MODELAGEM E GEOTECNOLOGIAS EM ESTUDOS SOBRE AS LEISHMANIOSES
[MODELING AND GEOSPATIAL TECHNOLOGIES ON LEISHMANIASIS STUDIES]

Elivelton da S. Fonseca

elivelton@unoeste.br

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Faculdade de Medicina da Universidade de São Paulo. Av. Dr. Arnaldo, 455. Bairro: Cerqueira Cesar, São Paulo/SP.

Presentation outline

São Paulo State background.

Geospatial and Public Health on disease programs.

Why Geospatial Technologies?

Study routines, mastering methodologies.

Study case proposal – Vleish.

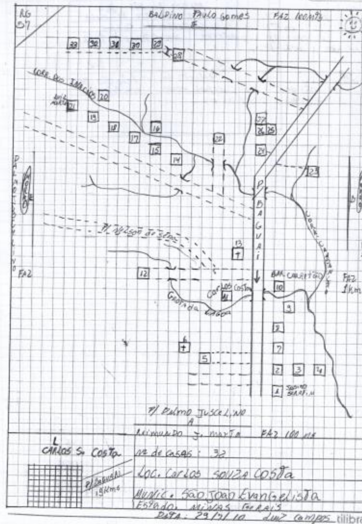
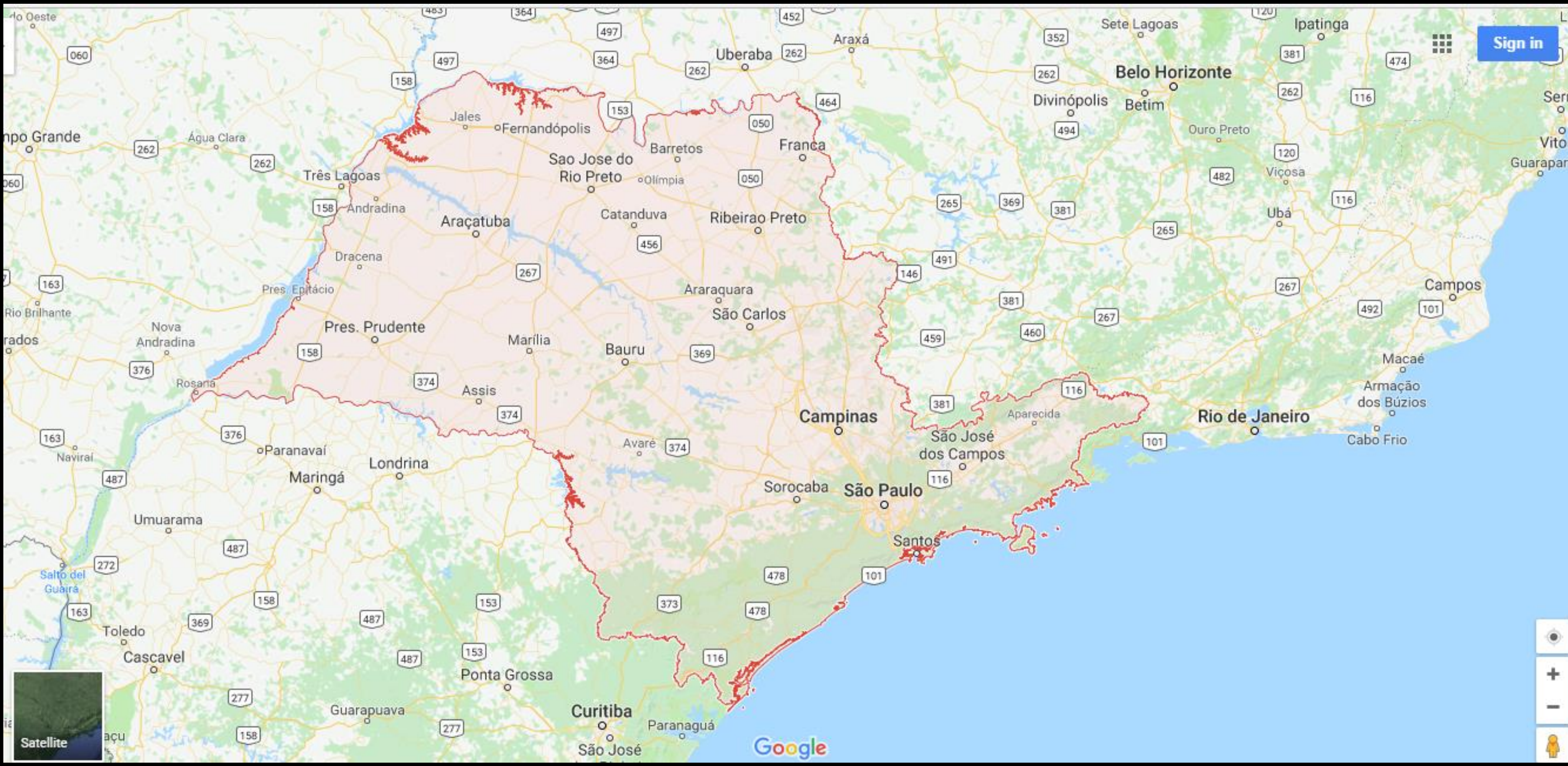


Fig. 1 — Mapa do município de São Paulo, localizando a região onde ocorreu o surto de leishmaniose tegumentar americana.



