

Executive Summary

Report on the Forest Component
of the Monitora Program
(2014 to 2022)



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Our planet is currently experiencing a biodiversity crisis, characterized by high rates of species loss and ecosystems degradation, which in many cases affects their functions and reduces their capacity to provide services. One of the main strategies for conserving biodiversity is the creation and maintenance of protected areas. However, there is limited information on the effect on biodiversity of protecting those areas. Furthermore, information on population trends in the protected areas is also important as it will help managers make better-informed decisions.

The Monitora Program was created by the *Instituto Chico Mendes* (Chico Mendes Institute for Biodiversity Conservation – *ICMBio*)¹ with the goal of generating information to assess the effectiveness of the National

System of Protected Areas, for climate change adaptation, and conservation and management of biodiversity. Additionally, the information generated is fundamental to propose conservation strategies for endangered species and to control invasive exotic species.

The Monitora Program is divided into three subprograms, and each subprogram is subdivided into two to three components, corresponding to the surveyed ecosystems or environments (Figure 1). In total, the Program surveys 21 target species or groups of species.

Currently established in 115 federal protected areas, the Monitora Program is the largest *in situ*² biodiversity monitoring program in Latin America.

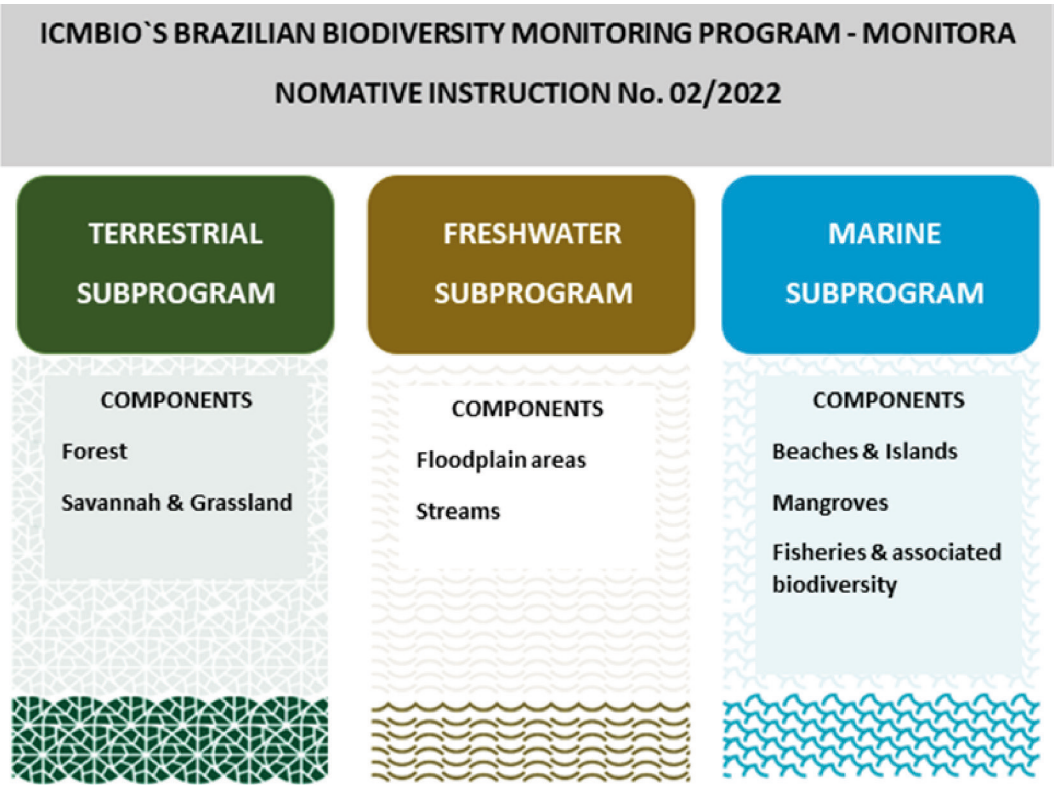


Figure 1 – The Monitora Program is divided into three sub-programs and nine components, each representing one ecosystem or environment monitored.

