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Predictive Model for Estimating Annual *Ebolavirus* Spillover Potential

Appendix

Appendix Table 1. Spillover events used in a predictive model for estimating annual *Ebolavirus* spillover potential*

ID	Country	*Ebolavirus* species	Year	Lat	Long	Source
1	Gabon	*Zaire*	2001	0.0550	11.8109	(*1*), (*2*)
2	Gabon	*Zaire*	2001	0.7001	14.1580	(*3*), (*4*), (*5*)
3	ROC	*Zaire*	2002	0.1333	14.2667	(*2*), (*5*)
4	ROC	*Zaire*	2002	0.2987	14.5075	(*6*)
5	ROC	*Zaire*	2003	0.0682	14.4200	(*2*), (*5*), (*7*)
6	ROC	*Zaire*	2003	0.5619	14.6573	(*5*)
7	South Sudan	*Sudan*	2004	4.5568	28.4016	(*8*)
8	ROC	*Zaire*	2004	0.9064	15.1751	(*9*)
9	ROC	*Zaire*	2005	0.4944	14.6786	Trevor Shoemaker, pers. comm., 2022 Jun 6
10	DRC	*Zaire*	2007	−5.259	21.4095	(*2*)
11	Uganda	*Bundibugyo*	2007	0.7038	30.1175	(*7*), (*10*), (*11*)
12	DRC	*Zaire*	2008	−5.24	21.4103	(*7*), (*12*)
13	Uganda	*Sudan*	2011	0.6444	32.7276	(*7*), (*13*), (*14*)
14	Uganda	*Sudan*	2012	0.6214	31.1685	(*7*), (*12*)
15	DRC	*Bundibugyo*	2012	2.7718	27.6196	(*7*)
16	Uganda	*Sudan*	2012	0.5784	32.5480	(*11*)
17	Guinea	*Zaire*	2013	8.6225	−10.064	(*7*)
18	DRC	*Zaire*	2014	−0.714	20.5302	(*15*)
19	DRC	*Zaire*	2017	3.2990	23.5430	(*16*), (*17*)
20	DRC	*Zaire*	2018	−0.737	18.4214	(*18*); Trevor Shoemaker, pers. comm., 2022 Jun 6
21	DRC	*Zaire*	2018	0.6059	29.3065	Trevor Shoemaker, pers. comm., 2022 Jun 6
22	DRC	*Zaire*	2020	0.0300	18.2800	Trevor Shoemaker, pers. comm., 2022 Jun 6
23	DRC	*Zaire*	2022	0.0414	18.2770	Trevor Shoemaker, pers. comm., 2022 Jun 6
24	Uganda	*Sudan*	2022	0.6697	31.4686	Trevor Shoemaker, pers. comm., 2022 Jun 6

*CDC, Centers for Disease Control and Prevention; DRC, Democratic Republic of the Congo; ROC, Republic of the Congo.

Appendix Table 2. Variable descriptions for a predictive model for estimating annual *Ebolavirus* spillover potential

Variable	Units	Original spatial resolution	Years represented in data	Temporal range of analysis	Citation
Elevation	Meters	1×1 km	2000	Single time point	(*19*)
Forest cover (FC)	Percentage	30×30 m	2000–2022	% FC during year of spillover	(*20*)
Forest fragmentation	Binary	30×30 (calculated using FC data)	2000–2022	% Fragmentation during year of spillover	(*21*)
Forest loss	Binary	30×30 m	2001–2022	% forest loss during same year, 1 y prior, and 2 years before spillover	(*20*)

Variable	Units	Original spatial resolution	Years represented in data	Temporal range of analysis	Citation
Night-time land surface temperature (NTLST)	Degrees Kelvin	0.05 degrees	2000–2022	Time Averaged mean monthly values	(*22*)
Potential evapotranspiration (PET)	mm day-1	1×1 km	2000–2022	Time Averaged mean monthly values	(*23*)
Precipitation	Millimeters	1×1 km	1970–2000	Time Averaged mean monthly values	(*19*)
Temperature seasonality	Standard Deviation	1×1 km	1970–2000	Time Averaged mean monthly values	(*19*)
Precipitation seasonality	Coefficient of Variation	1×1 km	1970–2000	Time Averaged mean monthly values	(*19*)
Population count	Population per grid cell	30 arc seconds (≈1× km)	2000–2022	Population per grid cell during year of spillover	(*24*)

