

Data collection and modeling distribution

The data on Anophelinae species from the Coleção Entomológica de Referência, Faculdade de Saúde Pública (CER-FSP), along with data from field collections in Brazilian territory and published literature records focused on taxonomic studies, were retrieved and used for distribution analyses and the creation of geographical distribution maps (Table I). The criterion for a municipality or location inclusion in the spatial database was the confirmation of the presence of a species. Geographical coordinates were either the centroid of the municipality where the species was recorded or the exact latitude and longitude of the collection sites. Geographical distribution maps were generated using the software QGIS version 2.6.1 [QGIS Development Team. Open-Source Geospatial Foundation (OSGeo)]. Additionally, for the twenty-eight vector species, the MaxEnt software⁽¹⁾ was employed for modeling species distributions by maximum entropy of climatic variables. The climatic variables, including annual mean temperature (°C = Celsius degree), mean diurnal range, isothermality, temperature seasonality, maximum temperature of the warmest month, minimum temperature of the coldest month, temperature annual range, annual precipitation, precipitation of the wettest month, precipitation of the driest month, precipitation seasonality, and relative humidity, were analyzed in relation to the presence of all vector species. These variables were selected because they affect the life cycles and bionomics of mosquitoes. The climate data were available at the WorldClim database — Global Climate Data,⁽²⁾ at a resolution of 30 arc seconds (approximately 1 km). A principal components analysis (PCA) was conducted to pre-select the most representative climatic variables for these species studied. Following the PCA, the four most representative eigenvectors were selected for use in the modeling analysis. The maximum entropy distribution model (MaxEnt)⁽¹⁾ was chosen, as it demonstrated the best performance compared to other species distribution models.⁽³⁾

After modeling the potential geographic distribution of vector species, a map illustrating the diversity distribution of these anophelines was generated. The Shannon-Wiener diversity index⁽⁴⁾ was applied to perform this analysis. This index accounts for the proportion of each species within the community, implying that species occurrences are not equally independent of sample size. This relationship is represented by the expression:

$$H' = -\sum_{(i=1)}^n p_i \cdot \ln(p_i)$$

Where: H' represents the diversity index, and p_i is the proportional abundance of each species in the sample.

This formula reflects the combined influence of species richness and evenness, providing a nuanced measure of diversity across the mapped geographic range. To calculate the Shannon-Wiener index, the results of maximum entropy modeling were adapted to estimate the relative abundance of each mosquito species. Using this approach was possible to produce a diversity map of anopheline vector species.

RESULTS

In the PCA analysis, the first two components (PCA1 and PCA2) accounted for the most significant eigenvalues. These components explained the variation for all vector species analyzed (Table II). The PCA showed the most significant variables for each anopheline vector species studied (Table III).

TABLE I

Summary of valid species included in this study, listing genus, subgenus, series, collection state, and *Plasmodium* vector status.
 Unnamed species identified by COI barcode are also included and marked accordingly

