



Environmental-Economic Accounting

# Ecosystem Accounting

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Threatened Species in Brazil  
2014

Photo: Bárbara Araújo R. Bergamini





# Presentation

Brazil is home to an important portion of the planet's biodiversity. This abundant variety of life – which translates into more than 20% of the total number of known species on Earth – makes Brazil one of the 17 megadiverse countries. With its continental dimension, Brazil has several terrestrial, aquatic and marine ecosystems distributed across six biomes: Amazônia, Cerrado, Caatinga, Mata Atlântica, Pampa, and Pantanal. Biodiversity generates countless direct and indirect benefits to economic activities and society's well-being. The increasing loss of biodiversity is currently perceived by experts from important international multilateral organizations as a risk to the economic system, as it generates an imbalance in the ecosystem, having strong implications for humanity, such as food insecurity, risks to human health, climate change, risks to business, among others. In this context, pressures on species, leading to greater risks of extinction and the consequent collapse of ecosystems, imply high impacts on society and the economy. IBGE, aiming to recognize the importance of integrating environmental data into the System of National Accounts, presents the results of the Threatened Species Accounts, carried out in the scope of Ecosystem Accounting, following the System of Environmental-Economic Accounting (SEEA).

This first version was prepared with data from the Red List of the *International Union for Conservation of Nature* (IUCN), National Lists of Threatened Species of Brazilian fauna and flora (MMA Ordinances No. 443, 444 and 445/2014) and additional information provided by the Chico Mendes Institute for Biodiversity Conservation (ICMBio) and the Brazilian National Center for Plant Conservation of the Rio de Janeiro Botanic Garden Research Institute (CNCFlora/JBRJ). The work developed contributes to the implementation of the international methodology System of Environmental Economic Accounting - Experimental Ecosystem Accounting - SEEA-EEA developed by the United Nations Statistics Division (UNSD), and was undertaken under the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project, funded by the European Union.

# Methodology

This publication presents a first approximation of the Threatened Species Accounts for Brazil. As a contribution to the SEEA-EEA international methodological development efforts, an application of the methodology proposed in the manual was carried out, based on global data from the IUCN Red List for assessed species in South America, with compilation of accounts for the years of 2010, 2014 and 2018, and the calculation of a simplified version of the Red List Index in different spatial and ecological profiles, enabling an analysis of trends in conservation status. In addition, as a starting point for future editions of the Threatened Species Accounts, a synthesis of the data from the National Lists of Threatened Species of Brazilian fauna and flora is presented, resulting from the assessments of the conservation status of the species of fauna and flora published by ICMBio and CNCFlora/JBRJ, respectively. Based on the data from the National Lists, the numbers of species by threat category are presented, disaggregated by the different Brazilian biomes and realms (terrestrial, fresh water and marine), as well as synthesis maps of information on the distribution of threatened species in the national territory. The results presented demonstrate an extensive potential for the Threatened Species Accounts, considering the amount of information that can be compiled. The application of the SEEA-EEA methodology based on global data allowed an efficient workflow, transferable to national data. Once updates to the National Lists are produced, it will be possible to update the indicators and statistics evaluated from experience with global data, as well as produce additional indicators. The information presented in this first version can be additionally organized in different configurations, allowing to assess other associations with space, types of environments or subgroups of organisms, in order to address several issues about national biodiversity. Additionally, it will be possible to integrate this information with the next editions of the Ecosystem Accounts. In future versions, an increase in the precision and detail of the information is expected as new data on areas of occurrence of the species are produced and the assessment of a larger set of species is produced. In addition, Threatened Species Accounts are expected to be a starting point for the institutional arrangements necessary for an ever-increasing integration of biodiversity information into decision-making processes, allowing for the preparation of other types of Species Accounts and favoring the production of environmental statistics and indicators based on the best scientific knowledge available.



Photo: Mauro Lambert Ribeiro



Photo: Leonardo Lima Bergamini



Ecosystem accounting is a coherent and integrated approach for measuring the assets and the ecosystem service flows in these ecosystems for economic and other human activities. Ecosystem accounting complements environmental asset accounting, as described in the Central Framework of the System of Environmental-Economic Accounting (SEEA-CF/UN), in which environmental assets are accounted for as individual resources, for example, water and wood. Embedding ecosystems in standardized accounting frameworks can help integrate environmental and ecosystem assets, as well as service flows, into decision-making and then promote more efficient and sustainable choices in resource management.

In the context of Ecosystem Accounts, the information collected during the process of assessing the risk of extinction of species allows the production of relevant statistics and indicators. Such data allow cross-referencing information from specific groups such as species associated with a certain type of environment or species affected by a particular threat, generating maps aimed at evaluating specific practical issues. In the particular case of the Threatened Species Accounts, the intended approach is the crossing between the spatially explicit information on the distribution of ecosystems and the species associated with them, with their respective conservation status, in the Brazilian territory. This type of information, together with other SEEA-EEA accounts, such as extent accounts by ecosystem type and ecosystem service accounts, are particularly relevant to understand the relationship of dependence between biodiversity and ecosystem services aiming at inclusive and sustainable development.

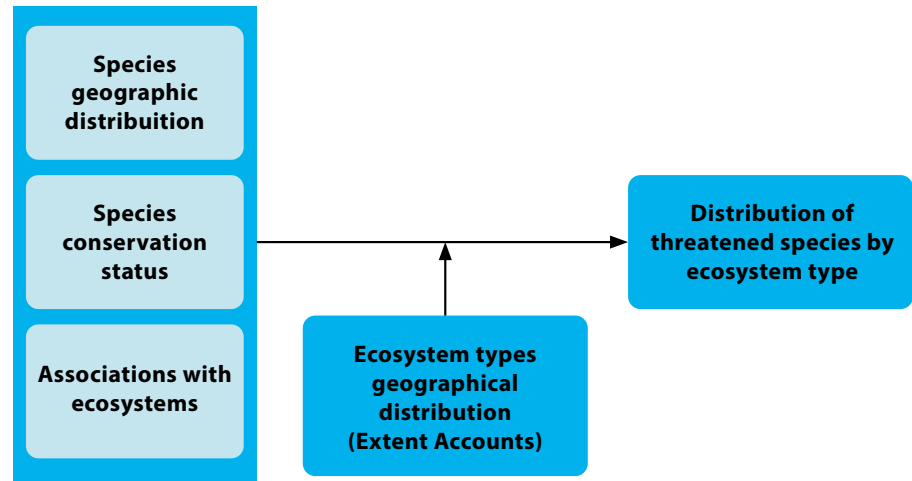


Figure 1: Diagram of the integration between the different Ecosystem Accounts and their Thematic Accounts.

The conservation status of each species is defined based on information about the distribution area, population trends, species ecology and threats to which they are exposed according to standardized and objective technical criteria. The classification covers nine categories, three of which are considered threatened: Critically Endangered - CR, Endangered - EN or Vulnerable - VU. For the purposes of Brazilian legislation, the category Extinct in the Wild (EW) is also considered to be threatened, and the categories Data Deficient - (DD) and Near Threatened (NT) are considered as priorities for research regarding their conservation status.

