

AFRIPOX

A One Health approach of monkeypox in the Central African Republic

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2-3 June 2022 – WHO monkeypox research webinar



One health – monkeypox - CAR

ZOOLOGY

Animal reservoir and intermediate hosts
identification – proliferation - contacts

ECOLOGY

Environnement, ecotopes,
ecological changes

ZOOLOGY

ECOLOGY

VIROLOGY

ANTHROPOLOGY

VIROLOGY

Molecular field diagnostic test
Sequencing & phylogeny
Serological test

ANTHROPOLOGY

illness, changing ecologies,
wildlife

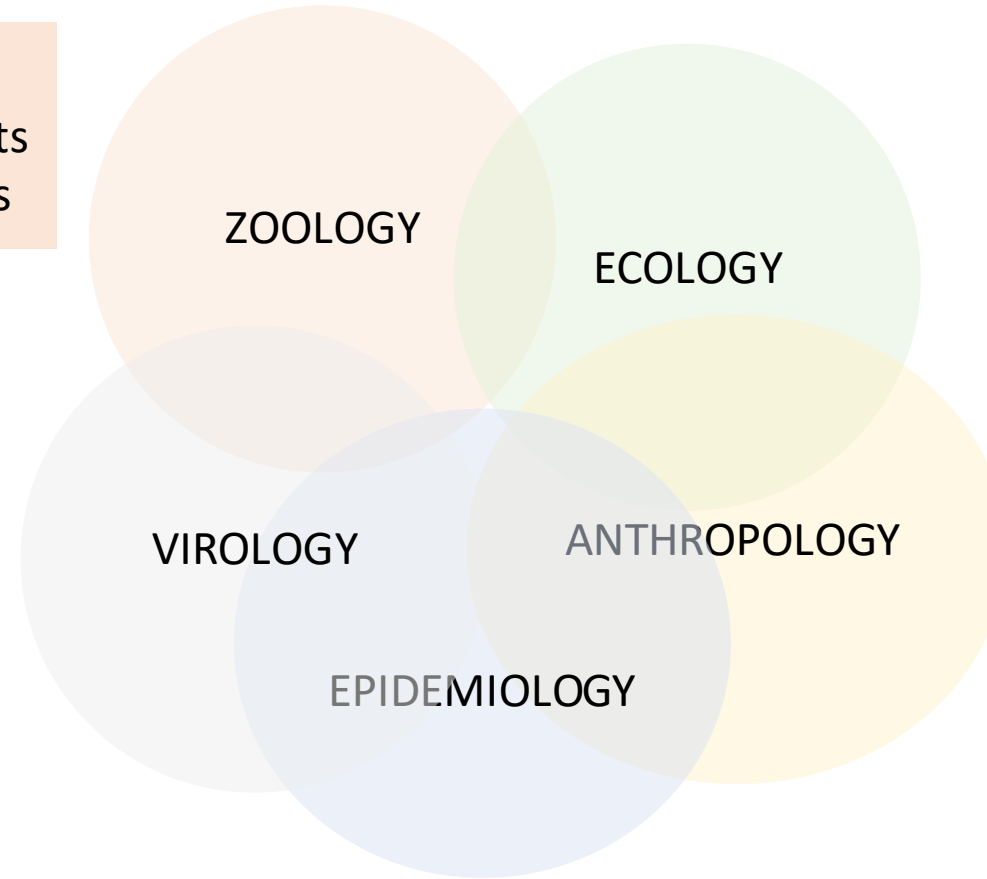
EPIDEMIIOLOGY

