



# Human disturbance and ecology of rodent-borne diseases: a One Health approach

**Catherine Dupont T. M.V.Z.**

Vector Borne and Zoonotic Diseases Unit – Virology and Emerging Infection Department.  
NAMRU-6. Lima, Peru.

# Disclaimer

- The views expressed in this article are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.
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- The study protocol was approved by the Naval Medical Research Unit Number Six Institutional Review Board, and the Naval Medical Research Unit Number Six Institutional Animal Care and Use Committee, in compliance with all applicable Federal regulations governing the protection of human subjects and .
- The experiments reported herein were conducted in compliance with the Animal Welfare Act and in accordance with the principles set forth in the "Guide for the Care and Use of Laboratory Animals," Institute of Laboratory Animals Resources, National Research Council, National Academy Press, 1996.
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- This study was approved via Resolucion Directorial 0387-2012-AG-DGFFS-DGEFFS by the Directorate of Wild Forest and Fauna Management, Peruvian Ministry of Agriculture.

# Collaborators



Museo de  
Historia  
Natural  
U N M S M



# Study Objectives



- ❑ Assess effects of changes in landscape on rodent populations
- ❑ Develop a tool to assess social impact in local communities \*
- ❑ Provide training and infrastructure for a multidisciplinary network

# Work plan

	Year 1	Year 2	Year 3	Year 4	Year 5
Peru	RT (1)    SCM QS	RT (3)	RT (3)    BIOCON SB	RT (3)    SCM / WS SB, I	RT (3)    FP
Bolivia		RT (1)    SCM / WS	RT (2)	RT (2)    QS	RT (2)    SCM / WS FP
Ecuador		RT (1)	RT (2)    SCM / WS	RT (2)    QS	RT (2)    FP

Steering committee meetings (SCM)

Training Workshops (WS)

Rodent trappings (RT)

Qualitative data collection (QS), Socio-behavioral study (SB), Social Intervention (I)

Final publications (FP)

## Animal component

- ❑ Habitat selection
- ❑ Rodent Trapping
- ❑ Samples collection and species identification
- ❑ Capture – release (3 days)
- ❑ Endo point: capture and necropsy

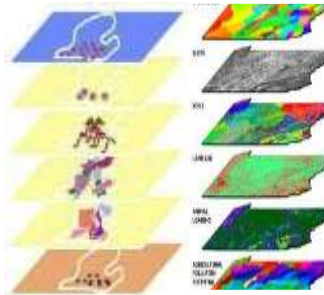
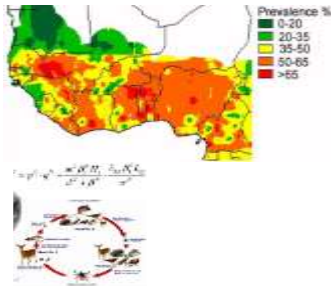


## Human component

- ❑ Human perception and behavior
  - ✓ -Rodent borne diseases
  - ✓ -Strengths and vulnerabilities associated with land change use



- ❑ Geographic Information Systems
- ❑ Remote Sensing
- ❑ Ecological Niche Modelling
  - Model land use change, shifts in rodent population dynamics and risk of rodent borne diseases



## Study sites

- ❑ 4 study sites
- ❑ 6 Trapping grids per site
  - ❑ 2: Non disturbed landscapes
  - ❑ 3: Edge landscapes
  - ❑ 1: disturbed landscapes
- ❑ Grids in FIXED locations (GPS Lat/Long)
- ❑ 3 samplings per year (every 4 months)
  - ❑ Dry, rainy and mid season





