



Supplementary Information for

Factors influencing terrestriality in primates of the Americas and Madagascar

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Other supplementary materials for this manuscript include the following:

Dataset S1

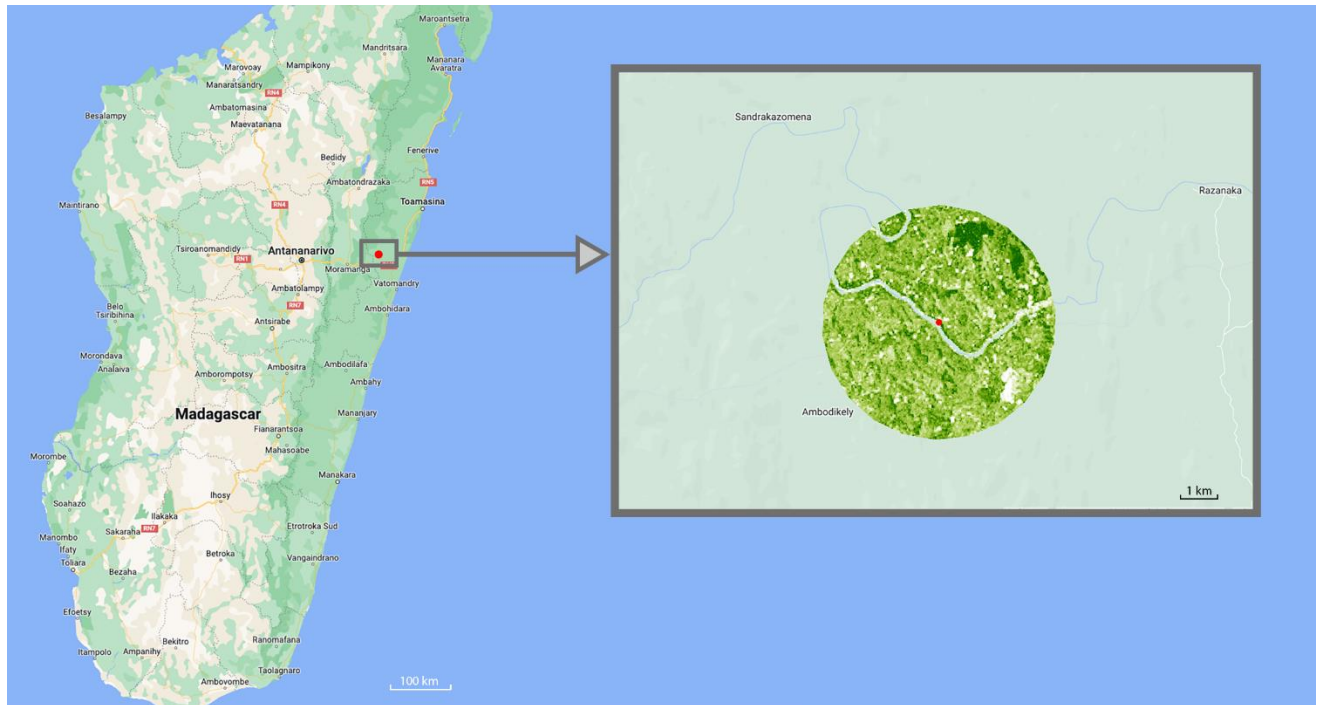


Fig. S1. Vegetation cover extracted from the Landsat Tree Cover Continuous Fields (GLCF) data set for a single observation using the Google Earth Engine. Each pixel included in the circular buffer (around the observation) quantifies the percentage of area covered by trees. The mean of all pixel values within the buffer was used as a final value for an observation. The circular buffer had the size of 2 times the home range.

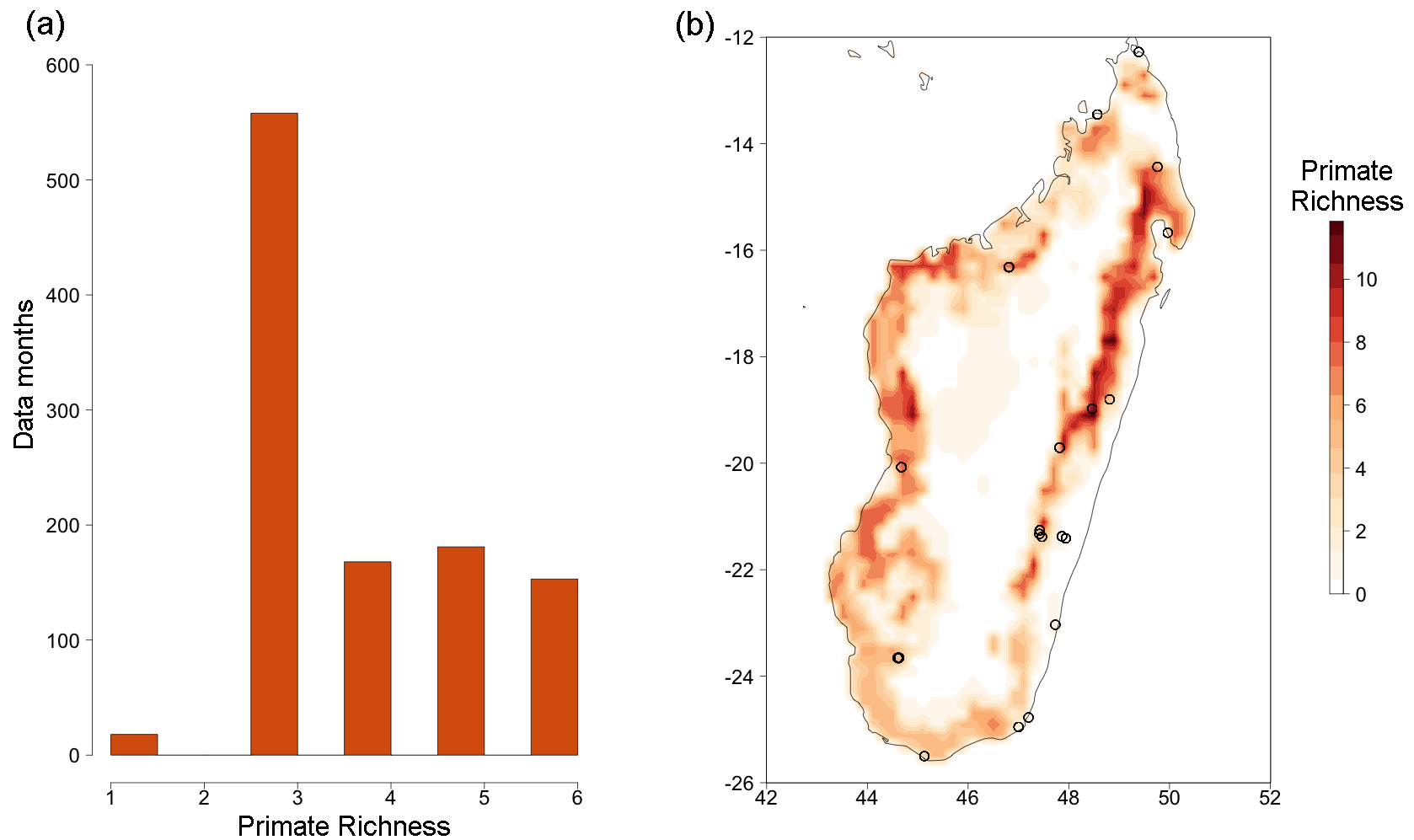


Fig. S2. Primate species richness (number of species) derived by summing presences using IUCN range maps for Madagascar. (a) Distribution of data months per diurnal primate species richness per site. (b) Richness map and distribution of study sites that richness values were extracted from. Darker coloration indicates areas of greater species richness.