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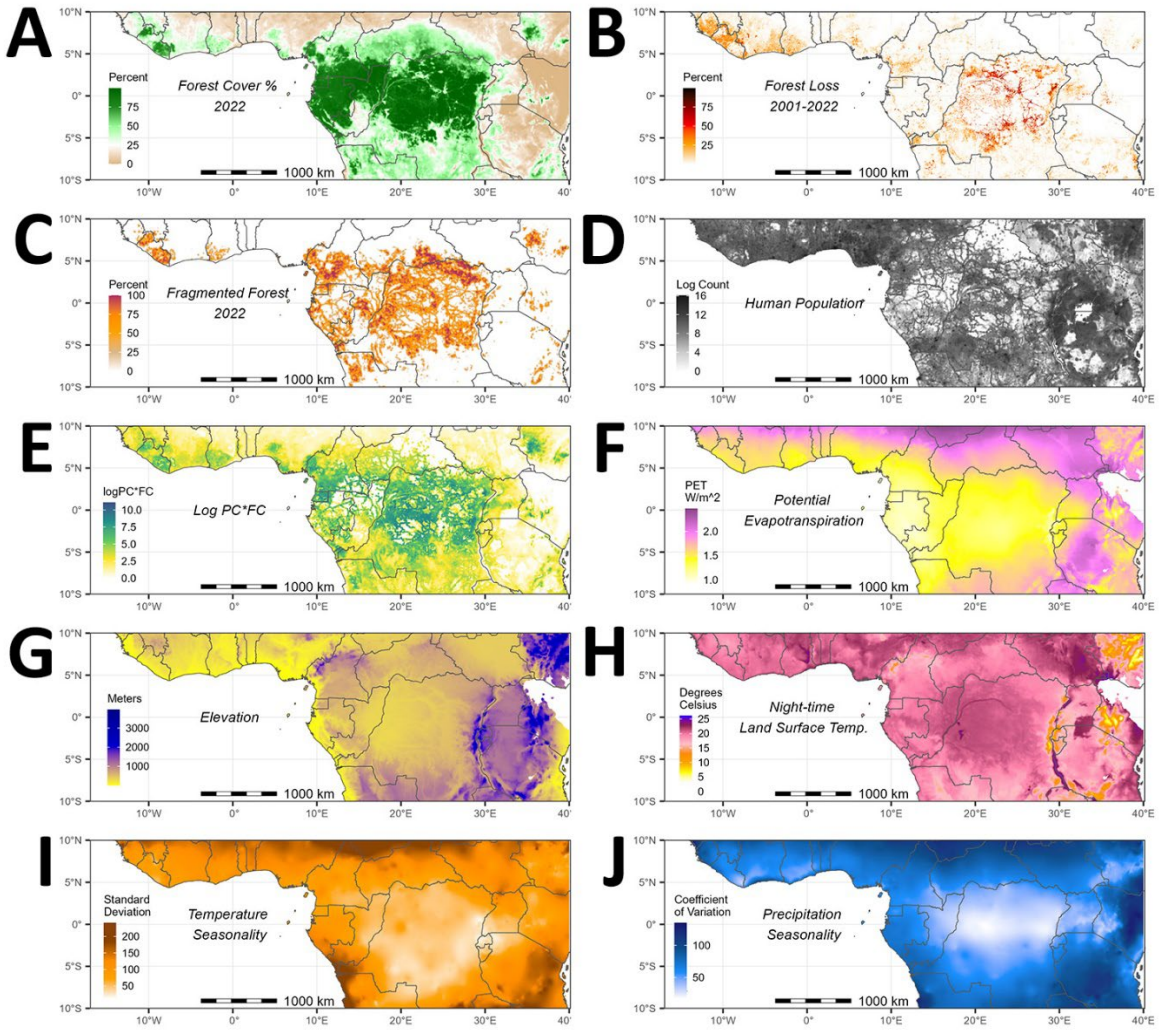
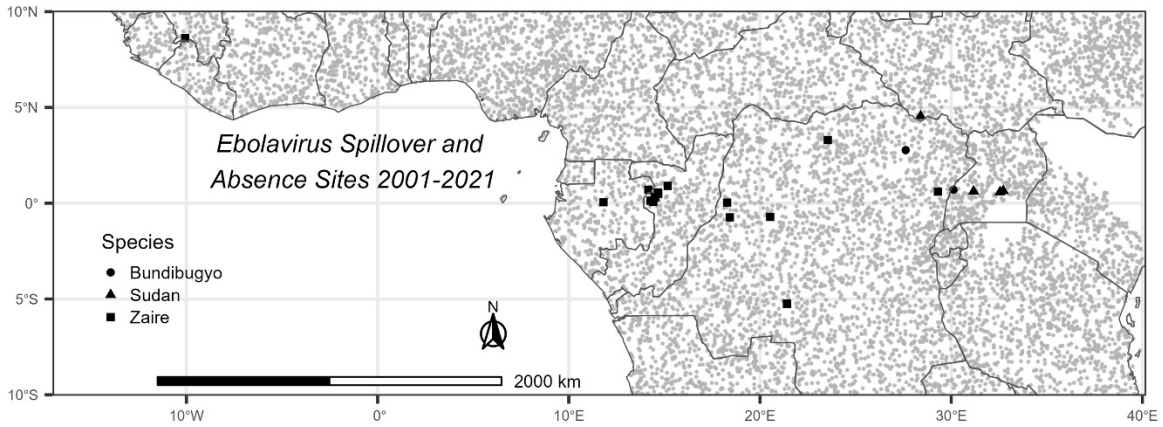
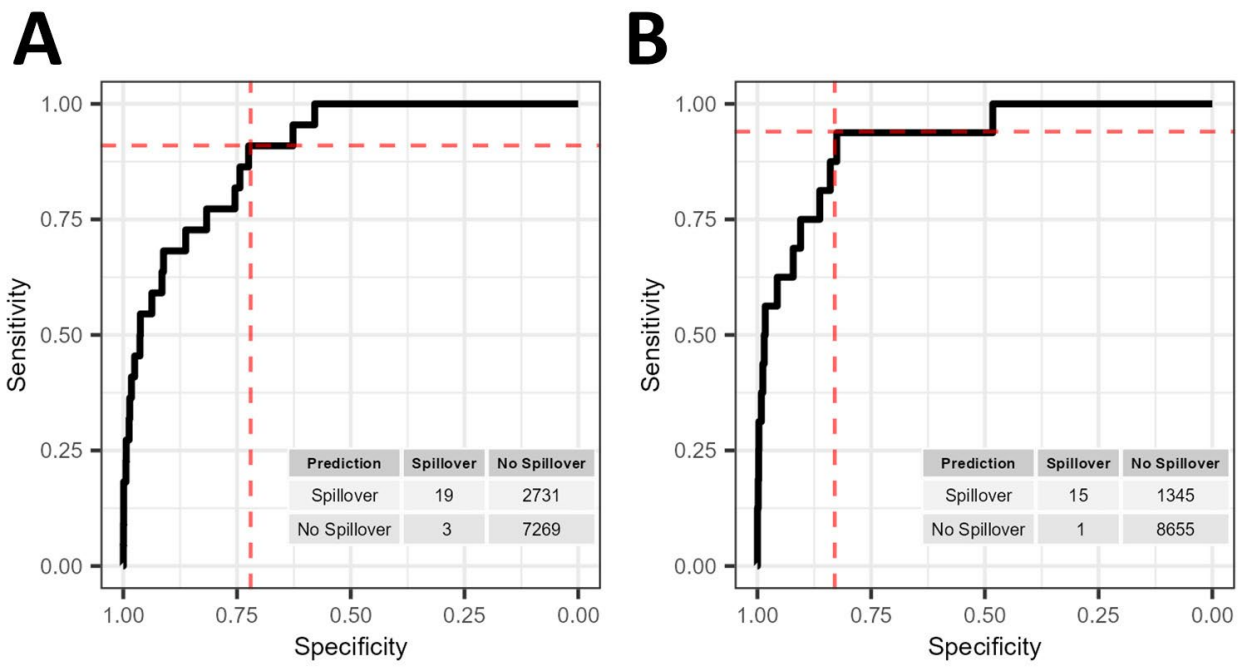


