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Soil fertility and anthropogenic disturbances drive mammal species richness and assemblage composition on tropical fluvial islands

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Abstract Floodplain areas comprise some 30% of the area in the Amazon, but are currently under severe anthropogenic threat. Across the Amazon Basin, forest-dwelling non-volant mammals play crucial roles in maintaining the integrity of forest functionality, yet have been poorly studied in fluvial island forests. Mammal assemblages may be affected by edaphic characteristics that operate indirectly via food nutritional quality, by patch attributes, and/or can be modulated by anthropogenic disturbances. Here, we conducted systematic and quantitative mammal surveys across fluvial islands of an Amazonian archipelago, to assess the influence of edaphic factors (soil fertility), island attributes (island area and degree of isolation) and anthropogenic characteristics (distance from human settlement and logging) on the patterns of mammal species composition and richness. On 28 islands, we conducted spoor surveys and deployed 49 camera traps (total effort of 2940 camera trap-days). Subsequently, we performed multiple regression analysis to investigate the influence of environmental and anthropogenic predictors on mammal species richness, while dbRDA (distance-based redundancy analysis) was used for species composition. We found that mammal species richness was positively correlated with soil fertility, and in combination with anthropogenic characteristics, both variables affected the species assemblage composition. In particular, smaller species were found across a variety of levels of soil fertility and anthropogenic disturbances, while larger mammals were mostly recorded at sites with higher soil fertility and low levels of anthropogenic disturbances. Understanding the contribution of environmental and anthropogenic characteristics to the observed mammalian species richness and assemblage composition patterns will help optimise management and conservation efforts on Amazonian fluvial islands. In particular, we suggest enforcing hunting and logging restrictions within fluvial islands through surveillance activities, especially in more fertile islands.

Key words: anthropogenic characteristics, Amazonian archipelago, edaphic characteristics, non-volant mammals.

INTRODUCTION

Island biogeography theory comprises one of the most important models to predict species richness in island environments (MacArthur & Wilson 1967; Warren *et al.* 2015). Formulated for oceanic islands, island biogeography theory postulates that the number of species on an island is affected by both island size and isolation, so that larger and less isolated islands support more species due to lower extinction and higher colonisation rates (McArthur & Wilson 1967). An extension of this theory, the species-energy theory, also accounts for biogeographical characteristics affecting species numbers, but considers differences in the physical environment and the effect of productivity on the number of species on islands (Wright 1983). Accordingly, many ecological and biogeographical studies have included proxies of forest productivity and other predictors to assess biodiversity patterns, including vertebrate species richness (Emmons 1984; Currie 1991; Cohn-Haft *et al.* 1997). However, edaphic and island features may interact (i.e. the habitat heterogeneity may increase with island area), and the relative

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contribution of each facet remains poorly understood on fluvial islands.

In the Amazon basin, flooded forests currently account for 30% of the area (Junk *et al.* 2010; Melack & Hess 2010). As Amazonian rivers act as sources of nutrients for flooded forests, soil properties and tree physiology are substantially influenced by river type (Junk *et al.* 2010). When inundated, those seasonally flooded forests may receive low nutrient or high nutrient input, depending on whether they are flooded by black or white-water rivers (Herrera *et al.* 1978; Vitousek 1984; Goulding *et al.* 2003). For instance, the Rio Branco carries more organic ions than black-water Rivers such as the Rio Negro, but less than white-water rivers of Andean origin, such as the Madeira or Solimões (Goulding *et al.* 2003). In particular, the Rio Branco is a sediment-rich white-water river, while all neighbouring rivers are black-water and sediment-poor (Leenheer & Santos 1980). Indeed, a system of fluvial islands within the nutrient-poor Rio Negro, the Anavilhanas Archipelago, receives greater nutrient input on islands of the northern side of the archipelago than on the south, due to the hydrochemical influence of the Rio Branco (Marinho *et al.* 2020). As a result, this specific feature may influence edaphic characteristics of flooded forests and fluvial islands in the region.

Fluvial islands establish naturally as a result of processes of sediment accumulation (Kalliola *et al.* 1993). They may be ephemeral, annual or multi-decade in duration (Puhakka *et al.* 1992). However, their tendency to inundation and changes in physical shape, mean they represent a fragmented habitat whose botanical composition is in perpetual flux (Kalliola *et al.* 1993). As they are often isolated by large stretches of water, they can provide refuges for forest species anthropically impacted on the adjacent mainland (Osterkamp 1998), including endemic and endangered vertebrates (Haugaasen & Peres 2007). Yet, the influence of ecosystem productivity on mammalian assemblages in fluvial islands remains poorly understood. A global meta-analysis revealed that productivity might be a powerful predictor for mammalian species richness (Mittelbach *et al.* 2001), and the limitation of soil nutrient affects the cost-effectiveness of plant investments in reproduction and fruiting bodies (Chave *et al.* 2010), as well as enhancing higher foliage nutrient content, making them more palatable for herbivores (Vitousek 1984; Coley *et al.* 1985).