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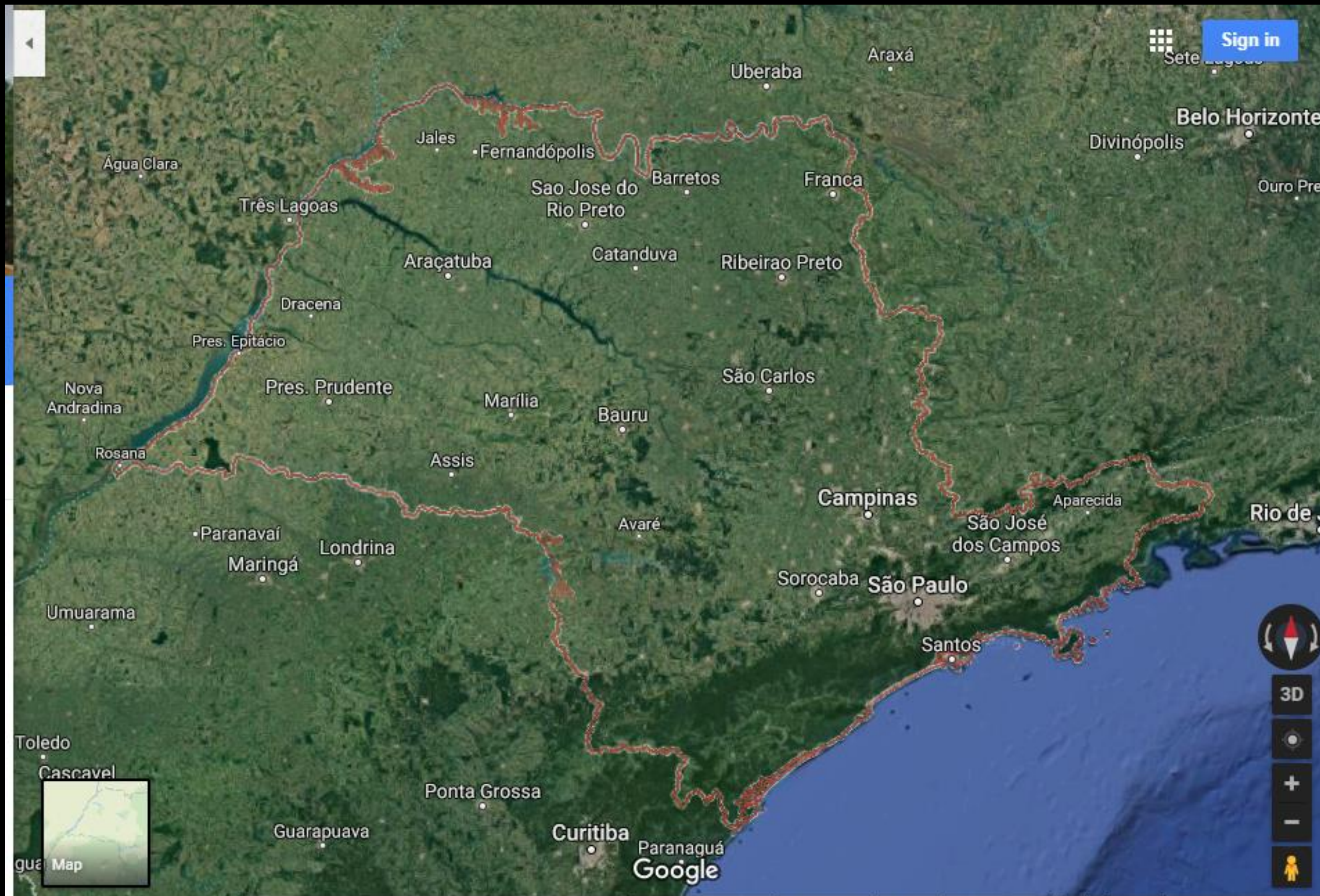
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Map
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São Paulo State background

Population and density

- Population – 43,932,763 mi llion
- population density of 177.23 inhabitants per km^{2}.
- Gross domestic product: 1,985,359 (R$ million)

Municipalities and area

- 645 municipalities
- Occupying an area of 248,219.63 km^{2}
- 20.6 % of the Brazilian Population.

Topographical Relief

- The relief units are: depressions, scarps and reverses, hills, plateaus, valleys and Cuestas.

Vegetation

- A semi-deciduous forest in the plateau.
- and rainforest in the *Serra do Mar* region.