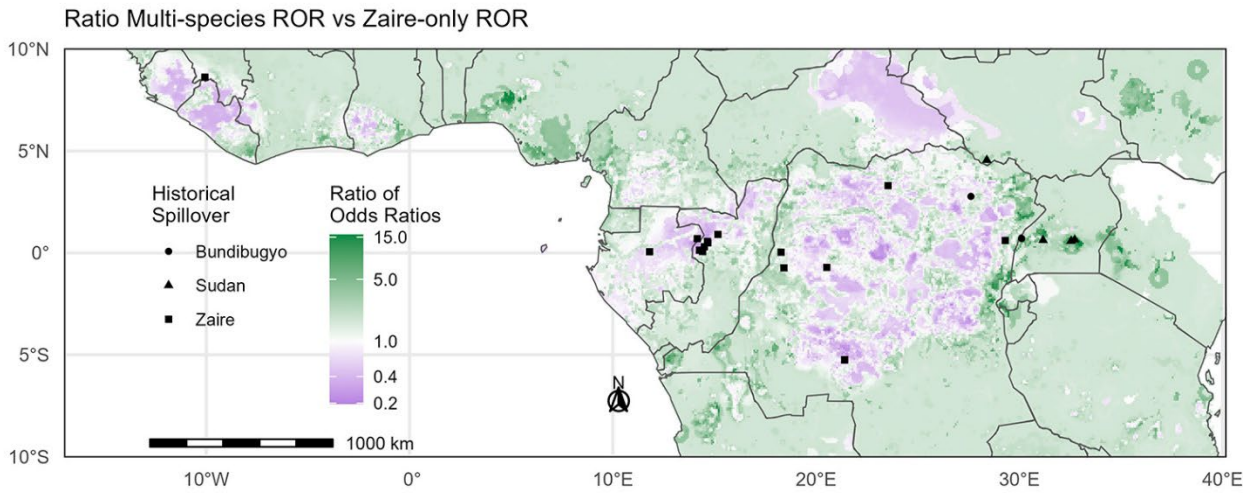
Appendix Figure 1. Maps displaying temporospatial data used in a predictive model for estimating annual *Ebolavirus* spillover potential.



