

Propagacion espacial e impacto social de la rabia del murcielago hematofago en el Peru

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Research goal in Peru

Improve well-being of small-scale farmers
by reducing transmission of Vampire Bat Rabies (VBR)

Research questions in Vampire Bat rabies (VBR)

- Understand VBR spread among bats using livestock data
- Quantify economic burden and under-reporting
- Test efficiency of bat vaccination and culling

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This talk

1- 'Make data talk': understand VBR spread among bats Using national surveillance passive livestock system in Peru

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Spatial expansions and travelling waves of rabies in vampire bats

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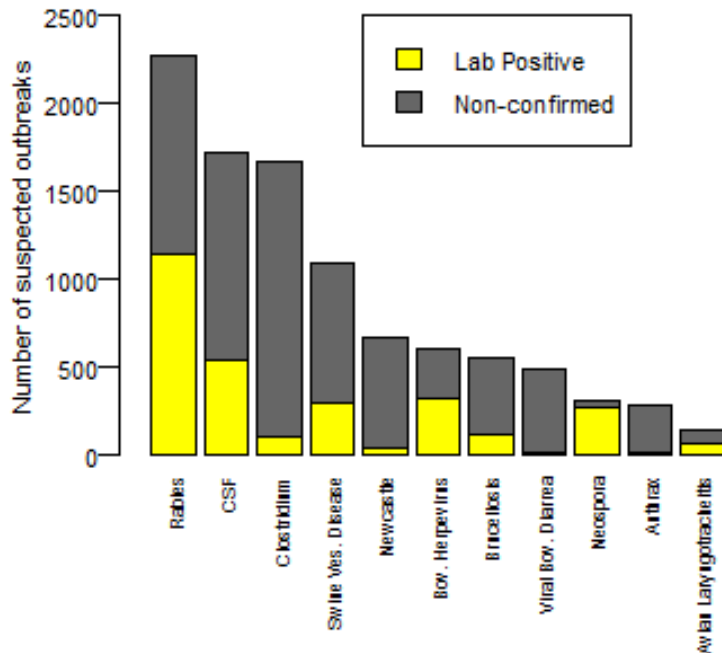
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2- Bring spatial ecology into disease surveillance: Estimate disease burden accounting for spatial heterogeneity

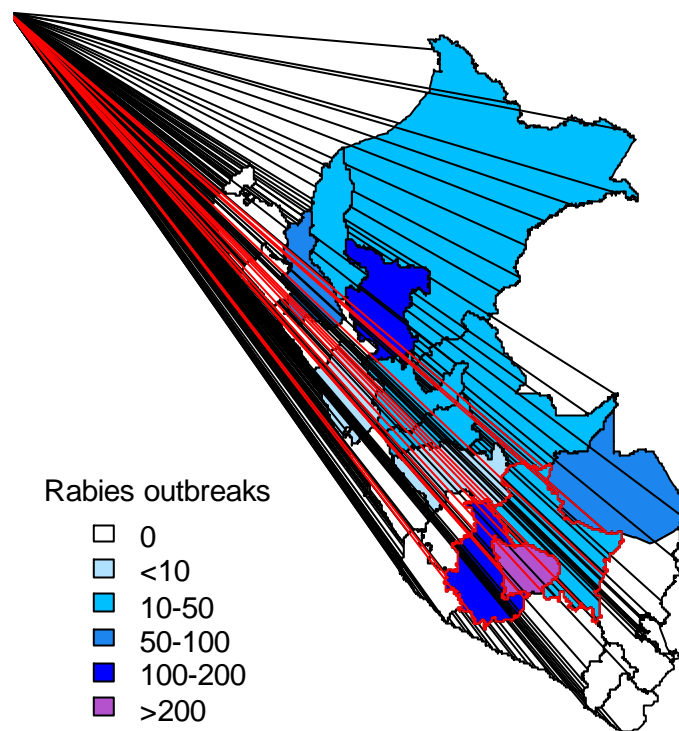
VBR in Peruvian livestock 2003-2014

- Most frequently reported livestock disease in Peru
- Highest vaccination cost (~ 1.1 dollar/vaccine)
- Bat culling does not (necessarily) reduce outbreaks



Data from Peru's surveillance system

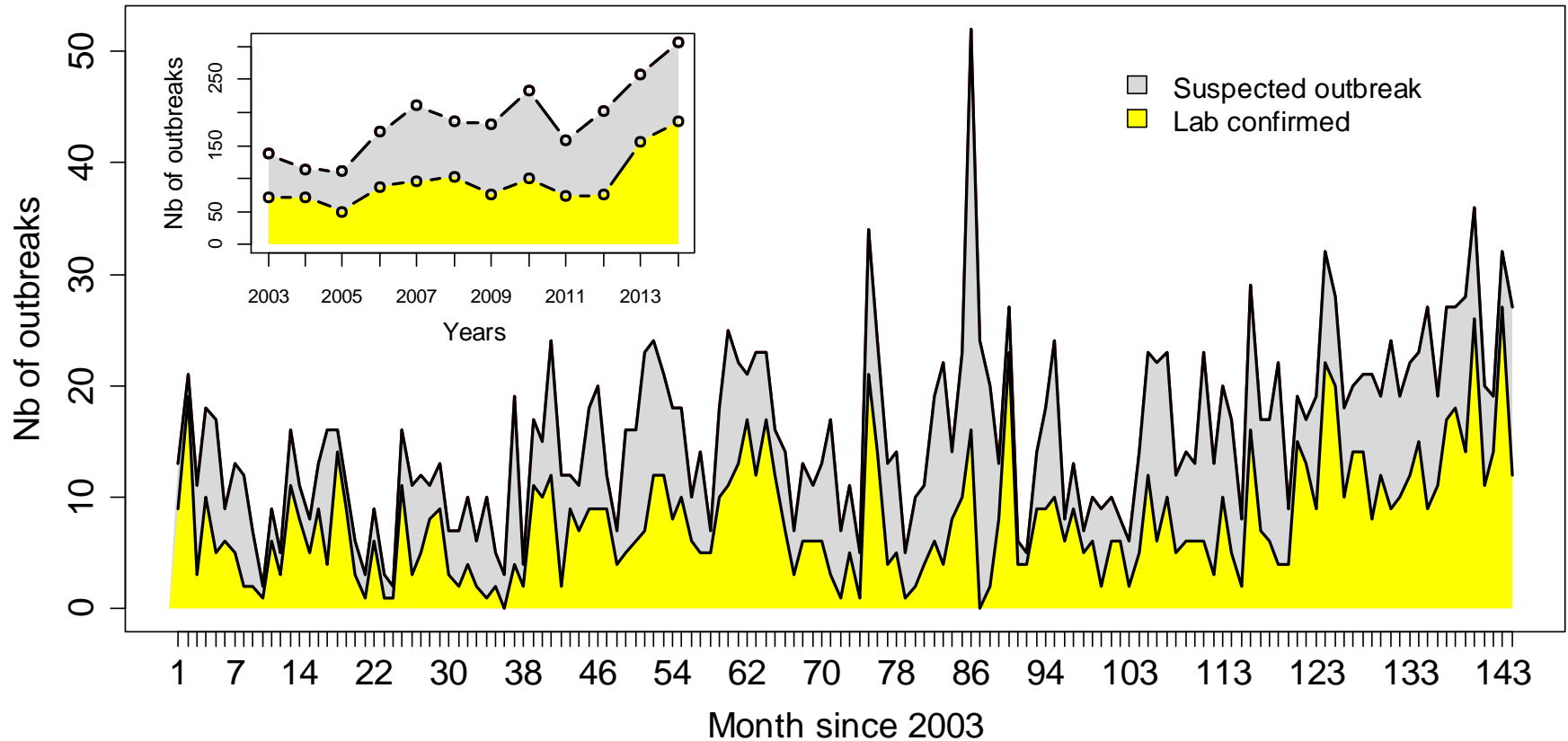
- 1148 (48%) confirmed outbreaks from 2269 suspected, reported to SENASA from 2003-2014
- 13/25 regions (178 districts) with confirmed outbreaks



