DISPERSIÓN RECIENTE DE LA LV URBANA EN ÁREA DE FRONTERA PROYECTO IDRC:

ADDRESSING THE EMERGENCE AND SPREAD OF LEISHMANIASES IN THE BORDERS OF ARGENTINA, BRAZIL AND PARAGUAY + URUGUAY + BOLIVIA

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23 e 24 de abril de 2018
Faculdade de Medicina da Universidade de São Paulo – SP - Brasil

SIMPÓSIO INTERNACIONAL

LEISHMANIOSE VISCERAL:

DESAFIOS PARA O CONTROLE

NO CONTEXTO DA DIVERSIDADE DE CENÁRIOS


Atlantic Ocean
VENEZUELA
GUYANA
FRENCH GUYANA
SURINAME
COLOMBIA
ECUADOR
PERU
Amazonas
BRAZIL
BOLIVIA
PARAGUAY
URUGUAY
ARGENTINA
South
Pacific
Ocean
Atlantic Ocean

ODS -INMET

VL epidemiological context

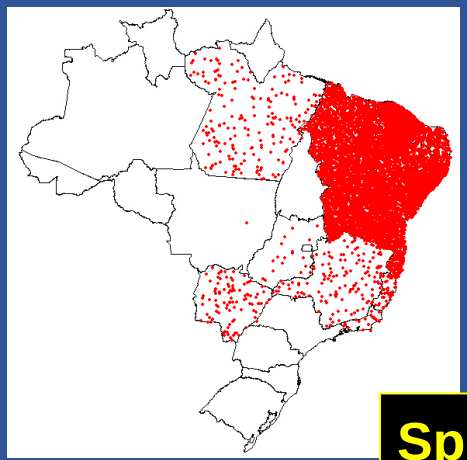
First reports of rural hVL in the country

PY 1911 railway SP-Corumba construction - Migone
AR 1923 Catania, Italia/ 1926 Salta - Mazza
BR 1936-38, *Leishmania chagasi* (1937 M da Cunha, Chagas E)
8 cases Pará, Ceará, Chagas E *et al*.
AR 1923-1989 16 hVL cases ou of border
1951 & 2000 *Lu longipalpis* NE border (forest)
Py 2005-2010 cVL foci (central Py) 20,9%-38,7%-69%

'80s BR Corumba hVL, 8,7% urban cVL, *Lu cruzi*, *Lu forattinii*

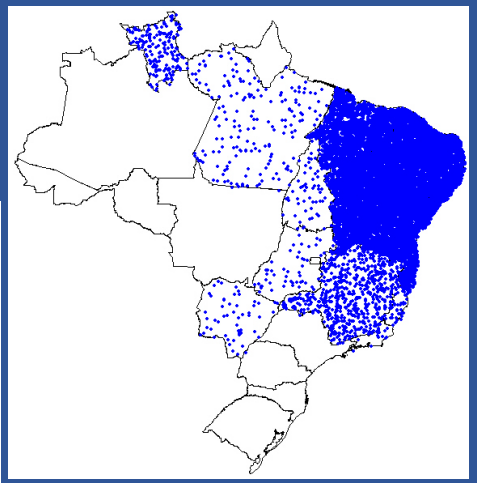
hVL Brazil, 1983 to 2008

1983-1988



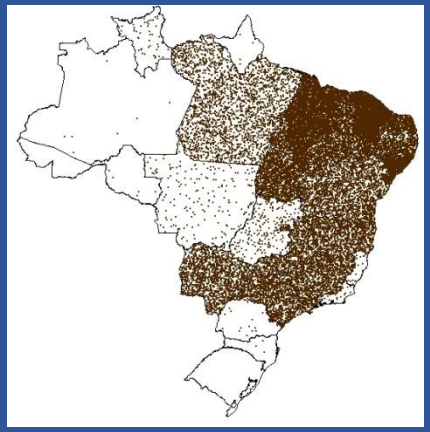
1 dot = 1 case

1989-1994



1995-2000

2001-2008



Spread to south

Urban epidemic transmission*

Parasite dispersion /reservoir migration-vector spread

Urban parasitology: visceral leishmaniasis in Brazil . Harhay et al.. Trends Parasitol. 2011 27(9):403-9.

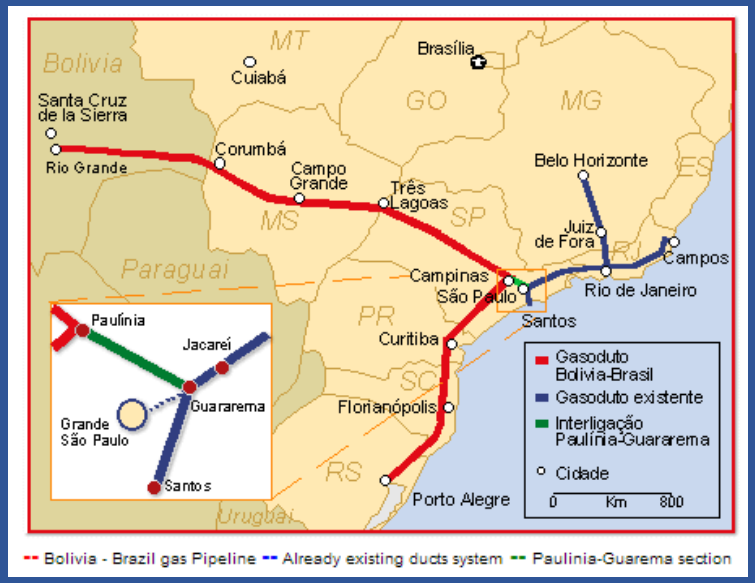
Source:
COVEV/DEVEP/SVs

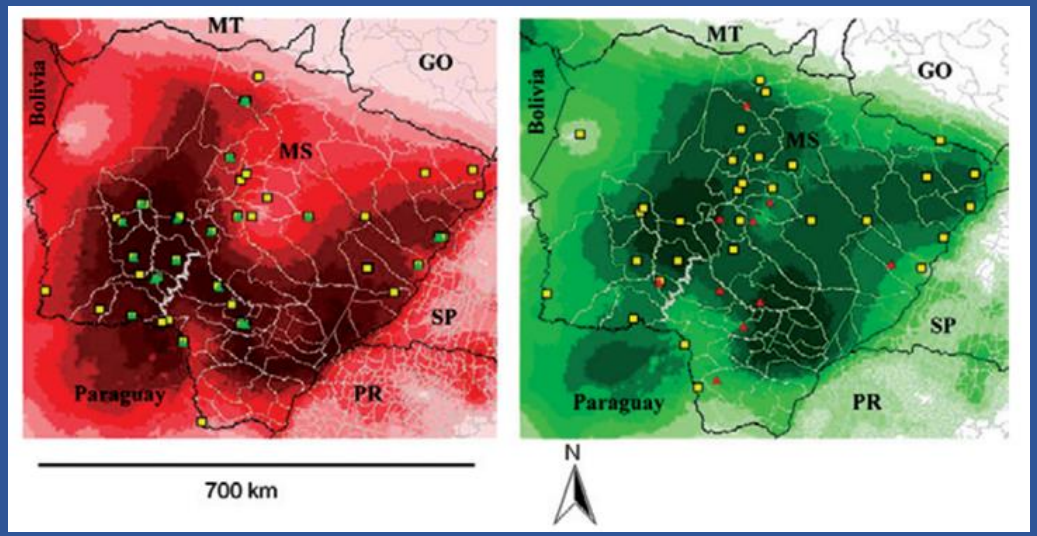
Ministério da Saúde

BRASIL UM PAÍS DE TODOS GOVERNO FEDERAL

Mato Grosso do Sul State, Brazil: VL expansion route west-east:

1) Federal highway/rail-road since early XXth century from SP State
2) Bolivia -Brazil gas pipeline since 1998, migration thousands of workers.





Salles Abreu Passos MF
http://ecen.com/eee10/gas.htm

ecological niche models projected for the potential distribution of *Lutzomyia longipalpis* (left) and human cases of visceral leishmaniasis (right). Areas identified as suitable based on the records of the occurrence of *Lu. longipalpis* are shown on a red scale: light red (low suitability) to dark red (high suitability), while areas identified as suitable based only on VL cases are presented on a green scale: light green (low suitability) to dark green (high suitability) .

De Almeida PS, *et al*. Mem Inst Oswaldo Cruz 2013;108:992-6

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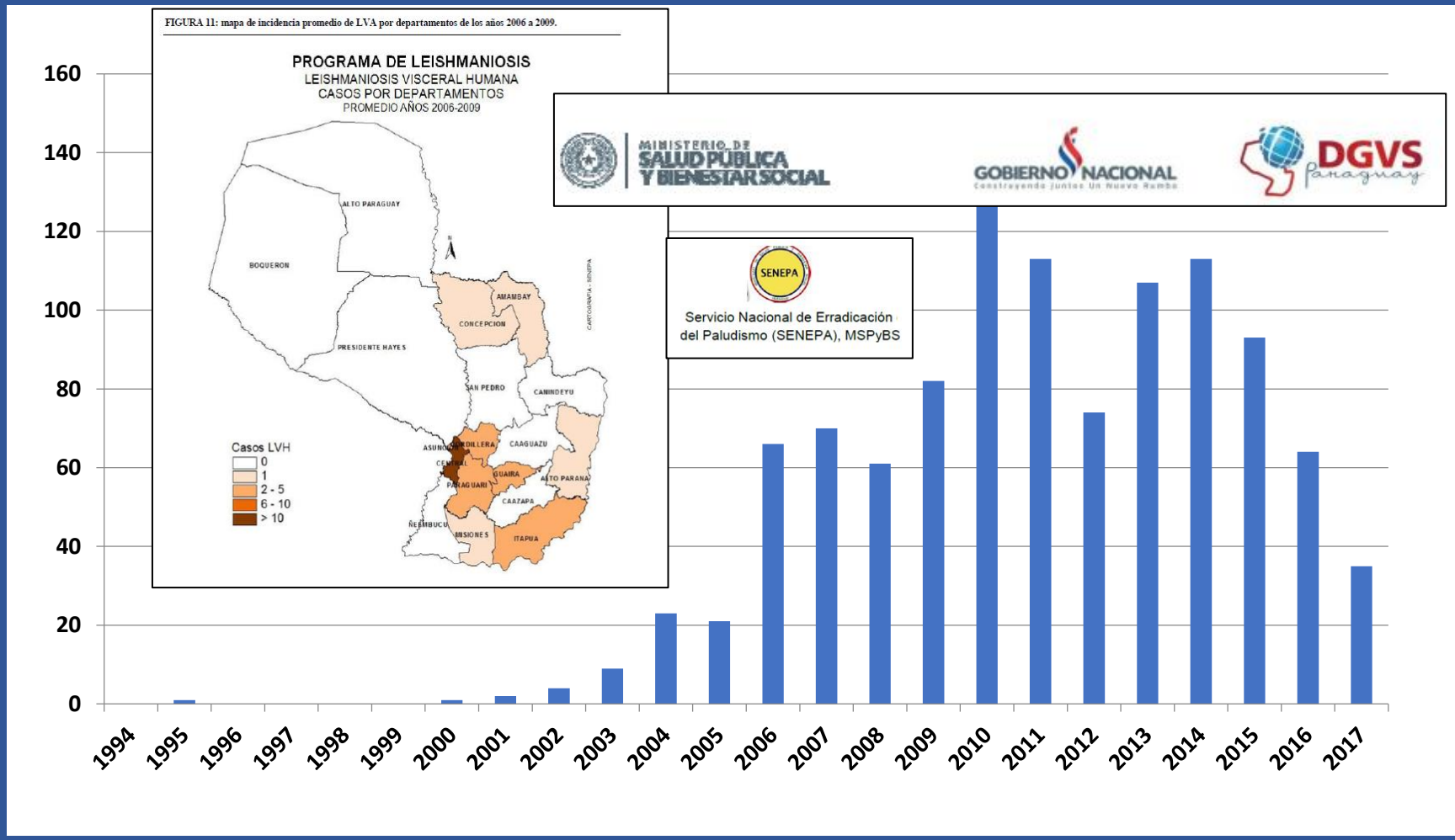
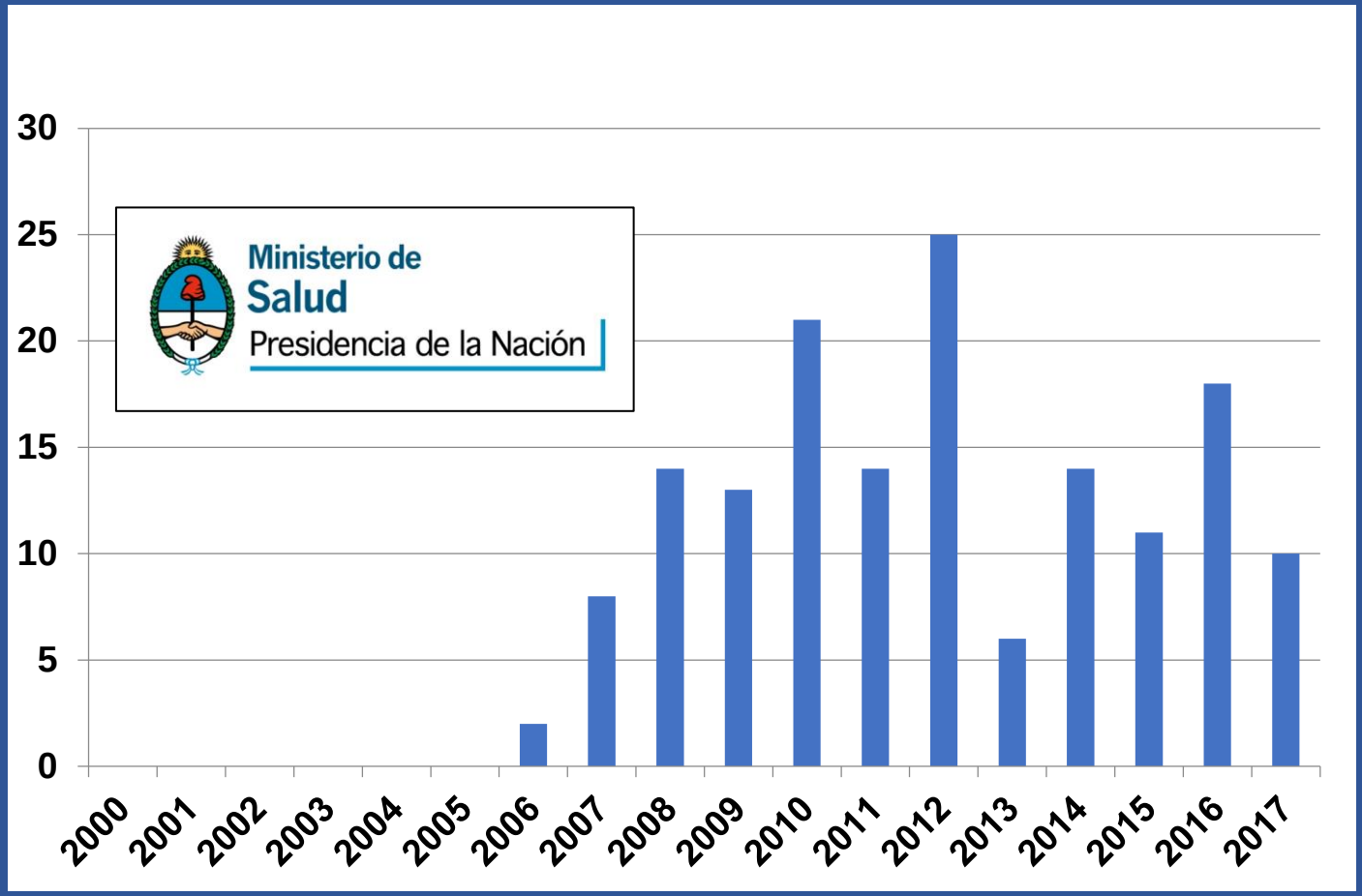
hVL cases Paraguay, 1994 - 2017



ODS -INMET

hVL cases Argentina, 2000 – 2017

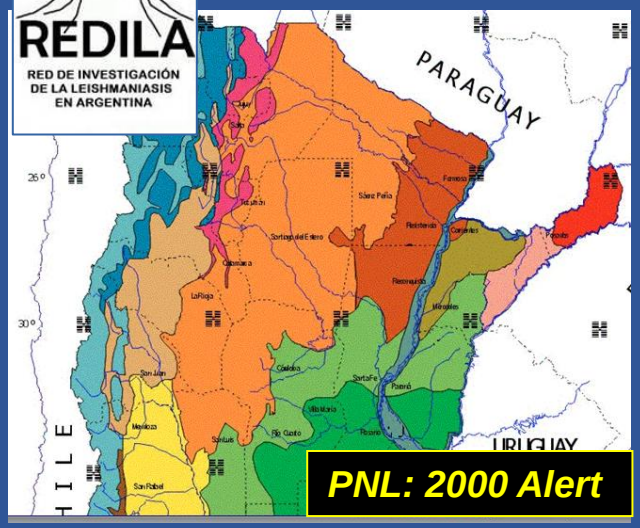


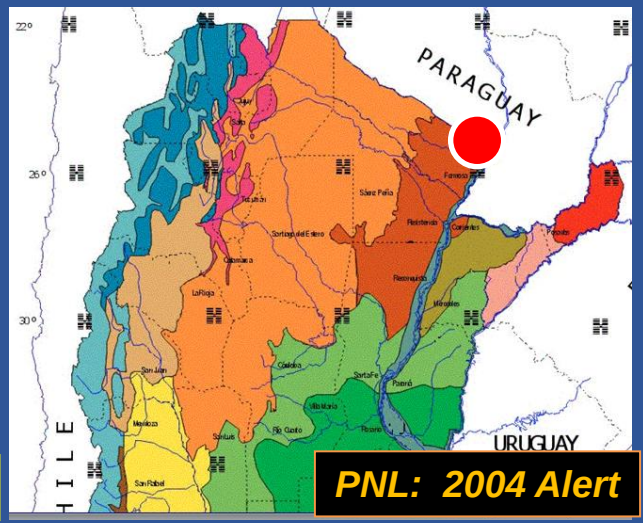
182 Cases (147- 80,8% NE), letality 15 (8,2%)