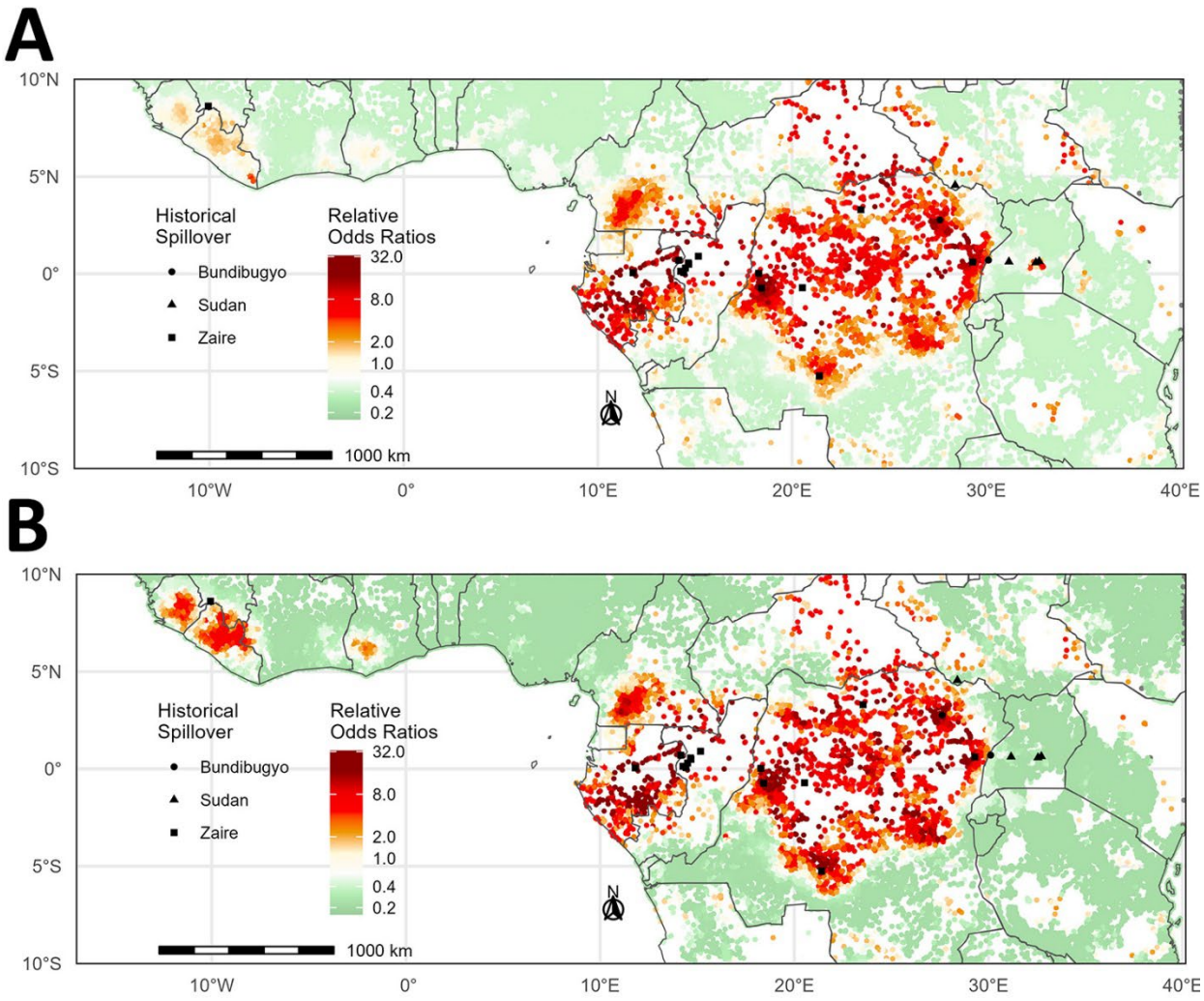
Appendix Figure 2. Map of *Ebolavirus* spillover sites, 2001–2021. Symbols indicate *Ebolavirus* species. Each gray dot represents a randomly generated location-year where spillover was not identified from 2001-2021.



