WHO Monkeypox Research:
What are the knowledge gaps and priority research questions?

Monkeypox and wildlife (animals)

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World Health Organization

World Organisation for Animal Health
Founded as OIE

EcoHealth Alliance

R&DBlueprint
Powering research to prevent epidemics

Overall objectives:

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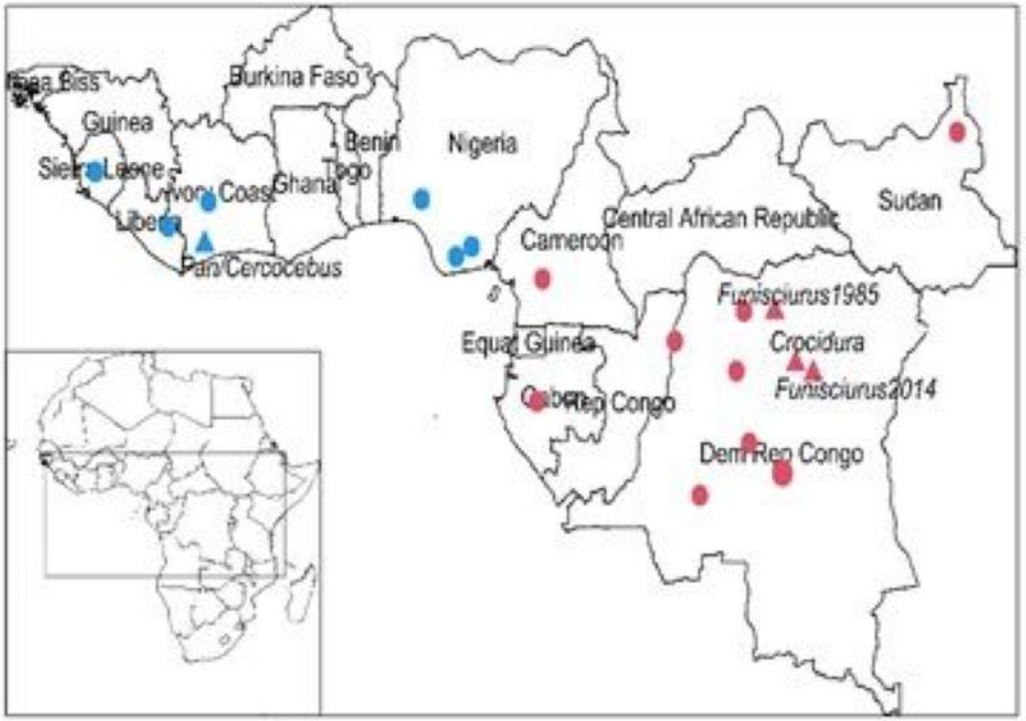
Prevent transmission between animals and humans including future spillover and potential creation of novel animal reservoirs, applying a One Health approach for risk reduction strategies at the human-animal-environment interface

- Identify animal source(s) and reservoir(s), as well as the mode of transmission between animals and humans
- Identify risk factors of spillover - behavioral, ecological, socio-economic
- Identify risk reduction strategies at the human-animal-environment interface

State of the art

- Definitive animal reservoir unknown



Mariën, Laudisoit, Patrono, et al. *in press*

State of the art

- Definitive animal reservoir unknown
- Evidence of infection/susceptibility:
  - *Crocidura littoralis,* **Butiaba naked-tailed shrew**

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  - *Crocidura littoralis,* **Butiaba naked-tailed shrew**
  - *Funisciurus anerythrus,* **Thomas's rope squirrel**

West and Central Africa

Wet lowland and swamp forest

State of the art

- Definitive animal reservoir unknown

- Evidence of infection/susceptibility:
  - *Crocidura littoralis,* **Butiaba naked-tailed shrew**
  - *Funisciurus anerythrus,* **Thomas's rope squirrel**
  - *Funisciurus bayonii,* **Lunda rope squirrel**

Moist Grasslands - Savanna

State of the art

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- Evidence of infection/susceptibility:
  - *Crocidura littoralis,* **Butiaba naked-taile**
  - *Funisciurus anerythrus,* **Thomas's rope squirrel**
  - *Funisciurus bayonii,* **Lunda rope squirrel**
  - *Stochomys longicaudatus,* **target rat**

Humid rainforest and swamps

State of the art

- Definitive animal reservoir unknown

- Evidence of infection/susceptibility:
  - *Crocidura littoralis,* **Butiaba naked-tailed shrew**
  - *Funisciurus anerythrus,* **Thomas's rope squirrel**
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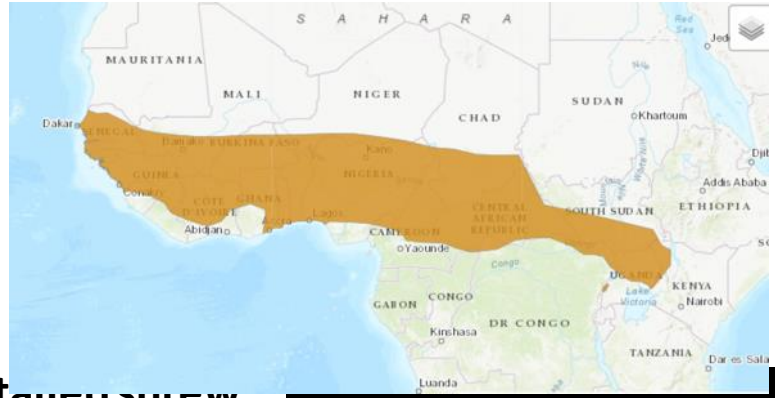
  - *Stochomys longicaudatus,* **target rat**
  - *Cricetomys sp,* **Giant pouched rats**