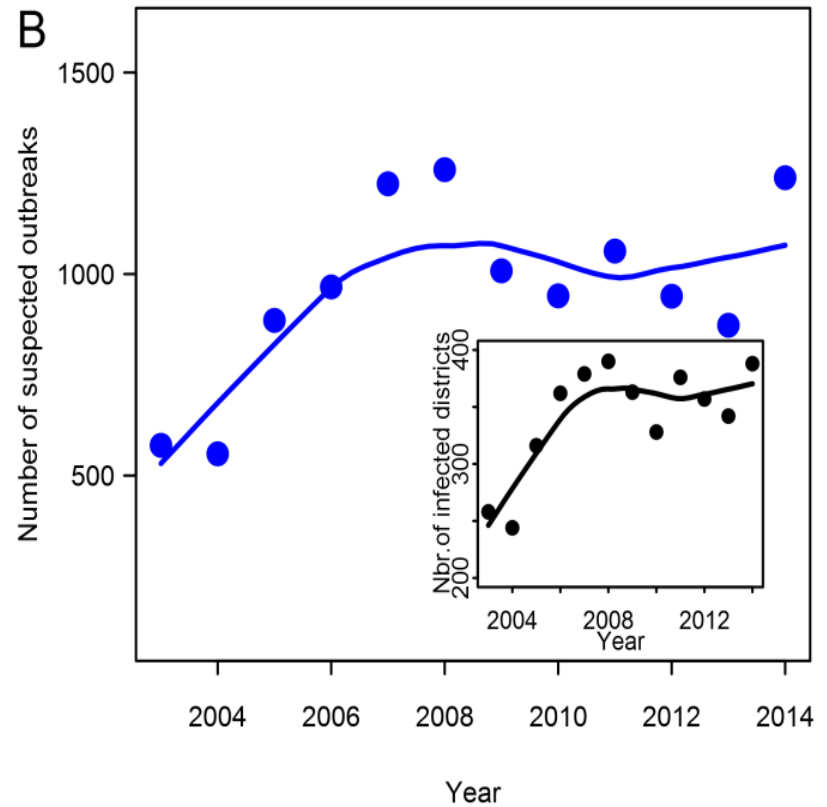
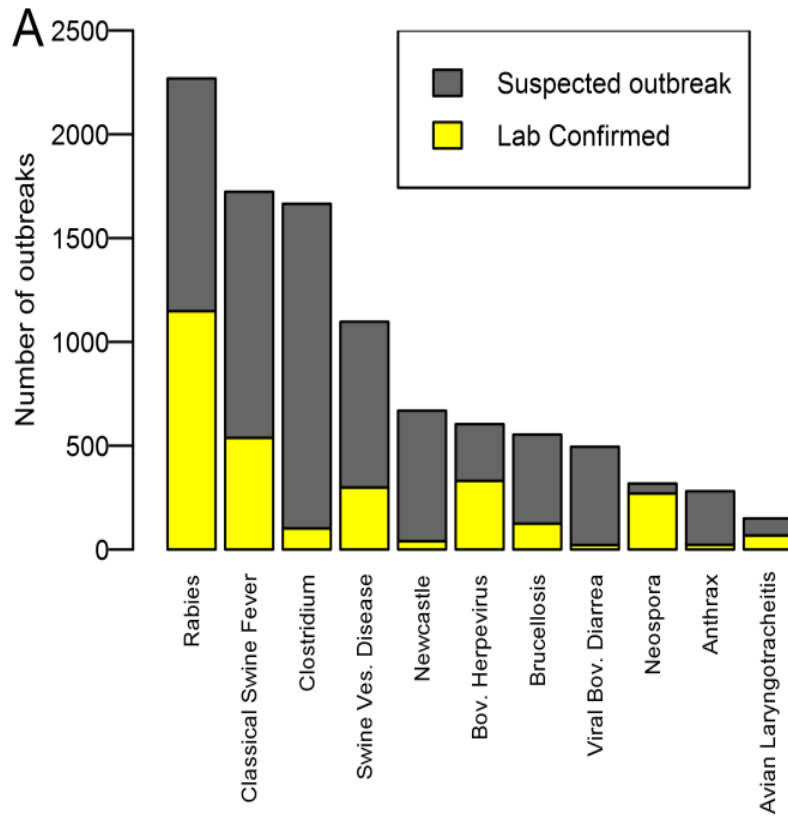
Temporal pattern of outbreaks in livestock

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- Increase in last years: VBR re-emerging?



