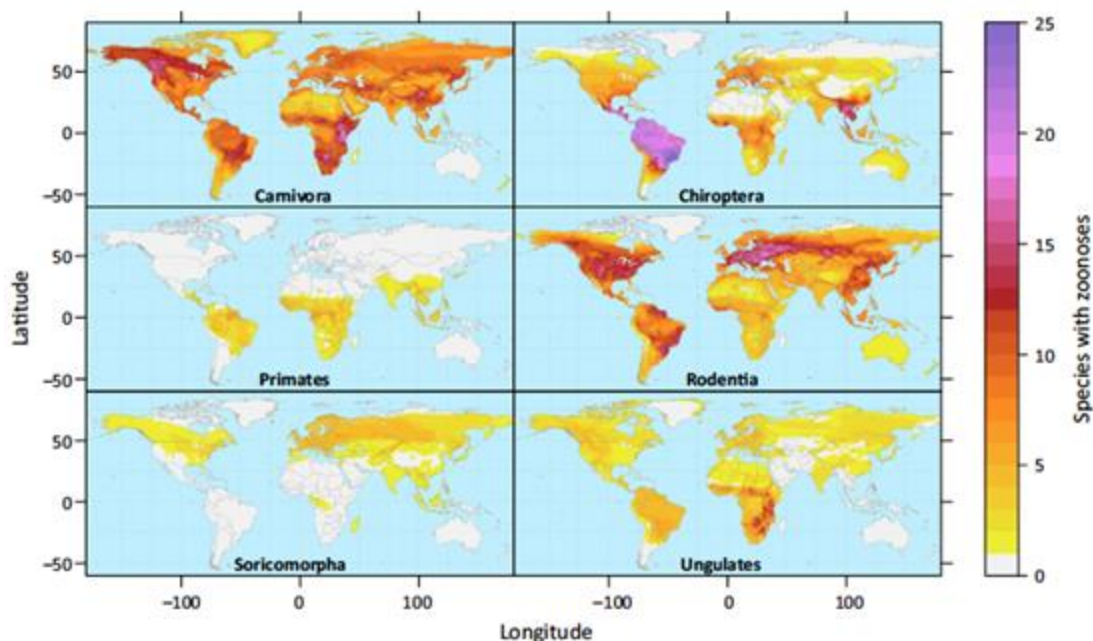




Patterns of Zoonotic Disease

HOW TO USE THIS RESOURCE

Show the figure below to your students along with the caption and background information. The “Interpreting the Graph” and “Discussion Questions” sections provide additional information and suggested questions that you can use to guide a class discussion about the characteristics of the graph and what it shows.



Caption: The six maps show the geographic distribution of clades, or groups, of mammal species known to carry zoonotic pathogens. The six clades include carnivores (Carnivora), bats (Chiroptera), primates (Primates), rodents (Rodentia), shrews and moles (Soricomorpha), and nondomesticated hoofed mammals (Ungulates). The color scale on the right represents the number of species known to carry at least one zoonotic pathogen.

BACKGROUND INFORMATION

A zoonotic pathogen is any pathogen that can be transmitted from animals to humans and cause disease. When a pathogen is passed from an animal to a human, it is known as a spillover event. The 2014 West African Ebola outbreak is a well-publicized example of a zoonotic disease outbreak, resulting from a spillover event strongly suspected to have come from a bat. The frequency and prevalence of zoonotic diseases is on the rise worldwide. In this study, scientists analyzed previously published data on terrestrial mammal zoonotic host species and the pathogens they carry to search for global patterns of zoonotic disease distribution. A better understanding of the diseases, animal hosts, and extrinsic factors (including climate change, urbanization, and the human population’s socioeconomic standing) may help predict where and when a spillover event may occur in the future, and where disease outbreaks may occur.

INTERPRETING THE GRAPH

This graph consists of six global heat maps: maps in which data is displayed as colors that represent a variable. Each global map depicts the number of species in a given mammal clade known to carry at least one zoonotic disease. For example, South America is a hot spot for zoonotic disease-carrying bats, with 25 host species in some areas. In contrast, the continent contains no known shrew or mole species capable of transmitting zoonotic diseases.

