Petits Mammifères à Bamako (Mali), paradis des rongeurs exotiques

Laurent Granjon, Solimane Ag Atteynine, Monique Bertrand, Fotigui Coulibaly, Alida Dembélé, Christophe Diagne, Alfousseyni Traoré…

Context

Development of research at the Biodiversity – Health – Urbanization interface

West African context where development benefits from / is impacted by global change

Understanding of the role of small mammals as reservoirs/vectors of zoonotic diseases

Important data sets in West Africa (Cotonou, Dakar, Niamey, Tambacounda, Kédougou...)

Specific questions / objectives in Bamako, capital city of a landlocked country

- composition of the small mammal community

- respective shares of native vs invasive species

- modes of expansion of invasive species (history, urbanization process, resistance from native species, etc.)

- geographic origin/ invasion routes of Invasive Alien Species (IAS)

- "catalogue" of zoonotic pathogens harbored by small mammals

- specificities vs Niamey, another landlocked, more Sahelian capital, and vs to port cities (Dakar, Cotonou)

Bamako

CARTE ADMINISTRATIVE DU MALI EN 2011

CARTE COMMUNALE DU DISTRICT DE BAMAKO ET DU CERCLE DE KATI

Bamako district
embedded
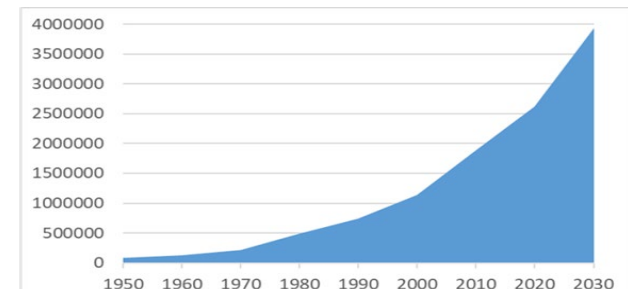In Kati Department

6 urban communes
within the district

Observatoire ouest-africain des petits Mammifères
Indicateurs des Changements Environnementaux
ObsMiCE

▲ Site urbain/périurbain – Priorité 1   ● Agro-écosystème – Priorité 1

▲ Site urbain/périurbain – Priorité 2   ● Agro-écosystème – Priorité 2

→ Project "Small mammals of Bamako: inventory, distribution, hosted parasites"

From 89000 inhabitants in 1950 to nearly
4 millions in 2030 (+4300%)
https://populationstat.com/mali/bamako
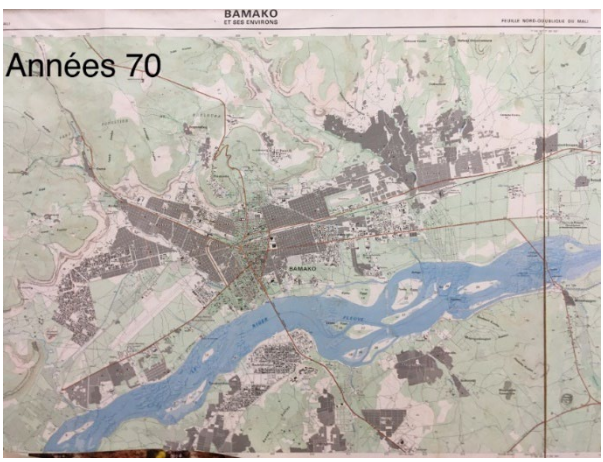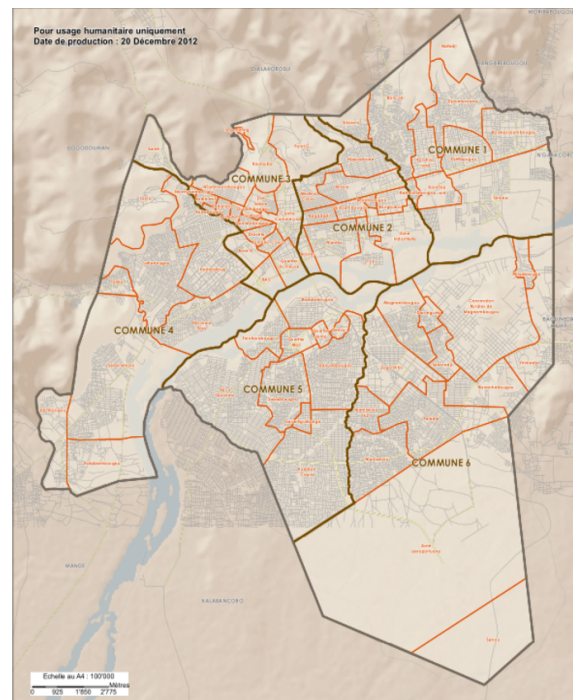
Bamako over time
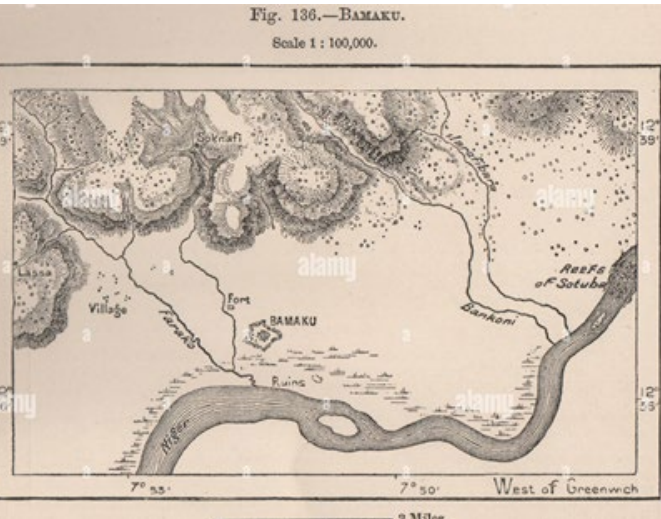
1885

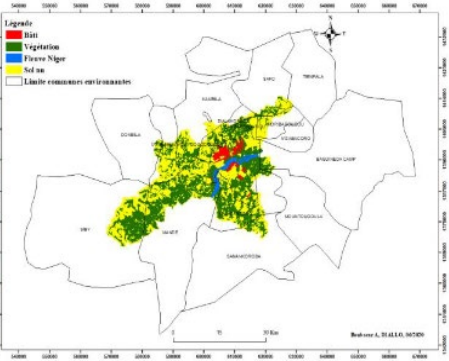French installation in Bamako (ca. 1 000 inhabitants in 1888)
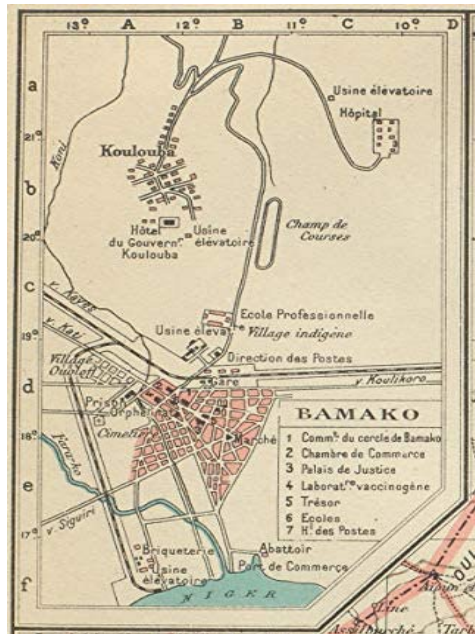
1931