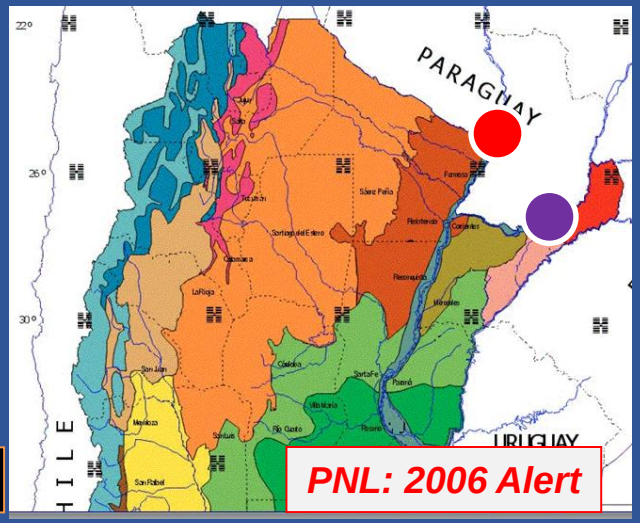
VLc foci 18,33% (8,5-26,2%)

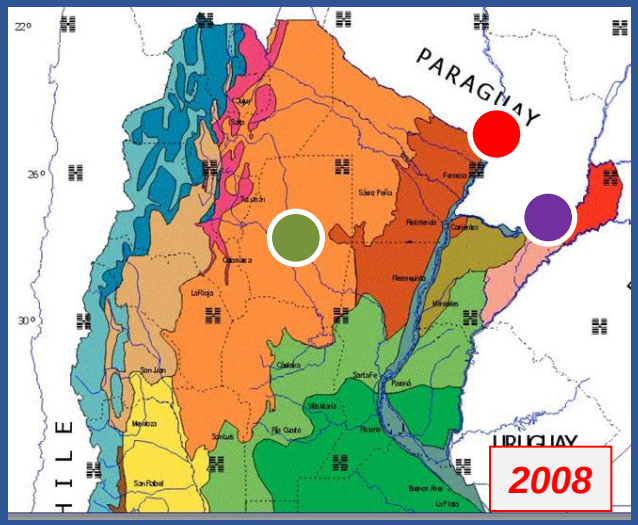
Urban VL ARGENTINA

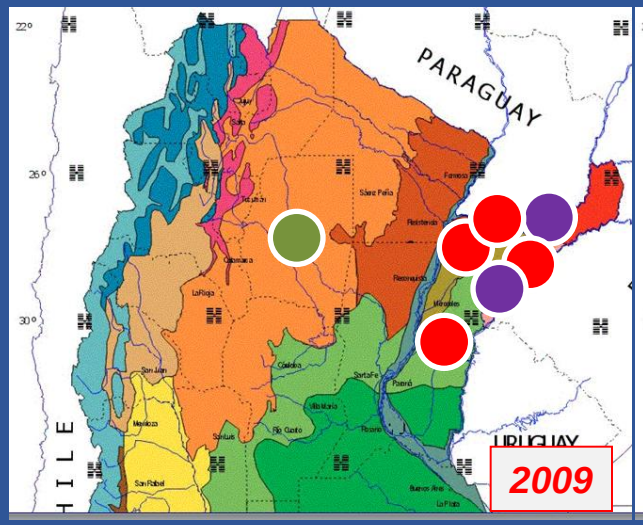
REDILA
RED DE INVESTIGACIÓN DE LA LEISHMANIASIS EN ARGENTINA

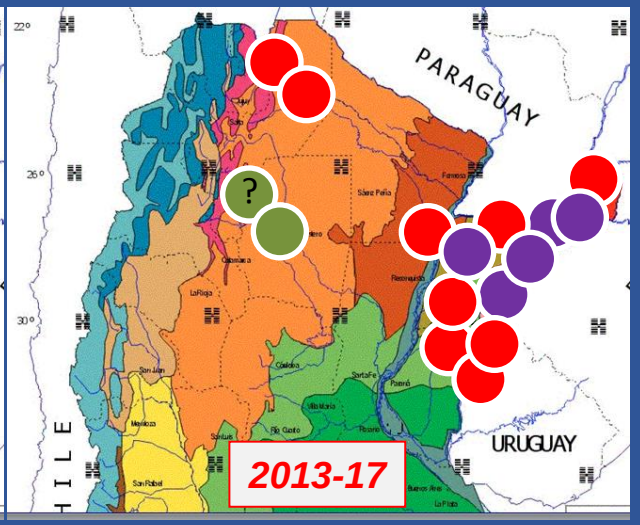












Lu longipalpis + cVL

Lu longipalpis + cVL +hVL

Mg migonei cVL + hVL

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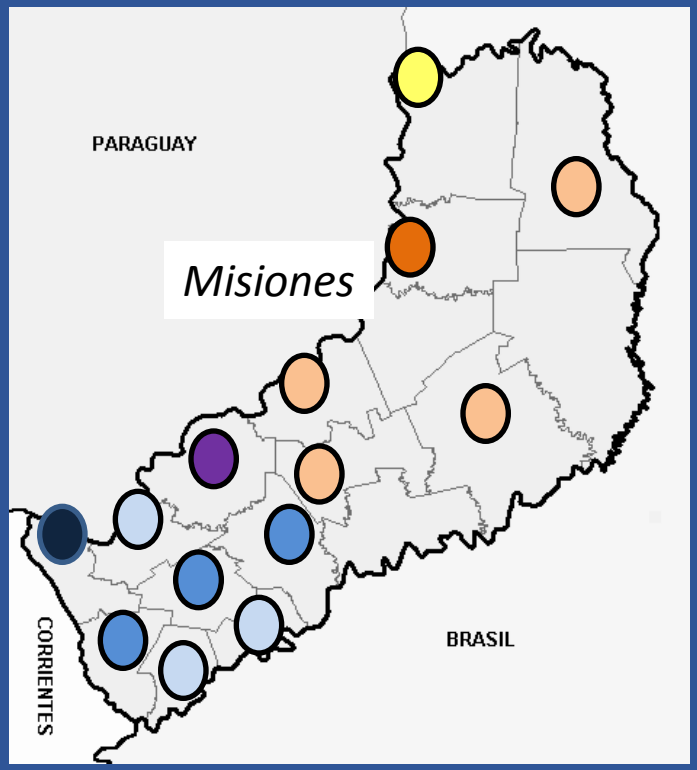
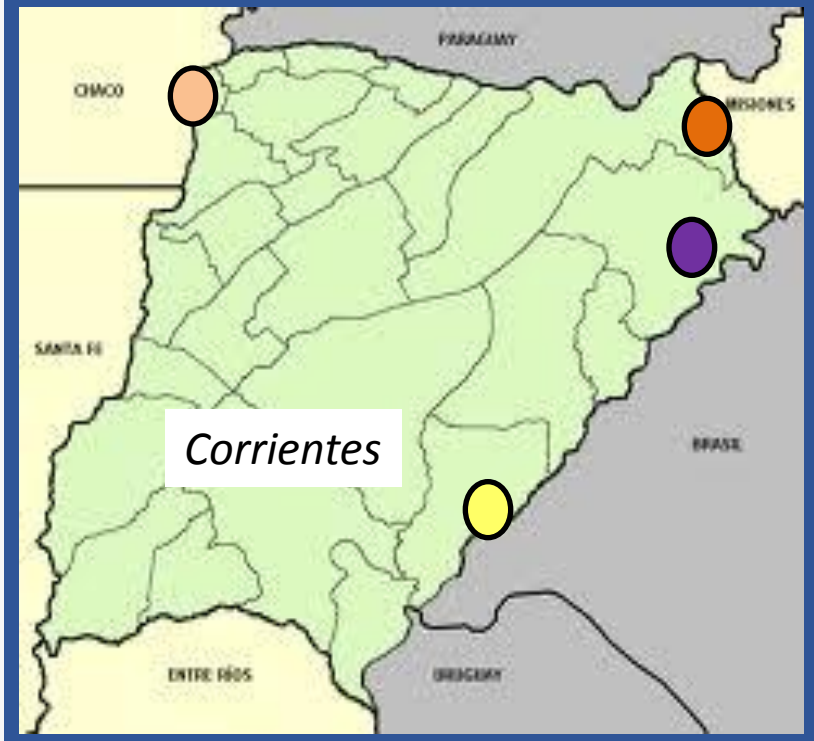
SPREAD BY CONTIGUITY
First report of hVL by second sub-national administrative level and year, ARGENTINA 2006-2014





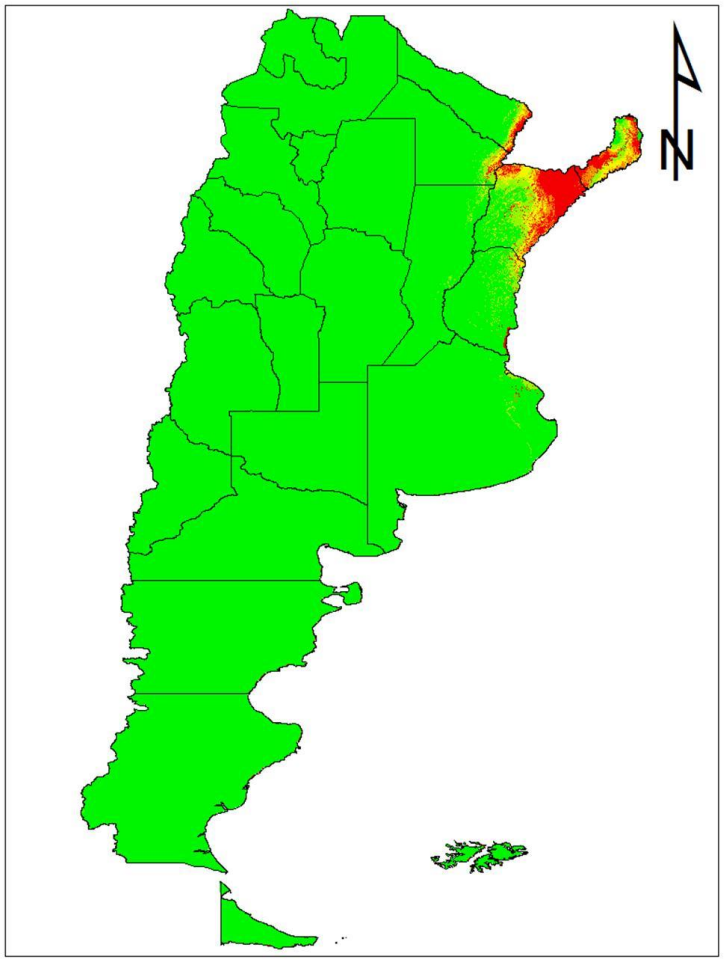
2006 2008 2009 2010 2011 2012 2013/4

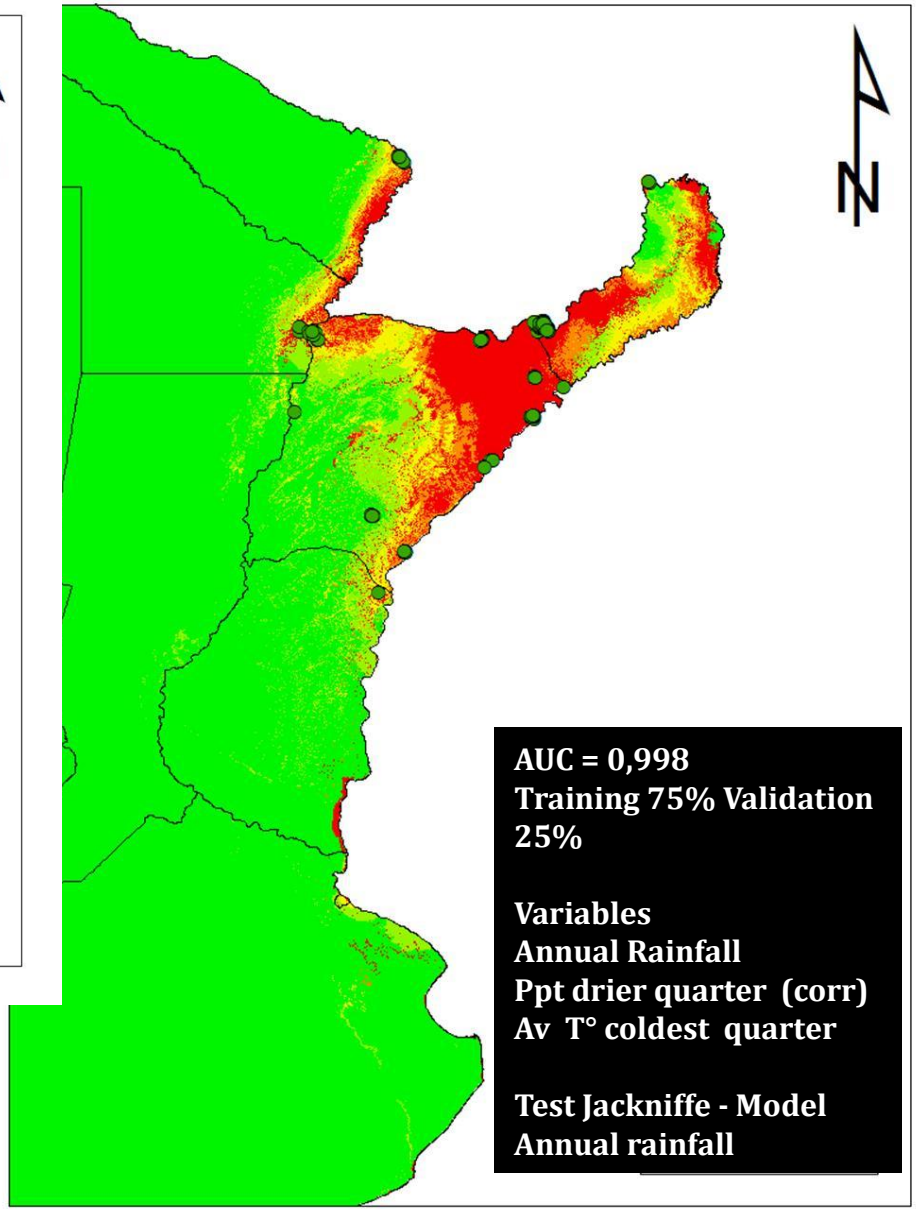
Ministerio de Salud
Presidencia de la Nación

INSTITUTO NACIONAL DE MEDICINA TROPICAL

REDILA
RED DE INVESTIGACIÓN DE LA LEISHMANIASIS EN ARGENTINA

Lutzomyia longipalpis modelling distribution





AUC = 0,998
Training 75% Validation 25%

Variables
Annual Rainfall
Ppt drier quarter (corr)
Av T° coldest quarter

Test Jackniffe - Model
Annual rainfall

Quintana MG, 2012

Ministerio de Salud
Presidencia de la Nación

INSTITUTO NACIONAL DE MEDICINA TROPICAL

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VL epidemiological context

BR - PR 1973/74 & 1980 autochtonous hVL in SEast
2012 Foz Iguaçu *Lu. longipalpis* (2010 AR Pto Iguazu)

BR- SC 2003 no *Lu longipalpis,* no hVL
2011 29/2124 cVL Florianópolis
2014 Border Argentina 48/252 cVL 7:3 rural:urban

BR – RS 1985 Santa María rural-central 5 cVL, 2003 no cVL, no *Lu. longipalpis*
2008 São Borja cVL, hVL, 2009 *Lu. longipalpis*
2009 Uruguaiana cVL, 1 hVL
2016-2017 Porto Alegre 3hVL deaths

UY 2009 *Lu. longipalpis* in border Salto y Bella Unión (AR Concordia)
2017 Arenitas Blancas- Salto 11/45 cVL, *Lu longipalpis, L infantum*

BO – 2013 (AR Tartagal) no records of hVL, cVL, *Lu. Longipalpis*

Pocai *et al*. 1998 Cienc Rural 28: 501-505. Cat *et al*. 1973, 1974, *An Fac Med Univ Fed Paraná 16/17*: 27-35. Ayala *et al*. 1980 *J Bras Med 39*: 88-89. Marcondes CB *et al*. RSBMT 2003;36:499-501, Souza GD *et al*, MIOC 2009 Dec;104(8):1181-2. Maziero *et al*, Vet Parasitol. 2014;205:92-5S. Steindel *et al* 2013Pesquisa Veterinária Brasileira 33(4):490-496, Thomaz-Soccol Rev Bras Parasitol Vet. 2009;18(3):46-51, Frehse *et al* Rev Bras Parasitol Vet. 2010 ;19(1):62-4. Salomón *et al* MIOC. 2011;106(3):381-2. Escobar *et al*. Semina: Ciências Agrárias, Londrina, 2018 39: 211-220. Santos *et al*. RSBMT 2012;45(5):643-5. Azevedo *et al*. Vet. Foco 2009; 7(1): 52-61. Satragno *et al*. EID 2017; 23:536-538

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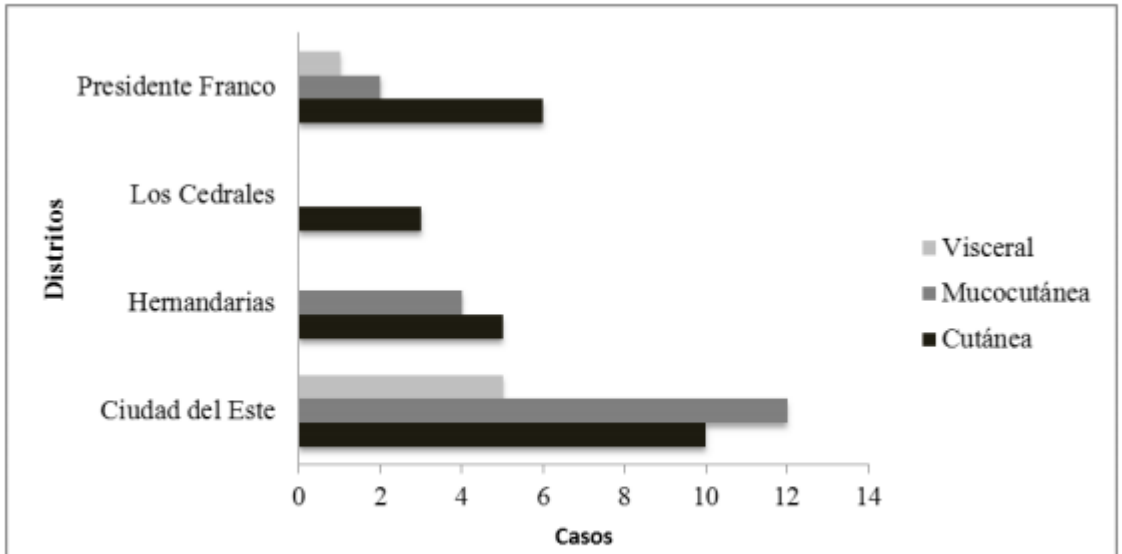
VL epidemiological context

