Identifying the optimal sampling design for the inventorying and monitoring of medium- and large-sized mammals

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Abstract:
This study aims to identify optimal sampling designs for the inventory and monitoring of medium- and large-sized mammals, considering different biodiversity dimensions (taxonomic, functional, and phylogenetic) in the Southern Brazilian Amazon. We established three line transects each 3 km long, and three camera trap grids, each with six cameras, totaling 176 kilometers walked and 4,914 camera trap-days. We defined fixed and variable costs associated with each method. We sought to identify the sampling arrangement that yielded the highest possible α-diversity at the lowest possible cost (i.e., inventory efficiency), and the combination of methods that minimized bias in recording β-diversity while also minimizing costs (i.e., monitoring efficiency). Camera traps detected 26 species, of which 16 were exclusive to this method. Line transects resulted in detection of 16 species, six of which were exclusive (all arboreal). It was generally not possible to identify a single sampling scheme that yielded higher diversity or lower bias at lower costs. However, it was clear that adding line transect sampling units increased costs without improving diversity or bias results. Then, for the inventory of functional and phylogenetic diversity and for monitoring taxonomic, functional, and phylogenetic diversity, the optimal sampling design involves the exclusive use of camera traps. For a taxonomic diversity inventory the optimal sampling scheme requires a combination of camera traps and line transects. We did not sweep the transects or search for tracks and other signs in our line transect surveys, which reduced the method's effectiveness in detecting some species. The superior cost-effectiveness of camera traps can be related to improvements in camera trap technology and reductions in their cost, although given their lower efficiency to detect arboreal species, including some effort in line transects may be necessary.

Keywords: Amazon, Camera traps, Functional diversity, line-transects, Neotropical mammals, Phylogenetic diversity.

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INTRODUCTION

Faunal inventories aim to record the diversity of a given location with the highest level of completeness as possible, while faunal monitoring is conducted to detect changes in community composition over time (Cardoso et al. 2024a). Inventories are essential for understanding local biodiversity and identifying areas of higher or lower species richness, thus providing a foundation for conservation decision-making (Silva-Dias et al. 2019). On the other hand, monitoring allows researchers to track the effects of environmental changes or interventions on biodiversity. In this context, efficient inventories seek to maximize recorded α-diversity at the lowest possible cost (Cardoso et al. 2024a, Burt et al. 2021, Carvalho et al. 2016, Garden et al. 2007, Gaidet-Drapier et al. 2006). Conversely, monitoring efforts require comparing community composition over different time periods (i.e., β-diversity), and therefore aim to minimize the discrepancy between true and sampled β-diversity (i.e., minimize bias in recording β-diversity – Cardoso et al. 2024a). True β-diversity represents differences in assemblage composition among sites estimated by pooling data from all sampling units, i.e. the β-diversity obtained under intensive sampling. Bias is calculated as the difference between estimates obtained from subsets of sampling units and those derived from the complete dataset (Cardoso et al. 2024a).

Although inventories and monitoring have distinct objectives, they are often carried out using similar methods for each taxonomic group (e.g., Welbourne et al. 2015, Garden et al. 2007). The existence of numerous methods used in faunal inventories and monitoring highlights the need to understand the limitations and advantages of each, supporting the selection of the most appropriate approaches for each situation (Burt et al. 2021, Carvalho et al. 2016, Gaidet-

Drapier et al. 2006). The primary methods employed in the inventory and monitoring of medium- and large-sized mammals include camera trapping, line transect surveys, and the identification of tracks and other signs (e.g., scratches, vocalizations, burrows, hair, odors – Meek et al. 2012; Cullen & Rudran 2006). Camera trapping involves placing cameras at predefined locations to record the species present and gathering information on their spatial distribution and relative abundance (Kéry 2011). Line transect surveys involve walking along predefined paths and recording sightings, allowing the assessment of species distribution along the surveyed or monitored area (Buckland et al. 2015). This method also allows for the concurrent recording of tracks and other mammalian signs.

