National Institute of Allergy and Infectious Diseases

Laboratory of Virology
Division of Intramural Research, NIAID, NIH

Key research needs to better predict future filovirus outbreaks

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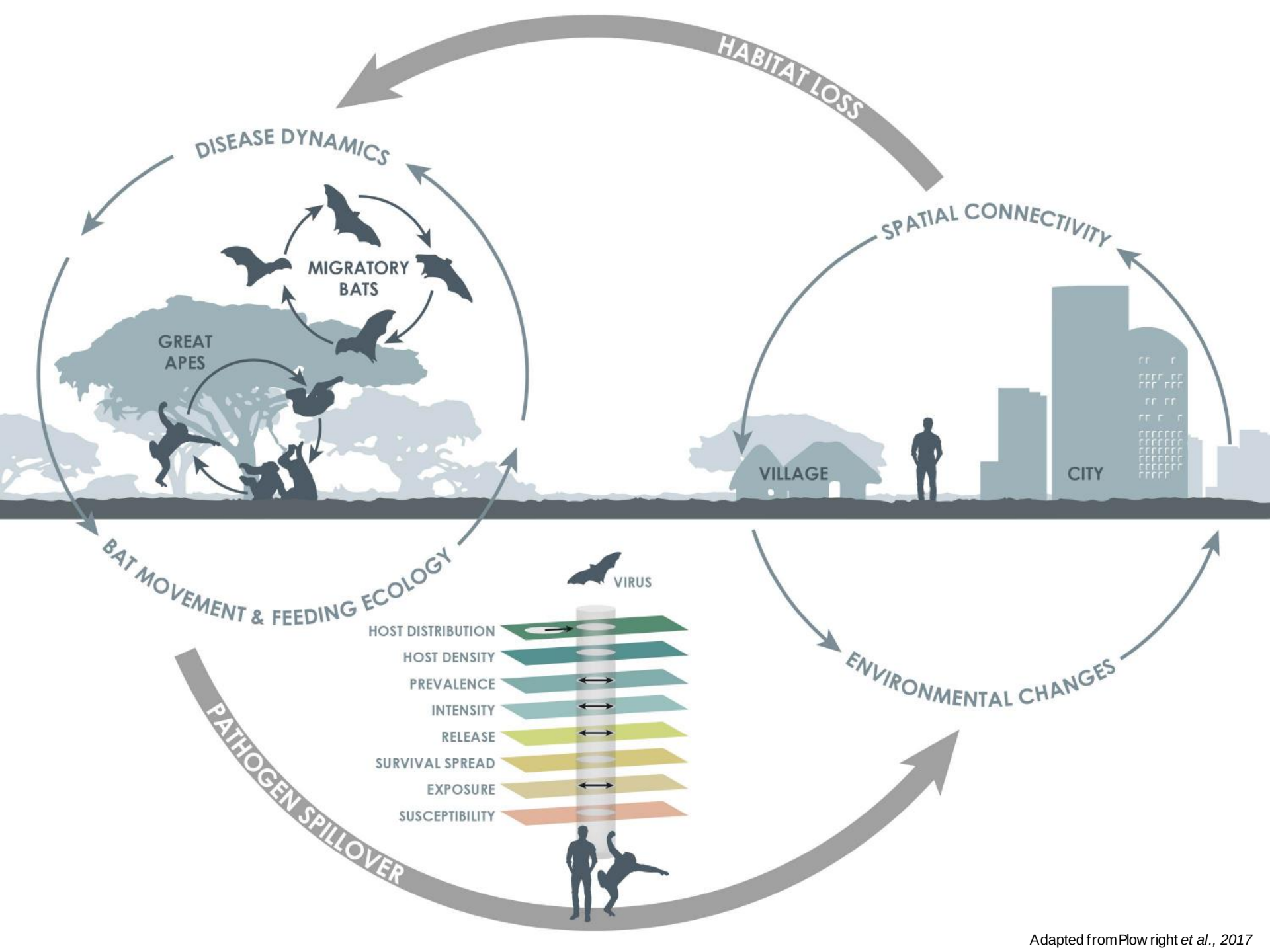
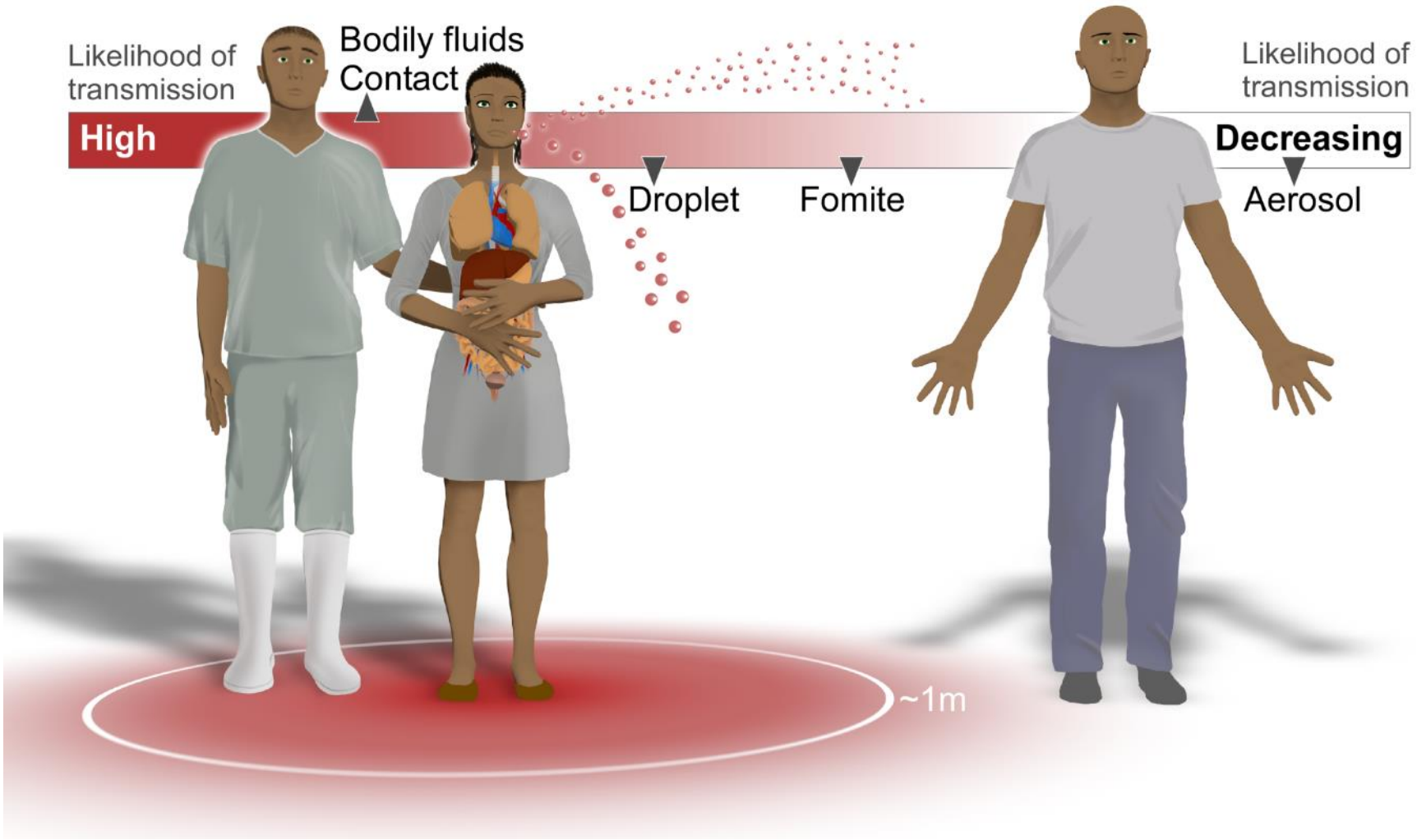