¹ Instituto Chico Mende de Conservação da Biodiversidade is the Brazilian federal governmental institution responsible for managing protected areas and for the conservation of biodiversity, linked to the Ministry of Environment and Climate Change.

The Monitora Program uses simplified, low-cost protocols, allowing participation of several stakeholders, including local communities. The Forest Component was the first to be structured, and the following target groups were monitored: i. plants, ii. fruit-feeding butterflies, iii. birds, and iv. mammals. This Executive Summary presents the main findings of the Forest Component Basic Module Report for the period of 2014-2022.

The data collection design was as follows: in each protected area, at least three sampling stations (SS) were installed in forest areas with the least possible anthropogenic interference. Each sampling station contained a set of sampling units (SU) of the selected targets (Figure 2).

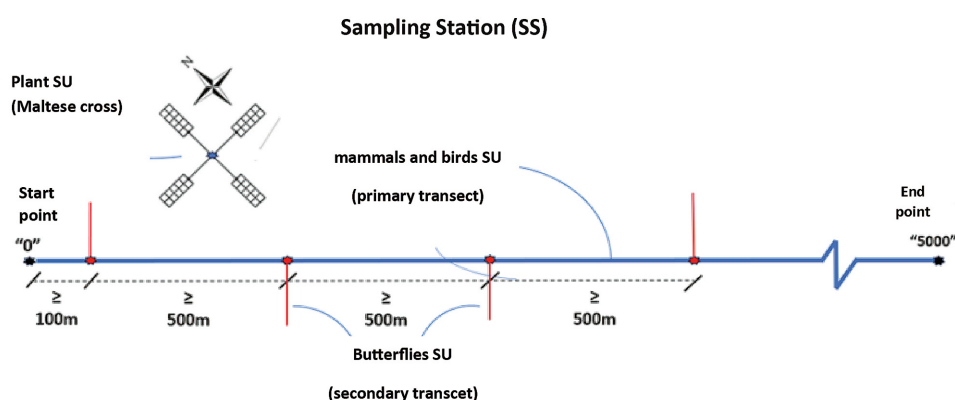


Figure 2 – Schematic representation of a Sampling Station (SS) in the Forest Component monitoring protocol. Each SS is made up of one sampling unit (SU) for plants, one for mammals and birds, and four for butterflies.



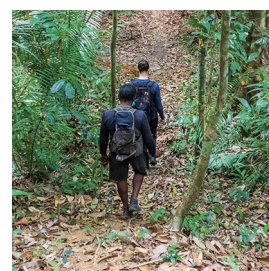
Photo archive PARNA Jaru



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Implementation



Data collection began in 2014, with 16 protected areas (PAs) sampled in the first two years. In 2016, after the adoption of the Monitora protocols by ARPA³ (Amazon Region Protected Areas Program), the number of PAs in the Programa grew by 194%, reaching 47 PAs

in 2019. In 2020, the Covid-19 pandemic reduced this number by about 50%, but in 2021 there was a recovery, with some PAs resuming their sampling and the inclusion of new PAs. In 2022, the total of PAs in operation surpassed the number registered before the pandemic, with 24 PAs (42%) consolidated, meaning they had at least three SS sampling of all targets (Figure 3).

² *In situ* monitoring: monitoring that collects data in the field.