Genus	Subgenus	Series	Species	State	Status <i>Plasmodium</i> vector
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles anchietai</i>	SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles apicimacula</i>	SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles bustamantei</i>	SC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles costai</i>	AC, AM, BA, ES, PA, RO, SP, TO	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Anopheles	<i>Anopheles eiseni</i>	PA, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Anopheles	<i>Anopheles eiseni geometricus</i>	GO, RJ, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles evandroi</i>	SC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles fluminensis</i>	BA, GO, MG, RJ, SC, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles forattinii</i>	AM, AP, RO	poorly known in Brazil
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles guarao</i>	AM	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles maculipes</i>	RJ, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles mattogrossensis</i>	AC, AM, MS, MT, PA, RN, RO	poorly known in Brazil
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles medialis</i>	AL, AM, AP, BA, PA, RN, RR, SP	poorly known in Brazil
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles mediopunctatus</i>	AC, AM, GO, MS, PA, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles minor</i>	AM, BA, ES, MT, PA, RN, RO	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near costai</i>	AC, AM, RO, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near costai</i> G1	AC, AM, RO, RR	found infected in Loreto, Peru, potential vector in Brazil
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near costai</i> G2	AC, AM	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near costai</i> G3	AC, AM	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near costai</i> G4	AC, AM	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near fluminensis</i>	AC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near fluminensis</i> G1	AC, RR	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near fluminensis</i> G2	AC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near fluminensis</i> G3	AC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near malefactor</i>	AC, AM	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles near punctimacula</i>	AC	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles peryassui</i>	AC, AM, AP, BA, GO, MS, PA, RN, RO, SP, TO	found infected in locations in Amazonas State, Brazil
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles pseudomaculipes</i>	SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles punctimacula</i>	AC, RJ, SP	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles rachoui</i>	PR	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Arribalzagia	<i>Anopheles shannoni</i>	AM, PA	unknown
<i>Anopheles</i>	<i>Anopheles</i>	Anopheles	<i>Anopheles tibiamaculatus</i>	GO, MG, MS, SP	unknown
<i>Chagasia</i>			<i>Chagasia bonneae</i>	GO, RO	unknown
<i>Chagasia</i>			<i>Chagasia fajardi</i>	AC, BA, GO, MG, PA, PR, RJ, RO, SP	unknown
<i>Chagasia</i>			<i>Chagasia fajardi/rozebomi</i>	RJ, SP	unknown
<i>Chagasia</i>			<i>Chagasia rozeboomi</i>	CE, SP	unknown
<i>Kerteszia</i>			<i>Kerteszia bambusicola</i>	PR	unknown
<i>Kerteszia</i>			<i>Kerteszia bellatrix</i>	BA, ES, PR, RJ, SC, SP	local vector in southeastern Atlantic Forest
<i>Kerteszia</i>			<i>Kerteszia cruzii</i>	BA, ES, PE, PR, RJ, RS, SC, SE, SP	local vector in southeastern Atlantic Forest



Genus	Subgenus	Series	Species	State	Status <i>Plasmodium</i> vector
<i>Kerteszia</i>			<i>Kerteszia homunculus</i>	BA, ES, SC, SP	local vector in southeastern Atlantic Forest
<i>Kerteszia</i>			<i>Kerteszia laneana</i>	SP	unknown
<i>Kerteszia</i>			<i>Kerteszia lepidota</i>	RR	vector in Colombia, potential vector in Brazil
<i>Kerteszia</i>			<i>Kerteszia neivai</i>	AM, AP, RR	vector in locations on Pacific Coast, Colombia, potential vector in Brazil
<i>Kerteszia</i>			<i>Kerteszia neivai</i> A	RR	unknown
<i>Kerteszia</i>			<i>Kerteszia neivai</i> B	RR	unknown
<i>Lophopodomyia</i>			<i>Lophopodomyia gilesi</i>	GO, MG	unknown
<i>Lophopodomyia</i>			<i>Lophopodomyia pseudotibimaculata</i>	SP	unknown
<i>Lophopodomyia</i>			<i>Lophopodomyia squamifemur</i>	AM, PA	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus albertoi</i>	GO, MG	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus albitarsis</i>	AM, AP, BA, ES, MG, MS, MT, PR, RJ, RN, RO, RS, SC, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus albitarsis</i> G	AM	Foley et al. (2014) potential vector in Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus albitarsis</i> H	PA, MA, TO, MT, RO	Foley et al. (2014) potential vector in Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus albitarsis</i> s.l.	AC, ES, GO, MA, MG, MS, MT, PA, PR, RO, SP, TO	Sinka et al. (2012) considered a dominant vector in Brazil
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus antunesi</i>	RJ, SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus antunesi</i> Type 1	SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus antunesi</i> Type 2	RJ, RS	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus antunesi</i> Type 3	RS	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus antunesi</i> Type 4	RS	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus aquasalis</i>	AL, BA, CE, ES, MA, PA, PE, PB, RJ, RN, SP	dominant vector across Atlantic Coast
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Argyritarsis	<i>Nyssorhynchus argyritarsis</i>	BA, CE, ES, GO, MG, MS, MT, PR, RJ, RN, RO, SE, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus arthuri</i>	GO, MA, MG, MS, MT, TO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus benarrochi</i> B	AC, PA, RO, TO	found infected in Pará State, Brazil and several provinces in Peru
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Argyritarsis	<i>Nyssorhynchus braziliensis</i>	AC, AM, AP, GO, MG, MS, MT, RN, RO, SP, TO	found infected in locations across Brazilian Amazon
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Argyritarsis	<i>Nyssorhynchus darlingi</i>	AC, AL, AM, AP, BA, CE, ES, GO, MG, MA, MS, MT, PA, PI, PR, RJ, RO, RR, SE, SP, TO	dominant vector in Brazilian Amazon
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus deaneorum</i>	AC, MS, MT, PA, PR, RO, SP, TO	local malaria vector in Acre State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus dunhami</i>	AC, AM, MS	found infected in Iquitos, Peru, potential vector in Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus evansae</i>	CE, MA, MG, MS, MT, PR, RJ, RS, TO, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus galvaoi</i>	AC, MG, MS, MT, PR, RO, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus goeldii</i>	AM, AP, PA, RO, TO	found infected in locations across Brazilian Amazon
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus guarani</i>	DF, PR, RJ, SC, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Triannulatus	<i>Nyssorhynchus halophylus</i>	MS	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus ibiapabaensis</i>	CE	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus jamariensis</i>	RO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus janconnae</i>	RR	primary vector in locations in Roraima State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus konderi</i>	MS, PR, RO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus konderi</i> A	AC, AM, AP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus konderi</i> C	MS	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Argyritarsis	<i>Nyssorhynchus lanei</i>	SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus lutzii</i>	MS, PR, RJ, SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus lutzii</i> Type 1	RS	unknown