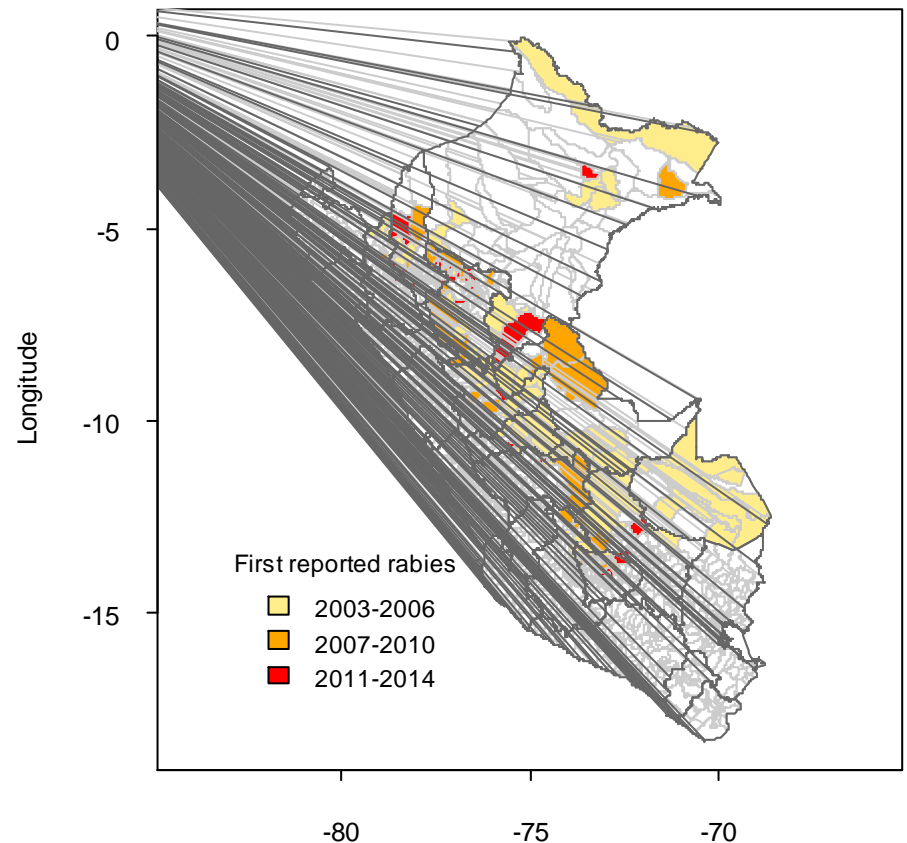
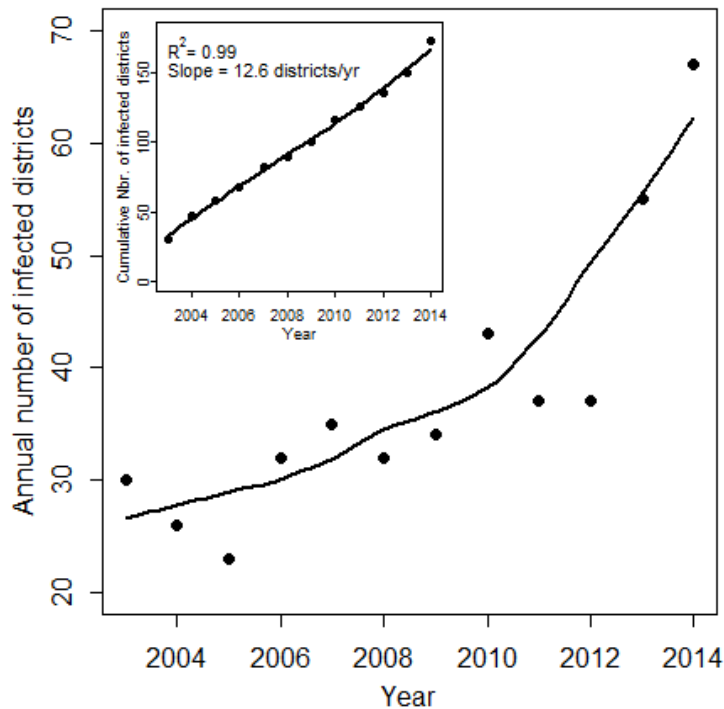
Increase of outbreaks not related (only) to increase of surveillance



Endemic persistence or spatial expansion ?

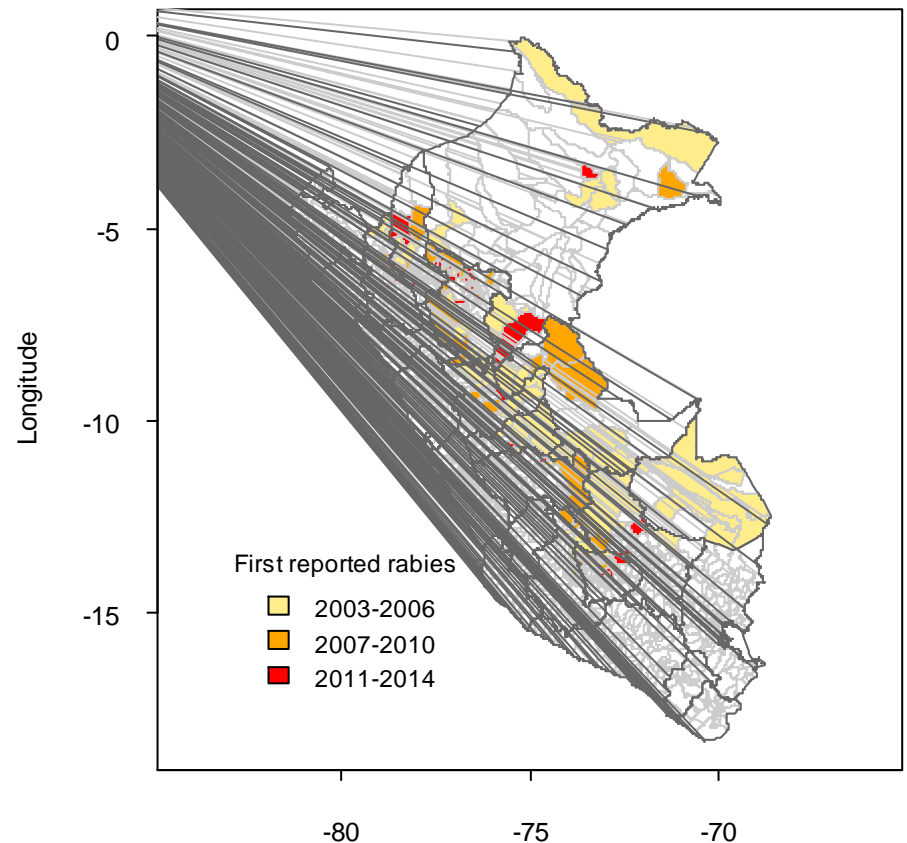
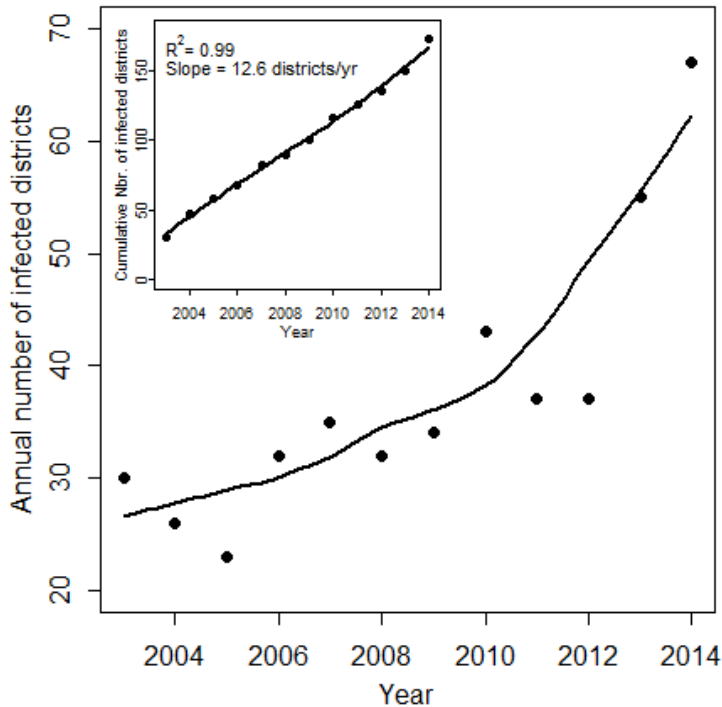
Endemic persistence or spatial expansion ?