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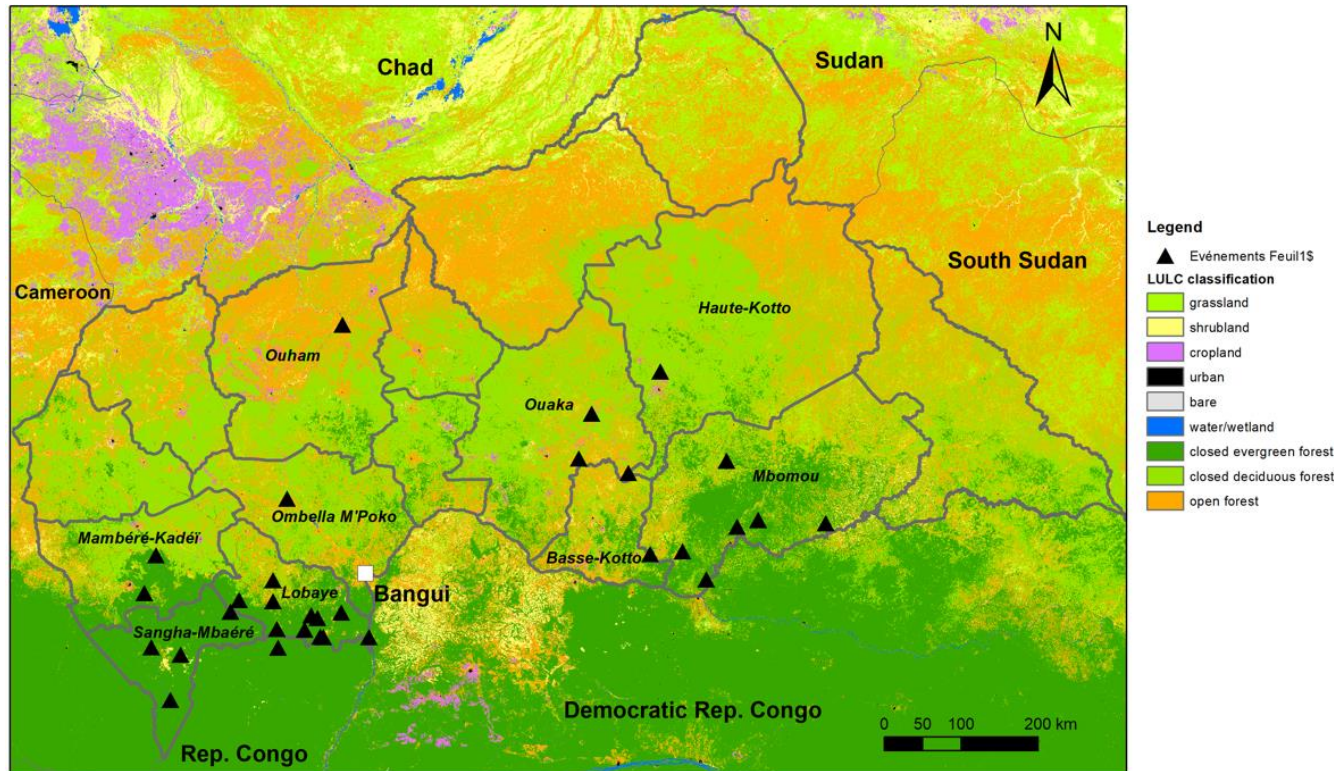
Surveillance, outbreak investigation,
modeling, transmission, natural history

CLINICAL RESEARCH

with University of Oxford:
clinical trial of tecovirimat

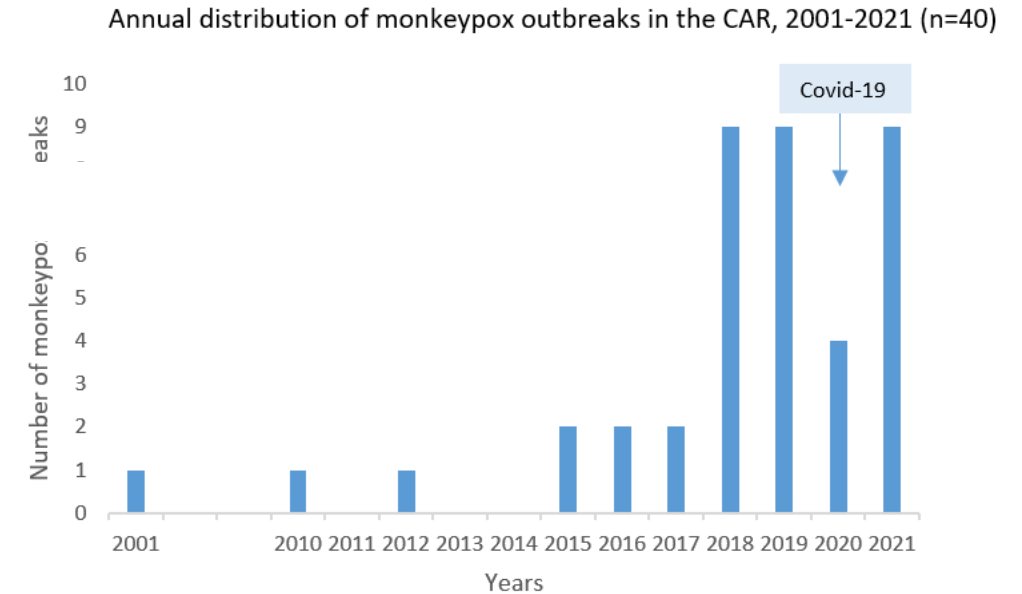


EPIDEMIOLOGY



Landuse/Landcover data source: Copernicus 2019 Global 100m Landcover

Buchhorn, M. ; Lesiv, M. ; Tsendbazar, N. - E. ; Herold, M. ; Bertels, L. ; Smets, B. Copernicus Global Land Cover Layers — Collection 2. Remote Sensing 2020, 12, Volume 108, 1044. DOI 10.3390/rs12061044