PY - 2008 first case hVL Ciudad del Este (away form border)
2014 No *Lu. longipalpis*



PY - 2008 - 2016 Leishmaniases Cases in the border area (IDRC Project Area)

Source: Programa Nacional de Leishmaniasis SENEPA

ADDRESSING THE EMERGENCE AND SPREAD OF LEISHMANIASES IN THE BORDERS OF ARGENTINA, BRAZIL AND PARAGUAY 2014-2017

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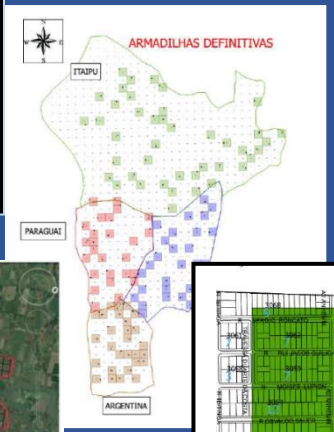
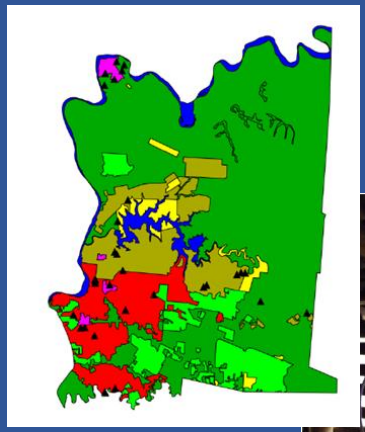
Sampling

Transversal
Seasonal (10%)

Urban grid 400x400
census or stratified
+ ecotone transects
≈ 750 sites



Environmental variables
Micro-scale: site
Meso-scale: area
Macro-scale: land use



Domestic reservoir/Biol Mol
5 dogs around each trap

Medical anthropology

Collectives
Key informants
Community

Synanthropic rodent activity traps /*Transects*

Entomology/Mol Biol '*Critical Site*'
REDILA light trap X 3 nights

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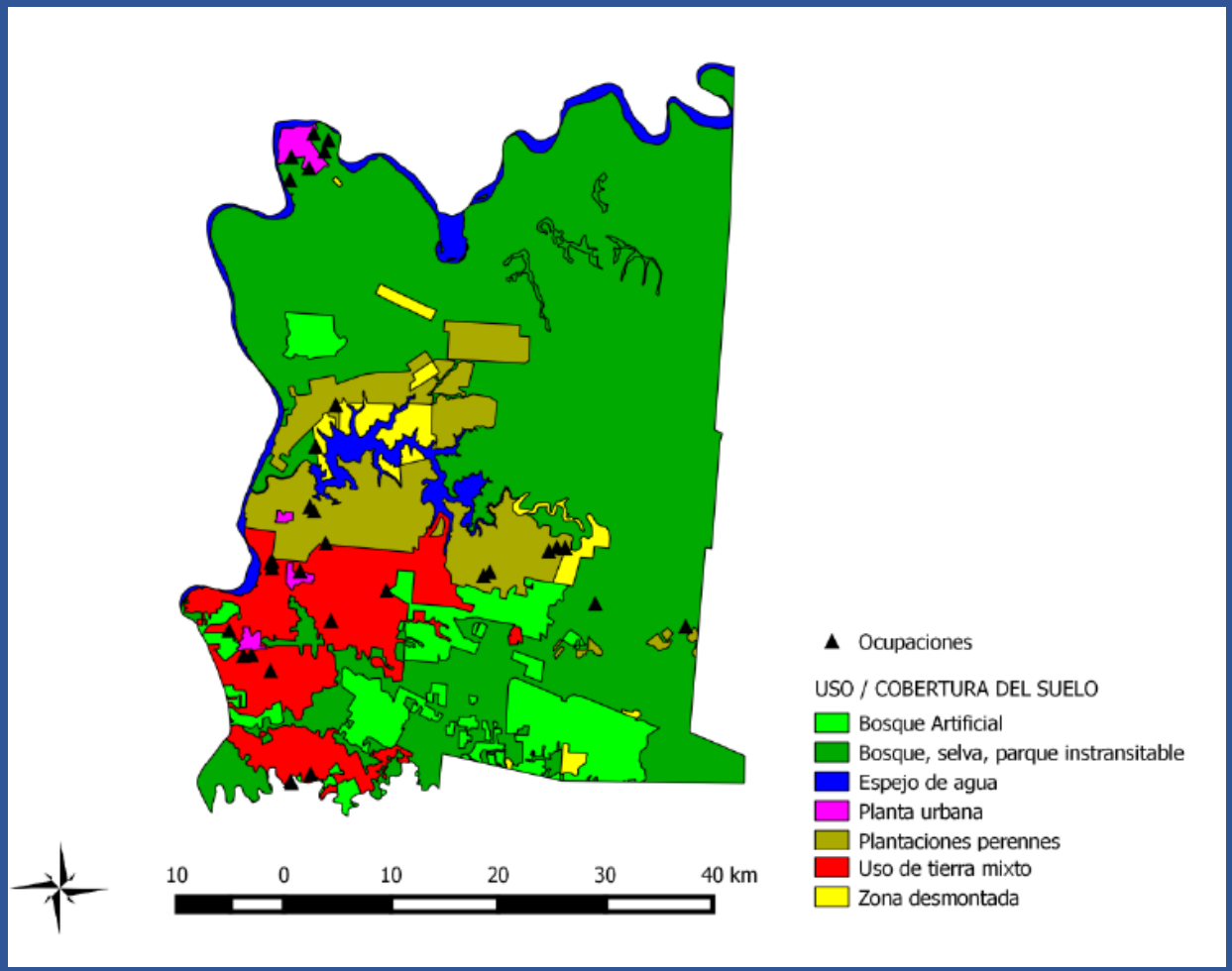
ARGENTINA Macro-Scale Land Use



Vulnerable Population - Puerto Iguazu Department 2001-2014, Association with land use and land cover

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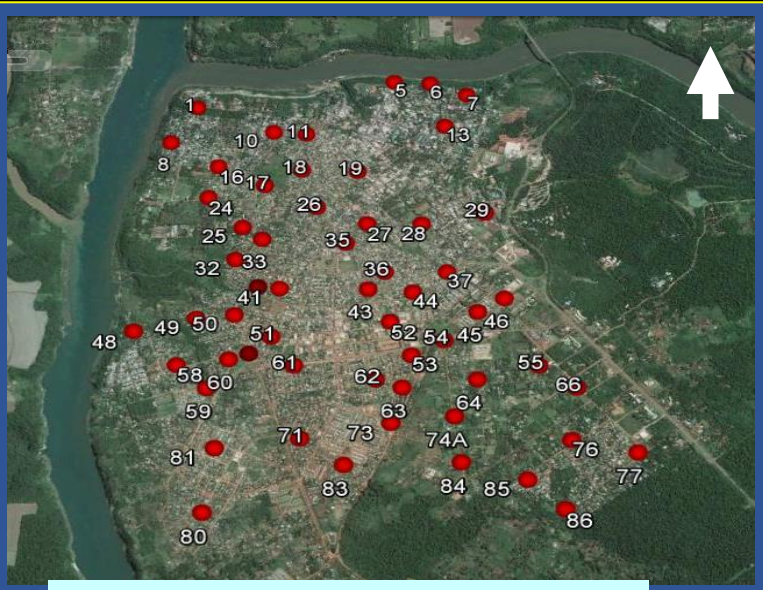
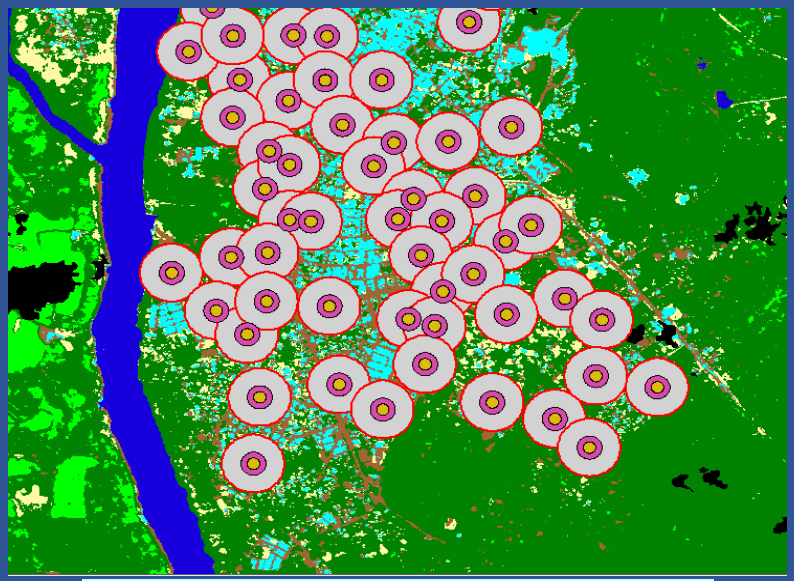
ARGENTINA Environment Stratification and Sampling
84 'critical areas and sites' (meso-scale and micro-scale)



Puerto Iguazú 400 x 400 m



29 environmental variables

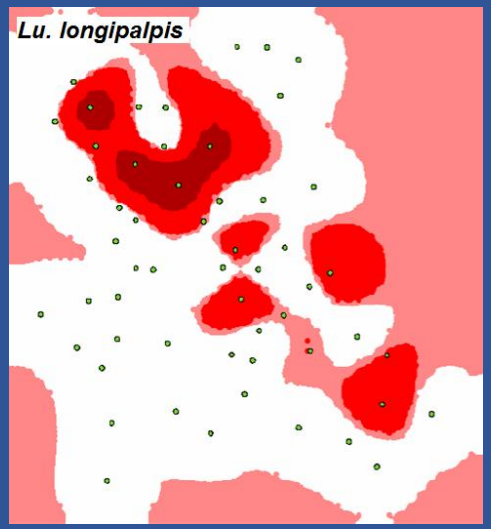
Puerto Libertad 400 x 400 m

Border transect
Barrio Pescadores e100m

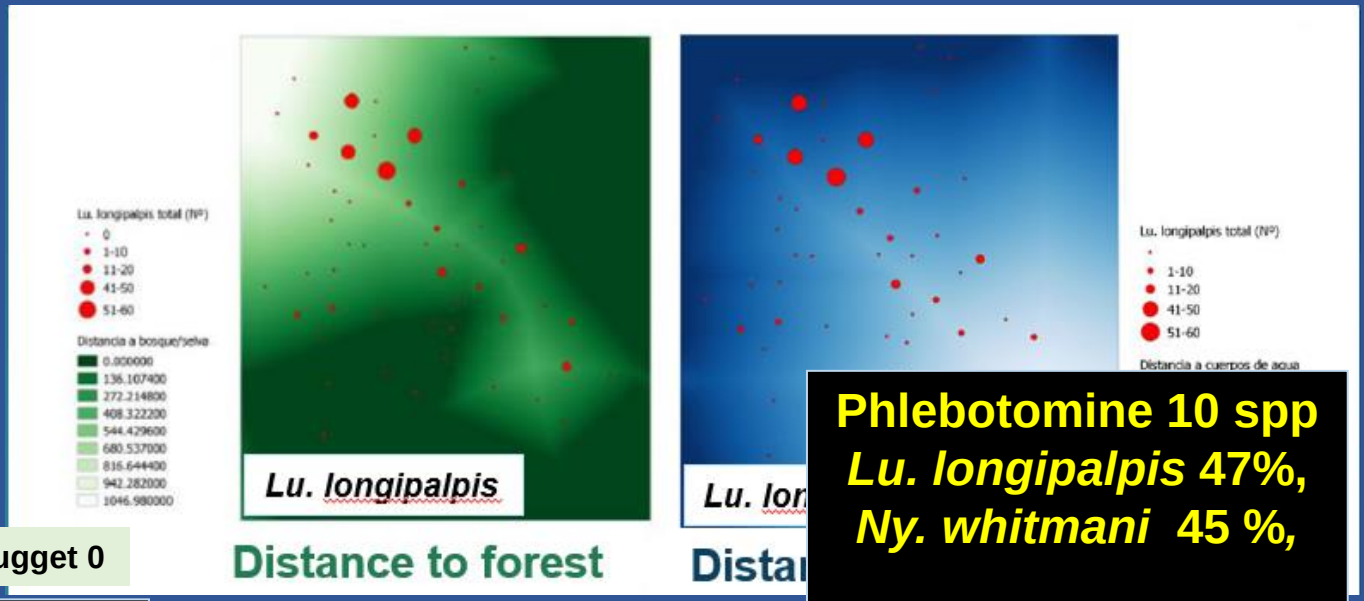
Border Ecotone
Barrio Cooperativa e50m

ARGENTINA Phlebotominae

‘HOT SPOTS’, ‘COLD SPOTS’ & ENVIRONMENT



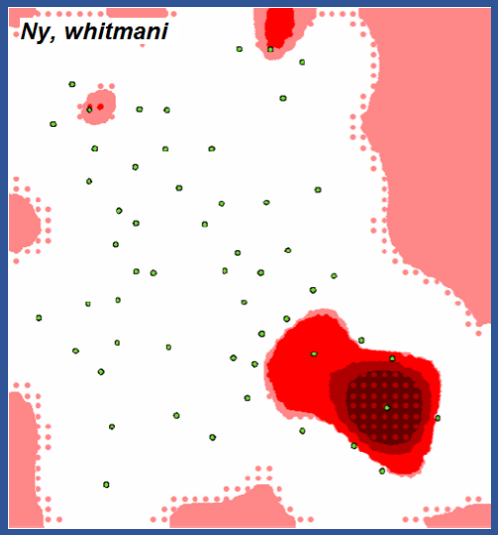
Krigging: range 400m, sill 20, nugget 0



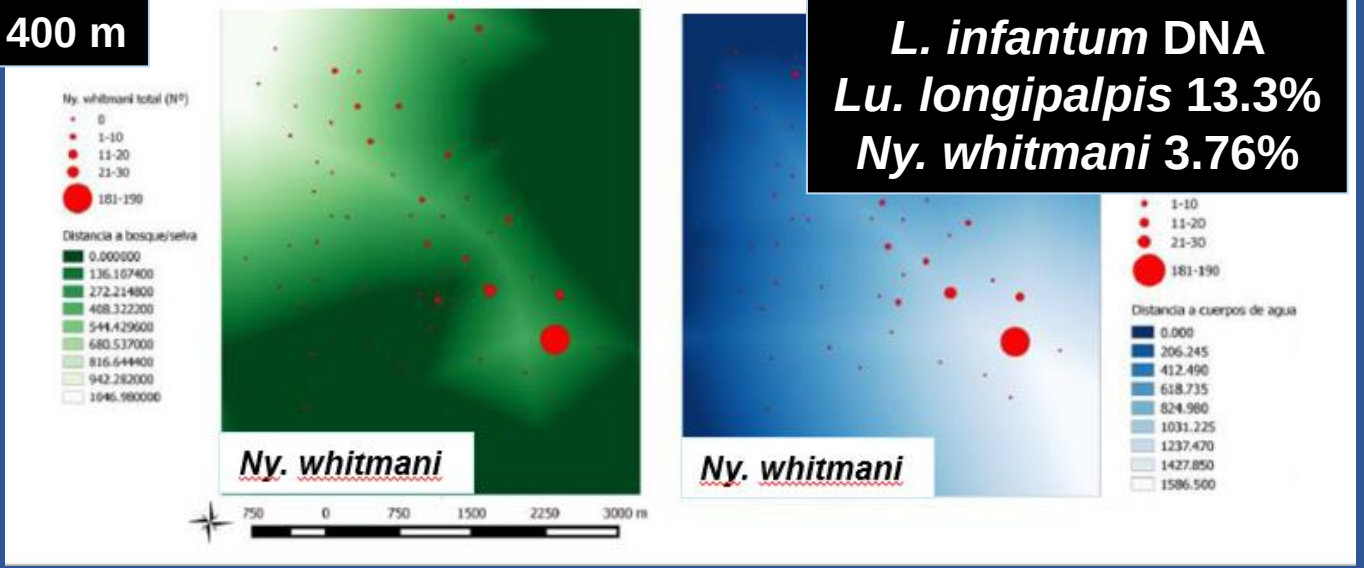
Phlebotomine 10 spp
***Lu. longipalpis* 47%,**
***Ny. whitmani* 45 %,**

***L. infantum* DNA**
***Lu. longipalpis* 13.3%**
***Ny. whitmani* 3.76%**

Spatial auto-correlation 400 m



Krigging: range 400m, sill 1.8, nugget 0



ODS -INMET

ARGENTINA Phlebotominae

Leishmania infantum* DNA detected in 7/369, 5 *Lu. longipalpis* , 1 *Ny. whitmani* and 1 *Micropygomyia quinquefer

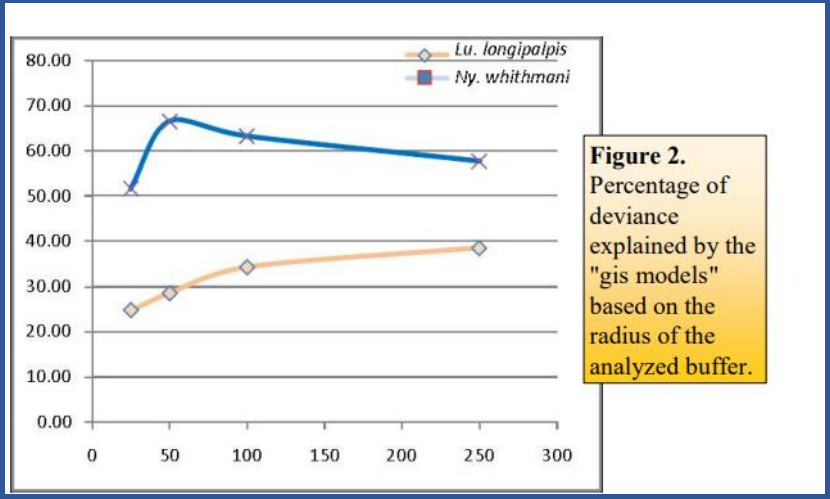


Figure 2. Percentage of deviance explained by the "gis models" based on the radius of the analyzed buffer.

