha and distributions by diameter category were identified, indicating that the conservation status of the species at the national level can vary quite widely from District to District, or Chiefdom to Chiefdom, depending on what anthropogenic and climatic impacts, individually, or combined, are observed. The present study is based on sampling areas where distribution, DBH, regeneration data were collected and validated in a later field visit and through more detailed analyses and GIS and statistical modelling carried out during steps 5 and 6. However, a more detailed and nuanced assessment of the status of the species by District and Chiefdom should be made by conducting a National Inventory and establishing a National Monitoring Plan, the results of which can be used for the development of management plans and the establishment of management measures tailored to each national forest, community, or forest concession level.

However, because there is not yet enough quantifiable data related to impacts and risks at District and Chiefdom level, and not enough inventory data and especially not a National Inventory of the species, we can consider that at national level the severity of conservation concern is considered **MEDIUM**.

Step 5. Evaluation of the Potential Biological Risks of *Pterocarpus erinaceus*

Based on the assessments of West Africa regional geographic distribution of *Pterocarpus erincaeus* the risk severity was assessed as being **MEDIUM.**

By carrying out the assessment at national and sub-national population size and distribution, using data compilation, supervised random forest algorithm, pixel-based analysis, predictive modeling, regression analysis and insights, the risk severity resulted to be **MEDIUM** as well.

Assessing the size structure of national and sub-national populations based on data collected in the field plots, it shows that the overall health of the population, based on the occurrence of many small, young trees, which are most likely to reproduce, the risk severity could be considered as **LOW**.

The evaluation of habitat specificity and vulnerability, since habitat types are declining in size and/or deteriorating in quality, due to various factors, such as land cover changes through extension of agricultural land, climate change or unsustainable past exploitations gives a **MEDIUM** risk severity.

Step 6 – Evaluate impacts of harvest for Pterocarpus erinaceus

Based on the analysis of current harvest practices and the historical impact on the species population, but also on running various analyses to determine the Minimum Diameter of Exploitation (MDE) and the rotation cycles for *Pterocarpus erinaceus* at regional (District levels), it resulted that there is an **UNKNOWN** harvest impact severity on harvest and national populations, as well as on the ecosystem.

Step 7 – Evaluate Impacts of Trade

Based on the volumes identified in the exploitation and export licenses, correlated with the lack of accurate inventory data from the exploitation areas from 2018 to 2021, and the lack of an NDF for these areas, we consider the impact of legal trade to be **HIGH.** In addition, the lack of a clear system to monitor the impact of exploitation, or a traceability system to help meet the LAF, supply chain transparency, or identification of illegal exploitation, we consider the impact of illegal trade to be **UNKNOWN**.

Factors to Consider Regarding the Evaluation of Existing Management Measures

The factors and indicators defined in this table rank management procedures relevant for conservation concerns, intrinsic biological risk factors, harvest impacts, and trade impacts according to rigour (complexity, accuracy, precision). These should be considered as examples of the types of management measures appropriate for “Low”, “Medium” and “High” levels of conservation concern, intrinsic biological risk, harvest impact, and trade impact. It is not expected or necessary that management measures in place will have all of the characteristics outlined in this table. Scientific Authorities can evaluate the existing management procedures for the target species and populations as “Uncertain”, “Minimal”, “Moderate” or “Intense” using this table in combination with Worksheet for Step 8 Part 3, and then evaluate whether the existing management measures are appropriate in Worksheet for Step 8, Part 4.

Level of existing management rigour	Management of conservation concerns (Step 4)	Management of intrinsic biological risks (Step 5)	Management of wild harvest impacts (Step 6)	Management of trade impacts (Step 7)
Uncertain				
Minimal	Part of the species natural range is included in protected areas, especially in the Northern and Eastern part of the country where there are a series of National Parks and Forest Reserves on the border with Guinea and within the natural range of the species. However, these protected areas cover less than 5% of the natural distribution of the species. In the Sierra Leonean legislation the community forests are also considered protected forests and are under the jurisdictions of chiefdoms and some of them have informal protection measures for Pterocarpus erinaceus, but they are of minimal rigour.	No clear harvest guidelines provided through legislation/regulations. The harvest methodology is usually described by the entities to which the concessions were granted and submitted for approval to the Director of Forestry through the local management plans. Inadequate management measures, defined in appropriate forest management plans, as well as the absence of standardized harvest guidelines and of a monitoring/traceability system in place to track	As in the case of the intrinsic biological risk, the inadequate management measures and standardized harvest guidelines also qualifies the existing management as of minimal rigour. This absence of precise guidelines for harvesting raises concerns about the sustainability of current practices. The absence of established management measures is evident. This lack of clarity could potentially lead to unregulated harvesting practices and pose a threat to the species' long-term survival.	

Level of existing management rigour	Management of conservation concerns (Step 4)	Management of intrinsic biological risks (Step 5)	Management of wild harvest impacts (Step 6)	Management of trade impacts (Step 7)
	There is also a reforestation programme in place at the country level, which includes *Pterocarpus erinaceus* among the key-species, but this should be included into a proper National Reforestation Plan which will have to be part of a National Forest Management Plan in order to be very effective – to know which are the most affected areas, to understand distribution, where the connectivity is missing, where inbreeding or low levels or no regeneration is an issue, so that the reforestation should happen in a targeted way.	exploitation practices and impacts, represent a cumulative risk to the species and might cause a overharvesting of the resource. From the analysis carried out in the Step 6 on MDE – Minimum Diameter of Exploitation , it results that the minimum diameter established by the Director of Forestry at national level of > 30 cm is not entirely accurate and should not apply at national level. According to the analysis, the MDEs should vary from one district to another from >30 cm in some districts to >35 - 40 cm in other, which proves the need for very adaptive management measures depending on the data collected on the ground.	Without defined management measures, the risk of overharvesting or harvesting immature trees increases. This could result in population decline and hamper the species' ability to regenerate and sustain its population. As in the case of Step 5 there is a need of an adaptive determination of MDEs at District, or even of Chiefdom or concession level, to provide sustainability to the harvesting practices and allow the species to recover. The lack of monitoring /traceability systems is also reducing the rigour of the management measures for Pterocarpus erinaceus as there are no clear records on inventoried trees – lack of coordinates of inventoried trees, detailed maps of the trees – no clear monitoring records on harvested trees and gaps in the correlation between the harvested trees and resulting logs.	

Level of existing management rigour	Management of conservation concerns (Step 4)	Management of intrinsic biological risks (Step 5)	Management of wild harvest impacts (Step 6)	Management of trade impacts (Step 7)
			Moreover there is no clear demarcation and control of access to the harvesting areas which could cause a high risk of illegal harvesting. Monitoring and impact assessment of cumulative harvesting – timber, charcoal, slash and burn for agricultural land conversion, or grazing is not very effective.	
Moderate				For each area of exploitation there is a file covering part of the supply chain information. There are management plans with minimal information, rather presented as operational plans, with maps showing basic details of harvested sections (boundary shapefiles), points with harvesting areas (shapefiles), lists of harvested trees (without coordinates and detailed maps) and lists of logs resulting from harvesting,

Level of existing management rigour	Management of conservation concerns (Step 4)	Management of intrinsic biological risks (Step 5)	Management of wild harvest impacts (Step 6)	Management of trade impacts (Step 7)
				in Excel format. The files also include exploitation, transport and export licenses, phytosanitary certificates, bills of lading. Although these legal measures on harvesting and trade exist and provide a minimum of traceability, the problem is more one of the difficulties related to tracking and linking information of origin, correlate exploited and extracted volumes of timber to those transported, stocked, processed, and exported at each level of the supply chain. There is a lack of centralization of this data, which needs a digitization.
Intense				

Future developments in improving the management measures of *Pterocarpus erinaceus* in Sierra Leone

A. Standardize management measures by redefining and implementing detailed forest management planning nationwide

In order to achieve robust management measures for *Pterocarpus erinaceus* species that meet the needs of conservation, biological risk reduction and exploitation and trade impacts, that can also meet the social and economic needs of sustainable exploitation, strict requirements for the development of management plans need to be defined that follow all the important steps of sustainable management, based on real data collection and adapted to different local conditions.

In order to have efficient and effective management plans, the methodology for their implementation needs to be correctly and clearly defined and reflected in legislation so that it can be standardised at national level for all stakeholders, be they from public administration, local and indigenous communities or the private sector.