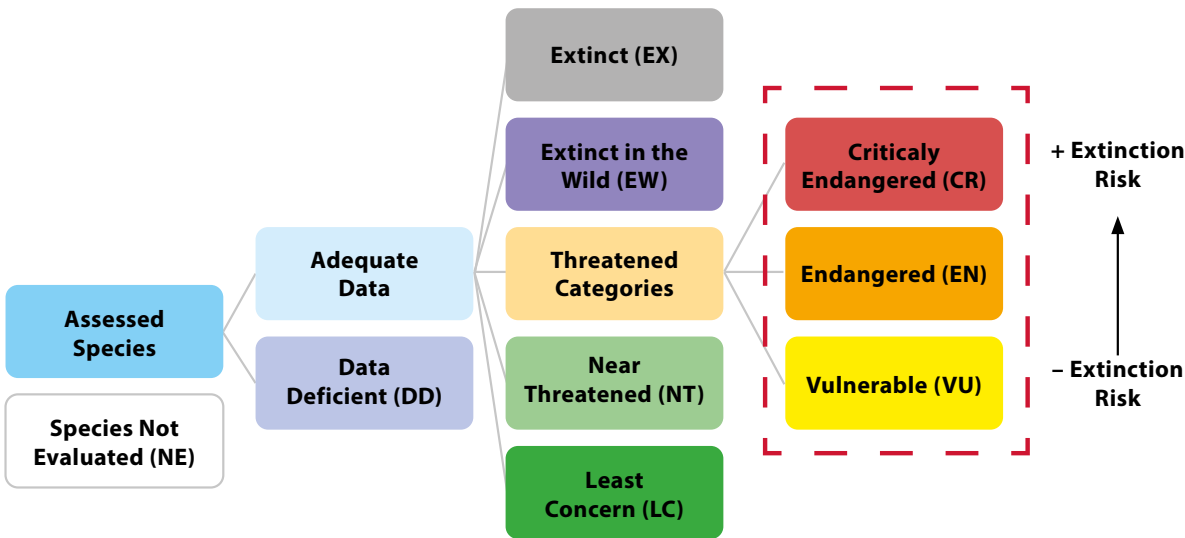
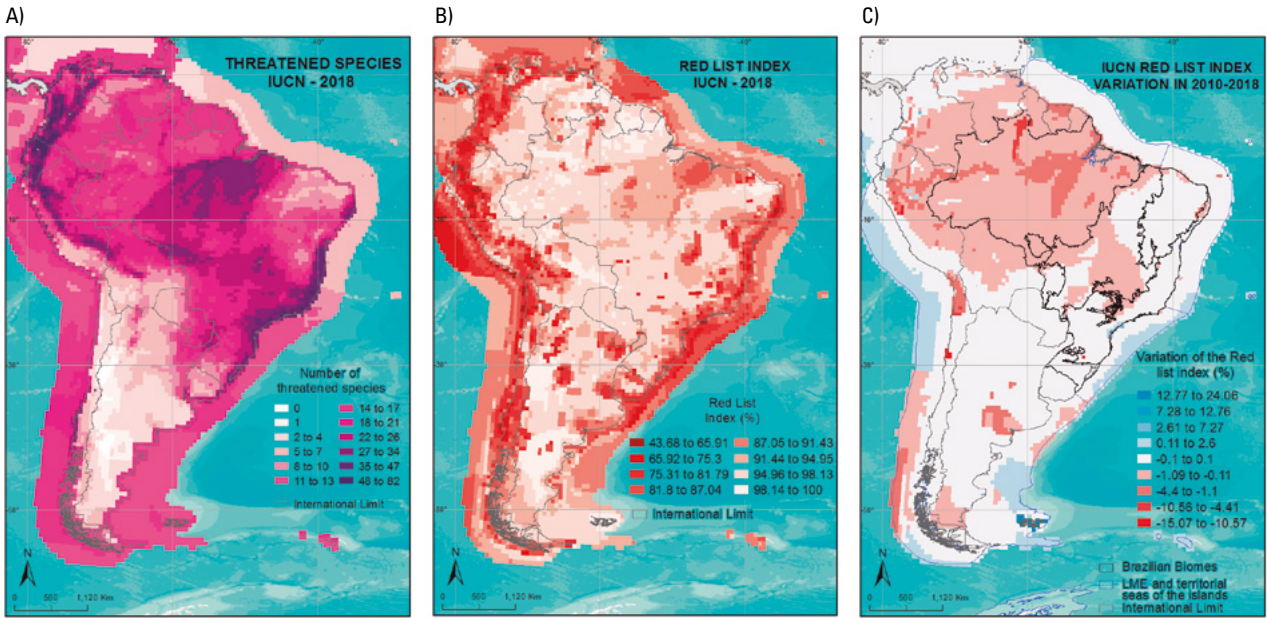


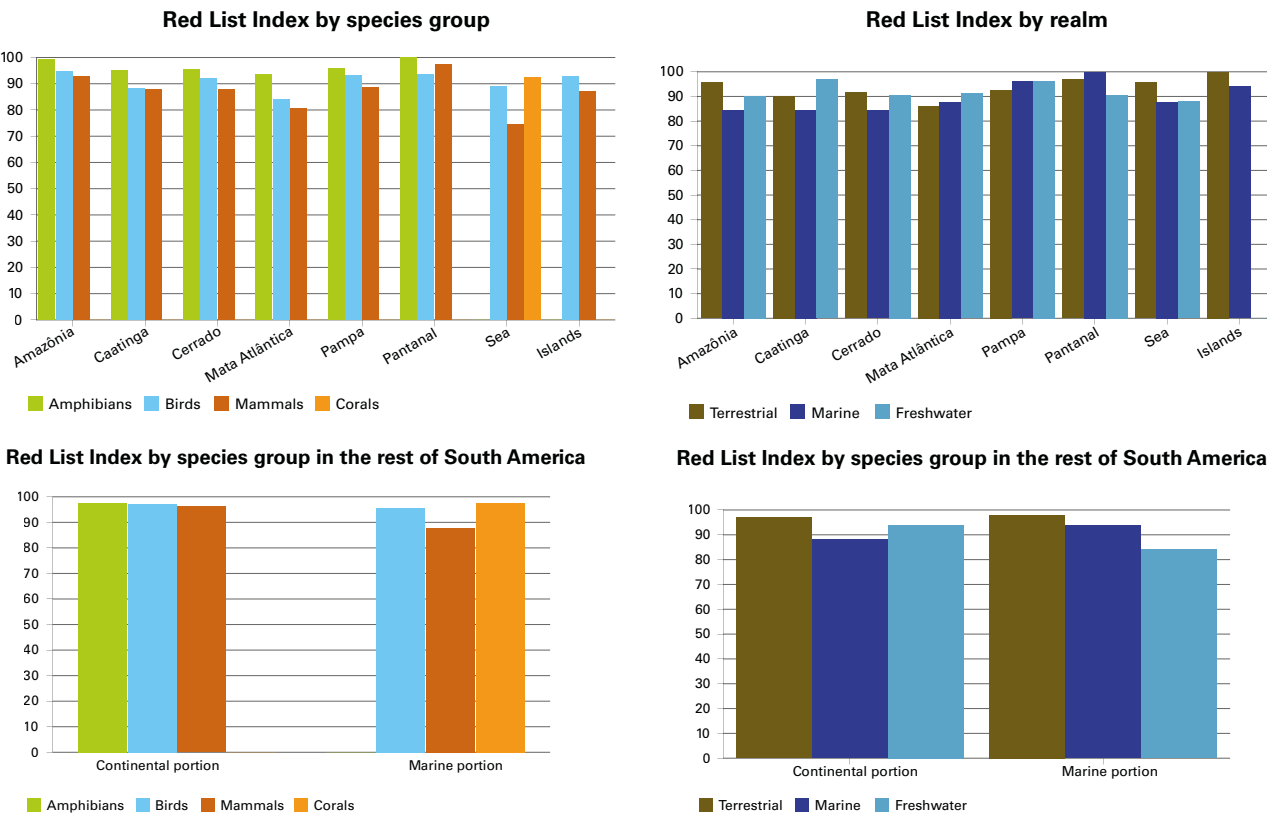
Figure 2 - Structure of the categories for preparing the Red List by the IUCN.