³ The Amazon Protected Areas Program (ARPA) is the largest tropical forest protection initiative in the world. It is implemented by Brazil with resources from international and national donors, such as the World Bank. It is the main source of funding for the implementation of the Monitora Program in the Amazon Protected Areas. For more information, visit: https://www.funbio.org.br/programas_e_projetos/programa-arpa-funbio/

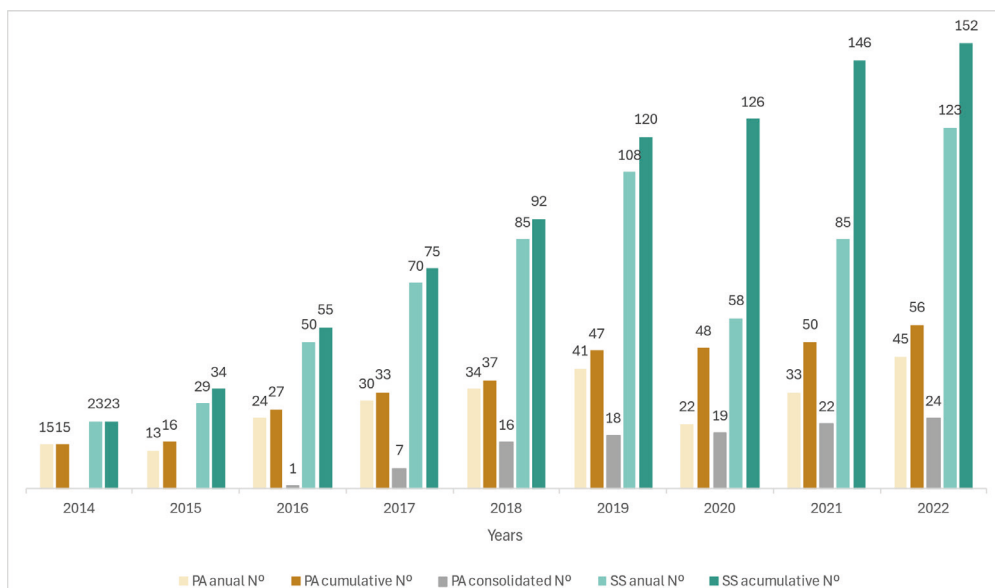


Figure 3 – Annual growth of number of protected areas (PAs) in the Monitora Program and number of Sampling Stations (SS) implemented. A Protected Area is considered consolidated when it has implemented all basic protocols in at least three SS.

From 2014 to 2022, sampling was carried out in 152 SSs and 789 SUs distributed in 56 PAs, 41 of which (73%) were supported by the ARPA Program. The monitored PAs are in 18 states and three biomes: 44 (78.6%) in the

Amazon, six (10.7%) in the Atlantic Forest and six (10.7%) in the Cerrado. In terms of their management goals, 18 PAs belong to the group of sustainable use and 38 to the group of full protection (Figure 4).