Thus, the elements, or the main steps to be taken in the forest planning process, which will be defined and introduced in Sierra Leone's forest legislation are:

- Redefinition of all types of national, community, protected and unclassified/private forests so that all of them can be included in a digital database with boundaries and related data related to ownership, owners, concessionaires, etc.
- Each delimited area of exploitable forest is defined as a logging concession.
- The timescale for a management plan for a concession where Pterocarpus erinaceus is present should be 20 years, to reflect the rotation cycle of the species, not 5 years as at present.
- Each area of forest designated as a concession should be further divided into well-defined and demarcated sections, or compartments, that form part of a national database.
- The sections, or logging compartments, should be the basis for dividing a management plan implementation period (the 20 years mentioned above) into logging cycles of between 1 and 3 years, the logging details of which should be included in Annual Operational Plans.
- Management plans at forest concession level must be based on an exploration inventory, taking into account trees at different stages of development, from old trees, to mature trees contributing to reproduction, to young trees with diameters below the minimum logging diameter, to saplings and coppices. During the development of this exploration inventory, dendrometric data are collected, which will then be analysed in terms of distribution patterns. These data are crucial for analysing the condition of the species on the selected plots and for making management decisions, such as determining minimum logging diameter, setting logging quotas, making decisions on reforestation, or other possible silvicultural works that would improve the condition of the species in the longer term at concession level.
- A 20-year management plan should also take into account management zoning of the concession, with logging areas, protection areas (streams, wetlands, reserves), wildlife sanctuaries, creation or maintenance of access roads, alternative use areas for local communities, for collection of non-timber products, or for grazing and possible expansion of agricultural land, etc.

- Following the establishment of minimum logging dimensions and diameters, as well as the areas where timber extraction can be carried out, for each section or compartment, annual operational plans will be drawn up.
- The annual operational plans are made for the purpose of approving the annual possibility of harvesting and are made on the basis of logging inventories, which record only those trees that meet the minimum logging diameter requirement.
- The annual operational plans shall determine the methods of harvesting, marking of felled trees and stumps, tree extraction routes, avoiding wetlands, agricultural or inhabited areas, and protection and quiet areas. Log yards are also established, with geographical coordinates, where logs will be created after tree removal.

In addition to redefining and legislating management plans, there is an urgent need for a National Forest Inventory to be undertaken in the short term by the Government of Sierra Leone. This National Forest Inventory should form the basis for the National Management Plan, which is provided for in the Forestry Act of 1988.

B. Develop and deploy a National Forest Traceability System

In order to facilitate the implementation of management plans as well as annual operational plans and to establish a monitoring system for forestry operations and practices, the Government of Sierra Leone is committed to developing and implementing a national digital forest traceability system to be defined and enforced through dedicated legislation for all stakeholders operating forests in Sierra Leone.

The main elements of this national forest traceability system are:

- The creation of a national digital database of all forest areas (concessions) as currently demarcated, regardless of their nature, to which attributes such as ownership status, owners, managers, concessionaires, logging companies, etc. are added.
- Create a digital index of concession and/or logging, transport and timber processing companies.
- Creation of an index of users, with access permissions to various levels of data, from public administration, to owners and concession, logging, transport and processing companies.
- Development of a web application and geoportal incorporating the above as well as data to be collected in the field by authorised users using mobile applications.
- Development of a mobile application incorporating the modules necessary to go through all the important steps in the supply chain related to logging, such as:
    - A module for conducting exploratory inventories, which has plot creation capabilities for collecting sample data and dendrometric data and georeferencing inventoried trees i.e. Arboreal Forest, which uses LIDAR technology.
    - A logging inventory module, which records all trees that meet the minimum logging diameter requirements, together with their geographic coordinates, as well as their 3D model made by scanning using a LIDAR sensor and processing through a custom Virtsilv algorithm. This module also estimates the volume per foot of the inventoried tree.

    - A felling registration module, using the same LIDAR technology and Virtsilv processing algorithm as the inventory module, which records the location of the felling and measures the felled tree.
    - A log recording and matching module, to be used when creating logs, which scans 3D, measures volume and creates the unique log model, using the same LIDAR and Virtsilv technologies.
- All this data recorded through the mobile app is synchronized via internet connection into a database in the web app and geoportal, and can be viewed and managed in near real time by authorized users at Ministry, local community/chiefdom, or company level.

C. Run a pilot for forest management planning and for the deployment of a traceability system in a pilot site

For piloting and adapting a digital traceability system for Pterocarpus erinaceus species, an area of woodland in Karene District, Sambakha Simibungie Chiefdom, where the species occurs and where previous logging has been carried out, was chosen.

This pilot aims to take the next steps and verify the viability of the proposed technological solutions:

- Carry out an exploratory inventory by collecting data in plots, using the Arboreal Forest mobile application, which allows the creation of plots and the inventory and measurement of DBH, height and standing volume of all trees in the selected plot, regardless of age, or diameter. The pilot is done using iPhone Pro 12, 13 and 14 phones, which are equipped with the LIDAR sensor that the app requires. The data thus collected will be used to estimate standing volumes and to estimate tree distribution and pattern within the selected area, contributing to the estimation of DME and a potential harvesting quota at Chiefdom level.
- Conduct a harvest inventory in the second phase, whereby all trees that will meet the DME requirement that will result from the previous analysis will be recorded. These trees will be 3D scanned using the available iOS 3D Scanner App, which will use the same LIDAR sensor available on the iPhone Pro 12, 13 and 14 phones and whose 3D point cloud images will be processed by the Virtsilv algorithm which will create a unique tree identity per standing tree and estimate its volume. All these trees will have their coordinates recorded and will be synchronised in a database and geoportal specifically created for this pilot.
- Retroactive recording of sample exploited trees, by geo-referencing and scanning the stumps, to achieve a reverse traceability for already exploited trees and estimating the extracted volumes and recording them in a database.
- Initiate the recording by scanning, georeferencing and 3D modelling using LIDAR and Virtsilv technology of logs stored in log yards and correlate their volumes with the retrospective recording of previous stage logging. Creation of a dedicated database for existing log stocks exploited during 2018-2021 in Sambakha Simibungie Chiefdom.
- Assess the impact of logging in this chiefdom based on retrospectively collected data.

D. Other actions and committments

The following actions will also contribute to improving and increasing the sustainability of forest management in Sierra Leone in general and Pterocarpus erinaceus in particular:

- Update the application process for accepting harvest plans from private sector companies based on modernizing and updating the regulations to reflect detailed processes and requirements.
- Investment in policy level changes
- **I**nitial Monitoring Efforts: While regular monitoring of Pterocarpus erinaceus was lacking historically, the current situation reflects a shift towards a more proactive approach. The initiation of monitoring samples across the habitat signifies a commitment to assessing the species' dynamics.
- Harvest Records and Locations: Although the harvested timber volumes are documented, the locations specified are often vague and lack precision. However, the fact that records now include locations is a positive development. Aligning the recorded locations with the actual sites of harvested trees is a crucial step for accurate impact assessment.
- Impact Assessment Emphasis: There is a notable emphasis on evaluating the impact of harvesting activities on the species and its surroundings. While historical monitoring gaps exist, the current focus on impact assessment indicates an intention to address ecological consequences more comprehensively
- Collaborative Research: Initiate collaborative research efforts involving scientific experts, local communities, and relevant stakeholders to determine appropriate management measures. Consider input from traditional knowledge holders to complement scientific findings.
- Scientific Data Collection: Conduct further studies and data collection to understand the species' growth patterns and age structure. This information is essential for formulating accurate MDE recommendations that align with the species' reproductive capacity
- Stakeholder Engagement: Involve local communities, indigenous groups, and relevant authorities in discussions about management measures. Their input can provide valuable insights into traditional harvesting practices and contribute to the success of the proposed measures.
- Identification Materials: Create and share identification materials that aid field workers, forestry officials, and other stakeholders in accurately identifying Pterocarpus erinaceus trees. This contributes to accurate data collection and monitoring efforts.
- Regular Review and Adaptation: Establish a mechanism for regular review and adaptation of management measures. As new scientific insights emerge and environmental conditions change, these measures should be updated to reflect the latest information.

CURRENT LEGAL PROVISIONS IN SIERRA LEONE REGARDING MANAGEMENT MEASURES, OBSERVATIONS AND PROPOSED CHANGES

Forestry Act of 1988		
Legal provision	**Observations**	**Changes that will improve legislation and management measures in Sierra Leone**
Part III, Section 6 of the 1988 Forestry Act states that the Director of Forestry is responsible for the preparation of a National Forest Inventory	There hasn't been any National Forest Inventory carried out since the enactment of the Act.	A National Forest Traceability and Monitoring System will be implemented over the longer term and defined in this Act and the Forest Regulations. In this way this legal provision can eventually be implemented and will be the basis for increasing the sustainability of forest management, with a database from which decisions can be made and forest policies defined that are appropriate to the requirements of modern forestry and adapted to the social, economic and environmental needs of Sierra Leone.
Part III, section 7 of the 1989 Forestry Act states that the Director of Forestry is responsible for the development of a National Forest Management Plan	The National Forest Management Plan has not yet been developed since the enactment of this Act.	Sierra Leone's National Forest Management Plan will also be carried out through a National Forest Traceability System, by integrating technological solutions that could help in the development of exploratory inventories, underpinning this National Plan and requiring a standardized methodology for developing similar plans at the forest concession level, using the same tools for inventorying and measuring DBH, basal areas, monitoring growth rates at the species level and estimating standing volumes for the entire forest resource. This traceability and monitoring system will have to be reflected in a new version of the legislation, thus defining its use for the elaboration of the National Forest Inventory and the National Forest Management Plan.