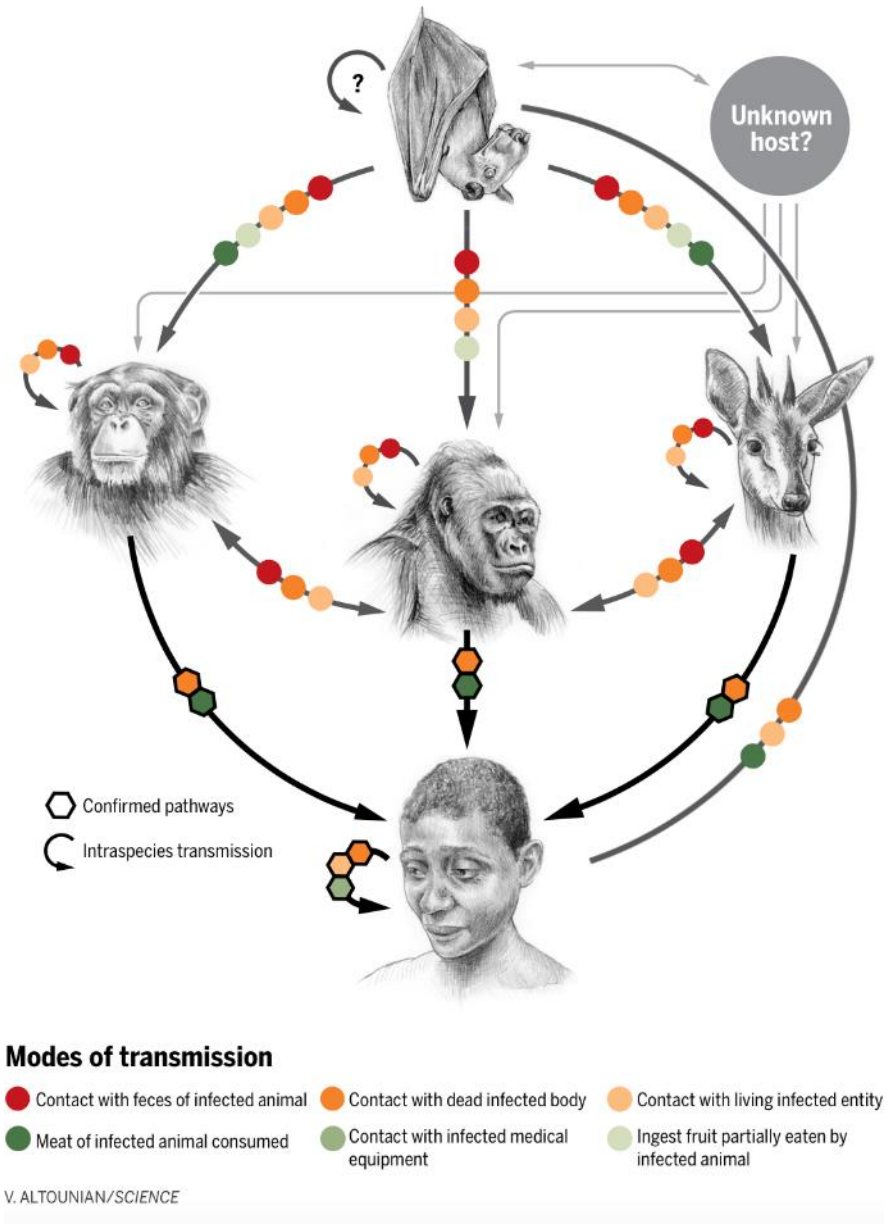
Adapted from Plowright *et al.*, *2017*

Ebola virus transmission

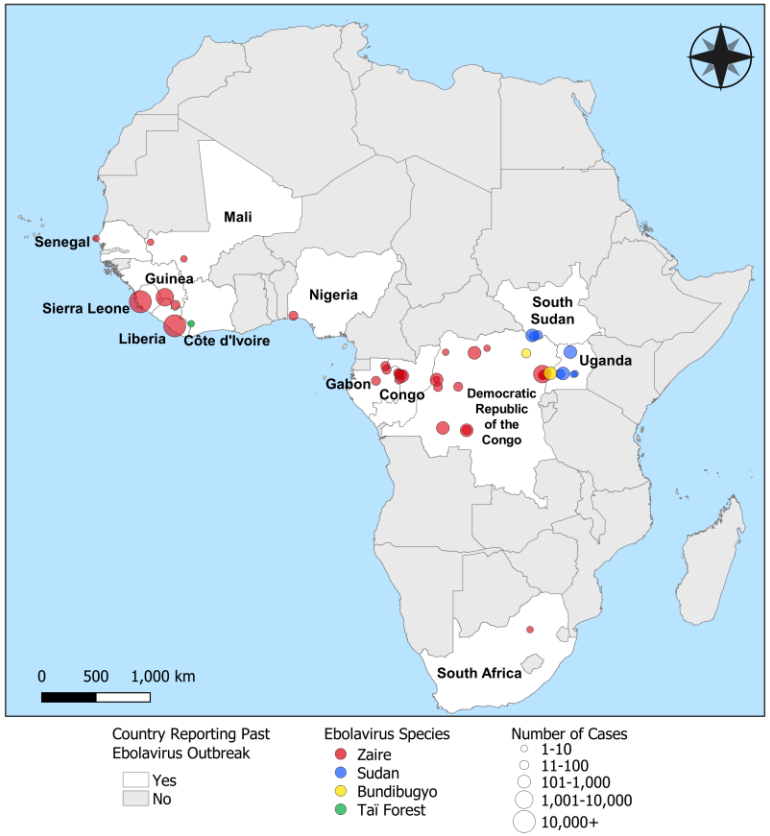


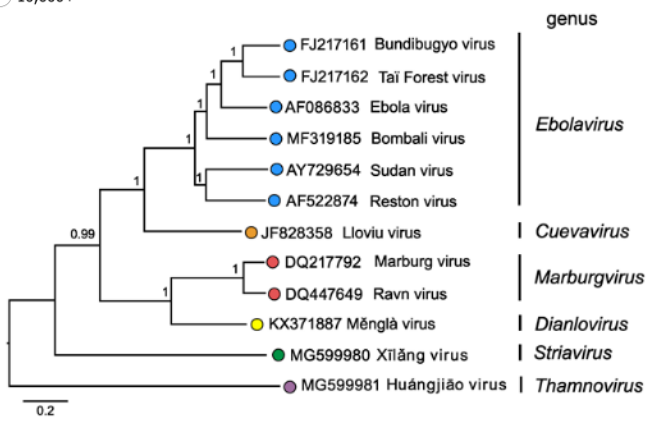
Judson *et al.*, Viruses 2015

Ebolavirus ecology: complex interplay between species