40 outbreaks, size range: 1 to 13 (1 to 25)
 99 confirmed cases, (160 with suspected cases)
 Case-fatality rate: 12/160 (7.5%)

(Besombes et al, in preparation)

VIROLOGY – diagnostic tools

Molecular field diagnostics

- Monoplex (RT-LAMP) and multiplex (RT-LAMP QUASR) rapid tests
Integrated test cartridges (Withings) (MPX lineage, VZV)
- Detection by isothermal amplification / RPA strip technology

Serological diagnostic tests

- Multiplex test based on a library of more than 7891 viral peptides representative of the proteome of human pathogenic OPXV (MPXV, VACV, CPXV, VARV) (PhiP-Seq)
- Multiplex assay based on a combination of a selection of 10 MPXV proteins and peptides (MMIA)



VIROLOGY - sequencing

- Use of capture probes for long DNA fragments
- Microfluidic technology and droplet generation for targeted enrichment of droplets containing viral genome fragments
- Direct Illumina sequencing, or direct and real-time MinION sequencing on samples

www.nature.com/scientificreports/

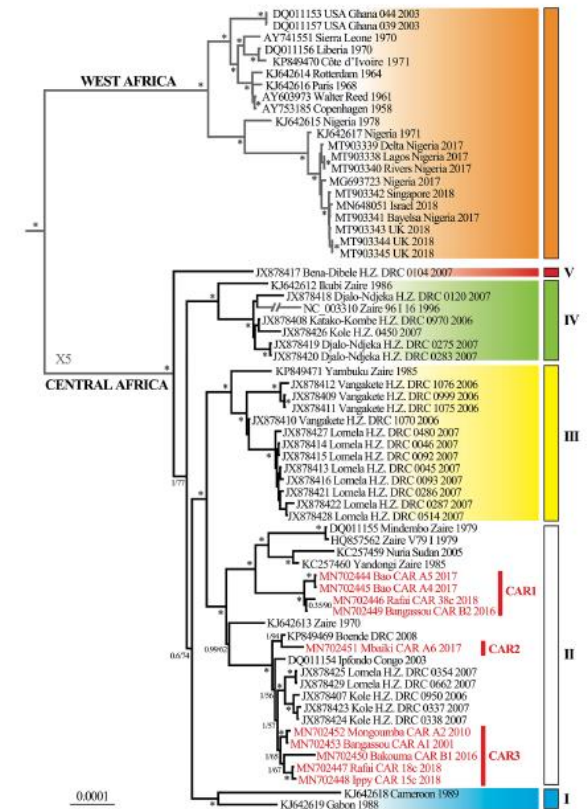
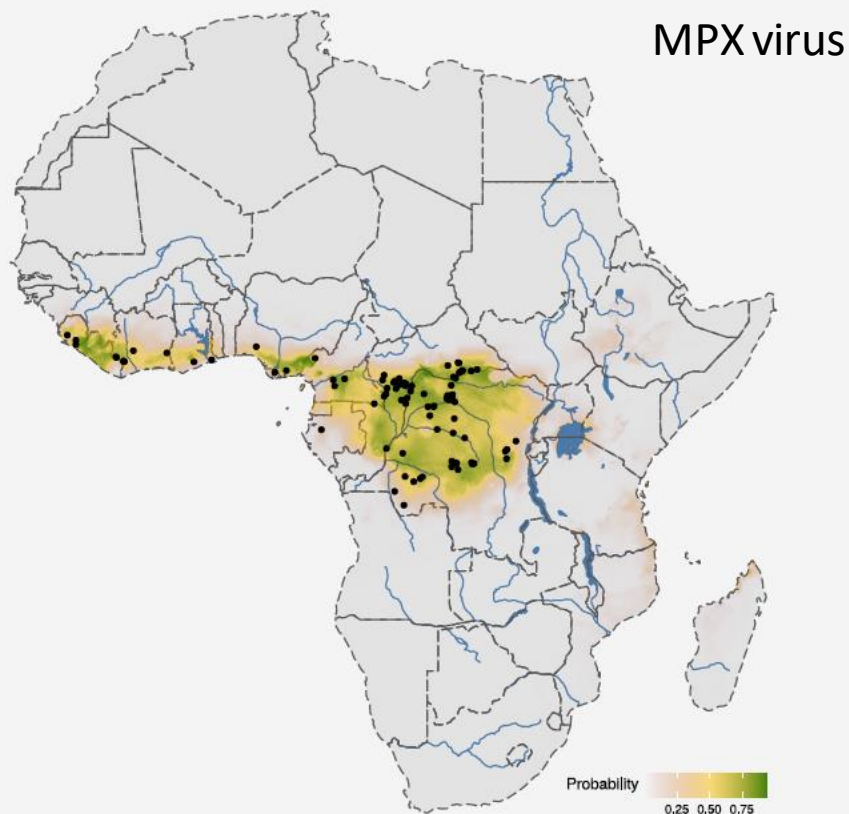


