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ESTIMATES OF SEQUESTERED CARBON STOCK FOR A PROPERTY LOCATED IN MANICORÉ – AMAZONAS

MANICORÉ

The municipality of Manicoré, situated in the heart of the Brazilian Amazon, is a fascinating example of the intersection between the lifestyle of local communities and the unique biodiversity of the region. Its economy, heavily based on agriculture, with a focus on banana and watermelon cultivation and flour production, reflects not only the natural wealth but also the adaptability and ancestral wisdom of its inhabitants in managing available resources.

Strategically located between the capitals Manaus and Porto Velho, and with an estimated population of 54,708 in 2017, Manicoré is a municipality that, despite its challenges, boasts a vibrant community that keeps local traditions and cultures alive. The extractive sector, especially rubber and nut production, also plays a crucial role in the local economy, emphasizing the importance of the forest not only for subsistence but as a source of income for many families.

From a climatic perspective, Manicoré is situated in a region with a humid tropical climate (Am), characterized by a brief dry season, average annual temperatures between 25 and 27 ºC, and high relative humidity ranging from 85 to 90%. These climatic conditions, along with annual rainfall between 2,250 and 2,750 mm, create a favorable environment for the lush Dense Tropical Forest that covers the region, offering rich biodiversity and abundant natural resources.

The complexity of life in Manicoré, intertwined with the biodiversity of the Amazon, presents both challenges and opportunities. On one hand, the dependence on traditional and extractive activities highlights the need for sustainable management practices and policies that ensure environmental preservation and the economic sustainability of these communities. On the other hand, the natural and cultural wealth of the municipality offers vast potential for the development of ecotourism and environmental education initiatives, promoting greater awareness of the importance of Amazon conservation for Brazil and the world.

Integrating traditional knowledge with modern sustainability practices can be an effective strategy to address these challenges. Standards such as ISO 14067:2018, which focuses on the quantification and communication of the carbon footprint of products, can offer valuable guidelines to promote more sustainable agricultural and extractive practices in Manicoré. When applied in a manner adapted to local realities, these standards can help reduce greenhouse gas emissions and efficiently manage natural resources, aligning economic development with environmental conservation needs.

Implementing sustainable practices along with supporting public policies that strengthen the local economy and protect the environment is crucial to ensuring that Manicoré continues to be an example of harmonious coexistence between man and nature. This balance is essential not only for the preservation of the unique biodiversity of the Amazon but also to guarantee a prosperous and sustainable future for future generations inhabiting this extraordinary region.

Identification of the Biome According to Attached Map and Georeferencing

As presented in Annex 1 (Brazilian Biome Map - First Approximation) by IBGE, the biome according to the georeferencing is the Amazon Biome.

Figure 1

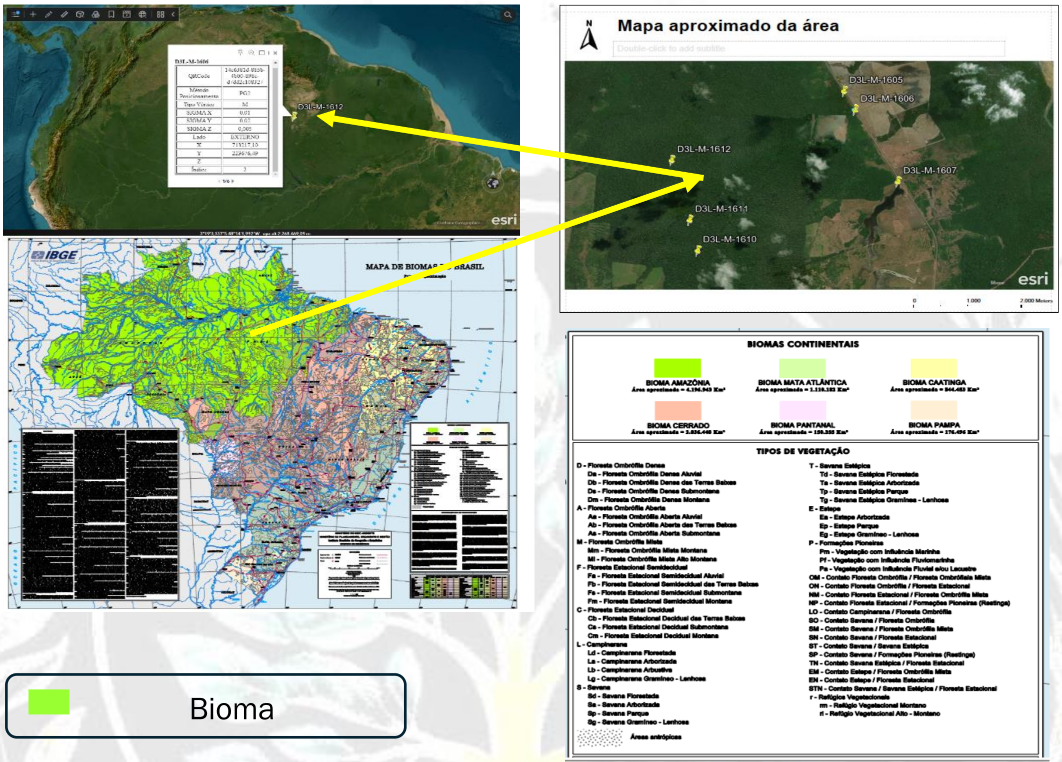


Figure 1: Representative Maps Confirming the Biome

Source: IBGE (2004)