Teacher Tip: Prompt your students to explain the parts of the graph as applicable:

- Graph Type: Six heat maps of global mammal clade distribution. The colors, from white to purple, show the number of species belonging to a particular clade that are known to carry zoonotic pathogen(s).
- X-axis: Longitude
- Y-axis: Latitude

DISCUSSION QUESTIONS

- What patterns do you notice across these six maps?
- How might the number of zoonotic pathogen-carrying species influence the likelihood of a spillover event? What other factors might influence the likelihood of a spillover event?
- What does it mean when a region is not shaded with any color? (*Teacher note: Print the supplementary maps on the next page to provide students with additional information.*)
- If you were to overlay all of the maps, which global regions have the most species carrying zoonotic disease (hot spots)? Which have the least (cold spots)?
- Is there a relationship between latitude and zoonotic host species? What about longitude?
- Which of the six mammal clades has the widest distribution of zoonotic hosts? How does this compare with the distribution of all species within the clades? What patterns do you notice about the ratio of zoonotic host species to total species? (*See the supplementary maps.*)
- The maps show mammals that are known to carry zoonotic pathogens. In what ways might this focus on mammals limit the information provided in the maps?
- How might different cultures experience different risk of exposure to mammals that carry zoonotic diseases? For example, in the United States, in what ways do humans come into contact with wild mammals?
- About 10% of rodent species carry zoonotic diseases, compared to 20% of primate species. Why then are there more rodent species on the map than primate species?
- How might climate change affect the distribution of the species shown in these maps and, consequently, the risk of humans contracting a zoonotic disease?

SOURCE

Figures 3 and S5 from:

Han, Barbara A., Andrew M. Kramer, and John M. Drake. (2016). "Global Patterns of Zoonotic Disease in Mammals." *Trends in Parasitology* 32: 565-577.

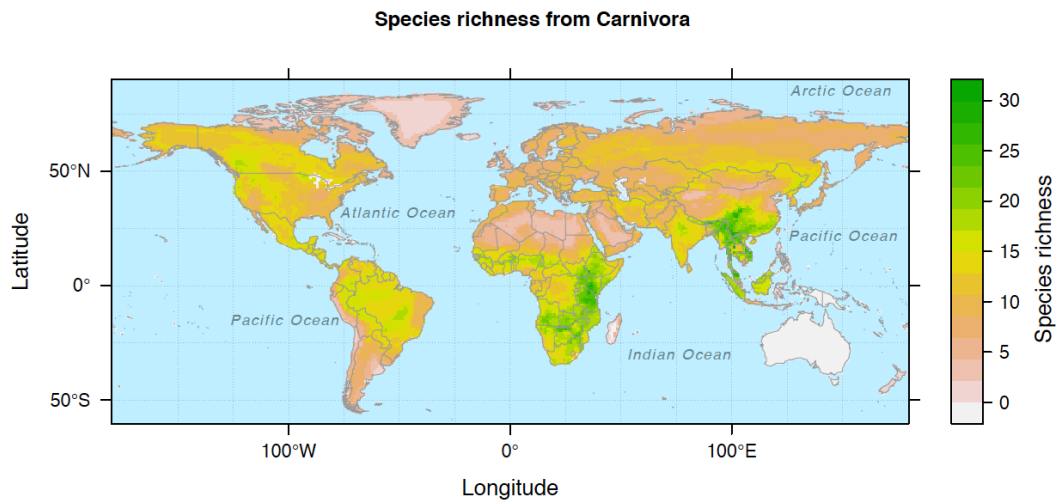
View article: [http://www.cell.com/trends/parasitology/abstract/S1471-4922\(16\)30010-1](http://www.cell.com/trends/parasitology/abstract/S1471-4922(16)30010-1)

AUTHOR

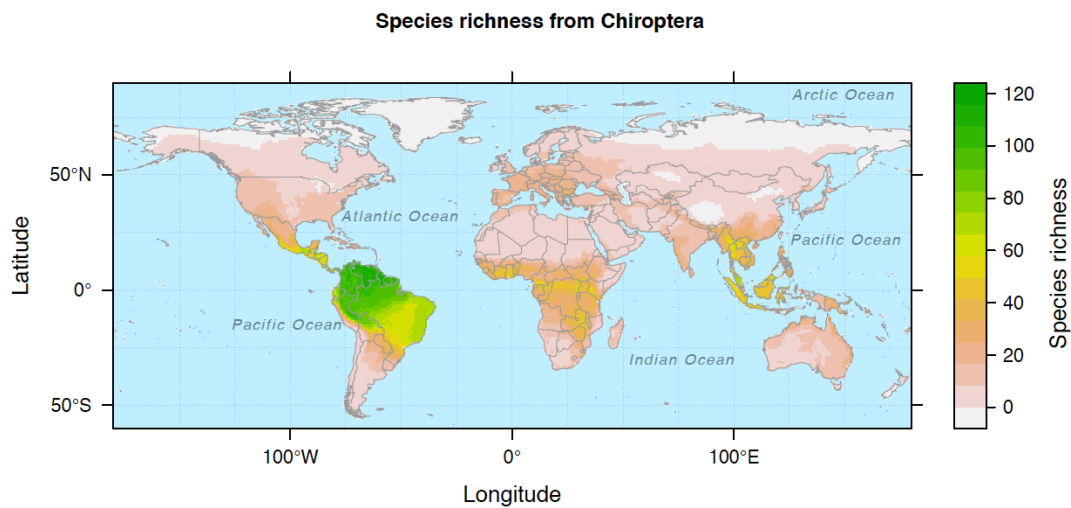
Natalie Dutrow, PhD, Judge Memorial Catholic High School, Salt Lake City, UT