- On average, 12 new districts reporting rabies each year
- 85% of 'newly infected' districts have a neighboring district already infected

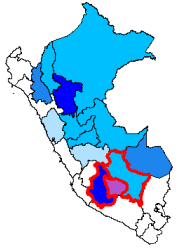


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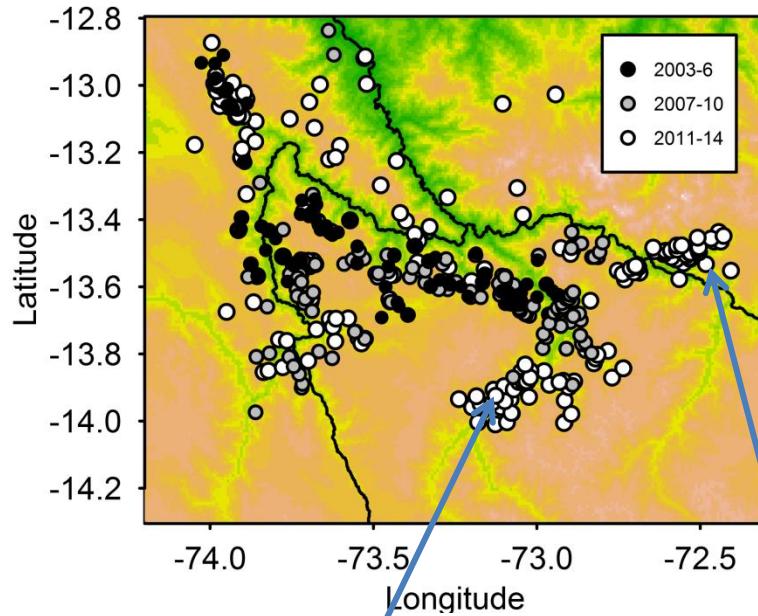
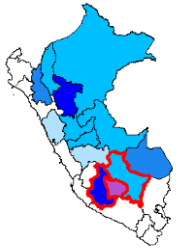
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Spatial expansion of VBR in the Apurímac, Ayacucho y Cusco regions (AAC)