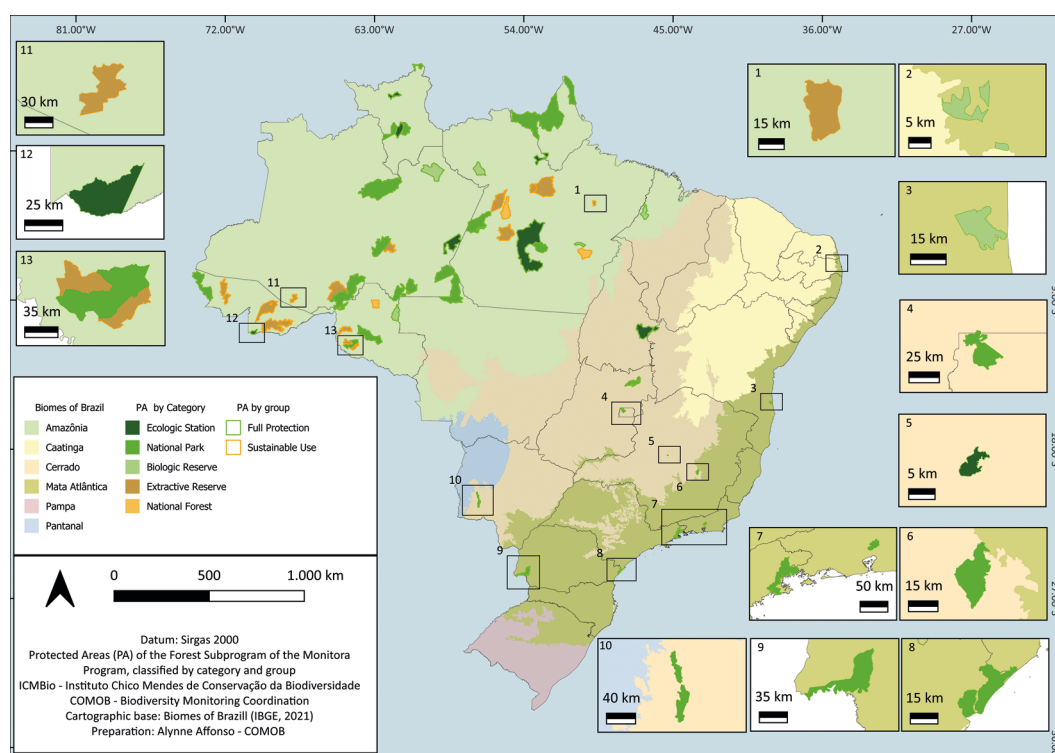


Figure 4 – Protected areas (PAs) in the Forest Component of the Monitora Program, categorized by biome. Data from 2024.

Plants



The protocol consists of measuring the circumference of the trunk at breast height (CBH) and the height of all trees with a CBH equal or greater than 31 cm, in each of the SUs (Maltese cross), with re-sampling every five years.

By 2022, the Monitora Program’s plant protocol had been implemented in 46 PAs, distributed over 110 plant SUs, of which 37 PAs (96 SUs) were in the Amazon, six (6) PAs (8 SUs) in the Cerrado and three (3) PAs (6 SUs) in the Atlantic Forest. In total, 25,816 trees were marked and measured.

This protocol establishes re-sampling every five years, therefore the results are still in their early stages, as 65% of the PAs have not yet been re-sampled.

Therefore, we were able to analyze temporal trends from only four PAs with three SUs and three PAs with two resampled SUs.

So far, results indicate that, in general, the Forest environments are in a good state of preservation and the variables assessed have remained stable, suggesting that most of the monitored forests have maintained the same structural characteristics throughout the monitoring period (Figure 5).

Although preliminary, the results are reassuring as forests that are more resilient and less susceptible to the direct impacts of human activities play an important role in carbon sequestration and storing. In addition, the stability of the monitored forests indicates that they are not suffering significant impacts, and that PAs have been effective in conserving biodiversity.