Section 8 of Part III of the Forestry Act specifies that the management plans underlying the granting of a concession must be made by, or authorized and approved by, the Director of Forestry.	If the approval shall remain under the responsibility of the Director of Forestry it is not clearly specified who is actually responsible for making these plans, as it shouldn't be the Director of Forestry, nor the District Forest Offices.	The forest and management, as well as reforestation plans will be made by the person, or the entity granted the concession, and formulated as such in the legal provisions and authorized and approved by the Director of Forestry, in order to transfer the responsibility and the costs of preparation to those who wish to benefit from the exploitation of the forest, without unduly hindering the work of those responsible in the Ministry.
Section 14 of the Forestry Act, specifies that the forest management and reforestation plans shall be developed by the Director of Forestry for the approval of a forest concession.	According to this provision the person, or concession entity, is solely responsible for developing an annual work plan. However, the approval of such plans shall remain under the responsibility of the Director of Forestry but shall be elaborated by the person, or concession entity/company.	
In Part V of the Forestry Act regulating the establishment and management of community forests, it is noted that the Chiefdom Council, or any other form of management authority for these forests, is responsible for determining the conditions of exploitation, setting fees and royalties for the use of the forests and their produce	Without a clear set of exploitation conditions in the Forestry Regulations for each forest type, including community forests, that is aligned with the principles of modern and sustainable forestry, these conditions could be interpreted in a variety of ways from Chiefdom to Chiefdom, creating unsustainable and unintegrated forest management. Moreover, there is no categorisation of the values of the forests and their produce according to the composition of the species and volumes present. Such a provision, coupled with the lack of field data on forest	The exploitation conditions will be clearly formulated in the Forestry Regulations, with a reference to this part of the Forestry Act. The conditions formulated will have to comply with the principles of sustainable forestry and all Chiefdom Councils will have to align to such a nationally integrated management practice. An index of all species of trees and types of forest produce, for which fees and royalties are set according to actual value in the markets, per cubic meter, or type of produce, will be estsblished and annexed to the Forest Regulations and referenced in this section of the Forestry Act.

	resources, may cause a number of unsustainable impacts and social inequalities, through lack of knowledge of the status and value of the resource, and the setting of logging quotas, fees and royalties that do not correspond to market values.	
Forestry Regulations of 1990		
Legal provision	**Observations**	**Commitment of the Government of Sierra Leone to improve legislation and management measures**
Part II Forest Administration and Management Section 3, provides the following sub-sections related to forest management plans: - (1) stipulates that any unclassified forest in private ownership may be put into operation only if a management plan has been drawn up by the owners or custodians of the forest and approved by the Director of Forestry of the Ministry of the Environment and Climate Change. - (2) All such management plans prepared as a result of the provisions of this regulation must meet the	The requirements for the development of forest management plans need to be reformulated into new legislation that meets the current needs of the State and Sierra Leoneans, but also the specific requirements of international agreements and external markets, which are putting increasing pressure on countries to manage their natural resources more sustainably, requiring major traceability and transparency systems.	The management plans will be regulated in such a way as to allow the design of sustainable forest management from a social, economic, environmental and cultural point of view. The sustainability of management plans will be ensured by requiring the following steps: • elaboration in a traceable and transparent way of exploratory forest inventories on a well-defined forest management unit • the establishment of harvesting quotas based on dendrometric data, tree densities of each marketable species and estimated standing volumes and rotation periods. • the carrying out of harvesting inventories for each operational unit, where annual operational plans will be established and approved • carry out inventorying and georeferencing of trees that meet the minimum DBH requirements, which should be formulated from one concession to another based on dendometric data • elaborate harvesting plans that are valid within a legally defined period of time • create annual operational plans which will frame the annual quota allowed for exploitation for each species,

requirements of section 8 of the Forestry Act		will provide for the mapping of access and evacuation routes for felled trees, water courses, bird and wildlife protection areas, protected flora areas, protected trees and monuments, as well as the exploitation methodology, such as marking, • georeferenced recording of stumps and the actual evacuation of felled trees and their transport to log yards • log recording and measurement. All these key requirements for the elaboration of management and operational plans will be covered by the development of a National Digital Forest Traceability System and a database and geoportal for the transparent management of the forest resource, which will have integrated state of the art technological solutions using LIDAR sensors for inventorying, through the Arboreal Forest application, both at the exploratory and harvesting level, and for the elaboration of a National Forest Inventory. In addition, using a 3D scanning application and a dedicated Virtsilv algorithm, it will be possible to create unique models of standing trees, stumps, felled trees and logs based on the images scanned in the field.
Section 4 addresses the requirements for the preparation of Inventories. - (1) Any person, or entity to whom the right to exploit an unclassified, or private forest has been granted, should do so on the basis of the achievement of a	It is noticed that, as in the case of the management plans in Section 3, no reference is made at any time to maps, either with the boundaries of the management units or for all the trees, or all the forest resources inventoried and required under this section of the Regulation.	In order to validate and make sustainable the management of forest resources, the deployment of state-of-the-art technological solutions, through a National Digital Traceabilty System will allow the georeferencing of each inventoried tree, either by means of the Arboreal Forest application or by 3D scanning it with Virtsilv. By synchronizing these field data, they will be translated into a geoportal, with the help of which inventory maps can be generated, which can then be used for the development of forest management plans, for setting up adapted

complete inventory of the forest resource. - (2) Inventories shall be submitted to the Director of Forestry for verification and approval as required.		management measures, for creating operational plans and for monitoring harvest levels and impacts.
Sections 6 and 7 make reference to the information required annually, regarding the areas exploited, i.e. blocks and their demarcation. - Any person, or entity to whom the right to harvest an unclassified, or private, forest has been granted, should provide to the Director of Forestry annual information on the entire area harvested in the previous year, together with a map showing the area and progress of activities. - Holders of concession contracts, or timber harvesting licenses, are required to demarcate the concession area into harvesting blocks and compartments.	There are no very specific requirements as to the nature of this information, i.e. whether in addition to the areas demarcated for logging (blocks), logged trees need to be included as georeferenced points. From what it is observed, operators only provided generic maps with blocks and compartments and individual points for each logging site, or log yard, without including points of exploited trees. All these data should be correlated with those provided in the management plans, but also correspond to an annual operational plan. Apparently the two plans are confused in the practices observed.	The National Forest Traceability System and technologies which will be implemented in the near future by the Government of Sierra Leone will provide quantitative and qualitative information on these operational plans and their status in real time, in that every action in the supply chain will be recorded, geolocated and dated in the system and synchronized, so that the status of logging works and their legality can be observed by any authorized user within the Ministry in near real time.

Section 8 refers to annual logging plans in unclassified forests. Thus: - (1) Holders of contracts and concession licenses in unclassified forests operating outside the Forestry Division's areas of jurisdiction must submit a prescribed annual harvest plan for approval by the Director of Forestry in the Department prior to the commencement of operations in the new year, no later than February 1 of each year. Such annual operating plans shall specify the following: (a) The block, or blocks, proposed to be logged that year; b) The choice of the mode of exploitation in the felling compartment and the minimum diameter determining the selection of trees to be felled; c) The sequence in which the compartments will be worked.	This section defines in fact an annual operational plan, and in addition to the required information, it should also provide information specifying the species and minimum DBHs to be harvested (by species), the estimated standing volume to be harvested (by species) and the list of inventoried trees that are selected for harvesting.	All this information will be easily presented and generated using a National Digital Forest Traceability System which will be deployed by the Government of Sierra Leone in the near future. The generation of an annual operational plan will be done from the use of data already collected in the field during the inventory and the generation of maps through the geoportal.