In accordance with the scope, the following information is provided

As shown on the IBGE map - Annex 1 (Brazilian Biome Map - First Approximation), the area is located in dense ombrophilous forest.

The dense ombrophilous forest, also known as tropical rainforest, has dense vegetation in all strata (arboreal, shrub, herbaceous, and lianas); it occurs in regions of the Amazon biome and the coastal zone of the Atlantic Forest where the biologically dry period is practically nonexistent.

THE PROPERTY

The Lagoa Grande property, with its 38,900.26 hectares situated in the Amazon biome, is a representative microcosm of the environmental complexity and richness that characterizes the region. The coexistence of two distinct typologies, the Dense Ombrophilous Forest and the Hydromorphic Fields, along with the abundance of water resources, reflects the diversity and uniqueness of the Amazonian ecosystems. This diversity not only contributes to global biological wealth but also offers an in-depth study of ecological interactions and natural balance within the biome.

The Dense Ombrophilous Forest is one of the pillars for maintaining planetary biodiversity, acting as a habitat for countless plant and animal species, many of which are endemic and some yet to be discovered. This forest is essential for regulating freshwater cycles on the planet, influencing regional and global climate patterns, and is a key player in the fight against climate change due to its carbon storage capacity.

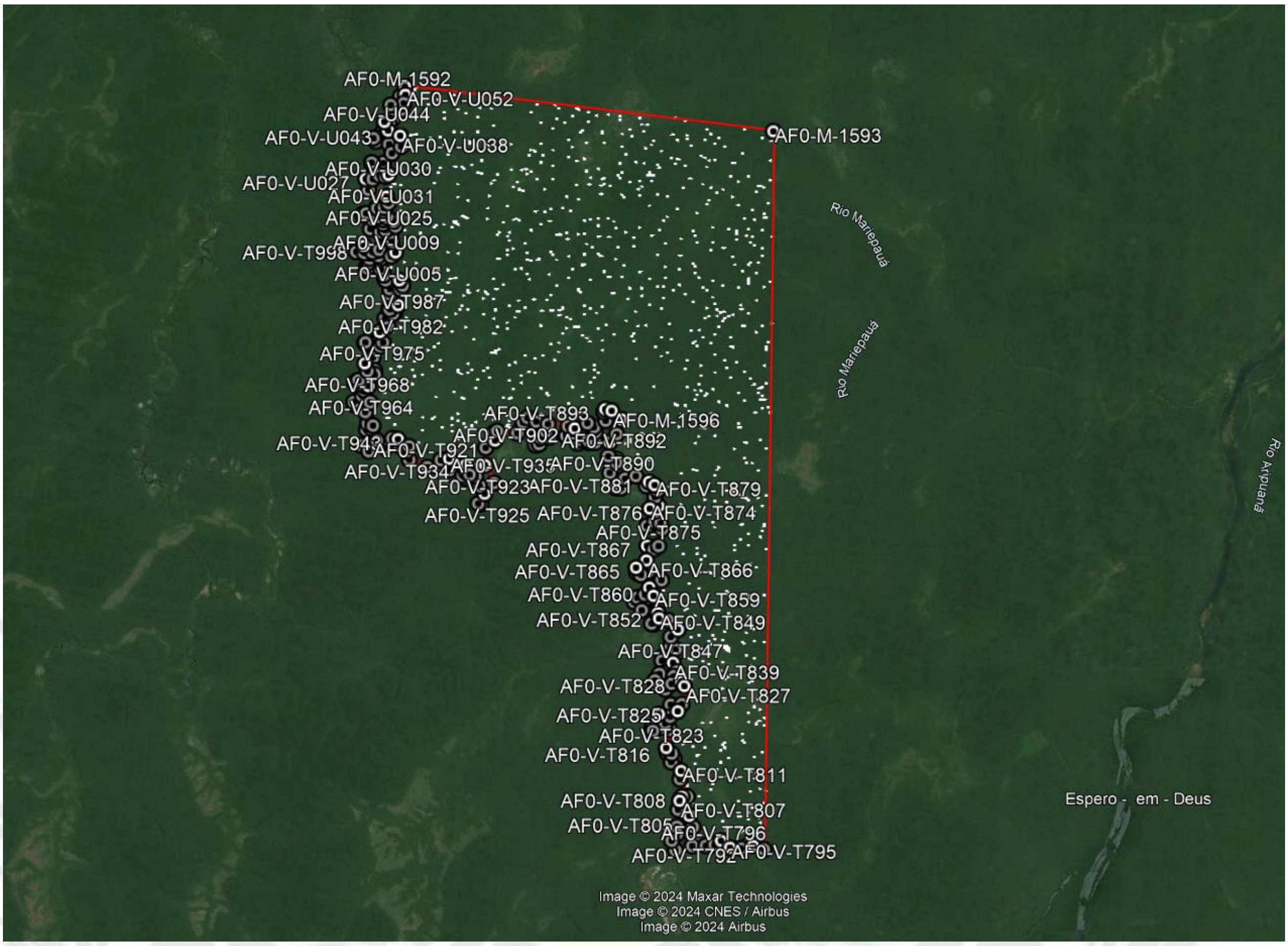
The Hydromorphic Fields, on the other hand, present an equally vital ecosystem, characterized by water-saturated soils that support vegetation adapted to waterlogging conditions. These areas play a crucial role in maintaining water quality, recharging aquifers, and preserving aquatic habitats essential for biodiversity.