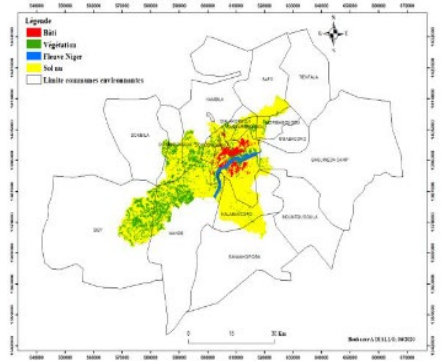Colonial period (ca. 20 000 inhabitants)

Années 70

1960: 1st bridge over the Niger river → beginning of urbanization of the right bank
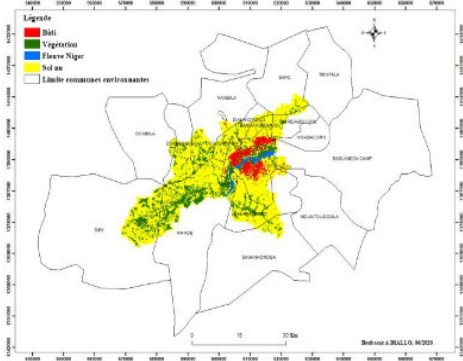
2012 3 bridges over the Niger river; ca. 2 millions inhabitants
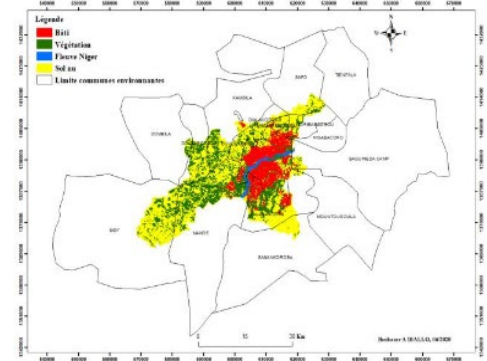
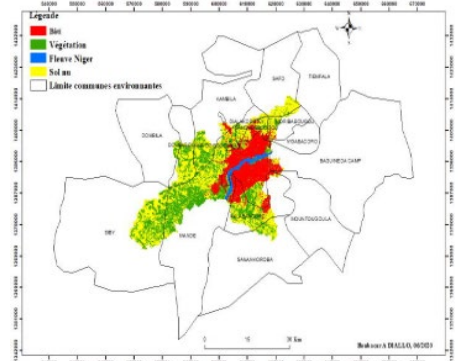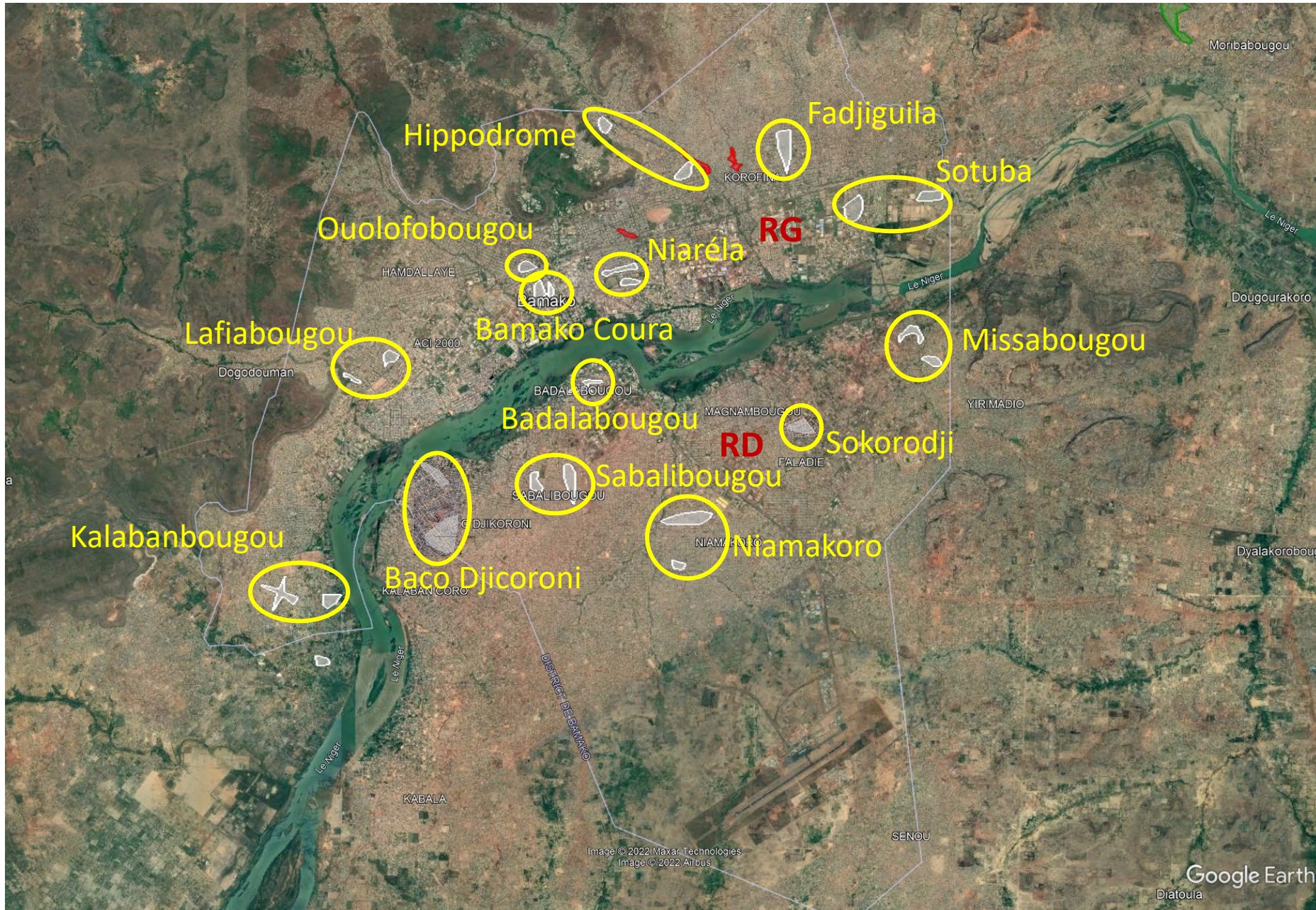1972   1986   1999   2009   2018

Diallo et al. 2020

Sampling scheme

- 2 quarters / commune (1-2 sectors / quarter)

- 4-5 nights of trapping / quarter

- 1 wire-mesh trap + 1 Sherman trap / room

- Standard room description + WPT

- Re-baiting every afternoon

- 450-600 trap.nights / quarter

- ca. 100 small mammals caught / quarter

+ 2009 population census data (on toilets, sewage disposal, built, pop. density...)