With respect to the monitoring of species conservation status trends, a relevant indicator is the Red List Index (RLI). This index allows the comparison of trends in the conservation status of the species assessed between different territorial areas and/or taxonomic groups. This is possible because it presents a value weighted by the total number of species assessed, considers only genuine category changes and numerically assesses the extinction risk categories. This makes it possible to compare trends between delimitations with different numbers of species, such as, for example, the different realms and biomes considered here.

Threatened Species (birds, amphibians, mammals and reef-forming corals) from South America. A) The Andes, Southern Amazônia, Cerrado and Mata Atlântica regions stand out for a high number of threatened species; B) There are, for example, low values (i.e. indicating worse conservation status) of the index in the Mata Atlântica, especially in the northern portion of the biome, as well as in the marine portion of the south and southeast regions in Brazil, in addition to areas such as the Andes and plateau regions such as Chapada Diamantina and Chapada dos Veadeiros; C) The greatest deteriorations in the conservation status of species are concentrated in the Amazon Basin. Improvements can be seen in some points, such as a portion of the Southeast coast of Brazil and isolated points in Peru and Ecuador.



Amphibians have the best conservation status, with higher RLI values, while mammals, especially marine ones, have the lowest values. Among the realms, the best conservation status is observed for the terrestrial species of the Brazilian oceanic islands and the marine species that occur in the Pantanal (for example, sea birds that also occur in this biome).



**Table 1: Threatened Species Accounts by terrestrial, fresh water and marine realms, for the years 2010, 2014 and 2018.**  
**EX = extinct; EW = extinct in the wild; CR = critically endangered; EN = endangered; VU = vulnerable; NT = near threatened; LC = least concern; DD = data deficient.**

	Terrestrial especies									Freshwater especies									Marine especies									Total								
	EX	EW	CR	EN	VU	NT	LC	DD	Total	EX	EW	CR	EN	VU	NT	LC	DD	Total	EX	EW	CR	EN	VU	NT	LC	DD	Total	EX	EW	CR	EN	VU	NT	LC	DD	Total
Opening stock 2010	3	1	32	69	113	149	2182	305	2854	1	-	4	8	26	31	752	177	999	-	-	1	8	14	10	158	36	227	3	1	33	72	117	152	2206	347	2931
Additions																																				
Improvement in the conservation status	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	
Worsening in the conservation status	-	-	3	3	21	27	-	-	54	-	-	2	-	3	4	-	-	9	-	-	-	1	-	1	-	-	2	-	-	3	3	21	27	-	-	54
Advances in knowledge	-	-	4	10	13	22	95	7	151	-	-	1	1	-	5	19	5	31	-	-	-	-	1	2	10	-	13	-	-	4	10	13	18	99	7	151
Total Additions	-	-	7	13	35	49	95	7	206	-	-	3	1	3	9	19	5	40	-	-	-	1	1	3	10	-	15	-	-	7	13	35	49	95	7	206
Reductions																																				
Improvement in the conservation status	-	-	-	-1	-	-	-	-	-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1	-	-	-	-	-1
Worsening in the conservation status	-	-	-	-1	-1	-7	-45	-	-54	-	-	-	-	-	-4	-5	-	-9	-	-	-	-	-1	-	-1	-	-2	-	-	-	-1	-1	-7	-45	-	-54
Advances in knowledge	-	-	-1	-3	-2	-8	-4	-1	-19	-	-	-	-	-	-	-1	-	-1	-	-	-	-1	-1	-	-	-	-2	-	-	-1	-3	-2	-8	-4	-1	-19
Total reductions	-	-	-1	-5	-3	-15	-49	-1	-74	-	-	-	-	-	-4	-6	-	-10	-	-	-	-1	-2	-	-1	-	-4	-	-	-1	-5	-3	-15	-49	-1	-74
Stable Reassessments	-	1	17	33	71	96	1452	15	1685	-	-	2	4	15	12	475	16	524	-	-	1	5	10	9	138	12	175	-	1	18	34	72	98	1462	28	1713
Opening stock 2014	3	1	38	77	145	183	2228	311	2986	1	-	7	9	29	36	765	182	1029	-	-	1	8	13	13	167	36	238	3	-	39	80	149	186	2252	353	3063
Additions																																				
Improvement in the conservation status	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	1	1	-	-	2
Worsening in the conservation status	-	-	1	1	3	3	-	-	8	-	-	-	1	1	2	-	-	4	-	-	-	-	-	2	-	-	2	-	-	1	1	3	3	-	-	8
Advances in knowledge	1	-	3	16	16	12	207	24	279	-	-	1	1	1	3	29	-	35	-	-	-	-	1	4	11	-	16	1	-	3	17	16	16	215	24	292
Total Additions	1	-	4	17	19	16	207	24	288	-	-	1	2	2	5	29	-	39	-	-	-	-	2	6	11	-	19	1	-	4	18	20	20	217	24	304
Reductions																																				
Improvement in the conservation status	-	-	-	-	-1	-	-	-	-1	-	-	-	-	-	-	-	-	-	-	-	-	-1	-	-	-	-	-1	-	-	-	-1	-1	-	2	-	-
Worsening in the conservation status	-	-	-	-1	-1	-2	-4	-	-8	-	-	-	-	-1	-1	-2	-	-4	-	-	-	-	-	-	-2	-	-2	-	-	-	-1	-1	-2	-4	-	-8
Advances in knowledge	-	-	-4	-8	-9	-13	-6	-10	-50	-	-	-	-1	-	-	-	-3	-4	-	-	-	-	-	-1	-	-14	-15	-	-	-4	-8	-9	-13	-6	-25	-65
Total reductions	-	-	-4	-9	-11	-15	-10	-10	-59	-	-	-	-1	-1	-1	-2	-3	-8	-	-	-	-1	-	-1	-2	-14	-18	-	-	-4	-10	-11	-15	-10	-25	-75
Stable Reassessments	-	1	23	48	101	133	1753	50	2109	-	-	3	5	16	19	407	7	457	-	-	1	7	11	11	151	3	184	-	1	24	50	103	135	1761	53	2127
Closing stock 2018	4	1	38	85	153	184	2425	325	3215	1	-	8	10	30	40	792	179	1060	-	-	1	7	15	18	176	22	239	4	1	39	88	158	191	2459	352	3292

Source: INTERNATIONAL UNION FOR CONSERVATION OF NATURE. The IUCN red list of threatened species. Version 2018.2.  
Gland: IUCN, 2018.