Non-volant forest mammals are often keystone species that play an important role in ecosystem function via seed dispersal (Sobral *et al.* 2017), pollination (Ollerton *et al.* 2011) and redistribution of nutrients between flooded and non-flooded environments (Buendía *et al.* 2018). Those non-volant mammals are an important part of the diet of local human communities across the Amazon, especially medium- to large-sized herbivores (Constantino 2015). Indeed, large herbivores (i.e. deers and capybaras) comprise vulnerable species to hunting pressure, being usually associated with areas presenting high productivity and low anthropogenic disturbances (Antunes 2015). Mammals and ecosystem functions are likely to interact reciprocally (Buendía *et al.* 2018), with the colonisation of certain species shaping the ecological interactions within islands and therefore contributing to the within-system energy flow. This is possible because of the swimming competence of non-volant mammals, which allows for lateral displacement between islands and between them and the mainland, as well as determining differential persistence of species on the islands themselves (Benchimol & Peres 2015). Successful dispersal depends not only on the ability of species to move between sites, but also on island attributes such as island area and isolation (Yu *et al.* 2012; Niebuhr *et al.* 2015). In addition, a myriad of anthropogenic stressors are likely to drive mammal local extinction in fragmented landscapes, including hunting and logging pressure (Benítez-López *et al.* 2017; Lavery *et al.* 2020).

In the Amazon, animal species are usually better able to cope with anthropogenic impacts on sites that have high soil fertility (Antunes 2015). This is linked to greater productivity, resulting in higher carrying capacity and therefore larger populations (Emmons 1984; Peres 2008). Here, we conducted surveys of non-volant mammals across a large set of Amazonian fluvial islands to evaluate the influence of edaphic characteristics (soil fertility), island attributes (island area and isolation) and anthropogenic stressors (distance from human settlement and logging), on both patterns of species richness and assemblage composition. We expected that environmental and anthropogenic stressors should interact (Peres 2001) and substantially affect the patterns of investigated mammals on fluvial islands. In particular, we predicted that a larger number of species and more dissimilar assemblages of mammalian species would be recorded on those fluvial islands with greater soil fertility, larger area, lower isolation (shorter distance) to the continuous forest, and less affected by hunting and logging. We also predicted that large herbivore species would be the most affected group and thus more likely to be absent from islands with lower soil fertility and/or higher hunting or logging pressure.

METHODS

Study area

The study was carried out within two protected areas and surrounding sites on the Rio Negro, central Brazilian Amazon – Anavilhanas National Park (farther from the Rio Branco) and Jaú National Park, in addition to other sampling stations in the proximities of the Jaú National Park