The characteristics of camera traps and line transects make each more suited for detecting species with different traits. While camera traps are more effective for detecting elusive, rare, and nocturnal animals (Benchimol 2016), line transects are more advantageous for sampling arboreal and diurnal fauna (Wix & Reich 2019, Carvalho et al. 2016, Roberts et al. 2016, Trolle et al. 2008). Thus, it is common for both methods to be used complementarily to improve species detection (Ponce-Martins et al. 2022, Moore et al. 2020). However, the simultaneous use of both methods often depends on the available budget and time for fieldwork. It is important to consider that camera traps remain relatively expensive due to their initial acquisition costs and potentially high maintenance and logistical expenses (Djekda et al. 2020, Lyra-Jorge et al. 2008, Silveira et al. 2003). Line transects, in turn, require more field effort, which can represent a significant cost depending on the number of days in the field (Carvalho et al. 2016). Therefore, to define an optimal allocation of effort between the two methods in inventories or monitoring of mammals, it is necessary to balance species detectability and the associated costs of each method.

Biological diversity can be assessed through multiple dimensions, including taxonomic, functional, and phylogenetic diversity (Chao et al. 2014). Taxonomic diversity is the most commonly used dimension, but it disregards ecological and evolutionary differences among species (Cardoso et al. 2024b; Chao et al. 2014, Purschke et al. 2013). Conversely, functional and phylogenetic diversity weight species according to their ecological traits and evolutionary lineages, respectively (Cardoso et al. 2024b, Chao et al. 2014). Given that camera traps and line transects differ in the species profile they tend to detect (Carvalho et al. 2016), these differences are expected to influence functional and phylogenetic diversity outcomes. For example, the concentration of line transect records on diurnal animals, and of camera trap records on terrestrial species (Moore et al. 2020, Carvalho et al. 2016) limits the functional diversity captured by these methods. Additionally, Neotropical primates—a speciose lineage of mammals—are predominantly arboreal (Paglia et al. 2012), which restricts the phylogenetic diversity captured by camera traps at ground level, as these devices are generally inefficient at detecting arboreal species. Thus, the optimal allocation of mammal sampling methods may vary depending on the assessed biodiversity dimension.

We sought to identify optimal sampling designs for the inventory and monitoring of medium- and large-sized mammals, considering different biodiversity dimensions (taxonomic, functional, and phylogenetic). The ultimate goal is to inform future research and improve sampling efficiency, i.e., maximize the number of species detected or minimize the bias in comparing species composition, while minimizing costs.

MATERIALS AND METHODS

Study Area

The study was conducted in the area of the Rondon II Hydroelectric Power Plant (Rondon II HPP), located in the state of Rondônia, in the southern Brazilian Amazon. The region is predominantly covered by Seasonal Semideciduous Forest and lies within the transition zone between the Amazon and Cerrado biomes, which influences its fauna and flora (Radam Brasil 1978). The Rondon II reservoir spans 4,930 hectares and is surrounded by approximately 11,000 hectares of forest (Rondônia 2002), contiguous with other forested areas in the surrounding landscape (Fig. 1). In well-preserved areas, the forest canopy can exceed 20 meters in height and includes a well-developed understory (Mattos et al. 2023). The region's soils are classified as hydromorphic quartzarenic with sandy texture and low relief (IBGE 2006). According to Köppen's classification, the local climate is Aw (tropical wet and dry climate with a dry winter – Kottek et al. 2006, IBGE 2002). The dry season lasts approximately three months, from June to August, while the rainy season generally spans from September to May (IBGE 2002). Average monthly precipitation during the driest months is below 50 mm, with total annual precipitation ranging from 1,400 to 2,600 mm. Annual mean temperatures vary from 21 to 37°C (Rondônia 2002).

Data Collection

Line Transects

We established three line transects, each with 3 Km, within the study area (Fig. 1). The transects were established in November 2017 to enable fauna monitoring at the Rondon II HPP, and their number and length were defined according to operational limitations at the locations where they were established and by the size constraints of the study site. Transects were cleared once or twice a year to remove shrubs growing along the trails and fallen branches and trees. However, the trails were not swept due to the high cost of this activity.

Transects were surveyed during 4-day field campaigns conducted two to five times per year between July 2019 and March 2025. Surveys were carried out by two observers walking at a constant speed of 1.5 km/h, searching for direct sightings of mammals. From 2019 to 2023, each transect was walked only once per field campaign. In the five campaigns conducted in 2024 and 2025, transects were walked between one and three times per campaign. In these cases, once a transect was sampled, it was not surveyed again for at least 48 hours to allow for the natural repositioning of wildlife and to ensure independence of records across different days on the same transect. This resulted in a total sampling effort of 222 kilometers walked.

