

Modelling Zoonoses in Rodent Communities

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Introduction

This is the working manuscript for a study on disease modelling in rodent communities by the Infectious Disease Systems Ecology group at the British Natural History Museum.

David Simons' paper: Simons et al. (2023).

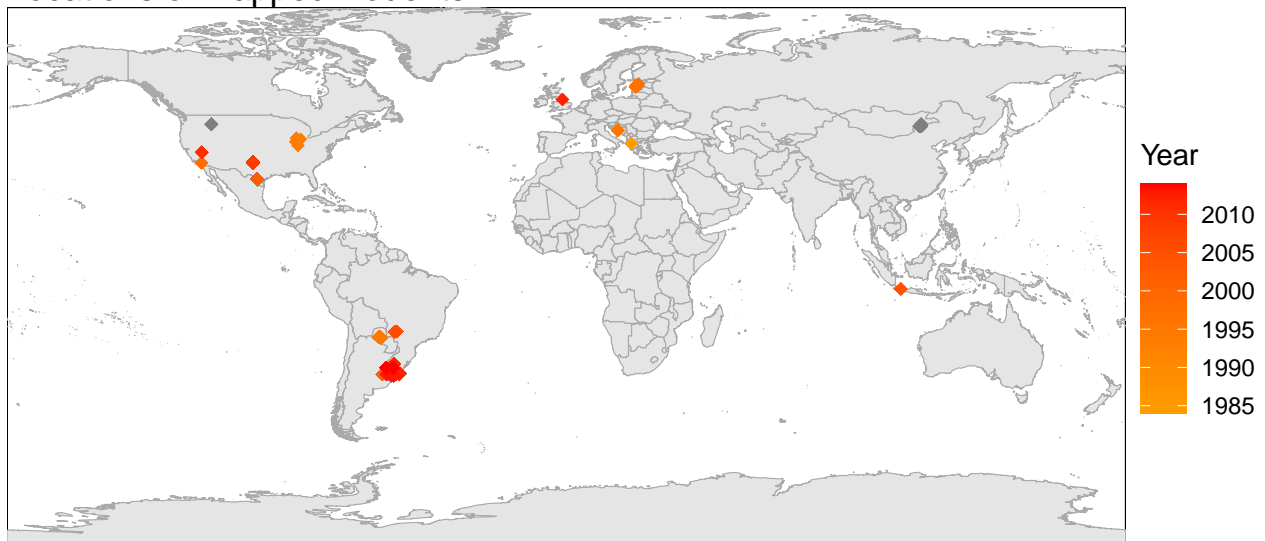
GLC: Zhang et al. (2024)

Methods

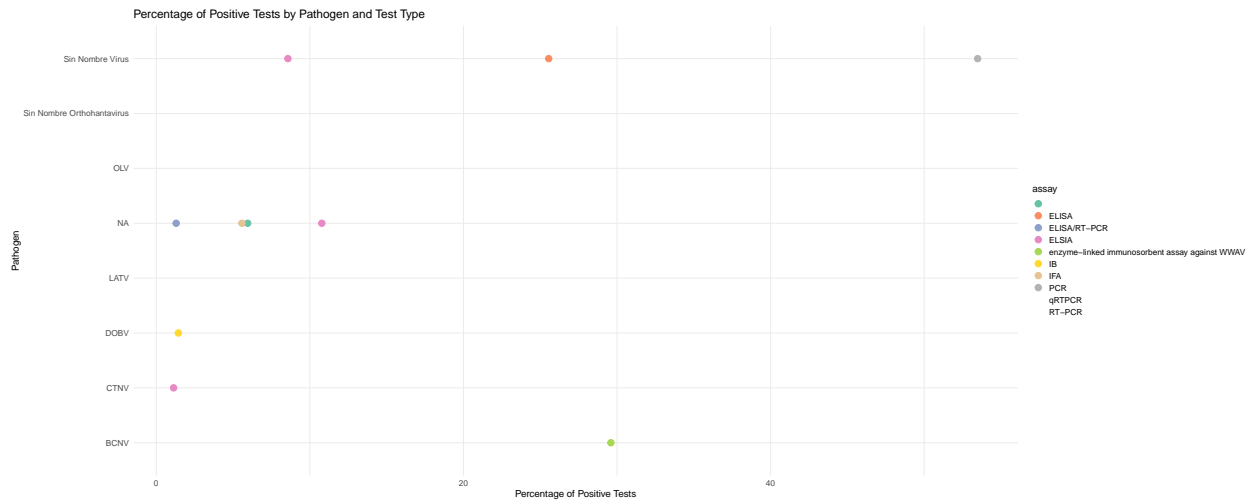
These are the methods.