Geospatial and Public Health on disease programs

Literature layering spatial analysis for disease control programs, using time and geographical space as elements in understanding diseases and Public Health;

Moreover, the set of techniques proposed in this paper can enable PH decision makers to organize information produced in a planning support system to envisage the organizational structure landscape and the impact of a set of actions.

How GeoHealth will work?

Hypothesis – Geospatial Techonologies can aid in unveiling the street-level bureaucracy and promote a better understanding of the intra-urban actions on disease control.

GeoHealth - Implementation of a geospatial surveillance and response system data resource for vector borne disease in São Paulo will be tested using:

- **NASA satellite data;**
- **Geographic information systems and;**
- **Community engagement in a HotSpot/GIS guided control**

Goals and objectives

Statewide - To characterize the geospatial distribution of sandflies in the state of São Paulo, supported by ecological niche models (ENM).

Community - To analyze, from the point of view of the set of Disease Control Programs, how the frontline intervention can influence the spatial distribution of diseases, or block the life cycle of parasites.

Specific objectives

- Provide a platform for processing data resources to discover ‘hidden’ associations of disease for ENM as an alternative to classical hypothesis-driven statistical analysis.
- Implement dissemination and training programs to

Why Geospatial Technologies? For PH? Leishmaniasis?

Landscape intervention, comprehension of the transmission cycle of diseases – plans for disease elimination.

Articulation of several surveillance and response system programs

Can enable the description of local-regional PH priorities.

Knowledge of the municipality control program action and metrics, the flow of information, networking needs, and data sharing.

Integration of information to a deeper analysis of how the landscape can be redesigned to promote a healthier landscape.

To improve management, community services, research.

Study routines, mastering methodologies

Model:

A generic term - abstract solutions with computational support to solve complex problems (Williams, 1990).

A modeling capability involves a separation of a set of meanings of particularities from the environment, in the form of variables, in order to solve any problem whatsoever.

The model can simulate the following situations:

- Decision-making process as events (time related)

- Characterization patterns of environments that receive the name of entities (Moura ACM, 2003).

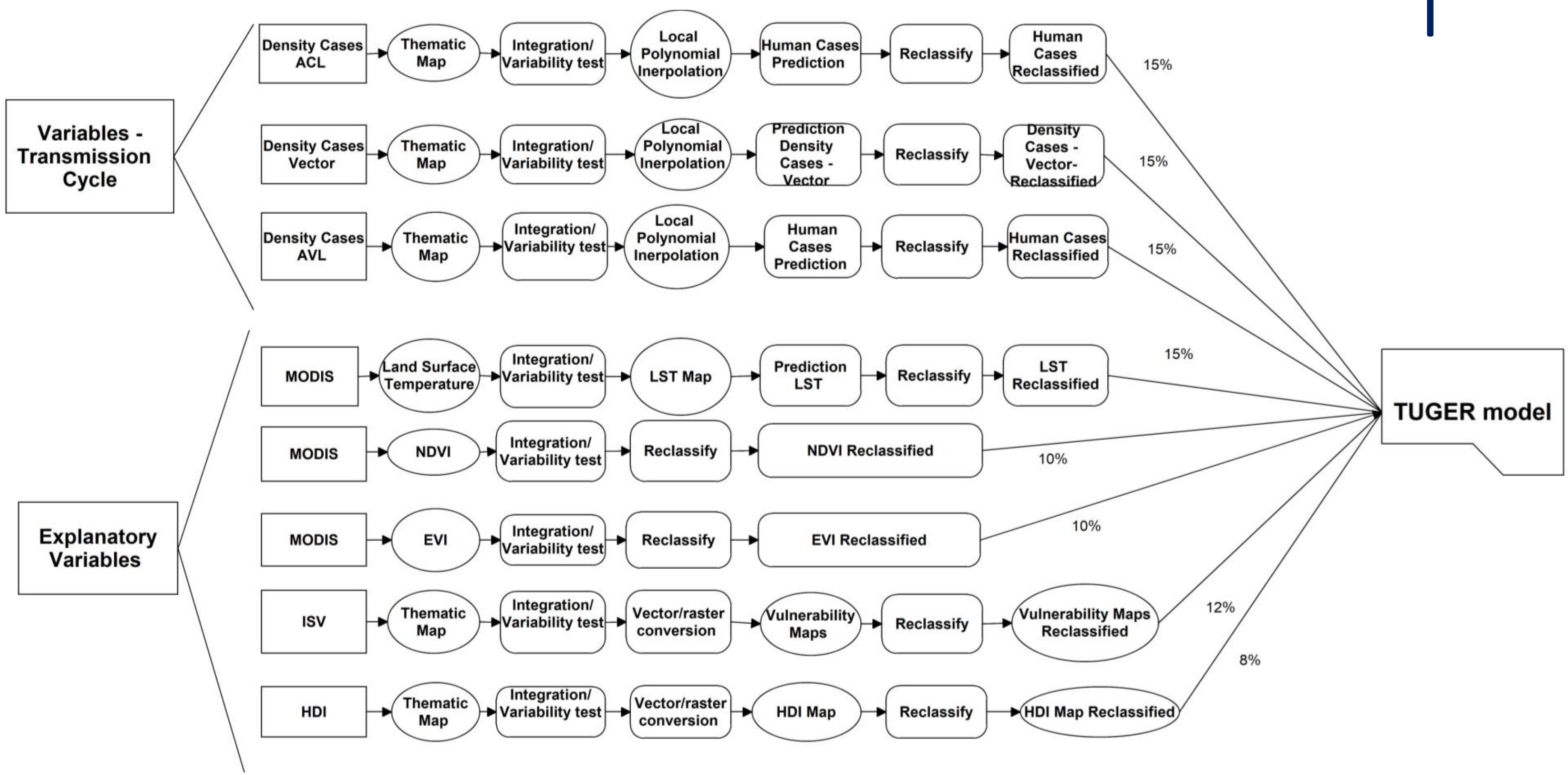
Although there is a wide distribution of leishmaniasis throughout Brazil.