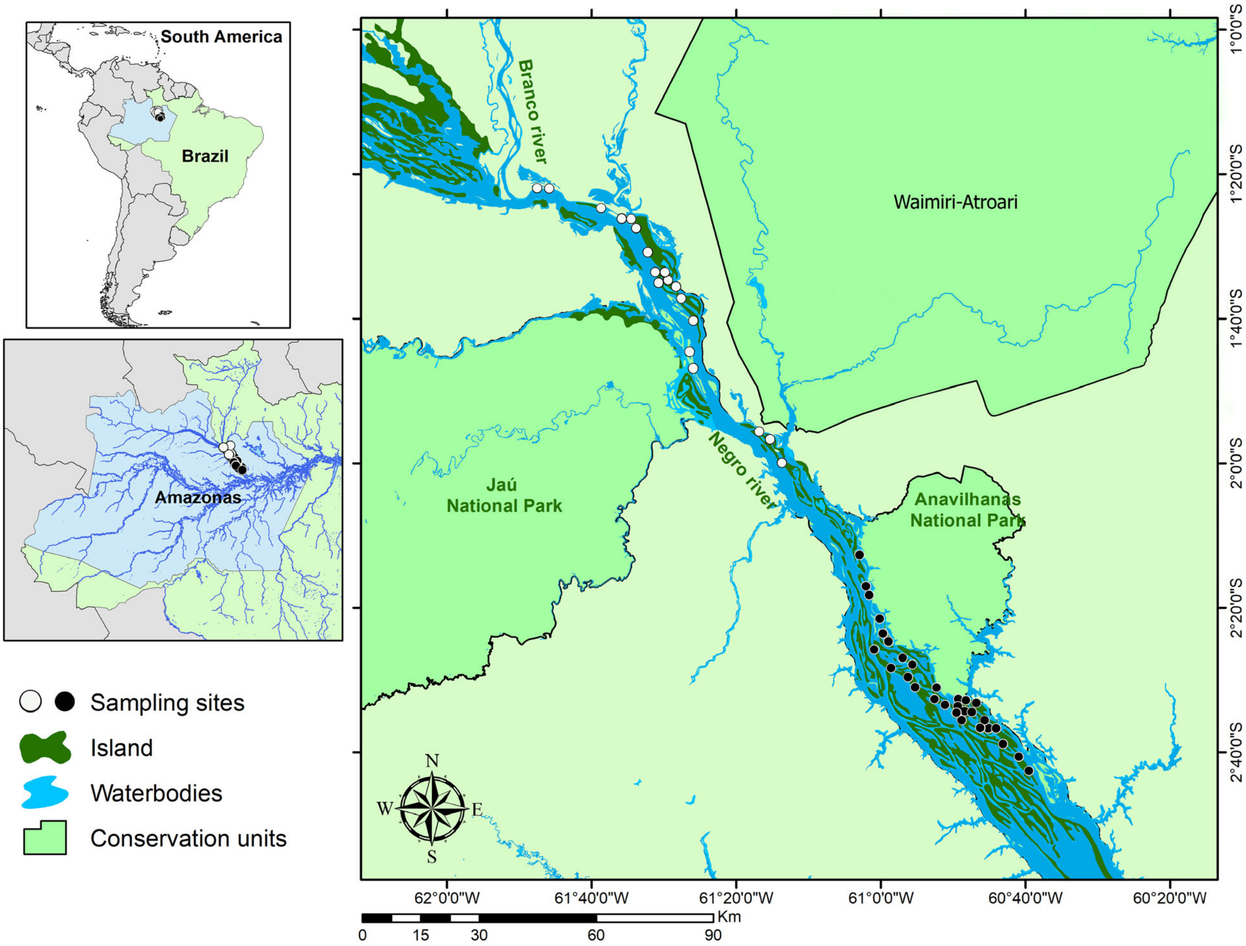

Fig. 1. Map of the study area in the Amazonas state, indicating the location of the 49 sampling stations in the Anavilhanas (black dots) and Jaú national parks (white dots), covering 28 fluvial islands in the lower Rio Negro Basin.

(Fig. 1). Both these conservation units occur at sites downstream from where the Rio Branco debouches into the Rio Negro.

The Anavilhanas National Park covers an area of 350 470 hectares located between the municipalities of Manaus and Novo Airão, between 3.4168°S and 65.8561°W (ICMBio 2017). Jaú National Park has an area of 2367.333 hectares, which is located between the municipalities of Novo Airão and Barcelos, between 2.2535°S and 62.6510°W (ICMBio 2017). Around 90 human settlements are established in the protected areas of the Anavilhanas, Jaú and neighboured adjacent areas (ICMBio 2017). Although both areas comprise conservation units, illegal extraction of high value commercial timber and subsistence hunting occur in both areas (Scabin *et al.* 2012).

The entire study area is affected by an annual flood pulse, which includes a dry season from June to October (where the islands reach maximum exposure) and a flooding season from November to May (where most islands are completely inundated, with a variability of 10 m; Junk *et al.* 2011; Junk 2013). Both Anavilhanas and Jaú National Parks are hydrochemically influenced by the Rio Branco (Fig. 1). However, the more northern islands are more greatly affected by the sediments carried by this river, due to their closer proximity to the river mouth (Filoso & Williams 2000). Natural fluvial islands of Anavilhanas can vary greatly in age and their soils are still in the process of evolution and maturation (Cunha & Sawakushi 2017).

Sampling design and mammal surveys

Initially, we established a 2 × 2 km sampling grid across the entire study area using GeoEye image from Google Earth, and then placed 65 sampling stations as close as logistically possible to the grid intercept points. This grid therefore covered the majority of the fluvial islands within Jaú and Anavilhanas national parks. However, as we were interested in analysing the greatest possible gradient of edaphic variation, we selected a higher number of intercept points on the northern sector of the archipelago, that is towards the left bank of the Rio Negro (Fig. 1). Each sampling station consisted of a single camera trap (Reconyx Hyperfire HC600 or Rapidfire RM45) in addition to one 0.1 ha forest plot (10 × 100 m). The camera was deployed at 30–40 cm height, fixed to a tree, without bait (to avoid potential bias in the species detection rates; Rocha *et al.* 2016). Camera traps are a widely used method to record midsized to large-bodied terrestrial mammals, as it allows for 24 h day^{-1} constant, and is effective in detecting nocturnal, low-density and/or rare species, or those species that are difficult to be recorded by other methods (O'Connell *et al.* 2010). Each camera trap operated continually for 60 days, from August to November 2017, to survey terrestrial and scansorial mammal species. Additionally, spoors of non-volant species were recorded on soft soil sediment at the fluvial islands plots. The spoors were recorded at the beginning and at the end of data collection and removed once recorded. This sampling technique enhances the probability of detecting elusive species and is therefore a recommended complementary technique to sample terrestrial mammals in the Amazon (Fragoso *et al.* 2016). As sixteen camera traps failed to work during surveys, a total of 49 sampling stations were operative across the entire sample period, resulting in a total effort of 2940 camera trap-days. The total species richness per sampling site was obtained by summing the occurence of all species recorded either by camera trap or by spoor surveys (Appendix S1).