« Rooms » sampled

yards

shops

stockrooms

bedrooms

veranda

Living rooms

kitchens

All GPS-geolocalized and described following standard procedure:
- Room type
- Floor materials
- Wall materials
- Ceiling materials
- Presence / Abundance of food

Daily routine

Sample path

Trap baiting / installation

Informed agreement signing

Capture management

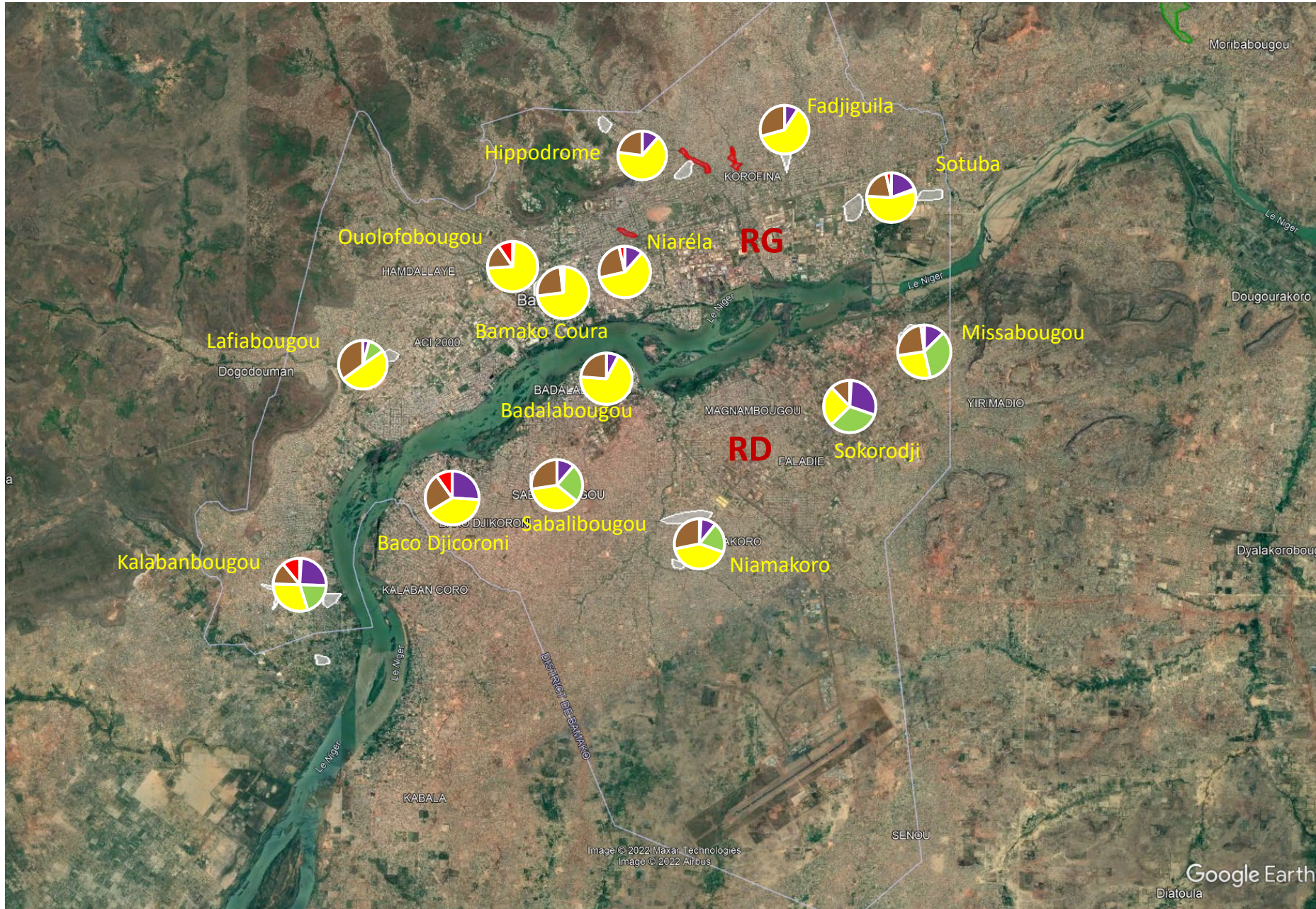
Setting up the dissecting table

Autopsies / dissections

- Standard measurements
- Reproductive state
- Ectoparasites (fleas, ticks)
- Biological samples
  - Blood blotter
  - Digestive tracks (helminths)
  - Spleen
  - Hind foot
  - Kidney

+ (for specific purposes): nasal/buccal swab, lung…)
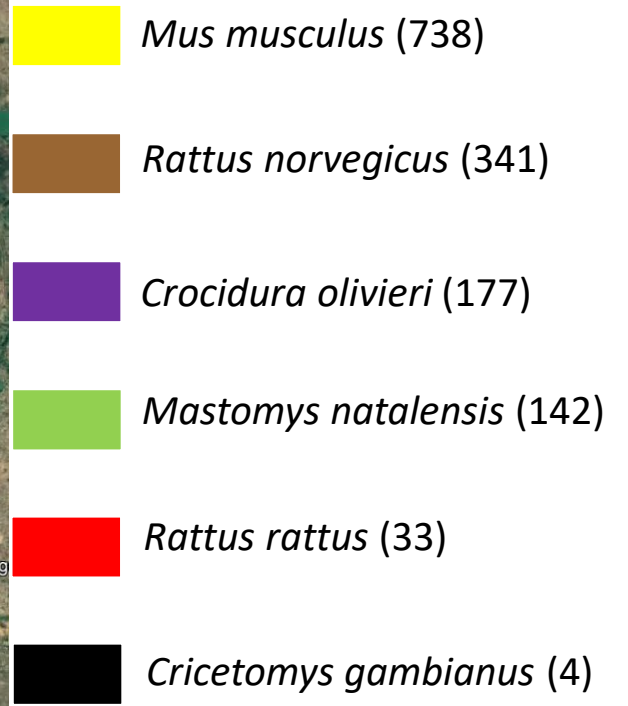
Results