However, the integrity of these ecosystems is under constant threat from anthropogenic pressures, including deforestation for agriculture and livestock, logging, mining, and uncontrolled urbanization. Habitat loss, forest fragmentation, and water resource pollution not only reduce biodiversity but also compromise the vital ecosystem services these areas provide.

In light of these challenges, sustainable management of the Lagoa Grande property becomes fundamental. Conservation strategies that integrate the sustainable use of natural resources with biodiversity protection can ensure the preservation of these unique ecosystems. This includes the implementation of sustainable forest management practices, the restoration of degraded areas, the creation of ecological corridors to connect fragmented habitats, and the promotion of ecotourism as an economic alternative that values environmental conservation.

Furthermore, it is essential to involve local communities in these conservation efforts, recognizing and strengthening their traditional knowledge and sustainable land-use practices. Environmental education and scientific research also play crucial roles in understanding the ecosystems present on the Lagoa Grande property and formulating effective conservation strategies.

The preservation of the Lagoa Grande property and its rich ecological typologies is imperative not only for maintaining Amazonian biodiversity but also for global environmental sustainability. Through collaborative efforts and integrated environmental management policies, it is possible to protect this natural heritage for future generations, ensuring that the Amazon continues to play its vital role in the planet's ecological systems.



ENVIRONMENTAL ANALYSIS

Flora

The Lagoa Grande property, immersed in the forest typology of the Dense Ombrophilous Forest, offers a window into understanding the complex ecological interactions that define the biomes of the Amazon and the Atlantic Forest. This forest, with its dense vegetation permeating all strata, from arboreal to lianas, is a vivid example of tropical rain formations characterized by high average temperatures of 25ºC and abundant precipitation, with an insignificant dry period of up to 60 days. The presence of dystrophic red latosols and, in exceptional cases, eutrophic red latosols, reflects the rich biodiversity and edaphic complexity that sustains this vegetation formation.

The subdivision of the vegetation into five facies, according to Embrapa (2023), highlights the sensitivity of this forest to ecotypic variations influenced by altimetric differences. Such classification underlines the importance of topography and soil conditions in determining the specific composition of vegetation and species distribution, demonstrating the intrinsic connection between abiotic factors and biodiversity.

Furthermore, the presence of Campinarana fragments in the region underscores the diversity of ecosystems within the Amazon biome. This "false field," with its woody vegetation adapted to swamp moisture conditions, reveals the unique adaptations of plants to environmental variations and contributes to the ecological complexity of the landscape.

Understanding these ecosystems and their associated biodiversity is crucial for developing effective conservation strategies. The Dense Ombrophilous Forest and Campinarana fragments are vital for maintaining hydrological cycles, conserving biodiversity, and mitigating climate change, serving as important carbon sinks. However, they face significant threats due to deforestation, logging, and changes in land use.

Thus, the conservation of these ecosystems requires a multifaceted approach that incorporates sustainable natural resource management, the restoration of degraded areas, and the implementation of ecological corridors that promote connectivity between fragmented habitats. Scientific research plays a fundamental role in gaining a deeper understanding of these ecosystems, allowing the formulation of public policies and management practices based on evidence and respecting the ecological complexities of these vegetation formations.

Promoting environmental awareness and involving local communities in the conservation of these ecosystems is equally important, recognizing the intrinsic value of these areas not only for local biodiversity but also for the well-being of human populations that depend on the ecosystem services they provide. Effective conservation of these ecosystems not only protects biodiversity but also contributes to global sustainability and the resilience of communities in the face of environmental changes.

Figure 02. Dense Ombrophilous Forest in the Amazon

Source: INCT Biomat

Fauna

The Amazon, estimated to harbor approximately thirty million animal species, is one of the richest and most diverse biomes on the planet, playing a fundamental role in maintaining global ecological balance. This region, often referred to as the "lungs of the world" due to its vast forest cover, is not only crucial for global climate regulation but also serves as a vital refuge for unparalleled biodiversity.

