



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 15, Issue, 07, pp. 68799-68802, July, 2025

<https://doi.org/10.37118/ijdr.29895.07.2025>



RESEARCH ARTICLE

OPEN ACCESS

ASSESSMENT OF HUMAN PRESSURE ON THE AMAPA STATE FOREST, AMAPA, BRAZIL FROM 1999 TO 2023

André L. S. Monteiro¹, Marcos R. D. de Almeida¹, Euryandro R. Costa¹, Regina M. S. Carvalho¹, Rafaela D. Amador² and Cinthia P. de Oliveira²

¹Secretaria de Estado de Meio Ambiente do Amapá-SEMA/AP, Av. Mendonça Furtado no 53-Centro- Macapá, Amapá, Brazil

²Universidade do Estado do Amapá-UEAP, Av. Presidente Vargas no 650-Centro-Macapá, Amapá, Brazil

ARTICLE INFO

Article History:

Received 17th April, 2025

Received in revised form

26th May, 2025

Accepted 03rd June, 2025

Published online 30th July, 2025

Key Words:

Amapa State Forest Humanpressure
Hotspots Deforestation.

*Corresponding Author:

André L. S. Monteiro,

ABSTRACT

The Amapa State Forest (Flota do Amapa) is a Sustainable Use Conservation Unit, which faces persistent human pressure. The objective of this study was to detect and quantify the vectors of human impact—specifically deforestation and hotspots on Flota do Amapa from 1999 to 2023, assessing the areas experiencing the greatest pressure. To achieve this, we utilized hot spot data from National Institute for Space Research- INPE's BDQueimadas database (2014-2023) and deforestation mapping provided by State Secretariat for the Environment- for the Environment of the Amapa- SEMA-AP (1999-2023). Spatial analyses involved overlaying hot spot and deforestation layers with the zoning data of Flota do Amapa. Results indicated that Flota do Amapa has lost approximately 2% of its original forest cover, with a peak in hot spots recorded in 2015 and a marked increase in deforestation between 2007 and 2015- several years after its establishment, being the population, temporary, and primitive one under the greatest pressure. Remote monitoring of human pressure is essential for the management and mitigation of environmental impacts on Flota do Amapa.

Copyright©2025, André L. S. Monteiro et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: André L. S. Monteiro, Marcos R. D. de Almeida, Euryandro R. Costa, Regina M. S. Carvalho, Rafaela D. Amador and Cinthia P. de Oliveira. 2025. "Assessment of Human Pressure on the Amapa state Forest, Amapa, Brazil from 1999 To 2023". *International Journal of Development Research*, 15, (07), 68799-68802.

INTRODUCTION

The Amapá State Forest (Flota do Amapá) was established in 2006 as a Sustainable Use Conservation Unit (UC), with its primary goal being the sustainable exploitation of natural resources, particularly timber, ensuring their long-term availability. It is managed by the State Secretariat for the Environment of Amapá (SEMA-AP). The Flota encompasses communities within and around its boundaries, half of which are located in settlement projects (Amapá, 2014), and as such, it experiences constant human pressure. Pressures include illegal mining, fires, deforestation, unofficial road construction, cattle ranching, and agriculture (Oliveira, 2013; Costa, 2016). Diagnosing human pressure is key to land-use planning and controlling illegal occupation of public lands. This study aimed to detect and quantify human pressure vectors— deforestation and fire hot spots—on the Flota do Amapá between 1999 and 2023, identifying the most pressured zones and evaluating whether the creation of the UC contributed to a reduction in human pressure.

MATERIALS AND METHODS

Study Area: The Flota do Amapá is located in the central-northern region of Amapá state and spans the municipalities of Oiapoque,

Calçoene, Pracuúba, Amapá, Tartarugalzinho, Serra do Navio, Pedra Branca do Amapari, Porto Grande, Ferreira Gomes, and Mazagão (Figure 1). Its vegetation includes lowland and submontane dense ombrophilous forests, savanna areas, anthropized areas, and forest-savanna transition zones. Key economic activities include mining, livestock farming, timber extraction, and extractivism. In 2010, the population of municipalities overlapping the Flota was 108,729 inhabitants, 16% of the state's population (IBGE, 2010). In 2012, the Flota had approximately 5 internal and 58 partially internal or surrounding communities (Amapá, 2014).

Data and Methodology

Hotspot data (2014–2023) were obtained from the BDQueimadas platform (<https://terrabrasil.dpi.inpe.br/queimadas/bdqueimadas/>) using MODIS Aqua-M/Terra sensors. Deforestation mapping was derived from visual interpretation of Landsat 7 and 8 imagery (30m resolution) and Planet imagery (3m resolution) provided by SEMA-AP, covering the period 1999–2023. Deforestation was assessed in three periods: i) 1999–2006: pre-Flota establishment; ii) 2007–2015: 9 years after creation; and iii) 2018–2023: 17 years after creation. Spatial analysis was performed in QGIS 3.28.3-Firenze, and statistics were generated in LibreOffice Calc. According to the Flota's management plan, the forest is divided into 11 zones (Table 1).