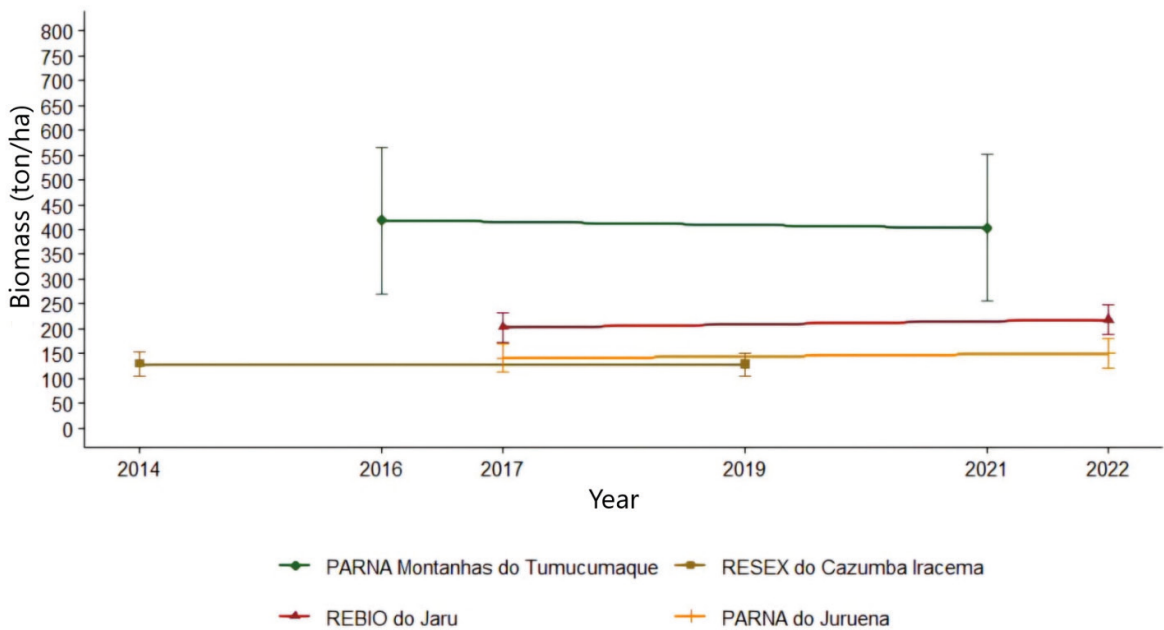


Figure 5 — Biomass (mean and standard deviation) in the four protected areas with three SUs sampled from 2014 to 2022.



Photo archive REBIO Jaru



Daniel Resende



Paulo Labiak

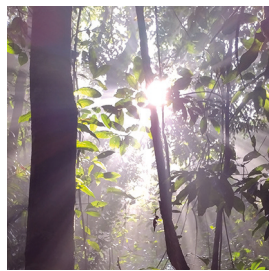


Photo archive FLONA do Tapajós



João Rafael Martins

Fruit-feeding butterflies



The protocol consists of monitoring the relative abundance of fruit-feeding butterfly tribes⁴ captured using bait traps. Individuals are identified at the tribe level and resampled annually.

The Monitora Program recorded 85,386 fruit-feeding butterflies across 51 federal protected areas, with a total sampling effort of 90,320 trap-days. The monitoring allowed the discovery of new species for science and new occurrences in Brazil. Overall, the abundance index of indicator butterfly tribes of dense/

preserved and open/disturbed forests has remained stable over the years, without showing consecutive significant increases or decreases (Table 1).

Climatic and environmental events seem to substantially influence the increase or decrease of indicator tribes at a regional level. This is evident in the eastern and southeastern regions of Amazon, known as the “arc of deforestation”, where trends of decreasing abundance have been observed in most years. Local disturbances amplify this effect, as demonstrated by the increase in the abundance of open forest indicator tribes in Acre State, caused by the fall of bamboo trees, as detailed in the full report.

Amazon	2014	2015	2016	2017	2018	2019	2020	2021	2022
Central									
Butterflies Indicators of dense forest	<i>i0</i>	↓	↑	↓	↑	↑	↑	↑	↑
Butterflies Indicators of open forest	x	x	<i>i0</i>	↑	↑	↓	↓	↑	↑
Southwest									
Butterflies Indicators of dense forest	x	x	<i>i0</i>	↑	↑	↑	↑	↑	↑
Butterflies Indicators of open forest	x	x	<i>i0</i>	↓	↓	↑	↓	↓	↓
East									
Butterflies Indicators of dense forest	x	x	<i>i0</i>	↑	↓	↓	↓	↑	↓
Butterflies Indicators of open forest	x	x	x	<i>i0</i>	↓	↓	↓	↓	↓
North									
Butterflies Indicators of dense forest	x	x	x	x	<i>i0</i>	↑	↓	↑	↑
Butterflies Indicators of open forest	x	x	x	x	<i>i0</i>	↑	↓	↓	↓
Southeast									
Butterflies Indicators of dense forest	x	x	<i>i0</i>	↓	↓	↓	x	↓	↓
Butterflies Indicators of open forest	x	x	x	x	x	x	x	x	x
Cerrado									
Butterflies Indicators of dense forest	x	<i>i0</i>	↑	↓	↑	↑	x	↑	↑
Butterflies Indicators of open forest	<i>i0</i>	↑	↑	↑	↑	↑	x	↓	↑
Atlantic Forest									
Butterflies Indicators of dense forest	x	<i>i0</i>	↓	↓	↓	↓	x	↓	↓
Butterflies Indicators of open forest	x	x	<i>i0</i>	↓	↓	↓	x	↓	↓