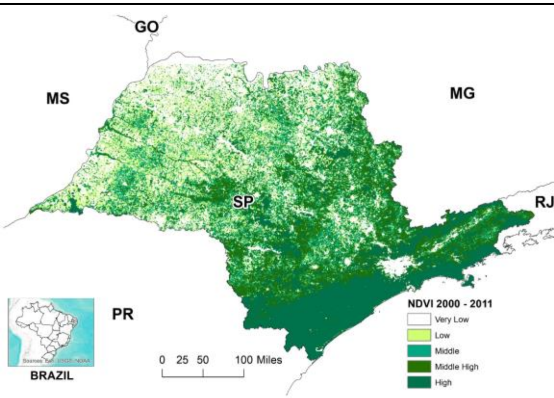
The pattern of dispersion in <u>endemic areas is poorly understood in terms of intrinsic environmental relationships</u>

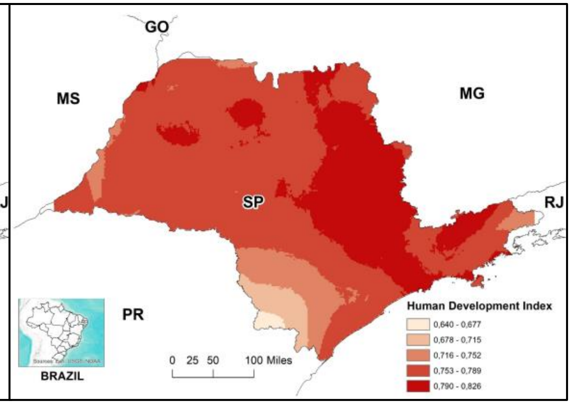
The state of São Paulo has <u>multiple eco-epidemiological settings</u> favorable to the transmission of leishmaniasis.

The expansion of reported cases to municipalities potentially carried from areas where the vector has previously been found.