Edited by: Barbara Han, PhD, Carey Institute of Ecosystem Studies; Aileen O'Hearn, PhD, Bridget Conneely, and Jessica Johnson, HHMI

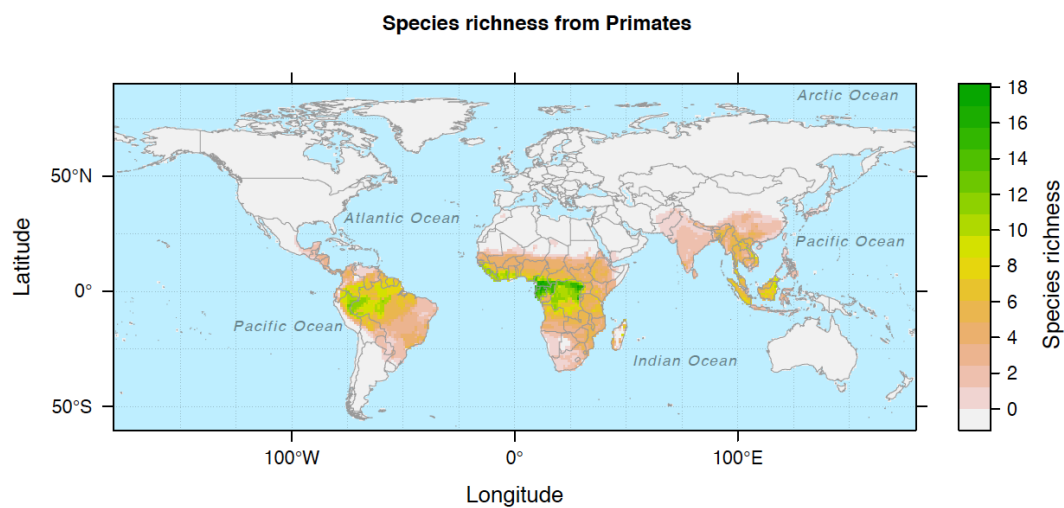
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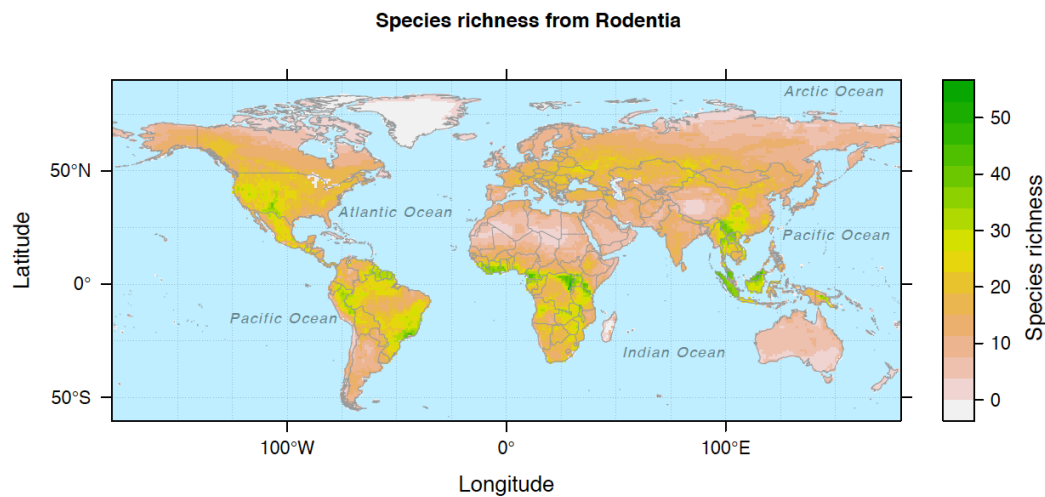
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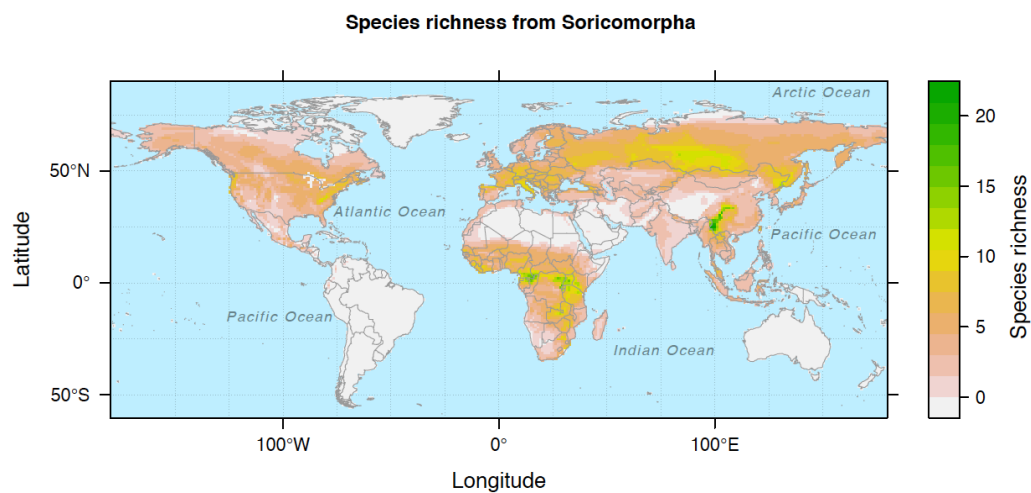
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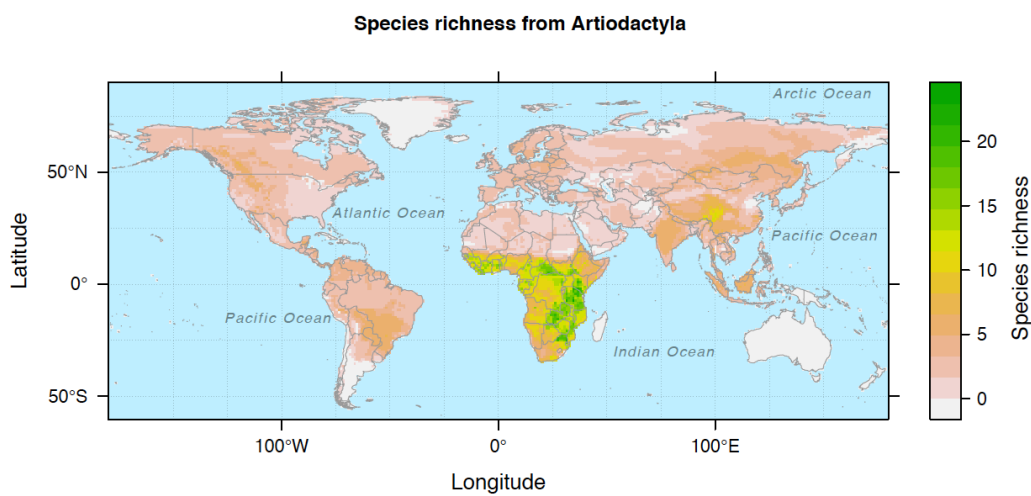
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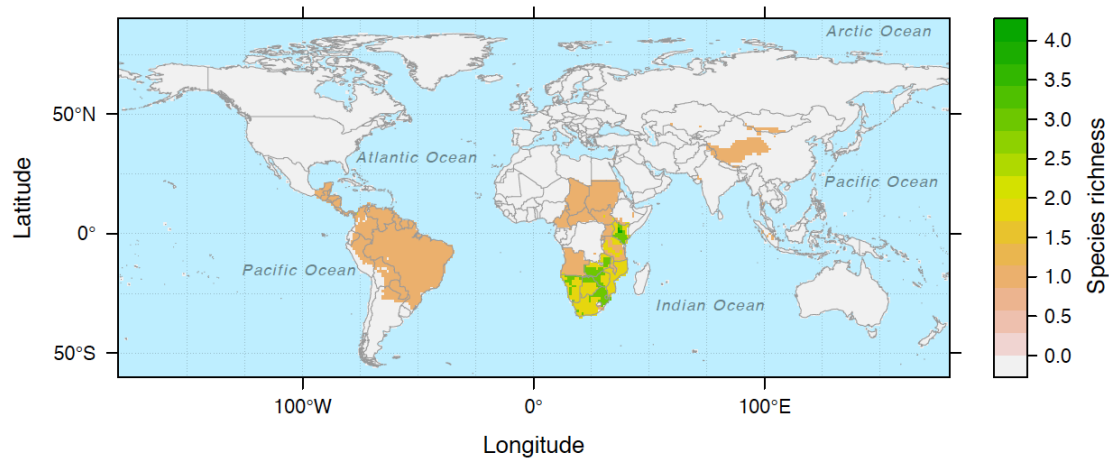


f)



g)

Species richness from Perissodactyla



Caption: The seven maps show the geographic distribution of orders of mammal species. The seven orders include a) carnivores (Carnivora), b) bats (Chiroptera), c) primates (Primates), d) rodents (Rodentia), e) shrews and moles (Soricomorpha), f) even-toed ungulates (Artiodactyla), and g) odd-toed ungulates (Perissodactyla). The original figure combines Artiodactyla and Perissodactyla to create the Ungulate clade. The color scale on the right represents the number of species. The range of this scale varies by order.