

## Protected Areas do not Outweigh Species Richness or Functional Diversity and Traits of Birds in Brazil

**Supplementary materials. Section S1.** Characterization of the study areas. They are numbered by legal protection status (1-7 are unprotected, 8-17 are protected areas), then ordered by increasing size of the fragment in hectares. In this section the areas are also presented according to their location in the states of São Paulo and Paraná, Brazil.

### São Paulo state

**5. Presidente Epitácio.** Mata Santa Maria (22°14'16,2"S e 52°18'24,7"W, 331 m) corresponds to the sixth largest fragment of Pontal do Paranapanema, the largest not included in a protected area. In this Semideciduous Seasonal Forest, emergent species such as *Aspidosperma polyneuron* Müll. Arg., *Astronium graveolens* Jacq., *Cariniana* spp. and *Hymenaea* spp. are evident, as well as generalist species, such as *Copaifera langsdorfii* Desf., *Zeyheria tuberculosa* (Vell.) Bureau ex Verl. and species of *Tabebuia* spp.; the cactus *Cereus hildmannianus* K. Schum also occur. The exotic grass *Urochloa* spp. predominates in its surroundings and sugarcane planting is the predominant land use. The small Água Sumida stream runs along the southeast and southwest edges of the fragment, flowing into the Paraná River [79]. The climate of the region is Aw, tropical with dry winters. The average annual temperature is 22.5 °C and rainfall throughout the year is 1276 mm, with an annual average of 106 mm [43].

**6. Caiuá.** This remnant, Mata Maturi 21°37'20,2"S e 51°53'10,3"W, 350 m), is similar to other remaining fragments of the Pontal do Paranapanema, westernmost São Paulo. However, to my knowledge, no information on its biota is available. The climate of the region is Aw, tropical with dry winters. The average annual temperature is 22.4 °C and rainfall throughout the year is 1,246 mm, with an annual average of 104 mm [43].

**7. Anhembi.** It encompasses the Piracicaba-Tietê interfluvium, within which is located the Bacury Farm (22°39'51.2"S and 48°09'05.4"W, 540 m), formerly known as the Barreiro Rico Farm. Their remaining forests total 2200 ha (including 5 ha of a cerrado enclave). The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 20.6 °C and rainfall throughout the year is equivalent to 1,288 mm, with an annual average of 107 mm [43].

**13. Porto Ferreira.** The Porto Ferreira State Park (21°51'01,4"S e 47°25'52,8"W, 589 m) borders the eastern bank of the Mogi-Guaçu river. It is dominated by the Semideciduous Seasonal Forest and the Cerrado, for which more than 200 species of plants have been recorded, including *Cariniana legalis* Kuntze [80]. The climate of the region is Cwa, subtropical with dry winters and hot summers. The average annual temperature is 20.5 °C and rainfall throughout the year is equivalent to 1419 mm, with an annual average of 118 mm [43].

**11. Santa Rita do Passa Quatro.** This region was known for its abundance of large *Cariniana legalis* Kuntze, which were almost all cut down with the advance of coffee plantations. In this municipality the Vassununga State Park differs from most parks in São Paulo for being composed of plots, that is, more than one continuous preservation area. I visited the Capetinga Leste plot (21°43'17,3"S e 47°35'34,5"W, 606 m). The climate of the region is Cwa, subtropical with dry winters and hot summers. The average annual temperature is 20.2 °C and rainfall throughout the year is equivalent to 1461 mm, with the annual average being 122 mm [43].

**16. Jundiaí.** The Serra do Japi is centered on four municipalities, Jundiaí, Cabreúva, Pirapora do Bom Jesus and Cajamar, in the Planalto Paulista. The last two are part of the Metropolitan Region of São Paulo, among the most populous in the world. Jundiaí is home to the Serra do Japi Biological Reserve (23°14'32.6"S and 46°55'36.0"W, 1060 m), which protects 2071 of the 38,197 ha of semideciduous seasonal forests of the entire Serra do Japi mountain range [81]. The climate of the region is Cfb, subtropical with no dry season and temperate summers. The average annual temperature is 18.5 °C and rainfall throughout the year is equivalent to 1376 mm, with the annual average being 115 mm [43].