Edaphic characteristics

At each sampling station, we collected ten soil samples, taken at a distance of 10 m from each other, and pooled to obtain one average measurement per plot (Appendix S2). Following leaf litter removal, soil was collected to a depth of 20 cm for shallow soils (Quesada *et al.* 2010), using a Dutch auger. Samples were bagged and stored individually in a styrofoam box, and then transferred to a freezer in a basecamp close to the study site. Time between collection and freezing was never more than 48 h. Chemical analyses were carried out at the Thematic Laboratory of Soils and Plants at the National Institute of Amazonian Research (INPA, Manaus, Brazil), with soils frozen upon arrival in the laboratory to avoid volatilisation after travelling from the research base freezer. From these, we obtained the sum of bases, considered as concentrations of Na (sodium), K (potassium), Ca (calcium) and Mg (magnesium) (Claessen 1997); their quantities were determined with the thiourea and silver nitrate method (Ag-TU) (Claessen 1997).

Island and anthropogenic features

We calculated both the total island area (in hectares) and isolation (the shortest distance from each sampling station to the nearest mainland forest site, in kilometres) based on Google Earth and Landsat TM 7 and TIRS 8 imagery from 2017 (i.e. same year of data collection). We also obtained two proxies of anthropogenic stressors based on the anthropogenic impacts commonly encountered in the region (Scabin *et al.* 2012): (i) hunting pressure, measured by the shortest distance of each sampling station to the nearest human settlement (in km); and (ii) logging pressure, assessed through the presence/absence of any direct or indirect sign of logging on each sampling station. Specifically, trees felled by humans inside the plot or photographs of loggers (e.g. carrying wood or equipment) taken by the camera trap comprised evidence of logging activity in an individual sampling station (Appendix S3).

Data analysis

We performed pairwise Pearson correlations to check for independence between variables using our five predictors: soil fertility, island area, isolation, distance from nearest human community and logging occurrence. Given that none exhibited moderate to high levels of correlation (i.e. all pairwise showed $\rho < 0.50$), we were able to conduct analyses considering all these predictor variables. We performed multiple regression models to evaluate the influence of all predictor variables (i.e. environmental and anthropogenic factors) on patterns of mammalian species richness. We used conditional plots to visualise the fit of regression models, which show the variation in the response variable (partial residuals) in relation to a given predictor while holding remaining predictors constant (Breheny & Burchett 2017).

We also performed distance-based redundancy analysis (dbRDA) using the Bray–Curtis distance to model the relationship between quantitative species composition (capture rate of the species in each camera and sign surveys) and all the predictor variables considering the capture rate of the species in each camera and sign surveys. The dbRDA is an extension to regular RDA to include non-Euclidean distances measures that are most appropriate for incorporation into a species composition matrix. (Legendre & Legendre 1998). To avoid negative eigenvalues, distances were square-root-transformed. We obtained statistical significance from each dbRDA model using analyses of variance (PERMANOVA; 999 permutations). Analyses used here do not account for the detectability of each species and, by using raw species estimates, does not provide confidence in species richness estimates locally. All analyses were performed in R version (R Core Team 2020), using *visreg* (Breheny & Burchett 2017) and *vegan* packages (Oksanen 2011).

RESULTS

Combining data from camera trapping and sign surveys, we recorded a total of 11 non-volant mammal species across all sampling stations. All species were detected by the camera trap method. Some species such as *Didelphis marsupialis*, *Nasua nasua*, *Philander opossum*, *Coendou prehenselis* and *Tamandua tetradactyla* were only detected by this sampling technique, whereas *Cuniculus paca*, *Hydrochaeris hydrochaeris*, *Mazama americana*, *Panthera onca*, *Pecari tajacu* and *Leopardus pardalis* were mostly detected by spoors. From this total, five comprised herbivore species – lowland paca (*C. paca*), capybara (*Hydrochoerus hydrochaeris*), red brocket deer (*M. americana*), collared peccary (*P. tajacu*), and Brazilian porcupine (*Coendou prehensilis*); three were omnivores – the

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common opossum (*D. marsupialis*), grey four-eyed opossum (*P. opossum*), and South American coati (*N. nasua*); two were carnivores – ocelot (*L. pardalis*) and jaguar (*P. onca*), and one species was insectivorous, lesser anteater (*T. tetradactyla*).