Camera Traps

Around each transect, we installed a rectangular grid (1 x 3 km) of camera traps (Tasco Low Glow 12MP Trail Camera, with infrared flash and a 1-second trigger speed), with six camera traps placed 1 km apart and approximately 500 meters from the trail (three on each side – Fig. 1). The distance between camera traps was chosen to ensure the independence of recorded data (e.g., Brandão et al. 2025). Cameras were mounted on tree trunks approximately 40 centimeters above the ground, in locations selected to maximize mammal detection, such as along natural animal paths. Cameras were programmed to operate 24 hours per day, and records of the same species at the same camera were considered independent if they occurred more than one hour apart (Tobler et al. 2008). Across the 18 camera trap sites, we obtained a sampling effort of 4,914 trap-days over an eight-month sampling period (from May 2024 to February 2025). However, a smaller effort (4,320 trap-days) was used in the analysis due to unbalanced sampling between points.

Transects were surveyed over a longer period (6 years) than camera traps (8 months), which may be a problem if the mammal assemblage varied during this time. To account for this temporal mismatch, we tested whether the number of species recorded per transect differed among the six years of transect surveys. Since we did not find evidence of significant changes in the assemblage (Permutational ANOVA: F=2.488; p=0.078), this mismatch does not represent a problem for our analyses.

Cost Definition for Methods

We categorized the costs associated with each method into fixed and variable costs (Tab. 1, e.g., Lyra-Jorge et al. 2008). Fixed costs were defined as those that do not vary with temporal replication of sampling (e.g., equipment purchase, trail establishment, etc.). Variable costs vary proportionally with the number of sampling units used in the study (e.g., transportation within the study area, researcher accommodation and meals, researcher per diems, vehicle rental, and fuel – Tab. 1). Costs were initially estimated in Brazilian reais (R$) and subsequently converted to U.S. dollars (US$) using an exchange rate of R$1.00 = US$5.97 (as of March 17, 2025).

Statistical Analyses

In this study, to identify the optimal sampling design for inventories, we used the *optim.alpha* function (Cardoso et al. 2024a) of the package 'BAT' (Cardoso et al. 2015), which seeks to identify the sampling arrangement that yields the highest possible α-diversity at the lowest possible cost. According to the method characteristics, the sampling units of the different methods do not need to be equivalent. The size of the sampling unit represents the size of the increment in cost and diversity/bias when a sampling unit is added to the sample (Cardoso et al. 2015). Therefore, sampling units should be relatively small to allow a fine-grained evaluation, while still being meaningful, i.e., representing what can typically be achieved in a field campaign. We defined sampling units as 90 camera trap-days, i.e., 30 days of sampling in a half-grid (3 camera traps), and 18 kilometers walked on transects, i.e., one 4-day sampling campaign across the three transects. Although replication of camera traps can be achieved either by increasing the number of devices or by extending their deployment time in the field, in this study we considered only temporal replication. Thus, fixed costs were based on the purchase value of three camera traps, regardless of the number of sampling units.

To identify the optimal design for mammal monitoring, we used the *optim.beta* function (Cardoso et al. 2024a), which identifies the combination of methods that minimizes bias in recording β-diversity while also minimizing costs. Although monitoring aims to assess changes in the community over time, the evaluation of the sampling effort that minimizes bias in differences between surveys can be carried out either spatially or temporally. Therefore, for this analysis, β-diversity was assessed as the Jaccard distance between the three transects and between the three camera trap grids, and we considered each sampling unit as one transect surveyed four times (i.e., 12 km), and 30 days of sampling within a grid of six camera traps (i.e., 180 camera trap-days). Note that the sampling units differ from those used in the inventory analysis, because in the monitoring analyses we need to assess beta diversity between transects or camera-trap grids. Both the inventory and monitoring analyses were conducted using taxonomic, functional, and phylogenetic diversity.

Optimal sampling arrangements were identified using plots that relate diversity (inventory) or 1 – bias (monitoring) to the cost associated with each sampling arrangement. Each point in these plots represents a combination of sampling units from the different methods. To identify the number of sampling units from each method represented by each point, we used the function ‘identify’. Identifying the optimal design is more straightforward when there is a clear inflection point beyond which increasing sampling costs does not lead to a substantial increase in diversity or 1 – bias. However, when diversity or 1 – bias increases gradually with sampling cost, defining an optimal design becomes more subjective.