1444 captures, 6 species

- *Mus musculus* (738)
- *Rattus norvegicus* (341)
- *Crocidura olivieri* (177)
- *Mastomys natalensis* (142)
- *Rattus rattus* (33)
- *Cricetomys gambianus* (4)

Choice / use of habitat variables

Field data at the scale of the rooms

- B = Banco
- C = Cement
- Tole = Sheet metal

Census data at the scale of the enumeration district or section (DD or SE)

Selected variables	Variable modalities
POPULATION2009_Densité/ha	
AISANCE2009 (Toilets)	Commun_plusieursétages_chassedeau Extérieurprivé_chassedeau Intérieurprivé_chassedeau Latrine_commune Latrine_privée Nature
EAUX_USEES2009 (Waste water)	Caniveau_collecteur Cour Fosse_septique Nature Puisard Réseau_dégout Rue
MURS2009 (walls)	Banco Bois_Paille Dur Semi_dur
ORDURES2009 (Garbage)	Caniveau_collecteur Fossé GIE Nature Poubelle_collective Ramassage_privé Rue Tas_immondices
SOL2009 (Floor)	Carreau Ciment Terre_battue
TOIT2009 (roof)	Banco Béton Chaume Tole_plafond Tole_seule Tuile

Retrieval of population census data

Enumeration district
(DD, in red)

And

Enumeration sections
(SE), in yellow)

=

Spatial entities on
which the 2009
population census was
based

↓

Census data available
at these scales

Niarela

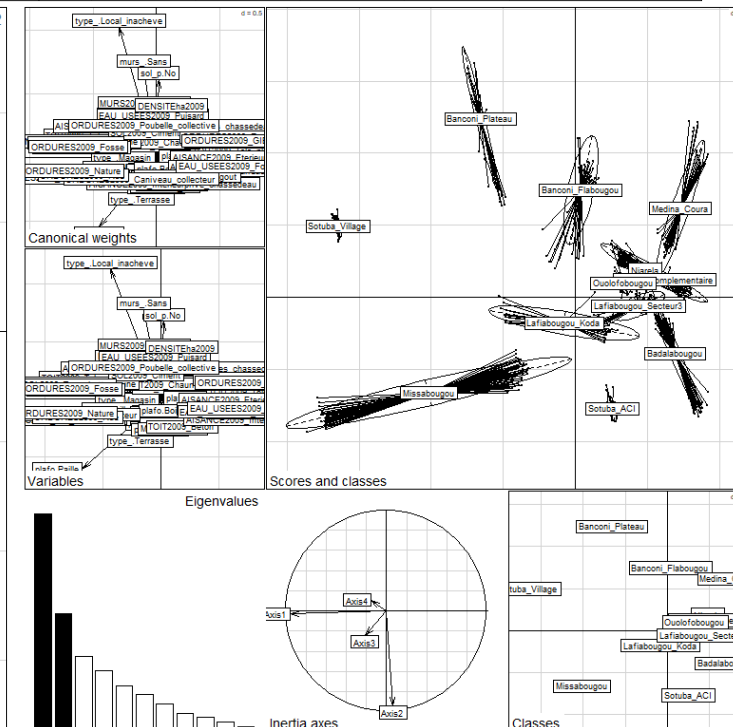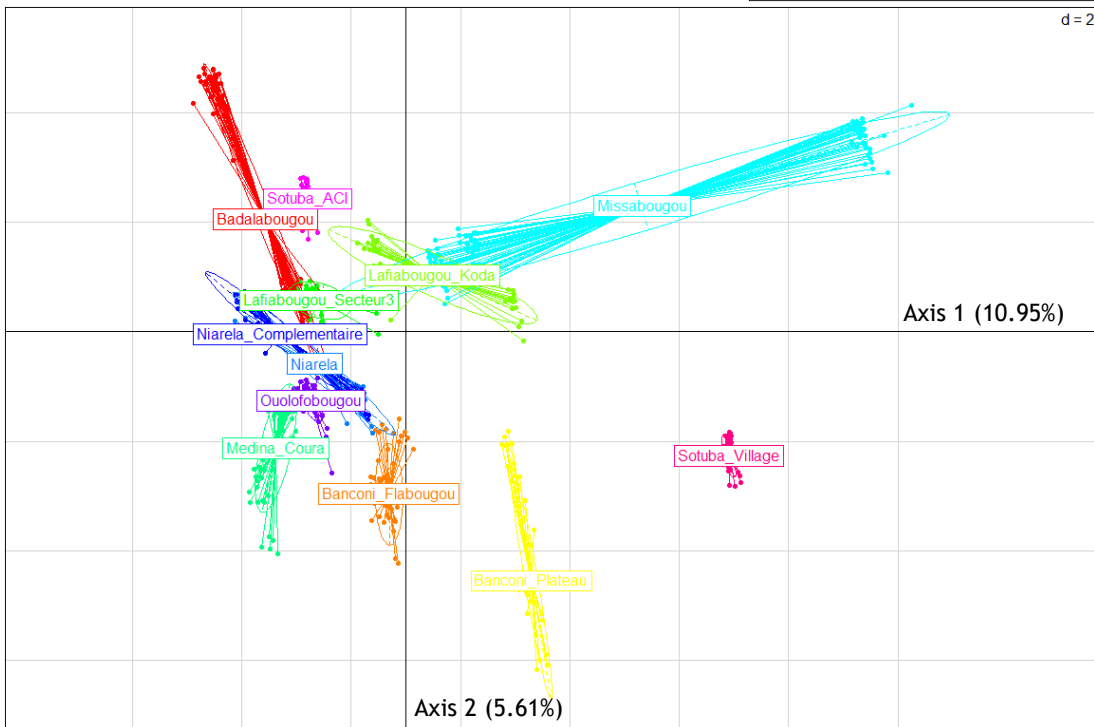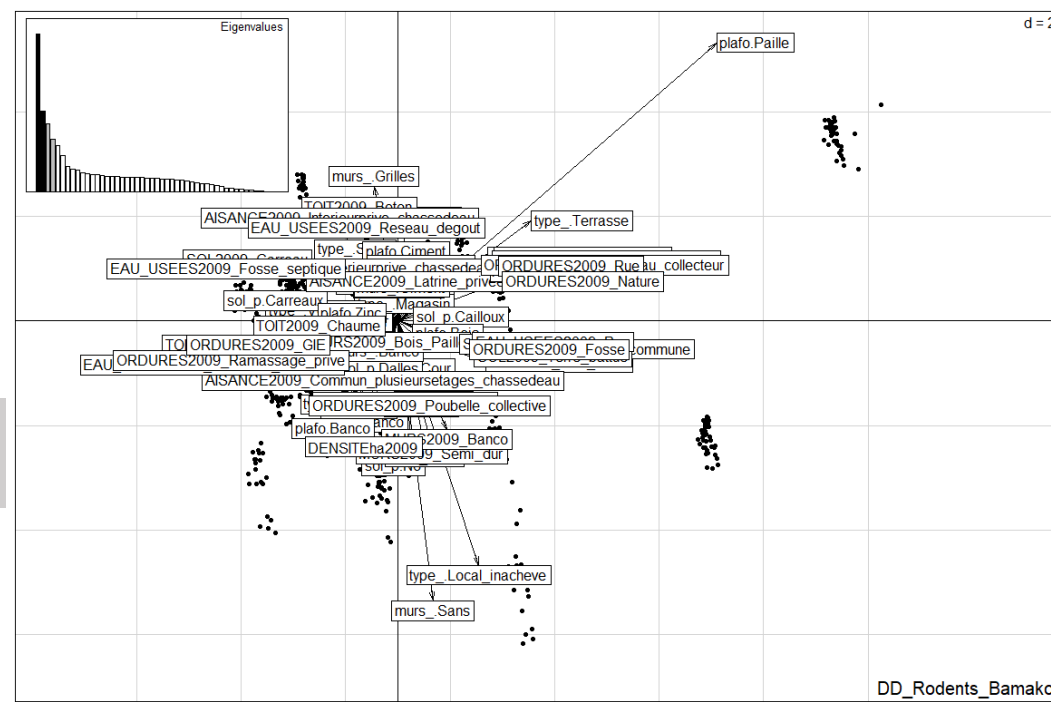→ assigning values of census variables to trapping / capture data