Species richness and assemblage composition differed in response to edaphic and anthropogenic characteristics. Species richness varied from 0 to 9 across all islands (mean (SD) = 2.63 (2.72)) and increased with soil fertility. The model containing all predictors explained 68% of the variation in species richness, all of which was solely accounted for by the soil fertility (cmolc kg^{-1}) (mean (SD) = 2.63 (2.72) range = 0.18–2.34; Fig. 2). Conversely, island area, mainland distance, logging and community distance did not explain patterns of mammal species richness in our data set (Table 1, Fig. 2).

Species composition varied accordingly with edaphic and anthropogenic factors. Non-volant mammal species composition was related to soil fertility, logging and community distance, with the model explaining 15% of the variation in species composition. Conversely, island area and mainland distance did not explain patterns of mammal species composition (Table 2, Fig. 3).

Mammal species also showed different patterns. Both ungulate species (red brocket deer and collared peccary) were only recorded in sampling stations exhibiting high values of soil fertility (>1.0 cmol kg^{-1}) and low anthropogenic disturbances (with no logging and with no human settlement around 7 km; Fig. 3a). Conversely, the common opossum occurred at sites representing the entire gradient of variables herein examined, even at the more disturbed sites (detected in 19 of the 49 camera trap sites and no spoor register), while other species, such as the South American coati and the porcupine, were rarely recorded (only one camera trap register and no spoor register). Large mammals such as the tapir (*Tapirus terrestris*) and the white-lipped peccary (*Tayassu pecari*) were not recorded on our study islands (Fig. 3b,c).

DISCUSSION

Our study shows that soil fertility was the strongest factor explaining patterns of species richness, whereas edaphic factors, hunting and logging pressures influenced mammal species composition in this natural

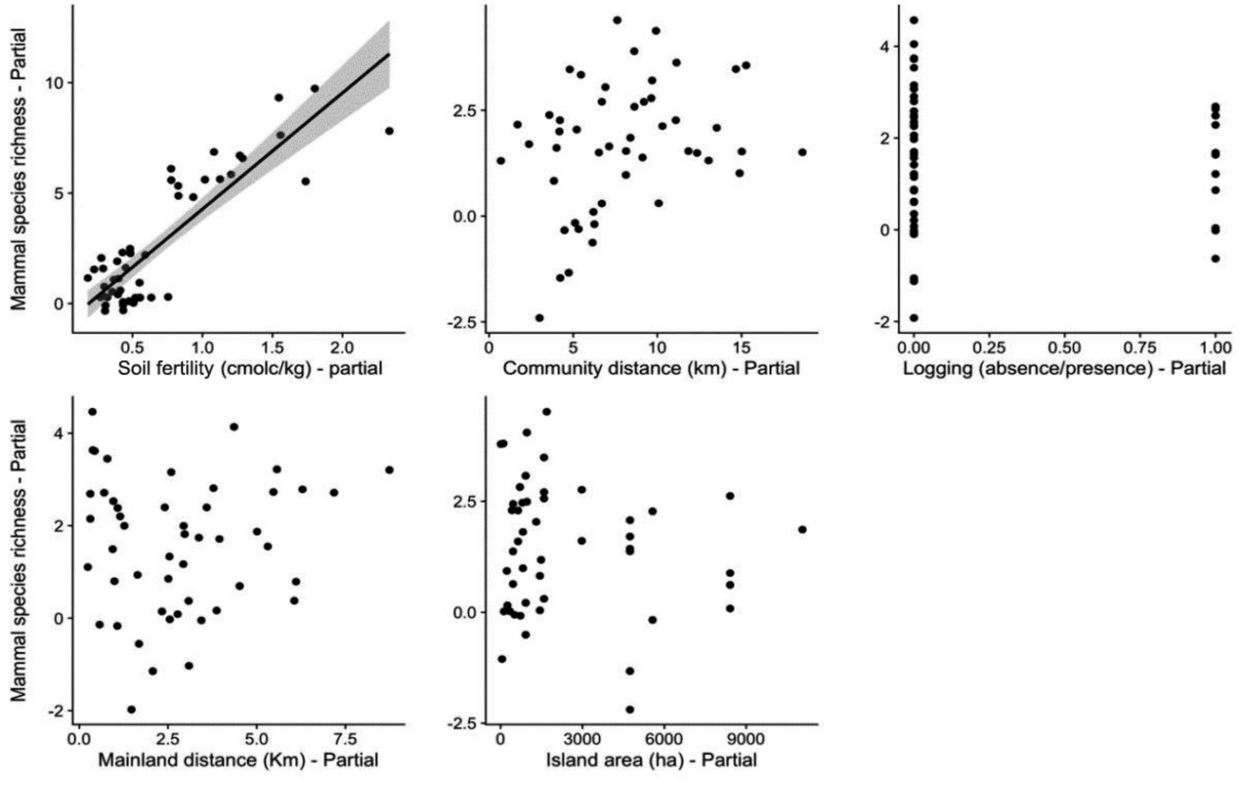

Fig. 2. Partial regression plots of the effects of soil fertility, community distance, logging, mainland distance and island area on mammal species richness. Each point represents one sampling station (n = 49). Lines represent model predictions of statistically supported effects; grey bands indicate 95% confidence bands, and partial residuals are given by black dots.