Section 9 refers to minimum operating diameters in situations where these have not been provided for in the concession contract, management plan, or operating licence.	The following limit diameters will be considered in classified and unclassified forests: - *Heritiera utilis* - 5 ft (1.52 m) - All other species - 6 ft (1.83 m). Both in selective logging areas - All species - 4 ft (1.22 m) in clearcut logging areas. This shows a lack of categorization of these limit diameters, which should be defined per each species, individually in an annexed index to the Forestry Regulations.	The traceability system, based on the inventory and collection of field data, which also refers to dendrometric data, will create a favorable framework for collecting these data in a national database, which will allow in the longer term the correct nuancing of these diameter limits according to tree species. The traceability and data collection system will also be useful for the National Forest Inventory and the creation of a monitoring system for forests and their component species through exploratory inventories.
Part V Timber licence Section 13 sets out the conditions under which an timber licence may be approved: - (1) Only tree species and sizes specified in the licence may be harvested. Only trees marked by a forestry officer can be harvested and extracted.	As the trees inventoried for logging are not required to be georeferenced and their selection is not based on a forest management plan that estimates the standing volume per ha, it is difficult to assess and monitor the sustainability of harvesting.	The deployment of a future National Forest Traceability System by the Government of Sierra Leone will allow, based on the exploratory inventories carried out for preparing the management plans, to select trees that meet requirements of minimum diameter for exploitation, sustainable densities of trees per ha, a favorable distribution of diameter classes which could prove appropriate regeneration, etc. All the harvestable trees will be then inventoried for exploitation and will be included into annual operational plans and annual allowable cuts to be approved by the Director of Forestry. All trees that will be felled will be marked and registered accordingly into a database. The felling itself will also be registered, georeferenced and the trees scanned before skidding and transformation into logs. This way all important steps in the supply chain is being recorded, uploaded into a database and trackable.

STEP 9 - NON-DETRIMENT FINDING AND RELATED ADVICE

Steps	Compliance	Related Advice
Step 1 - Review Specimen Identification	Target species has been identified.	NDF Positive
Step 2 - Review Compliance with Requirements for Artificial Propagation	Target speices is in compliance with requirements for Artificial Propagation.	NDF Positive for Wild specimens. There is currently no artificial propagation.
Step 3 - Review of Relevant Exclusions and Previously Made NDFs	Target species has been evaluated and there were no previous exclusions.	NDF Positive
Step 4 - Evaluate Conservation Concerns	Target species has been evaluated for conservatioion concerns.	NDF Positive Step 4 of NDF provides actions for mitigating and monitoring conservation concerns Traceability system for inventory management is critical.
Step 5 - Evaluate Potential Biological Risks of Pterocarpus	Target species has been evaluated for potential biological risks.	NDF Positive Step 5 of NDF provides actions and methodologies for evaluating and mitigating potential biological risks. Traceability system for inventory management is critical.

Step 6 - Evaluate impacts of harvest for Pterocarpus erinaceus	Target species has been evaluated for impacts of harvest.	Positive NDF Step 6 of NDF provides actions and methodologies for evaluating and mitigating impacts of harvest. Traceability system for inventory management is critical.
Step 7 - Evaluate impacts of trade for *Pterocarpus erinaceus*	Target species has been evaluated for impacts of tade.	Positive NDF Step 7 of NDF provides actions and methodologies for evaluating and mitigating impacts of trade. Analysis must be completed on levels and impacts of domestic trade. International trade is predominant and must be monitored. Traceability system for inventory management is critical.
Annex: Step 8 - Evaluate Appropriate Rigour of Existing Management Measures	Target species has been evaluated for appropriate rigor of existing management measures.	Step 8 of NDF provides actions and methodologies for evaluating and mitigating risk through management measures. Management Authority and Scientific Authority have been advised on the steps and actions for updating systems. With these actions the NDF will be positive. Traceability system for inventory management is critical.

Step 10 - Legal Acquisition Findings Procedures:

The mandate of the Forestry Department within the Ministry of the Environment and Climate Change is to sustain the efficient management and utilization of forest resources, and forest preservation of the forest environment for biodiversity conservation, research, and education in Sierra Leone.

The following existing legal instruments empowered the Forestry Department to carry out its mandate.

The Forestry Act of 1988 (Amended 2022) is the primary legislation guiding the efficient management and regulation of forestry and classified and unclassified Forests in Sierra Leone and the establishment of a Reforestation Fund.
The Forestry Regulations of 1990 and other legal instruments that were developed and approved by Cabinet for the efficient management and utilization of timber and other forest products in Sierra Leone clearly outline the procedures for timber utilization, afforestation and reforestation management and the list of the timber species found in our forests across the country.
Forestry Development, Exploitation and Trade Reforms of 2010, standardize the processes and guidelines for leasing Forest Reserve and Community Forests, issuing logging permits, use of stumpage fees, benefit sharing from forest exploitation, transportation of forest products, urban tree management services, export permits, import of chain saws and sawmills, registration of timber and wood product enterprises.
The Forestry Policy of 2010 presented policy statements, each having a set of strategies to implement and ultimately accomplish that policy statement. Successful implementation of most strategies will require participatory engagement of a range of stakeholders.

In compliance with the national legal instruments highlighted above, harvesting of the *Pterocarpus erinaceus* for exportation is generally done in accordance with Section 20 (Utilization of Community Forests) of The Forestry Act, 1988 and Section 8 (Submission of Logging Plans for Unclassified Forests) of The Forestry Regulations, 1990, according to the steps outlined below for Forest Utilization in Sierra Leone; -

- LEGAL RIGHT TO HARVEST
  A Company/Individual should apply to the Ministry of the Environment and Climate Change for either **Forest Concession/Timber Sales Agreement for a particular Forest Reserve or Community Forest,** which will be signed for and on behalf of the Chiefdom, District, Landowning Family, Company/Individual and endorsed by the Minister of the Environment or Director of Forestry. This is immediately followed by **Stock Inventory of the Forest Resources** within the Forest Concession/Timber Sales Agreement Area and the preparation of **Forest Harvesting Management and Reforestation Plan** and the **Annual Operations/Working Plan** for approval before harvesting starts.

- The Company/Individual shall furnish the Director of Forestry with a Performance Bank Guarantee from a recognized Bank as security for compliance with the Forest Concession/Timber Sales Agreement.
- TIMBER HARVESTING ACTIVITIES
  The Forest Concession/Timber Sales Agreement holder must uniquely number and record each tree on the stock survey and block map. The block map and stock survey are verified by the Forestry Department.
  Forest Concession/Timber Sales Agreement holders are only allowed to fell trees when they are in the possession of a valid **Annual Timber License**. This Licence can only be obtained after they have

among others, an **approved** A**nnual Operations/Working Plan** and an **approved Forest Harvesting Management and Reforestation Plan** covering the area to be harvested. The Annual Operations/Working Plan shall specify the volume and species of the annual coupe, or the annual block of harvest.

The following payments should be made to Government before timber is harvested from the Forest Concession/Timber Sales Agreement area for further distribution by the Ministry of the Environment as specified in the **Forestry Development, Exploitation and Trade Reforms of 2008:**

– **Land Lease Rent**
– **Stumpage**
– **Royalty**
– **Reforestation and Training**

• TIMBER TRANSPORT PERMIT
Process involved in the issuance of Timber Transport Permit is as follows: -

i. Application is made to Forestry Department to transport timber from one point to the other
ii. Applicant must have a Forest Concession/Timber Sales Agreement or, in the case of a private timber businessperson, an attestation from the Forest Concession/Timber Sales Agreement holder
iii. All timber being transported should have identification marks/codes stamped by Forestry Department showing the origin of the timber and the Forest Concession/Timber Sales Agreement holder
iv. M & E Officers in all the Districts will assist the Forestry Department to enforce
v. Defaulters will have their timber detained and allowed 48 hours for the payment of a penalty of four-fold the fees for timber transportation
vi. Failing to pay the penalty in (v) will lead to a forfeiture of the illegally transported timber.

• EXPORT
Forest Concession/Timber Sales Agreement holders shall make available its processing facility in Freetown for checking volume calculations prior to determining the export levy. Permission to export will be granted to **only** the Company/Individual that have acquired Forest Concession/Timber Sales Agreement for a particular forest and will be contingent upon compliance with the **approved** A**nnual Operations/Working Plan** and the **approved Forest Harvesting Management and Reforestation Plan** and any other conditions that will be imposed out of necessity.

Research on available stock and forest inventory of all the forests where *Pterocarpus erinaceus* is found has always been of paramount importance, therefore the commitment in conducting this assessment in making a Non-Detriment Finding (NDF) and Legal Acquisition Finding (LAF) for *Pterocarpus erinaceus* in Sierra Leone will provide scientific information to justify that international trade from the country is not detrimental to the survival of the species and that the trade is compliant with Article IV of CITES.

The quota system will be developed by the Ministry of the Environment and Climate Change depending on the type of species and NDFs to control the export of timber.

Sierra Leone - CITES Management Authority

Legal Acquisition Findings Procedures

The Management Authority of Sierra Leone has instituted comprehensive procedures for completing Legal Acquisition Findings for all CITES timber export permit applications.

The Legal Acquisition Findings procedures are mandated by the Ministry of Environment and Climate Change for evaluating compliance to all regulations concerning the legal chain of custody for CITES listed species.

The following is a stepwise framework for documenting and evaluating applications for export for any CITES Appendix II timber species from Sierra Leone. The procedures were developed to demonstrate the systems the Management Authority has instituted to complete a LAF of the chain of custody and traceability of the log or forms of wood back to the forest concession where the trees were harvested.