Niarela

Multivariate analyses
(habitat data)

Hill & Smith analyses
(DD level)
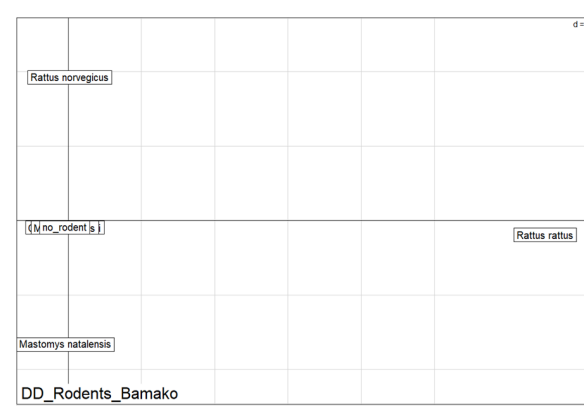
Original variables
(class « sectors »)

Inter-class structuration
(simulated p-value: 0.001;
Observation: 0.401524)

Multivariate analyses (habitat / trapping data)
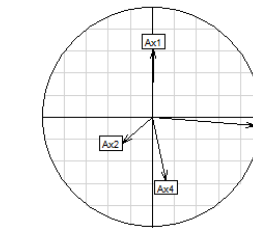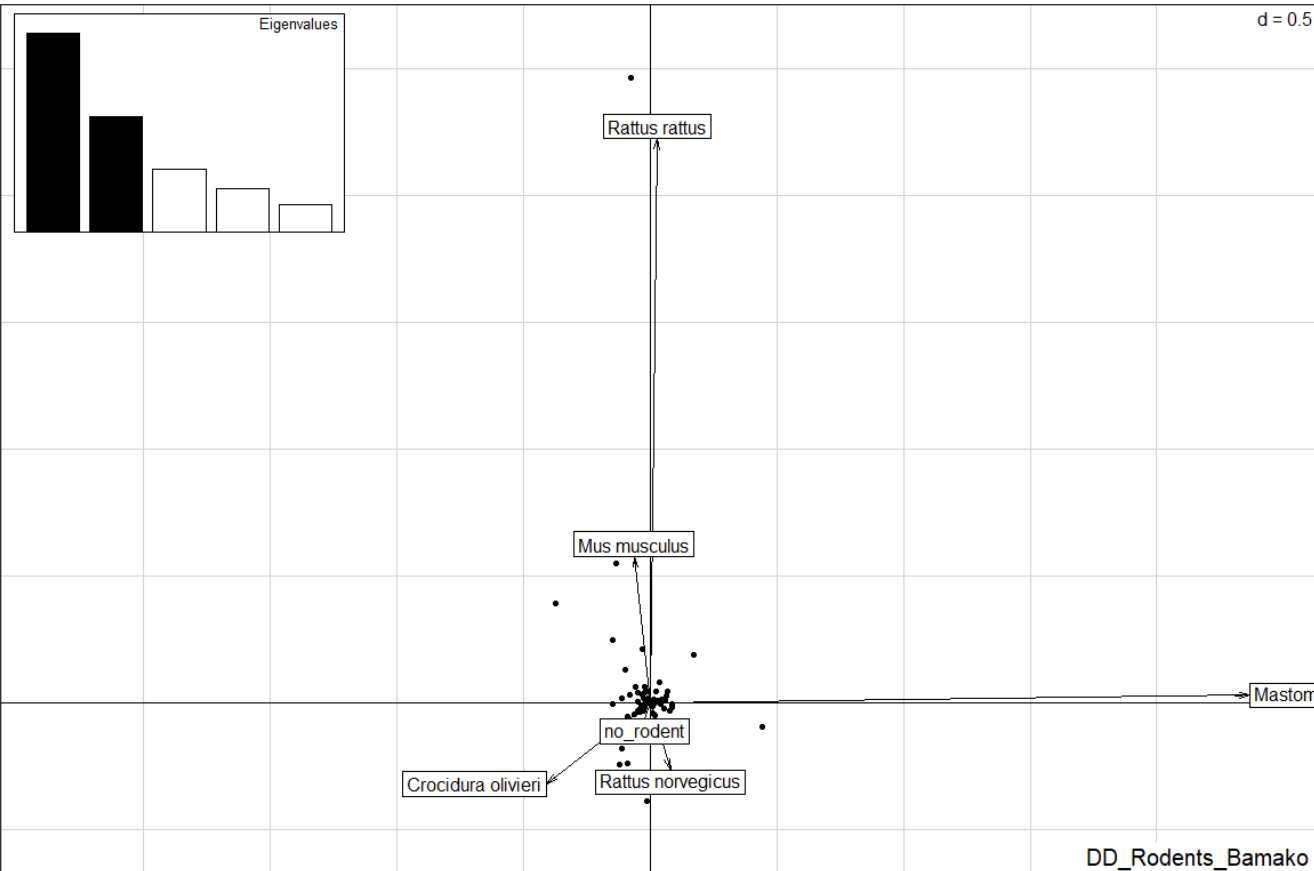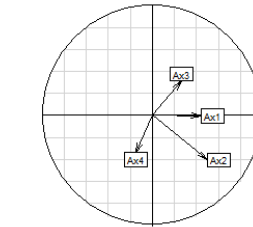
Co-inertia analyses
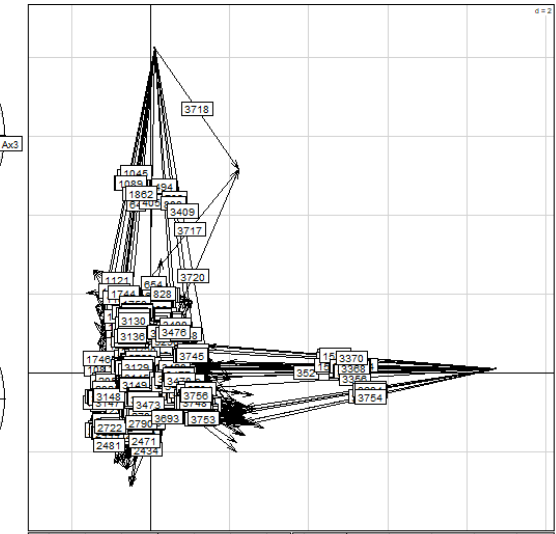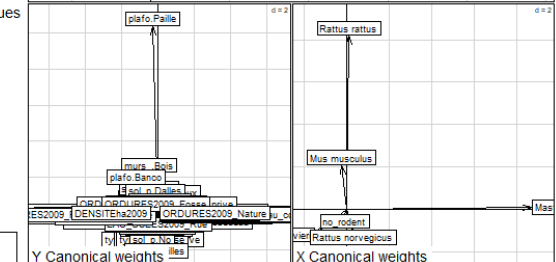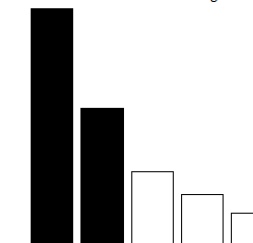(DD level)