Here is a world map displaying locations of our sampled rodents:

Locations of Trapped Rodents

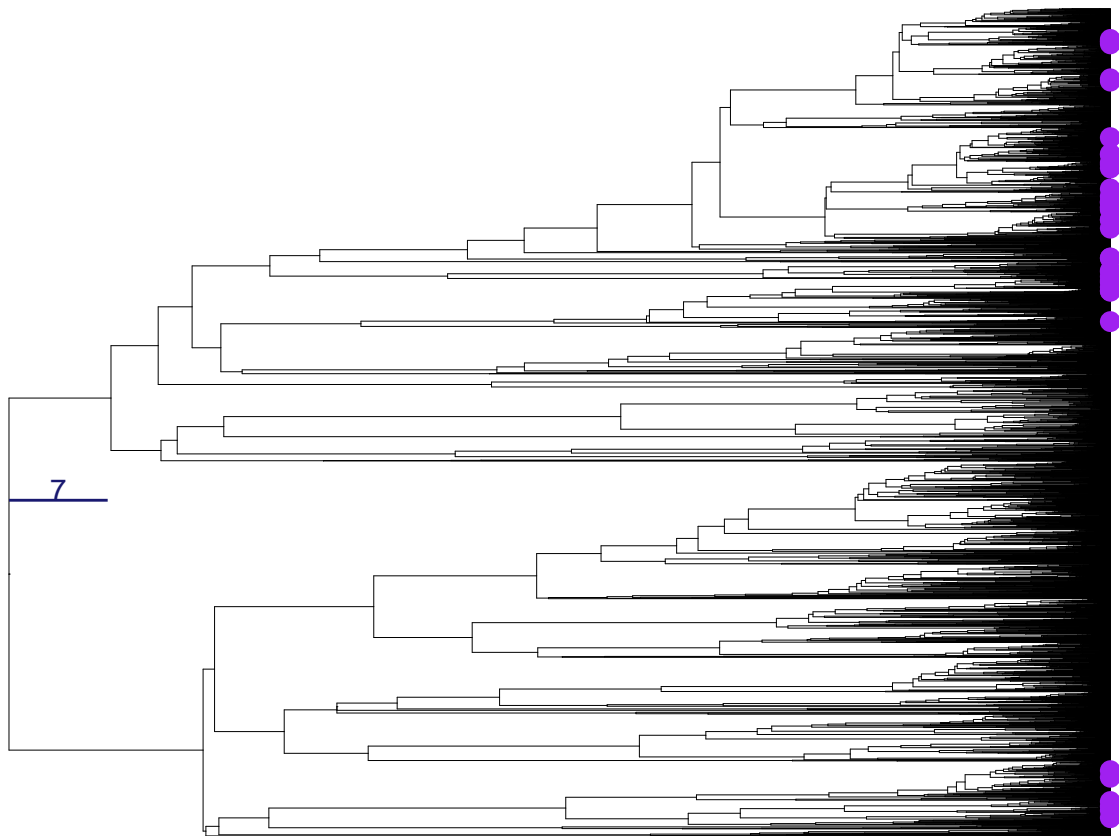


Here is the infectivity rates of our sampled rodents:



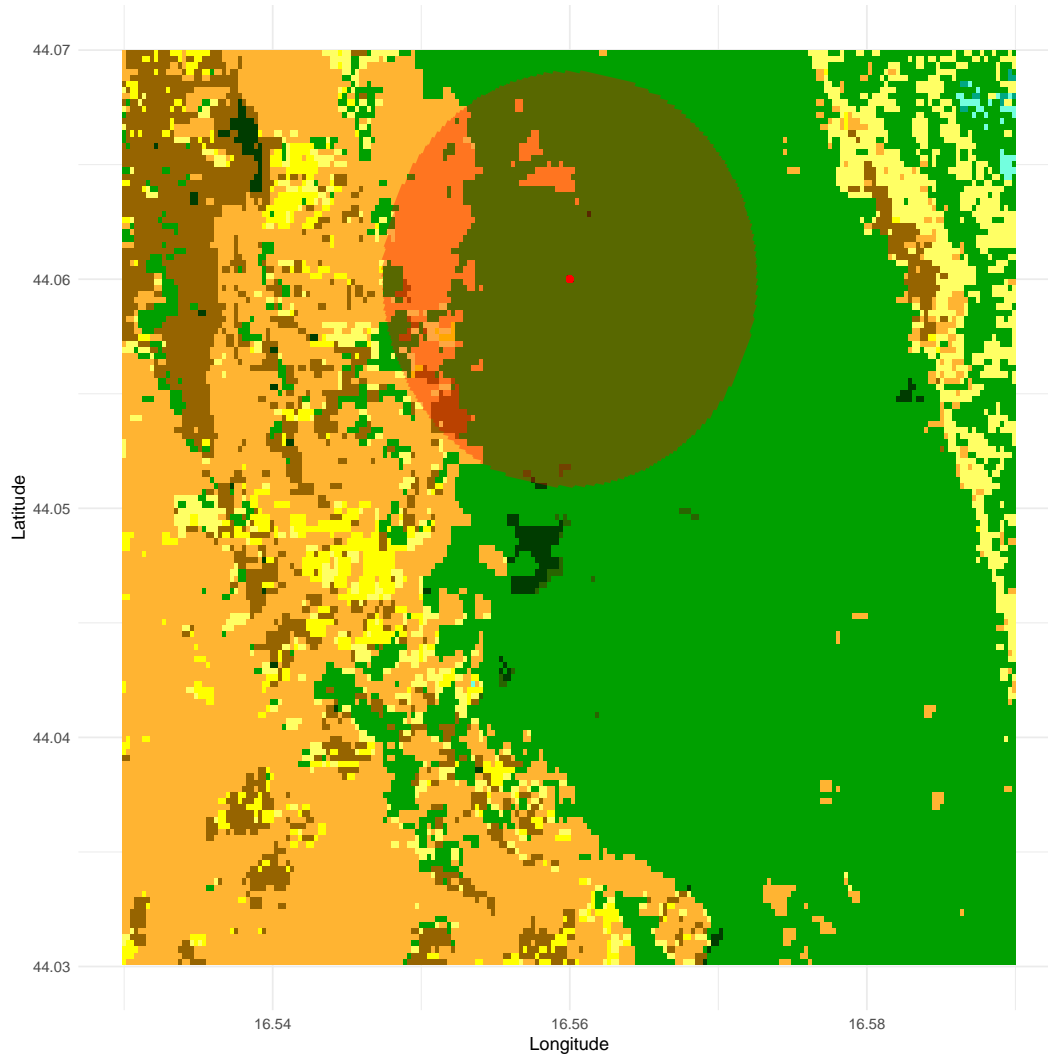
Rodent phylogeny

Here is the mammal tree with our host species highlighted



GLC database

Here is an example of a raster from the GLC database with the site coordinate plotted and a buffer of radius 1 km.