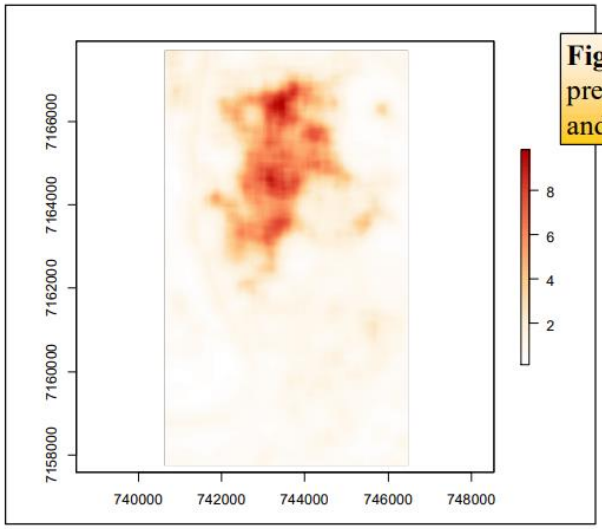


Figure 3. Relation between presence of *Lu. longipalpis* and NDVI 250 variable.

Six landcover classes was estimated for surface areas between 0.27 and 20.25 hectares. Adjusted GLM. Zero-inflated negative binomial regression model.

***Lu. longipalpis* abundance better explained by land cover characteristics of 20.25ha.**

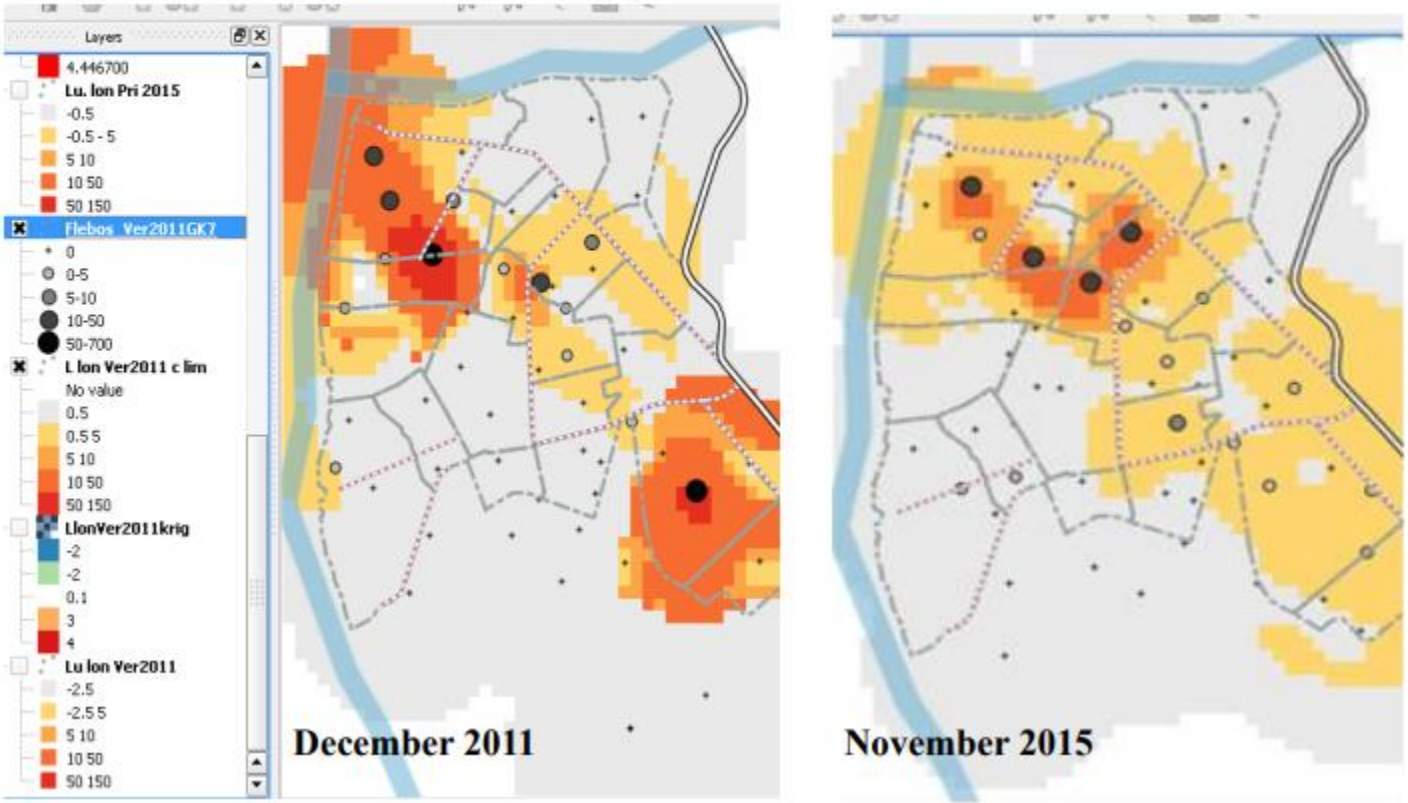
Significant variables:
Presence - chicks (micro scale) and NDWI (meso scale),
Abundance - availability of different blood sources (hens, dogs or both) (micro scale); drinking water network, garbage collection, sewer (meso scale),.

ODS -INMET

ARGENTINA Phlebotominae

Lu longipalpis

5-1 neighbor, ratio between 850-1000 m

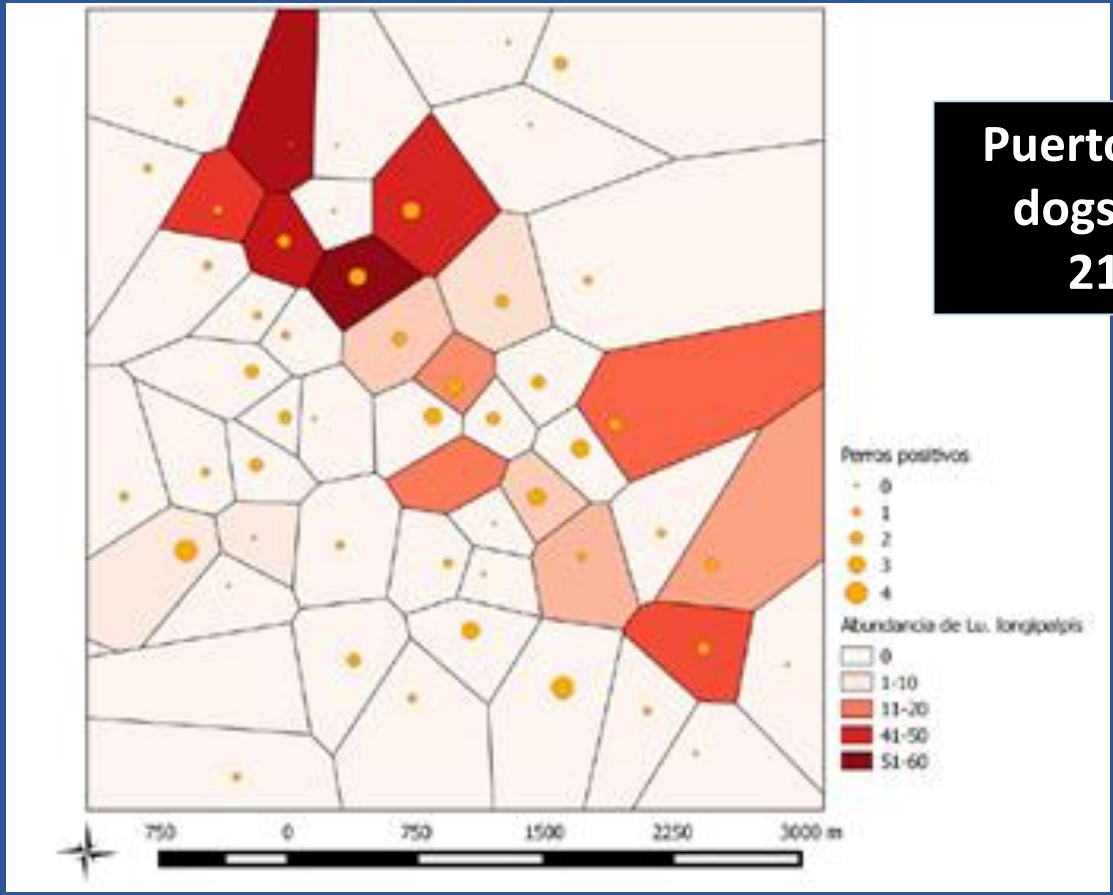


Lu. longipalpis **autocorrelated up to 700-1000 m**
Lu. longipalpis **kept 76.4% of 2011 distribution in 2015**
'Hot spots' consistent with other modeling approaches

Santini MS, Fernández MS, Cavia R, Salomón OD.Co-occurrence and seasonal and environmental distributions of the sandflies *Lutzomyia longipalpis* and *Nyssomyia whitmani* in the city of Puerto Iguazú, northeastern Argentina. Med Vet Entomol 2017 Nov 27. doi: 10.1111/mve.12283

ARGENTINA cVL

Distribution of Abundance *Lu. Longipalpis* and Rk39+ Dogs



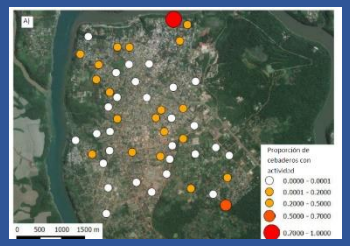
Puerto Iguazu
dogs rK39+
21,2%

> Abundance *Lu longipalpis* > dogs rK39+
Dog distribution rK39+ explained by dog associated-social networks
> Abundance < distance Phlebotomine trap- human sleeping area
> *Lu. longipalpis* peridomestic than indoors (> autumn)

ODS -INMET

RODENT ACTIVITY

AR- SOCIAL COMPONENT



- Border territory – environment - urbanization
social history – construction – porosity

- Land use – urban 'green patches'
'low cost areas' CL - labour regulation

Inter-sectoral POLICY

11,7%+ sites (n 773) None spatial auto-correlation Urban > forest > rural

Actor map – actor KAPP*:
- **Focused in cVL.**
- **KAPP disparate, fragmentated, opposites**
- **Human-dog interspecific distance**
- **Gender bias domestic issues**
  family health, environment 'cleanliness'
- **Dog uses - stray dogs**
- **State de-legitimization but accountability**

Master Plan dog management- P.Iguazu

Public-Private cVL management Workshop & Agreement Act

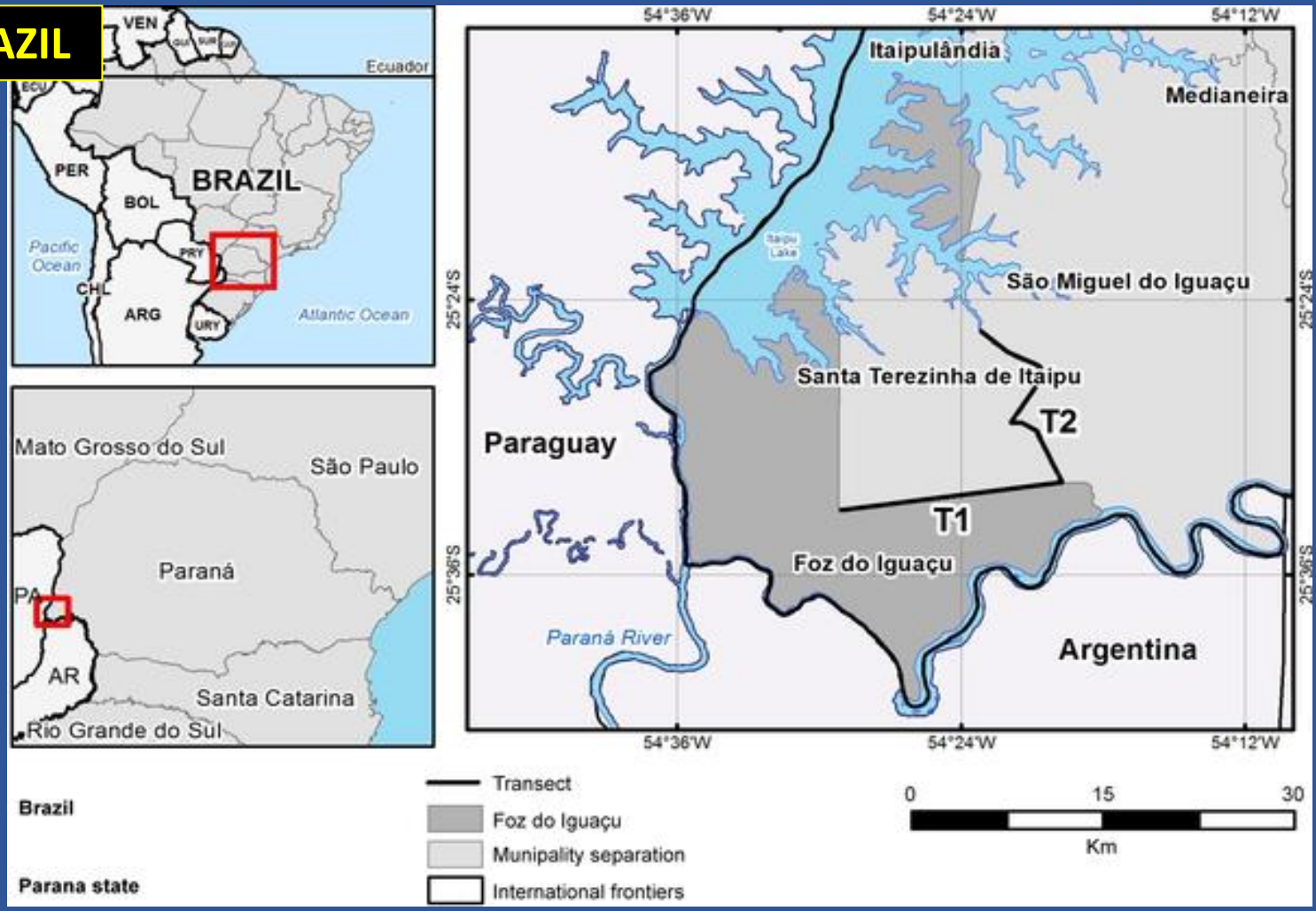
Discourses-practices participative and actor oriented

SOCIAL INEQUITIES – PROGRAM INEFFECTIVENES

*Decision makers. Public Health agents (Hospital, PHC, zoonosis, vectors). Park rangers- Custom officials. Private practitioners (MD, MV). Dog breeders/-trainers-protectionists. Dog owners (with/without VL) - community.

ODS -INMET

IDRC BRAZIL

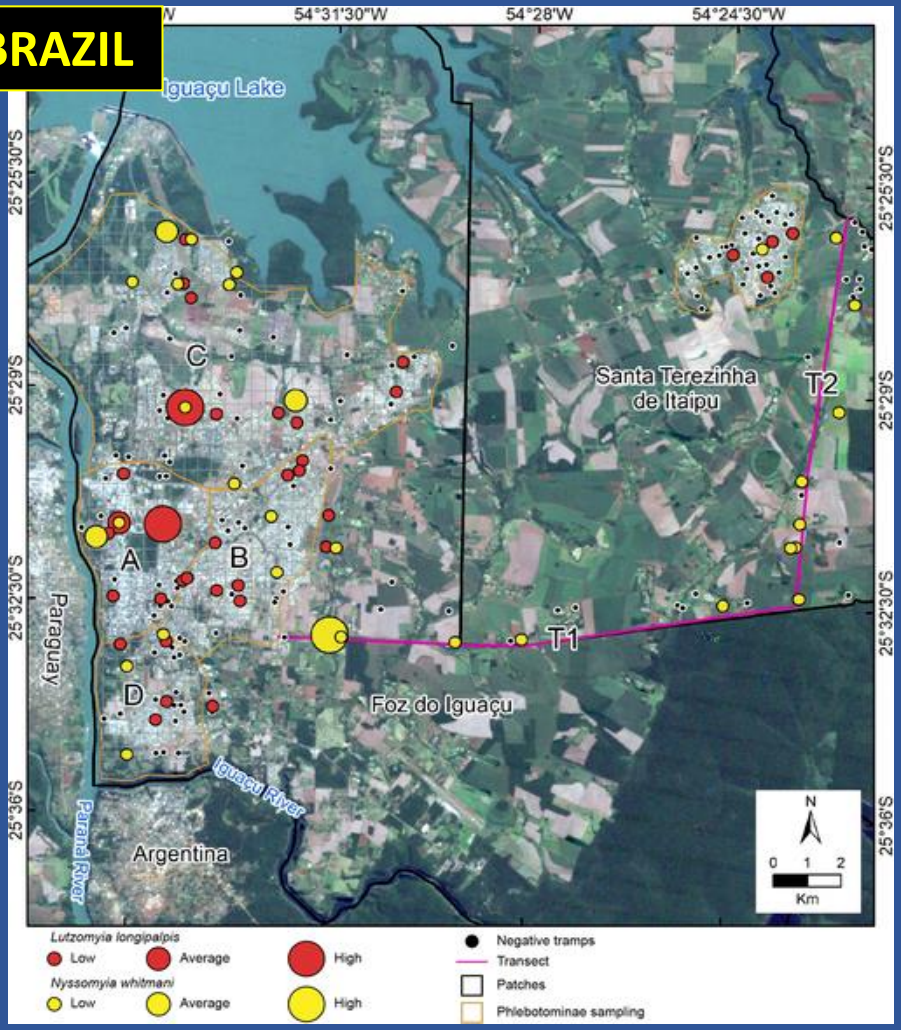


Area where CDC traps were installed for sand fly fauna studies: Foz do Iguaçu city; T1 and T2 transects areas (between Foz do Iguaçu and Santa Terezinha de Itaipu); Santa Terezinha de Itaipu city.