Original variables

AFC small mammals

H&S environment

DD_Rodents_Bamako

Historical data on invasive species in Bamako

Rattus norvegicus   *Rattus rattus*   *Mus musculus*

Period	*Rattus norvegicus*	*Rattus rattus*	*Mus musculus*
Curasson 1931 — before 1931	✔ « *Mus decumanus* »	✔ « *Mus alexandrinus* »	✔ « *Mus musculus* »
« Historical » data in the CBGP Small Mammal database — 1936 1992	✖ But few data available from Mali	✔ (Samaya, near Bamako)	✖
Notes on the mammal fauna of the southern part of the Republic of Mali, West Africa (Holger Meinig) — 1994-1995	✔	❓ « does not seem to be present »	✖
MEMOIRE DE D.E.A. Présenté et soutenu par Sadio TRAORE, Date de soutenance 5 Octobre 1999 — 1998-1999	✔	✔	✖
« Recent data » in the CBGP Small Mammal database — 2002- 2003	✔	✔ (Baguineda, near Bamako)	✖

Bonn. zool. Beitr. | Bd. 49 | H. 1–4 | S. 101–114 | Bonn, Dezember 2000
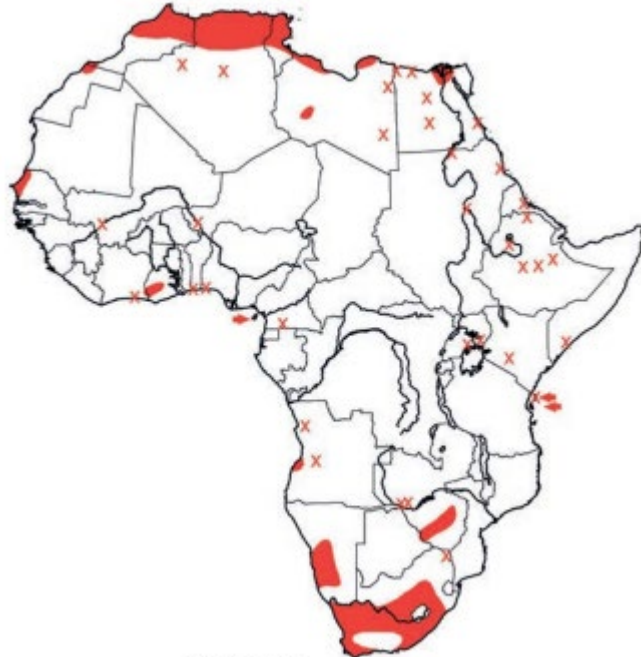
Recent data on *Mus musculus* aka. « Messi »

Comm. pers. A. Dalecky / S. Ag Atteynine:

1 spécimen de *Mus musculus* (cf. biométrie corporelle) du quartier Badialan (Bamako centre) en **novembre 2015**

+

« Plaintes » du personnel local IRD Bamako sur dérangements liés à petits rongeurs récemment arrivés

Happold 2013, Mammals of Africa

Mus musculus

Le devin et le dératiseur. Traces de souris en Afrique de l'Ouest

Julien Bondaz   *Université Lumière Lyon 2*

Anthropologica 62 (2020) 139–150

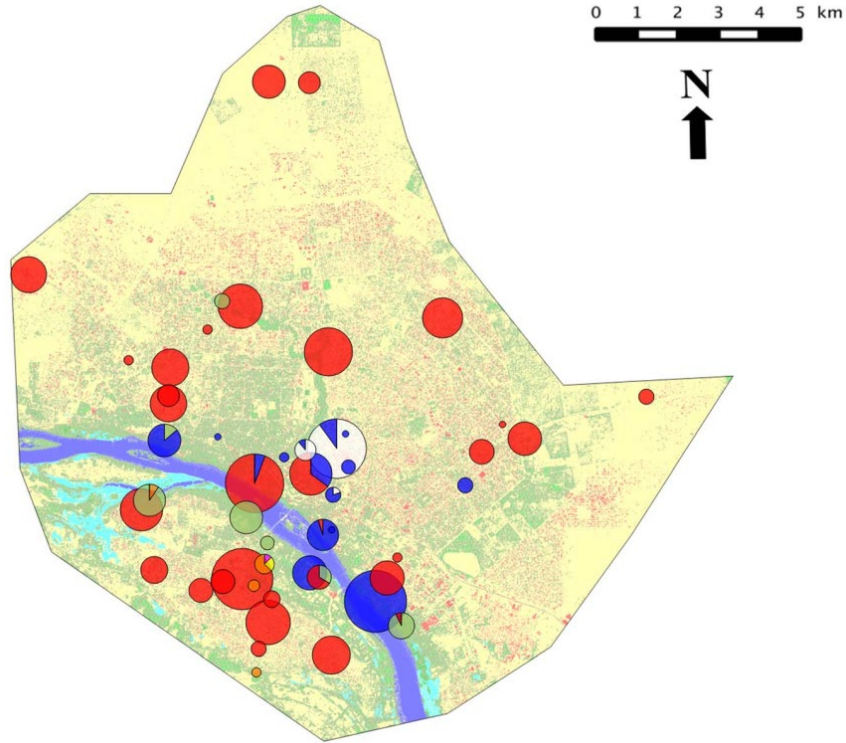ɲinɛfitini (« petite souris ») = Messi

arrivées au Mali au début des années 2010, selon les uns dans des containers en provenance de Chine, d'Inde ou de Dubaï, selon les autres du Sénégal par le train Dakar-Bamako