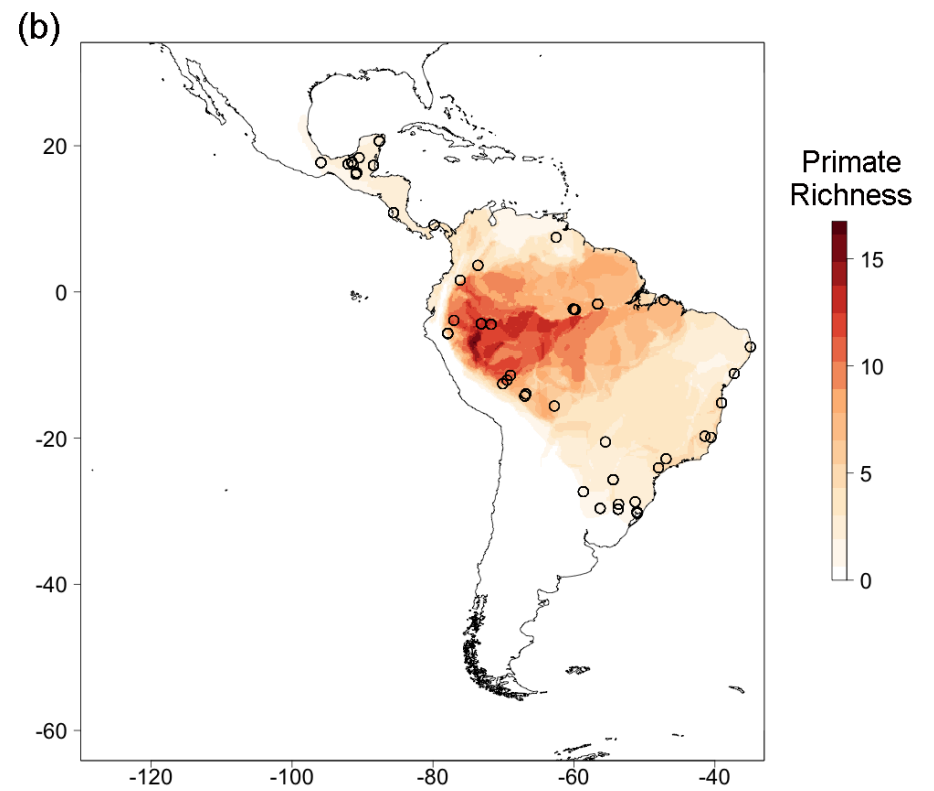
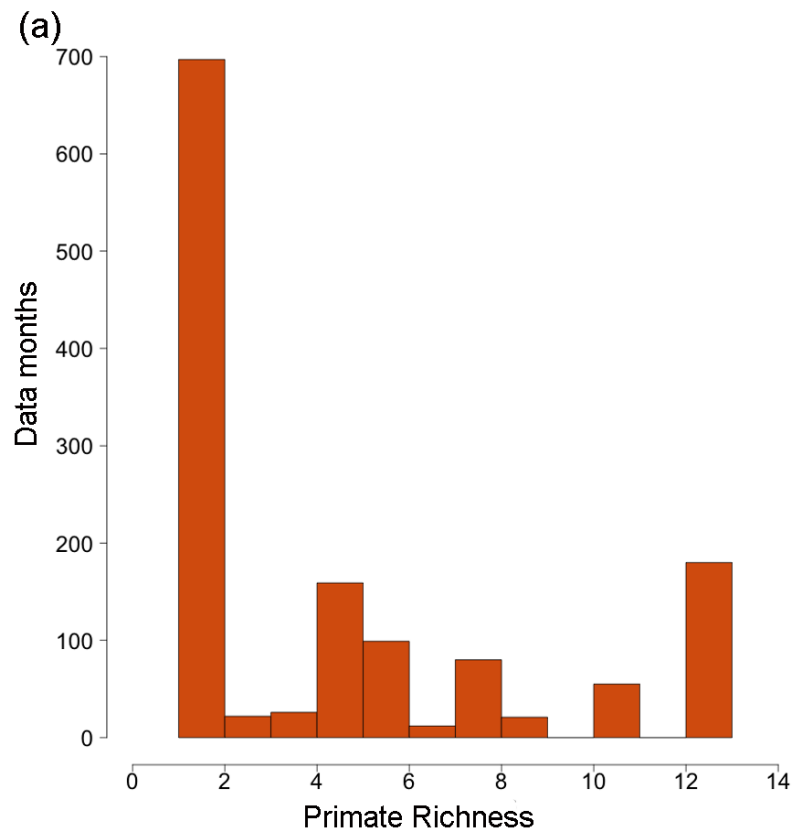


Fig. S3. Primate species richness (number of species) derived by summing presences using IUCN range maps for the Americas. (a) Distribution of data months per diurnal primate species richness per site. (b) Richness map and distribution of study sites that richness values were extracted from. Darker coloration indicates areas of greater species richness.