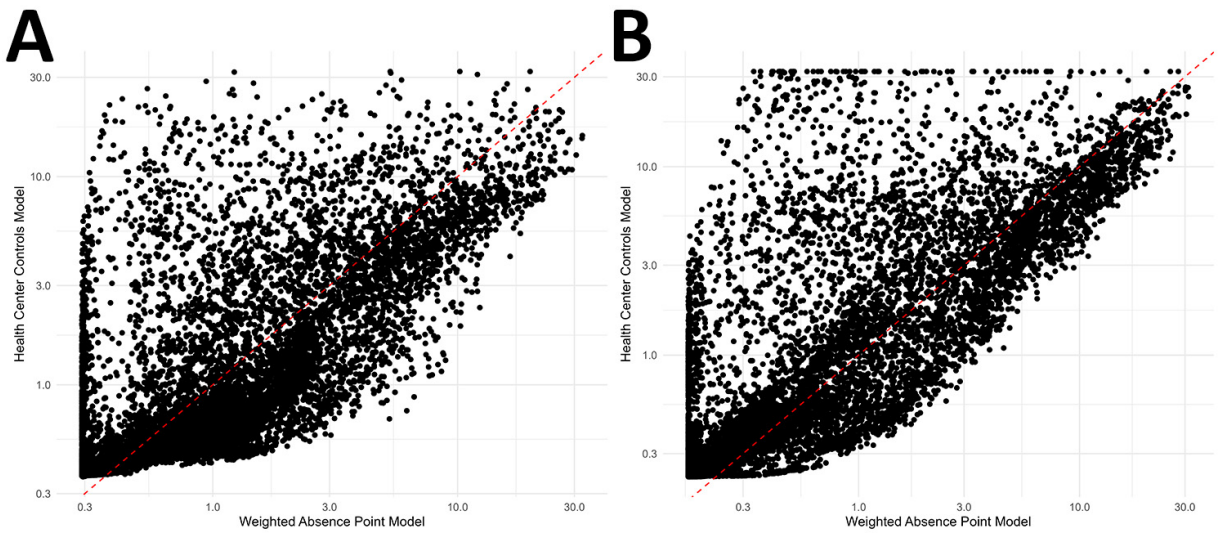
Appendix Figure 3. Receiver operator curves (ROC) visualizing sensitivity and specificity in predicting ebolavirus spillover from the All-species full and reduced analyses (A) and ZEBOV-only full and reduced analyses (B) based on leave-one-year-out cross validation and corresponding confusion matrices resulting from each analysis.