**17. Teodoro Sampaio.** Currently, the largest continuous area of seasonal forests in São Paulo is protected in the Morro do Diabo State Park (22°33'05.6"S and 52°18'30.1"W, 380 m), with approximately 37,000 ha. These Seasonal Forests have at least 266 species of trees, shrubs and herbaceous plants. There is also an area of Cerrado to the north of the Caldeirão Stream [82]. The Botucatu (or Caiuá) sandstone is easily visible when walking through Teodoro Sampaio and the entire Pontal do Paranapanema region, therefore, cacti are common and there is a relative absence of bodies of water, easily drained by the highly permeable sandy soil. The northern portion of the State Park has been much more altered in relation to the south, where the best-preserved forests are located [83]. The climate of the region is Aw, tropical with dry winters. The average annual temperature is 22 °C and rainfall throughout the year is equivalent to 1294 mm, with an annual average of 108 mm [43].

#### **Paraná state**

**1. Barra do Jacaré.** This remnant (23°07'10.6"S and 50°05'18.6"W, 505 m) had poorer vegetation structure compared to other fragments of the region, but to my knowledge, no information on its biota is available. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 20.9 °C and rainfall throughout the year is equivalent to 1359 mm, with an annual average of 113 mm [43].

**2. Santo Antônio da Platina.** This remnant (23°13'36.5"S and 50°01'05.5"W, 485 m) had poorer vegetation structure compared to other fragments of the region, but to my knowledge, no information on its biota is available. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 20.5 °C and rainfall throughout the year is equivalent to 1426 mm, with an annual average of 119 mm [43].

**3. Jacarezinho,** within the *Norte Pioneiro* mesoregion, where Seasonal Semideciduous Forests were replaced for coffee plantations during the beginning of the 19<sup>th</sup> century [26]. This remnant (23°02'39.8"S and 49°57'42.8"W, 410 m) had similar vegetation structure as the intermediate second growth of the Jacarezinho Wildlife Refuge, but, to my knowledge, no information on its biota is available. Soils are an ecotone of sedimentary Rio do Rastro Sandstone and Serra Geral basalt formations [84]. Mean annual temperatures vary from 21 to 22 °C, with 16 °C being the mean lowest and 28 °C, the mean highest temperatures. Mean annual precipitation is around 1400 – 1600 mm. Important water courses that drain the region are Fartura River and Jacarezinho River, the latter, an important tributary of the Cinzas River [84].

**4. Cornélio Procópio.** This remnant (23°11'33.7"S and 50°37'13.4"W, 610 m) had similar vegetation structure as the Mata de São Francisco State Park, but, to my knowledge, no information on its biota is available. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 20.7 °C and rainfall throughout the year is equivalent to 1331 mm, with an annual average of 111 mm [43].

**8. Ibiporã.** The Ibiporã State Park (23°15'23.8"S and 51°01'53.0"W, 470 m) is situated 1 km from the urban area of the homonymous city. It is constituted of secondary, selectively logged (during the 1980s) forest, which has not undergone clear cut. The surroundings are composed of highways, conventional agriculture, and a quarry [85]. Some 176 plant species, 98% of which are angiosperms, have been recorded within the park, being Fabaceae, Bignoniaceae, Malvaceae, Meliaceae, Rubiaceae, Solanaceae, Asteraceae, Bromeliaceae, Euphorbiaceae, Malpighiaceae and Myrtaceae the most representative families [85]. The Serra Geral formation predominates the lower Tibagi Basin [86]. Seasonal Semideciduous forests remnants are the relictual testimonies of the original vegetation below 800 m and, above this elevation, Paraná Pines *Araucaria angustifolia* (Bertol.) can occur [87]. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 21.1 °C and rainfall throughout the year is equivalent to 1433 mm, with an annual average of 119 mm [43].

**9. Jacarezinho.** The Jacarezinho Wildlife Refuge (23°11'04.2"S and 49°58'05.9"W, 480 m) lies within the *Norte Pioneiro* mesoregion, where Seasonal Semideciduous Forests were replaced for coffee plantations during the beginning of the 19<sup>th</sup> century [26]. Here, the vegetation is composed of advanced (2%) and intermediate (65%) successional stages of second growth, pioneer formations (3 %) and lots (26 %) of *Pinus* sp. and *Eucalyptus* sp. The remaining percentage refers to anthropic areas; some 93 species of trees have been recorded [84]. Soils are an ecotone of sedimentary Rio do Rastro Sandstone and Serra Geral basalt formations [84]. Mean annual temperatures vary from 21 to 22 °C, with 16 °C being the mean lowest and 28 °C, the mean highest temperatures. Mean annual precipitation is around 1400 – 1600 mm. Important water courses that drain the region are Fartura River and Jacarezinho River, the latter, an important tributary of the Cinzas River [84].