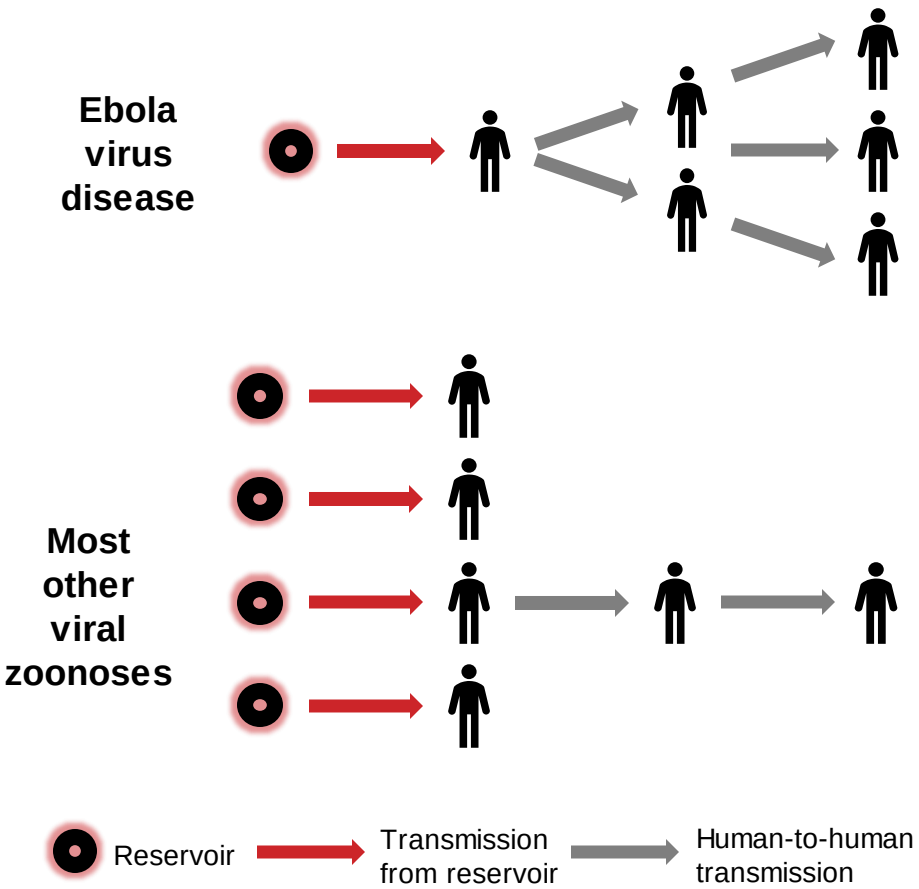
-Filoviruses and their outbreaks

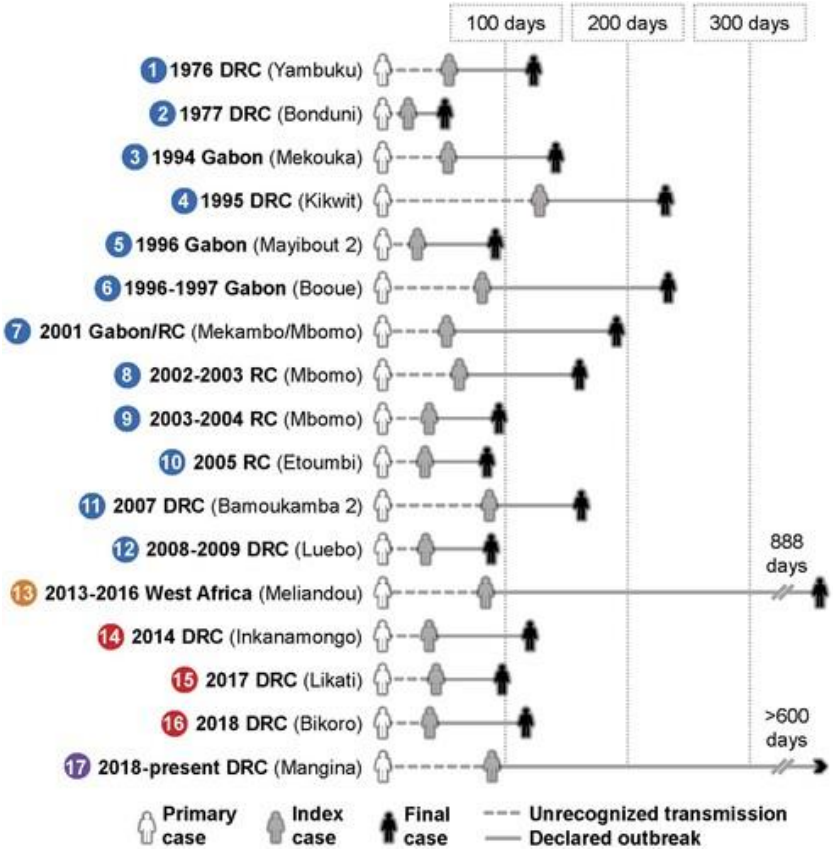




CDC
ICTV: filoviridae
CDC website

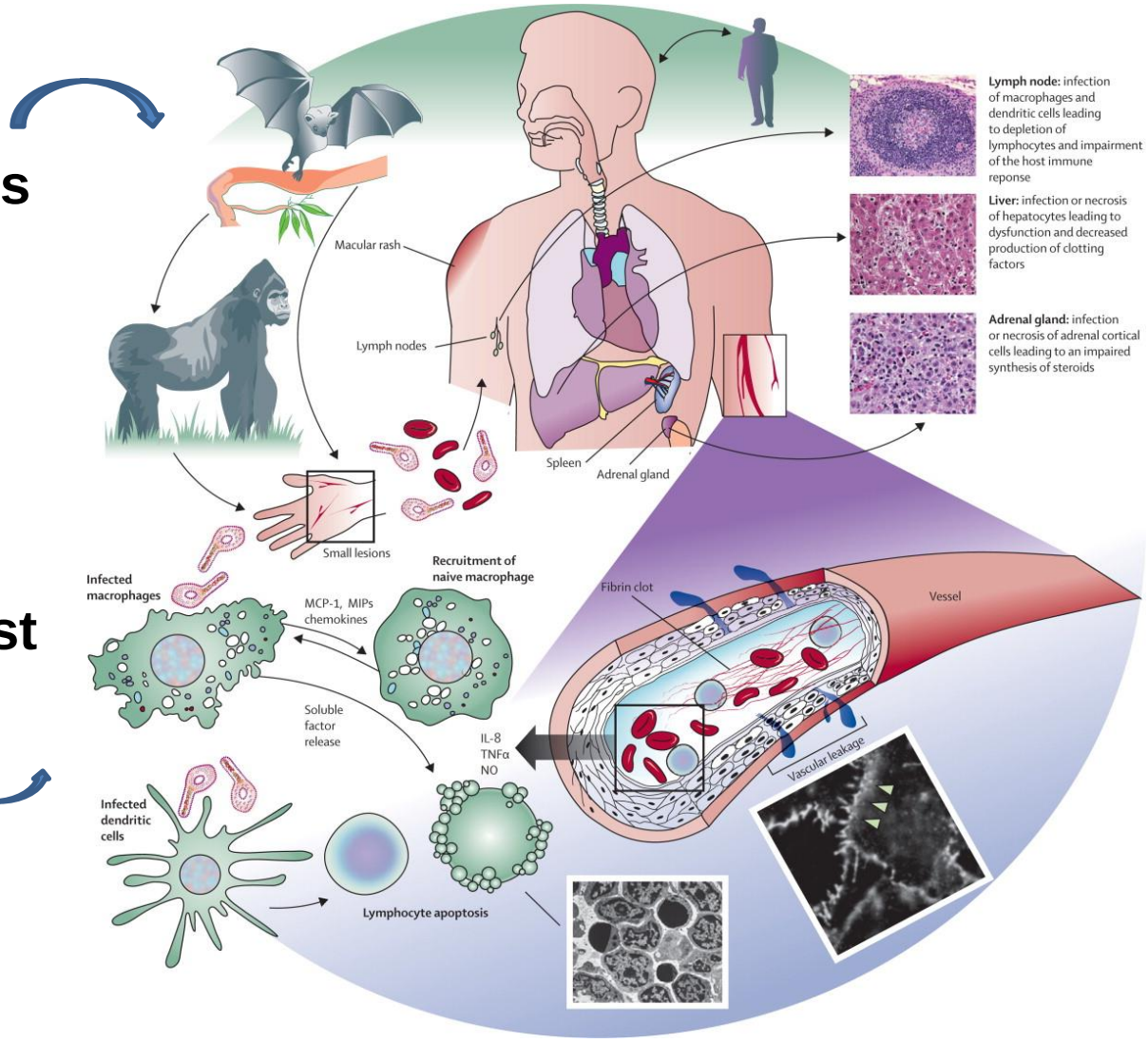
Why is Ebola virus special?