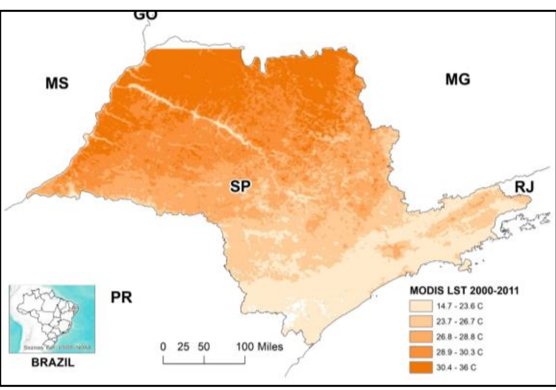
Models - statewide

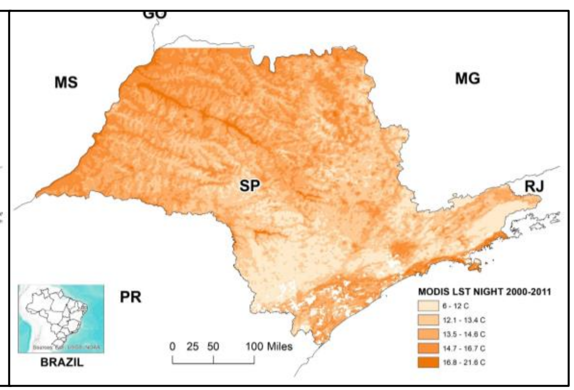


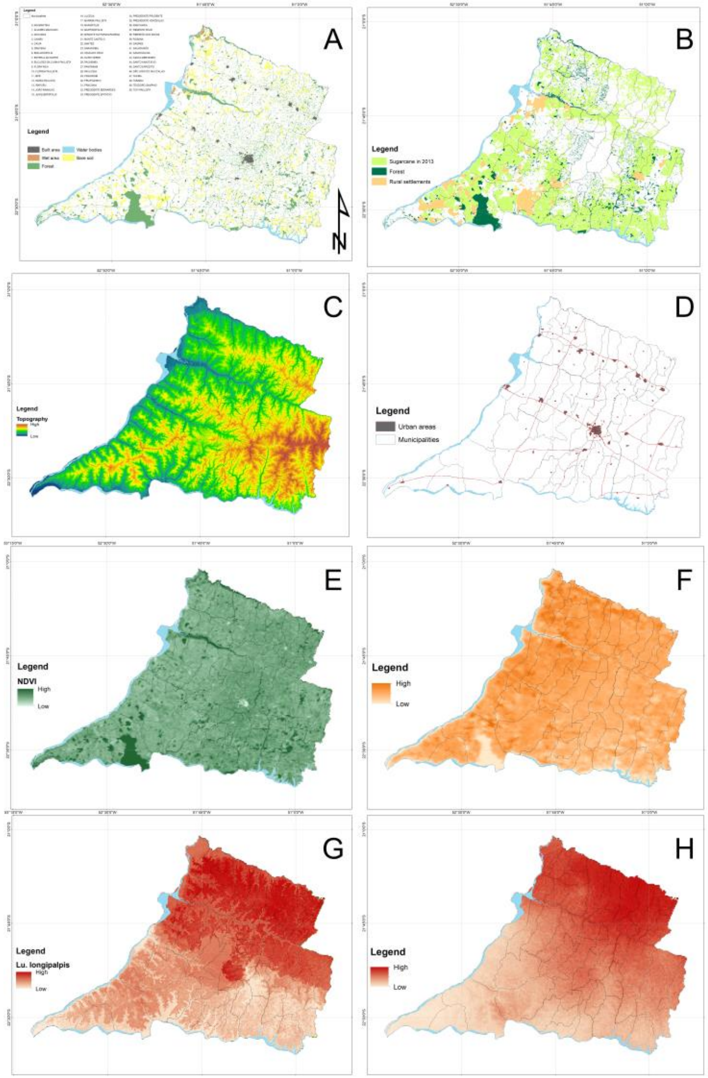


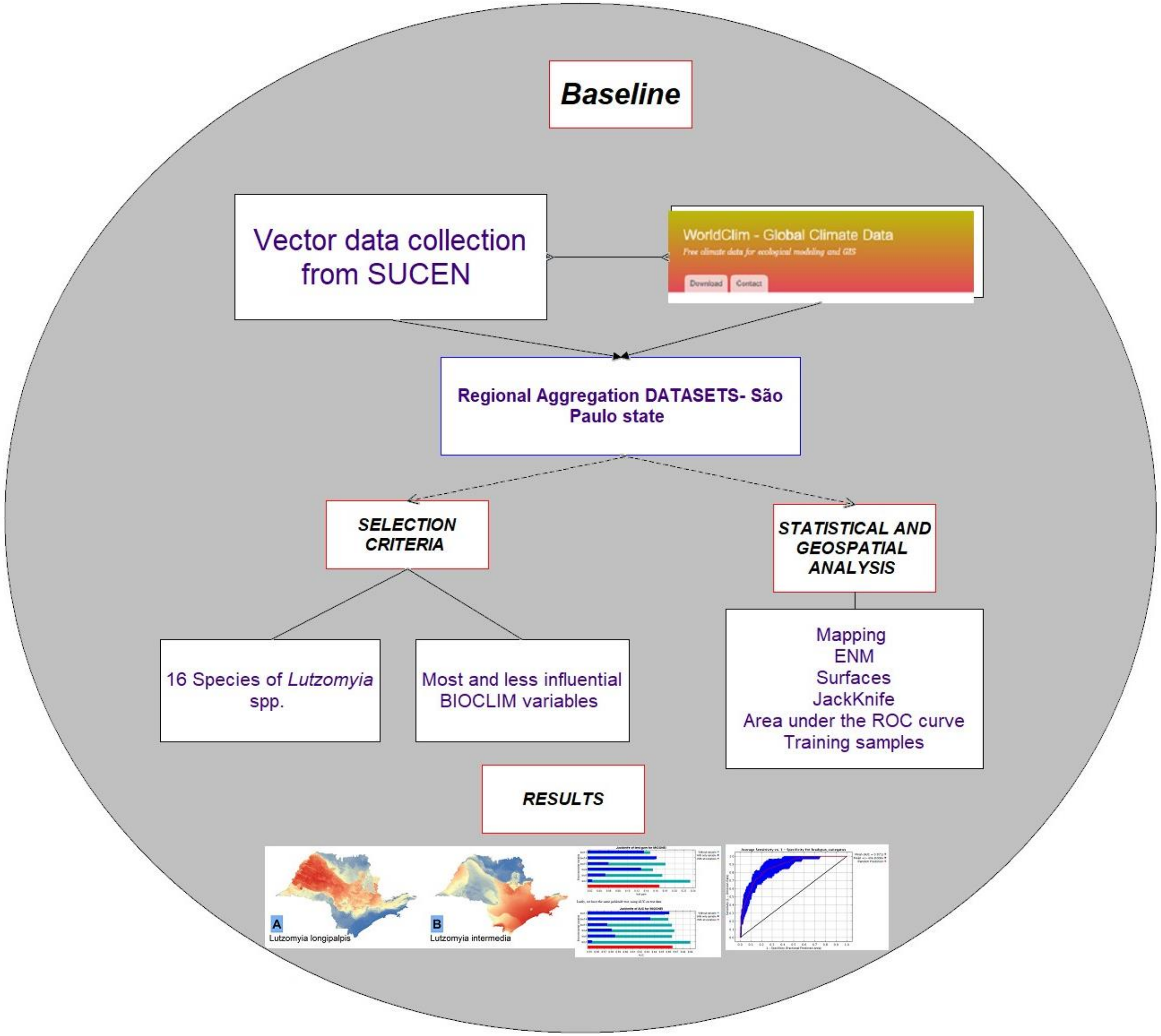


REGIONAL LEVEL








Baseline
Vector data collection from SUCEN
WorldClim - Global Climate Data
Free climate data for ecological modeling and GIS