Below are the mandated steps for completing the Legal Acquisition Findings.

Procedure	Actions
Check and Confirm Ownership	Create a file for each company that has timber harvest license. Check the map of concessions and region where they have a license to harvest.
Data Collection and Documentation Review	Gather all available documentation related to the area and logging activities, including contracts, permits, and any existing records from the NDF from the Scientific Authority and Forestry Department. Refer to LAF Document Checklist.
Check Geoportal for Forest Management Data	Use the database of concessions and geoportal for traceability to check information about the log origin through checking the concession area, Geo located trees, volume and log ID in the database. All harvestable trees and corresponding logs are issued a unique ID in the geoportal and are georeferenced to the exact area of harvest.
Transport Permits	Check all official transport documentation for owner, dates, volumes, species, origin and destination. Check checkpoint stamps.
Document Depots and Locations of Logs	Create a list of all locations where harvested logs are currently stored. This includes all village level logs. Create a Geo reference for each location using the Forest-Source traceability system with the designated I Phone GPS applications.

	Photos are very useful for providing evidence.
Require a total count and marking on all logs at each location	Establish a total number of logs that are owned by each company. Mark logs with a paint or marker that indicates that they have been tallied. Photos are very useful for providing evidence.
Check a sample volume of each owner's log stocks	Use Forest-Source 3D scanning and traceability system to scan logs and check sample of logs for volume. If logs need to be measured manually, use standard measurements of length and diameter of a sample of logs from each bundle or area to confirm the applicant's volume for each location. 1. Take the average diameter of the log by measuring the largest end and smallest end (excluding bark if present) and divide by 2. 2. Divide the average diameter by 2 to calculate the average radius (r). 3. Use the formula for the volume of a cylinder and insert the average radius of the log (i.e., 3.14 x r^2 x length).
Evaluate Security and Depot Locations	Document and establish a monitoring and site inspection schedule for all depots where private companies store logs at district and export level.
Consult with Scientific Authority and Forestry Department on Field Verification	Use inventories from Scientific Authority and review of concession where logs were harvested to collect data for CITES permit application and inventory analysis. After harvest, Forest Officer and Scientific Authority representative should conduct on-site visits to the concession area to assess the harvest of *Pterocarpus erinaceus* against the management plan and timber license.
NDF and LAF Checklist Report	Compile the collected data from LAF evaluation into LAF Checklist to confirm LAF.

Sierra Leone - CITES Management Authority
Legal Acquisition Findings Procedures
Pre-Zero Export Quota Harvested Stocks
Log and Depot Documentation

Legal Acquisition Findings Analysis Relating to Pre-zero Export Quota Harvested Stocks.

This document outlines the procedures for documenting the logs and declaring a volume of the pre-zero export harvested stocks.

It is necessary to establish a baseline for implementing a methodology for completing a chain of custody and traceability of the materials back to the forest concession where the trees were harvested.

Below are the mandated procedures for completing the process of documenting the logs.

Procedure	Actions
Check and Confirm Ownership	Create a file for each company and the region where their logs were harvested.
Data Collection and Documentation Review	Gather all available documentation related to the area and logging activities, including contracts, permits, and any existing records from current NDF from the Scientific Authority and Forestry Department. Refer to LAF Document Checklist.
Document Depots and Locations of Logs	Create a list of all locations where harvested logs are currently stored. This includes all village level logs. Create a Geo reference for each location using the Forest-Source Traceability platform. Photos are very useful for providing evidence.
Count and mark all logs at each location	Establish a total number of logs that are owned by each company. Scan a sample of 50 logs using Forest-Source 3D scanning applications. Upload scans to dedicated geoportal for pre-zero export quota for volume trends and analysis. Mark logs with a new paint or marker that indicates that they have been tallied. Photos are very useful for providing evidence.
Calculate a volume of each owners log stocks	

	Once samples have been analyzed and method approved, Use Forest-Source 3D scanning and traceability system to scan all logs to establish a total volume for each company. If logs need to be measured manually, use standard measurements of length and diameter of a sample of logs from each bundle or area to confirm the applicants volume for each location. 4. Take the average diameter of the log by measuring the largest end and smallest end (excluding bark if present) and divide by 2. 5. Divide the average diameter by 2 to calculate the average radius (r). Use the formula for the volume of a cylinder, and insert the average radius of the log (i.e., 3.14 x r^2 x length).
Secure Locations	Document and establish a monitoring and site inspection schedule. Photos are very useful for providing evidence.
Generate Report	Input data of locations, log count and volume into a report for completing the retroactive analysis of NDF.

Retroactive NDF Analysis for Pre-zero Export Quota Harvested Logs

Procedure	Actions
Trace Documented Logs to Concessions in regions of Harvest.	Based on company documentation generated from the LAF procedures and volumes, trace documented logs to concessions based on a range of data: dates of harvest, volumes, harvest areas.
Use Dedicated Geoportal for Data Management	Use Forest-Source geoportal to generate transparent information about the concession area, harvested trees, and log origins. Same as traceability system for NDF but needs to be specific to the task of LAF for harvested logs.
	Use inventories from Scientific Authority and review of concession where logs were harvested to collect data for retroactive inventory.

Field Verification and Dendrometric Measurements	Conduct on-site visits to the concession area to assess the current status of Pterocarpus erinaceus populations. Utilize Arboreal Application or similar tools for dendrometric measurements of remaining trees.
Sustainable Harvest Analysis: NDF	Calculate whether declared volume could have originated from the concession under review. Yes or No. The potential for the area to produce a volume will be a deciding factor of analysis.
Assessment of Population Impact	Analyze the data collected to determine the impact of the past logging activities on Pterocarpus erinaceus populations. Calculate mortality rates, growth rates, and population density changes.
Restoration Potential Analysis	Evaluate the potential for restoring Pterocarpus erinaceus populations in the concession area based on available data. Estimate restoration percentages and assess the feasibility of recovery.
Compilation of NDF and LAF Report	Compile the collected data, restoration potential analysis, proposed management measures, and traceability system details into a comprehensive report.

ANNEX I A

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Kono District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, EASTERN PROVINCE, KONO DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known): IUCN Global status:___ENDANGERED___National status:__CITES APPENDIX II SPECIES___Other……	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	10%	15%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na			✓			75%				✓
		Unregulated		✓	na		✓			5%	15%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	0%		✓	✓	

ANNEX I B

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Bombali District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHERN PROVINCE, BOMBALI DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known): IUCN Global status:___ENDANGERED National status _CITES APPENDIX II SPECIES___Other_____.	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	15%	5%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				80%				✓
		Unregulated		✓	na			✓		10%	20%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	10%		✓	✓	

ANNEX I C

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Tonkolili District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHERN PROVINCE, TONKOLILI DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known): IUCN Global status:___ENDANGERED___National status:___CITES APPENDIX II SPECIES___Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	15%	5%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				70%				✓
		Unregulated		✓	na			✓		5%	30%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	10%		✓	✓	

ANNEX I D

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Koinadugu District

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHERN PROVINCE, KOINADUGU DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known): IUCN Global status:___ENDANGERED___National status:__CITES APPENDIX II SPECIES_____Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	15%	5%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				75%				✓
		Unregulated		✓	na			✓		15%	25%	5%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	5%		✓	✓	

ANNEX I E

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Falaba District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHERN PROVINCE, FALABA DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known) : IUCN Global status:___ENDANGERED___National status:_CITES APPENDIX II SPECIES___Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	15%	5%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				70%				✓
		Unregulated		✓	na			✓		5%	30%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	5%		✓	✓	

ANNEX I F

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Kambia District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHERN PROVINCE, KAMBIA DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known) : IUCN Global status:___ENDANGERED__National status:___CITES APPENDIX II SPECIES_____Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				5%	10%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	10%	10%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				80%				✓
		Unregulated		✓	na			✓		5%	20%	15%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	5%	10%		✓	✓	

ANNEX I G

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Karene District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHWESTERN PROVINCE, KARENE DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known) : IUCN Global status:___ENDANGERED__National status:____CITES APPENDIX II SPECIES_____Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				15%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	10%	10%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na		✓				70%				✓
		Unregulated		✓	na			✓		10%	30%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	15%		✓	✓	

ANNEX I H

Summary of Harvest Regime for *Pterocarpus erinaceus* in the Port Loko District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, NORTHWESTERN PROVINCE, PORTLOKO DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known) : IUCN Global status:___ENDANGERED___National status:___CITES APPENDIX II SPECIES_____Other_____	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	P. erinaceus	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/leaves	P. erinaceus	Regulated													
		Unregulated		✓	na	✓				10%	10%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	P. erinaceus	Regulated													
		Unregulated	✓	✓	na	✓			✓	15%	20%		✓	✓	
1.4 Removal of whole plant	P. erinaceus	Regulated		✓	na		✓				60%				✓
		Unregulated		✓	na			✓		10%	40%	5%	✓	✓	✓
1.5 Removal of whole bulb	P. erinaceus	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	P. erinaceus	Regulated													
		Unregulated	✓	✓	na				✓	5%	15%		✓	✓	