Table 1 – **Population Trend Index** - A first occurrence was considered when the sum of the abundances of the indicator tribes in the year was ≥ 20 individuals. The abundance index of the first occurrence (*i0*) was standardized as 1.0. Values above 1.0 indicate population increase (↑) and below 1.0 population decrease (↓) in relation to the first year of occurrence. Green indicates stability in the value of the index compared to the first year, yellow indicates that the value has increased or decreased reasonably from the mean (mean ± 1 standard deviation), and red indicates an extreme variation from the mean (mean ± 2 standard deviations).

⁴ According to biological systematics and taxonomy, a tribe is a classification level of a given group of living beings, positioned between the subfamily and genus levels. The protocol for monitoring fruit-feeding butterflies uses the classification of butterfly tribes belonging to the Nymphalidae family.

Mammals and Birds



The protocol consists of walking along a 5km trail (linear transect), recording and taxonomically identifying individuals by means of direct visualization and the perpendicular distance between the animal and the trail. Re-sampling takes place annually.

Between 2014 and 2022, the protocol for medium and large terrestrial mammals and ground-dwelling game birds was implemented in 53 federal PAs in the Amazon, Cerrado and Atlantic Forest biomes, totaling around 25,000 Km covered in 140 SUs sampled.

During this period, 22,985 records were obtained of 131 species and 60 genera of mammals and 29 species and 13 genera of birds. Most of the records corresponded to diurnal species of the mammal orders Primates and Rodentia, and the bird orders Galliformes and Tinamiformes.

Thirty-five endangered species were recorded, 29 mammals and six birds, equivalent to 8% of all records. Invasive species were rare, with only three records in two PAs in the Atlantic Forest Biome.

Most populations remained stable. The analysis of population trends, including 161 populations of 49 species with more robust data, revealed that 148 (91.9%) showed no significant variation, while two (1.2%) showed an upward trend and 11 (6.8%) showed a downward trend.

The biodiversity trend index remained stable throughout the monitoring period (Figure 6) suggesting that the protected areas monitored have been effective in conserving the species targeted by the monitoring program. It should be noted that the time series is still relatively short and that the species with the best data are mostly common and ecologically flexible.