Matson et al, 2020 EMI

- **Ecology between hosts**
  - Host interactions
  - Ecological niches
  - Transmission
- **Ecology within the host**
  - Immune response
  - Virus mechanics
  - Persistence



Feldmann, H., & Geisbert, T. W. (2011). Ebola haemorrhagic fever. *The Lancet*

Bats as Filovirus Hosts

(Kemenesi et al. 2022; doi: 10.1038/s41467-022-32735-w)
(Kemenesi et al. 2018; doi: 10.1038/s41426-018-0067-4)
(Negredo et al. 2011; doi: 10.1371/journal.ppat.1002304)

Lloviu virus

Schreiber's bat
Miniopterus schreibersii

(Yang et al. 2019; doi: 10.1038/s41564-018-0328-y)

Měnglà virus

Rousettus sp.

(He et al. 2024; doi: 10.1073/pnas.2313789121)

Dehong virus

Leschenault's rousette
Rousettus leschenaultii

Marburg virus

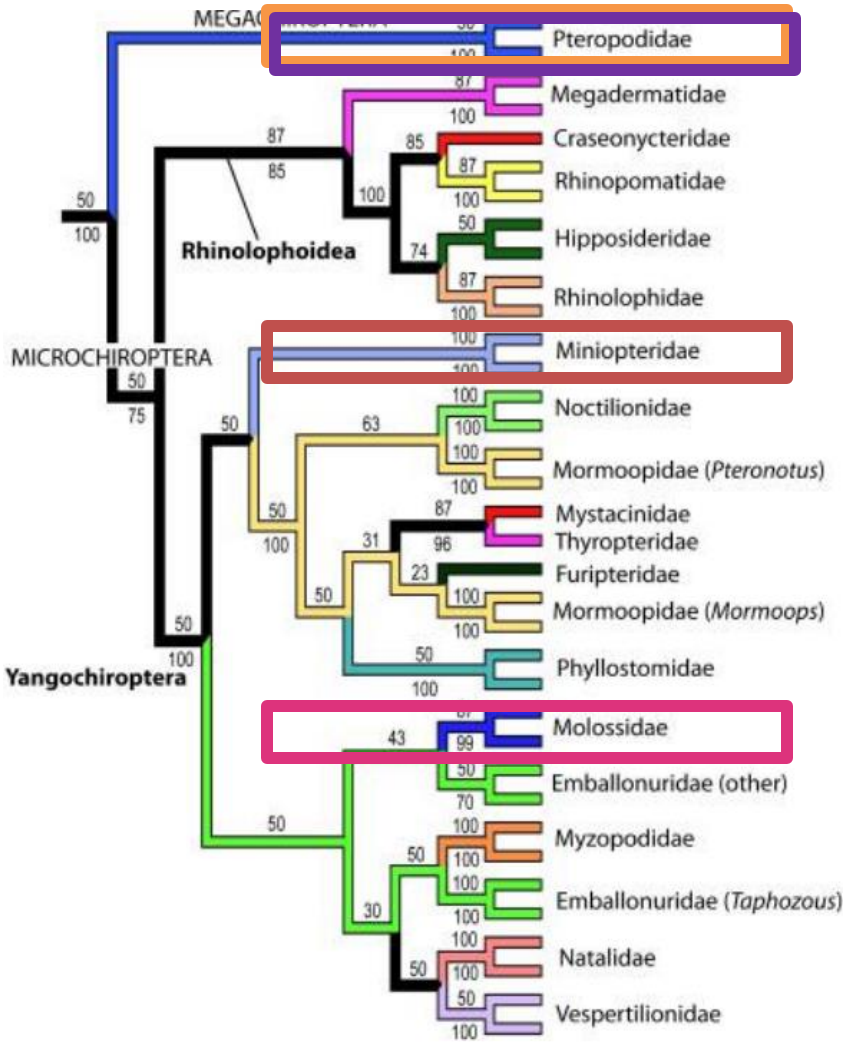
Egyptian rousette
Rousettus aegyptiacus

(Towner et al. 2008; doi: 10.1371/journal.pone.0000764)
(Towner et al. 2009; doi: 10.1371/journal.ppat.1000536)
(Ammann et al. 2012; doi: 10.1371/journal.ppat.1002877)

Bombali virus

Mops condylurus
Chaerephon pumilus

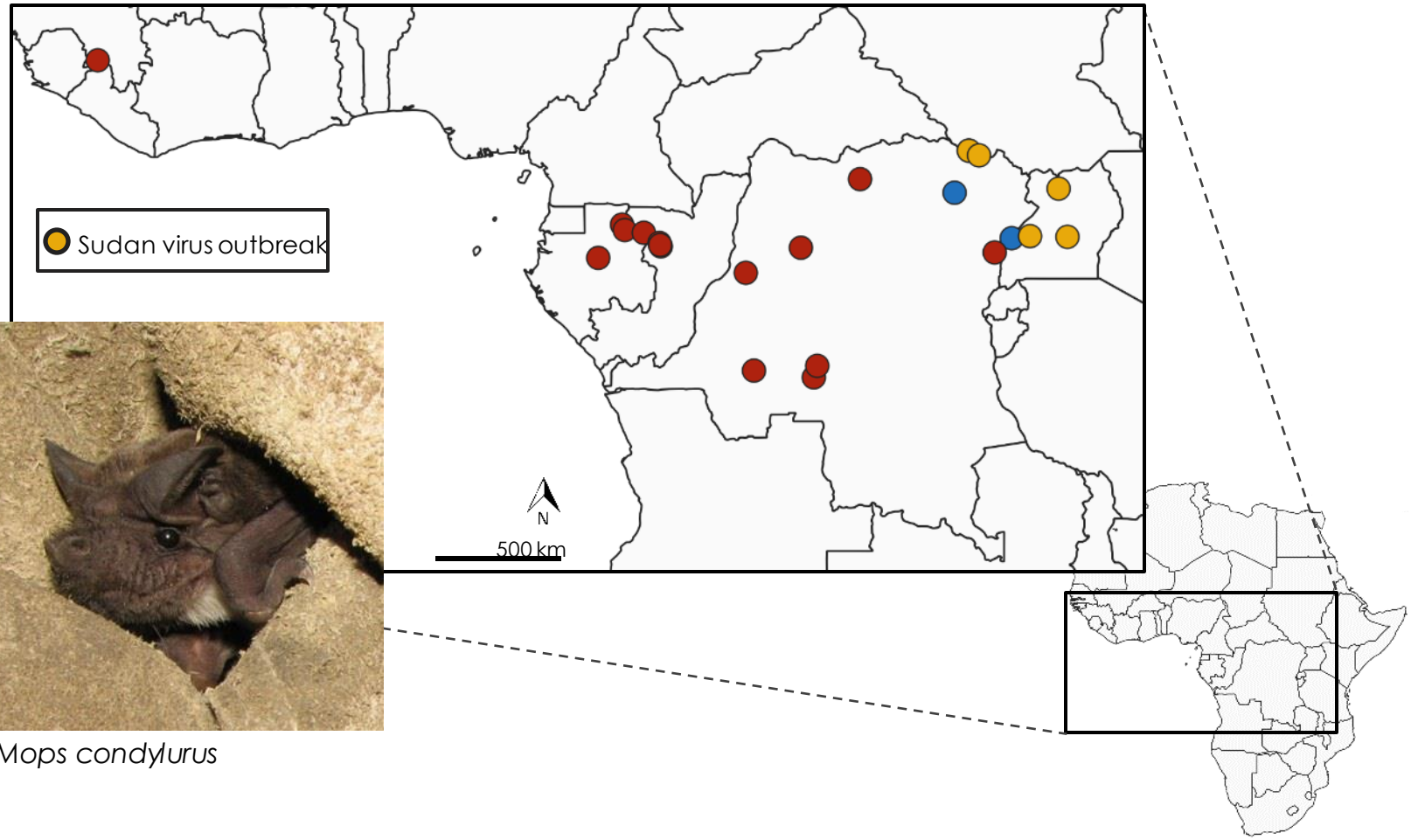
(Lebarbenchon et al. 2022; doi: 10.3201/eid2812.220853)
(Kareinen et al. 2020; doi: 10.3201/eid2612.202925)
(Karan et al. 2019; doi: 10.3201/eid2509.190581)
(Forbes et a;. 2019; doi: 10.3201/eid2505.181666)
(Goldstein et al. 2018; doi: 10.1038/s41564-018-0227-2)