The fact that many species in the Amazon remain unidentified or poorly studied highlights the urgent need for continuous scientific research. This knowledge gap not only underscores the intrinsic complexity of Amazonian fauna but also emphasizes the importance of preserving this unique ecosystem against the growing threats of deforestation, illegal resource exploitation, and climate change.

Primates such as spider monkeys, howler monkeys, and woolly monkeys are just one example of the extraordinary diversity of life that inhabits the Amazon, navigating and living in the intricate canopy of the trees. These animals not only contribute to the ecological complexity of the forest but also play crucial roles in seed dispersal and the maintenance of forest structure and composition.

In addition to primates, the presence of a vast range of mammals, including terrestrial predators like jaguars and aquatic mammals like manatees and river dolphins, illustrates the richness of Amazonian fauna. These animals are essential components of both terrestrial and aquatic ecosystems, contributing to the health and balance of the habitats they live in.

The conservation of Amazonian biodiversity is a multidimensional challenge that requires an integrated approach involving scientific research, public policies, community involvement, and international cooperation. Protecting this biome is not only an environmental preservation issue but also a global sustainability issue, given its importance in climate regulation, water conservation, and the sustenance of indigenous and local communities.

Promoting the conservation and sustainable use of the Amazon involves valuing traditional knowledge, strengthening protected areas, encouraging scientific research, and implementing sustainable development practices that minimize human impact. Global awareness of the importance of the Amazon and continuous support for conservation efforts are crucial to ensuring the survival of this vital biome for the health of our planet.

Roraima, one of Brazil's states, presents a unique diversity of landscapes and biomes that contribute to a rich and varied fauna. Despite many scientific studies focusing on specific objectives, an overview of the local biodiversity is available as summarized on the website animalia.bio. Below are some of the species that make up the fauna of this state:

Mammals:

- Jaguar (Onça-pintada): Found in the tropical forests of the Amazon, it is known for its coat filled with dark spots.
- Tapir: A herbivorous mammal that lives in forests and savannas.
- Margay (Gato-mourisco): A medium-sized feline with a spotted coat.
- Giant Otter (Ariranha): A member of the otter family that inhabits rivers and lakes.
- Wild Horses (Cavalos Lavradeiros): One of the last populations of wild horses, found in the region.

Primates

- Red-faced Spider Monkey (Macaco-aranha-de-cara-vermelha) (Ateles paniscus): Found in the tropical forests of northern South America, also known as the Guiana spider monkey.
- White-bellied Spider Monkey (Macaco-aranha-de-barriga-branca) (Ateles belzebuth): An endangered species.
- Common Squirrel Monkey (Macaco-de-cheiro-da-Guiana) (Saimiri sciureus): A primate native to South America.

- Guianan Red Howler Monkey (Bugio-vermelho de Guyanan) (Alouatta macconnelli): A New World monkey native to Suriname, Guyana, Venezuela, and Brazil.

Reptiles

- Caimans (Jacarés): Aquatic reptiles that inhabit rivers, lakes, and swamps.
- Várzea Bistriata: A species of scaly reptile with bronze or copper skin.
- Atractus trilineatus: A species of colubrid snake.

Amphibians

- Oreophrynella quelchii: A species of toad restricted to Mount Roraima.

Fish

- Colomesus asellus: A pufferfish from the Amazon, Essequibo, and Orinoco basins.
- Metynnis argenteus: Known as the "silver dollar," endemic to the Tapajós River Basin.
- Leporinus fasciatus: A species introduced in some U.S. states.

Other Vertebrates

- Black Ghost Knifefish (Peixe-faca fantasma preto) (Apteronotus albifrons): A tropical fish native to South America.
- Anolis eewi: A lizard found in Venezuela, Guyana, and Brazil.
- Kentropyx striata: A lizard endemic to South America.

Figure 03. Fauna of the Dense Ombrophilous Forest (FOD) in the Amazon

Source: ISPN

METHODOLOGY OF ANALYSIS

The analysis of satellite images, such as those provided by Hecta & PlanetScope/SkySat, to stratify land use in a property as diverse as the one mentioned, is a powerful tool for mapping and understanding the composition and distribution of ecosystems. In this specific case, the division into Dense Ombrophilous Forest, Hydromorphic Fields, and Water Resources reveals a rich and complex intersection of natural habitats, each with its unique characteristics, ecological importance, and conservation challenges.

Dense Ombrophilous Forest: This classification reflects areas with high tree density, which are crucial for global biodiversity, carbon storage, and the provision of ecosystem services such as water regulation and climate control. The preservation of these forests is vital, considering their importance for maintaining biodiversity and as a barrier against climate change.