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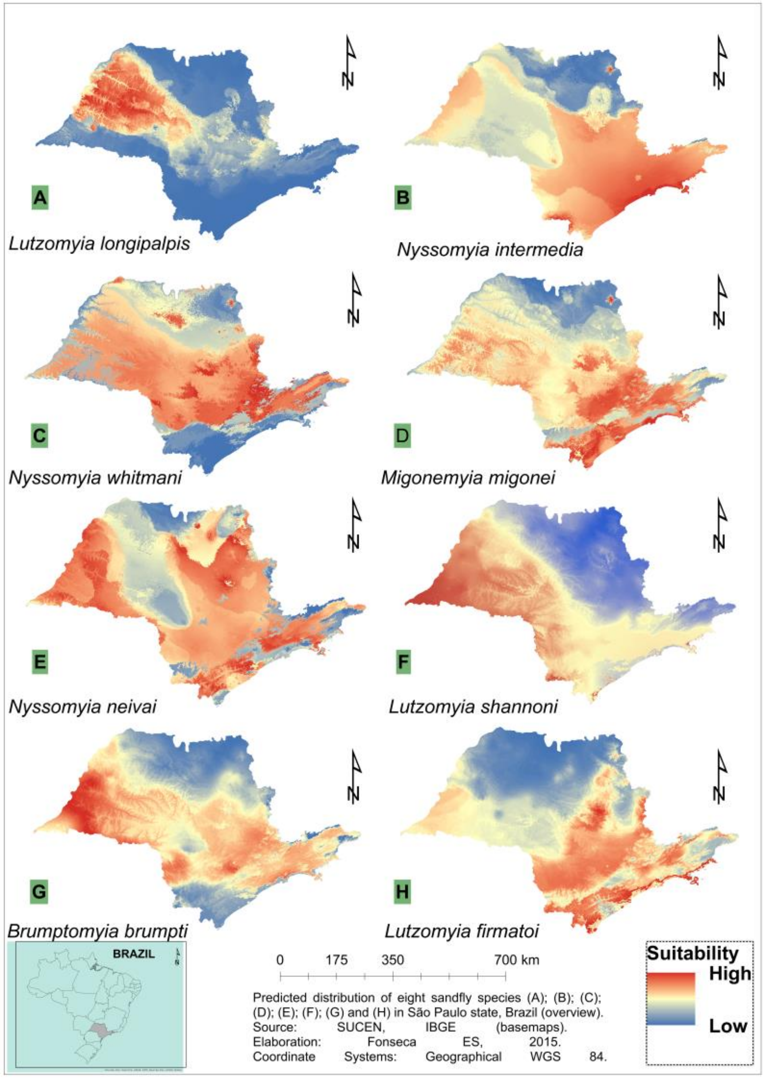
Regional Aggregation DATASETS- São Paulo state
SELECTION CRITERIA
STATISTICAL AND GEOSPATIAL ANALYSIS
16 Species of Lutzomyia spp.
Most and less influential BIOCLIM variables
Mapping
ENM
Surfaces
JackKnife
Area under the ROC curve
Training samples
RESULTS
A
Lutzomyia longipalpis
B
Lutzomyia intermedia