Genus	Subgenus	Series	Species	State	Status <i>Plasmodium</i> vector
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus lutzii</i> Type 2	RS	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus marajoara</i>	AC, AM, AP, MG, MT, PA, RJ, RO, SP	dominant vector across Brazilian Amazon
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus nigratarsis</i>	GO, MG, MT, PR, TO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus nuneztovari</i> s.l.	AC, AM, MA, MT, PA, RO, RR, TO	primary vector in Venezuela and Colombia
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Albitarsis	<i>Nyssorhynchus oryzalimnetes</i>	AC, CE, ES, GO, MA, MG, MT, PA, PR, RO, SE, SP, TO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus oswaldoi</i>	AC, AM, BA, ES, MA, MS, PA, RS, SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus oswaldoi</i> A	AC, AM, PA, RO, RR	found infected in Rondônia State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus oswaldoi</i> B	AM, RR	potential vector in Putumayo, Colombia
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus oswaldoi</i> s.l.	AC, AM, MS, MT, PA	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus oswaldoi</i> SPForm	SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus parvus</i>	GO, MG, MT, PR, RJ, SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus parvus</i> Type1	DF, MG, MT	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus parvus</i> Type2	DF	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus pristinus</i>	SP	unknown
<i>Nyssorhynchus</i>	<i>Myzorhynchella</i>		<i>Nyssorhynchus pristinus</i> Type1	SP	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus rangeli</i>	AC, AM, MT, PA, RO	found infected in Acre State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus rondoni</i>	MG, MS, MT, PR, SP, TO	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus rondoniensis</i>	AC, RO	found infected in Rondônia State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Argyritarsis	<i>Nyssorhynchus sawyeri</i>	CE, GO, MG, SE	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus striatus</i>	ES, MG, PR	unknown
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus strodei</i>	AC, ES, GO, MG, MS, MT, PR, RO, RS, SC, SP	found infected in locations in São Paulo State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus tadei</i>	AC, AM, MS	found infected in Acre State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Triannulatus	<i>Nyssorhynchus triannulatus</i>	AC, AM, AP, BA, ES, GO, MA, MG, MS, MT, PA, PR, RJ, RN, RO, RR, SP, TO	found infected in Acre State, Brazil
<i>Nyssorhynchus</i>	<i>Nyssorhynchus</i>	Oswaldoi	<i>Nyssorhynchus untii</i>	MG	unknown
<i>Stethomyia</i>			<i>Stethomyia kompi</i>	AM, BA, ES, PA, RN, SP	unknown
<i>Stethomyia</i>			<i>Stethomyia kompi/canorii</i>	AM, SP	unknown
<i>Stethomyia</i>			<i>Stethomyia nimbus</i>	AC, AM, BA, GO, MA, PA, RJ, RN, SP	unknown
<i>Stethomyia</i>			<i>Stethomyia nimbus/thomasi</i>	AM, SP	unknown
<i>Stethomyia</i>			<i>Stethomyia thomasi</i>	AM, SP	unknown