DATA AND METHODOLOGY

Hot spot data (2014–2023) were obtained from the BDQueimadas platform (<https://terrabrasilis.dpi.inpe.br/queimadas/bdqueimadas/>) using MODIS Aqua-M/Terra sensors.

Deforestation mapping was derived from visual interpretation of Landsat 7 and 8 imagery (30m resolution) and Planet imagery (3m resolution) provided by SEMA- AP, covering the period 1999–2023. Deforestation was assessed in three periods: i) 1999–2006: pre-Flota establishment; ii) 2007–2015: 9 years after creation; and iii) 2018–2023: 17 years after creation. Spatial analysis was performed in QGIS 3.28.3-Firenze, and statistics were generated in LibreOffice Calc.

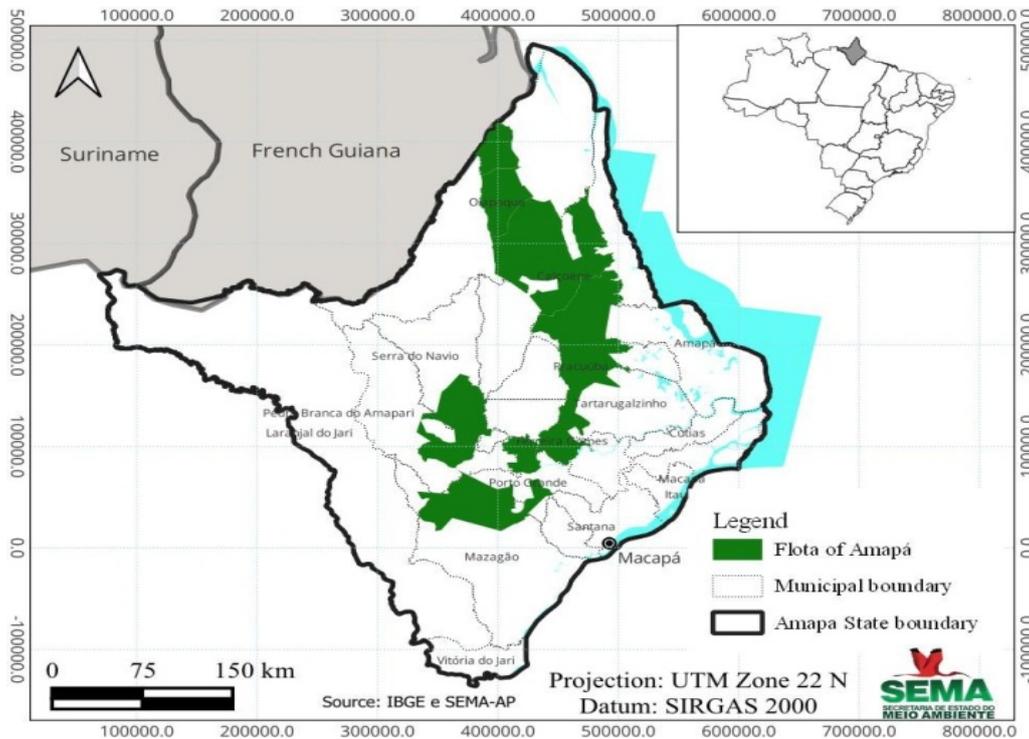


Figure 1. Location of the Amapá State Forest-Flota do Amapá

Table 1. Zoning of the Amapá State Forest- Flota do Amapá (Source: Amapá, 2014)

ZONE	DESCRIPTION
Special	Structures required for the administration of Flota do Amapá
Experimentation	Natural or modified areas where research activities should be prioritized
Community forest management	Designated area to support the needs of the traditional communities residing in and around Flota do Amapá
Sustainable forest management	Area with economic potential for sustainable commercial forest management
Mining	Territories encompassing legally sanctioned mineral reserves and designated easement corridors
Population	Areas inhabited by traditional populations residing within the Flota do Amapá
Primitive	Area with little to minimal human intervention
Recuperation	Areas significantly altered by human activity that, once restored, will be incorporated into permanent zones
Overlap	Portions of Flota do Amapá with spatial overlap involving quilombo communities, protected areas such as National Parks and Sustainable Development Reserves, National Fores zones, military bases, extractive reserves and Private Natural Heritage Reserves
Temporary	Area with permanent or seasonal occupation by community members or regions designated for the expansion of rural settlements
Public use	Area designated to host tourism infrastructure

RESULTS

Hotspots temporal analysis revealed a rise in hotspots in 2015(186) compared to 2014(114). From 2016 to 2021, hotspots decreased from 119 to 34. However, in 2022 and 2023, they rose again to 53 and 90, respectively. Spatially, the zones under the greatest fire pressure were: Temporary zone (59%), Primitive zone (10%), Sustainable Forest Management zone (10%) and Community Forest Management zone (9%) (Figure 2 and 3).