ANNEX II A

REVIEW OF BIOLOGICAL CHARACTERISTICS, HARVEST AND EXPORTATION REGIMES

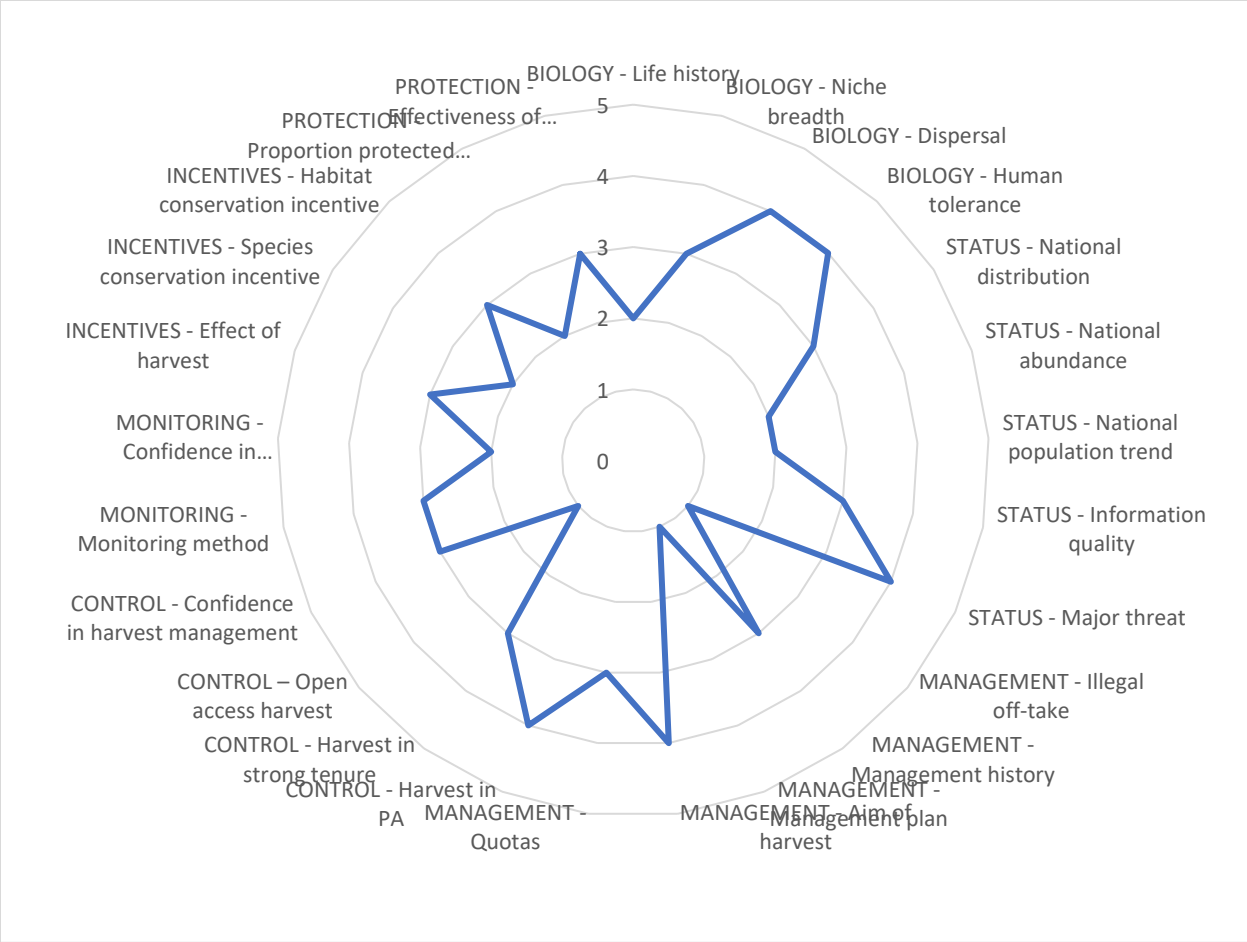
In conducting this Non-Detriment Finding, information was collected on the morphological data, types of harvest, the degree of control over the harvest, the segment of the population harvested, the level of total off-take (for domestic and international use), the reason for the harvest, and the end users of the harvest. It was observed that the data management system should be improved with reference to data availability at the point of harvest for the volume of harvest and the volume of export for each Concessionaire.

Though the species has high potential to coppice, regenerate and quickly dispersed by wind to many other areas, if harvesting of the trees for both domestic use and export, slash and burn agriculture, charcoal production are not properly managed in some Districts, mature stands that are commercially viable will not be the available in the near future.

The Government of Sierra Leone appointed a Sole Timber Agent in June 2018, charged with the responsibility to facilitate all timber exportation from the country in collaboration with the CITES Management Authority. The Timber Agent has handled the trade responsibly and paid all revenues emanating from tax levy on export of timber in full to the National Revenue Authority. This decision has yielded positive results on the trade due to its well-coordinated structure, insulating it from illegal dealings along the supply chain, with a particular focus on this species.

Biological and Management Characteristics (Plot of Responses)

QUESTION NUMBER	QUESTION CATEGORY	QUESTIONS	RESPONSES 1 – 5
2.1	Biology	BIOLOGY - Life history	1
2.2		BIOLOGY - Niche breadth	2
2.3		BIOLOGY - Dispersal	1
2.4		BIOLOGY - Human tolerance	2
2.5	Status	STATUS - National distribution	2
2.6		STATUS - National abundance	2
2.7		STATUS - National population trend	2
2.8		STATUS - Information quality	3
2.9		STATUS - Major threat	4
2.10	Management	MANAGEMENT - Illegal off-take	1
2.11		MANAGEMENT - Management history	3
2.12		MANAGEMENT - Management plan	1
2.13		MANAGEMENT - Aim of harvest	4
2.14		MANAGEMENT - Quotas	3
2.15	Control	CONTROL - Harvest in PA	4
2.16		CONTROL - Harvest in strong tenure	3
2.17		CONTROL – Open access harvest	1
2.18		CONTROL - Confidence in harvest management	3
2.19	Monitoring	MONITORING - Monitoring method	3
2.20		MONITORING - Confidence in monitoring	2
2.21	Incentives	INCENTIVES - Effect of harvest	3
2.22		INCENTIVES - Species conservation incentive	2
2.23		INCENTIVES - Habitat conservation incentive	3
2.24	Protection	PROTECTION - Proportion protected from harvest	2
2.25		PROTECTION - Effectiveness of protection	3



Plot of responses to questions in the Table above: Scores of various parameters that determine Non-Detriment Findings

Factors Affecting Management of the Harvesting Regime

Biological characteristics: Plants only		
2.1. Life form: What is the life form of the species?	Annual	
	Biennial	
	Perennials (herbs)	
	Shrub and small trees (max. 12 m.)	
	Trees	✓
2.2. Regeneration potential: What is the regenerative potential of the species concerned?	Fast vegetatively	
	Slow vegetatively	✓
	Fast from seeds	
	Slow or irregular from seeds or spores	✓
	Uncertain	
2.3. Dispersal efficiency: How efficient is the species' dispersal mechanism?	Very Good	
	Good	
	Medium	

	Poor	
	Uncertain	✓
2.4. Habitat: What is the habitat preference of the species?	Disturbed open	
	Undisturbed open	
	Pioneer	
	Disturbed forest	
	Climax	✓
National status: Animals and plants		
2.5. National distribution: How is the species distributed nationally?	Widespread, contiguous in country	
	Widespread, fragmented in country	
	Restricted and fragmented	
	Localised	✓
	Uncertain	
2.6. National abundance: What is the abundance nationally?	Very abundant	
	Common	✓
	Uncommon	
	Rare	
	Uncertain	
2.7. National population trend: What is the recent national population trend?	Increasing	
	Stable	
	Reduced, but stable	✓
	Reduced and still decreasing	
	Uncertain	
2.8. Quality of information: What type of information is available to describe abundance and trend in the national population?	Quantitative data, recent	✓
	Good local knowledge	
	Quantitative data, outdated	
	Anecdotal information	
	None	
2.9 Major threats: What major threat is the species facing (underline following: overuse/ habitat loss and alteration/ invasive species/ other: and how severe is it?	None	
	Limited/Reversible	
	Substantial	✓
	Severe/Irreversible	
	Uncertain	
Harvest management: Animals and plants		
2.10. Illegal off-take or trade: How significant is the national problem of illegal or unmanaged off-take or trade?	None	
	Small	
	Medium	✓
	Large	
	Uncertain	
	Managed harvest: ongoing with adaptive framework	