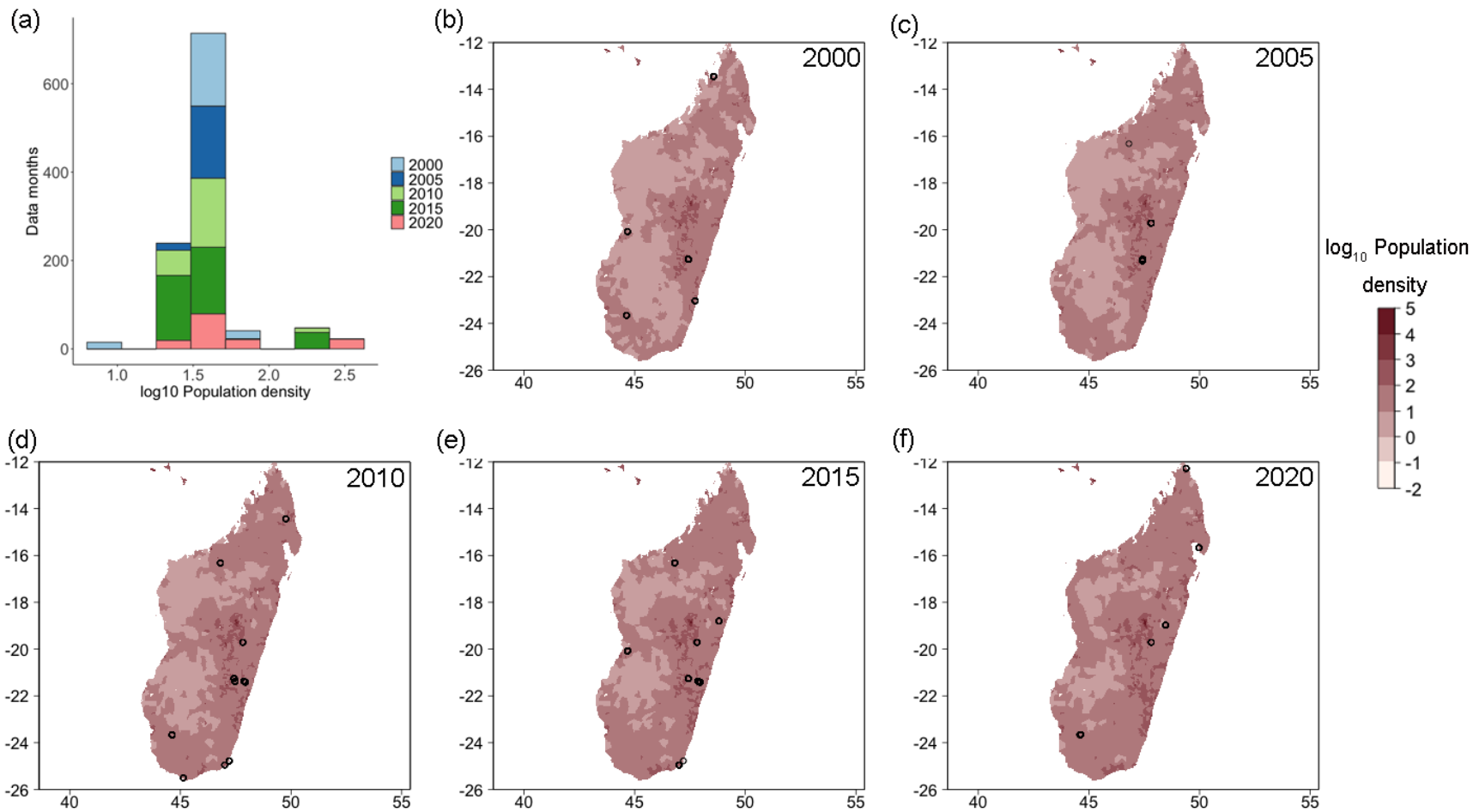


Fig. S4. Human population density data for Madagascar, obtained from the Socioeconomic Data and Applications Center (<http://sedac.ciesin.columbia.edu/>). Maps were generated using the Gridded Population of the World (GPW) dataset, v.4 dataset (CIESIN, 2018) for 2000, 2005, 2010, 2015, and 2020 at 30 arcsecond resolution (~1km). (a) Distribution of human population density values for the study sites included in the dataset, with colors representing the proportion of estimates per bin across different years. Estimates were extracted from human population density rasters available for five years (b-f) using the raster map closest in time to the behavioral observation.