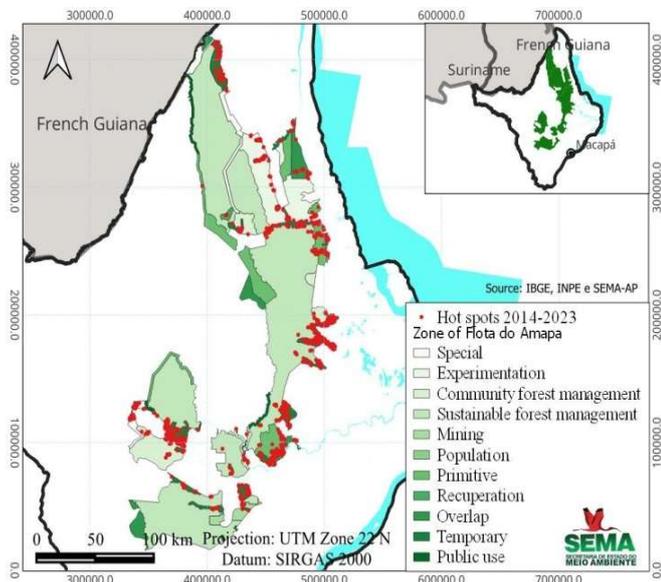


Figure 2. Hotspots mapping on Flota do Amapá (2014-2023)

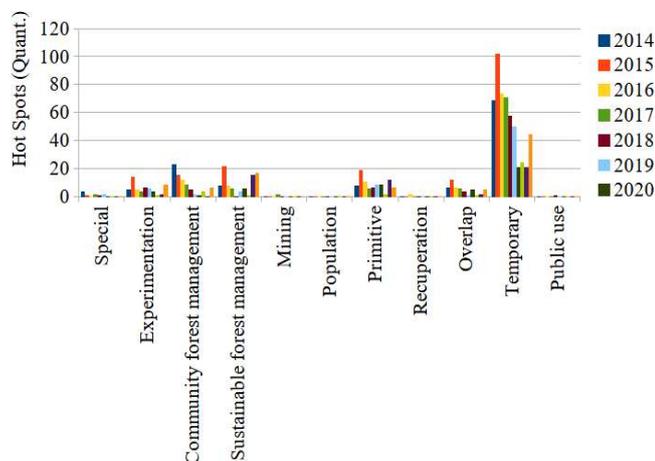


Figure 3. Temporal analysis of hot spots on Flota of Amapá (2014-2023)

Deforestation: Approximately 2% of the Flota’s original forest cover has been lost (Table 2). Most of this deforestation occurred in the populated zone, where 81% of the vegetation was cleared. The temporary zone showed a 14% loss of vegetation, followed by the recovery zones with 11%, and the primitive zone with 4% (Table 2). Assessing deforestation within the Amapá State Forest (Flota do Amapá) by period, it was observed that 38% occurred between 1999 and 2006 (up to the year of the forest’s creation), 52% occurred between 2007 and 2015 (nine years after its establishment), and 9% between 2018 and 2023 (seventeen years after its creation). The spatial analysis of deforestation by zones within the Amapá State Forest (Flota do Amapá) revealed that 59% of this human pressure vector was concentrated in the temporary zone, 17% in the primitive zone, 8% in the sustainable forest management zone, 5% in the overlapping zone, and 4% in the community forest management zone (Figures 4 and 5).

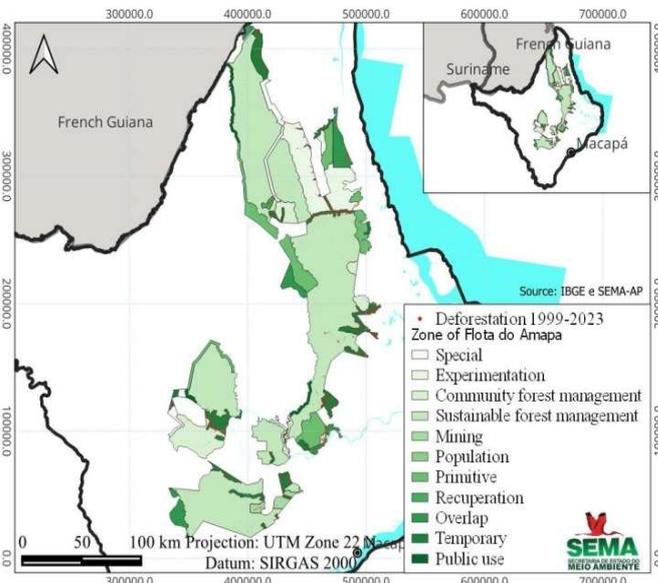


Figure 4. Deforestation mapping on Flota do Amapá (1999-2023)