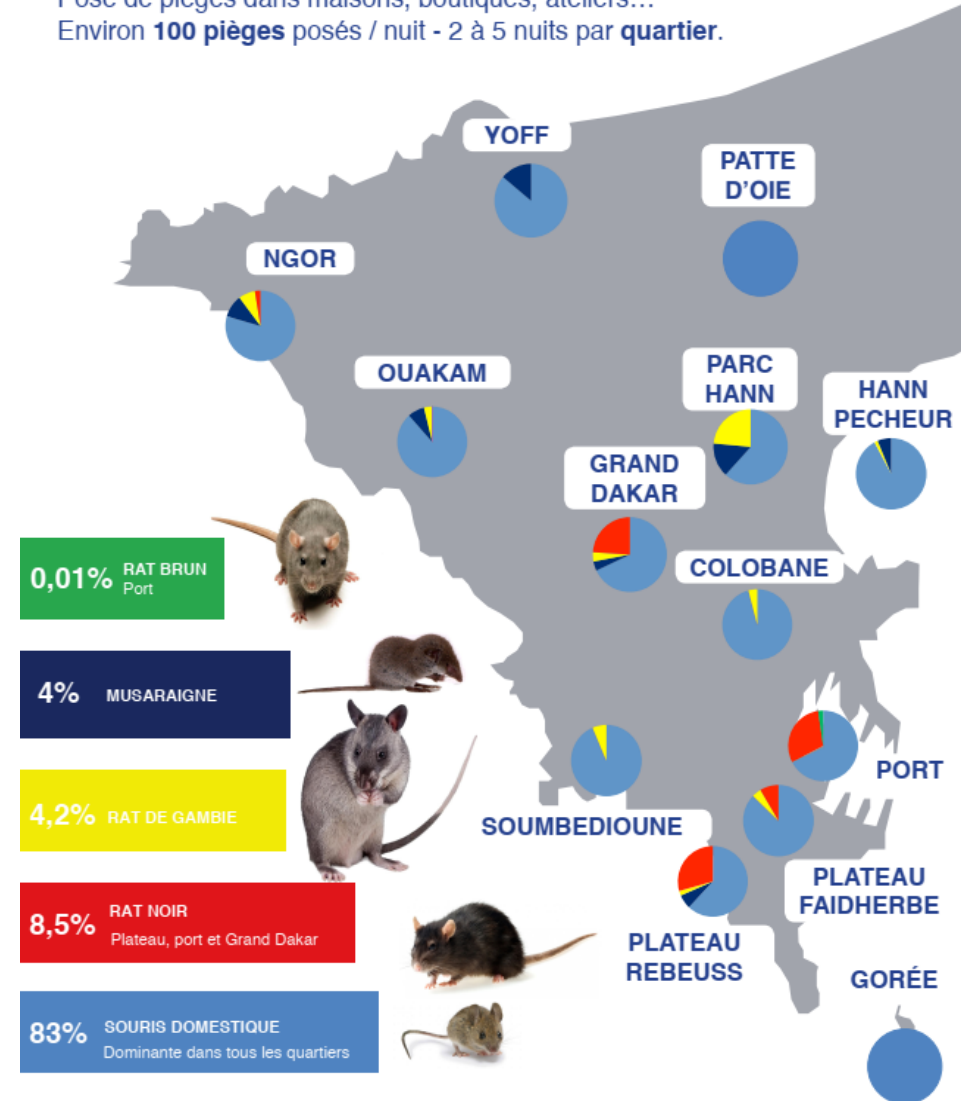# Small mammal communities of W. African cities

Niamey (Niger), 2010

Dakar (Sénégal), 2016-2017

LES PETITS MAMMIFÈRES À DAKAR

Pose de pièges dans maisons, boutiques, ateliers…
Environ **100 pièges** posés / nuit - 2 à 5 nuits par **quartier**.

YOFF

PATTE D'OIE

NGOR

OUAKAM

PARC HANN

HANN PECHEUR

GRAND DAKAR

COLOBANE

0,01% RAT BRUN
Port

4% MUSARAIGNE

4,2% RAT DE GAMBIE

8,5% RAT NOIR
Plateau, port et Grand Dakar

SOUMBEDIOUNE

PORT

PLATEAU FAIDHERBE

PLATEAU REBEUSS

GORÉE

83% SOURIS DOMESTIQUE
Dominante dans tous les quartiers

■ *Mastomys natalensis*

□ *Mus musculus*

■ *Rattus rattus*

■ *Arvicanthis niloticus*

Garba *et al.* (2014)

Stragier et coll.

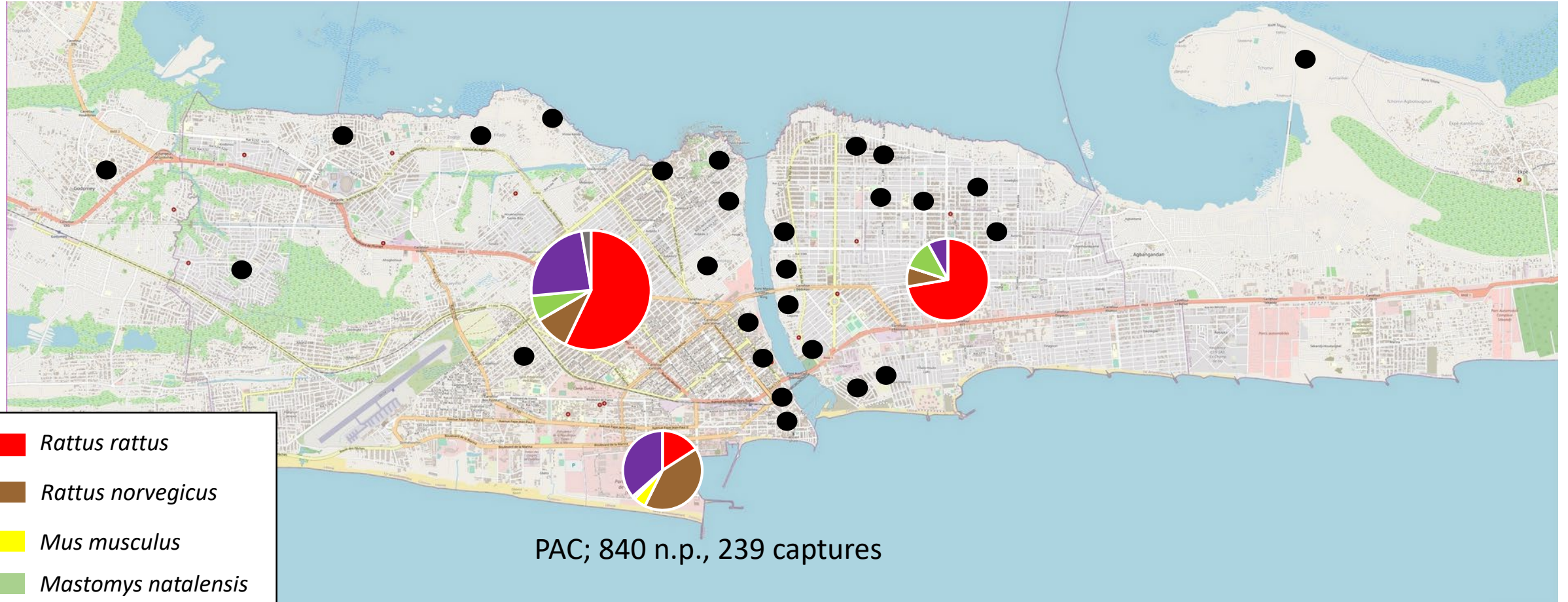# Small mammal communities of W. African cities