(Agnarsson et al. 2011; doi: 10.1371/currents.RRN1212)

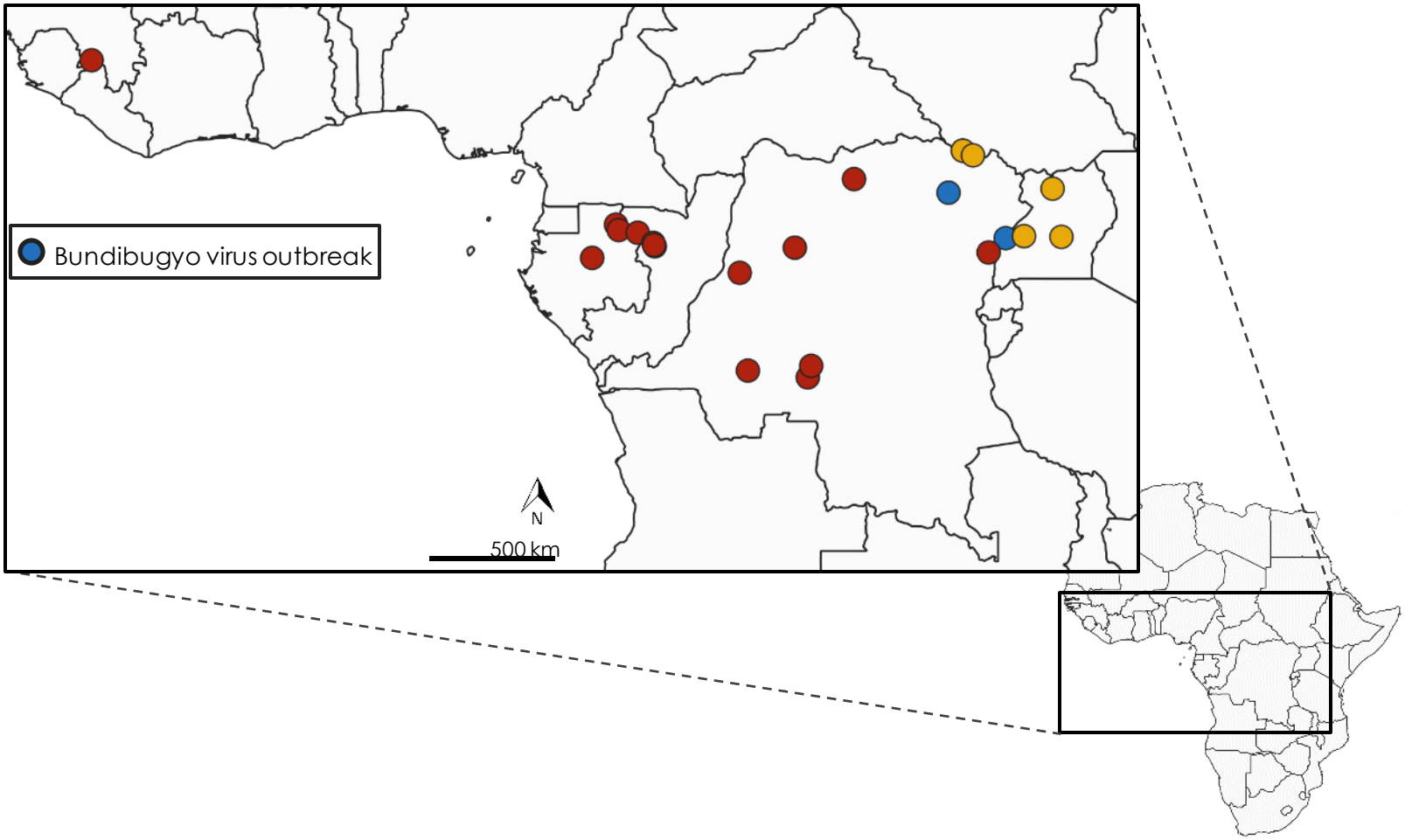
Ebolaviruses: Evidence for bats as the reservoir

Mops condylurus

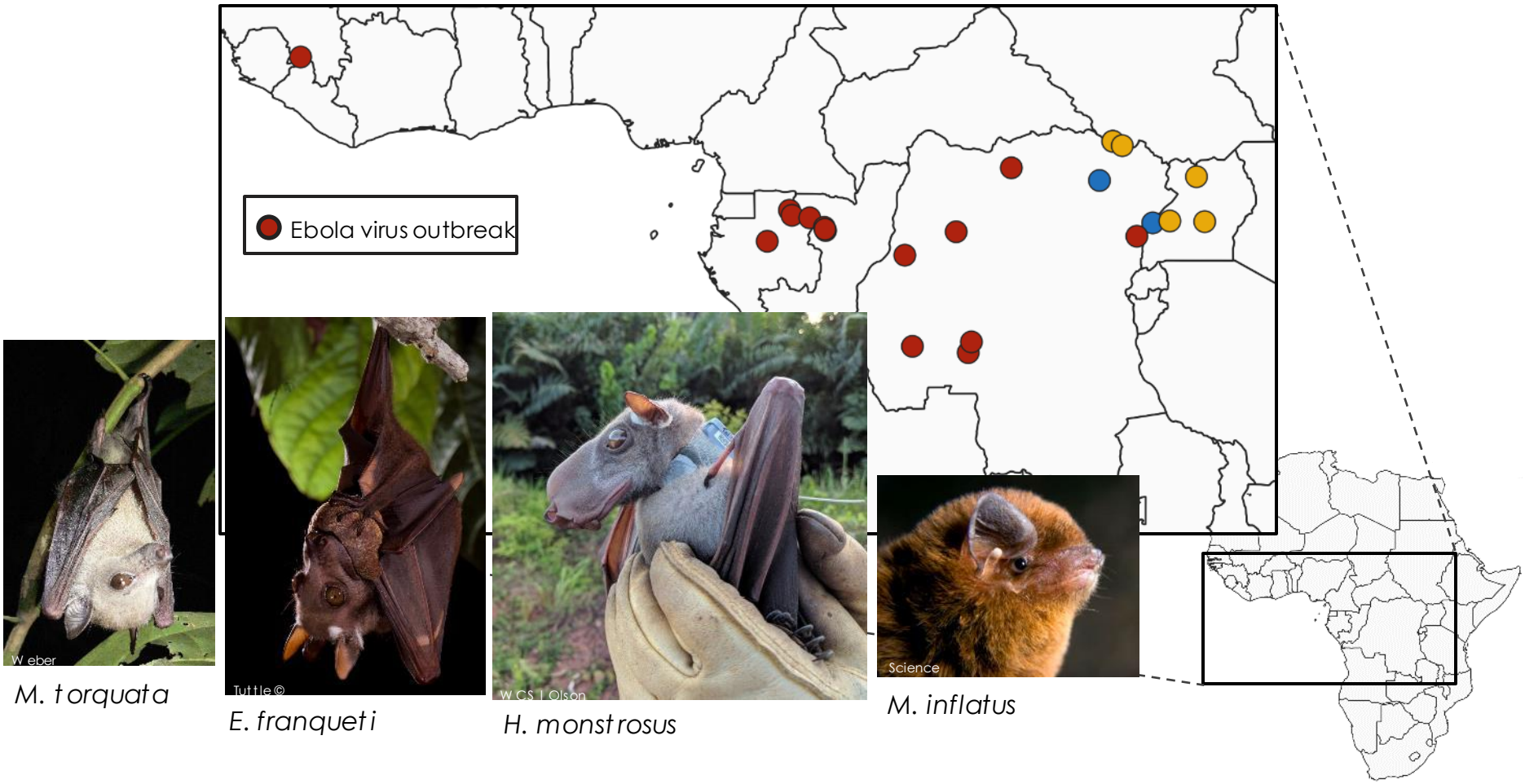


Mops condylurus (Angolan free-tailed bat): host for Bombali virus – Sierra Leone and Kenya