AC, Acre; AL, Alagoas; AM, Amazonas; AP, Amapá; BA, Bahia; CE, Ceará; DF, Distrito Federal; ES, Espírito Santo; GO, Goiás; MA, Maranhão; MG, Minas Gerais; MS, Mato Grosso do Sul; MT, Mato Grosso; PA, Pará; PB, Paraíba; PE, Pernambuco; PI, Piauí; PR, Paraná; RJ, Rio de Janeiro; RN, Rio Grande do Norte; RO, Rondônia; RR, Roraima; RS, Rio Grande do Sul; SC, Santa Catarina; SE, Sergipe; SP, São Paulo; TO, Tocantins.

TABLE II
Results of the principal component analysis (PCA) of climate variables

Species	PCA results
<i>Anopheles forattinii</i>	72.3
<i>Anopheles mattogrossensis</i>	69.0
<i>Anopheles medialis</i>	73.4
<i>Anopheles peryassui</i>	80.5
<i>Kerteszia bellatrix</i>	66.3
<i>Kerteszia cruzii</i>	62.9
<i>Kerteszia homunculus</i>	77.9
<i>Kerteszia lepidota</i>	66.4
<i>Kerteszia neivai</i>	63.3
<i>Nyssorhynchus albitarsis</i> G	68.8
<i>Nyssorhynchus albitarsis</i> H	72.9
<i>Nyssorhynchus aquasalis</i>	75.3
<i>Nyssorhynchus benarrochi</i> B	70.6
<i>Nyssorhynchus braziliensis</i>	79.1
<i>Nyssorhynchus darlingi</i>	77.4
<i>Nyssorhynchus deaneorum</i>	84.9
<i>Nyssorhynchus dunhami</i>	75.1
<i>Nyssorhynchus goeldii</i>	65.5
<i>Nyssorhynchus janconnae</i>	82.9
<i>Nyssorhynchus marajoara</i>	79.1
<i>Nyssorhynchus nuneztovari</i>	68.9
<i>Nyssorhynchus oswaldoi</i> A	65.5
<i>Nyssorhynchus oswaldoi</i> B	72.3
<i>Nyssorhynchus rangeli</i>	79.3
<i>Nyssorhynchus rondoniensis</i>	80.3
<i>Nyssorhynchus strodei</i>	74.5
<i>Nyssorhynchus tadei</i>	76.3
<i>Nyssorhynchus triannulatus</i>	78.0

TABLE III
Results of the principal component analysis (PCA). The red number show the variables with the highest scores using eigenvectors