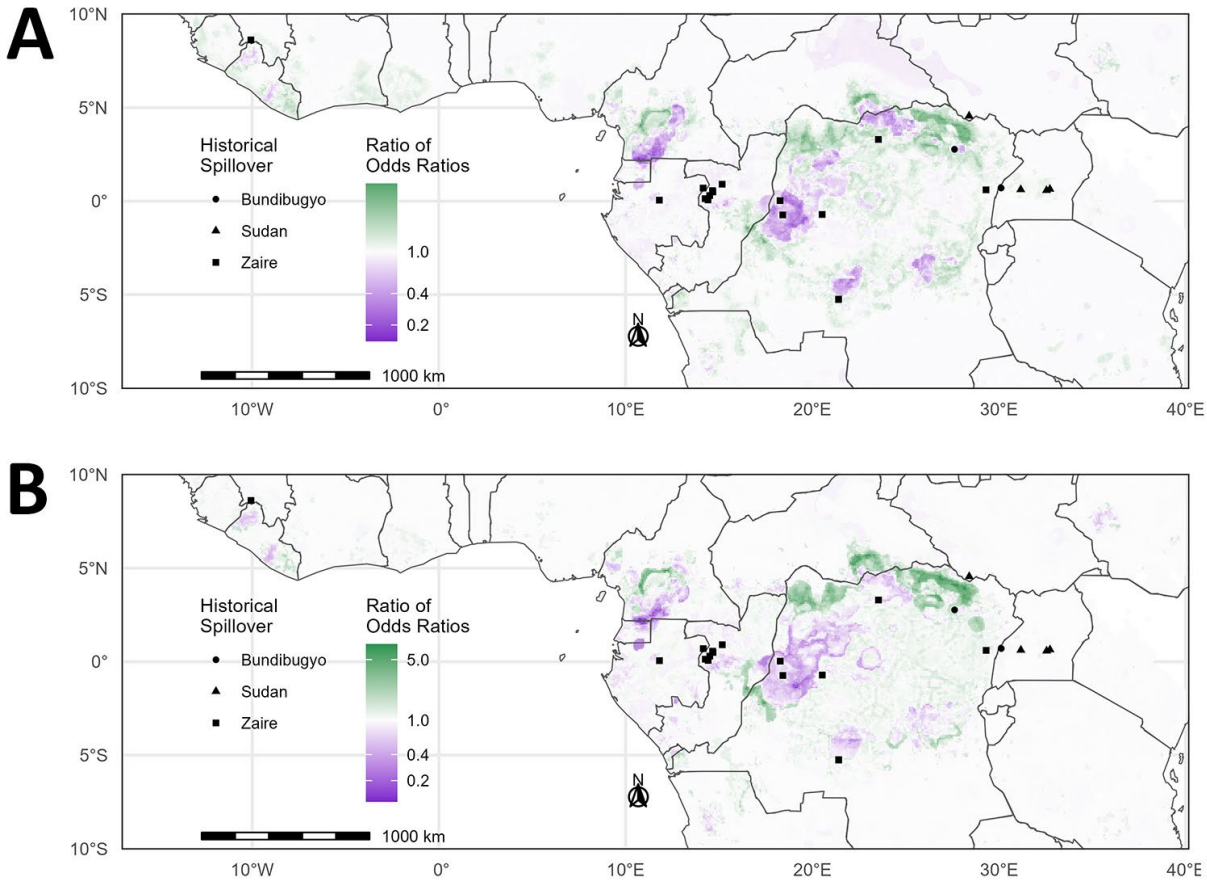
Appendix Figure 4. Map representing the ratio between estimated relative spillover odds in 2022 resulting from the multispecies relative to the ZEBOV-only analysis. Values >1 represent locations where relative spillover odds estimates from the Multi-species analysis were higher, while values <1 represent locations where estimates from the ZEBOV-only analysis were higher. ZEBOV, *Ebolavirus zaire*.