To obtain the optimal sampling design for inventories and monitoring of medium- and large-sized mammals based on phylogenetic diversity, we generated a consensus phylogenetic tree of the species recorded in this study using the VertLife.org database (Upham et al. 2019). For the functional dimension, we used functional data related to diet (proportion of diet consisting of invertebrates, fish, vertebrates, carrion, fruits+seeds, nectar, and leaves), activity period (whether the animal is active during the day, night, or twilight), and body size (log-transformed). These data were obtained from Wilman et al. (2014). Based on these data, we created a distance matrix between species using the *gawdis* function of the package ‘gawdis’ (de Bello et al. 2021), specifying that the diet and activity period variables were grouped. We then built a functional tree based on the resulting distance matrix using the *tree.build* function of the package ‘BAT’ (Cardoso et al. 2015). All the analyses were performed in the software R (R Core Team 2025).

RESULTS

Considering both methods used, we recorded 32 species of medium- and large-sized mammals in the study area (Tab. 2). Camera traps detected 26 species, of which 16 were exclusive to this method. Among the species recorded exclusively by camera traps, most were terrestrial, but scansorial species (such as the South American Coati and the Brazilian Squirrel) and arboreal species (e.g., the Black-tailed Marmoset) were also detected (Tab. 2). In contrast, the line transect method detected 16 species, 6 of which were exclusive to this method—five primates species, and the Brazilian Porcupine (Tab. 2).

Regarding the taxonomic diversity inventory, the graph shows a sequence of ascending curves from left to right (Fig. 2). On the far left of the graph, the curve that stands out most includes only sampling units composed of camera traps. The addition of line transect sampling units shifts the curves to the right, increasing the cost and correspondingly increasing the resulting diversity. There is a gradual increase in diversity with sampling cost, such that within the sampling limits of this study, it is not possible to objectively define an optimal sampling design for the inventory of taxonomic diversity of medium- and large-sized mammals.

The same initial ascending trend is observed for functional diversity inventory, with the curve on the far left composed of camera-trap-only sampling units. Adding line transect units again shifts the curve to the right, indicating increased cost. However, unlike taxonomic diversity, the corresponding increase in functional diversity is comparatively small. Thus, the optimal sampling design for functional diversity inventory involves using only camera traps, although the decision regarding the number of cameras remains somewhat subjective. The curve stabilizes, indicating that beyond a certain number of camera trap units, the cost increases faster than the gain in diversity. Therefore, the optimal number of sampling units lies between 720 and 3600 camera trap-days, at a cost ranging from US$ 6,751.01 to US$ 32,714.85 (Fig. 2).

For phylogenetic diversity, the pattern is similar to that observed for functional diversity. The graph also shows an ascending curve on the left composed of sampling units using only camera traps. This curve stabilizes more quickly, suggesting that the optimal sampling design for the inventory of phylogenetic diversity requires less sampling effort and lower cost: between 450 and 1440 camera trap-days, with a corresponding cost ranging from US$ 4,316.90 to US$ 13,241.97 (Fig. 2).

Regarding monitoring, for all biodiversity dimensions (i.e., taxonomic, functional, and phylogenetic), we observed a sequence of points on the left side of the graph that show an increase in the 1 - bias ratio as the number of camera traps increases, without including any transect sampling units. Adding transect units shifts the curve to the right—i.e., it increases cost—with only a minor improvement in the 1 - bias ratio. Therefore, the optimal monitoring design can also be defined as one relying solely on camera traps, although the precise number of cameras used remains a subjective choice, considering that increasing the number of cameras reduces bias. The costs associated with the optimal sampling schemes for monitoring are similar between taxonomic, functional, and phylogenetic diversities (Fig. 2). Furthermore, the monitoring costs are lower than those required for inventorying (Fig. 2).

DISCUSSION

We showed that for the inventory of functional and phylogenetic diversity of medium- and large-sized mammals and for monitoring taxonomic, functional, and phylogenetic diversity, the optimal sampling design involves the exclusive use of camera traps. Only in the case of taxonomic diversity inventory did the optimal sampling scheme require a combination of camera traps and line transects.