Note: Some species can inhabit more than one realm, which is why the tables do not total the assessed species.

From systematic assessments, it is possible to build a Threatened Species Account, following an accounting model, as proposed by the SEEA-EEA. Such an account summarizes the assessment of the conservation status of species over time, allowing the monitoring of stocks and changes of species between categories. The information from the threatened species accounting also allows the monitoring of the assessment process itself, by showing, for example, the number of species assessed for the first time and in subsequent years.

• **Opening/closing stock:** number of species in each category in each year of the period assessed. Aggregation by species groups or ecosystem type allows you to follow trends in these interest groups.

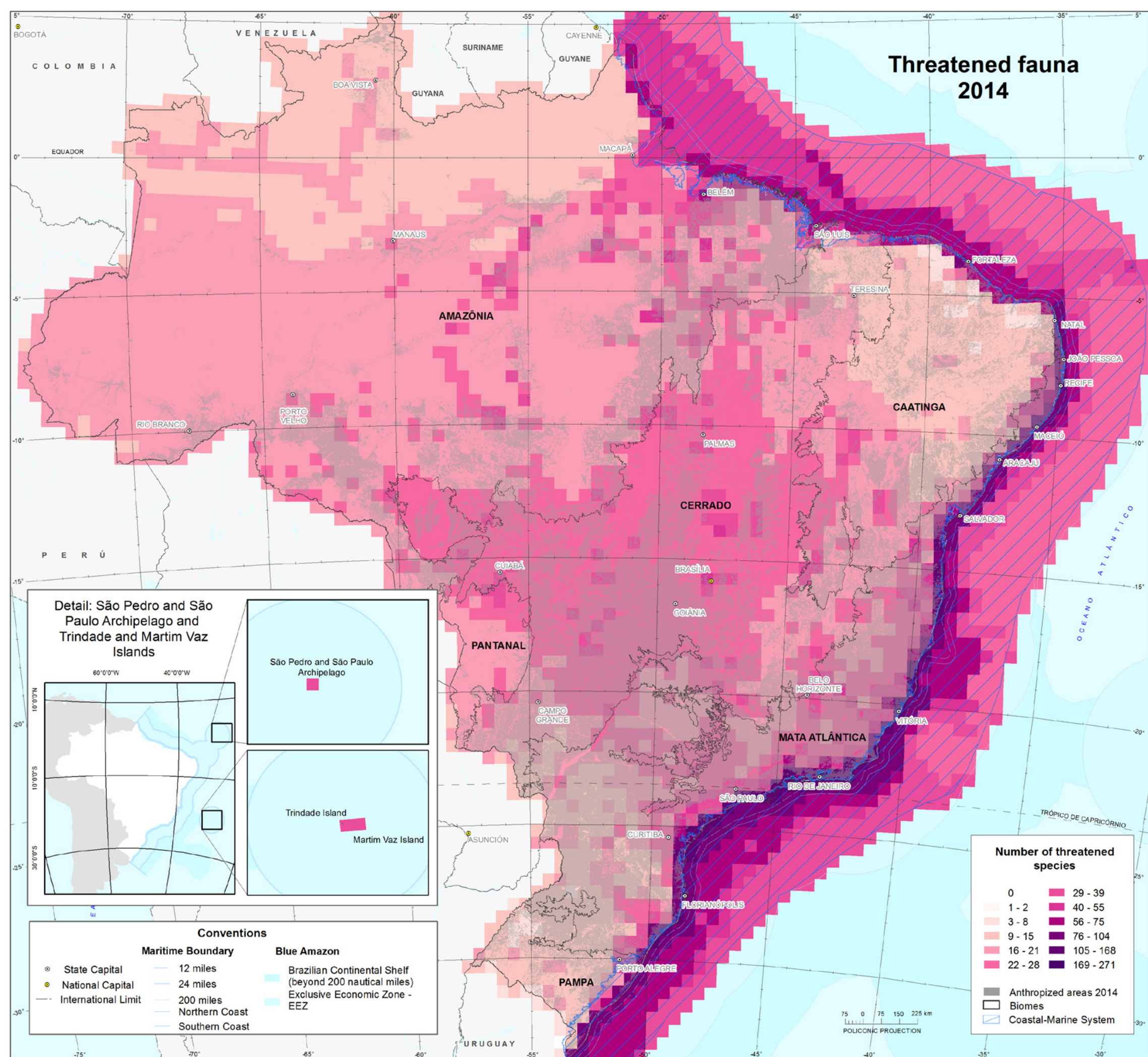
• **Additions and Reductions:** over the period, additions and reductions to the initial numbers of species by category are recorded. When a species is re-evaluated and changes category, this results in an addition to the new category and a corresponding reduction in the previous category.

• **Species that show an improvement or worsening in conservation status:** are considered genuine category changes, when conservation measures or threats have actually decreased or increased the species’ risk of extinction.

• **Advances in knowledge:** species assessed for the first time, recategorizations resulting from new data or studies, taxonomic revisions, and correction of errors in the previous assessment.

• **Stable Reassessments:** the number of species reassessed in the period that remained in the same category. Along with the total changes, enables the measurement of assessment effort. Ideally, all species should be reevaluated during each period, but this is not always possible.

