

Frugivory Richness Predicts Ebola Spillover in Africa Mireya Dorado¹, Mekala Sundaram², Patrick Stephens²

¹Northeastern University, ²University of Georgia – Odum School of Ecology



Introduction

Ebola viruses are deadly filoviruses that infect a variety of mammals including humans in Sub-Saharan Africa. The first Ebola outbreak only occurred in 1976, and most outbreaks appear to have been zoonotic in origin. In other words, most Ebola outbreaks begin with a spillover event where the virus is transmitted from a wild animal host. Numerous past studies have considered risk factors for spillover of Ebola and other filoviruses, but few have directly analyzed the effect of mammalian host biodiversity.



Goal/Hypothesis

Previous studies have been limited to known Ebola host diversity¹ and bat diversity². However, Ebola has a broad host range, the limits of which are poorly understood. Our goal was to determine whether and what aspects of mammalian species richness play a significant role in predicting Ebola spillover events. We hypothesized that overall mammalian species richness or richness of certain key taxa, such as Nycterid bats and Cercopithecoid primates, would best predict sites of spillover.

Methods

- Response: Spillover occurrence data from Schmidt et al. 2017³
- Predictor: IUCN range files used to calculate species richness in 50 km by 50 km grid cells in Africa
- Richness calculated for subgroups following IUCN taxonomic nomenclature and foraging trait information in EltonTraits
- Analysis: Used presence absence approach to compare species richness at sites of spillover to pseudo absence background locations
- Bagged logistic regression predicting spillover using richness of different mammal subgroups with R package 'caret'
- Parameters: Repeated cross validation performed with 10 folds and 100 repeats, down-sampling of pseudoabsences
- Output: AUC values, maps (ArcGIS)



Zoonotic

ecies Richness of Cercopithecida

Human

2 - 4

5 - 8

9 - 11

12 - 17

Species richness of frugivores are best predictors of Ebola spillover events.





Results

Group/Family	Min AUC	Mean AUC	Max AUC
General	0.764	0.904	0.990
Bovidae	0.191	0.739	0.896
Cercopithecidae	0.858	0.943	0.988
Frugivores	0.747	0.956	0.997
Frugivores & Scavengers	0.155	0.570	0.735
Muridae	0.554	0.849	0.986
Nycteridae	0.825	0.929	0.978
Pteropodidae	0.749	0.936	0.995
Scavengers	0.485	0.788	0.849
Vespertilionidae	0.650	0.858	0.987

Discussion

We show that the diversity of fruit eating mammals better predicts spillover risk than other sets of mammalian diversity we considered. This strongly implicates a role of fruit in Ebola transmission. The geographic concentration of frugivores during masting and fruiting seasons may lead to a spread of Ebola.⁴ African frugivores include Pteropodidae and Cercopithecidae. More targeted field studies are needed to confirm frugivory as a mechanism of spread.

References

750 1,500 Kilometers

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