Forests and thickets - colonies

State of the art

- Definitive animal reservoir unknown

- Evidence of infection/susceptibility:
  - *Crocidura littoralis,* **Butiaba naked-tailed shrew**
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  - *Funisciurus bayonii,* **Lunda rope squirrel**
  - *Stochomys longicaudatus,* **target rat**
  - *Cricetomys sp,* **Giant pouched rats**
  - *Human and non-human primates*

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  - *Human and non-human primates*
  - *Prairie dogs, hamsters - pet trade related*

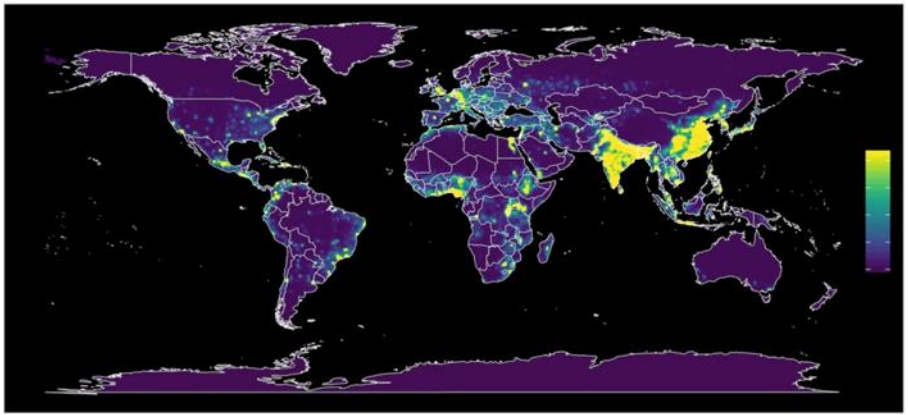
Research priorities	Why?	What type of research/studies are needed ?
1. Investigation of animal sources and routes of transmission	To identify animal sources	• Identify/characterise MPXV's in captive and free-ranging wildlife and, livestock and pets animals. • Trace-back investigations of wildlife around index cases • Wildlife surveillance in endemic areas
	To increase knowledge about transmission pathways between animals and humans	• Monitoring and characterization of the infection with MPXV in susceptible species; • Effectiveness and impact of protective and sanitary measures for high risk / high value animals • Human to animal transmission routes
	To increase knowledge of the role of animals and animal products for human and animal infections to inform risk reduction strategies	• Monitoring of susceptible species; • Surveillance of animals and animal products in trade

Research priorities	Why?	What type of research/studies are needed ?
2. Understanding viral circulation in animal populations	To prevent spillover (risk reduction)	• Monitoring of the emergence in susceptible species; • Characterization of the susceptibility, infectivity, pathogenicity and transmissibility in animal species and populations. • Characterization of different strains in circulation
3. Socio-economic and behavioural risk factors for spill-over	To identify the risks linked to trade and consumption of potentially infected animal species and the communities or occupational groups more at risk across different interfaces.	• Better understanding of the dynamics around wildlife capture, transport, and trading, and current prevention strategies • Analysis of behavioural and organisational risks along the wild animal value chain • Identify strategies to manage infection risks related to handling of of wild animals

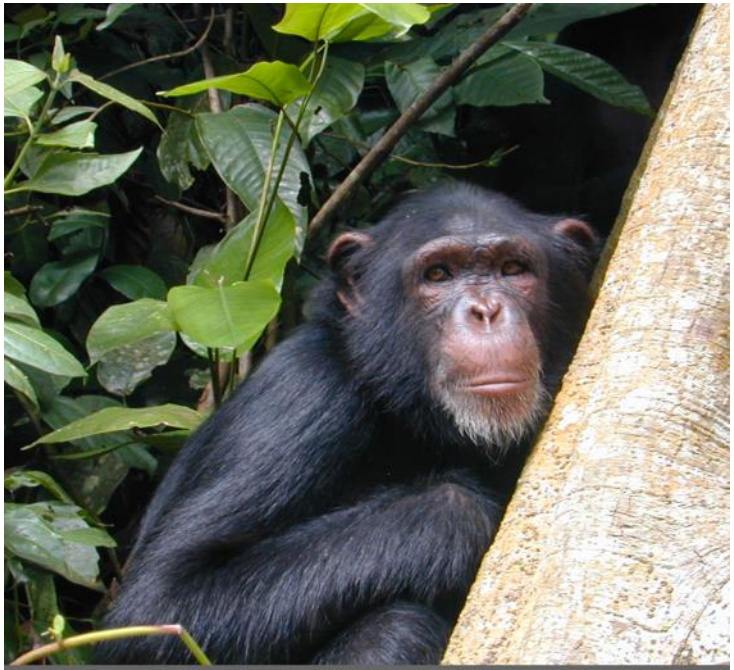
Research priorities	Why?	What type of research/studies are needed ?
4. Risk reduction strategies at the human-animal-environment interface	To increase knowledge about reducing risk along transmission pathways between animals and humans	• Risk communication strategies avoiding stigmatisation and other unintended consequences; • Social and behavioural change (SBC) practices to improve hygiene practices along the food chain; • SBC practices to implement realistic and feasible strategies to encourage a high level of compliance with hygienic and other universally adopted standards in markets;