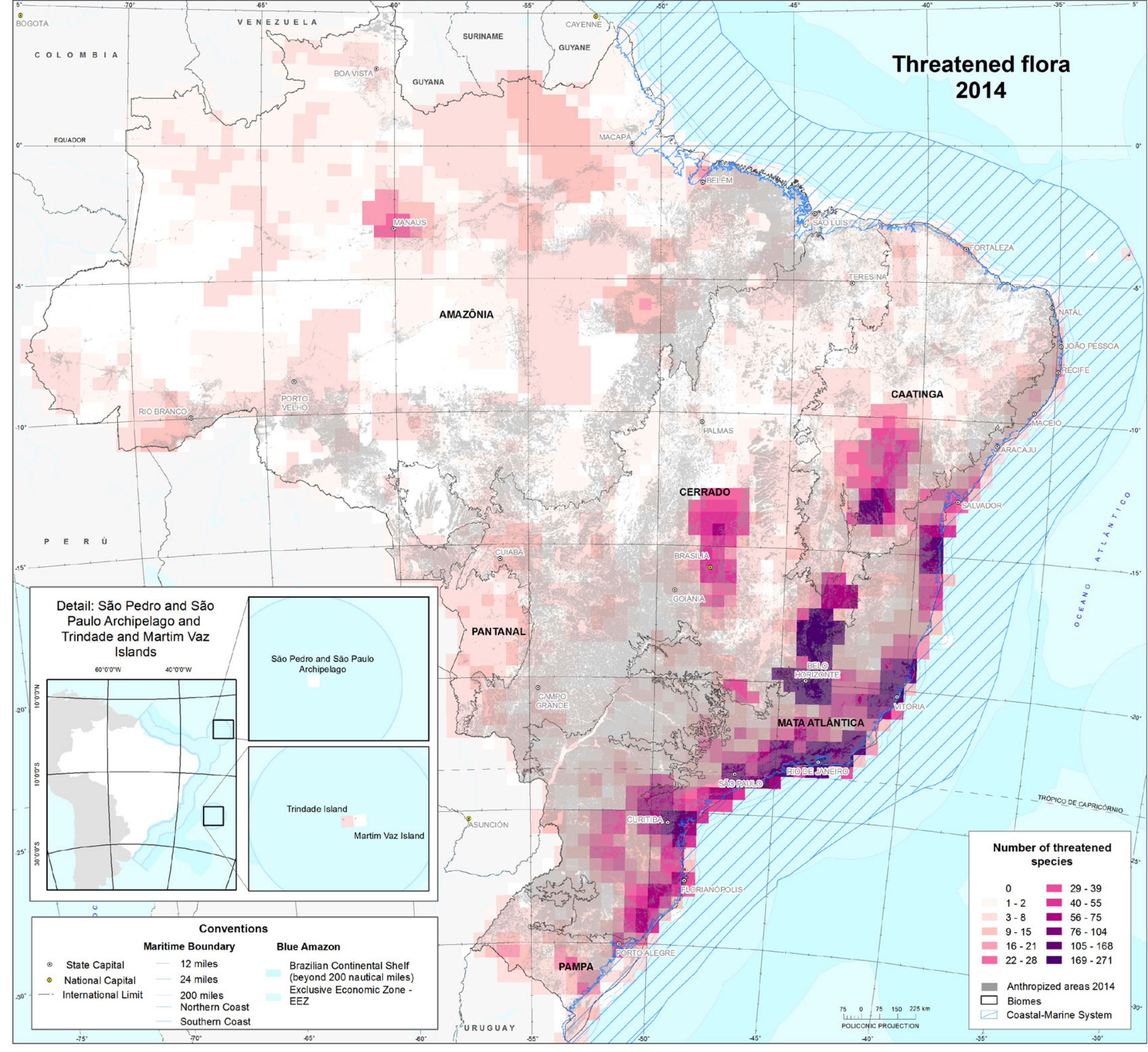
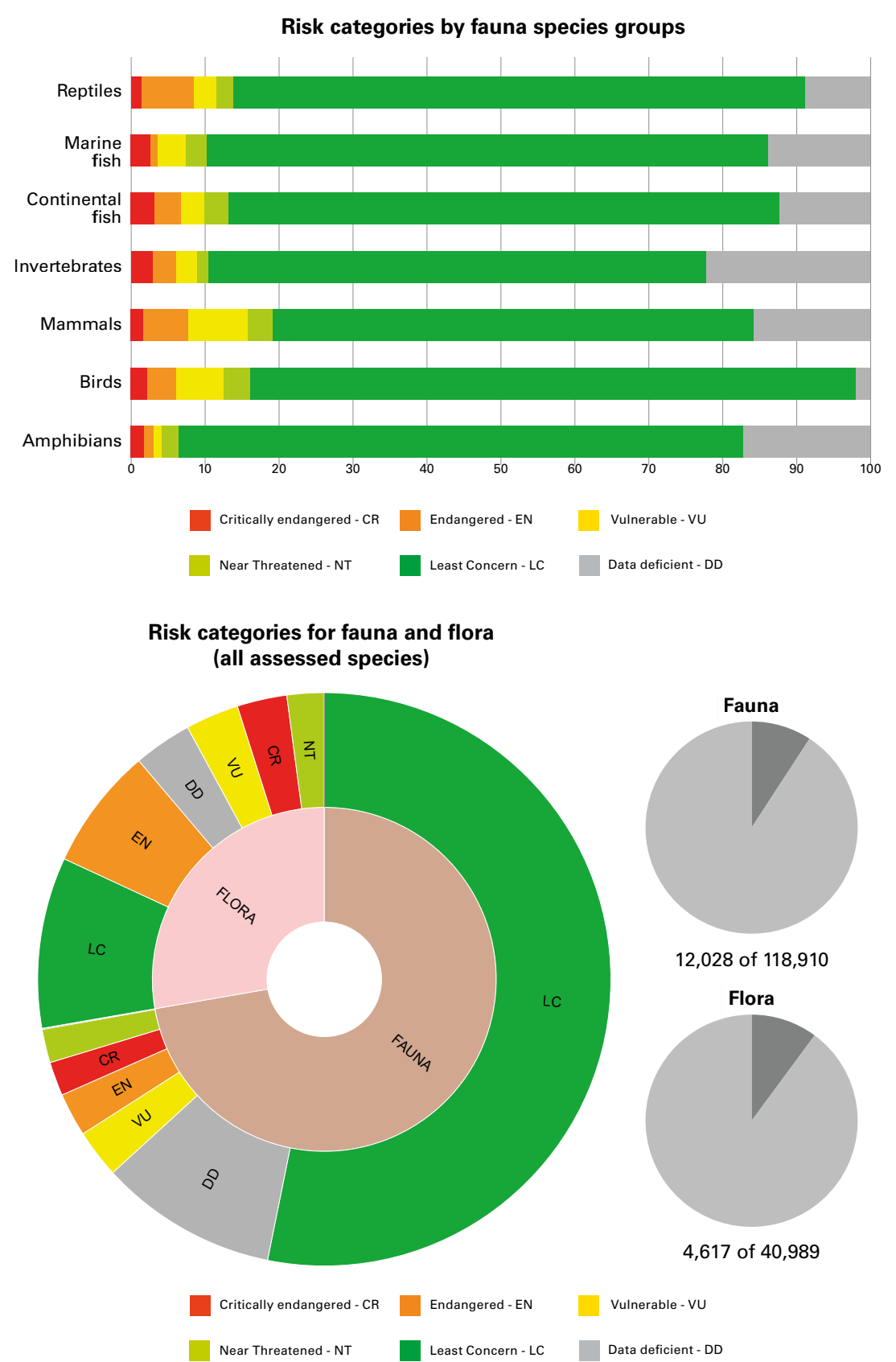




The maps on the left and right show the distribution of threatened species of fauna and flora in the territory.