Figure 2. Phylogeny of monkeypox viruses (MPXV) based on complete genomes. The Bayesian tree was

(Berthet et al, Scientific Reports, 2021)

ZOOLOGY – Ecological niche



Curaudeau *et al.*, in prep

Ecological Niche Modelling with MaxEnt in R

African squirrels as a potential reservoir of Monkeypox virus

Squirrels



Funisciurus anerythrus



Funisciurus bayoni



Heliosciurus rufobrachium

1. MMPXV isolated from two African squirrels
 - *Funisciurus anerythrus* (Khodakevich *et al.*, 1986)
 - *Funisciurus bayonii* (Mariën *et al.*, in review)
 2. MPXV DNA in African squirrel museum specimens (Tiee *et al.*, 2018)
 - Five species of *Funisciurus* including two new species
 3. Anti-OPXV antibodies in African squirrels (Khodakevich *et al.*, 1988)
 - *Funisciurus*
 - *Heliosciurus*
- **African squirrels are good candidates for the reservoir of Monkeypox virus**
- **Focus on African squirrels**

ZOOLOGY – Field work



Animal samples: 250

2019 Toma outbreak

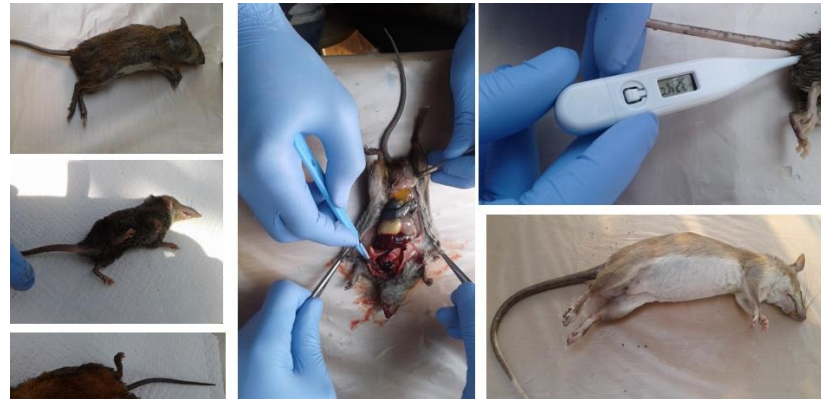
2021 Moloukou outbreak

2021 Grima outbreak

Rodents, duikers, squirrels,
bats, pangolins

PCR

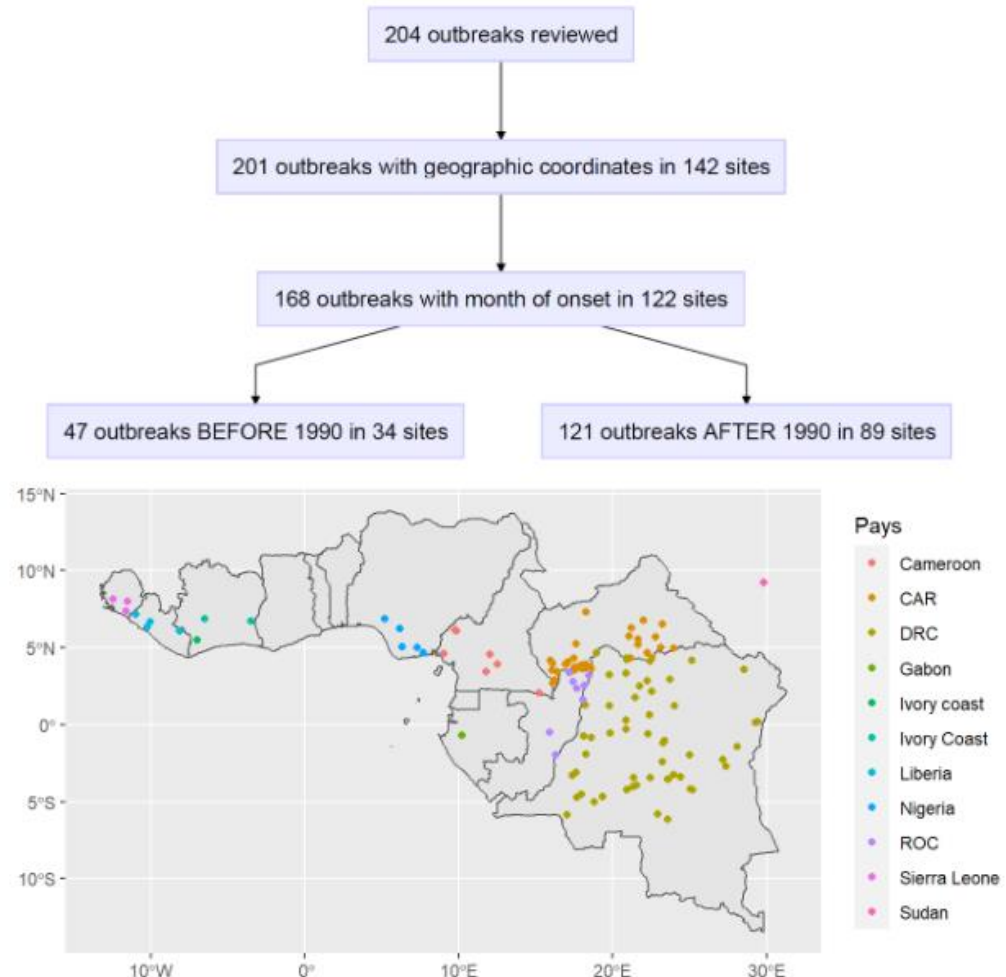
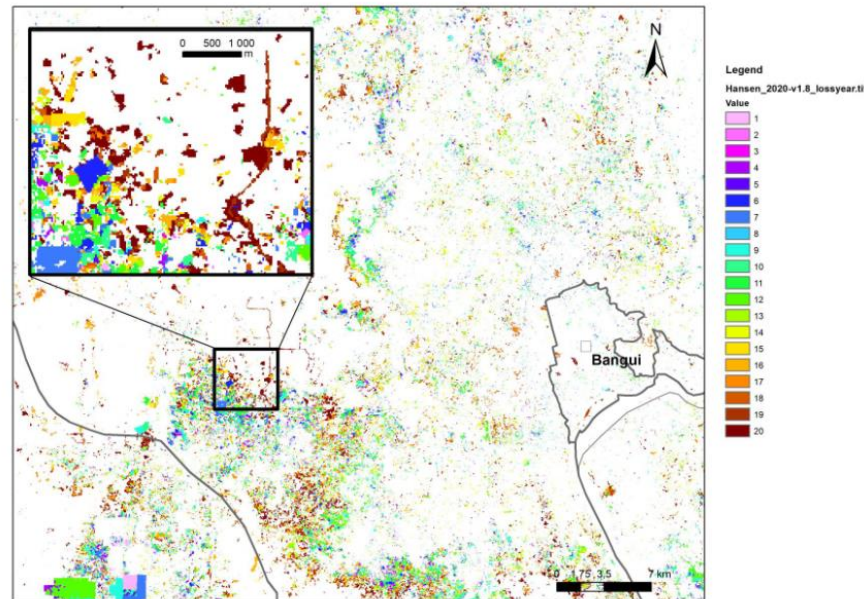
Serological assay



ECOLOGY

Environmental atlas
Climate profile
Human activities

DEFORESTATION



ANTHROPOLOGY

- **Anthropological investigation** of monkeypox illness, diagnosis & treatment pathways, care: formal health care workers, traditional healers, former patients
- **Participatory investigation of « local epidemiologies »** (local understandings of origins, emergence, transmission)
- **Ethnohistorical** study of local ecological (forest, wildlife) & social changes implied in monkeypox emergence in the CAR since 1970
- **Ethnoecology:** local conceptions and observations of wildlife; current practices with wildlife



Collaborators

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