Ebolaviruses: Evidence for bats as the reservoir



Ebolaviruses: Evidence for bats as the reservoir



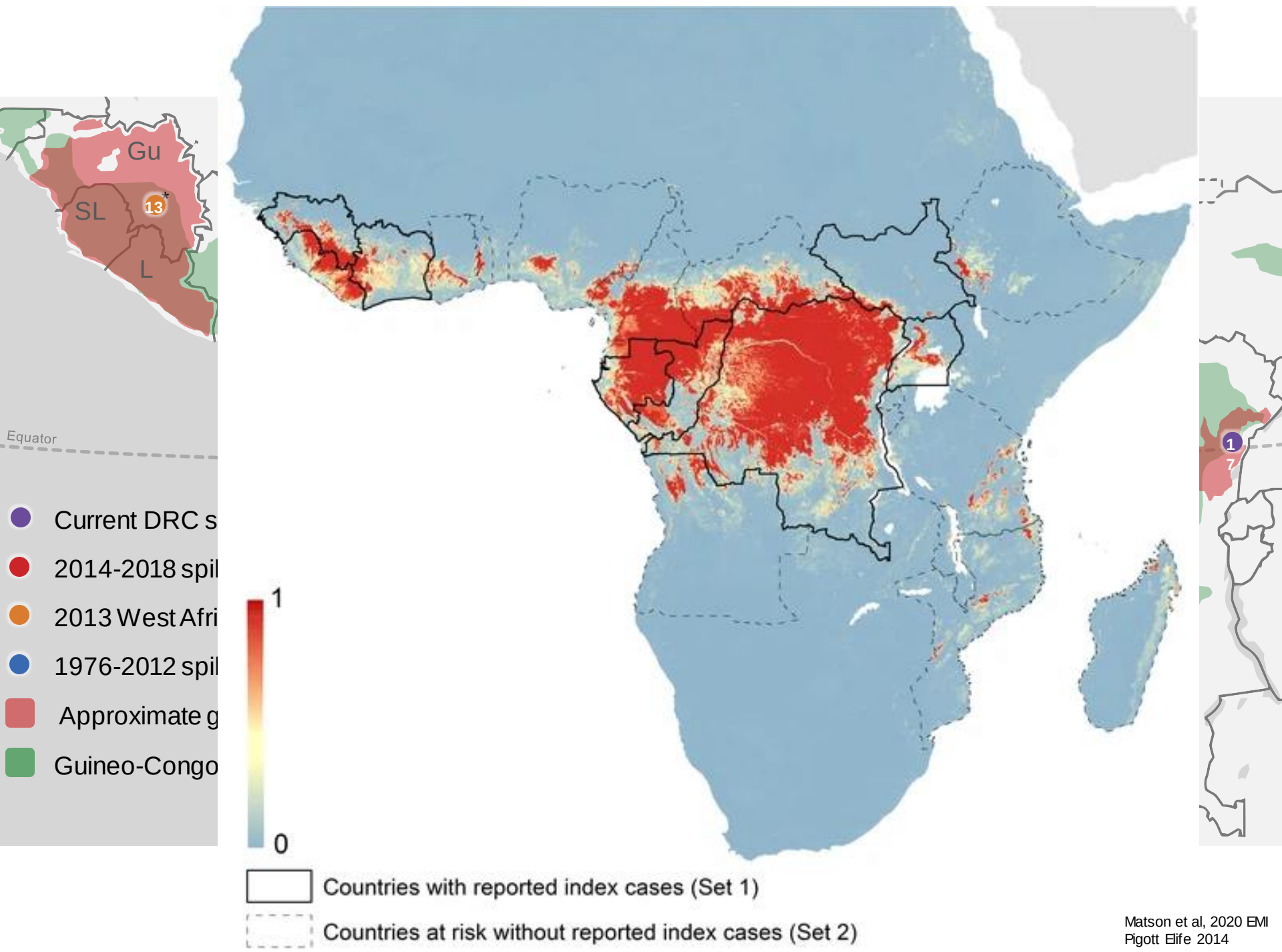
M. torquata

E. franqueti

H. monstrosus

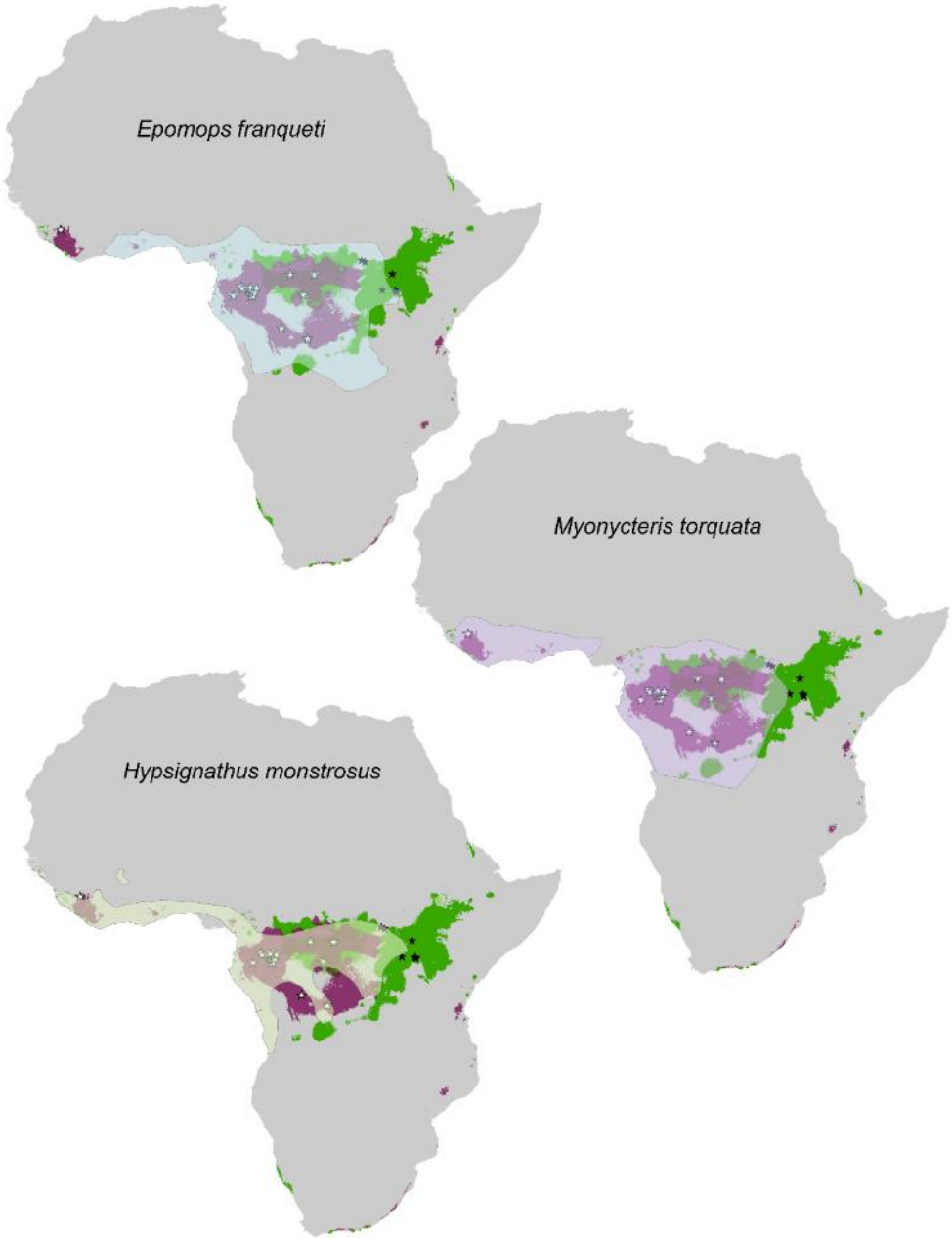
M. inflatus

Mineopterus inflatus (Greater Long-fingered bat): 25% EBOV genome



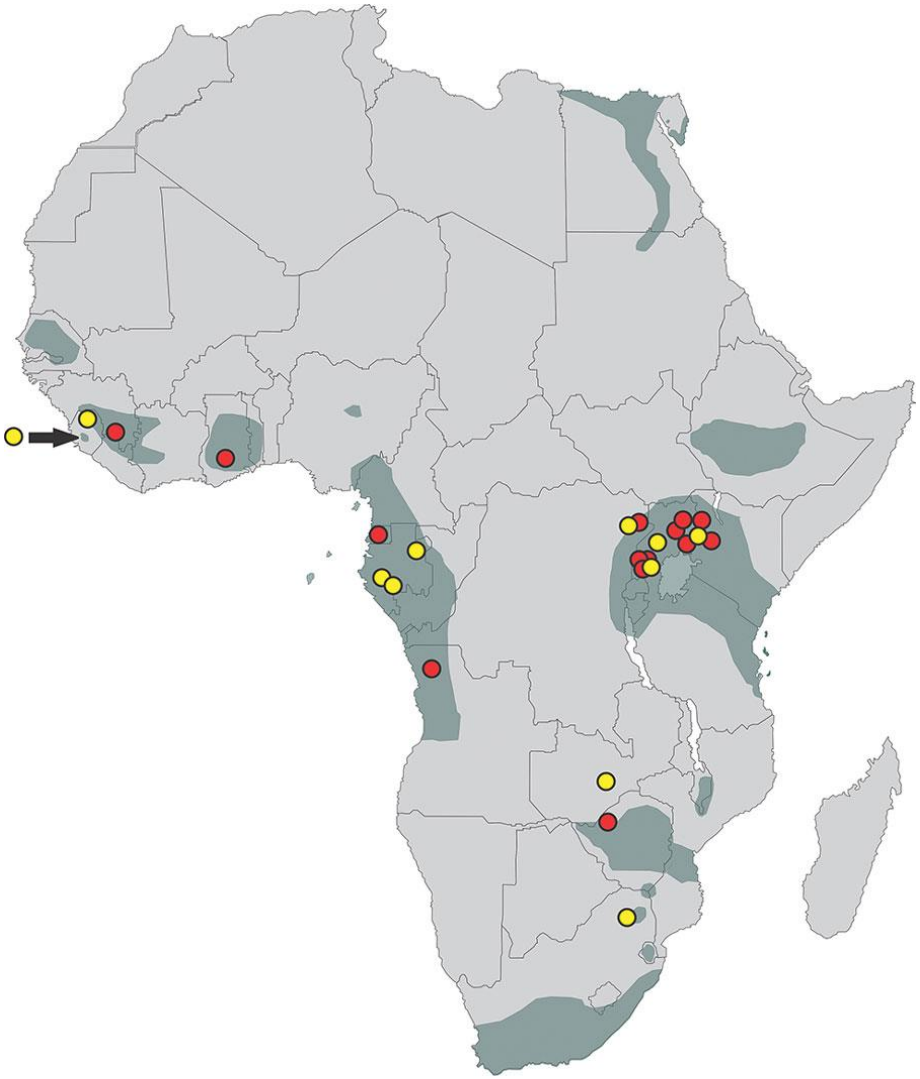
Matson et al, 2020 EMI
Pigott Elife 2014