Thomaz-Soccol V, Gonçalves AL, Piechnik CA, Baggio RA, Boeger WA, et al. (2018) Hidden danger: Unexpected scenario in the vector-parasite dynamics of leishmaniases in the Brazil side of triple border (Argentina, Brazil and Paraguay). PLOS Neglected Tropical Diseases 12(4): e0006336. https://doi.org/10.1371/journal.pntd.0006336
http://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0006336

PLOS | NEGLECTED TROPICAL DISEASES

IDRC Phlebotomine BRAZIL

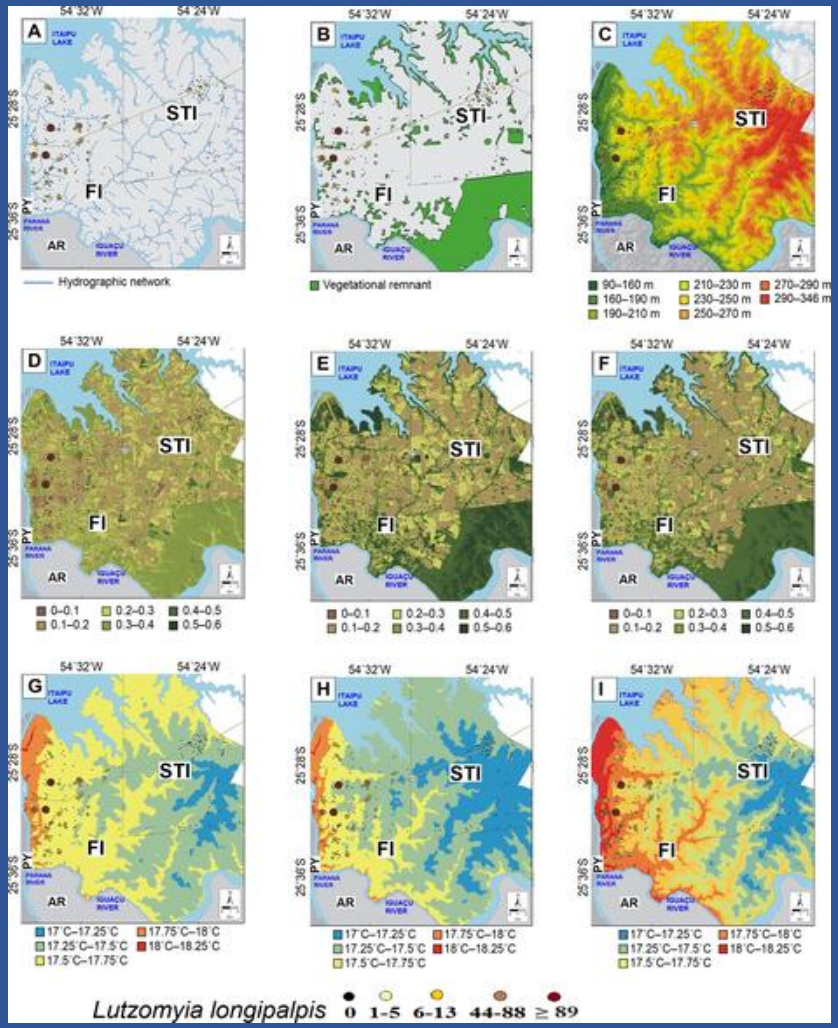


Phlebotominae sand fly distribution in the three survey areas (Foz do Iguaçu, Santa Terezinha de Itaipu and transects).

Thomaz-Soccol V, Gonçalves AL, Piechnik CA, Baggio RA, Boeger WA, et al. (2018) Hidden danger: Unexpected scenario in the vector-parasite dynamics of leishmaniases in the Brazil side of triple border (Argentina, Brazil and Paraguay). PLOS Neglected Tropical Diseases 12(4): e0006336. https://doi.org/10.1371/journal.pntd.0006336
http://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0006336

PLOS | NEGLECTED TROPICAL DISEASES

IDRC Phlebotomine BRAZIL

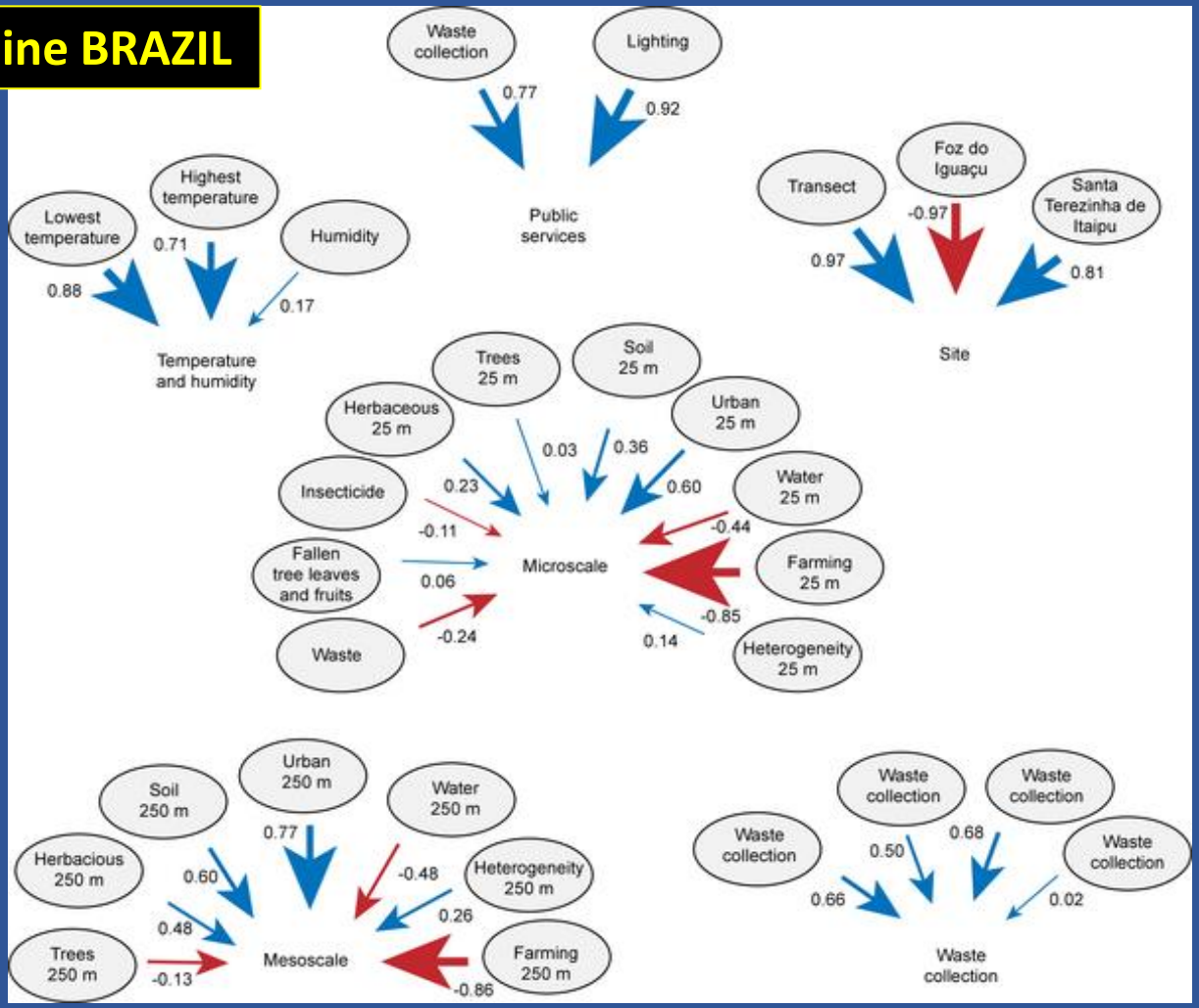


Abundance and spatial *Lutzomyia longipalpis* distribution showing the number of collected specimens: (A) hydrographic network, (B) forest remnant, (C) hypsometry in m, (D) normalized vegetation index—winter period, (E) normalized vegetation index summer period, (F) normalized vegetation index—spring period, (G) winter temperatures, (H) summer temperature, (I) average temperature over the last 30 years in Foz of Iguaçu (FI) and transects areas (T1 + T2) October/November 2014 and Santa Terezinha de Itaipu (STI) October 2015.

Thomaz-Soccol V, Gonçalves AL, Piechnik CA, Baggio RA, Boeger WA, et al. (2018) Hidden danger: Unexpected scenario in the vector-parasite dynamics of leishmaniases in the Brazil side of triple border (Argentina, Brazil and Paraguay). PLOS Neglected Tropical Diseases 12(4): e0006336. https://doi.org/10.1371/journal.pntd.0006336
http://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0006336

PLOS | NEGLECTED TROPICAL DISEASES

IDRC Phlebotomine BRAZIL



Loadings of the variables public services, temperature and humidity, food supply, site, mesoscale, microscale analyzed in each group.

Thomaz-Soccol V, Gonçalves AL, Piechnik CA, Baggio RA, Boeger WA, et al. (2018) Hidden danger: Unexpected scenario in the vector-parasite dynamics of leishmaniases in the Brazil side of triple border (Argentina, Brazil and Paraguay). PLOS Neglected Tropical Diseases 12(4): e0006336. https://doi.org/10.1371/journal.pntd.0006336
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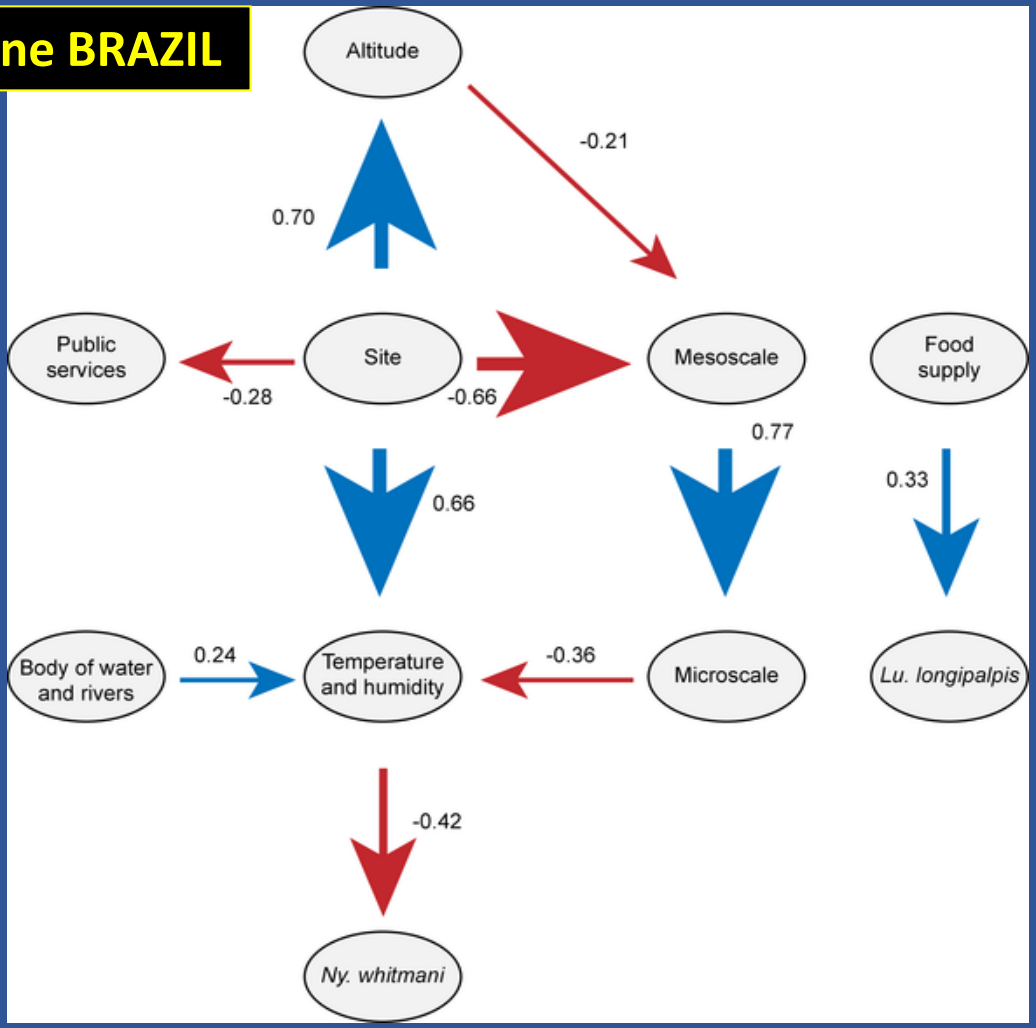
PLOS | NEGLECTED TROPICAL DISEASES

IDRC Phlebotomine BRAZIL

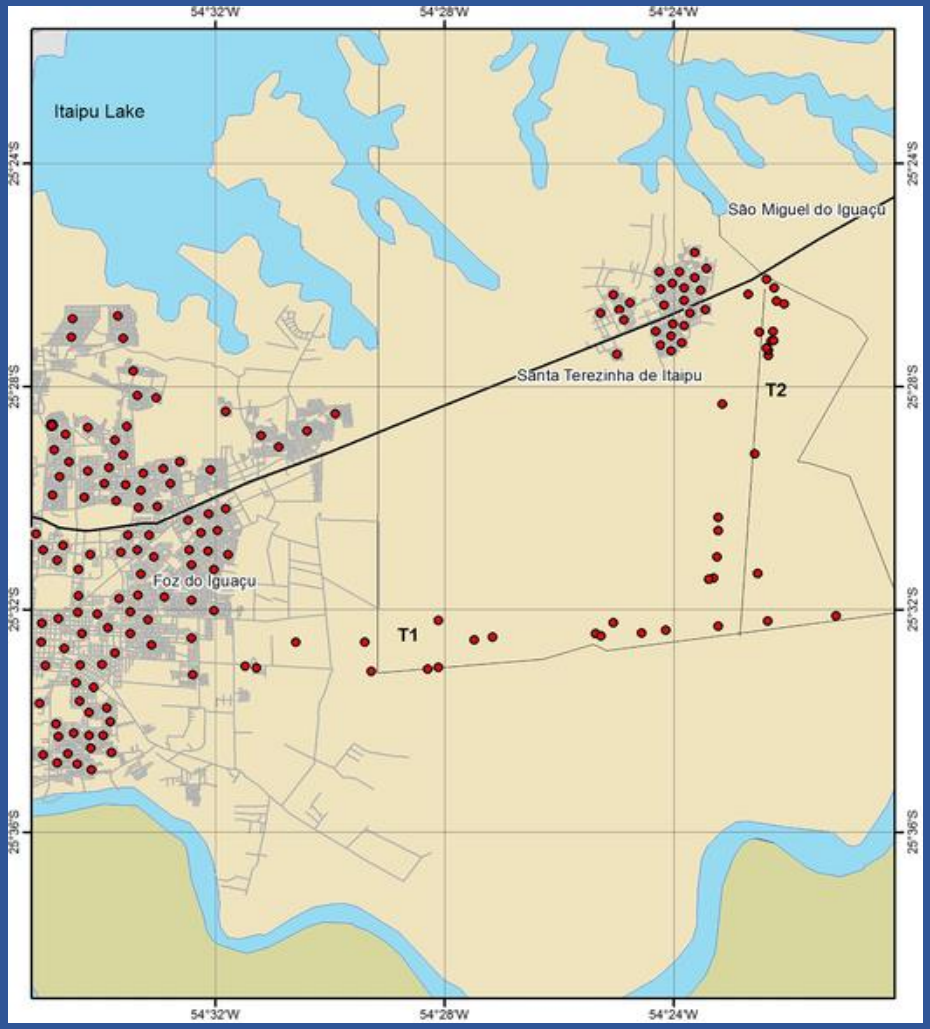


Network of influence of the public services, temperature and humidity, food supply, site, mesoscale, microscale on the abundance of *Nyssomyia whitmani and Lutzomyia longipalpis*.

Thomaz-Soccol V, Gonçalves AL, Piechnik CA, Baggio RA, Boeger WA, et al. (2018) Hidden danger: Unexpected scenario in the vector-parasite dynamics of leishmaniases in the Brazil side of triple border (Argentina, Brazil and Paraguay). PLOS Neglected Tropical Diseases 12(4): e0006336. https://doi.org/10.1371/journal.pntd.0006336
http://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0006336

PLOS | NEGLECTED TROPICAL DISEASES

IDRC cVL BRAZIL

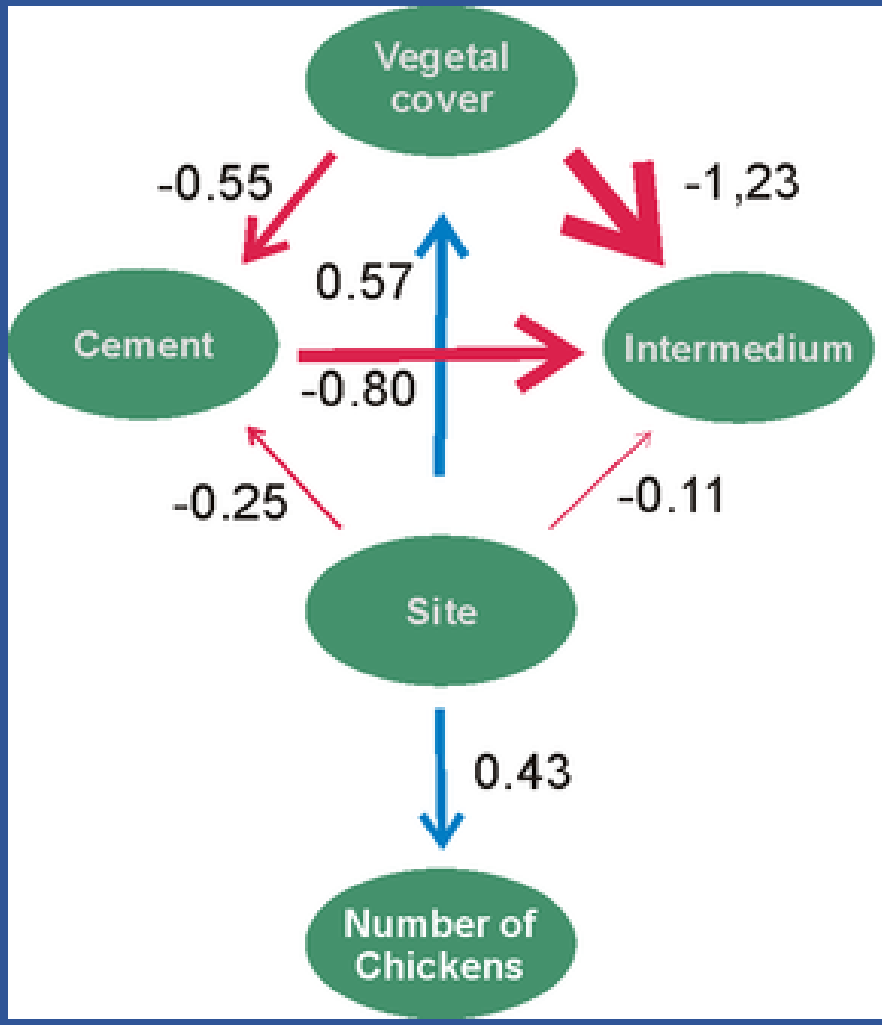


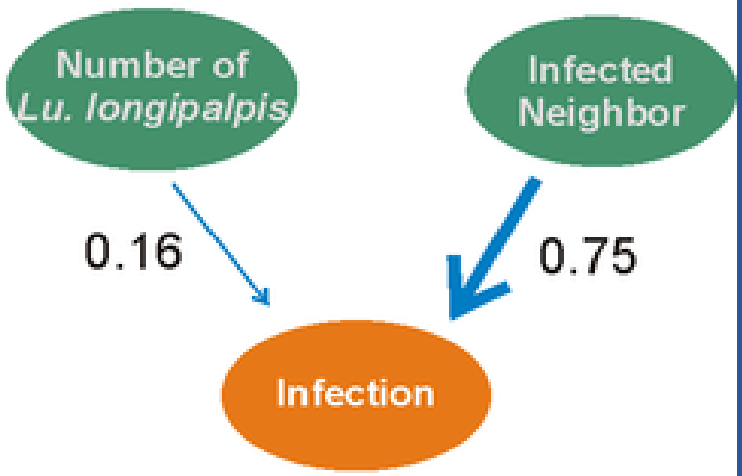
In the 196 sites (pointed in the maps) from three areas of the extreme -west of the Southern of Brasil (Foz do Iguaçu, Santa Terezinha de Itaipu and transect between the two cities) dogs were sampled to determine the seroprevalence to leishmaniases.