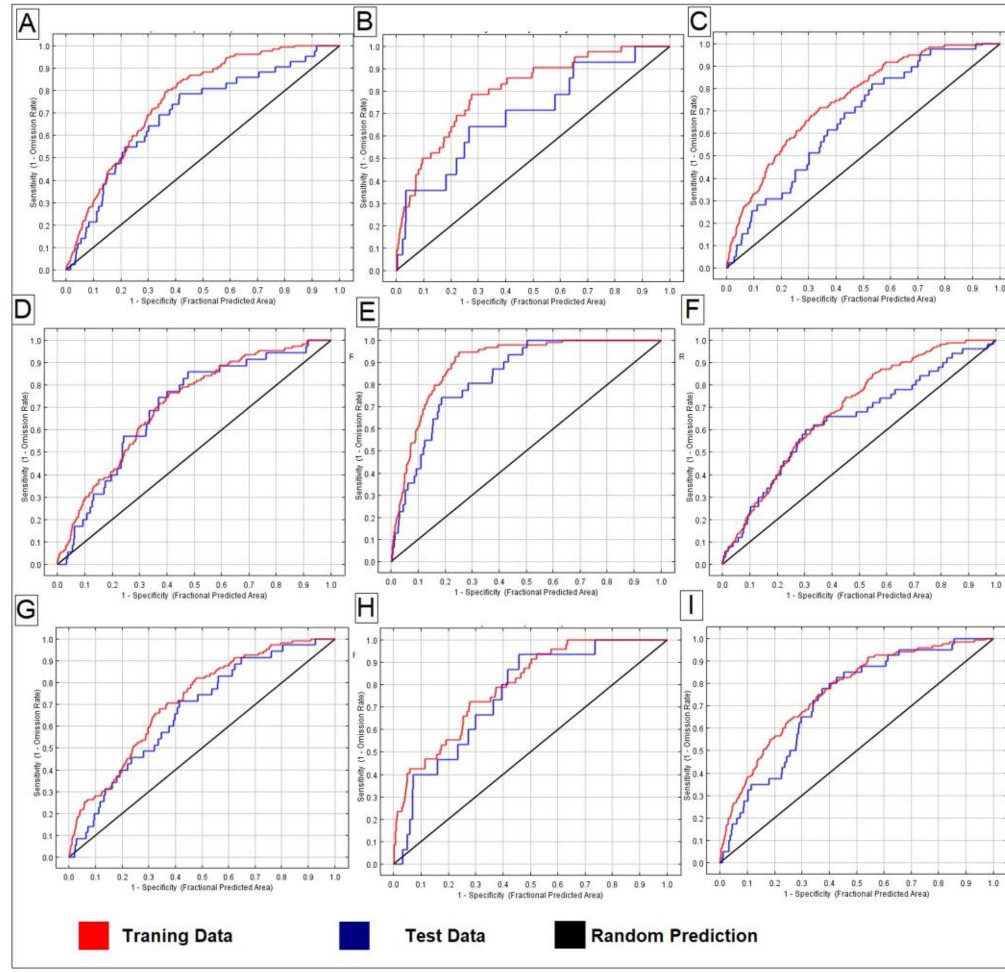
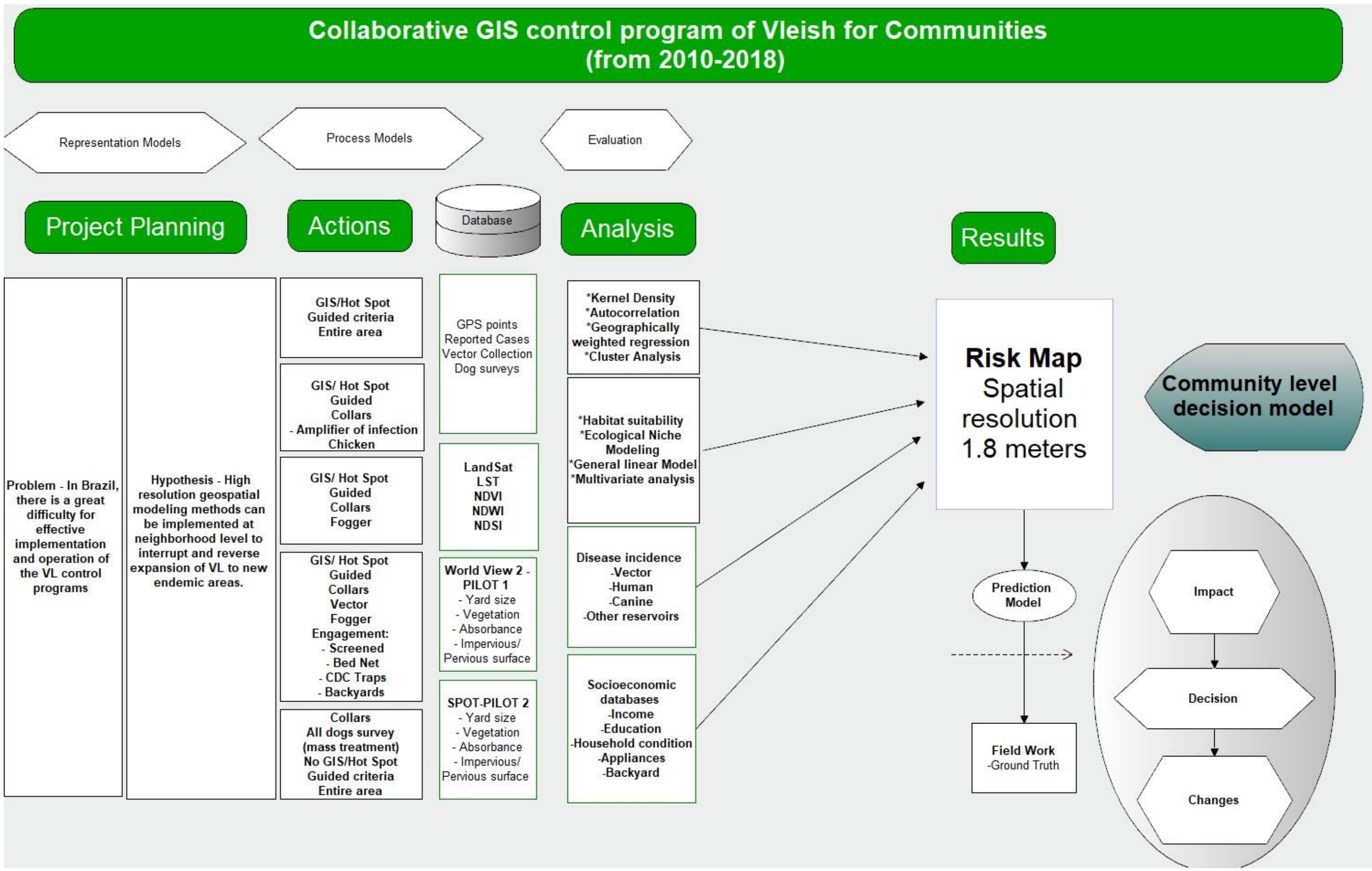