2.11. Management history: What is the history of harvest?	Managed harvest: ongoing but informal	
	Managed harvest: new	
	Unmanaged harvest: ongoing or new	✓
	Uncertain	
2.12. Management plan or equivalent: Is there a management plan related to the harvest of the species?	Approved and co-ordinated local and national management plans	
	Approved national/state/provincial. management plan(s)	
	Approved local management plan	
	No approved plan: informal unplanned management	✓
	Uncertain	
2.13. Aim of harvest regime in management planning: What is harvest aiming to achieve?	Generate conservation benefit	
	Population management/control	
	Maximise economic yield	✓
	Opportunistic, unselective harvest, or none	
	Uncertain	
2.14 Quotas: Is the harvest based on a system of quotas?	Ongoing national quota: based on biologically derived local quotas	
	Ongoing quotas: "cautious" national or local	✓
	Untried quota: recent and based on biologically. derived local quotas	
	Market-driven quota(s), arbitrary quota(s), or no quotas	
	Uncertain	
Control of harvest: Animals and plants		
2.15. Harvesting in Protected Areas: What percentage of the legal national harvest, occurs in State-controlled Protected Areas?	High	
	Medium	
	Low	✓
	None	
	Uncertain	
2.16. Harvesting in areas with strong resource tenure or ownership: What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use?	High	
	Medium	✓
	Low	
	None	
	Uncertain	
2.17. Harvesting in areas with open access: What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access?	None	
	Low	
	Medium	
	High	✓
	Uncertain	
2.18. Confidence in harvest management: Do budgetary and other	High confidence	
	Medium confidence	✓

factors allow effective implementation of management plan(s) and harvest controls?	Low confidence	
	No confidence	
	Uncertain	
Monitoring of harvest: Animals and plants		
2.19. Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest?	Direct population estimates	
	Quantitative indices	
	Qualitative indices	
	National monitoring of exports	✓
	No monitoring or uncertain	
2.20. Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring?	High confidence	
	Medium confidence	✓
	Low confidence	
	No confidence	
	Uncertain	
Incentives and benefits from harvesting: Animals and plants		
2.21. Utilisation compared to other threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?	Beneficial	
	Neutral	
	Harmful	✓
	Highly negative	
	Uncertain	
2.22. Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?	High	
	Medium	✓
	Low	
	None	
	Uncertain	
2.23. Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?	High	
	Medium	
	Low	✓
	None	
	Uncertain	
Protection from harvest: Animals and plants		
2.24. Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest?	> 15%	
	5-15%	✓
	< 5%	
	None	
	Uncertain	
2.25. Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?	High confidence	
	Medium confidence	✓
	Low confidence	
	No confidence	
	Uncertain	

2.26. Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse)?	Very effective	
	Effective	✓
	Ineffective	
	None	
	Uncertain	

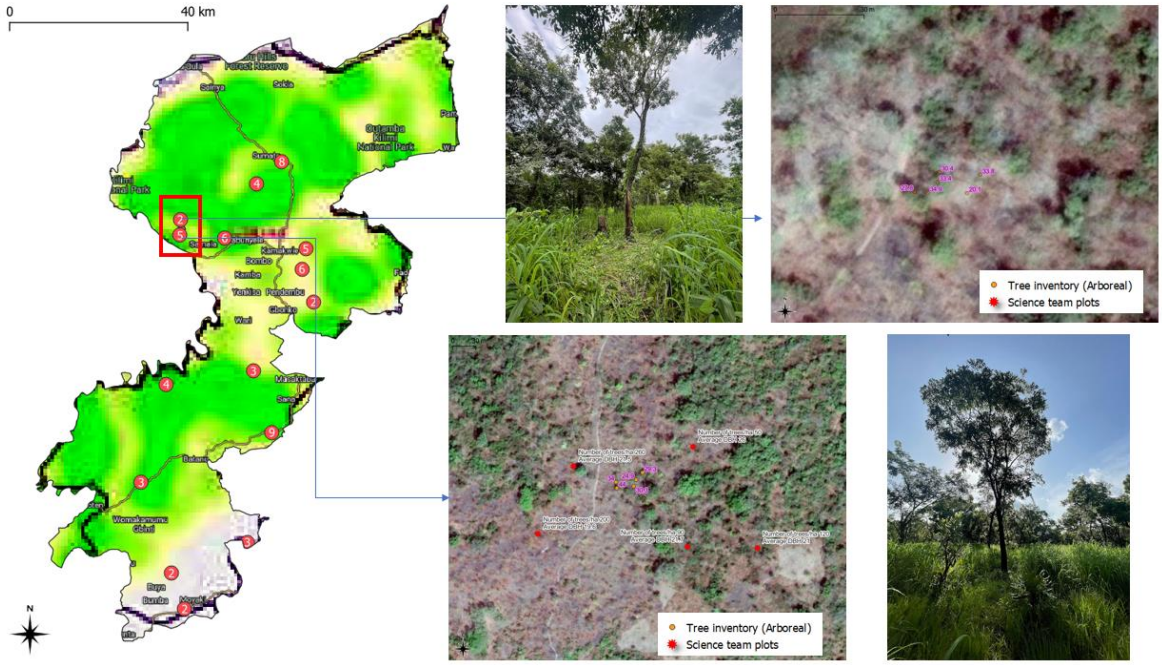
ANNEX II B

Conclusion on the Status of The Non-Detriment Finding in the Study Areas

PROVINCE	DISTRICT & NO. OF CHIEFDOM	CHIEFDOMS	CONCLUSION ON NDF
EASTERN PROVINCE	Kono District	Sandor	NEGATIVE
		Fiama	NEGATIVE
		Gbanekondor	NEGATIVE
		Lei	POSITIVE
		Mafindor	NEGATIVE
		Soa	POSITIVE
		Toli	POSITIVE
NORTHERN PROVINCE	Bombali District	Biriwa	NEGATIVE
		Gbendembu	NEGATIVE
		Kamaranka	NEGATIVE
	Tonkolili District	Dansogoia	POSITIVE
		Kholifa-Mabang	NEGATIVE
		Sambaia	POSITIVE
	Koinadugu District	Alkalia	POSITIVE
		Diang	POSITIVE
		Kamukeh	POSITIVE
		Nieni	POSITIVE
		Tamisso	POSITIVE
		Wara Wara Yagala	NEGATIVE
	Falaba District	Barawa	POSITIVE
		Delmadugu	POSITIVE
		Dembelia-Musaia	NEGATIVE
		Dembelia-Sinkunia	NEGATIVE
		Folosaba-Kamba	NEGATIVE
		Kabillia	NEGATIVE
		Kamadugu	POSITIVE
		Kurosaradu	POSITIVE
		Mongo Bendugu	NEGATIVE
		Morifindu	POSITIVE
		Neya	POSITIVE
		Nyedu	POSITIVE
		Sulima	NEGATIVE
	Kambia District	Brimaia	NEGATIVE

PROVINCE	DISTRICT & NO. OF CHIEFDOM	CHIEFDOMS	CONCLUSION ON NDF
NORTH-WESTERN PROVINCE		Dixon	NEGATIVE
		Khonimakeh	NEGATIVE
		Mambolo	NEGATIVE
		Masungbala	NEGATIVE
		Munu-Talah	NEGATIVE
		Samu	NEGATIVE
		Tonko-Limba	NEGATIVE
	Karene District	Buya	NEGATIVE
		Gbanti	POSITIVE
		Lebei-Saygahun	NEGATIVE
		Mafonda Makerembay	NEGATIVE
		Romende	NEGATIVE
		Sanda Loko	POSITIVE
		Sanda Magbolontor	POSITIVE
		Sanda Tendaran	NEGATIVE
		Sella Limba	NEGATIVE
		Tambakha-Simibungie	POSITIVE
		Tambakha-Yobangie	POSITIVE
	Portloko District	Bureh	NEGATIVE
		Kasseh	NEGATIVE