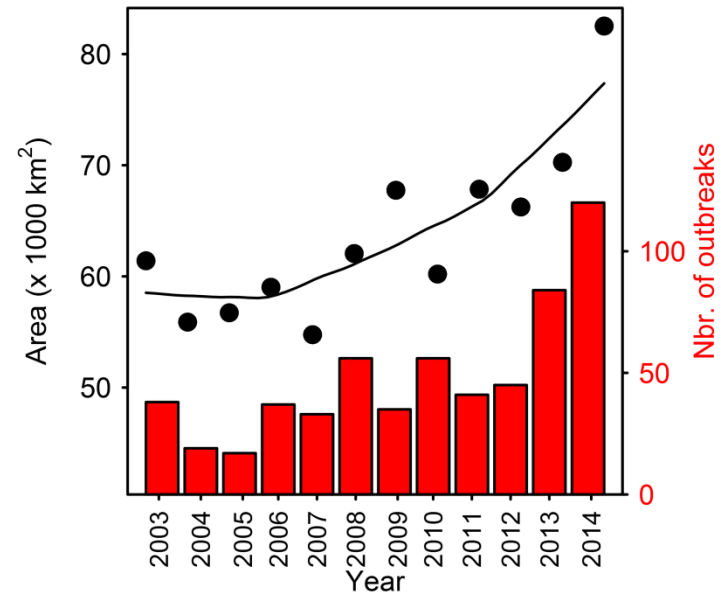


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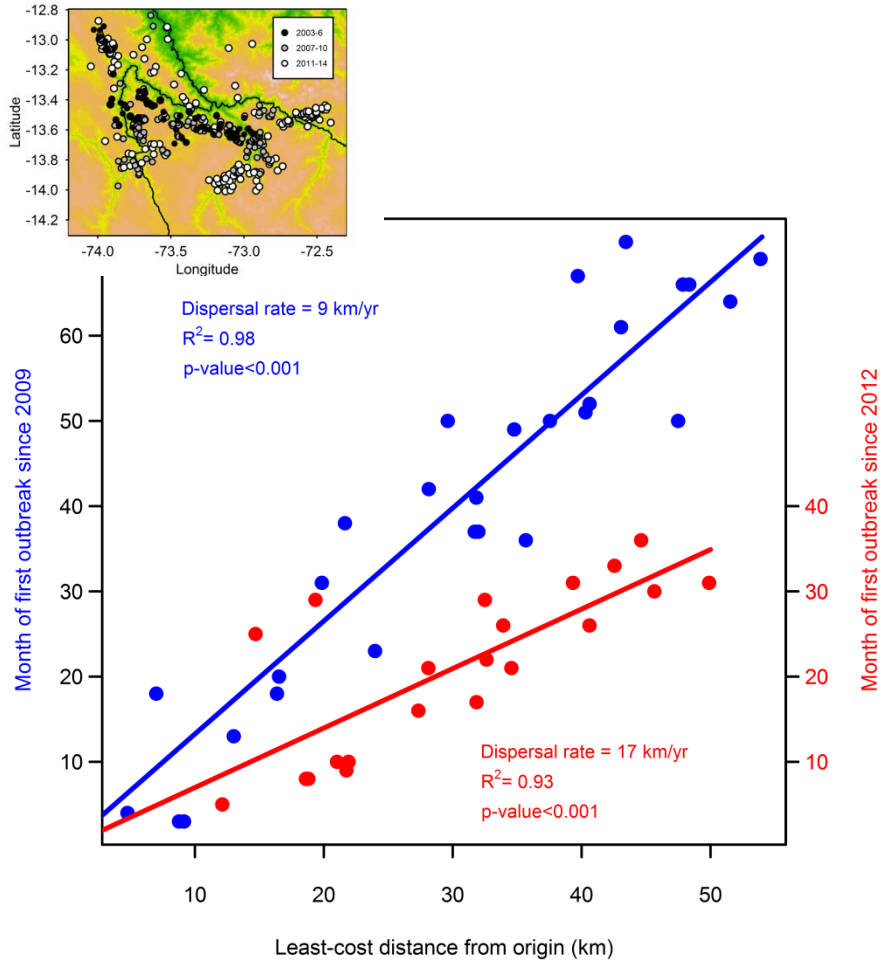
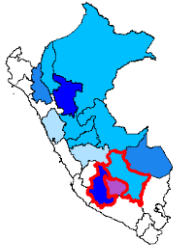


Chalhuauca

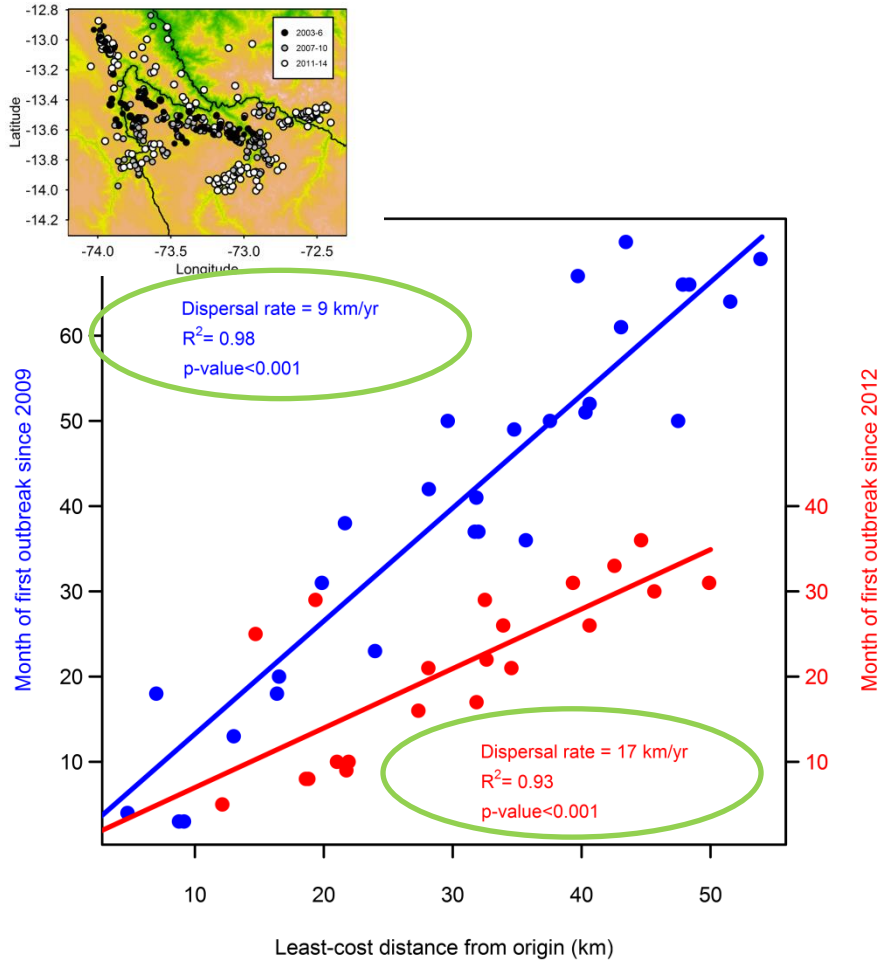
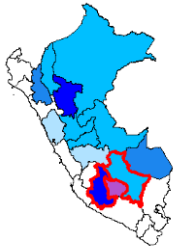
Rio Apurimac



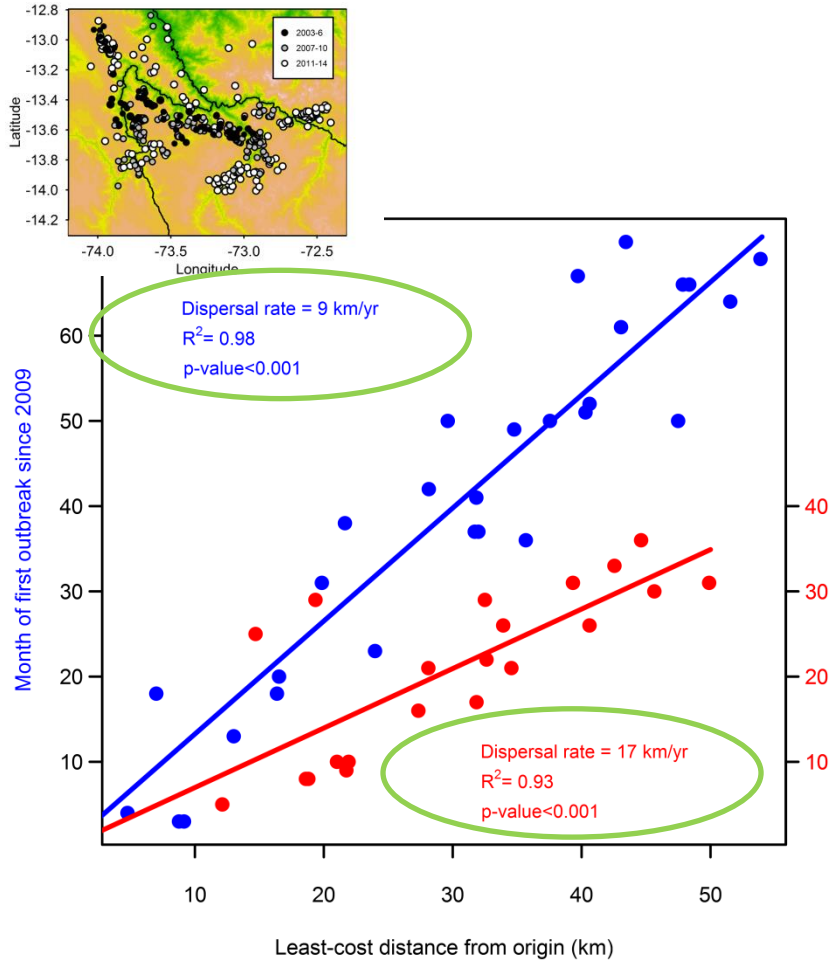
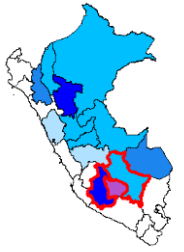
Wave-like pattern of VBR in AAC