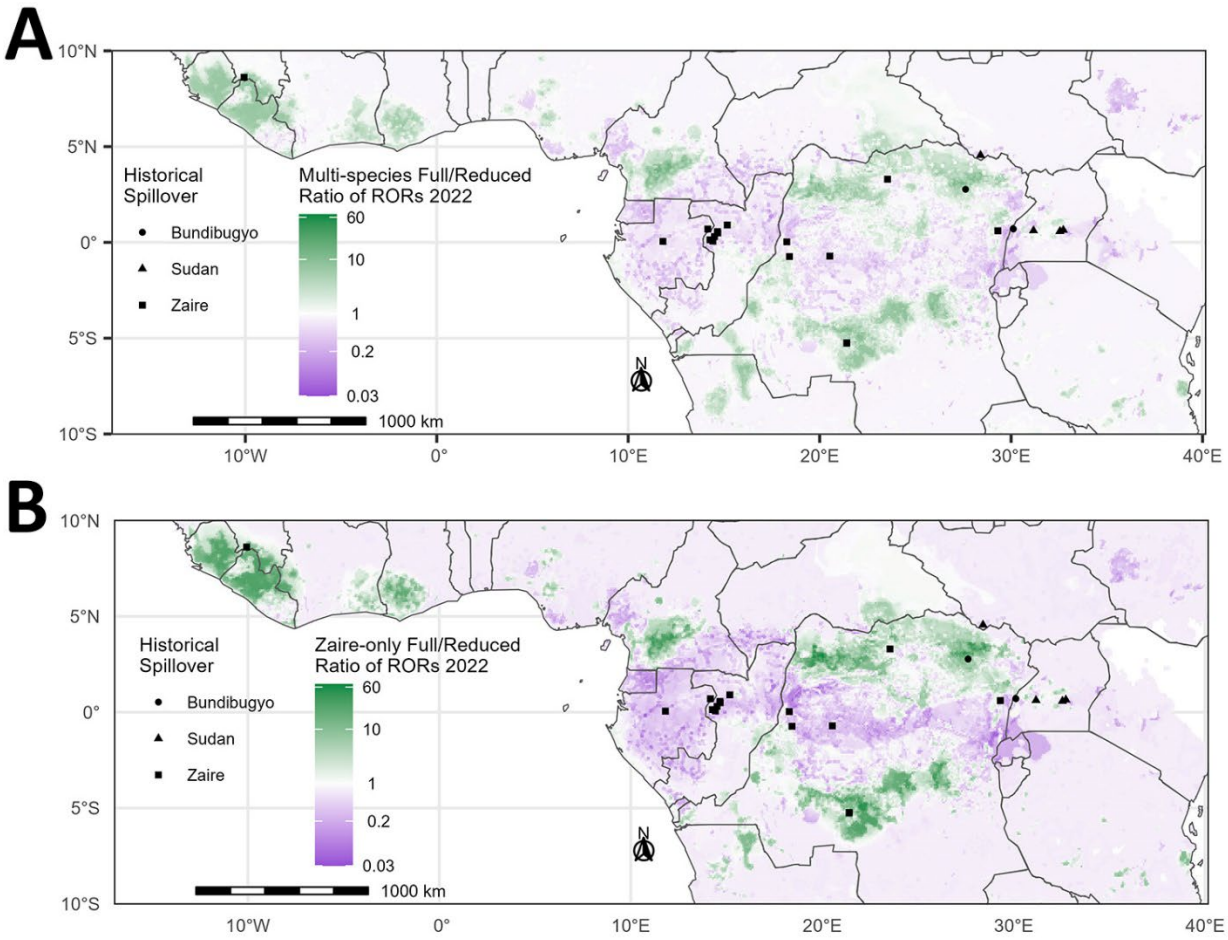
Appendix Figure 5. Relative spillover odds ratio estimates in 2022 resulting from sensitivity analysis which used health center coordinates throughout equatorial Africa as controls to train model of ebolavirus spillover. There were 57,920 heath facilities used as controls and at which estimates of relative spillover odds were made. Each dot in the figure represents a health facility. A) Multispecies model sensitivity; B) *Ebolavirus zaire* only model.



Appendix Figure 6. Estimated spillover relative odds ratios at the locations of health facilities resulting from the primary model trained on random absence points throughout the study area compared to a model whose controls were health facilities for the multispecies (A) and ZEBOV-only (B) analyses. ZEBOV, *Ebolavirus zaire*.



Appendix Figure 7. Sensitivity analysis of different forest definition cutoff values used to classify fragmented forests and their impact on relative spillover odds estimates. A) Multispecies model; B) ZEBOV-only model. Based on previous methods (*21*), fragmented forests are determined based on a binary classification of forests. Maps corresponding to each analysis represent the ratio between the estimated ratio of odds ratios (RORs) using the 80% forest cover as a cutoff versus 70% forest cover as a cutoff to define forests. Purple locations are those whose ROR estimates were higher when forest were defined as >80% forest cover. Green areas are those whose ROR estimates were higher when forests were defined as >70% forest cover. ZEBOV, *Ebolavirus zaire*.



Appendix Figure 8. Ratio between estimated relative spillover odds in 2022 resulting from full models in the multispecies (A) and Zaire-only (B) analyses, relative to the reduced versions of the models that did not make predictions with covariates related to forest changes.