The superior cost-effectiveness of camera traps in recording mammal species can be attributed to several factors. First, the cost of camera traps has declined over the years, while the quality of the devices has improved in terms of sensor sensitivity, trigger speed, and image resolution (Rovero et al. 2013, Swann et al. 2011). This has led to lower fixed costs and increased efficiency in mammal detection (Palencia et al. 2022, Rovero et al. 2013, Swann et al. 2011). Furthermore, the extended battery life and high-capacity memory cards reduce variable costs by decreasing the need for frequent field visits (Swann et al. 2011). As a result, both fixed and variable costs of camera trapping have become lower than those of line transects, as our results showed. It is also worth noting that the camera trap model used in this study (Tasco Low Glow 12MP Trail Camera) had a relatively low cost (US$ 50.36 per unit, including import taxes) compared to other models, which may have further favored camera traps in our cost-effectiveness analysis.

Our results contrast with those of previous studies conducted in Neotropical ecosystems similar to our study area. For example, studies have found greater efficiency for line transects (Silveira et al. 2003), similar cost-effectiveness between camera traps and line transects (Carvalho et al. 2016), or the need for a combination of methods (Munari et al. 2011). Several factors may explain these differences. Notably, Silveira et al. (2003) and Munari et al. (2011) did not incorporate sampling costs into their evaluations. Carvalho et al. (2016) was carried out on already established transects and did not consider the cost of establishing them, which can be substantial when trails are not already present in the study area. Additionally, improvements in camera trap technology and reductions in their cost since those studies were published help explain the divergent findings. Finally, we did not sweep the transects or include the search for tracks and other signs in our line transect surveys, which reduced the method's effectiveness in detecting some species. In fact, sign detection is essential for increasing the effectiveness of line transect surveys (Carvalho et al. 2016, Silveira et al. 2003) and including sign detection in our analyses could have qualitatively altered the results. On the other hand, the ongoing development of camera trap technology and continued cost reductions are likely to favor this method increasingly. This is supported by more recent studies, such as Djekda et al. (2020), which also found camera traps to be the most cost-effective method for sampling African mammals. Similarly, there has been ongoing development in the use of drones for species inventorying (Larsen et al. 2023). Such developments may expand their applications and reduce costs, potentially leading to improved cost-effectiveness in the future (Burke et al. 2019). Importantly, our results indicate greater cost-effectiveness of camera traps only for inventorying or monitoring purposes. The use of camera traps in studies with different objectives, such as estimating species density, is expected to result in substantially different cost-effectiveness trade-offs (e.g. Delisle et al. 2023).

The result for the taxonomic diversity inventory was the only one that indicated the need to combine line transects with camera traps. This finding is associated with the fact that six species—all arboreal—were recorded exclusively by line transects, as also demonstrated by other studies in the Neotropical region (e.g., Moore et al. 2020, Carvalho et al. 2016). Thus, the most favorable strategy for species inventories is to rely primarily on camera traps, while allocating some sampling effort to line transects to record arboreal species.

Taxonomic diversity is often the focus of mammal biodiversity studies (Xavier et al. 2023). However, we showed that functional and phylogenetic diversity can be assessed at a lower cost, due to the sharing of functional traits among species and because certain lineages include species that are more easily detected than others. Indeed, camera traps were able to detect some arboreal species—such as the Black-capped Capuchin Monkey, Golden-backed Squirrel Monkey, and Black-tailed Marmoset—and recorded species from all mammalian orders and 15 out of the 18 families identified in this study. Therefore, despite their lower effectiveness in detecting primates and other arboreal mammals (Srbek-Araujo & Chiarello 2005), camera traps can still record these animals, supporting their high efficiency in functional and phylogenetic diversity inventories.

We also found that monitoring medium- and large-sized mammals using only camera traps provides the best cost-effectiveness. In contrast, Munari et al. (2011) recommended combining multiple methods to monitor Amazonian mammals. Once again, it is important to highlight that camera traps, when installed at ground level, are less effective at detecting arboreal species (Srbek-Araujo and Chiarello 2005; Carvalho et al. 2016). Therefore, if the monitoring objective targets arboreal mammals, it is necessary to include some effort in line transects. However, if the goal is to assess changes in the composition of medium- and large-sized mammal communities more broadly and with minimal cost, then relying exclusively on camera traps is the most appropriate approach. Another possible strategy is installing camera traps in the canopy. This approach is more challenging than installing camera traps at ground level, due to undesired triggers and higher installation costs. Although recent advances have reduced these problems, camera traps in the canopy still seem to require higher costs per species recorded than those at ground level (Goebel et al. 2025). A formal comparison of the costs of using canopy camera traps and line transects is necessary to determine which method is more cost-effective.