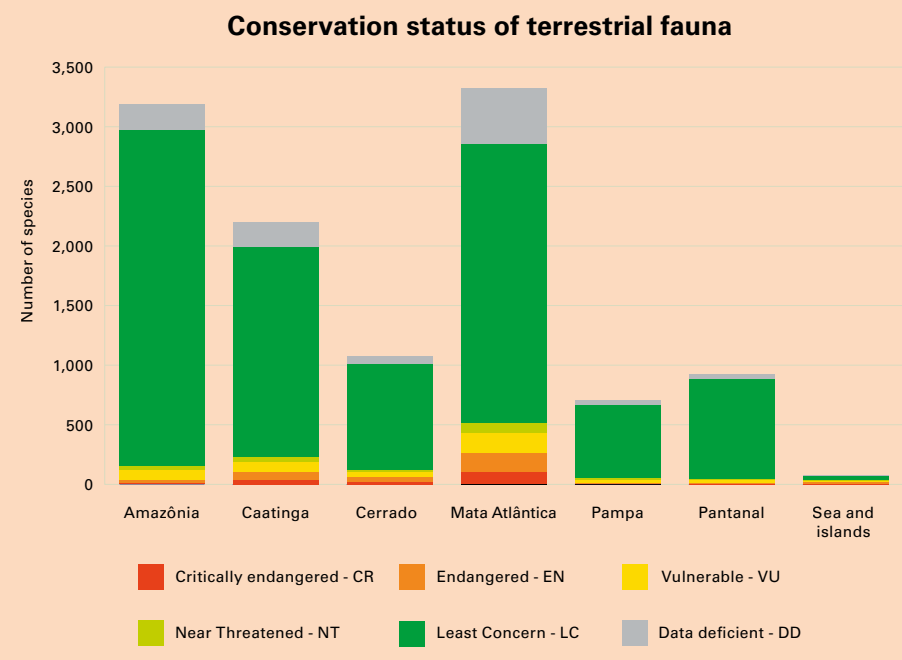
It is important to note that, for both fauna and flora, some points with a higher number of threatened species coincide with regions where the sampling effort is greater, such as areas close to major urban centers, where most research institutions are located, as well as access roads, such as highways or navigable rivers. This pattern of geographic bias in biodiversity information is well described in the literature and reflects the need to make more efforts in the production of primary information, which will serve as a basis for better ecosystem management.

In the maps, it is possible to observe the places with the greatest number of threatened species, as well as the distribution of anthropic areas, according to data from the Extent Accounts. The conservation of threatened species in areas with a high degree of anthropism, for example, depends on restoration initiatives and connectivity improvements. On the other hand, places with a great number of threatened species in broad natural areas are good candidates for the implementation of preventive measures, such as the creation of protected areas or stronger investments in existing ones.



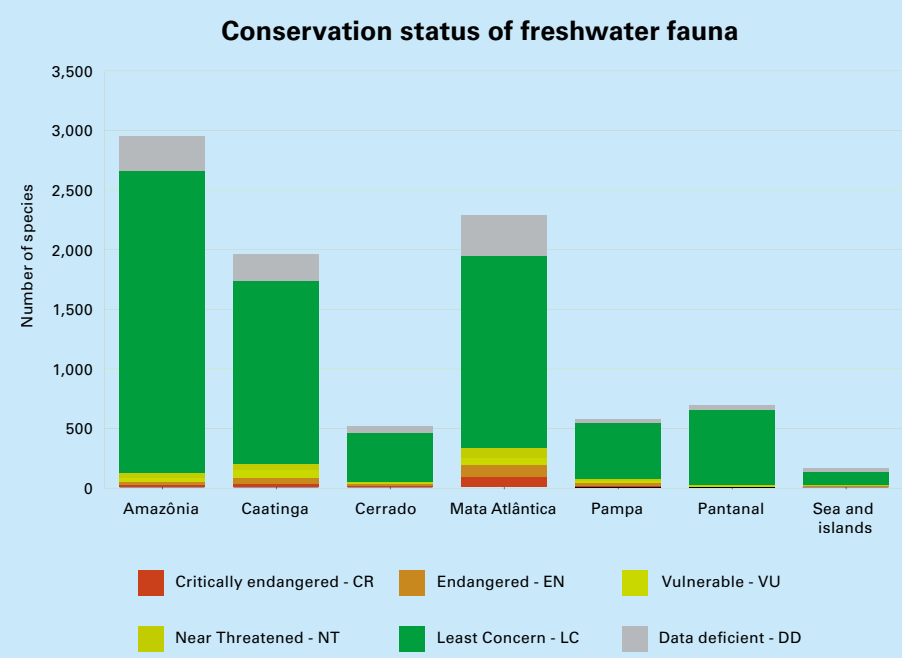
### Terrestrial Fauna

In relation to fauna in the terrestrial realm, the largest proportion of threatened fauna species is found in the Sea and oceanic islands, totaling 30 threatened species (38.46% of the total terrestrial species in the Sea and islands) and in the Mata Atlântica, totaling 426 threatened species (12.82% of the total terrestrial species in the Mata Atlântica). Both the islands and the Mata Atlântica Biome are characterized by many species with restricted distributions, which makes these regions of special interest for preservation. In addition to the data visible in the graph, there are six species in the EX category in the Mata Atlântica, two in the Pampa, and one in the Pantanal, such as the Great Red-breasted bird (*Sturnella defilippii*) that occurred in the Pampa. There is also one species in the EW category in the Mata Atlântica - the Mutum-do-Nordeste (*Pauxi mitu*).



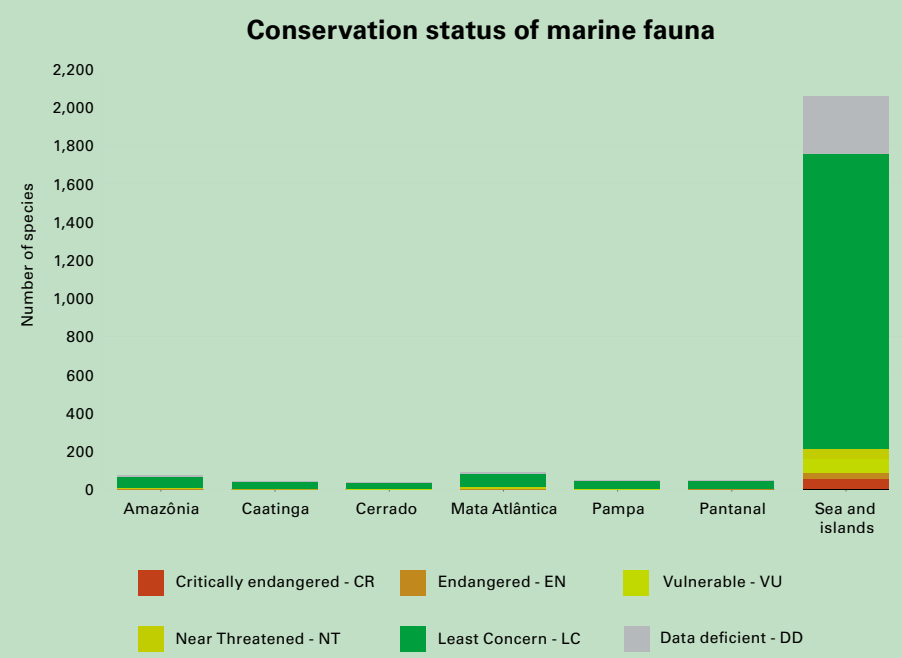
### Freshwater Fauna

Fauna in the freshwater realm has a pattern similar to that observed in the terrestrial realm, with slightly smaller proportions of threatened species. However, in this realm, high proportions of species classified as Data Deficient are observed for most regions, highlighting the need for better information for groups such as continental fish and freshwater invertebrates. In addition to the data visible in the graph, there are two species of fresh water fauna in the EX category: the fimbriae tree frog (*Phrynomedusa fimbriata*) which occurred in the Mata Atlântica and the eskimo bird (*Numenius borealis*) which occurred in the Mata Atlântica, Pampa and Pantanal.