Figure 3 – Receiver operating characteristic (ROC) curve for the different species of sand-fly vector. Fig. 3: **A**: *Nyssomyia whitmani*. **B**: *Lutzomyia cortelezii*. **C**: *Migonemyia migonei*. (0.5). **D**: *Lutzomyia ubiquita*. **E**: *Lutzomyia longipalpis*. **F**: *Nyssomyia intermedia*. **G**: *Nissomyia neivai*. **H:** *Lutzomyia monticola*. **I:** *Lutzomyia fischeri*.

Species	Variable that produces the largest AUC when included	Percent contribution	*AUC value	Variable that produces the smallest AUC curve	Percent contribution	AUC value
LL	Precipitation of Driest Month	21.3	0.835	Precipitation of Wettest Month	0.1	0.653
LI	Precipitation Seasonality (Coefficient of Variation)	30.9	0.642	Isothermality (BIO2/BIO7) (* 100)	8.5	0.633
LW	Temperature Seasonality (standard deviation *100)	33.8	0.697	Min Temperature of Coldest Month	10.2	0.667
LM	Temperature Seasonality (standard deviation *100)	29.3	0.665	Max Temperature of Warmest Month	8.3	0.581
LN	Mean Diurnal Range (Mean of monthly (max temp - min temp))	39.9	0.666	Mean Temperature of Driest Quarter	7	0.609
LS	Precipitation Seasonality (Coefficient of Variation)	55.6	0.591	Altitude	2.4	0.688
Llen	Isothermality (BIO2/BIO7) (* 100)	37.1	0.648	Precipitation Seasonality (Coefficient of Variation)	2.8	0.482
LF	Precipitation of Driest Month	52.1	0.678	Precipitation of Wettest Quarter	2.8	0.491
Lmon	Mean Temperature of Driest Quarter	56.4	0.754	Temperature Annual Range (BIO5-BIO6)	6.4	0.622
LC	Precipitation of Wettest Quarter	29.8	0.701	Precipitation of Driest Quarter	8.9	0.722
LE	Mean Diurnal Range (Mean of monthly (max temp - min temp))	53.6	0.762	Precipitation of Wettest Month	6.6	0.511
LA	Min Temperature of Coldest Month	67.2	0.891	Mean Temperature of Warmest Quarter	0.8	0.699
Llan	Mean Diurnal Range (Mean of monthly (max temp - min temp))	70.4	0.935	Precipitation of Warmest Quarter	5.4	0.542
LG	Altitude	56.6	0.631	Mean Diurnal Range (Mean of monthly (max temp - min temp))	8.1	0.572
LB	Precipitation of Driest Month	31.7	0.581	Max Temperature of Warmest Month	8.5	0.547
Lfis	Mean Diurnal Range (Mean of monthly (max temp - min temp))	23.1	0.724	Mean Temperature of Coldest Quarter	8.2	0.581
*AUC Lutzomyia Longipalpis						

Models – community-based level



Concluding remarks

- Actions in climate change and health
- Contextual solutions for hotspots of infection
- More adaptative solutions
- Social determinants
- Multiple species simultaneously
- E-Epidemiology
- Neocartography
- Health in all policies
- Learn from the past for alternative futures
- Multidimensional information
- Collection of data and increasy of analytical capacity
- New techniques for spatial prediction
- Complexity and One-size-fits-all
- Resource poor policy-makers
- Post elimination period
- Anthropocene
- Construction of landscape models

Acknowledgement

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Archie Clements	*Curtin Universty*

PARTNERSHIP

Thank you!
I will take questions!