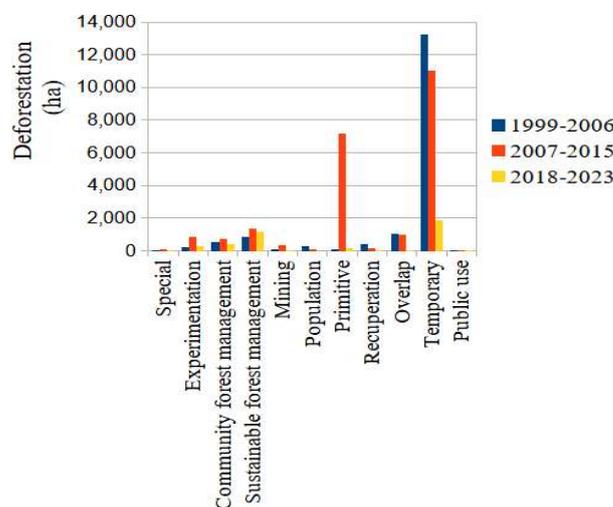


Figure 5. Temporal analysis of deforestation by period (1999-2006, 2007-2015, 2018-2023) by zone on Amapá State Forest-Flota do Amapá

DISCUSSION

Human pressure through deforestation and fire occurred across all zones but was most critical in the Temporary zone, where communities maintain economic activities such as agriculture and livestock. This zone also includes areas of settlement expansion, which likely increased pressure on the Flota. Silva & Parise (2023) found higher fire densities near settlements and highways from 2012 to 2021.

The Primitive one was also critically impacted, especially from 2007 to 2015, and it contains the headwaters of the Araguari, Falsino, Cassiporé, Amapá Grande, and Calçoene rivers, as well as savanna ecosystems with endemic species and savanna-forest transition areas. According to Pereira et al. (2024), recurrent fires eliminate up to 71% of forest biomass, altering structure, diversity, and species composition, pushing forests toward collapse.

Zones designated for sustainable and community forest management also experienced pressure. These zones are targets for future forest concessions—both remunerated and non-remunerated—making the implementation of concession processes urgent to prevent further degradation. The increase in pressure after the Flota’s creation may be linked to uncertainty and lack of awareness among communities during the participatory management plan process (Amapá, 2014).

Another hypothesis is the increase in land registrations in the SIGEF system—496% in 2015 and 182% in 2016 (Source: <https://g1.globo.com/ap/amapa/noticia/quase-40-de-area-de-floresta-no-ap-foi-cedida-ilegalmente-para-propriedades-privadas-diz-mp.ghtml>). The reduction in pressure from 2017–2018 may be due to finalization of the management plan and intensified inspections by SEMA-AP.

REFERENCES

- Amapá, 2014- Plano de Manejo da Floresta Estadual do Amapá, Resumo Executivo, Instituto Estadual de Florestas do Amapá-IEF/AP, 65p. In portuguese.
- C. A. Pereira, J. Barlow, M. Tabarelli, A. L. Giles, A. E. M. Ferreira and I. C. G. Vieira. Recurrent wildfires alter forest structure and community composition of terra firme Amazonian forests. *Environmental Research Letters*, 19 (2024) 114051. Disponível em: <https://doi.org/10.1088/1748-9326/ad77e6>.
- C. P. Oliveira. Uso do solo e suas mudanças na fronteira Brasil-Guiana Francesa, Módulo IV da FLOTA/APE entorno. 2013. 74f. Monografia (TCC em Geoprocessamento) – Coordenadoria do Curso de Engenharia Florestal, Universidade do Estado do Amapá. In portuguese.
- E.R. Costa. Conflitos Socioambientais e Governança em Unidades de Conservação: o caso da Floresta Estadual do Amapá (FLOTA/AP). Dissertação de Mestrado. Núcleo de Meio Ambiente/ UFPA, 2016, 135f. In portuguese.
- Instituto Brasileiro de Geografia e Estatística (IBGE). Censo Brasileiro de 2010. Rio de Janeiro: IBGE, 2012. In portuguese.
- P. A. T. da Silva Jr & F. J. O. Parise. Análise dos focos de calor na Floresta Estadual do Amapá entre os anos de 2012 e 2021. *Revista Arquivos Científicos (IMMES)*. Macapá, AP, Ano 2023, v.6, n.1, p.1-6- ISSN 2095-4407. In portuguese.