Species	Eigenvectors	Annual mean temperature	Annual precipitation	Precipitation of wettest month	Precipitation of driest month	Precipitation seasonality	Mean diurnal range	Isothermality	Temperature seasonality	Max temperature of warmest month	Min temperature of coldest month	Temperature annual range	Humidity relative
<i>Anopheles forattinii</i>	PC1	0.109	-0.334	-0.003	-0.362	0.372	0.326	-0.195	0.297	0.317	-0.161	0.369	-0.335
	PC2	0.535	0.077	0.243	0.127	0.021	-0.282	-0.230	-0.018	0.357	0.510	-0.180	-0.283
<i>Anopheles mattogrossensis</i>	PC1	0.308	0.412	0.223	0.395	-0.314	-0.131	0.258	-0.330	0.193	0.340	-0.276	0.099
	PC2	-0.323	0.218	0.159	-0.017	-0.057	0.435	0.390	-0.321	-0.122	-0.336	0.315	0.385
<i>Anopheles medialis</i>	PC1	0.366	0.327	0.284	0.171	-0.072	-0.130	0.324	-0.357	0.289	0.374	-0.351	0.220
	PC2	0.082	-0.072	0.211	-0.527	0.623	0.348	0.216	-0.087	0.251	0.030	0.095	-0.171
<i>Anopheles peryassui</i>	PC1	0.333	0.346	0.289	0.214	-0.125	-0.245	0.311	-0.336	0.011	0.354	-0.352	0.326
	PC2	0.162	0.026	0.180	-0.447	0.502	0.372	0.261	-0.203	0.479	0.019	0.104	0.031
<i>Kerteszia bellatrix</i>	PC1	0.404	-0.222	-0.292	0.096	-0.205	-0.205	0.275	-0.320	0.328	0.415	-0.352	-0.164
	PC2	-0.031	-0.495	-0.314	-0.425	0.260	0.502	0.242	-0.131	0.091	-0.078	0.214	0.138
<i>Kerteszia cruzii</i>	PC1	0.436	0.009	0.138	-0.203	0.213	-0.248	0.118	-0.296	0.339	0.450	-0.362	-0.177
	PC2	-0.098	-0.246	-0.002	-0.409	0.358	0.315	0.454	-0.362	-0.140	-0.073	-0.016	0.156
<i>Kerteszia homunculus</i>	PC1	0.261	0.420	0.315	0.213	-0.012	-0.366	-0.319	0.171	0.342	0.220	-0.131	-0.403
	PC2	-0.363	0.127	0.263	-0.200	0.324	0.240	-0.273	0.363	0.071	-0.397	0.432	-0.157
<i>Kerteszia lepidota</i>	PC1	-0.111	-0.376	-0.175	-0.380	0.346	0.395	0.095	0.186	0.241	-0.310	0.392	-0.209
	PC2	0.565	-0.120	0.143	-0.174	0.198	-0.073	0.211	-0.246	0.446	0.422	-0.167	-0.249
<i>Kerteszia neivai</i>	PC1	-0.160	-0.385	-0.119	-0.389	0.347	0.411	0.114	0.208	0.123	-0.317	0.408	-0.181
	PC2	0.446	-0.048	0.318	-0.238	0.313	0.033	0.364	-0.217	0.432	0.390	-0.144	-0.047
<i>Nyssorhynchus albitarsis</i> G	PC1	0.056	-0.323	0.325	-0.391	0.416	-0.048	-0.358	0.370	0.120	-0.050	0.224	-0.356
	PC2	0.509	0.306	0.264	0.165	-0.130	0.032	-0.061	0.089	0.517	0.494	0.094	0.024
<i>Nyssorhynchus albitarsis</i> H	PC1	-0.123	-0.338	-0.181	-0.333	0.349	0.337	-0.173	0.284	0.279	-0.296	0.354	-0.301
	PC2	0.541	-0.064	0.386	-0.076	0.226	-0.237	-0.239	0.217	0.305	0.388	-0.169	-0.255
<i>Nyssorhynchus aquasalis</i>	PC1	0.391	-0.043	0.145	-0.304	0.352	-0.072	0.359	-0.379	0.215	0.384	-0.321	-0.181
	PC2	-0.023	0.542	0.475	0.325	-0.134	-0.135	0.175	-0.179	-0.272	0.086	-0.204	0.391
<i>Nyssorhynchus benarrochi</i> B	PC1	-0.172	-0.315	-0.043	-0.361	0.338	0.388	-0.148	0.239	0.248	-0.341	0.389	-0.258
	PC2	0.528	0.011	0.416	0.000	0.234	-0.020	0.033	-0.216	0.466	0.300	-0.029	-0.370
<i>Nyssorhynchus braziliensis</i>	PC1	0.327	0.354	0.281	0.118	-0.133	-0.185	0.353	-0.359	0.186	0.362	-0.352	0.282
	PC2	-0.214	0.008	-0.156	0.510	-0.467	-0.419	-0.135	0.148	-0.416	-0.055	-0.159	0.187
<i>Nyssorhynchus darlingi</i>	PC1	0.315	0.297	0.272	0.148	-0.071	-0.196	0.288	-0.321	0.063	0.361	-0.337	0.209
	PC2	0.235	-0.140	0.087	-0.377	0.450	0.349	0.217	-0.160	0.434	0.057	0.150	-0.333
<i>Nyssorhynchus deaneorum</i>	PC1	0.319	0.233	0.331	-0.254	0.259	-0.127	0.363	-0.362	0.132	0.359	-0.353	0.226
	PC2	0.220	-0.379	-0.067	-0.356	0.333	0.383	-0.077	-0.001	0.482	0.039	0.133	-0.402
<i>Nyssorhynchus dunhami</i>	PC1	-0.272	-0.318	-0.268	-0.222	0.155	0.294	-0.307	0.354	0.212	-0.345	0.361	-0.283
	PC2	0.215	0.162	-0.025	0.515	-0.487	-0.170	-0.264	0.196	0.386	0.050	0.072	-0.361
<i>Nyssorhynchus goeldii</i>	PC1	0.393	0.098	0.075	0.315	-0.224	-0.418	-0.249	0.163	0.230	0.418	-0.349	-0.262
	PC2	0.109	-0.397	-0.260	-0.192	0.261	0.099	-0.369	0.419	0.318	-0.106	0.307	-0.360