Thomaz Soccol V, Pasquali AKS, Pozzolo EM, Leandro AdS, Chiyo L, et al. (2017) More than the eyes can see: The worrying scenario of canine leishmaniasis in the Brazilian side of the triple border. PLOS ONE 12(12): e0189182. https://doi.org/10.1371/journal.pone.0189182
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0189182

PLOS ONE

IDRC cVL BRAZIL



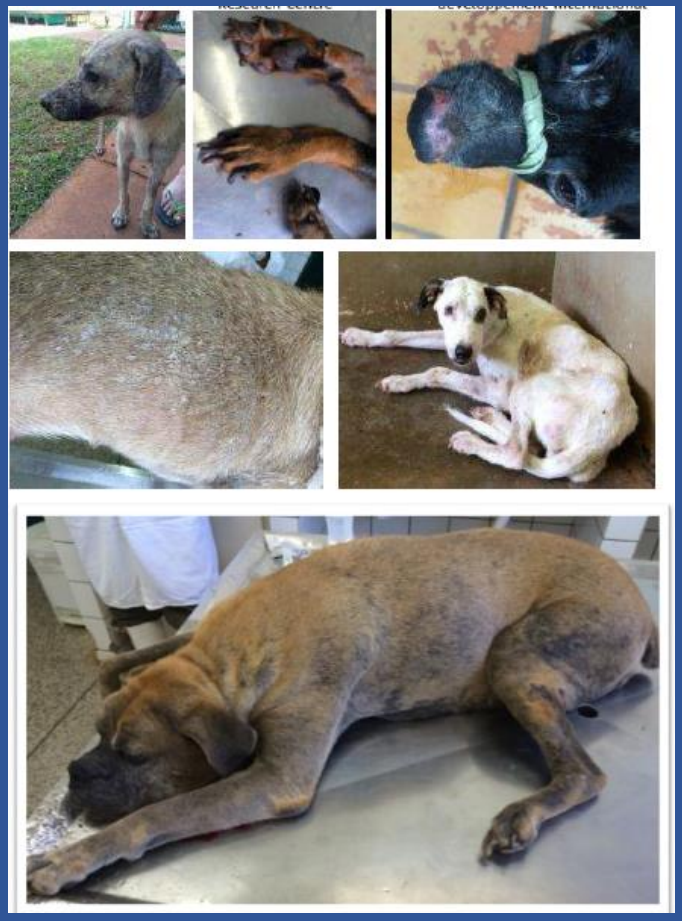


Path analysis with extrinsic (environmental) characteristics that affect the infection rate in dogs from western region of the Paraná State, Brazil.

Thomaz Soccol V, Pasquali AKS, Pozzolo EM, Leandro AdS, Chiyo L, et al. (2017) More than the eyes can see: The worrying scenario of canine leishmaniasis in the Brazilian side of the triple border. PLOS ONE 12(12): e0189182. https://doi.org/10.1371/journal.pone.0189182
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0189182

PLOS ONE

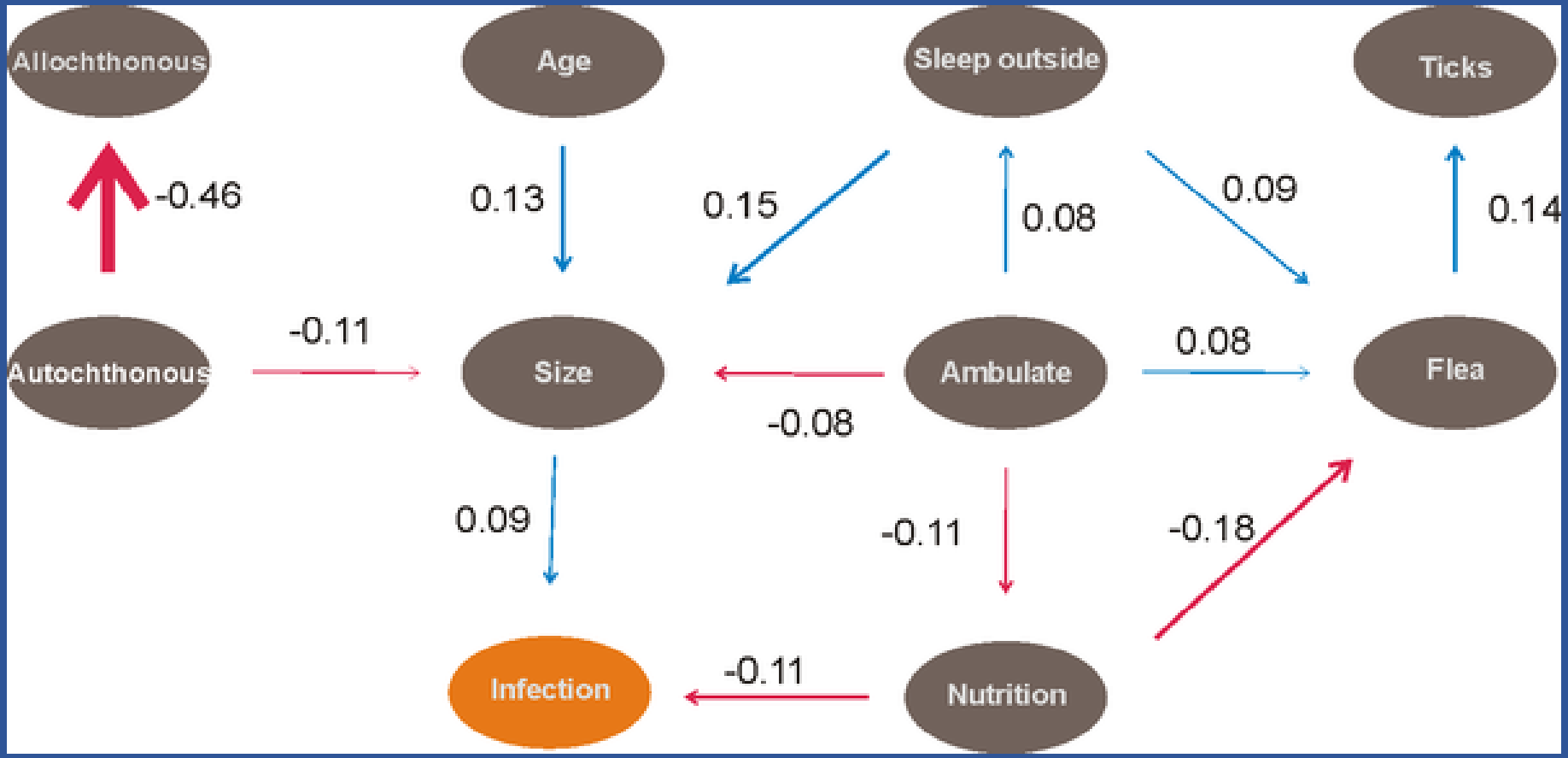
IDRC cVL BRAZIL



ASPECTO CLÍNICO EM CÃES	UNIDADES					
SINAIS DERMICOS	A	B	C	D	TOTAL	%
Úlcera em bolsa escrotal	0	0	0	0	0	0,0
Descamação furfurácea	1	1	0	0	2	0,3
Úlcera em outro local (Descrição)	0	2	0	0	2	0,3
Seborreia Úmida	0	1	1	1	3	0,4
Nódulos (Dérmicos)	0	1	3	0	4	0,6
Úlcera em membros	0	2	3	0	5	0,7
Úlcera em nariz	4	2	1	2	9	1,3
Eritema	4	5	0	1	10	1,5
Alopecia em Região abdominal	4	1	2	4	11	1,6
Alopecia em Membro Anterior	6	1	1	5	13	1,9
Alopecia em Outro Local	10	1	1	1	13	1,9
Seborreia Seca	7	2	1	4	14	2,1
Alopecia em Focinho	4	2	3	9	18	2,6
Úlcera em ponta de orelhas	3	7	4	4	18	2,6
Alopecia em Região Dorsal	1	5	4	9	19	2,8
Prurido	8	7	3	1	19	2,8
Alopecia em Membro Posterior	9	1	4	6	20	2,9
Hiperqueratose	3	9	8	1	21	3,1
Alopecia Generalizada	10	3	5	6	24	3,5
Onicogrifose	8	9	15	1	33	4,8
Alopecia em Orelhas	26	5	5	11	47	6,9
Adenomegalia	11	23	22	6	62	9,1

Thomaz Soccol V, Pasquali AKS, Pozzolo EM, Leandro AdS, Chiyo L, et al

IDRC cVL BRAZIL



Path analysis with intrinsic characteristics of the dogs that affect their probability of infection in the western region of the Paraná State, Brazil.

Thomaz Soccol V, Pasquali AKS, Pozzolo EM, Leandro AdS, Chiyo L, et al. (2017) More than the eyes can see: The worrying scenario of canine leishmaniasis in the Brazilian side of the triple border. PLOS ONE 12(12): e0189182. https://doi.org/10.1371/journal.pone.0189182
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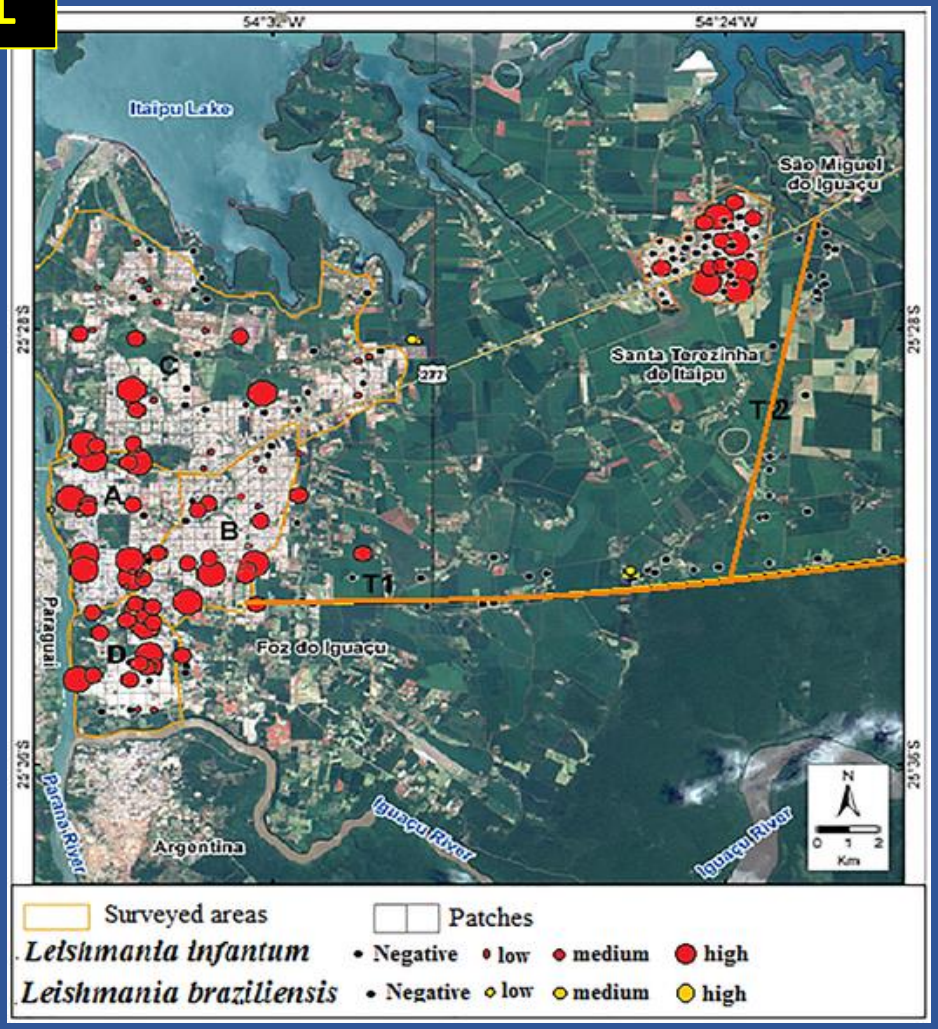
PLOS ONE

IDRC parasite BRAZIL



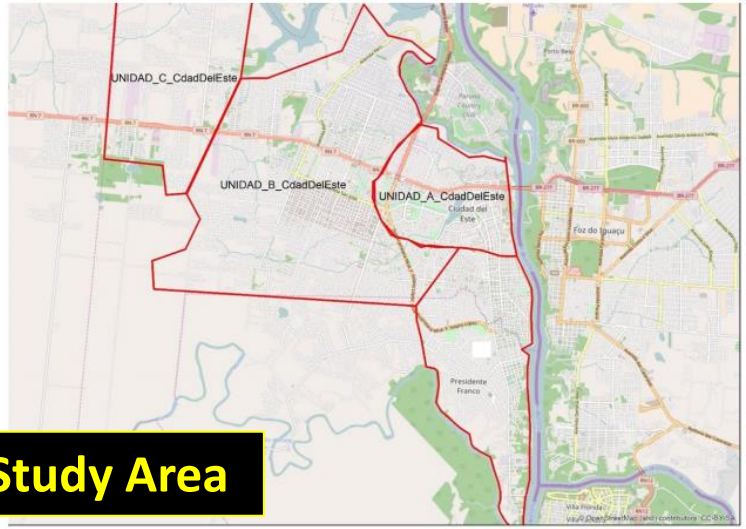
Patches sampled and spatial distribution of *Leishmania spp*. in the extreme west of Parana state, Southern Brasil.

Thomaz Soccol V, Pasquali AKS, Pozzolo EM, Leandro AdS, Chiyo L, et al. (2017) More than the eyes can see: The worrying scenario of canine leishmaniasis in the Brazilian side of the triple border. PLOS ONE 12(12): e0189182. https://doi.org/10.1371/journal.pone.0189182
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0189182

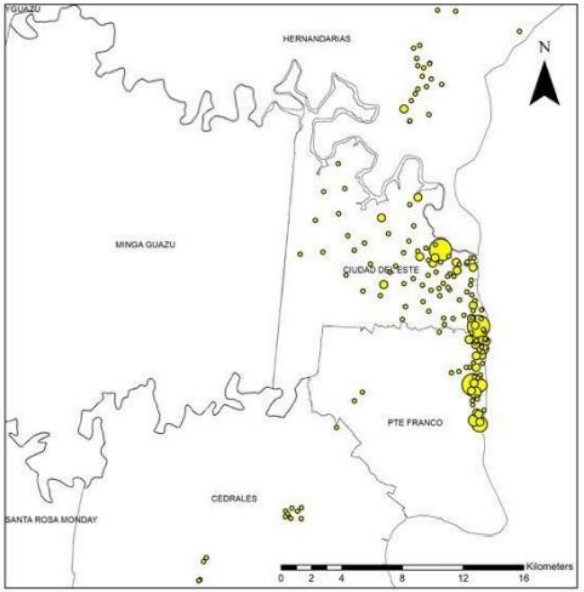
PLOS ONE

IDRC Paraguay

Figura 5. Área de estudio divida en zonas correspondiente a los distritos de Ciudad del Este y Presidente Franco.