**10. Centenário do Sul.** The primitive Seasonal Semideciduous Forest of the Ibicatu State Park (22°47'02.4"S 51°29'10.7"W, 368 m) suffered in the past from selective logging but retains characteristics of the original forest with a mean 25 m canopy [88]. There have been recorded 35 regenerating species and 58 vascular species [89]. The region lies within the Caiuá Sandstone in semideciduous forests predominated by the presence of *Aspidosperma polyneuron* Müll. Arg. in its emerging strata and *Astronium urundeuva* (M. Allemão) Engl.) [23]. The palm *Euterpe edulis* Mart. is less common compared to other Seasonal Forests in the state, replaced by *Syagrus romanzoffiana* (Cham.) Glassman, or by *Acrocomia aculeata* (Jacq.) Lodd. ex Mart. along the margins of the Paraná River [23]. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 21.4 °C and rainfall throughout the year is equivalent to 1346 mm, with an annual average of 112 mm [43].

**12. Londrina.** The Mata dos Godoy State Park (23°27'13.7"S and 51°14'45.2"W, 635 m) is the most representative remnant of the original Seasonal Semideciduous Forest of this region, where the occurrence of late secondary and climax species is greater than that of pioneer ones [90,91]. It is bordered by the Apertados Stream to the south, where 96 species of plants have been recorded [92] and mature and secondary forests account for 508 vascular species, of which 40 represent ferns [93]. The Serra Geral formation predominates the lower Tibagi Basin [86]. Seasonal Semideciduous forests remnants are the relictual testimonies of the original vegetation below 800 m and, above this elevation, Paraná Pines *Araucaria angustifolia* (Bertol.) can occur [87]. The climate of the region is Cfa, subtropical without a dry season with hot summers. The average annual temperature is 20.3 °C and rainfall throughout the year is equivalent to 1575 mm, with an annual average of 131 mm [43].

**14. Santa Mariana.** The Mata de São Francisco State Park (23°09'35.3"S and 50°34'04.4"W, 558 m) suffered from a great fire some 45 years ago and from selective logging of *Aspidosperma*

*polyneuron*, which reflects on the irregular diametric distribution of the latter as well as the presence of bamboo thickets on 57% of the entire area [94]. It is isolated within a matrix of soybean, wheat, and corn crops, and surrounds the Araras Stream. There are closed and open canopies, where there is plenty of bamboo thickets. Its vegetation is composed of 274 vascular species, six of which represent ferns. The most representative families include Fabaceae, Asteraceae, Bignoniaceae and Sapindaceae [95]. Mean annual temperatures fall between 10 °C and above 22 °C, and mean annual precipitation is 1443 mm [94].

**15. Diamante do Norte.** The Caiuá Ecological Station (22°37'12.0"S and 52°52'14.9"W, 315 m) is in the lower watershed of the Paranapanema River by the shores of the Rosana Hydroelectric Dam, in the last lotic portion of that river [96]. The Station's riparian forests are undergoing floristic and structural modification due to the influence of the Rosana Dam, and contain 85 species mostly represented by Leguminosae, Myrtaceae, Rutaceae, Meliaceae, Lauraceae and Euphorbiaceae [97]. Some 53 vine species have been reported from the area [98] for a total of 309 vascular species, including exotic plants [99]. The region lies within the Caiuá Sandstone in semideciduous forests predominated by the presence of *Aspidosperma polyneuron* Müll. Arg. in its emerging strata and *Astronium urundeuva* (M. Allemão) Engl.) [23]. The palm *Euterpe edulis* Mart. is less common compared to other Seasonal Forests in the state, replaced by *Syagrus romanzoffiana* (Cham.) Glassman, or by *Acrocomia aculeata* (Jacq.) Lodd. ex Mart. along the margins of the Paraná River [23]. The climate of the region is Aw, tropical with dry winters. The average annual temperature is 22.1 °C and rainfall throughout the year is equivalent to 1388 mm, with an annual average of 116 mm [43].