Ongoing research priorities

Research priorities	Why?	What type of research/studies are needed ?
1. Drivers of emergence and hotspots	Identification of areas, timing, and activities that increase risk of infection.	Spatial analyses and modeling of ecological factors and human activities associated with infections.
2. Investigation of circulation of viruses in animal populations in emerging infectious diseases hotspots; development of field diagnostic tools	Determination of viruses circulating in wildlife, farmed and domestic animals and potentially dangerous for humans	Continued sampling of species of interest for identification of OPXV's, could be extended to other virus families

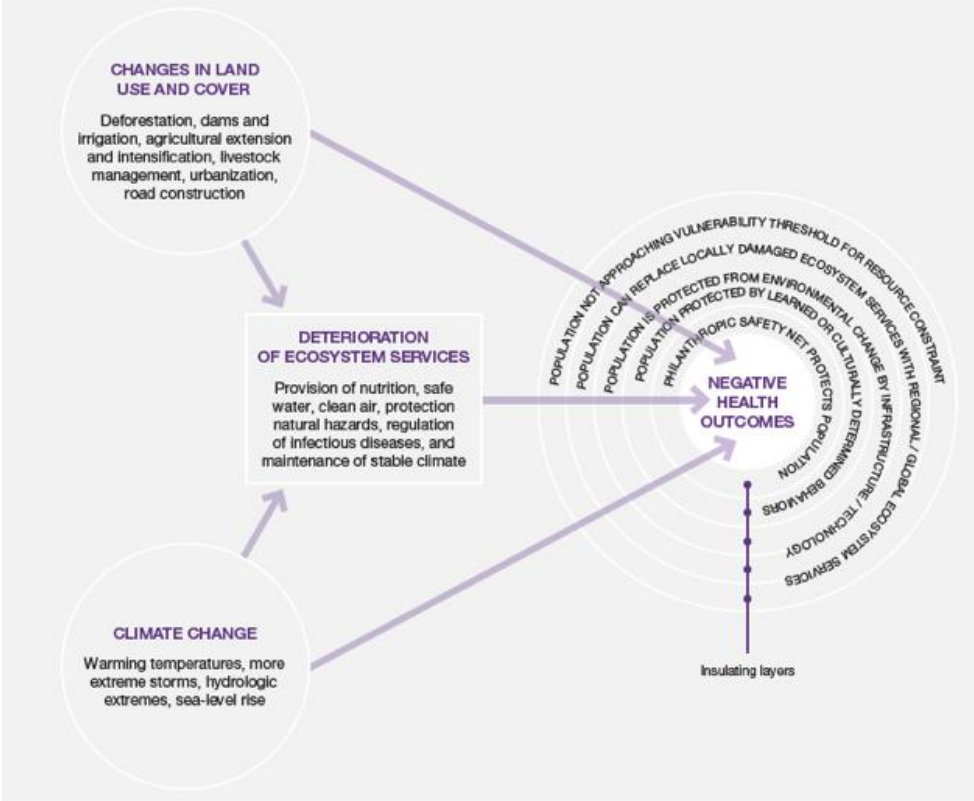


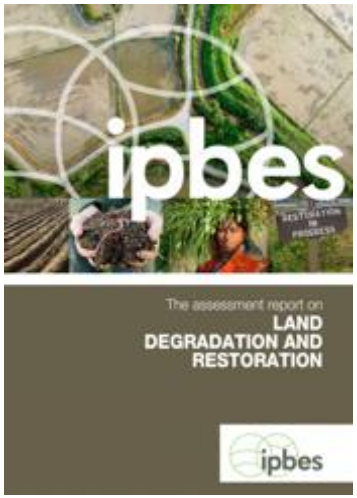
One Health
In practice



After the outbreak ended and the investigation was complete, agencies compared this response to previous outbreak responses. The use of a One Health approach in this case was estimated to provide a two-third reduction in the total cost of the investigation and a response time that was a full 10 days faster. This was achieved through sending a single investigation team with representatives from multiple ministry sectors and requiring only a single government travel authorization.

Land Degradation, Climate, Mediators, and Health Outcomes





Working Group:

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Emmanuel Couacy-Hymann (Cote D'Ivoire), president of WOAH Biological Standards Commission