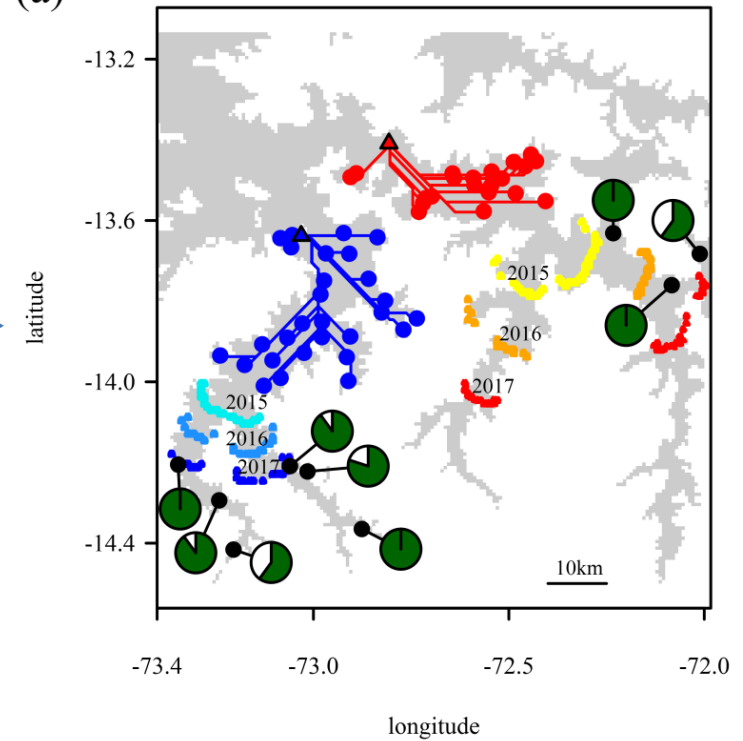
Estimate the wave's speed



Predicting location of future outbreaks



(a)



Conclusions: VBR spread in bats

- VBR in Peru is an emerging disease
- In Andean valleys, predictable wave-like invasions like in Argentina in the 70s
- Direct policy implications to reduce livestock mortality ahead of the wave (education and vaccination campaigns) or stop waves in bats (vaccination)
- Unknown mechanism triggering expansions

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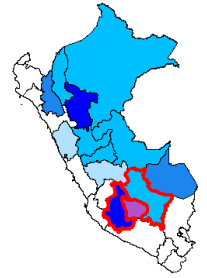
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2- **Bring spatial ecology into disease surveillance:** Estimate disease burden accounting for spatial heterogeneity

Study goals: Estimate economic burden of VBR using community based surveillance

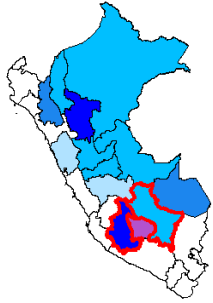
- Quantify under-reporting and economic burden
- Identify key drivers of reporting and vaccination uptake
- Use statistical tools from spatial ecology (mixed effects generalized models with spatial autocorrelation: R package for glmmPQL and SPAMM)

Surveys

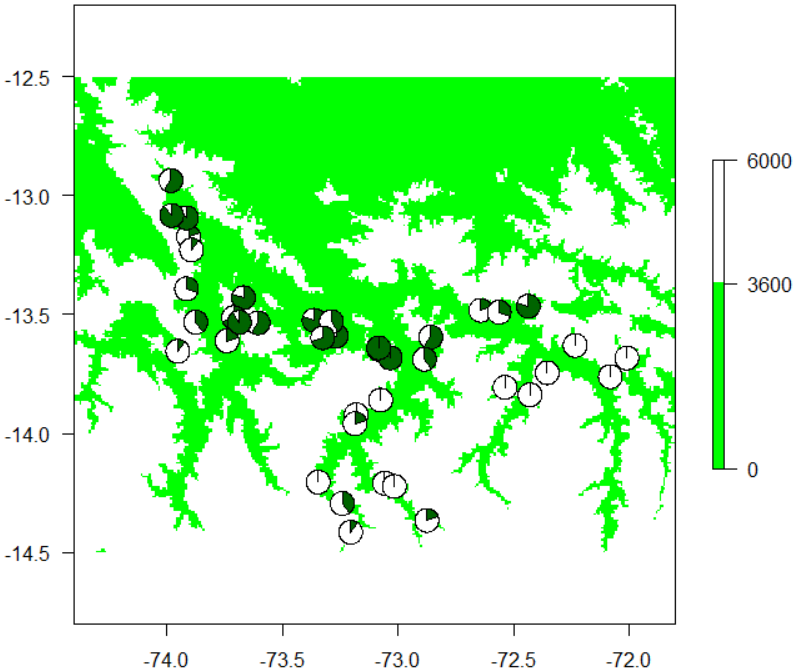


- Questionnaires (60 questions, ~1 hour)
400 farmers, 10 farmers per community
- 40 communities, 32 districts, 3 regions of Peru
- 5 month (May- October 2015)