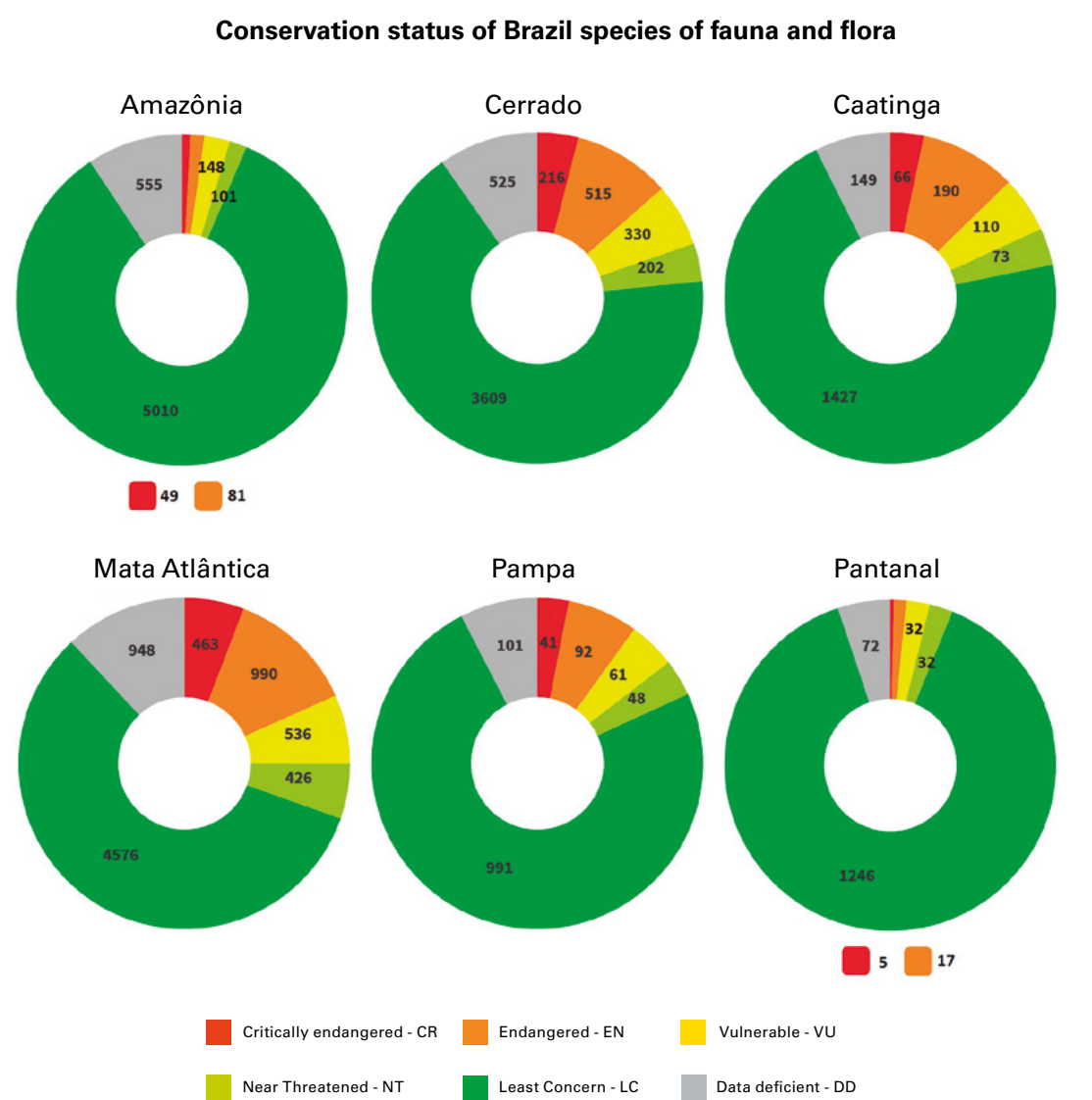
### Marine Fauna

Fauna evaluated in the marine realm is mainly located in the Sea and oceanic islands (2,056 species) and in the Mata Atlântica (91 species). In addition to completely aquatic groups, such as fish and several groups of marine invertebrates, coastal species such as seabirds are included here, many of which have a wide distribution, and also occur in continental water environments. In addition to the data visible in the graph, there are two species in the EX category in the sea and islands - the sharks *Carcharhinus isodon* and *Schroederichthys bivius*.

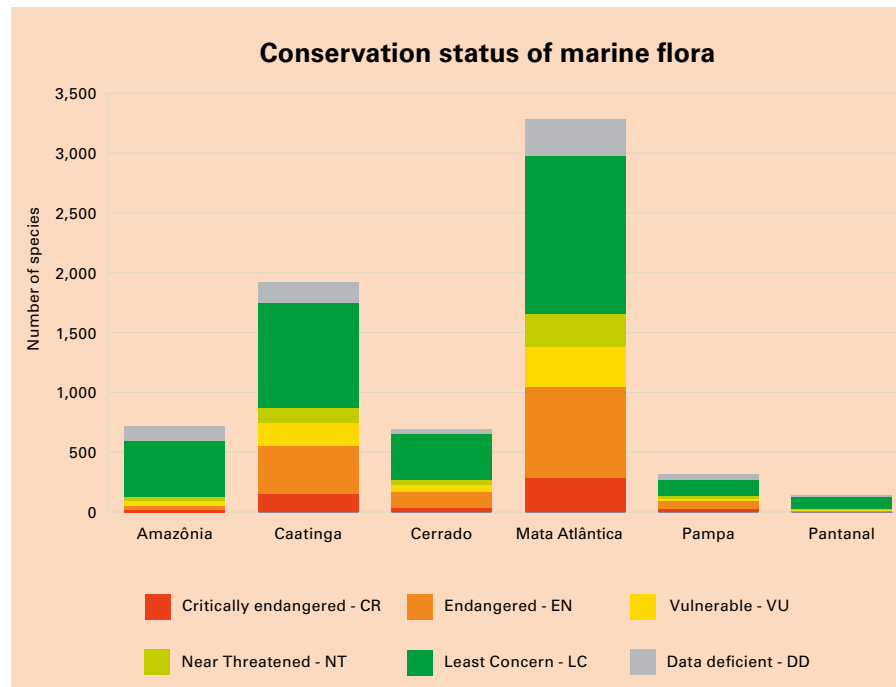


The national extinction risk assessments for species of Flora (CNCFlora, 2013) and Fauna (ICMBio, 2018) follow the criteria for the classification of degree of extinction risk defined by the IUCN, and resulted in the publication of the Official National Lists of Threatened Species (MMA Ordinance 443, 444 and 445 of 2014). Currently, a total of 49,168 plant species are recognized in Brazil (Flora do Brasil 2020) and 117,096 animal species, with estimates that the number of animal species exceeds 137 thousand (ICMBio, 2018). Of that total, CNCFlora/JBRJ assessed 4,617 plant species until 2014 and ICMBio/MMA assessed 12,262 animal species.