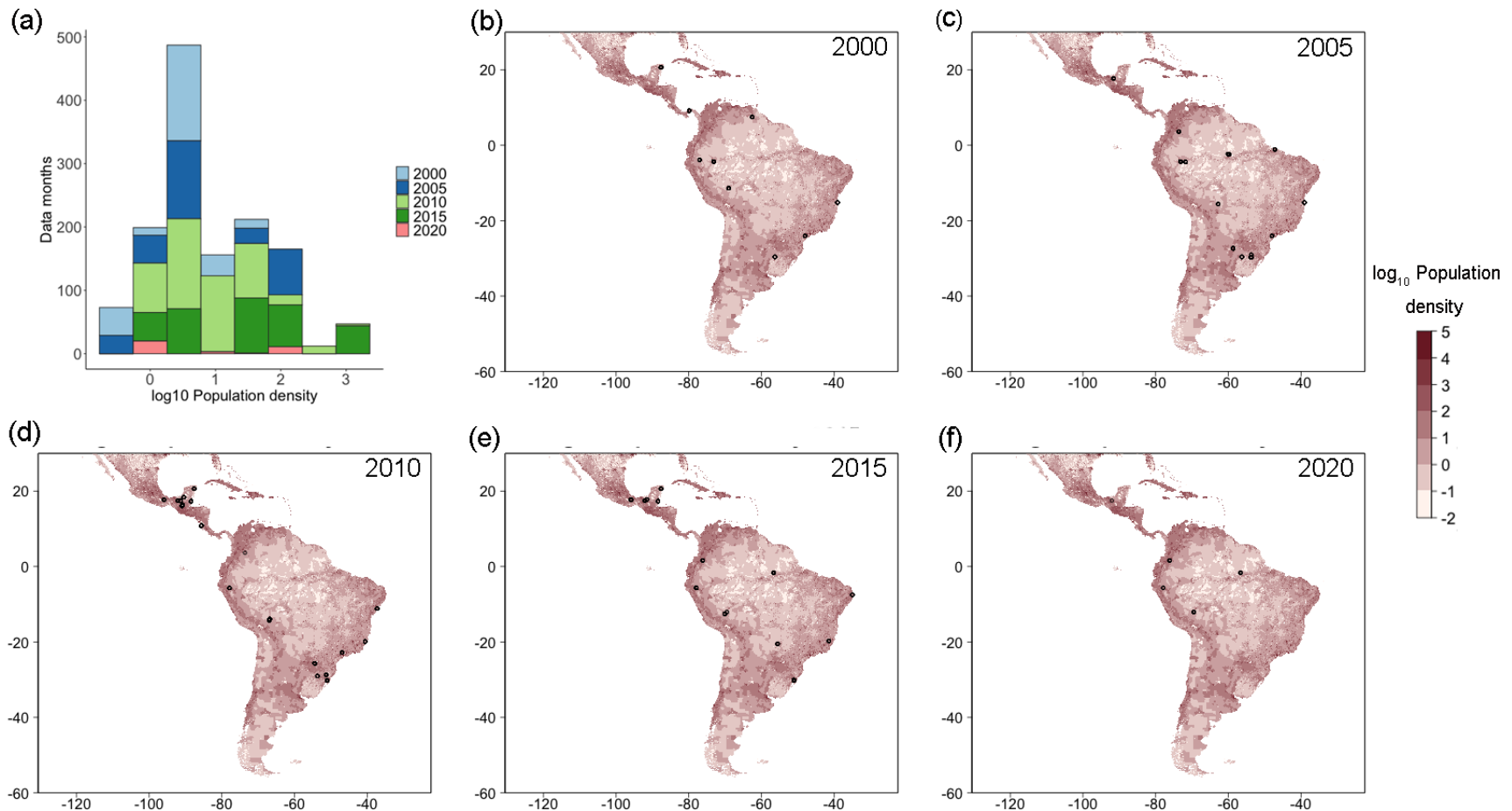


Fig. S5. Human population density data for the Americas, obtained from the Socioeconomic Data and Applications Center (<http://sedac.ciesin.columbia.edu/>). Maps were generated using the Gridded Population of the World (GPW) dataset, v.4 dataset (CIESIN, 2018) for 2000, 2005, 2010, 2015, and 2020 at 30 arcsecond resolution (~1km). (a) Distribution of human population density values for the study sites included in the dataset, with colors representing the proportion of estimates per bin across different years. Estimates were extracted from human population density rasters available for five years (b-f) using the raster map closest in time to the behavioral observation.

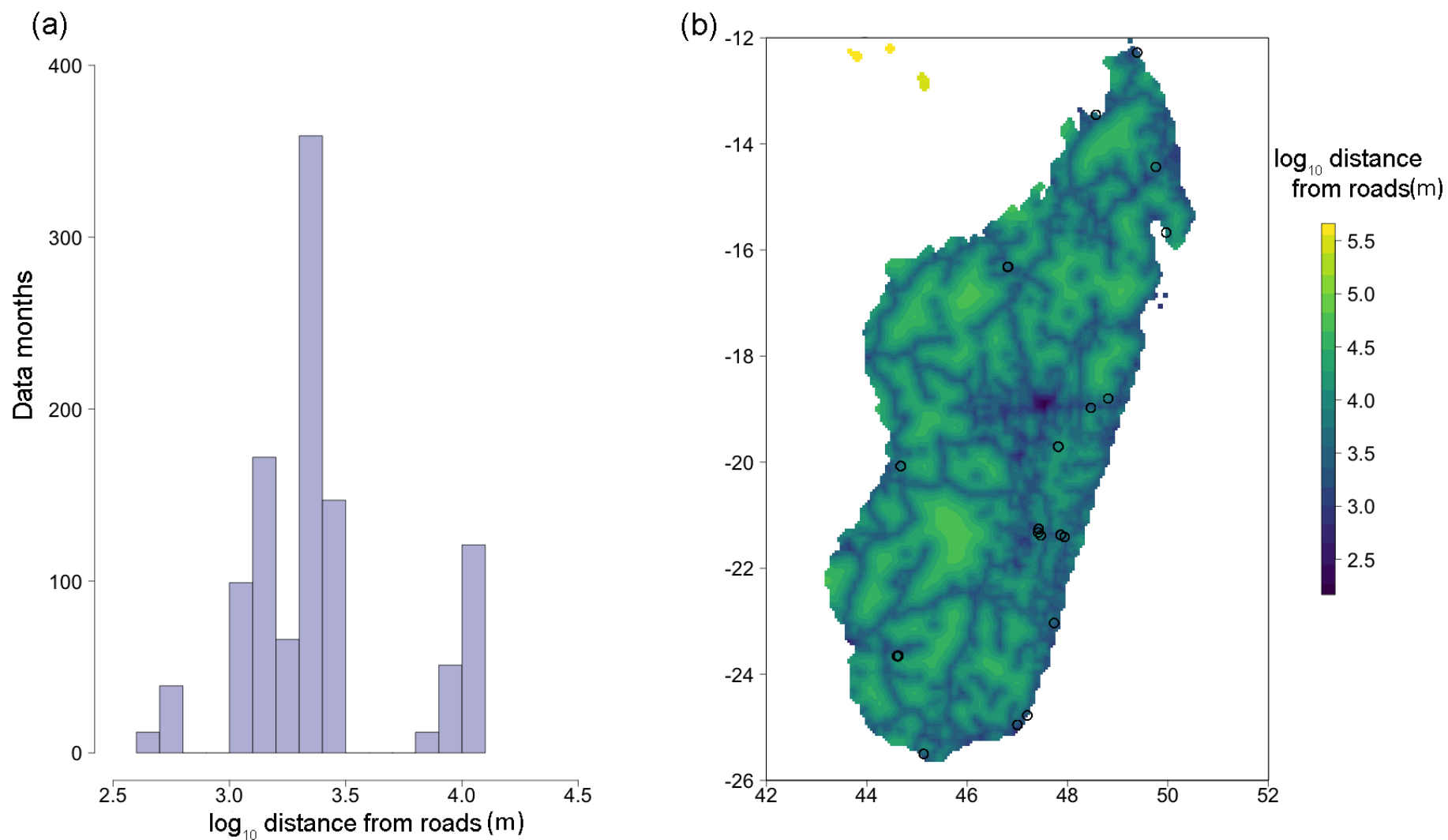


Fig. S6. Maps of \log_{10} distance from roads (m) obtained using the data in the OpenStreetMap database (openstreetmap.org) for Madagascar. Only primary, secondary, and tertiary roads, motorways, trunks, all related “links”, and residential roads were considered. (a) Distribution of data months of road density values per site. (b) Road density map and distribution of sites that values were extracted from. Lighter colors (yellow) indicate further distances to roads, with distance units expressed as decimal degrees.