Ecological niche mapping identifies putative bat host species for EBOV



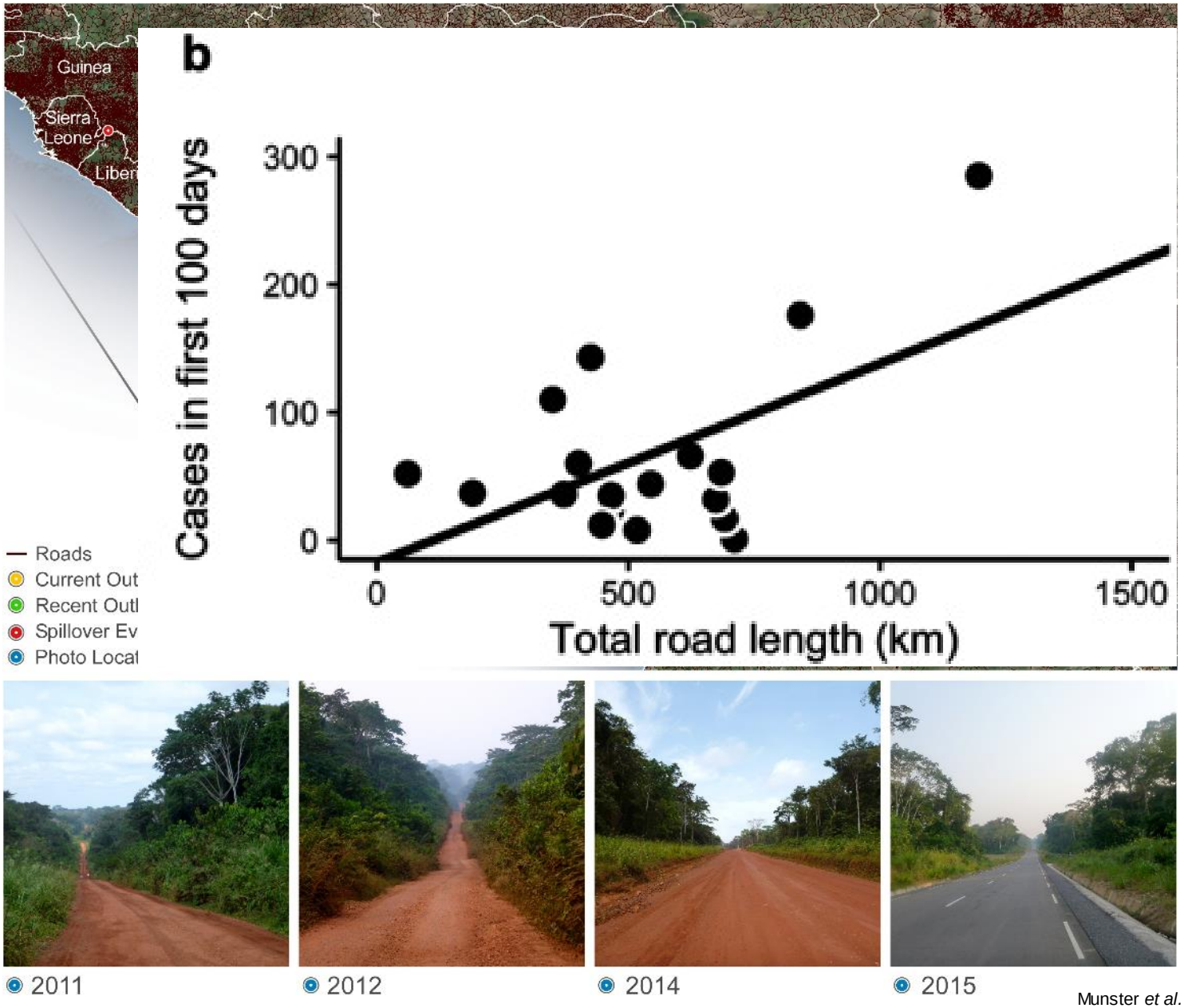
Judson *et al.*, PLoS Pathogens 2016

Marburg Rousettus host mapping shows clear spillover risk



Amman *et al.*, *EID 2023*

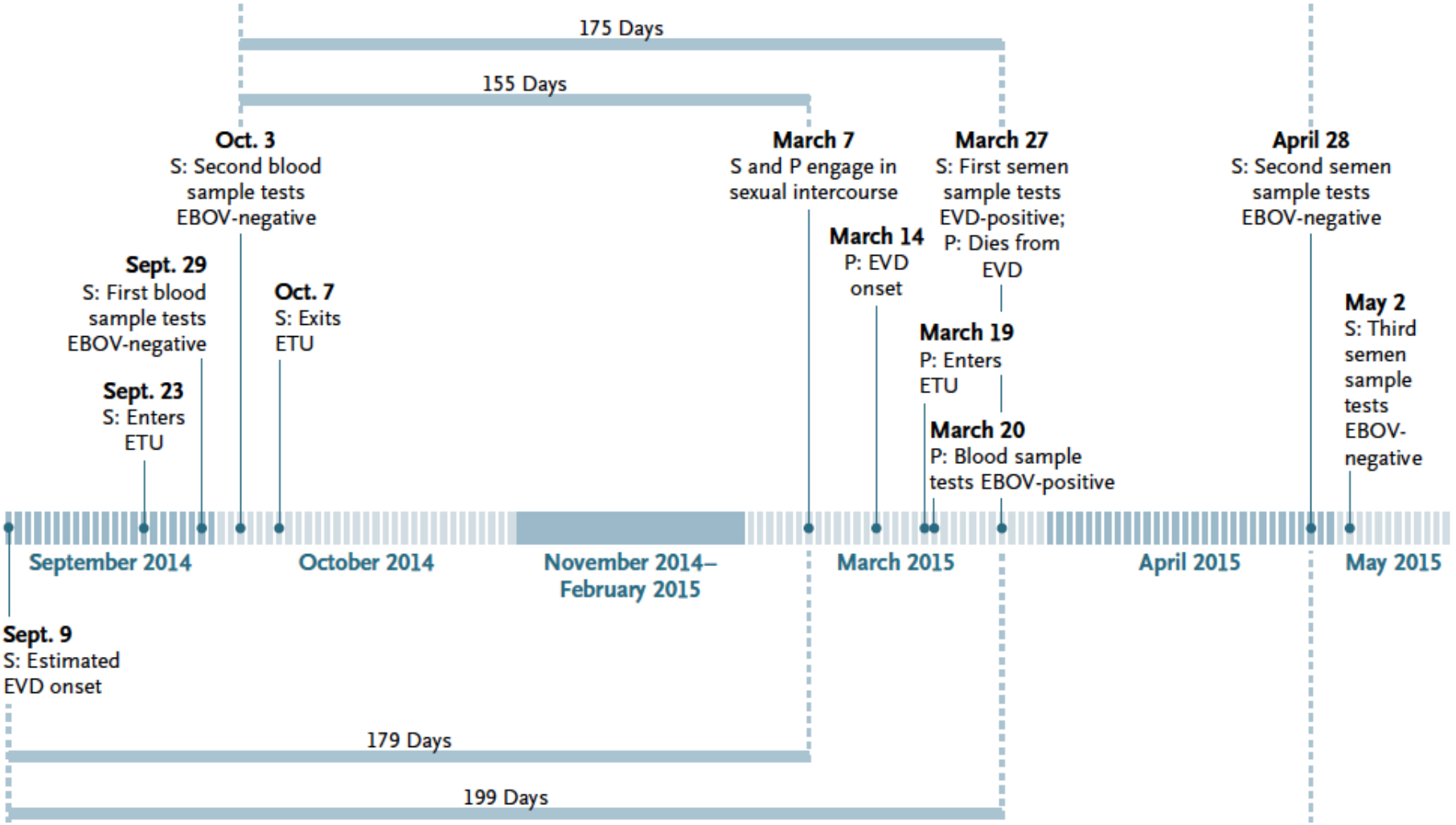
Ebolavirus: changing spatial connectivity in Africa



Munster *et al.*, NEJM 2018
Gonzales et al, Biorxiv 2023

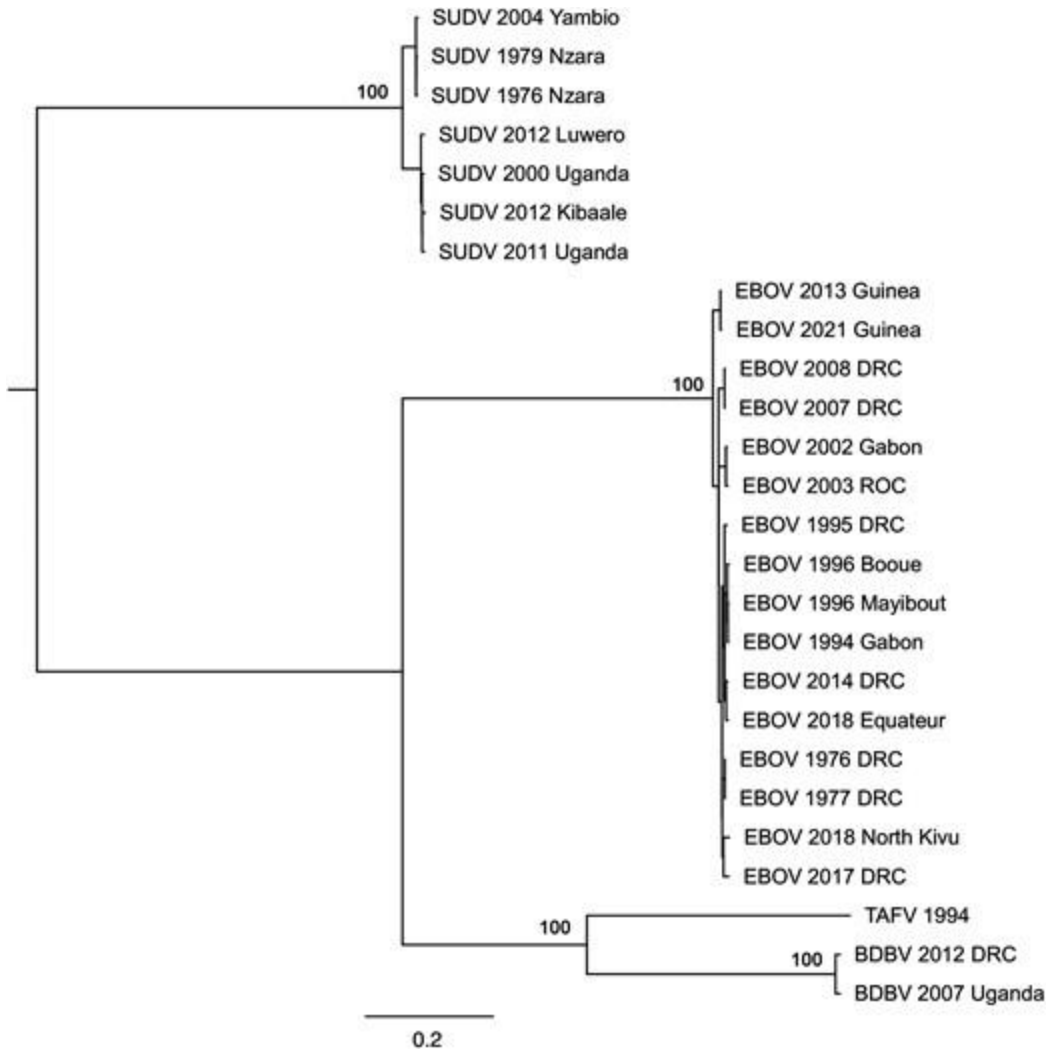
Ebolavirus, bats as bushmeat, DRC 2017

Ebolavirus outbreak West Africa, Liberia
- Sexual transmission -



Christie et al., MWWR 2015
Mate *et al.*, NEJM 2015

Multiple origins of Ebola virus Disease outbreaks



Mate *et al.*, NEJM 2015
Judson *et al.*, JID 2023

Knowledge gaps and perspective

- The diversity of filoviruses in bats / reservoir hosts is still poorly understood
- The geographical “at risk” area increased dramatically over the last decade
- Multiple species are involved in the circulation of Ebolaviruses
- A better understanding of the drivers of Filovirus spillover are needed
- Human-animal interface is increasing
- Better understanding of human survivors as a spillover risk