## Habitat selection

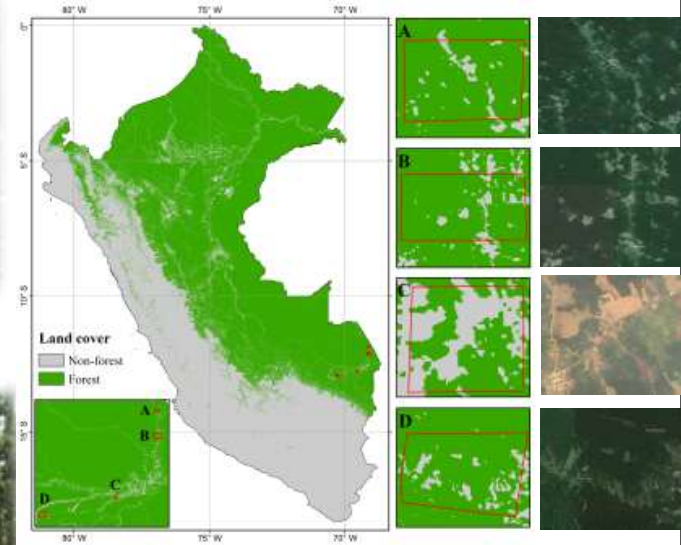
➤ Disturbed



➤ Edge

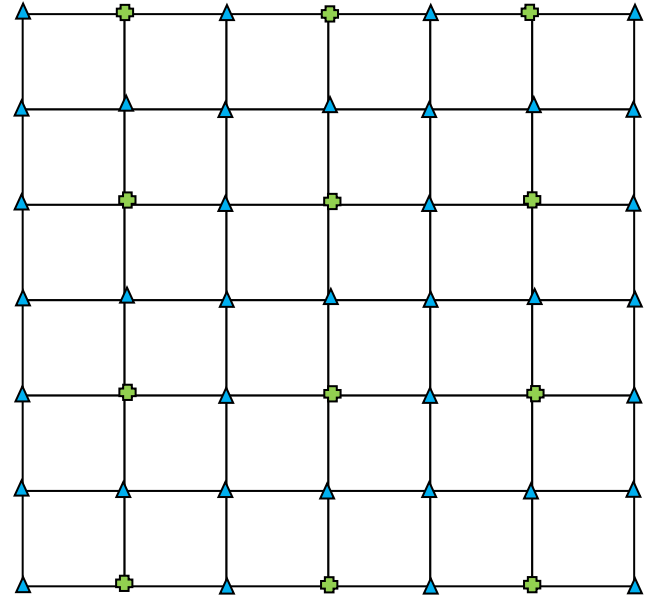
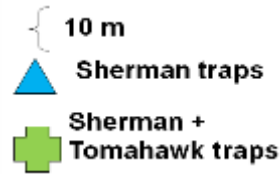


➤ Undisturbed



# The Trapping Grid

- Live capture traps
- Trap stations every 10 meters (49 stations):
  - 12 Tomahawk
  - 49 Sherman
  - Area covered: 3600 m<sup>2</sup>
- Traps bait: nuts paste, raisins, etc.



## Rodent trapping



- 4 consecutive nights
  - 3 nights: capture release
  - 4th night: necropsy
- Field lab setting
  - Blood samples
  - Tattooing (mark-release)
  - Necropsy and tissue samples collection (4th day)





## Trapping effort

- ❑ 4 sampling periods
- ❑ 22024 trap nights

Sampling dates	Dec'13	Jun'14	Sep_Oct'14	Jan_Feb'15	Sub-total 4 trap/nights
Santa Rosa	1210	1463	1216	1220	5109
Florida baja	1383	1455	1463	1464	5765
La novia	1220	1464	1396	1464	5544
Alegria	1337	1464	1342	1463	5606
<b>Total Trap/nights</b>					<b>22024</b>



## ❑ Species identification

- ❑ **728** captures; **130** recaptures; **15** different species
  - ❑ **14** native and **1** opportunistic