In the chart above, on the right are shown the proportions of the known species of each groups that have already been assessed. The biggest challenges concern invertebrate animals (except for some groups such as sponges and dragonflies) and plants. A possible solution is to prioritize complete assessments for certain groups of species with greater availability of information, such as vertebrates, in the case of fauna, and tree species, in the case of flora. However, less studied groups also prove to be important components for the functioning of various ecosystems. In these cases, assessment efforts focused on specific interest groups, or assessment strategies by sampling can be used to generate data capable of adequately informing the species' conservation status.

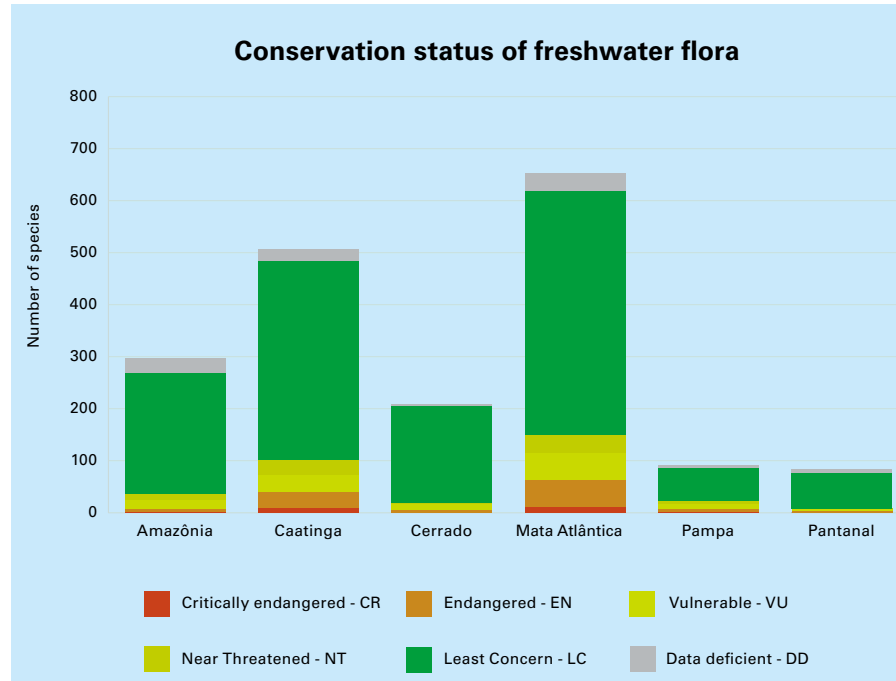


Among all Brazilian biomes, the Mata Atlântica stands out for the total number of threatened species, and also proportionally to its high richness of evaluated species. This region is the one with the greatest presence of anthropic environments, a reflection of the historical process of occupation of the National Territory, as discussed in the Ecosystem Extent Accounts, published by IBGE in 2020.



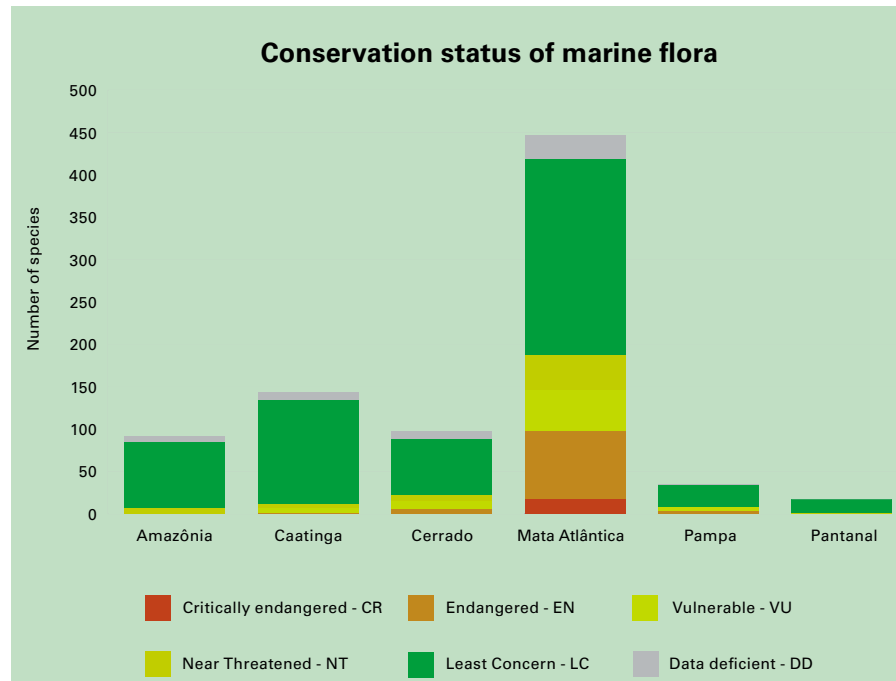
### Terrestrial Flora

As observed for the fauna, there is a large number and a large proportion of threatened species of terrestrial flora in the Mata Atlântica biome. In general, the proportional values of threatened species of flora mainly reflect the higher altitude environments of the Mata Atlântica and the plateaus of the Cerrado and Caatinga Biomes. Many endemic plants are found in these landforms, in environments of low resilience.



### Freshwater Flora

Among the flora species associated with the freshwater realm, both strictly aquatic species and those from riparian or seasonally flooded environments are considered. The Pampa biome stands out in this realm, which, despite a relatively low number of freshwater species evaluated (92 species), has 17 of them as threatened species (18.48%), which makes it the largest proportion of threatened species. Next, there is the Mata Atlântica biome, with the highest number of species evaluated and 116 threatened species (17.67%), the second highest proportion.



### Marine Flora

Vegetation associated with the marine realm, such as mangroves and sandbanks, often have a particular flora, adapted to salinity and high incidence of sun and strong winds. Because it comprises the largest proportion of this realm in Brazil, the Mata Atlântica biome is home to most flora species associated with the sea. Of the total species evaluated in the Mata Atlântica, 146 species are threatened (32.66%). Next, the Pampa, despite having a low number of evaluated species (35 species), has the second highest proportion, with 8 threatened species (22.86%).





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