Hydromorphic Fields: These areas are characterized by water-saturated soils, supporting a unique type of vegetation adapted to waterlogged conditions. These ecosystems perform essential functions such as water filtration and providing habitat for species adapted to these conditions. Sustainable management of these fields is crucial for maintaining water quality and aquatic and terrestrial biodiversity.

Water Resources: The identification of areas rich in water resources underscores the importance of these ecosystems for sustaining life, both for local flora and fauna and for human communities. They not only support rich aquatic biodiversity but are also fundamental for economic activities such as fishing and ecosystem services such as climate and water cycle regulation.

The stratification of land use through satellite images offers a starting point for conservation actions and the sustainable use of natural resources, allowing for:

Conservation Planning: Prioritizing areas for protection and recovery based on their ecological importance and vulnerability to threats.

Natural Resource Management: Guiding natural resource management practices to ensure sustainability and minimize human impact.

Environmental Monitoring: Facilitating continuous monitoring of changes in land use and vegetation cover, allowing for early detection of degradation or ecological recovery.

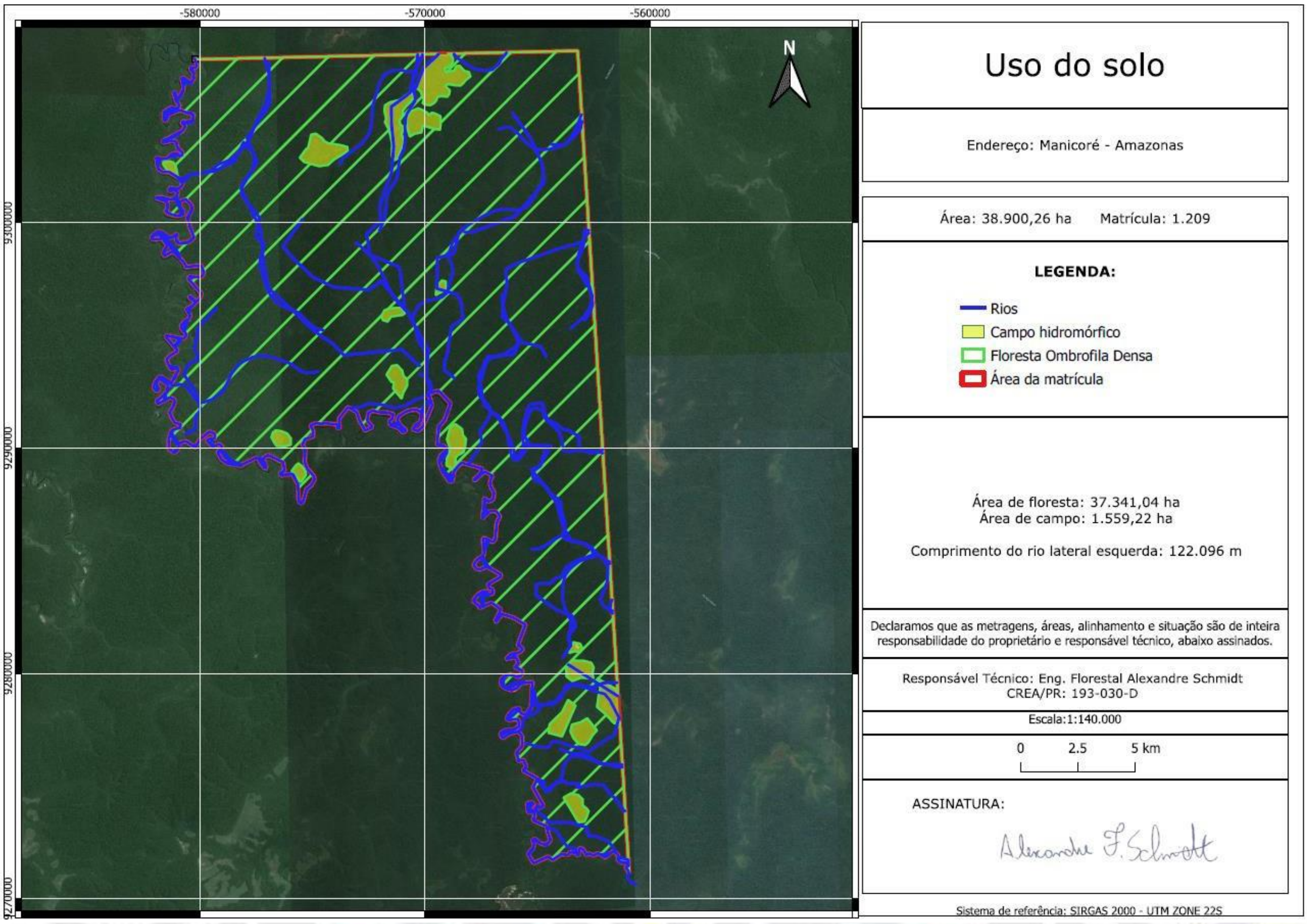
Sustainable Development: Supporting the planning of economic activities that are compatible with biodiversity conservation and ecosystem sustainability.