Table 1. Relationship between mammal species richness and environmental and anthropogenic factors, as revealed by multiple regressions

Adjusted R^2	F	P	Predictor	Estimate	P
0.68	21.67	<0.001	Community distance	117.40	0.16
			Island area	−0.07	0.45
			Logging	−117.70	0.93
			Mainland distance	48.62	0.70
			Soil fertility	525.70	**0.001**

Bold numbers indicate statistically significant effects ($P < 0.05$).

Table 2. Distance-based redundancy analysis (dbRDA) of mammal species composition (based on adjusted Bray–Curtis dissimilarities) by using analyses of variance (PERMANOVA; 999 permutations) in relation to environmental and anthropogenic predictors

Unadjusted R^2	Adjusted R^2	Predictors	F	P
0.27	0.15	Community distance	31.56	**0.02**
		Island area	0.31	0.87
		Logging	0.02	**0.03**
		Mainland distance	0.40	0.52
		Soil fertility	41.64	**0.001**

Bold numbers indicate statistically significant effects ($P < 0.05$).

archipelagic system. As far as we are aware, we provide here the first study to combine edaphic characteristics, patch attributes and anthropogenic stressors to scrutinise the main drivers of mammal species in fluvial Amazonian islands.

The soils of the fluvial islands are generally weathered and with low fertility. Overall, soil nutrients varied between islands from 0.18 to 2.34 cmolc kg^{-1}, but in general, soils were found to be poorer than Amazonian basin standards that range from 0.10 to 9 cmolc kg^{-1} (Quesada *et al.* 2012). Here, we were able to detect a positive effect of soil fertility on both species richness and assemblage composition in a regional scale. Evidence for the effect of bottom-up constraints on mammals at a regional scale has been derived from other ecosystems, for example, the biomass of small mammals in the grasslands of Argentina (Rodríguez & Ojeda 2015), species richness and diversity of arboreal mammals in eucalypt forests in Australia (Braithwaite *et al.* 1983) and species richness of large herbivores in the mountains of sub-Himalayan India (Ahrestani *et al.* 2011), which also had a positive effect.

Several factors may explain the observed importance of edaphic factors for mammal species richness and assemblage composition. Soil fertility is known to be a key driver of forest dynamics in terms of productivity, tree turnover and cation exchange capacity (soil's ability to hold essential nutrients) at the larger scale (Quesada *et al.* 2010; Quesada *et al.* 2012), and had also been suggested to have a strong relationship with arboreal and terrestrial mammals in Amazonia (Emmons 1984; Peres 2008). In this study, we confirmed the relationship between soil fertility and species richness and assemblage composition of mammals at a smaller scale, probably because more fertile soils provide more favourable conditions for plant establishment and growth, which invest more carbon in reproduction (i.e. flowers and fruits) than in secondary compounds (Vitousek 1984; Quesada *et al.* 2011). Such relationships would indicate that enhanced availability of high quality resources (Coley *et al.* 1985) will have a direct effect on the number of mammal species (Emmons 1984). As a result, soil fertility limitation on tropical forests is likely to affect the dynamics, abundance, assemblage composition and richness of vertebrates (Emmons 1984; Joshi & Gadgil 1991).

In addition to soil fertility, anthropogenic factors also influenced patterns of Rio Negro fluvial island mammal assemblage composition. We found a strong shift in species composition in areas close to human settlements and under logging activities. Closer to human settlements, we found mostly smaller species, while species were mostly recorded in unlogged sites and areas with higher soil fertility. Given that hunting is not random, with some species such as capybaras, peccaries and deers being preferentially sought by hunters rather than smaller-bodied taxa, sampling stations nearby to human communities are likely to experience more abrupt changes in assemblage composition (Chapin *et al.* 2000; Mesquita & Barreto 2015). This change in mammal assemblage composition could compromise ecosystem services provided by mammals, such as pollination, seed dispersal, herbivory and redistribution of nutrients (Metcalfe *et al.* 2014; Buendía *et al.* 2018; Lavery *et al.* 2020).