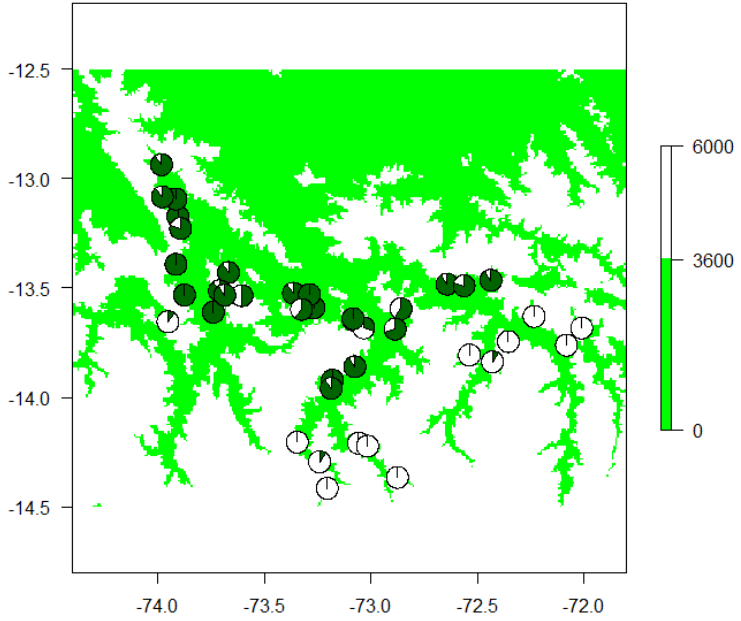
Important spatial variability (within and between communities) on disease reporting and livestock vaccination



**Report death cow
to SENASA = 37.5%**



Vaccination coverage = 59%



What drives cattle disease reporting and vaccination uptake ?

- Drivers from literature:

LOGISTICS

- Distance to office/city to buy vaccine
- Community Identity

KNOWLEDGE AND/OR AWARENESS BY FARMER

- Disease knowledge
- Perception of risk (is disease present in community and how important is the disease)
- Knowledge of vet

SOCIO-ECONOMICS

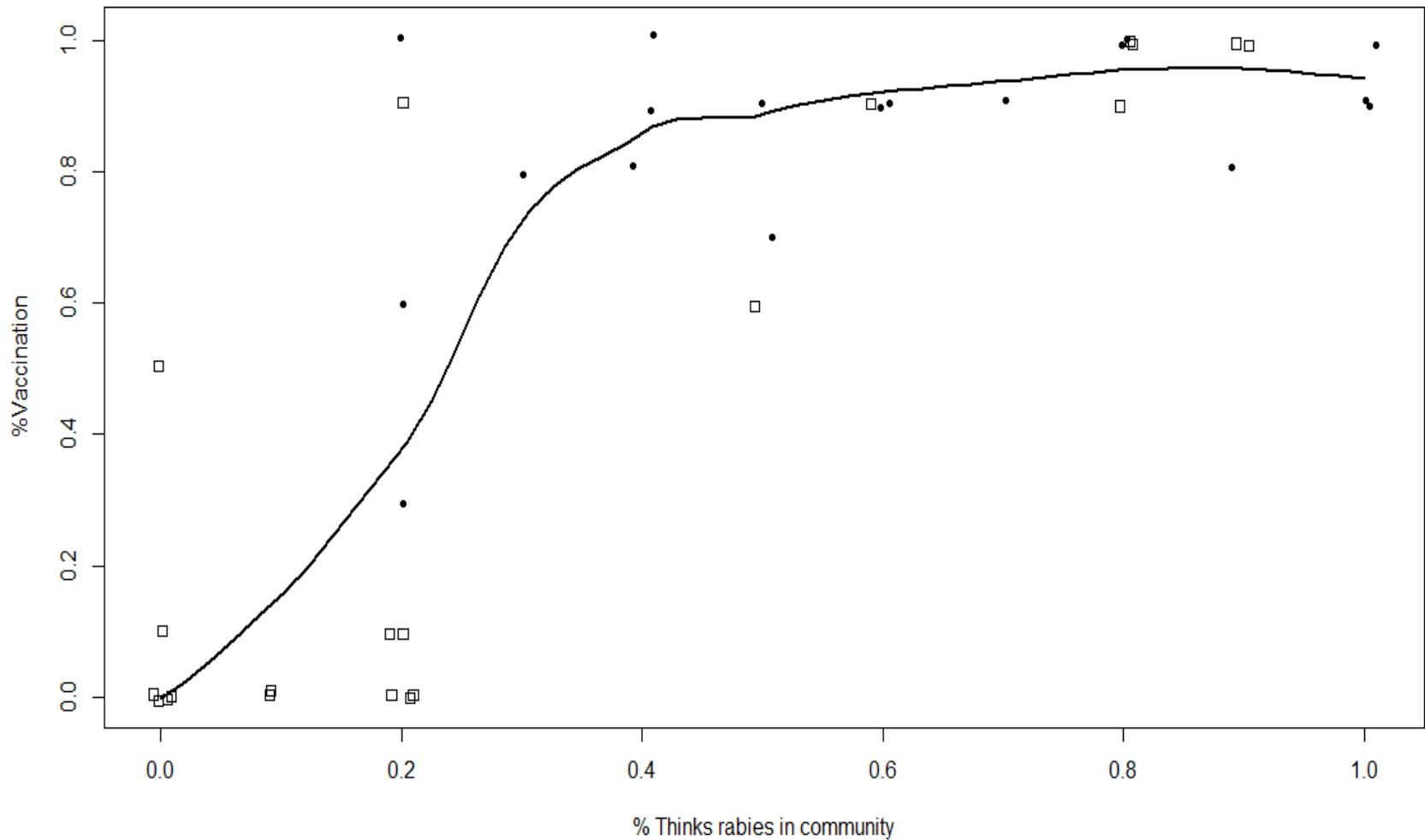
- Gender
- Socio Economic Status (SES) : vaccination for rabies is expensive (1-2 dollars per animal/year)
- Number of animals

PUBLIC AUTHORITIES

- Perception of public institution (are they coming if I report)