This detailed mapping and classification of habitats on the property not only highlight the natural wealth present but also emphasize the need for integrated management approaches that reconcile biodiversity conservation with the sustainable use of natural resources. Adopting practices that respect the carrying capacity of local ecosystems is essential to ensure that these areas continue to provide their invaluable ecosystem services for future generations.

Table 01 – Area of the Land Classified by Strata

Stratum	**Area (ha)**
Dense Ombrophilous Forest	37.341,04
Hydromorphic Fields	1.559,02
Total Area	38.900,26

Figure 04 – Map of the Stratified Area



Investigation of Vegetal Biomass and Soil in Different Vegetal Formations

Investigating the vegetal biomass and soil in different vegetal formations is crucial for understanding the role of forests in climate change mitigation, especially through carbon sequestration. Specialized literature reveals a trend in research primarily directed at above-ground biomass due to its accessibility and ease of measurement. This part of the biomass is essential, as trees and other vegetation store large amounts of carbon, which, when quantified, can offer a clear view of an ecosystem's carbon storage potential.

Importance of Above-Ground Biomass

Above-ground biomass includes all parts of plants and trees that are above the soil surface, such as trunks, branches, leaves, and fruits. This component is vital for the carbon cycle because it absorbs CO2 from the atmosphere during the photosynthesis process. Measuring above-ground biomass allows estimation of the amount of carbon being sequestered by forests, which is fundamental for climate change mitigation strategies.

Challenges in Measuring Soil and Root Biomass

Although above-ground biomass is more visible and easier to measure, below-ground components, including roots and soil itself, are equally important for carbon storage. Plant roots, especially deep roots, can store significant amounts of carbon. Additionally, soil is one of the largest reservoirs of organic carbon, playing a critical role in the global carbon cycle.

Measuring soil and root biomass presents significant challenges due to its inaccessibility and the complexity of interactions in the subsoil. Traditional methods such as trench digging and soil sampling are labor-intensive and can be invasive, disturbing the studied ecosystem. Furthermore, the spatial heterogeneity of soil and roots requires extensive sampling effort to obtain accurate estimates.

Significance of Soil Carbon Accumulation

Soil is a critical component in forest ecosystems, not only as a support for plants and trees but also as an important carbon reservoir. Soil organic matter, derived from the decomposition of plants, animals, and microorganisms, is rich in carbon. Under ideal conditions, this carbon can be stored in the soil for long periods, contributing to climate change mitigation.

Understanding soil carbon dynamics is essential for predicting how changes in land use, agricultural and forestry practices, and climate change can affect carbon sequestration. Additionally, identifying practices that increase soil carbon accumulation can offer valuable strategies for reducing atmospheric CO_2 levels.

SECONDARY DATA ON CARBON SEQUESTRATION IN THE BIOME

Understanding the carbon sequestration capacity of different vegetation types is fundamental for developing effective climate change mitigation strategies. Above-ground vegetation biomass, such as trees and shrubs, is often the primary focus of studies due to its ease of measurement and its significant contribution to carbon storage. However, the importance of other compartments, including roots and soil, cannot be underestimated, as they together form a critical and long-lasting carbon reservoir.

Methods of Aerial and Soil Carbon Analysis

- **Aerial Carbon Measurement:** Using advanced Hecta.ai technology, aerial carbon estimation was enhanced by processing data with extreme precision. High-resolution satellite images from the Dove and SuperDove series by Planet, which capture details with a resolution of up to 3 meters per pixel, were fundamental in this analysis. The combination of these images with the Normalized Difference Vegetation Index (NDVI) provided a solid basis for quantifying above-ground vegetation biomass, crucial for estimating the volume of atmospheric carbon retained in the region's forests.

- **Near-Surface Carbon Measurement:** Similarly, near-surface carbon was analyzed using a refined methodology that integrates the Enhanced Vegetation Index (EVI) through Hecta.ai technology. This improved approach allowed for a detailed assessment of carbon retained in near-surface vegetation, resulting in more precise and reliable data. The advanced analysis offers a comprehensive view of carbon dynamics, essential for conservation and environmental management strategies.

- **Average Soil Carbon Stock:** The average soil carbon stock was calculated using a combination of satellite technologies and field analyses via the Hectare app (if necessary). This integrated approach not only improved the accuracy of soil carbon storage estimates but also demonstrated the effectiveness of synergy between orbital technologies and terrestrial analyses in producing robust data.

Analysis Results

The results indicate a significant stock of both aerial and soil carbon. These quantities are fundamental to understanding the area's carbon sequestration potential. The specific values reflect not only above and below-ground biomass but also the dynamic interaction between different vegetation layers and soil, essential for climate change mitigation and environmental conservation strategies. The methodologies used ensure precise and reliable data, essential for continuous monitoring and effective management of natural resources.