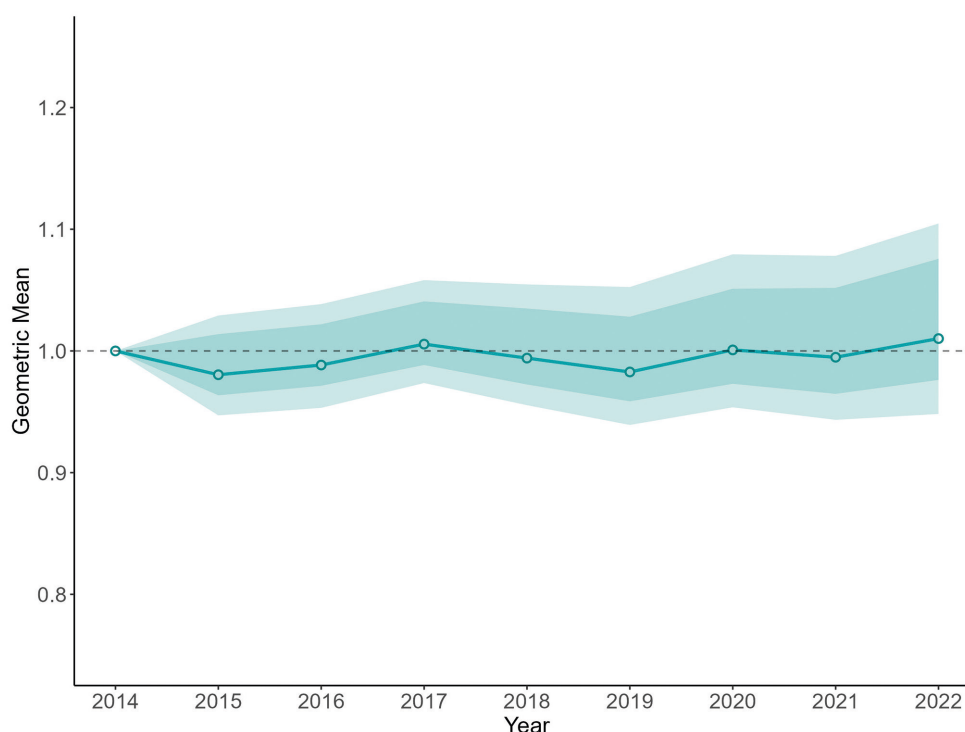


Figure 6 — Geometric mean of relative abundance estimates for 161 monitored populations. The blue line corresponds to the mean values; shaded blue bands (90 and 95% confidence intervals).

In addition to assessing the effectiveness of protected areas, the Monitora Program has also

contributed to the process of assessing the risk of extinction of Brazilian mammals and bird species.

Final Considerations



The results obtained through the Monitora Program indicate that the federal protected areas analyzed so far fulfill their role of conserving biodiversity, considering the four targets addressed: plants, fruit-feeding butterflies, mammals, and birds. The time series is still too short to draw long-term conclusions, but the establishment of the Monitora as an ICMBio institutional program provides reassurance that this is a long-term project that will be maintained and consolidated.

As a strategy for implementing the Monitora Program in the coming years, priority will be given to consolidating the protocols for all the targets

and implementing monitoring in areas with low sample representativeness. In addition, there is a need to prioritize analyses that include climate and environmental parameters to better understand the effects of climate and environmental changes on biodiversity in protected areas.

An important advance in the report presented here is the development of interactive dashboards (available in the QR Code at the end of this summary) that allow managers and society to access the results of the different targets for each protected area, enabling them to be used as a direct subsidy to their management. The dashboards will be updated annually as soon as the data collected in the field is validated, eliminating the time lag for making the results available.

The full report is available at:

<https://www.gov.br/icmbio/pt-br/assuntos/monitoramento/conteudo/relatorios/RelatorioFlorestal20142022.pdf>

The Forest Component Report's interactive dashboard is available at:

<https://www.gov.br/icmbio/pt-br/assuntos/monitoramento/painel-interativo-relatorio-florestal>

Learn more about Monitora Program at:

<https://www.gov.br/icmbio/pt-br/assuntos/monitoramento>



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This Executive Summary was translated into English by Maria Luisa Silva Pinto Jorge and Juliana Carvalho Frota Mattos

Credits for the cover photos:

- 1- Jônatas Lima (*S. weddelli melanoleucus* – sagui-de-manto-branco)
- 2- Silvana Cristina Silva da Ponte (forest at Tapajós National Forest)
- 3- Silvana Cristina Silva da Ponte (*Cithaerias* spp. – translucent butterfly)
- 4- Arquivo PARNA Jaru (*Pauxi* sp. – mutum)
- 5- Arquivo PARNA Jaru (*Panthera onca* – jaguar)
- 6- Daniel Resende (forest at Jari Ecologic Station)
- 7- Jônatas Lima (*Colobura dirce* – zebra butterfly)
- 8- Jéssica dos Anjos (*Penelope pileata* – Jacupiranga)