Contrary to the situation in fragmented landscapes and oceanic islands, where island area and degree of isolation have been widely recognised as the most important predictors for vertebrate species (Prugh *et al.* 2008), our results did not detect a influence of

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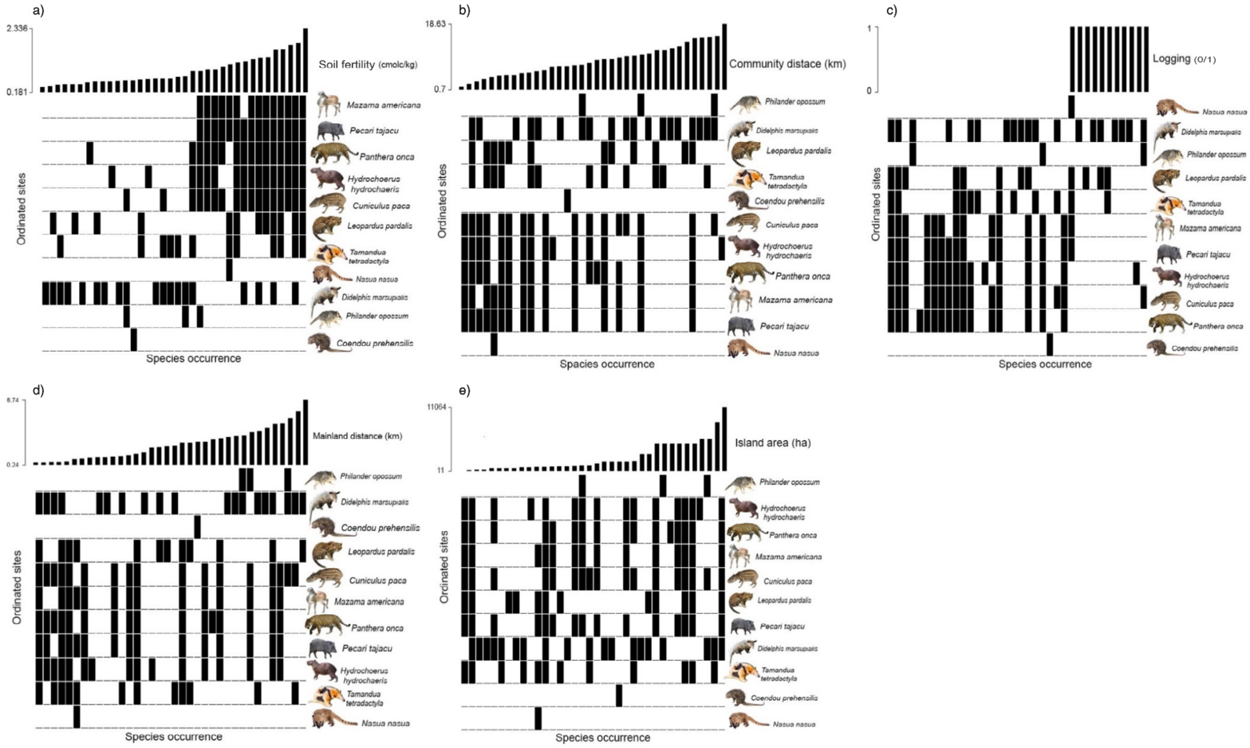

Fig. 3. Compound graphs showing how species are related to the environmental (a) soil fertility, (d) mainland distance, (e) island area and anthropogenic gradient, (b) community distance and (c) logging, indicated by dbRDA. Abundance was scaled to proportions for each species to facilitate visualisation. Species more abundant in the lower part of the gradient are placed near the bottom of the graph, and species more abundant in plot with higher predictor values are positioned near the top.

these island attributes on mammals species richness and assemblage composition. Indeed, from the current study, it appears that fluvial islands systems are not analogous to oceanic islands, so that the island biogeography theory may not be appropriate to fluvial islands. This might be the result of the natural seasonal flood pulse regime of the studied archipelagic system (Junk *et al.* 2010), which might enable species to travel between fluvial islands when the water level is low (and distances therefore reduced), or the ability of some species to swim across the aquatic matrix and visit several islands (a characteristic of several species, including jaguars and deer; Benchimol & Peres 2015), even during the flooding season (Junk *et al.* 2011). Fluvial islands also differ in stability and formation processes from most oceanic islands and also from nearby terra-firme forests (Ayres & Clutton-Brock 1992; Puhakka *et al.* 1992; Kalliola *et al.* 1993; Cunha & Sawakuchi 2017). Accordingly, we suggest alternative hypothesis that could best explain variation in mammal species richness and assemblage composition, such as species-energy theory (Wright 1983). More productive sites may harbour more individuals and therefore may accumulate more species, which will be less susceptible to local extinctions (Hubbell 2001; Allen *et al.* 2007; Hurlbert & Stegen 2014).