Monitoring costs were lower than inventory costs, which is both expected and necessary, given the requirement for temporal replication in monitoring (Cardoso et al. 2024a). Sampling with up to 2880 camera trap-days (i.e., the total effort employed in our monitoring analysis) appears sufficient to detect temporal variation in large mammal community composition. While this sampling effort may require an important initial investment, the low cost of temporal replication with camera traps makes it feasible for long-term studies (Djekda et al. 2020, Silveira et al. 2003).

Finally, our findings reflect, to some extent, the biodiversity characteristics of our study area. With eight primate species and the Brazilian Porcupine, the study site is particularly rich in arboreal mammals, favouring sampling designs that incorporate line transects. In areas with fewer arboreal species, inventories and monitoring may be even more efficiently conducted using only camera traps. On the other hand, including line transects may be advisable even for monitoring or for functional and phylogenetic diversity inventories in areas potentially harbouring a greater number of arboreal species. Besides the number of arboreal species, the balance between camera traps and line transects for mammal inventory and monitoring may also depend on the site's vegetation structure. For example, in open environments, the effectiveness of line transects may increase due to greater visibility. This increased visibility does not benefit camera traps, which typically detect animals only within a limited range (e.g., up to 30 meters). Thus, conducting similar analyses in regions with high arboreal mammal diversity is crucial to better elucidate the potential role of line transects in mammal inventory and monitoring under different ecological contexts.

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Table 1 - Values in USD representing the fixed and variable costs associated with camera trapping and line transects.

	Description	Camera traps		Line transects	
		Amount	**Total Cost**	**Amount**	**Total Cost**
Fixed costs	External hard drive	1	67.50	-	-
	Camera traps, including import taxes	3	151.08	-	-
	Storage cards	3	18.39	1	6.13
	AA batteries	24	23.08	-	-
	Photo camera to record animal sightings	-	-	1	770.52
	Trail establishment	-	-	3	4522.61
	Trail cleaning (only for monitoring)	-	-	3	2261.31
	Total		**1129.83**		**21128.41**
Variable costs	Traveling to the field site	2	29.60	2	29.60
	Food for two people	2	46.90	4	93.80
	Lodging for two people	2	73.70	4	147.40
	Per diem for field assistant	2	50.25	4	100.50
	Per diem for researcher	2	402.01	4	804.02
	Hours to screen photos	1.5	90.45	-	-
	Car rental (days)	2	76.79	4	153.58
	Fuel (liters)	34.54	41.66	44.54	53.72
	Total per sampling unit		**2933.11**		**7649.09**

Table 2 - List of species recorded by line transects and camera traps in this study, organized by order and family.

Classification	Common name	Line transect	Camera trap
Pilosa			
Myrmecophagidae			
Myrmecophaga tridactyla	Giant Anteater		x
Tamandua tetradactyla	Southern Tamandua	x	x
Cingulata			
Dasypodidae			
Cabassous unicinctus	Amazon Naked-tailed Armadillo		x
Dasypus novemcinctus	Nine-banded Armadillo		x
Euphractus sexcinctus	Yellow Armadillo		x
Priodontes maximus	Giant Armadillo		x
Primates			
Cebidae			
Sapajus apella	Black-capped Capuchin	x	x
Saimiri ustus	Golden-backed Squirrel Monkey	x	x
Pitheciidae			
Chiropotes albinasus	White-nosed Saki	x	
Pithecia irrorata	Gray's Bald-faced Saki	x	
Plecturocebus parecis	Parecis Titi	x	
Atelidae			
Ateles chamek	Black Spider Monkey	x	
Lagothrix lagothricha	Common Woolly Monkey	x	
Callitrichidae			
Mico melanurus	Black-tailed Marmoset		x
Carnivora			
Felidae			
Leopardus pardalis	Ocelot		x
Panthera onca	Jaguar		x
Herpailurus yagouaroundi	Jaguarundi		x
Canidae			
Atelocynus microtis	Short-eared Dog		x
Cerdocyon thous	Crab-eating Fox		x
Speothos venaticus	Bush Dog		x
Mustelidae			
Eira barbara	Tayra	x	x
Procyonidae			
Nasua nasua	South American Coati		x
Procyon cancrivorus	Crab-eating Raccoon		x
Perissodactyla			
Tapiridae			
Tapirus terrestris	Lowland Tapir	x	x
Artiodactyla			
Tayassuidae			