Data papers

We collected data from the following papers for use in this analysis: Burns et al. (2018), Cabrera et al. (2023), Dietrich et al. (1997), Fernandes et al. (2015), Fulhorst et al. (2002), Jameson et al. (2013), Kosasih et al. (2011), Ledina et al. (2002), LeDuc, Antoniadis, and Siamopoulos (1986), Mauldin et al. (2013), Milazzo et al. (2013), Nemirov et al. (1999), Zhang et al. (2024), Seijo et al. (2003), Sheikh Ali et al. (2014), Suárez et al. (2003), Williams et al. (1997), Williamson et al. (2021).

References

- Burns, Joseph E, Marco E Metzger, Sharon Messenger, Curtis L Fritz, Inger-Marie E Vilcins, Barryett Enge, Lawrence R Bronson, Vicki L Kramer, and Renjie Hu. 2018. "Novel Focus of Sin Nombre Virus in Peromyscus Eremicus Mice, Death Valley National Park, California, USA." *Emerging Infectious Diseases* 24 (6): 1112.
- Cabrera, Andrés, David Romero, José Carlos Guerrero, Mario Clara, and Adriana Delfraro. 2023. "Deciphering the Hantavirus Host Range Combining Virology and Species Distribution Models with an Emphasis on the Yellow Pygmy Rice Rat (*Oligoryzomys Flavescens*)." *Transboundary and Emerging Diseases* 2023 (1): 2730050.
- Dietrich, Nanette, Shaina Pruden, Thomas G Ksiazek, Sergey P Morzunov, and Joseph W Camp. 1997. "A Small-Scale Survey of Hantavirus in Mammals from Indiana." *Journal of Wildlife Diseases* 33 (4): 818–22.