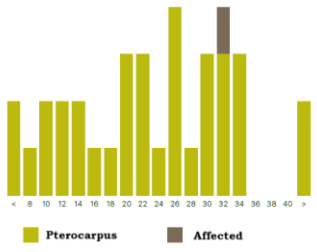
Annex III - Field check in Karene



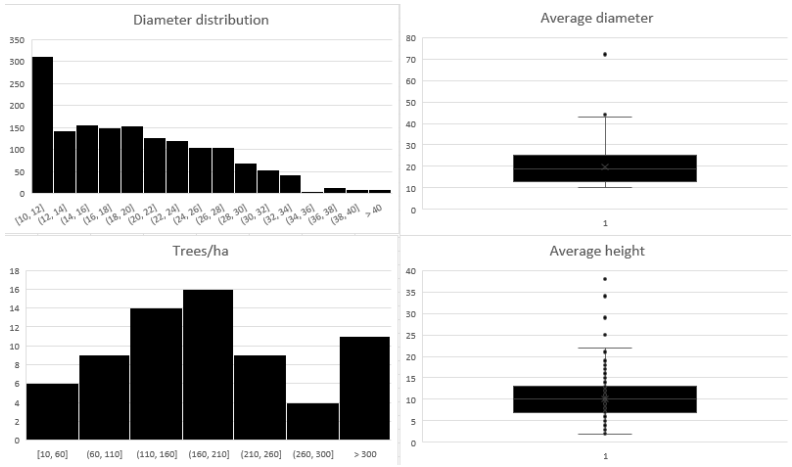
Statistics from field team

Total plot area: 3800 m2
Total number of trees: 35

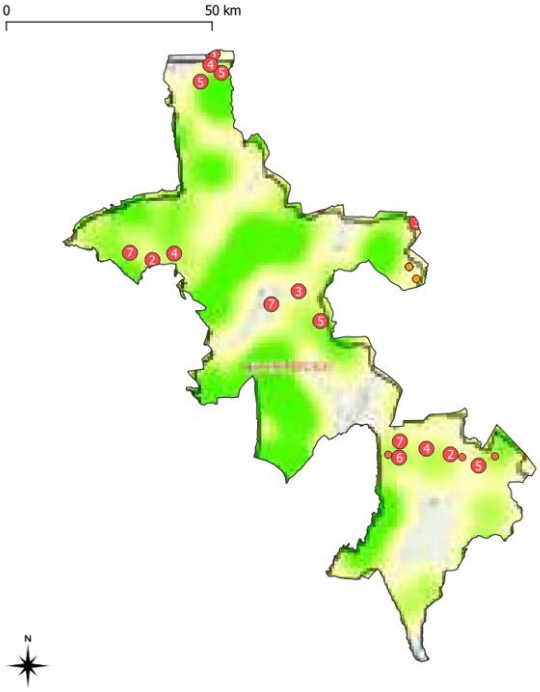
	B A Basal Area	Q M D Diameter	Trees Trees / ha	Height Lorey's H.
Pterocarpus	5.1 96 %	34.4	89	10.1
Affected	0.2 4 %	33.4	3	12.0



Statistics from science team



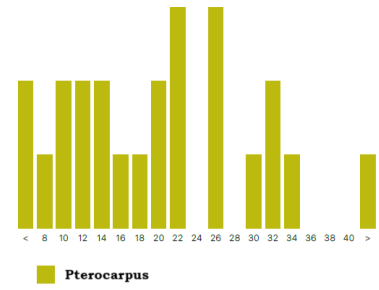
Annex IV - Field check in Koinadugu



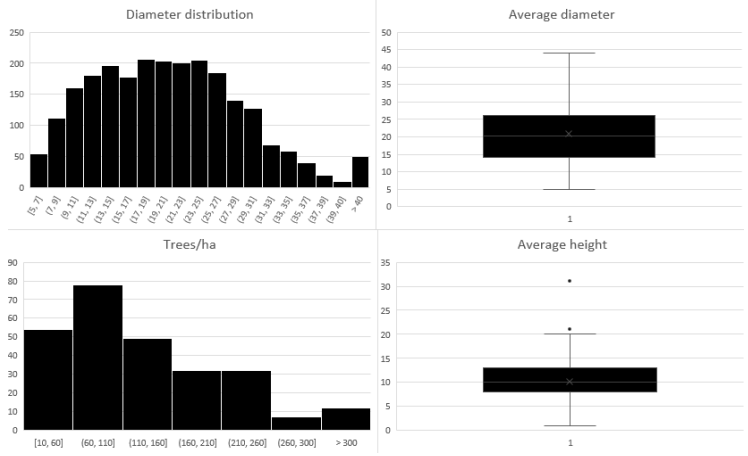
Statistics from field team

Total plot area: 1940 m2
Total number of trees: 24

	B A Basal Area	Q M D Diameter	Trees Trees / ha	Height Lorey´s H.
Pterocarpus	6.0 100 %	35.0	123	10.2



Statistics from science team

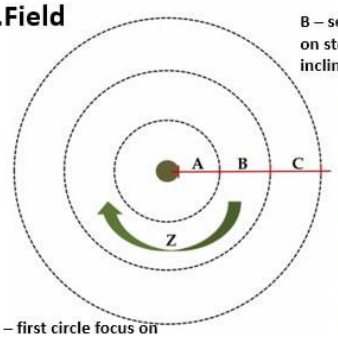


Annex V: Photos and workflow of Field Level Traceability System Training in Karene and Koinadugu

Karene Training with local DFO and team: 3D scanning and pilot tests

Scanning a standing tree using iPhone LiDAR

1.Field

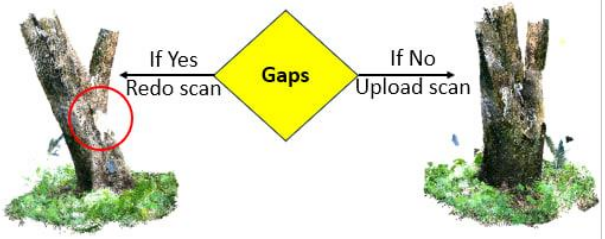


A – first circle focus on ground and stump

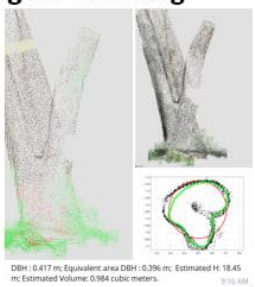
B – second circle focus on stem, phone inclined to the ground

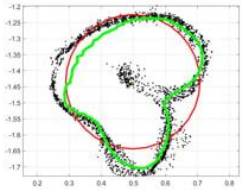
C – third circle (optional), focus on stem phone inclined to approximately 4 m on the stem

2.Result check for gaps



3.Automatic measurement and digital twinning

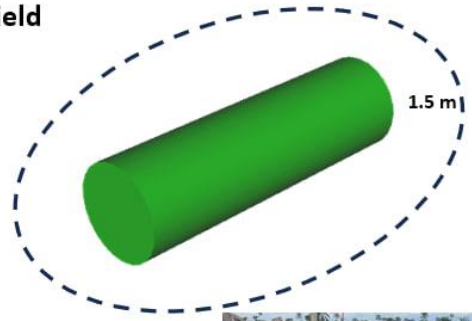




1.3 unique section and GPS located DBH and height

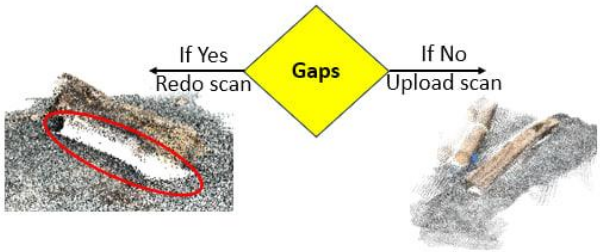
Scanning a log using iPhone LiDAR

1.Field

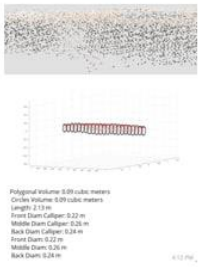


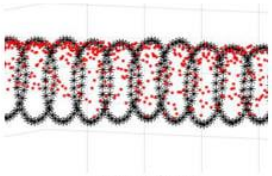
Scan around the log to be scan
Face the phone to the ground, to an angle to assure visibility of the contact area between log and ground

2.Result check for gaps



3.Automatic measurement and digital twinning





Unique shape measurement and GPS located volume, length and diameters

Annex VI. Legal Acquisition Checklist Template

LAF Checklist Template	
Regulation	Company:
Region of Harvest	Area of harvest / District
Timber License Application (Schedule 1)	Designates company and region
Chain Saw Permit	Receipt for payment
Timber Sales Agreement	Contract with Chiefdom and District: Yes or No
Forest Management Plan	Outlines basic operations.
Maps of designated harvest areas or compartments	Check areas of harvest on maps in management plan.
Inventory of Standing Trees to be Harvested	Outlines total of harvestable standing volume and average cubic meter per tree. Yes or No Gives tree number: Yes or No GIS coordinates: Yes or No
Official Timber License (Schedule 6) Forestry Regulation 1990	Permit numbers: Species Minimum diameter of 30cm> Volume in cbm
Inventory of logs from harvested trees at forest level and section level	Lists of logs harvested. Check volumes
Official Transport Permit (Schedule 13) Forestry Regulation 1990	Permit Numbers: Designates company, type of product transported, volume, location of origination and dates of validity.
Processing	Location: Form: Logs, Sawn wood, veneer etc…
Royalties and license fees Finance Act 2023	Paid upon export based on volume per 20ft container. Total:

The LAF checklist is for Management Authority CITES permit application evaluation and is reflective of the regulations directly related to the legal harvest, transport, processing and inventory management of the species.