We also observed that species responded differently to environmental and anthropogenic disturbance gradients. For example, some herbivore species (e.g. deer and peccary) were only recorded at sampling stations exhibiting high soil fertility and low disturbance. These large mammals comprise an important part of the diet of many human communities across the Amazon (Constantino 2015). Conversely, smaller omnivorous (both grey four-eyed and common opossum) exhibited high densities across the studied archipelago across the entire soil and anthropogenic gradient, suggesting their greater ability to exploit resources on fluvial islands. These species are also scansorial, which potentially provides advantages when responding to the flood regime (O'Connell 1989). Thus, the disappearance of larger mammals such as capybaras, peccaries, jaguars and deers from the islands may trigger several cascading effects, leading to a disruption in key ecosystem functions (Buendía *et al.* 2018; Bogoni *et al.* 2020).

Our study clearly demonstrates that both edaphic and anthropogenic factors affect mammal species composition in a fluvial Amazonian archipelago,

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while only soil fertility had influence on species richness at the regional scale. One reason why anthropogenic factors only affect species assemblage composition could be density compensation on islands (MacArthur *et al.* 1972; Wright 1980). Under such circumstances where hunted mammals have disappeared, other species may occupy the sites, so that the species composition is different, but species richness and biomass could continue to be similar at hunted and non-hunted sites (Peres & Dolman 2000). Another explanation would be that more fertile soils experience greater ecosystem turnover (Quesada *et al.* 2010; Quesada *et al.* 2012), which weakens the effect of human-disturbed factors and increases the chance of individual and species survival via higher productivity (Peres 2008; Ahrestani *et al.* 2011; Rodríguez & Ojeda 2015).

This study also provides potential contributions for mammal conservation. Indeed, from the 11 species recorded, only jaguars are considered threatened to extinction and the red brocket deer is data-deficient at the national level (Duarte & Vogliotti 2016; Quigley *et al.* 2017). Other threatened species were not registered, but occur in our study area (ICMBio 2017) such as *Myrmecophaga tridactyla* (giant anteater); *Tapirus terrestres* (tapir); *Priodontes maximus* (giant armadillo); and *Tayassu pecari* (white-lipped peccary) (Keuroghlian *et al.* 2013; Miranda *et al.* 2014; Anacleto *et al.* 2014; Varela *et al.* 2019). Based on our results, we suggest a combination of camera trap and spoors methods in future surveys in fluvial islands in order to increase the detectability for the more elusive species.

Non-volant mammals comprise a key group for forest functionality and deliver vital ecosystem services between flooded and non-flooded ecosystems in the Amazon (Sobral *et al.* 2017; Buendía *et al.* 2018). Improving our understanding on the spatial distribution of mammal assemblages and their linkage to edaphic constraints could help predict the persistence and safeguard vertebrate species in tropical undisturbed ecosystems. Our findings offer guidelines that could be used for management decisions in order to combine the economic use of fluvial islands for local communities and conservation. In particular, we recommend enforcing hunting and logging restrictions within fluvial islands through surveillance activities especially in more fertile islands, which are likely to safeguard a great number of mammal species.

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CONFLICT OF INTEREST

There is no conflict of interest.

AUTHOR CONTRIBUTIONS

Gilson de Souza Ferreira Neto: Conceptualization (lead); Formal analysis (lead); Funding acquisition (lead); Methodology (equal); Resources (lead); Writing-original draft (lead); Writing-review & editing (lead). **Fabricio Beggiato Baccaro:** Conceptualization (supporting); Formal analysis (supporting); Methodology (equal); Writing-original draft (supporting); Writing-review & editing (supporting). **Wilson Roberto Spironello:** Conceptualization (supporting); Methodology (equal); Resources (supporting); Writing-original draft (supporting); Writing-review & editing (supporting). **Maíra Benchimol:** Writing-original draft (supporting); Writing-review & editing (supporting). **Katrin Fleischer:** Writing-original draft (supporting); Writing-review & editing (supporting). **Carlos Alberto Nobre Quesada:** Methodology (supporting); Resources (supporting); Writing-original draft (supporting). **André Luis Sousa Gonçalves:** Methodology (supporting); Writing-original draft (supporting); Writing-review & editing (supporting). **Pedro Aurélio Costa Lima Pequeno:** Formal analysis (supporting); Writing-review & editing (supporting). **Adrian Paul Ashton Barnett:** Conceptualization (supporting); Funding acquisition (supporting); Methodology (equal); Writing-original draft (supporting); Writing-review & editing (supporting).

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SUPPORTING INFORMATION

Additional supporting information may/can be found online in the supporting information tab for this article.

Appendix S1. Mammal species recorded in each surveyed fluvial islands in Central Amazon, during the dry season based on camera traps (C) and/or spoor (S).

Appendix S2. Edaphic, island and anthropogenic predictors obtained for each sampling station and used in the final analysis of this study.

Appendix S3. Records of loggers carrying equipment (A) and sawn wood (B).

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