Species	Eigenvectors	Annual mean temperature	Annual precipitation	Precipitation of wettest month	Precipitation of driest month	Precipitation seasonality	Mean diurnal range	Isothermality	Temperature seasonality	Max temperature of warmest month	Min temperature of coldest month	Temperature annual range	Humidity relative
<i>Nyssorhynchus janconnae</i>	PC1	-0.155	0.331	-0.053	0.360	-0.375	0.337	0.370	-0.378	-0.161	-0.125	-0.120	0.380
	PC2	0.501	0.247	0.386	0.160	-0.067	0.057	0.059	-0.040	0.497	0.500	-0.010	0.049
<i>Nyssorhynchus marajoara</i>	PC1	-0.295	-0.335	-0.268	-0.231	0.169	0.279	-0.339	0.345	-0.114	-0.350	0.354	-0.275
	PC2	0.351	-0.015	0.133	-0.391	0.395	0.309	0.151	-0.138	0.580	0.118	0.092	-0.231
<i>Nyssorhynchus nuneztovari</i>	PC1	-0.119	-0.335	-0.129	-0.302	0.285	0.341	-0.232	0.287	0.290	-0.344	0.382	-0.290
	PC2	0.245	0.126	0.588	-0.285	0.400	0.087	0.274	-0.340	0.247	0.152	-0.019	-0.230
<i>Nyssorhynchus oswaldoi</i> A	PC1	-0.211	-0.355	-0.127	-0.373	0.384	0.396	0.038	0.257	0.078	-0.362	0.385	-0.131
	PC2	0.421	-0.115	0.105	0.113	-0.029	-0.041	-0.393	0.228	0.564	0.187	0.134	-0.454
<i>Nyssorhynchus oswaldoi</i> B	PC1	-0.179	-0.300	0.214	-0.383	0.388	0.380	0.009	0.286	0.214	-0.294	0.395	-0.142
	PC2	0.475	-0.277	-0.031	-0.035	0.080	-0.167	-0.335	-0.055	0.468	0.352	-0.035	-0.450
<i>Nyssorhynchus rangeli</i>	PC1	-0.205	-0.239	-0.035	-0.243	0.264	0.353	-0.277	0.326	0.280	-0.351	0.380	-0.345
	PC2	0.223	0.368	0.534	-0.399	0.371	0.097	0.202	-0.306	0.258	0.102	0.013	-0.110
<i>Nyssorhynchus rondoniensis</i>	PC1	-0.066	-0.357	-0.348	0.237	-0.242	-0.044	-0.381	0.383	0.226	-0.260	0.299	-0.362
	PC2	-0.224	0.029	0.204	-0.363	0.397	0.559	-0.024	-0.018	0.203	-0.356	0.363	-0.068
<i>Nyssorhynchus strodei</i>	PC1	-0.335	-0.036	-0.274	0.341	-0.335	-0.235	-0.363	0.366	-0.243	-0.313	0.198	0.256
	PC2	0.109	0.532	0.165	0.214	-0.143	-0.455	-0.028	-0.106	-0.099	0.305	-0.471	0.258
<i>Nyssorhynchus tadei</i>	PC1	-0.276	-0.317	-0.259	-0.215	0.133	0.289	-0.316	0.352	0.221	-0.343	0.357	-0.303
	PC2	0.344	-0.053	0.378	-0.373	0.640	-0.058	-0.029	-0.052	0.337	0.190	-0.063	-0.162
<i>Nyssorhynchus triannulatus</i>	PC1	0.345	0.337	0.320	0.107	0.040	-0.210	0.345	-0.365	0.178	0.373	-0.359	0.237
	PC2	0.158	-0.084	0.116	-0.501	0.515	0.386	0.152	-0.132	0.387	0.003	0.150	-0.277