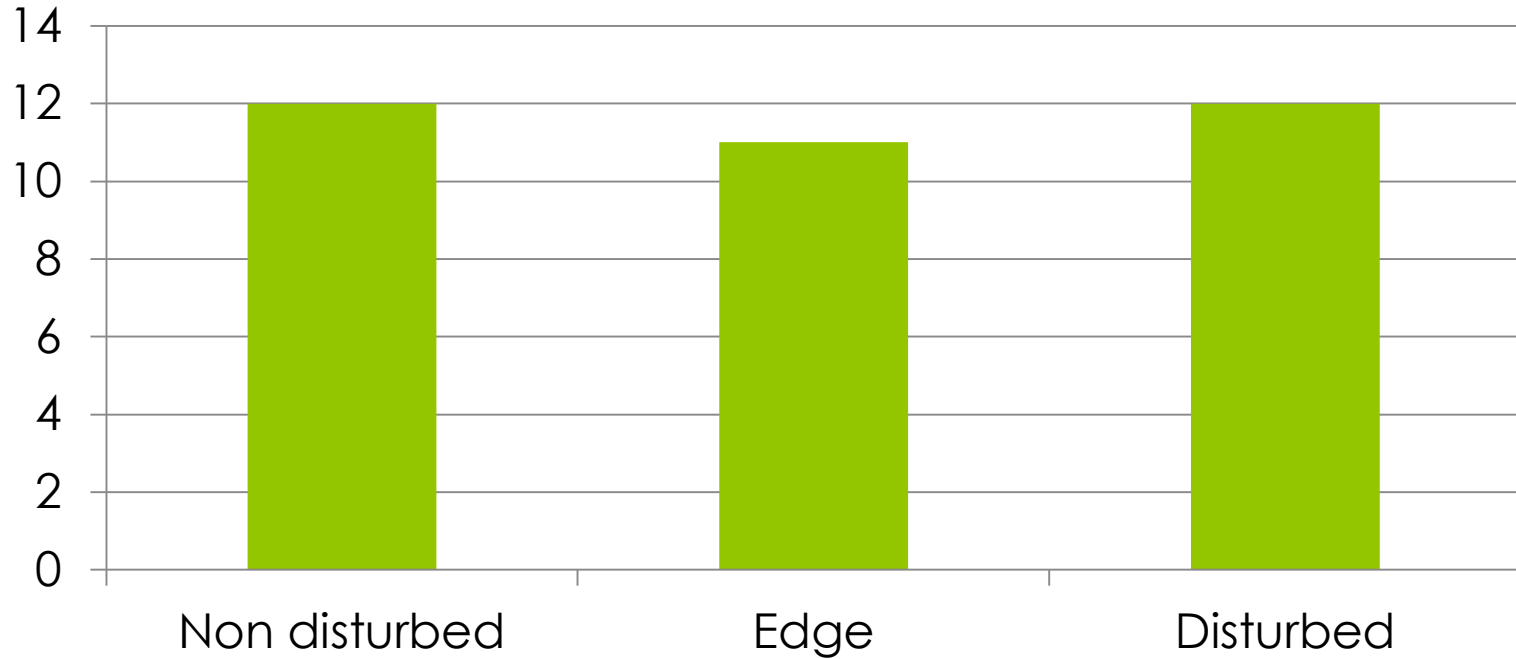
# Trapping seasonality

Fieldtrip collection	Trap effort	# total captures	Season
December 2013	5150	167	Rainy
June 2014	5846	230	Dry
September- October 2014	5417	189	Mid-season
January-February 2015	5611	141	Rainy