Rabies perception risk influence vaccination at the community level

%Vaccination v/s % Thinks rabies in the community

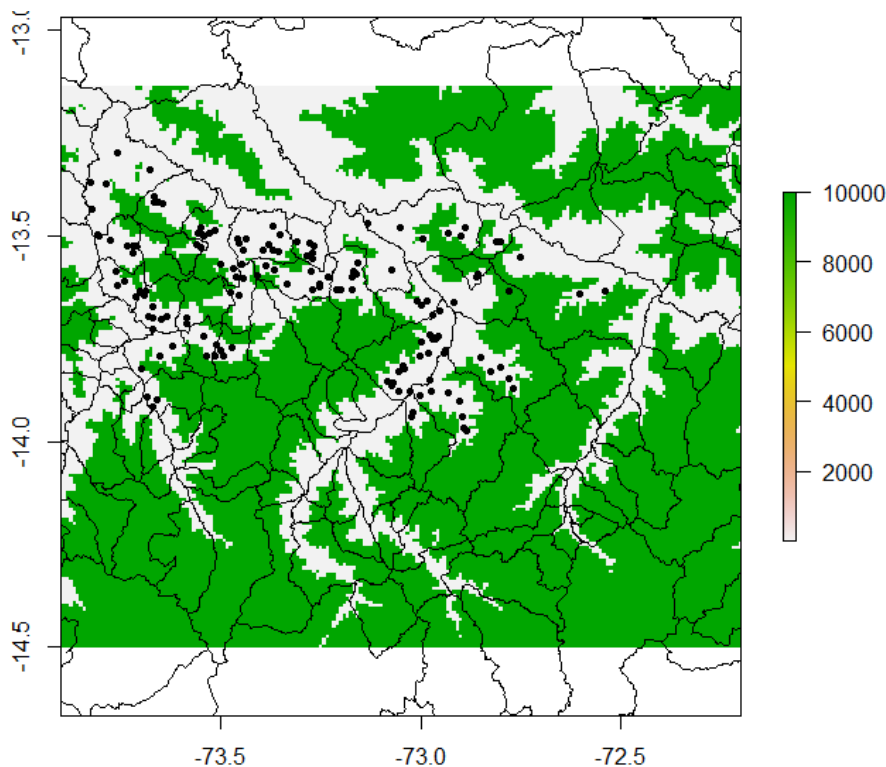


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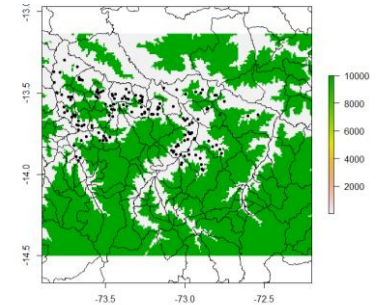
Efficiency of bat culling and bat vaccination for reducing bit rate and number of VBR outbreak ?

Control poblacional en Apurímac desde 2014



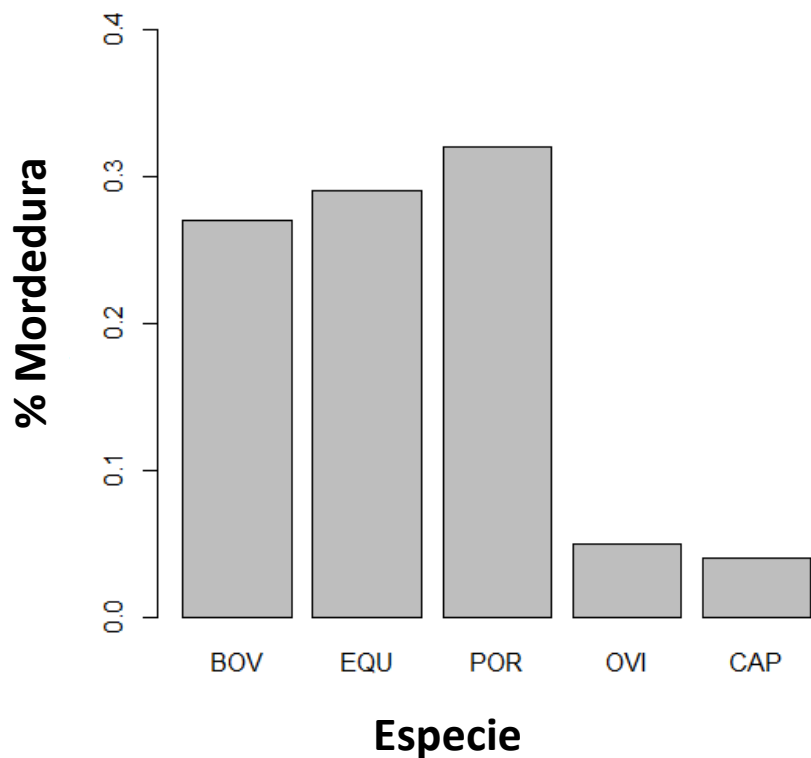
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Control poblacional en Apurímac desde 2014: % PREDIOS MORDIDOS

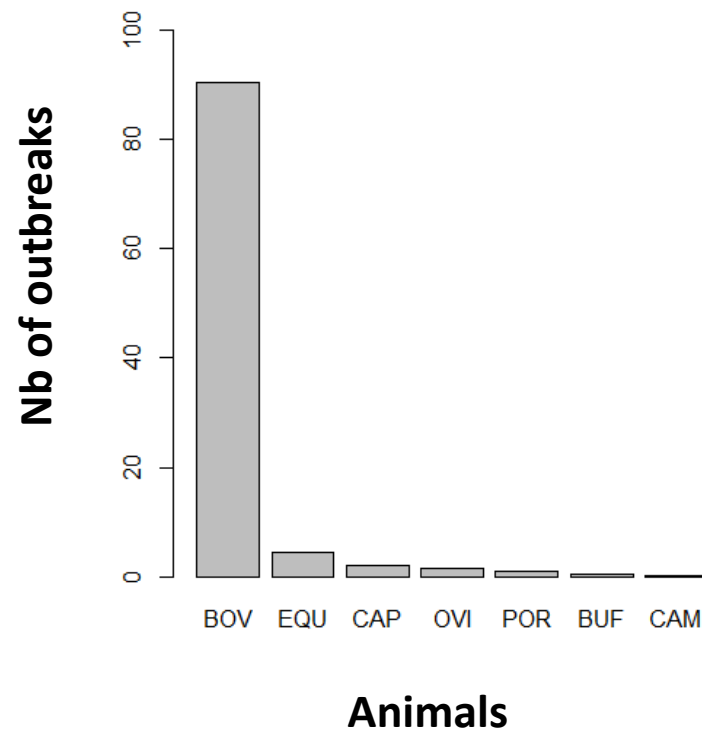


Efficiency of bat culling and bat vaccination for reducing bit rate and number of VBR outbreak ?

BITES



REPORTED OUTBREAKS



Agradecimientos

- RENACE
- Universidad Peruana Cayetano Heredia
- SENASA
- Field assistants and farmers
- Gobierno Regional de Apurímac
- Universidad de Glasgow and Wellcome Trust