Enhanced Studies and Results Thanks to Planet Constellation and Hecta Processing Technology

The significant contribution of dense forests, especially the Amazon Rainforest, to carbon sequestration both in above-ground biomass and soil is well established in scientific literature. Additionally, ecosystems such as mangroves and peatlands stand out for their exceptional carbon storage capacities, often surpassing tropical forests in carbon stored per hectare. The innovative use of Planet's satellite constellation, combined with advanced data processing technology from Hecta, has been fundamental in unlocking deeper insights into these carbon dynamics.

Through high spatial resolution images captured by the Planet constellation, combined with powerful analysis provided by the Hecta platform, researchers can now conduct detailed studies on carbon sequestration across various vegetation types. This technological synergy allows for precise identification of variations in vegetation cover and seasonal changes, essential for understanding carbon sequestration processes over time.

Conclusion and Implications Reinforced by Planet Constellation and Hecta Technology

The need to expand our understanding of soil carbon dynamics, highlighted by the scarcity of focused studies in this area, stands out as an imperative research domain. Significant advances in measurement methodology, driven by unprecedented access to Planet satellite data and advanced analysis enabled by Hecta technology, are crucial for more precise and effective evaluation of terrestrial ecosystems' carbon sequestration potential.

These advances not only optimize strategies for mitigating climate change but also provide valuable data to guide soil management practices towards environmental sustainability and food security. Integrating this knowledge into conservation and land use policies has the potential to maximize carbon sequestration while preserving biodiversity and ecosystem services.

The adoption of these innovative technologies in environmental studies, as demonstrated in "Table 02," which details the amount of carbon captured per hectare in different ecosystems, clearly illustrates the competitive advantage that the Planet constellation and Hecta processing technology bring to contemporary environmental research. The path ahead requires continuous investment in these technologies to fully uncover the potential of our natural ecosystems in the fight against climate change.

Table 02. Carbon Stock in Phytophysiognomies of the Amazon Biome

Phytophysiognomy	Source	Aerial Carbon Stock (T/ha)	Soil Carbon Stock (T/ha)
ense Ombrophilous Forest	Higuchi et al, 2004	120	
	Marques et al, 2013		96.9
	Zelarayan et al. 2015	145	
	Santos et al. 2018	297,17	
	Silva, 2007	97,75	
	Piva et al, 2021	163	
Hydromorphic Field	França, 2015		243,16
	França et al., 2013		200
	Meirelles et al., 2006		241

(T/ha = Tons per hectare)

In this context, arithmetic means were calculated for each type of vegetation formation based on available bibliographic data using the average formula:

$$\bar{x} = \frac{\sum x_i}{n}$$

Table 03. Average Carbon Stock from Bibliographic Data

Phytophysiognomy	Aerial Carbon Stock (T/ha)	Soil Carbon Stock (T/ha)
Dense Ombrophilous Forest	164,58	96.9
Hydromorphic Field	-	228,05

(T/ha = Tons per hectare)

The strategy of using arithmetic means to estimate the carbon stock in different phytophysiognomies is a powerful tool in environmental management. Considering the natural variability and the methodological approaches associated with carbon measurement, it is essential to account for these factors when evaluating the carbon storage potential.

In summary, the strategy of using arithmetic means to calculate the carbon stock in different phytophysiognomies is a valuable tool in environmental management. It provides a basis for assessing the financial viability of conservation and carbon sequestration projects, as well as for strategic planning for the sustainable use of natural resources.

Table 04. Results of Carbon Stock Quantification Studies in Phytophysiognomies Found in the Terrain under the Amazon Biome

Phytophysiognomy	Aerial Carbon Stock (T/ha)	Soil Carbon Stock (T/ha)	Carbon Stock (T/total area)
Dense Ombrophilous Forest	6.145.737,73	3.618.346,78	**10.119.664,63**
Hydromorphic Field		355.580,12	
Total	6.145.737,73	3.973.926,90	

Phytophysiognomy	Source	Aerial Carbon Stock (T/ha)	Carbon Stock (T/total area)
Dense Ombrophilous Forest	3rd National Communication of Brazil to the UNFCCC, 2016	155,27 a 197,71	100,37 a 116,37
Hydromorphic Field	3rd National Communication of Brazil to the UNFCCC, 2016	Not specified	Not specified
Open Ombrophilous Forest (Alluvial)	3rd National Communication of Brazil to the UNFCCC, 2016	390,00	Proportional estimate
Open Ombrophilous Forest (Lowlands)	3rd National Communication of Brazil to the UNFCCC, 2016	349,11	Proportional estimate
Seasonal Semideciduous Forest	3rd National Communication of Brazil to the UNFCCC, 2016	283,40 a 330,36	Proportional estimate

(tons/total area = tons per total area of the physiognomy)

Improved Results with Planet Constellation and Hecta Processing Technology informative table for Open Ombrophilous Forest (Alluvial and Lowlands subtypes) and Seasonal Semideciduous Forest, with specific data for the Amazon biome:

Notes:

- **Soil Carbon Stock:** Estimates for soil carbon stock were based on standard IPCC proportions for forests, applied to the values of above-ground biomass.