Pecari tajacu	Collared Peccary	x	x
Tayassu pecari	White-lipped Peccary	x	x
Cervidae			
Mazama nemorivaga	Amazonian Brown Brocket	x	x
Rodentia			
Sciuridae			
Sciurus aestuans	Brazilian Squirrel		x
Caviidae			
Hydrochoerus hydrochaeris	Capybara	x	x
Cuniculidae			
Cuniculus paca	Paca		x
Dasyproctidae			
Dasyprocta azarae	Agouti	x	x
Erethizontidae			
Coendou prehensilis	Brazilian Porcupine	x	

FIGURE LEGENDS

Figure 1 - The study area's location, showing the transects (purple lines) and camera trap sites (yellow points) used to sample medium- and large-sized mammals in the Rondon II Hydroelectric Power Plant, Rondônia state, southern Brazilian Amazon. Sources: Google Satellite and IBGE.

Figure 2 - Relationship between resulting diversity (inventory) or 1 - bias (monitoring) and sampling cost (in US$) for three biodiversity dimensions (taxonomic, functional, and phylogenetic). Each point represents a combination of sampling units of camera traps and transects. Points representing the most cost-effective arrangements (i.e., optimal sampling designs) are highlighted in orange. Note that for taxonomic diversity inventory, defining an optimal sampling design is impossible, as diversity increases gradually with sampling cost.

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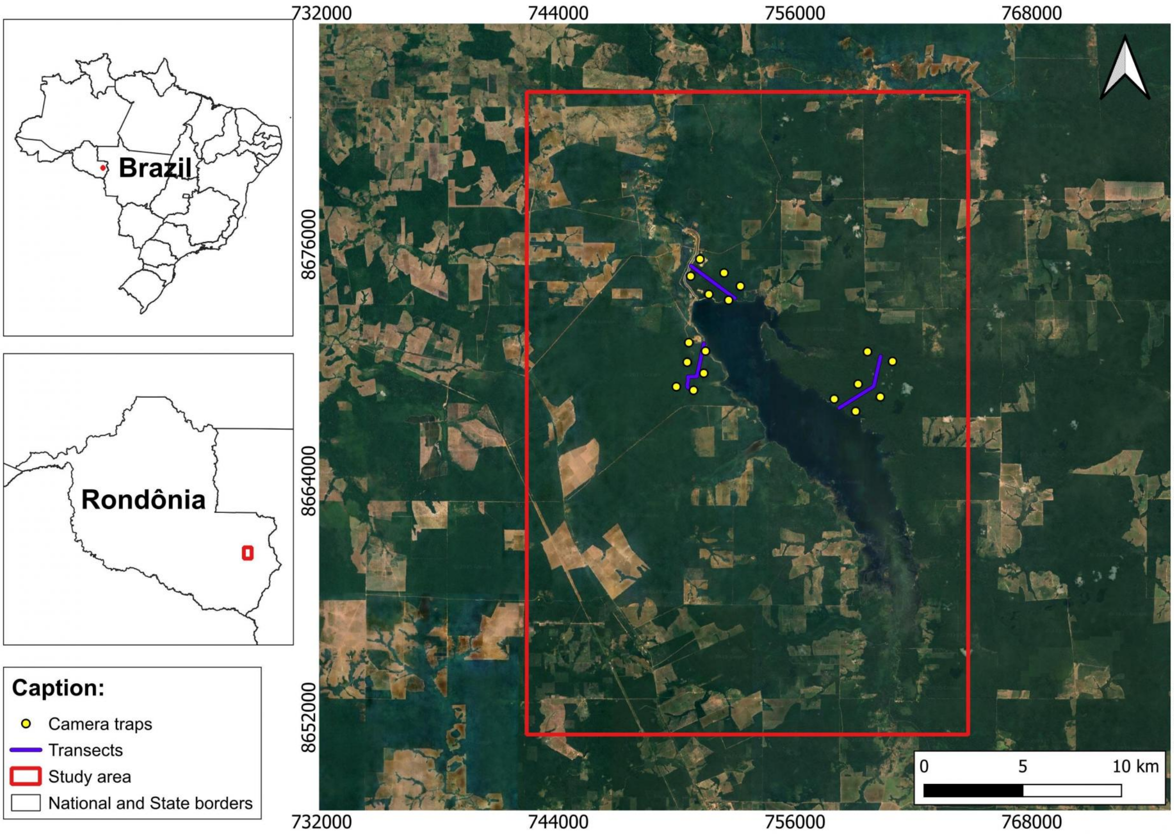