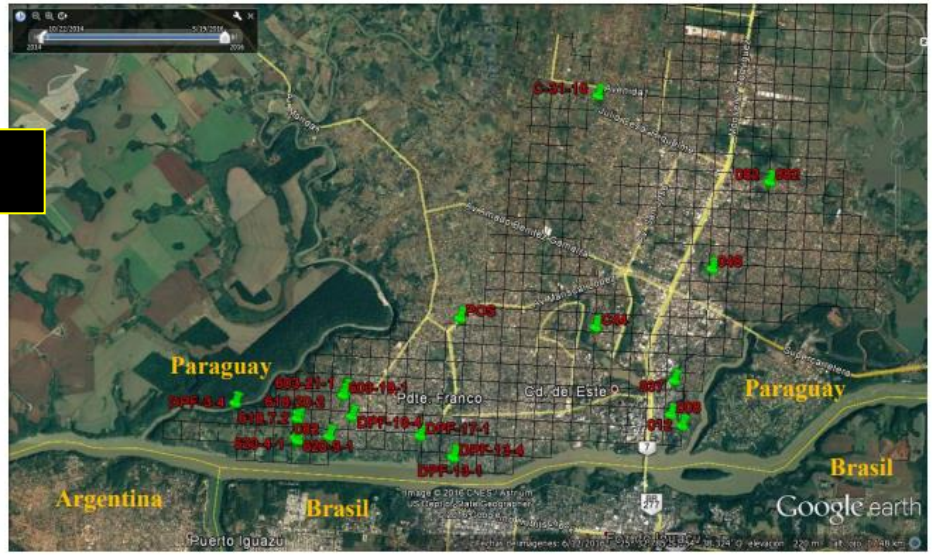


Study Area



Phlebotominae abundance

cVL



IDRC Paraguay

Journal of Public Health: From Theory to Practice
https://doi.org/10.1007/s10389-018-0908-6

ORIGINAL ARTICLE

Knowledge, attitudes, and practices regarding the leishmaniases among inhabitants from a Paraguayan district in the border area between Argentina, Brazil, and Paraguay

Andrea Giménez-Ayala[1] · Nilsa González-Brítez[2] · Antonieta Rojas- de- Arias[3] · Mónica Ruoti[3]

We also asked respondents what they thought about the feelings perceived by animals, mainly dogs, and most of them stated that animals have rights (95.2%), morality (74.2%), and feelings (98.4%), and that they need to be respected

Cuadro 3. Nivel de conocimiento y actitudes de los grupos domésticos con casos (un caso de leishmaniasis visceral humana entre 2006 y 2009) y los de control (sin casos de la enfermedad), Posadas, Argentina, 2009

Puntaje	Caso n %	Control n %
Nivel de conocimiento (puntos)		
>0 y ≤60	0 (0)	55 (76)
>60 y ≤100	2 (8)	11 (15)
>100 hasta 140	22 (92)	6 (9)
Media	134,2	32,9
Nivel de actitud		
>0 y ≤40	0 (0)	50 (70)
>40 y ≤60	2 (8)	11 (15)
>60 y hasta 90	22 (92)	11 (15)
Media	85,0	30,4

Biomédica 2016;36(Supl.1):51-63
doi: http://dx.doi.org/10.7705/biomedica.v36i2.2953

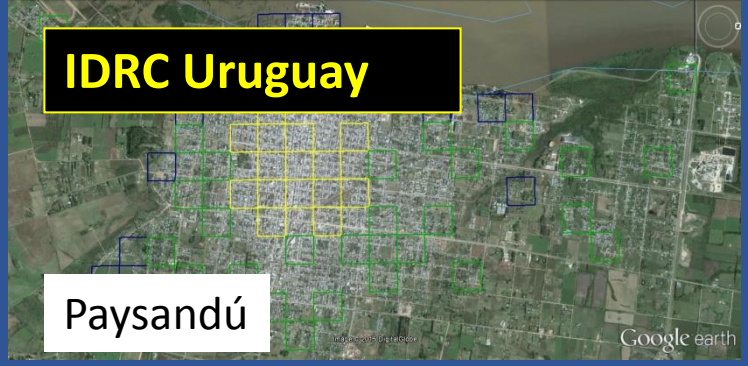
ARTÍCULO ORIGINAL

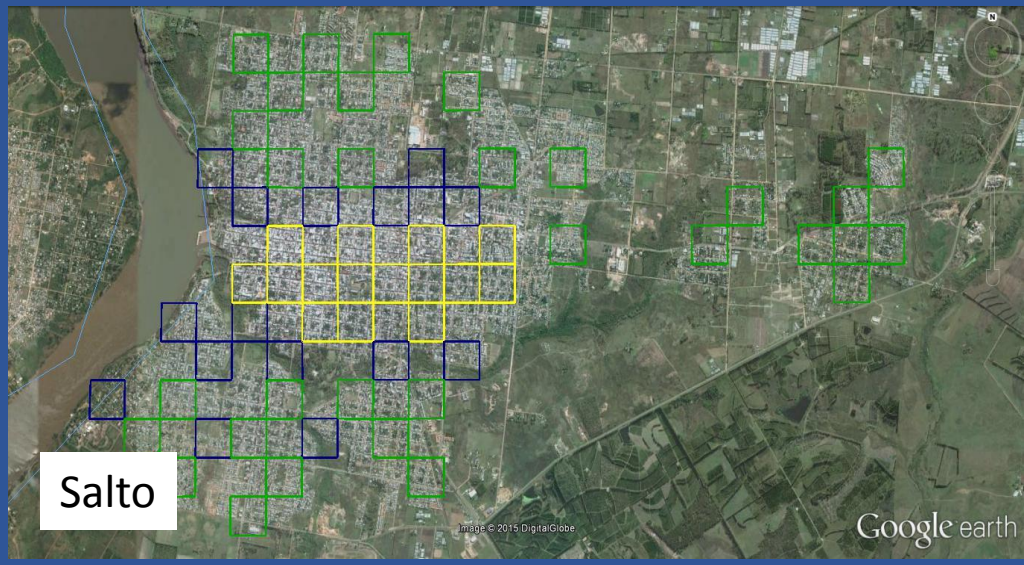
Factores de riesgo, representaciones y prácticas asociadas con la leishmaniasis visceral humana en un foco urbano emergente en Posadas, Argentina

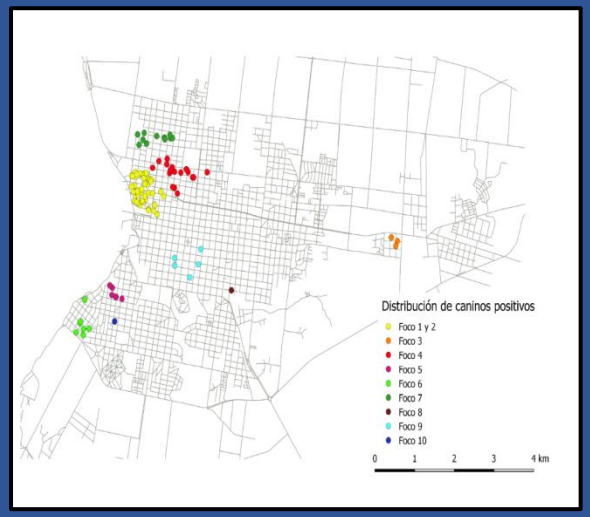
Karen López[1,2], Lilian Catalina Tartaglino[1], Ingrid Iris Steinhorst[1], María Soledad Santini[3,4], Oscar Daniel Salomón[4,5]

IDRC Uruguay

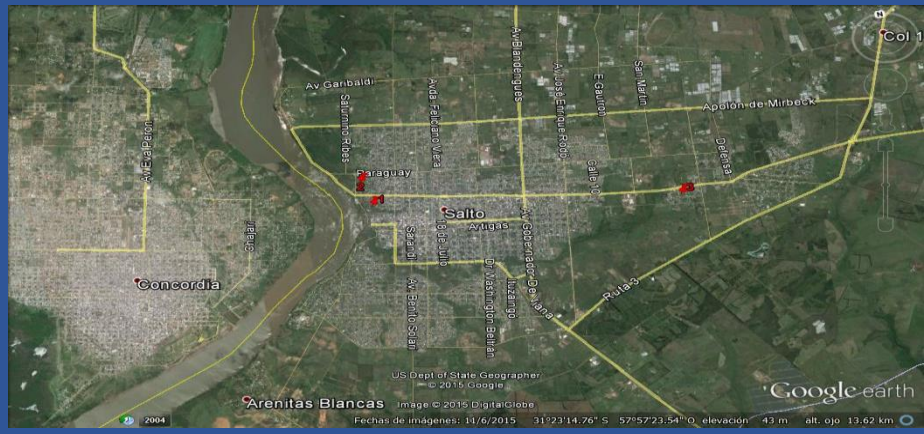
Paysandú







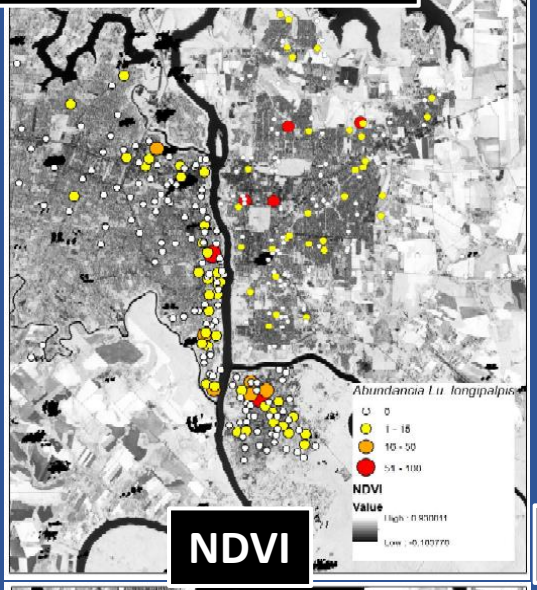
LVc



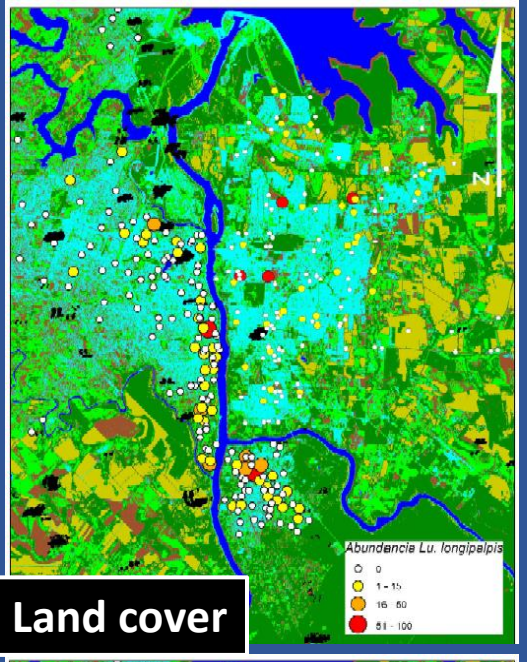
Lu longipalpis

PHLEBOTOMINE DISTRIBUTION

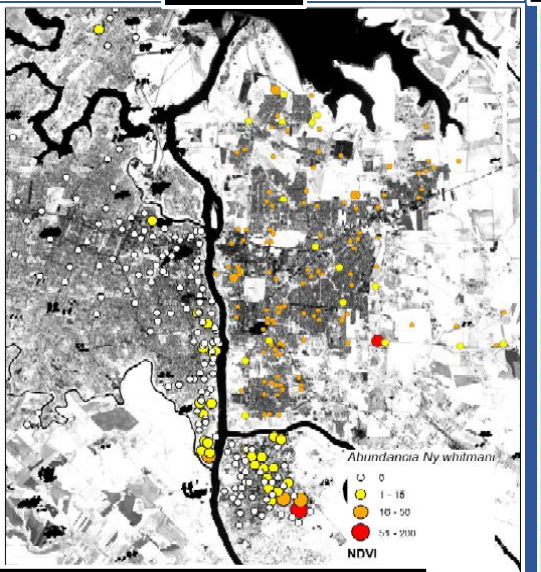
Lutzomyia longipalpis



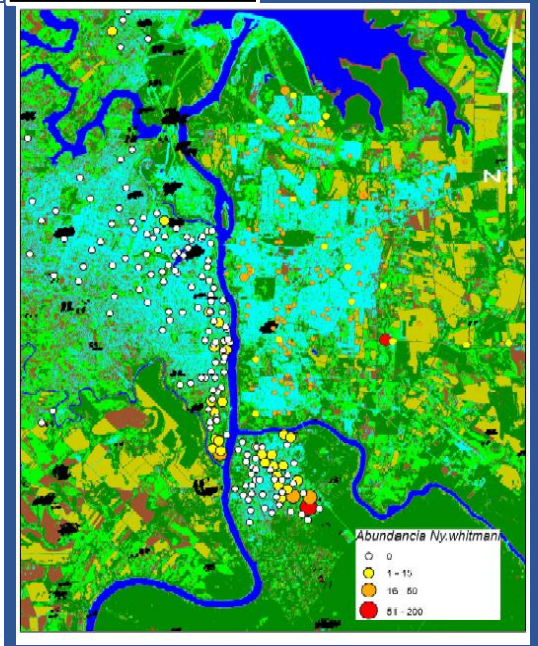
NDVI



Land cover



Nyssomyia whitmani



‘Hot spots’

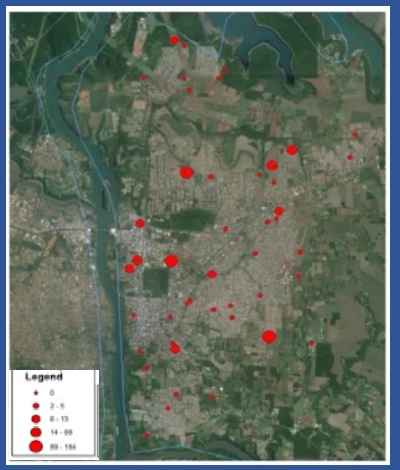
Metapopulation dynamics

Source populations

IDRC TRANSMISSION SCENARIOS

Visceral Leishmaniasis settled

Urban distribution of *Lutzomyia longipalpis in 'hot spots'*,
Canine VL prevalence rates 22-26% increasing along time.
Ar- Puerto Iguazu, Br- Foz do Iguacu



Visceral Leishmaniasis incipient

***Lu. longipalpis* and canine VL restricted to small clusters,**
Canine VL general prevalence up to 4%.
Br- Santa Terezinha do Itaiupu,
Pr- Presidente Franco, Ur- Salto, Bo – Pocitos.

Cutaneous Leishmaniasis steady

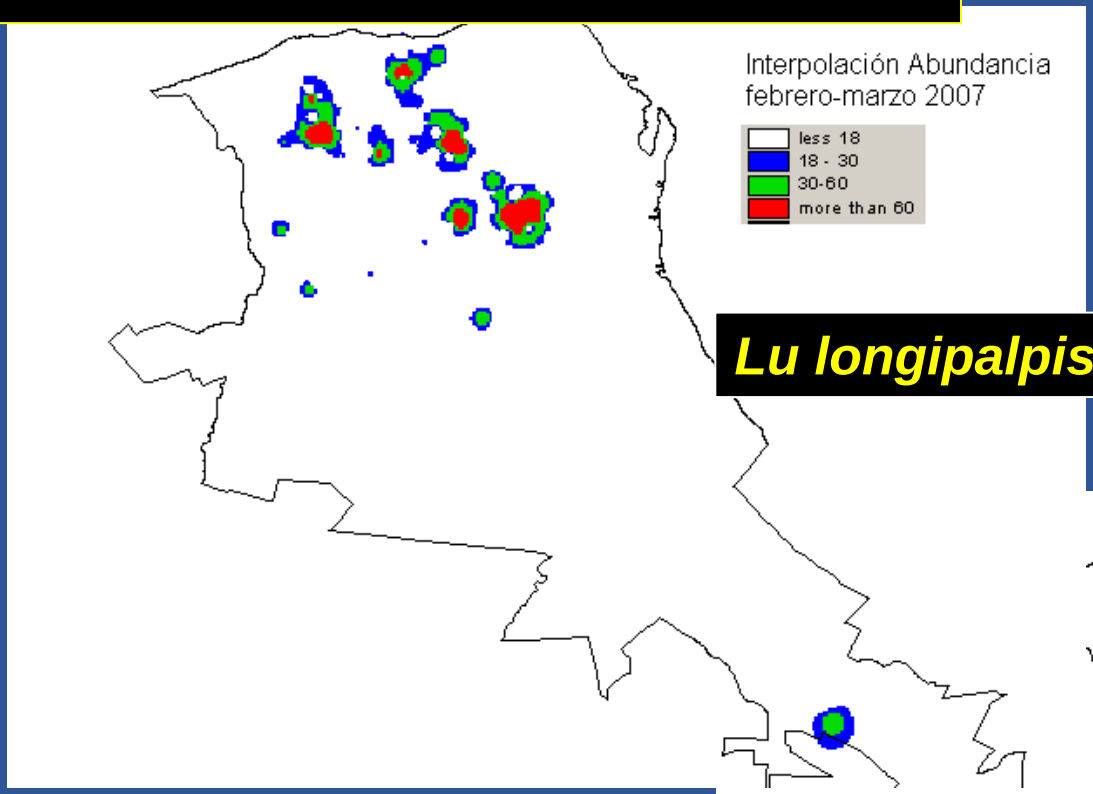
***Nyssomyia whitmani* in ecotones,**
Without *Lu. longipalpis*, canine VL imported cases.
Ar – Puerto Iguazu urban periphery, Ar, Br, Py - transects

Uy-Paysandu No risk 32º19'S, 58º04'W

Ministerio de SALUD
UFPR
INMeT INSTITUTO NACIONAL de MEDICINA TROPICAL
Organización Panamericana de la Salud
Organización Mundial de la Salud
IDRC