TABLE IV
Results of the ROC curve

Species	ROC curve results
<i>Anopheles forattinii</i>	0.85
<i>Anopheles mattogrossensis</i>	0.81
<i>Anopheles medialis</i>	0.91
<i>Anopheles peryassui</i>	0.78
<i>Kerteszia bellatrix</i>	0.97
<i>Kerteszia cruzii</i>	0.98
<i>Kerteszia homunculus</i>	0.86
<i>Kerteszia lepidota</i>	0.86
<i>Kerteszia neivai</i>	0.89
<i>Nyssorhynchus albitarsis</i> G	0.81
<i>Nyssorhynchus albitarsis</i> H	0.80
<i>Nyssorhynchus aquasalis</i>	0.77
<i>Nyssorhynchus benarrochi</i> B	0.85
<i>Nyssorhynchus braziliensis</i>	0.79
<i>Nyssorhynchus darlingi</i>	0.70
<i>Nyssorhynchus deaneorum</i>	0.88
<i>Nyssorhynchus dunhami</i>	0.87
<i>Nyssorhynchus goeldii</i>	0.88
<i>Nyssorhynchus janconnae</i>	0.91
<i>Nyssorhynchus marajoara</i>	0.83
<i>Nyssorhynchus nuneztovari</i> s.l.	0.81
<i>Nyssorhynchus oswaldoi</i> A	0.85
<i>Nyssorhynchus oswaldoi</i> B	0.89
<i>Nyssorhynchus rangeli</i>	0.71
<i>Nyssorhynchus rondoniensis</i>	0.83
<i>Nyssorhynchus strodei</i>	0.90
<i>Nyssorhynchus tadei</i>	0.88
<i>Nyssorhynchus triannulatus</i>	0.81

After selecting the four most significant variables for each species separate, a MaxEnt model⁽¹⁾ was employed to estimate the potential distribution of all Anophelinae vectors species in Brazil. The logistic model implemented in MaxEnt yielded AUC scores (Table IV), indicating high predictive accuracy.⁽⁵⁾

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