The approach used to calculate the arithmetic means to represent the carbon sequestration values in the various phytophysiognomies was detailed in the document "3rd National Communication of Brazil to the United Nations Framework Convention on Climate Change – Volume III." This method proved effective, allowing for an adequate synthesis of the available data and providing a preliminary assessment of the carbon storage potential in specific areas. This methodology is essential for enabling researchers and environmental managers to understand the carbon storage potential in different strata and phytophysiognomies. Such understanding is crucial for decision-making in conservation projects and the implementation of carbon credits, significantly contributing to climate change mitigation strategies.

How the Strategy is Enhanced by Planet Constellation and Hecta Technology:

1. **Advanced Data Compilation:** Data collection and analysis are intensified by the use of high-resolution images from the Planet constellation, allowing for precise identification of different phytophysiognomies. The Hecta platform processes this data with advanced algorithms to extract detailed information about the carbon stored in each vegetation type, surpassing the limitations of isolated scientific studies.

2. **Optimized Calculation of Arithmetic Means:** With the inclusion of remote sensing data and analyses processed by Hecta, the calculation of the arithmetic mean of carbon values for each phytophysiognomy gains a richer and more diverse database. This results in more accurate and reliable representative values that effectively reflect the area's carbon sequestration potential.

3. **Precise Estimation of Carbon Stock:** By multiplying the calculated means by the extent of each type of vegetation identified in the satellite images, the accuracy of the total estimated carbon stock is significantly improved. Hecta technology provides a detailed analysis of the extent of each phytophysiognomy, ensuring that the carbon sequestration potential estimate is as accurate as possible.

4. **Detailed Financial Viability Analysis:** With improved carbon stock estimates, the financial viability analysis of carbon sequestration projects becomes more robust. Using precise data on the amount of carbon sequestered allows for appropriate valuation of carbon credits in the market, optimizing the financial return of conservation projects and reinforcing the commitment to environmental sustainability.

The joint application of the Planet constellation and Hecta technology revolutionizes traditional methodology, providing an integrated approach that enhances analysis and planning capabilities in carbon sequestration projects. This technological advancement not only facilitates the implementation of conservation initiatives based on solid evidence but also promotes transparency and effectiveness in the carbon credit market, significantly contributing to global climate change mitigation efforts.

Importance and Applications:

Environmental Conservation: Carbon stock assessment helps identify priority areas for conservation, contributing to climate change mitigation and biodiversity preservation.

Sustainable Development: Information on carbon sequestration can guide land use policies and management practices that promote environmental and economic sustainability.

Carbon Market: Precise quantification of stored carbon is essential for participation in the carbon market, allowing landowners and conservation projects to generate revenue from the sale of carbon credits.

Annual Carbon Sequestration Estimate for the Lagoa Grande Property

Introduction

The growing concern with global climate change has heightened the importance of studying carbon sequestration by forest ecosystems. This chapter aims to estimate the annual carbon sequestration at the Lagoa Grande property, located in the Amazon biome. The analysis is based on methodologies described by renowned researchers and organizations such as Higuchi et al. (2004), Marques et al. (2013), Silva (2007), and through the technological collaboration of Hecta.AI, which provides precise data on the extent and density of forest cover.

Methodology

Using the cited references and satellite image analysis technology from the Planet constellation, combined with advanced processing from Hecta, it was possible to delineate the forest composition of the Lagoa Grande property. The identified phytophysiognomies were primarily Dense Ombrophilous Forest and Hydromorphic Fields, with a total area of 38,900.26 hectares.

From the literature review and the application of arithmetic means of carbon stocks found in previous studies, the following formula was applied:

Annual Carbon Sequestration=Area×(Aerial Carbon Stock+Soil Carbon Stock)

The values used for the averages were taken from previous studies indicating the aerial and soil carbon stocks for the relevant phytophysiognomies.

Results

For the Dense Ombrophilous Forest, an average aerial carbon stock of 164.58 T/ha and soil carbon stock of 96.9 T/ha was found. For the Hydromorphic Fields, the average aerial carbon stock was not specified, but the soil carbon stock was found to be 228.05 T/ha. Applying these values to the total area of each phytophysiognomy, the total carbon stock was calculated.

Given the static nature of these values, it was assumed that vegetative growth and the consequent carbon sequestration capacity would be proportional to the existing carbon stocks, adjusted for estimated vegetative growth and decomposition rates for the region.

Discussion

The annual carbon sequestration estimate for Lagoa Grande highlights the crucial role of forests in climate change mitigation. The results demonstrate not only the significant carbon sequestration capacity of these phytophysiognomies but also the importance of sustainably preserving and managing these ecosystems.