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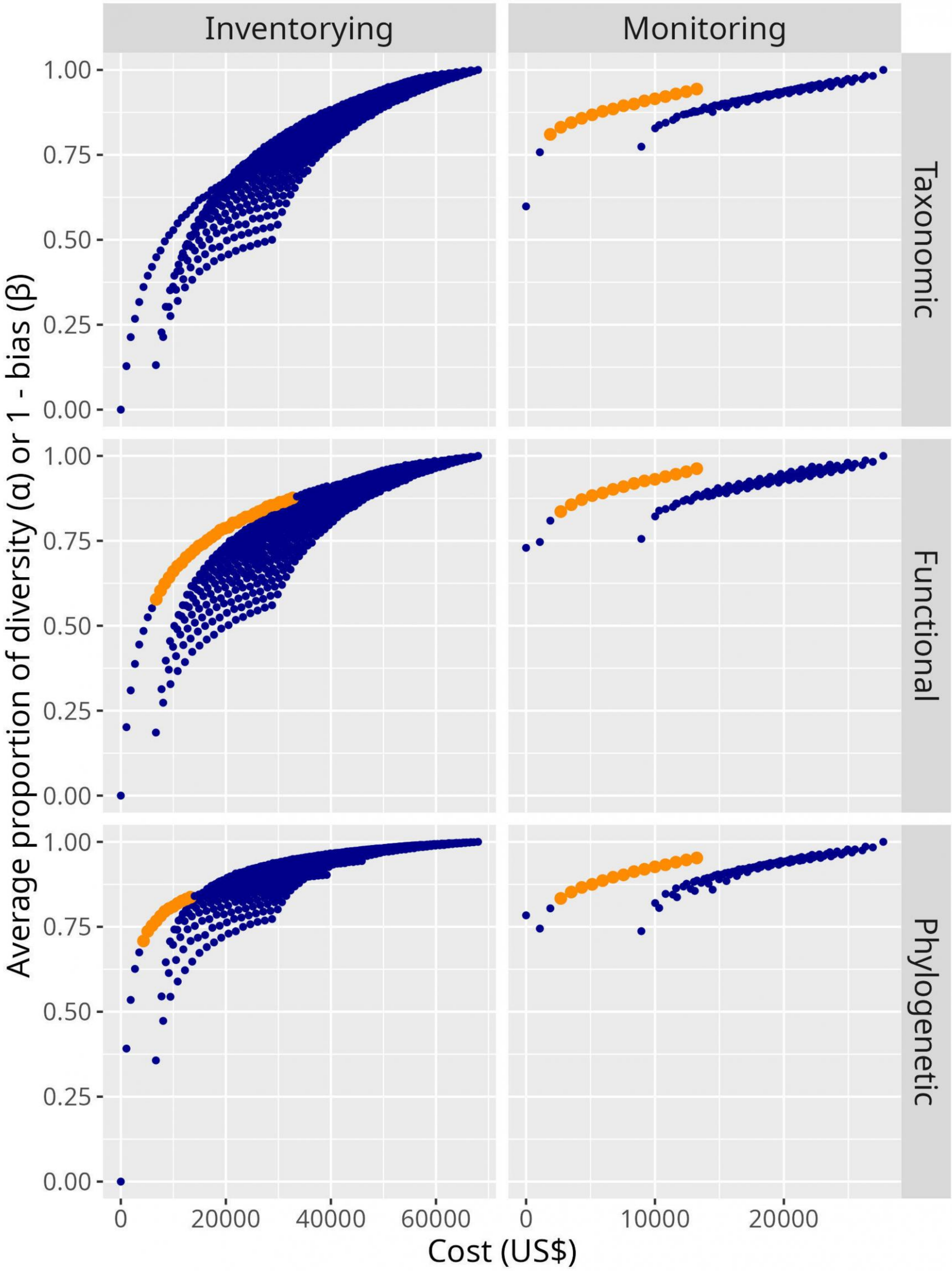

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