ODS -INMET

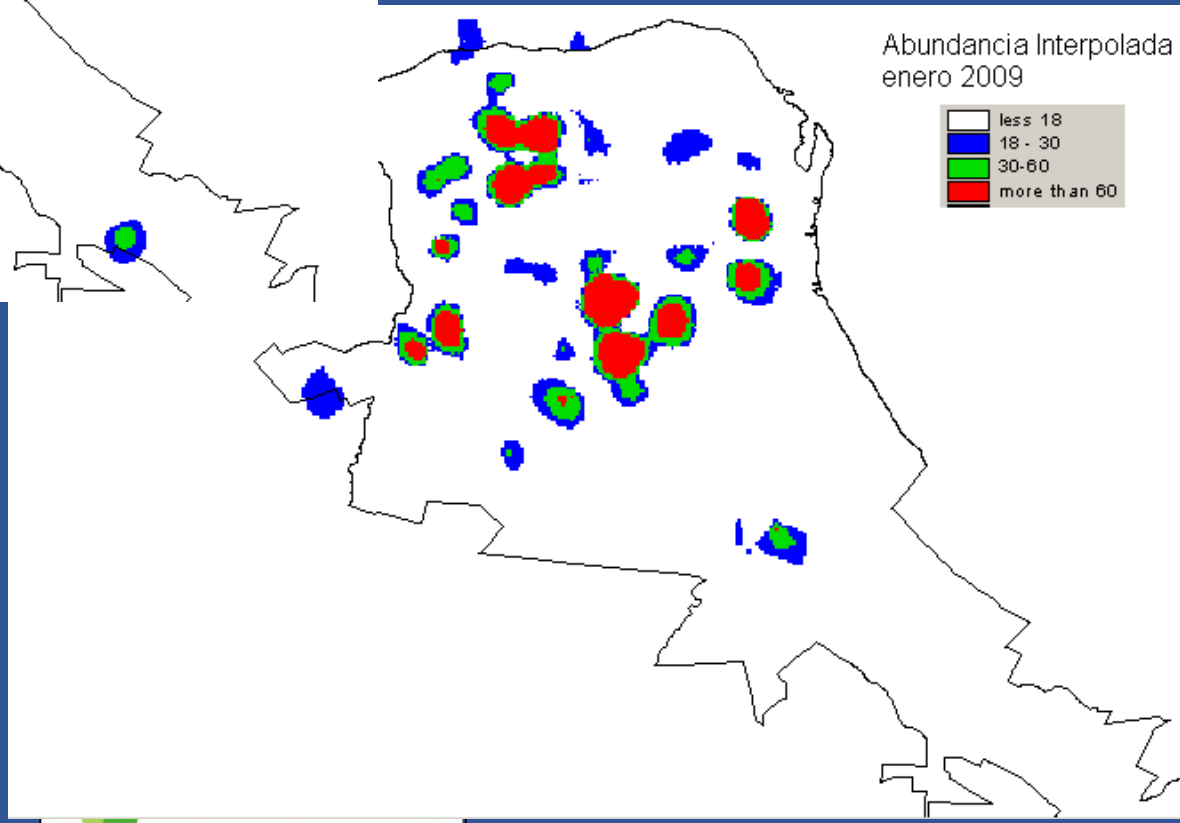
Consistent S-T Models



POSADAS ARGENTINA 2007

REDILA
RED DE INVESTIGACIÓN DE LA LEISHMANIASIS EN ARGENTINA

***Lu longipalpis* ~ 400 sampling sintews**



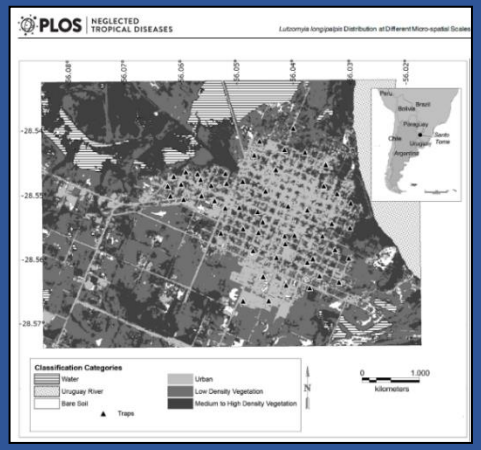
POSADAS ARGENTINA 2009

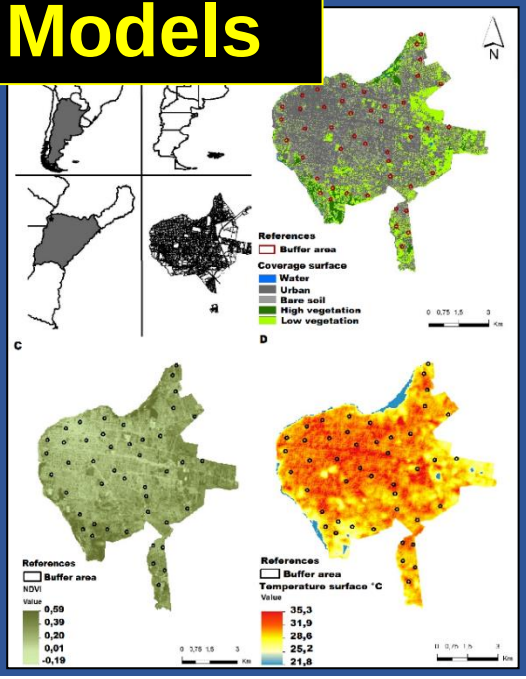
ODS -INMET

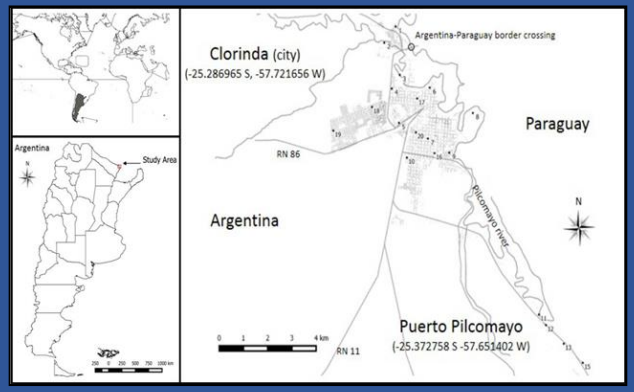
Consistent S-T Models

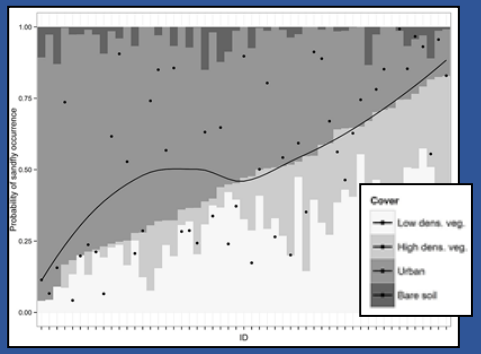
ODS -INMET

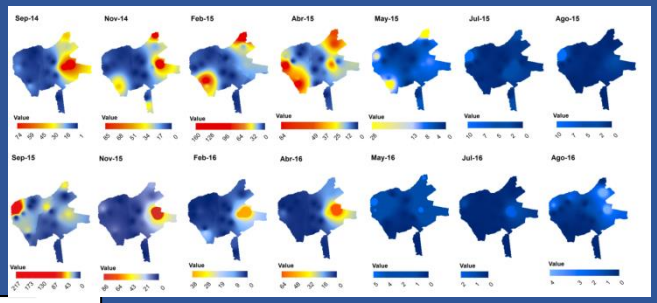
REDILA
RED DE INVESTIGACIÓN DE LA LEISHMANIASIS EN ARGENTINA

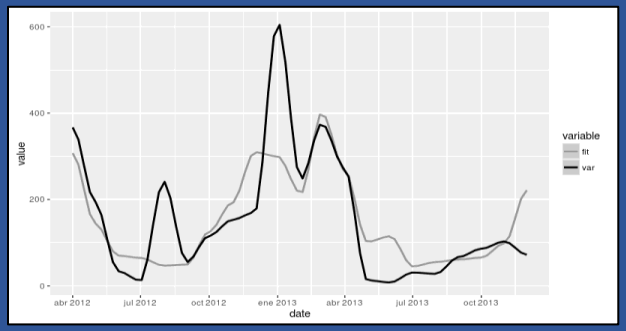












	Covariate	Parameter	SE	Lower BCa CL	Upper BCa CL	P value
Presence model	Intercept	0.210	0.427	-0.637	0.991	0.562
	Border	5.355	2.124	1.205	8.173	0.0036
	HMDenVegC	8.435	4.685	0.410	16.136	0.0194
	LDenVegC	7.172	3.498	-0.187	12.992	0.0255
	Stream	3.282	2.062	-0.571	7.115	0.0531
Abundance model	Intercept	3.289	3.151	-8.495	4.302	<0.001
	Stream	7.384	5.049	1.979	24.520	0.0016
	Stream²	-50.137	19.175	-80.91	-17.97	<0.001
	Trees	0.400	0.208	0.123	0.909	0.0014

	Estimate	SE	CI Lw Lim	CI Up Lim
Intercept	-0.93802	0.63066	-1.9311	1.1087
Bare soil	0.73648	0.43975	-0.1279	1.5878
NDVI	-1.67021	0.67154	-3.168	-0.362
Animals	4.97687	1.27531	2.107	7.563

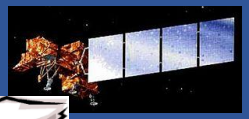
	Estimate	Std. Error	z value	Pr(>|z|)	Significance
Intercept	2.61E+000	6.61E-001	3.944	8.03E-005	***
LSTnightlag	-2.31E-002	1.27E-002	-1.82	0.06881	.
LSTdaylag2	1.43E-001	8.75E-003	16.346	< 2e-16	***
NDVIlag3	-5.28E+000	8.75E-003	-2.985	0.00283	**
TRMMlag1	1.72E-004	3.25E-004	0.528	0.5972	
NDWIlag3	4.295	9.57E-001	4.486	7.27E-006	***

Santini MS *et al.*, PLOS NTD 2015
Santo Tome Corrientes

Berrozpe P. *et al.* MIOC 2017 Corrientes City

Gomez-Bravo A *et al.* Parasites & Vectors. 2017 Clorinda Formosa

MODEL of MODELS



Census

Secondary sources
Primary sources

REDILA
RED DE INVESTIGACIÓN DE LA LEISHMANIASIS EN ARGENTINA

Surveillance-Control
Cost-effective strategy

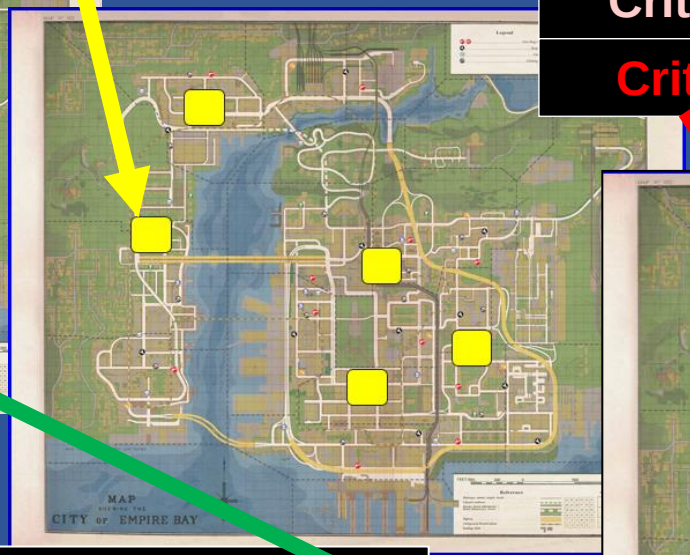
Remote sensing
Secondary sources

Potential risk

Probable Risk
Critical area

Critical site

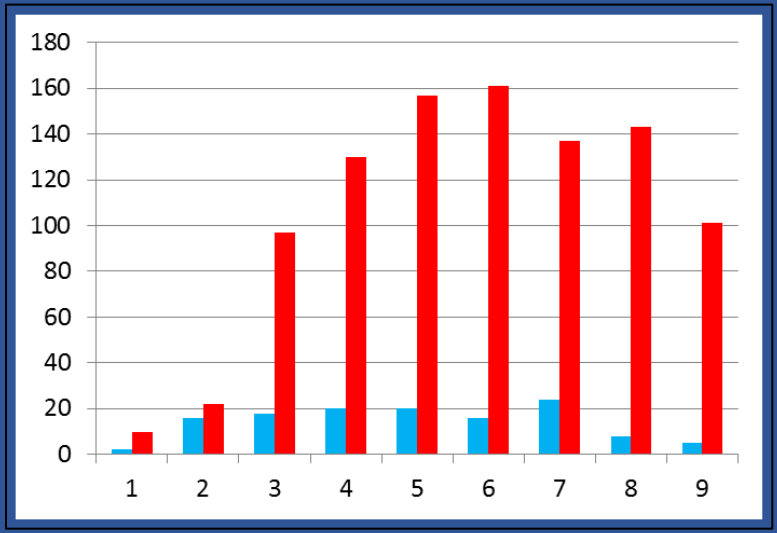
Weigthed environmental, biological, social risk drivers



Few ‘hot spots’ monitoring
Few source populations interventions

Validation – transference- evaluation

Ministerio de SALUD
UFPR
INMeT
Organización Panamericana de la Salud
Organización Mundial de la Salud
IDRC



- ***hVLh Cases first 9 years***
  - ***Argentina 2006-14***
  - ***Campo Grande MS 2001-09***

Ratio vCL : hVL

Social Unfeasibility of cVL culling

Inefficiency –stray dogs

Public-Private cVL management- Workshop & Agreement Act

Puerto Iguazú, 8/2015

ODS -INMET

Public-Private cVL management- Workshop & Agreement Act

Programas Nacionales: Leishmaniasis; Control Enfermedades Zoonóticas; Tenencia Responsable y Sanidad de Perros y Gatos; SENASA

Zoonosis Provinciales: Misiones, Corrientes, Formosa, Chaco, Santa Fe, Entre Rios, Santiago del Estero (no concurre Salta)

Zoonosis Municipales: Posadas, Iguazú, Santo Tomé, Oberá, Instituto Pasteur BsAs

Federación Veterinaria Argentina
Consejo Veterinarios Provincia: Misiones, Corrientes, Chaco, Formosa, Entre Ríos (no concurre Santiago del Estero, Salta)

Discussion of evidences and roles

Public-Private cVL management- Workshop & Agreement Act

National Leishmaniasis Program

+ Standardized integrated interventions by risk stratification

+ Natl lab network: cVL diagnoses QC and lab certification (publ & private)

+ Validation of new techniques, experimental designs, health cards.

+ Dog culling just another possible complementary measure:

Risk stratification and cVL prevalence, individual reservoir capacity, psycho-social context, vector/environment managemet, dog replacement, stray dogs

Private MVs National Federartion

+ Dog owner: right to be informed about actual risk

+ Infected dog conditions that allow the culling refusal

+ Co-responsibility form signed by owner, MV, NLP local agent

+ NLP accepted treatments / preventive measures:

Castration, restriction of transit , traceability, follow up.

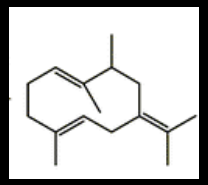
Intersectoral Technical Advisory Group - CITAG coordinated by the National Leishmaniasis Program

SP germacrene-B and Cembrene 1 ≠ Vectorial capacity and dispersal potential

Galvis-Ovallos F, *et al.* Par Vectors 2017; 10: 269.

Posadas/Misiones:

- Pheromone (S)-9-methylgermacrene-B *(spreading type)*
- *per* gene: Fst values ranging from 0.17-0.43, might be a different sibling species from those found in NE and SE Brazil



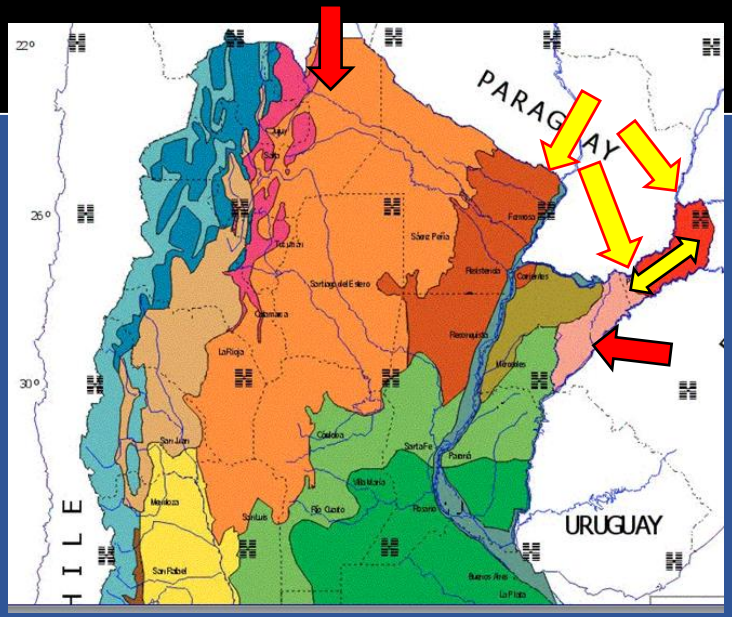
Salomón OD, Araki AS, Hamilton GC, Acardi SA, Peixoto AA., MIOC 2010

Argentina populations: Haplotype diversity motochondrial markers ND4, cytb.

- Two K populations
- Three clusters (lineages).: Ar1, Ar2 (six populations), Ar-Bra grouped with Jacobina and Lapinha, Brazil

Pech-May A Thesis unpublished

Dispersion routes hypothesis



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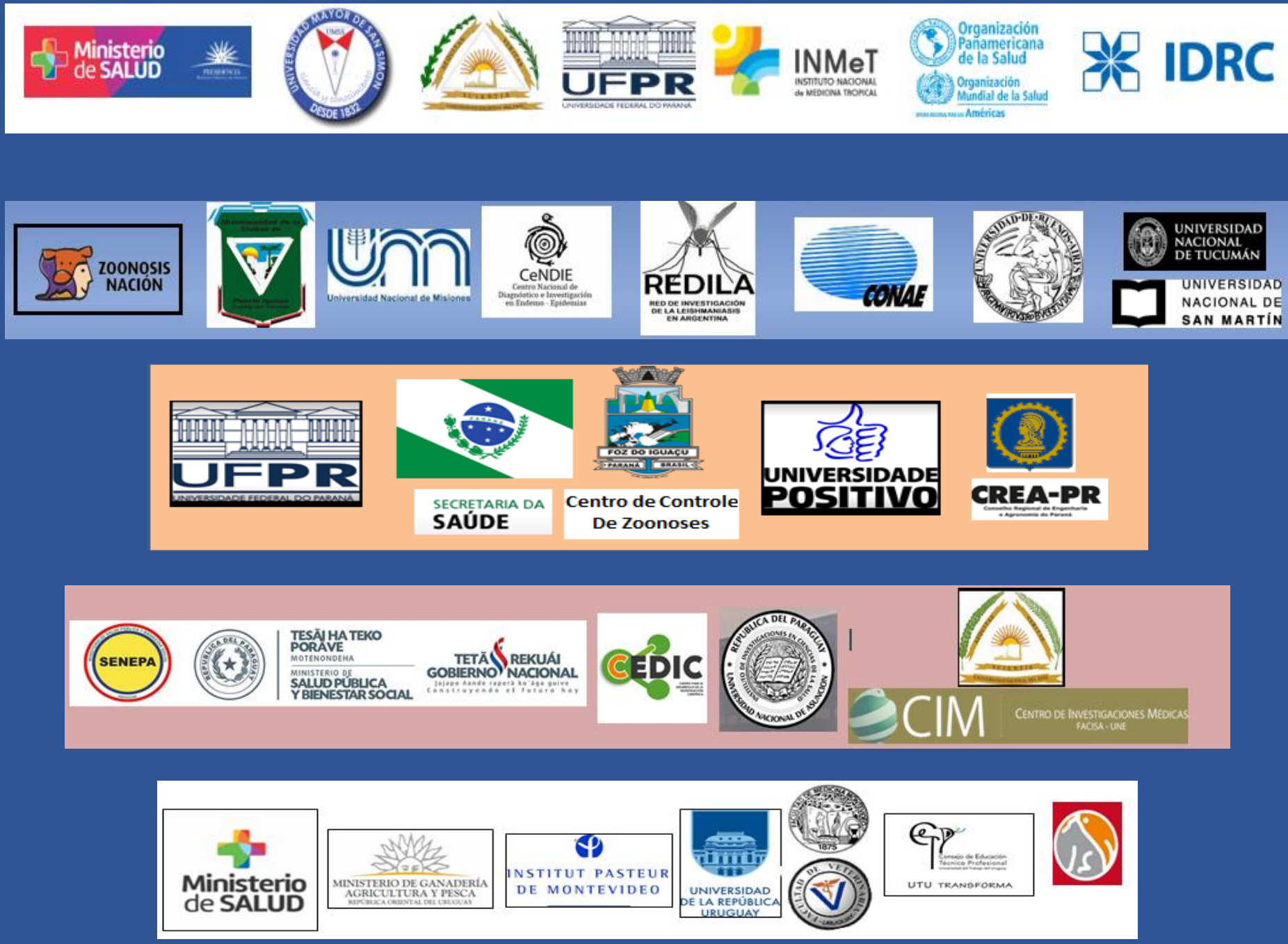
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UTU TRANSFORMA

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Photo Credit: Dr. Salomón