# Species relative abundance by habitat

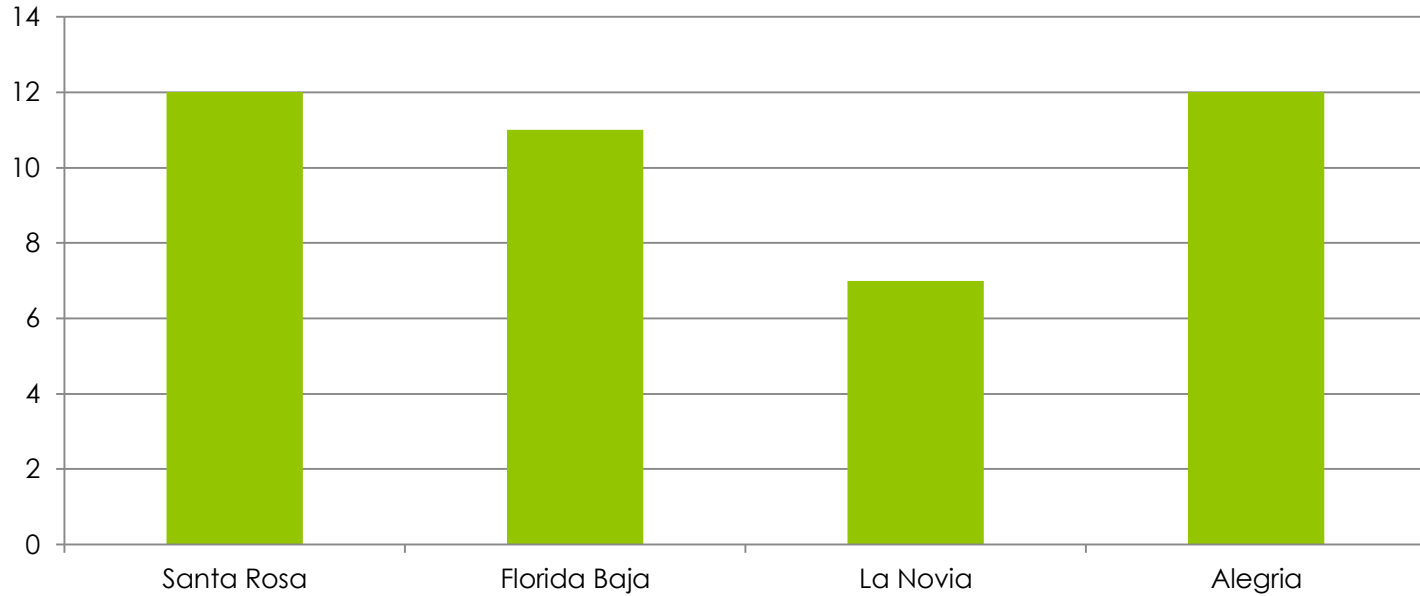
Species	Non Disturbed	Edge	Disturbed	Total
<i>Euryoryzomys macconnelli</i>	1	0	0	1
<i>Euryoryzomys nitidus</i>	21	52	4	<b>77</b>
<i>Holochilus sciureus</i>	0	3	3	6
<i>Hylaeamys perenensis</i>	42	23	1	66
<i>Neacomys spinosus</i>	9	18	3	<b>30</b>
<i>Oecomys bicolor</i>	7	25	8	40
<i>Oecomys roberti</i>	1	0	1	2
<i>Oligoryzomys microtis</i>	3	262	71	<b>336</b>
<i>Proechimys sp.</i>	2	0	1	3
<i>Proechimys pattoni</i>	14	6	1	21
<i>Proechimys simonsi</i>	16	11	2	29
<i>Proechimys brevicauda</i>	3	1	0	4
<i>Rattus rattus</i>	1	0	0	1
<i>Oxymycterus inca</i>	0	27	7	34
<i>Necromys lenguarum</i>	0	40	38	<b>78</b>
<b>Total</b>	<b>120</b>	<b>468</b>	<b>140</b>	<b>728</b>

## Species richness by habitat





## Species richness by site



## Relative species abundance by season

Species	Dry	Rainy	Mid-Season	Total
<i>Euryoryzomys macconnelli</i>	0	0	1	1
<i>Euryoryzomys nitidus</i>	28	36	11	75
<i>Holochilus sciureus</i>	1	4	1	6
<i>Hylaeamys perenensis</i>	24	40	3	67
<i>Neacomys spinosus</i>	8	22	0	30
<i>Oecomys bicolor</i>	6	14	29	49
<i>Oecomys roberti</i>	0	2	0	2
<i>Oligoryzomys microtis</i>	<b>101</b>	<b>126</b>	<b>103</b>	<b>330</b>
<i>Proechimys</i> sp.	1	0	2	3
<i>Proechimys pattoni</i>	12	5	4	21
<i>Proechimys simonsi</i>	9	14	6	29
<i>Proechimys brevicauda</i>	0	4	0	4
<i>Rattus rattus</i>	0	1	0	1
<i>Oxymycterus inca</i>	14	14	6	34
<i>Necromys lenguarum</i>	28	27	23	78
<b>Total</b>	<b>232</b>	<b>309</b>	<b>189</b>	<b>730</b>



*Euryoryzomys nitidus*



*Neacomys spinosus*



*Necromys lenguarum*



*Hyleaemys yunganus*

## Training and infrastructure

- ❑ Undergraduate and graduate students, post docs.
- ❑ Nested studies, thesis research
- ❑ Workshops
  - ❑ Biosafety
  - ❑ Rodent trapping and sampling

- ❑ Dissemination



- ❑ Multidisciplinary network: Red Americana de Investigación en Cambios en la Ecología y Salud (RAICES)
- ❑ Webpage



# Conclusions

- ❑ Edge habitat: less biodiversity / more abundance (opportunistic species)
- ❑ Species related to HTVs are more abundant
- ❑ Landscape is changing fast and drastically
- ❑ Analysis is underway...





17/9/2013 16:03

**It takes a (big) team...**



## What's next???

- ❑ Longitudinal analysis
- ❑ Pathogen testing
- ❑ Long-term: repeat sampling