- Fernandes, Jorlan, Renata Carvalho de Oliveira, Alexandro Guterres, Fabiana de Carvalho Serra, Cibele Rodrigues Bonvicino, Paulo Sergio D’Andrea, Rivaldo Venâncio Cunha, Silvana Levis, and Elba Regina Sampaio de Lemos. 2015. “Co-Circulation of Clade C New World Arenaviruses: New Geographic Distribution and Host Species.” *Infection, Genetics and Evolution* 33: 242–45.
- Fulhorst, Charles F, Stephen G Bennett, Mary L Milazzo, Hugh L Murray Jr, James P Webb Jr, Maria NB Cajimat, and Robert D Bradley. 2002. “Bear Canyon Virus: An Arenavirus Naturally Associated with the California Mouse (*Peromyscus Californicus*).” *Emerging Infectious Diseases* 8 (7): 717.
- Jameson, LJ, CH Logue, B Atkinson, N Baker, SE Galbraith, MW Carroll, Timothy Brooks, and R Hewson. 2013. “The Continued Emergence of Hantaviruses: Isolation of a Seoul Virus Implicated in Human Disease, United Kingdom, October 2012.” *Eurosurveillance* 18 (1): 20344.
- Kosasih, Herman, Ima Nurisa Ibrahim, Rudi Wicaksana, Bachti Alisjahbana, Yumilia Hoo, Iing H Yo, Ungke Antonjaya, Susana Widjaja, Imelda Winoto, and Maya Williams. 2011. “Evidence of Human Hantavirus Infection and Zoonotic Investigation of Hantavirus Prevalence in Rodents in Western Java, Indonesia.” *Vector-Borne and Zoonotic Diseases* 11 (6): 709–13.
- Ledina, Dragan, N Bradaric, B Borcic, B Turkovic, I Ivic, J Bakic, Marijan Erceg, and N Tvrtkovic. 2002. “Dinara-New Natural Focus of Hemorrhagic Fever with Renal Syndrome in Croatia.” *Croatian Medical Journal* 43 (5): 576–80.
- LeDuc, JW, A Antoniadou, and K Siamopoulos. 1986. “Epidemiological Investigations Following an Outbreak of Hemorrhagic Fever with Renal Syndrome in Greece.” *The American Journal of Tropical Medicine and Hygiene* 35 (3): 654–59.
- Mauldin, Matthew R, Megan S Keith, Mary Louise Milazzo, and J Delton Hanson. 2013. “Assessment of Hantavirus and Arenavirus Antibody Prevalence and Associated Rodent Species in Dickens County, Texas.” *Texas J Sci* 64: 157–71.
- Milazzo, Mary L, Brian R Amman, Maria NB Cajimat, Francisca M Méndez-Harclerode, John R Suchecki, J Delton Hanson, Michelle L Haynie, B Dnate’Baxter, Ciro Milazzo Jr, and Serena A Carroll. 2013. “Ecology of Catarina Virus (Family Arenaviridae) in Southern Texas, 2001–2004.” *Vector-Borne and Zoonotic Diseases* 13 (1): 50–59.
- Nemirov, Kirill, Olli Vapalahti, Åke Lundkvist, Vera Vasilenko, Irina Golovljova, Angelina Plyusnina, Jukka Niemimaa, Juha Laakkonen, Heikki Henttonen, and Antti Vaheri. 1999. “Isolation and Characterization of Dobrava Hantavirus Carried by the Striped Field Mouse (*Apodemus Agrarius*) in Estonia.” *Journal of General Virology* 80 (2): 371–79.
- Seijo, Alfredo, Noemí Pini, Silvana Levis, Héctor Coto, Bettina Deodato, Beatriz Cernigoi, Diana de Bassadoni, and Delia Enría. 2003. “Study of Hantavirus Seoul in a Human and Rodent Population from a Marginal Area in Buenos Aires City.” *Medicina* 63 (3): 193–96.
- Sheikh Ali, Hanan, Stephan Drewes, Edyta T Sadowska, Magdalena Mikowska, Martin H Groschup, Gerald Heckel, Pawel Koteja, and Rainer G Ulrich. 2014. “First Molecular Evidence for Puumala Hantavirus in Poland.” *Viruses* 6 (1): 340–53.
- Simons, David, Lauren A Attfield, Kate E Jones, Deborah Watson-Jones, and Richard Kock. 2023. “Rodent Trapping Studies as an Overlooked Information Source for Understanding Endemic and Novel Zoonotic Spillover.” *PLOS Neglected Tropical Diseases* 17 (1): e0010772.
- Suárez, Olga V, Gerardo R Cueto, Regino Cavia, Isabel E Gómez Villafañe, David N Bilenca, Alexis Edelstein, Paula Martínez, Sergio Miguel, Carla Bellomo, and Karina Hodara. 2003. “Prevalence of Infection with Hantavirus in Rodent Populations of Central Argentina.” *Memórias Do Instituto Oswaldo Cruz* 98: 727–32.
- Williams, R Joel, Ralph T Bryan, James N Mills, R Eduardo Palma, Ivan Vera, Floria De Velasquez, Eugenio Baez, Wesley E Schmidt, Ruben E Figueroa, and Clarence J Peters. 1997. “An Outbreak of Hantavirus Pulmonary Syndrome in Western Paraguay.” *The American Journal of Tropical Medicine and Hygiene* 57 (3): 274–82.
- Williamson, Brandi N, Kimberly Meade-White, Kristin Boardman, Jonathan E Schulz, Carson T Telford, Dania M Figueroa Acosta, Trenton Bushmaker, Robert J Fischer, Kyle Rosenke, and Heinz Feldmann. 2021. “Continuing Orthohantavirus Circulation in Deer Mice in Western Montana.” *Viruses* 13 (6): 1006.
- Zhang, X., T. Zhao, H. Xu, W. Liu, J. Wang, X. Chen, and L. Liu. 2024. “GLC_FCS30D: The First Global 30\,m Land-Cover Dynamics Monitoring Product with a Fine Classification System for the Period from 1985 to 2022 Generated Using Dense-Time-Series Landsat Imagery and the Continuous Change-Detection

Method.” *Earth System Science Data* 16 (3): 1353–81. <https://doi.org/10.5194/essd-16-1353-2024>.