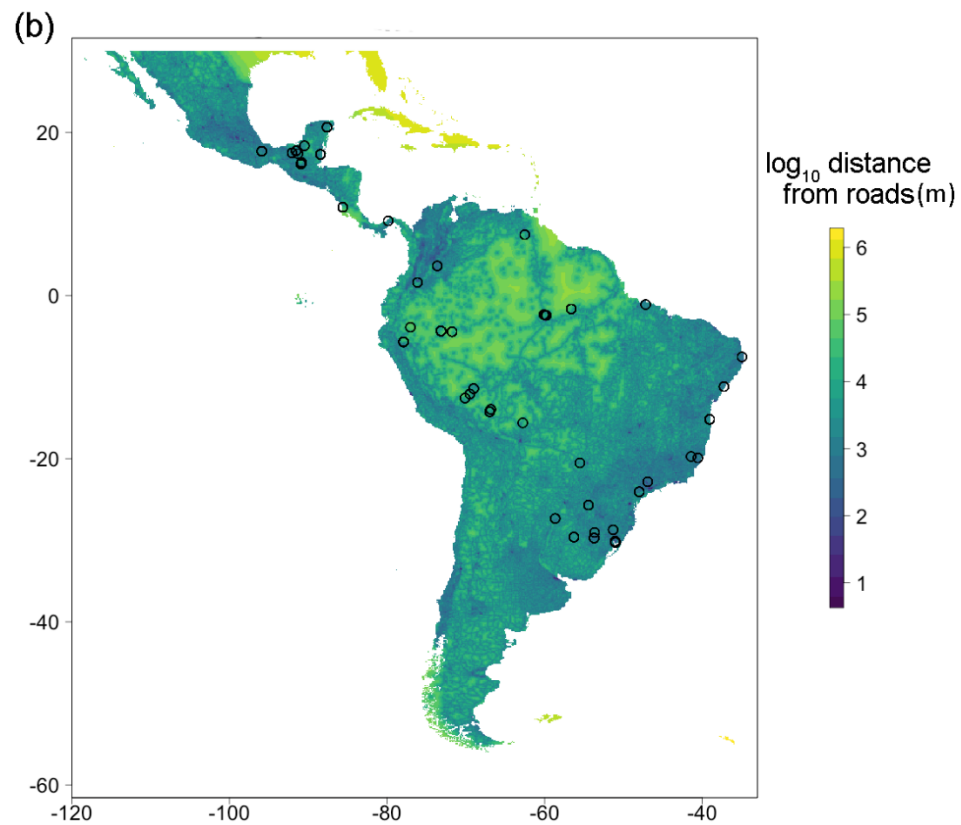
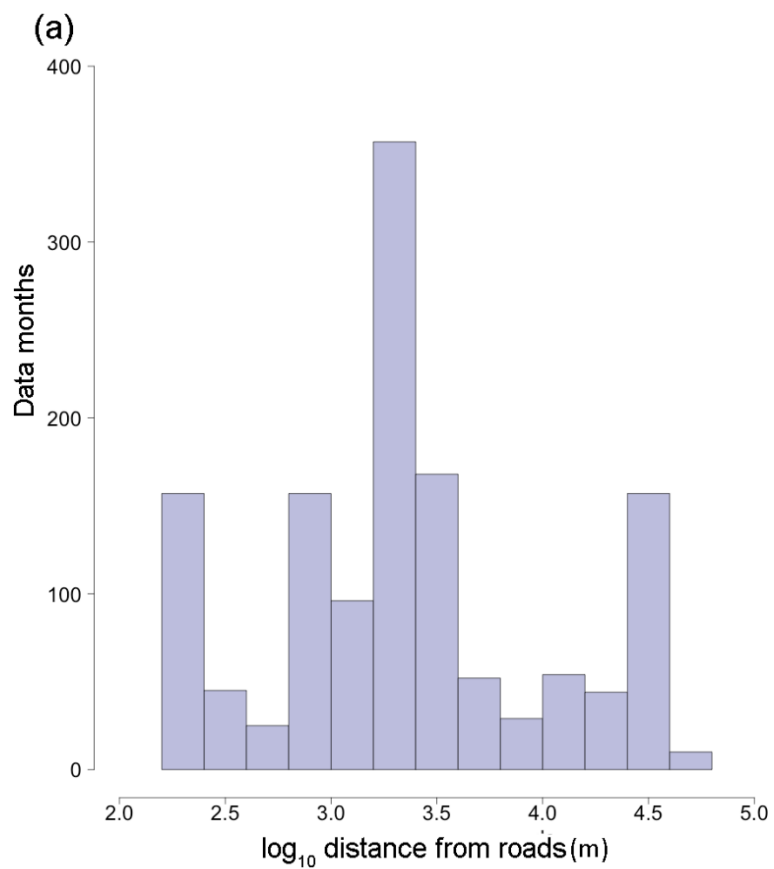


Fig. S7. Maps of \log_{10} distance from roads (m) obtained using the data in the OpenStreetMap database (openstreetmap.org) for the Americas. Only primary, secondary, and tertiary roads, motorways, trunks, all related "links", and residential roads were considered. (a) Distribution of data months of road density values per site. (b) Road density map and distribution of sites that values were extracted from. Lighter colors (yellow) indicate further distances to roads, with distance units expressed as decimal degrees.

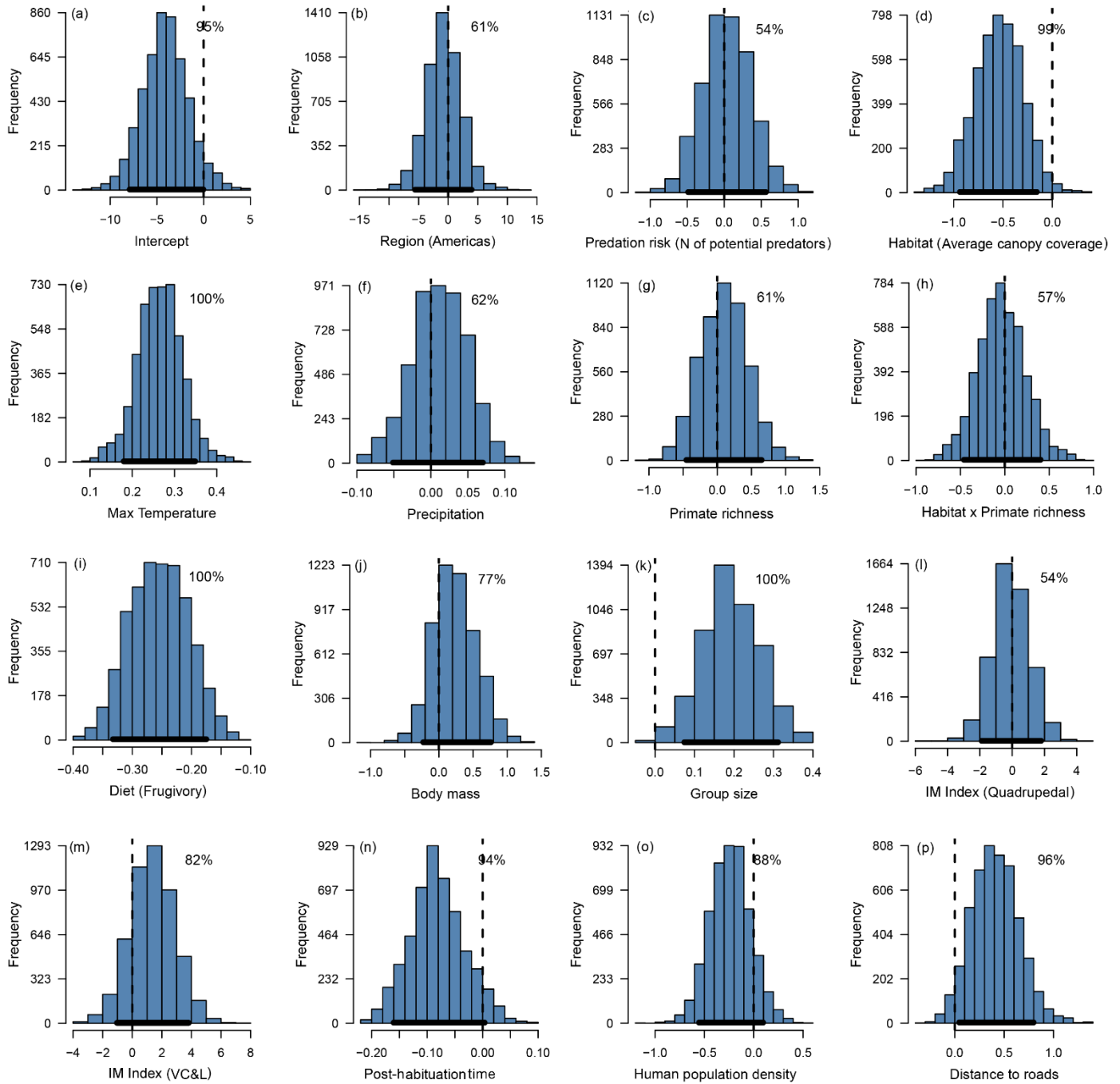


Fig. S8. Posterior distributions of the full model and their potential effect on terrestriality among arboreal primates. Histograms represent the distribution of coefficient values for the (a) intercept, (b) Americas, (c) number of potential predators, (d) average canopy coverage, (e) maximum temperature, (f) precipitation, (g) primate richness, (h) interaction between average canopy cover and primate richness, (i) frugivory, (j) body mass, (k) group size, (l) inter-membral index of quadrupedal species, (m) inter-membral index of vertical clinging and leaping species, (n) post-habituatation time, (o) human population density, and (p) distance to roads.

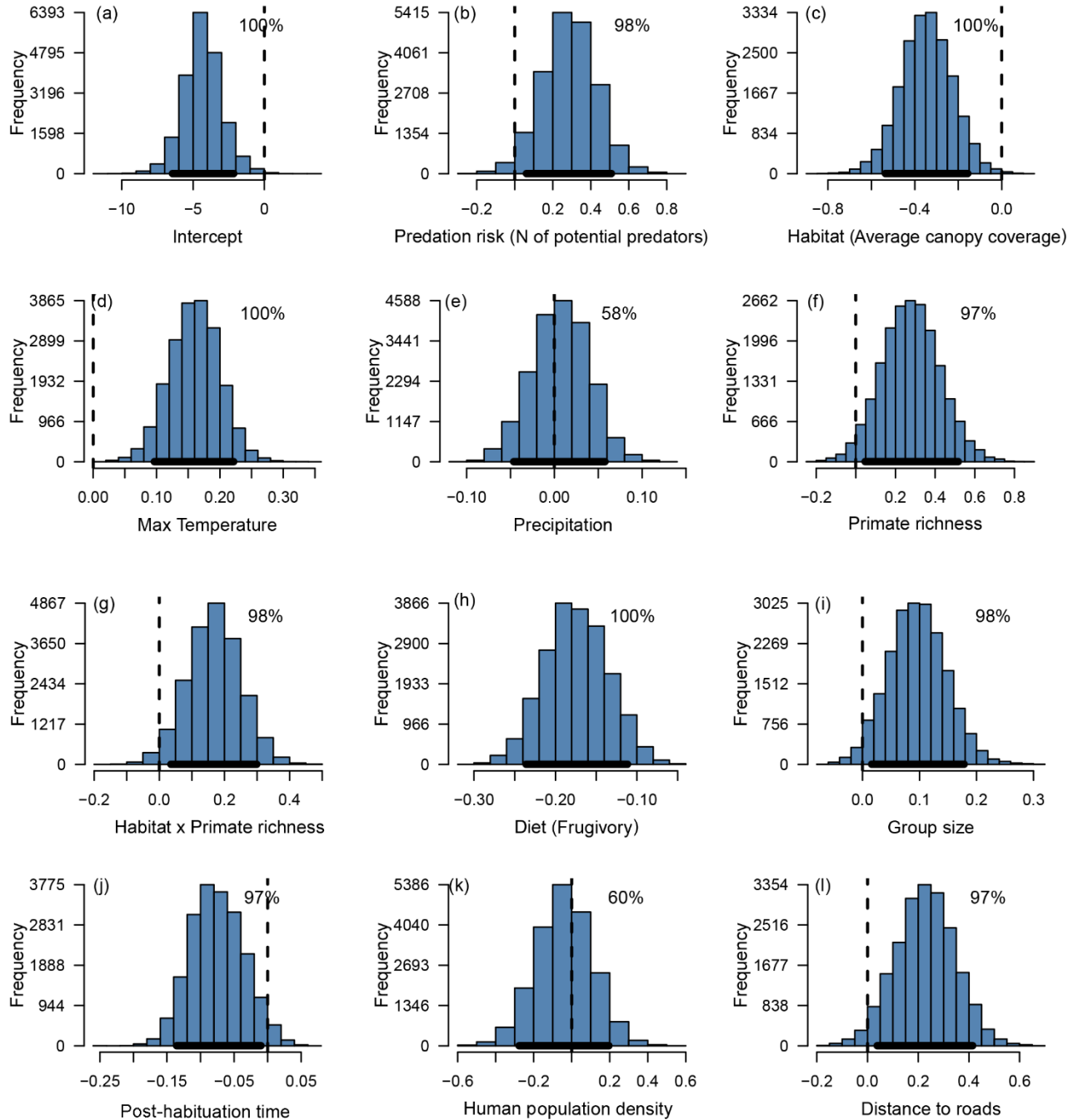


Fig. S9. Posterior distributions of the within-species model and their potential effect on terrestriality among arboreal primates. Histograms represent the distribution of coefficient values for the (a) intercept, (b) number of potential predators, (c) average canopy coverage, (d) maximum temperature, (e) precipitation, (f) primate richness, (g) interaction between average canopy cover and primate richness, (h) frugivory, (i) group size, (j) post-habitation time, (k) human population density, and (l) distance to roads.

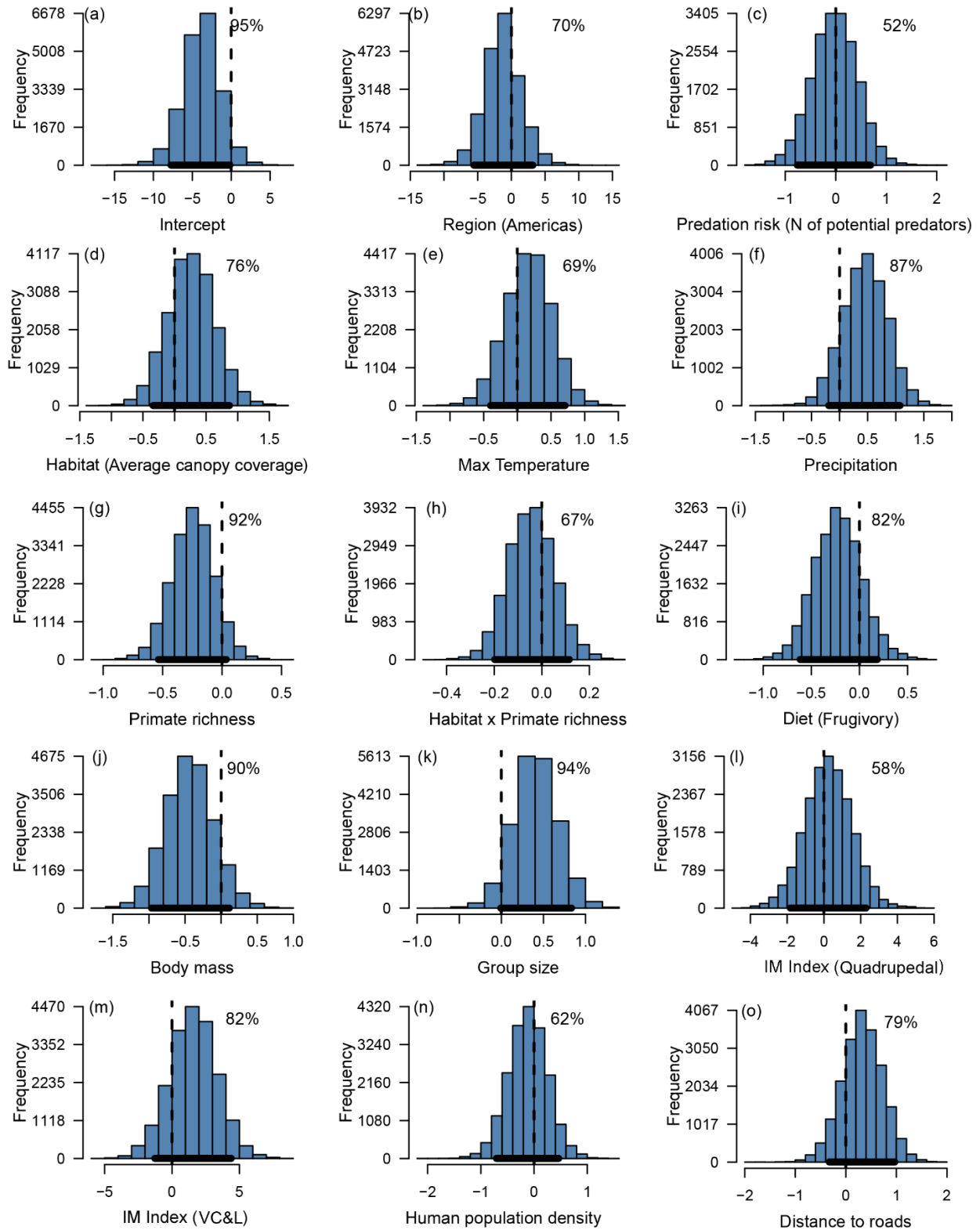


Fig. S10. Posterior distributions of the between-species model and their potential effect on terrestriality among arboreal primates. Histograms represent the distribution of coefficient values for the (a) intercept, (b) Americas, (c) number of potential predators, (d) average canopy

coverage, (e) maximum temperature, (f) precipitation, (g) primate richness, (h) interaction between average canopy cover and primate richness, (i) frugivory, (j) body mass, (k) group size, (l) inter-membral index of quadrupedal species, (m) inter-membral index of vertical clinging and leaping species, (n) human population density, and (o) distance to roads.

Table S1. Research sites, GIS location and observed primate taxa, included in the study.

Region	Country	Study site	Location (lat, long)	Species
Madagascar	Madagascar	Ambalafary	-18.8018, 48.8108	<i>Prolemur simus</i>
		Ambato Massif	-13.4500, 48.5667	<i>Eulemur macaco</i>
		Ankarafantsika National Park - Ampijoroa	-16.3143, 46.8170	<i>Eulemur fulvus</i>
		Masoala National Park - Andranobe	-15.6716, 49.9658	<i>Varecia rubra</i>
		Cap Sainte Marie - Bevaro Moravato	-25.5010, 45.1320	<i>Lemur catta</i>
		Cap Sainte Marie - Tsankalmanga	-25.4460, 45.1660	<i>Lemur catta</i>
		Bezà Mahafaly Special Reserve	-23.6565, 44.6290	<i>Lemur catta</i> <i>Propithecus verreauxi</i>
		Kirindy Forest	-20.0745, 44.6749	<i>Eulemur rufifrons</i> <i>Propithecus verreauxi</i>
		Mandena	-24.9525, 47.0026	<i>Eulemur collaris</i> <i>Hapalemur meridionalis</i>
		Manombo Special Reserve	-23.0333, 47.7333	<i>Varecia variegata</i>
		Marojejy National Park	-14.4349, 49.7607	<i>Propithecus candidus</i>
		Maromizaha	-18.9763, 48.4651	<i>Propithecus diadema</i>
		Oronjia	-12.2770, 49.3889	<i>Eulemur coronatus</i>
		Ranomafana National Park - Mangevo	-21.3831, 47.4667	<i>Varecia variegata</i>
		Ranomafana National Park - Talatakely	-21.2613, 47.4209	<i>Eulemur rubriventer</i> <i>Prolemur simus</i> <i>Propithecus edwardsi</i>
		Ranomafana National Park - Vatoharanana	-21.3280, 47.4160	<i>Eulemur rubriventer</i> <i>Eulemur rufifrons</i> <i>Propithecus edwardsi</i> <i>Varecia variegata</i>
		Sainte Luce	-24.7748, 47.1999	<i>Eulemur collaris</i>
		Sangasanga	-21.3725, 47.8658	<i>Eulemur rubriventer</i> <i>Eulemur rufifrons</i> <i>Varecia variegata</i>
		Tsinjoarivo-Ambalaomby NAP - Ankadivory	-19.7087, 47.8172	<i>Eulemur fulvus</i> <i>Propithecus diadema</i>
		Vatovavy	-21.4116, 47.9422	<i>Eulemur rubriventer</i> <i>Eulemur rufifrons</i> <i>Varecia variegata</i>
Americas	Argentina	Iguazú National Park	-25.6868, -54.4450	<i>Sapajus nigritus</i>

		Isla Brasileira	-27.3330, -58.6660	<i>Alouatta caraya</i>
	Belize	Runaway Creek Nature Reserve	17.3058, -88.4451	<i>Ateles geoffroyi</i>
	Bolivia	La Asunta cattle ranch	-14.2423, -66.9778	<i>Plecturocebus olallae</i>
		La Chonta	-15.6072, -62.7831	<i>Ateles chamek</i>
		Estación Biológica Tahuamanu	-11.4100, -69.0100	<i>Callimico goeldii</i> <i>Leontocebus weddelli</i> <i>Saguinus labiatus</i>
		San Miguel cattle ranch	-13.9516, -66.8345	<i>Plecturocebus modestus</i>
	Brazil	Ananim	-1.1000, -47.1900	<i>Saimiri collinsi</i>
		Augusto Ruschi Biological Reserve	-19.9059, -40.5603	<i>Callithrix flaviceps</i>
		Biological Dynamics of Forest Fragments Project (BDFFP)	-2.4046, -59.8714	<i>Chiropotes sagulatus</i>
		Caapora	-7.5200, -34.9620	<i>Sapajus flavius</i>
		Caratinga	-19.7310, -41.4190	<i>Brachyteles hypoxanthus</i>
		Carlos Botelho State Park	-24.0595, -47.9948	<i>Brachyteles arachnoides</i>
		Estabelecimento Nossa Senhora da Conceição	-29.6119, -56.2731	<i>Alouatta caraya</i>
		Estância Casa Branca	-29.6155, -56.2869	<i>Alouatta caraya</i>
		Estância Crioula Farm	-20.5204, -55.5349	<i>Alouatta caraya</i>
		Fazenda Trapsa	-11.1678, -37.2537	<i>Callicebus coimbrai</i>
		Ipê-RS	-28.7206, -51.3126	<i>Alouatta guariba</i>
		Itapuã Village	-30.2839, -51.0191	<i>Alouatta guariba</i>
		Morro São Pedro	-30.1100, -51.0607	<i>Alouatta guariba</i>
		Parque Estadual de Itapuã	-30.2316, -51.0243	<i>Alouatta guariba</i>
		Parque São Paulo	-30.1218, -51.0606	<i>Alouatta guariba</i>
		Ribeirão Cachoeira	-22.8326, -46.9276	<i>Callicebus nigrifrons</i>
		Santa Maria	-29.7300, -53.7300	<i>Alouatta guariba</i>
		Saracá-Taquera National Forest	-1.6536, -56.6305	<i>Saguinus martinsi</i> <i>Chiropotes sagulatus</i>
		Tupanciretã	-29.0442, -53.6736	<i>Alouatta caraya</i>
		Una Biological Reserve	-15.1769, -39.0581	<i>Leontopithecus chrysomelas</i>
	Colombia	Parque Nacional Natural Cueva de los Guacharos	1.6038, -76.1369	<i>Lagothrix lagotricha</i>
		San Martín	3.6336, -73.6249	<i>Saimiri cassiquiarensis</i>
	Costa Rica	Sector Santa Rosa, Área de Conservación Guanacaste	10.8390, -85.6180	<i>Cebus imitator</i>
	Ecuador	Yasuni National Park	-3.8899, -77.0378	<i>Ateles belzebuth</i>
	Mexico	Balancan	17.7801, -91.5061	<i>Alouatta pigra</i>

		Balancan II	17.4000, -91.3000	<i>Alouatta pigra</i>
		Escarcega, Campeche	18.3644, -90.4831	<i>Alouatta pigra</i>
		Palenque National Park	17.4849, -92.0514	<i>Alouatta pigra</i>
		Área de protección de flora y fauna Otoch Ma'ax yetel Kooh	20.6333, -87.6167	<i>Ateles geoffroyi</i>
		R/A Leona Vicario	17.7170, -91.5558	<i>Alouatta pigra</i>
		Reforma Agraria	16.2534, -90.8332	<i>Ateles geoffroyi</i>
		Reserva de la Biósfera Montes Azules	16.1162, -90.9384	<i>Ateles geoffroyi</i>
		San José Nuevo Río Manso	17.6970, -95.8960	<i>Ateles geoffroyi</i>
		Zamora Pico de Oro	16.3235, -90.8455	<i>Ateles geoffroyi</i>
	Panama	Barro Colorado Island	9.1500, -79.8500	<i>Ateles geoffroyi</i>
	Peru	Estación Biológica Los Amigos	-12.5686, -70.0991	<i>Pithecia rylandsi</i>
		Estación Biológica Quebrada Blanco	-4.3500, -73.1500	<i>Leontocebus nigrifrons</i> <i>Plecturocebus cupreus</i> <i>Saguinus mystax</i>
		Las Piedras Amazon Center	-12.0671, -69.4938	<i>Ateles chamek</i>
		Río Yavari	-4.4356, -71.7495	<i>Cacajao calvus</i>
		Yambrasbamba	-5.7079, -77.9061	<i>Lagothrix flavicauda</i>
	Venezuela	Lago Guri	7.4600, -62.5300	<i>Pithecia Pithecia</i>

Table S2. Summary results of the complete model (variability within and across species) testing the influence of potential anthropogenic and ecological drivers, and intrinsic factors on monthly terrestrial activity.

	Estimate	Error	CI	PD
Complete Model				
Intercept	-4.07	2.48	-9.15 – 0.83	95%
Region (Americas)	-0.77	3.03	-6.91 – 4.95	61%
Predation risk	0.04	0.33	-0.60 – 0.67	54%
Habitat (canopy cover)	-0.54	0.25	-1.03 – -0.09	99%
Temperature maximum	0.26	0.05	0.15 – 0.37	100%
Precipitation	0.01	0.04	-0.07 – 0.08	62%
Primate species richness	0.10	0.35	-0.58 – 0.75	61%
Habitat x Primate species richness	-0.03	0.27	-0.60 – 0.49	57%
Diet (frugivory)	-0.25	0.05	-0.35 – -0.16	100%
Body mass	0.24	0.31	-0.31 – 0.90	77%
Group size	0.19	0.07	0.05 – 0.34	100%
IM index (quadrupedal)	-0.08	1.16	-2.35 – 2.18	54%
IM index (VCL)	1.37	1.51	-1.57 – 4.39	82%
Post-habituatation	-0.08	0.05	-0.18 – 0.02	94%
Human population density	-0.24	0.21	-0.62 – 0.20	88%
Distance to road	0.41	0.24	-0.03 – 0.88	96%

Estimate = Mean of the posterior distribution; Error = Standard deviation of the posterior distribution; CI = 95% credible intervals; PD = probability of direction indicating the probability of a coefficient of being different from zero. Coefficients with PD > 90% are considered strong evidence of directional effects and are highlighted in bold. IM (inter-membral) index intercept is a categorical variable and corresponds to brachiator, while VCL (vertical clinging and leaping) and quadrupedal are the estimated differences from the intercept.