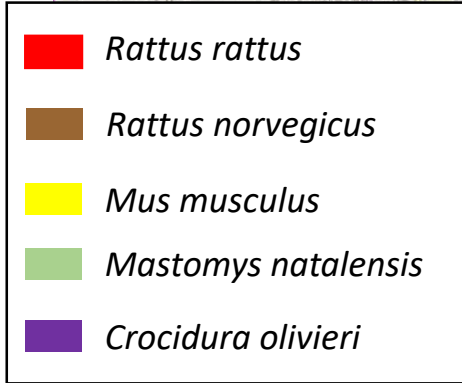## Cotonou (Bénin): 2005 - 2017
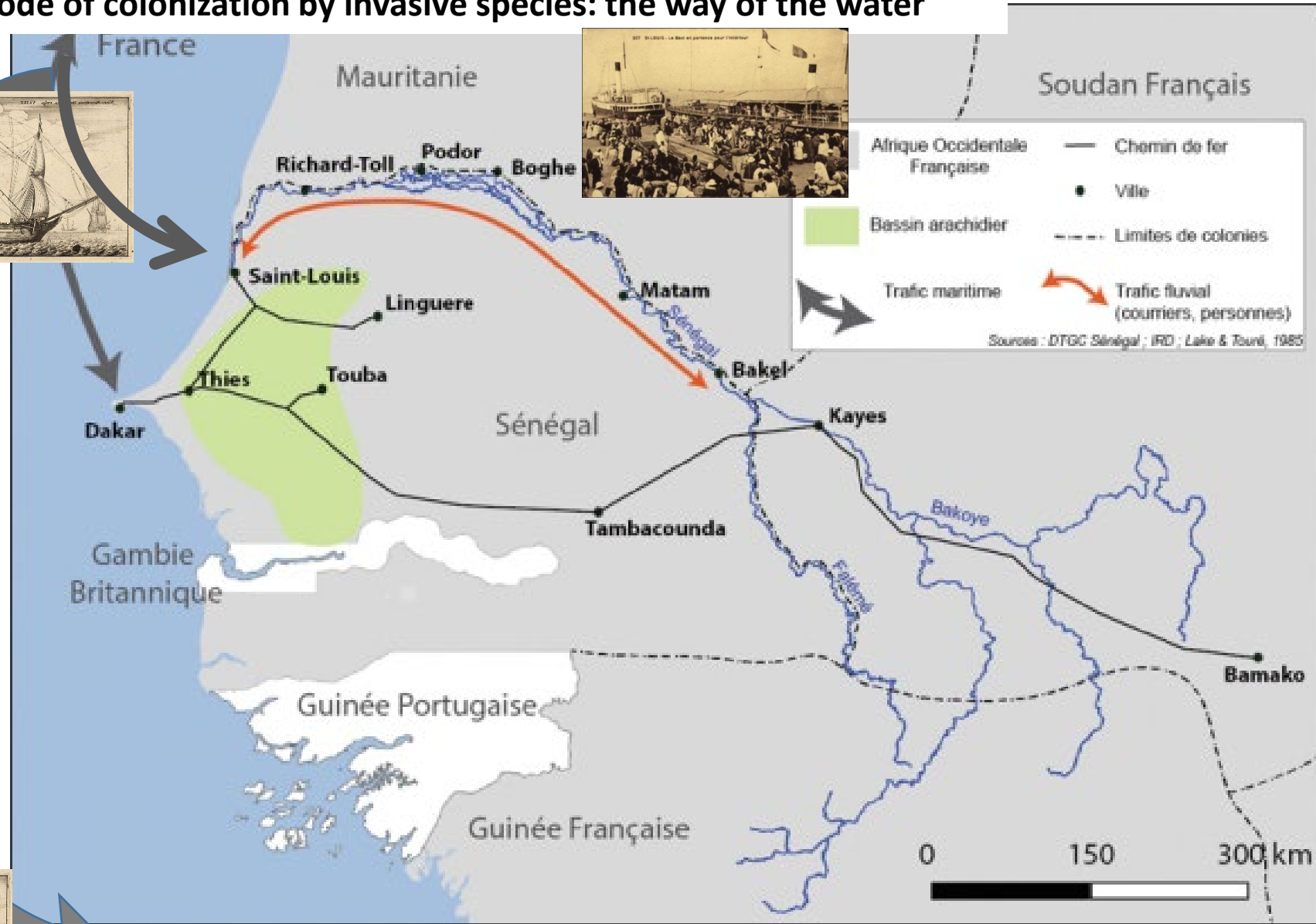
Ouest chenal
14 quartiers, 7743 n.p., 1298 captures

Est chenal
13 quartiers, 2595 n.p., 400 captures

PAC; 840 n.p., 239 captures

Legend:
- *Rattus rattus* (red)
- *Rattus norvegicus* (brown)
- *Mus musculus* (yellow)
- *Mastomys natalensis* (green)
- *Crocidura olivieri* (purple)

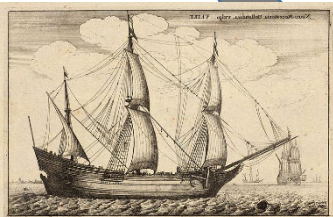Données tirées de Hima et al. (2019)

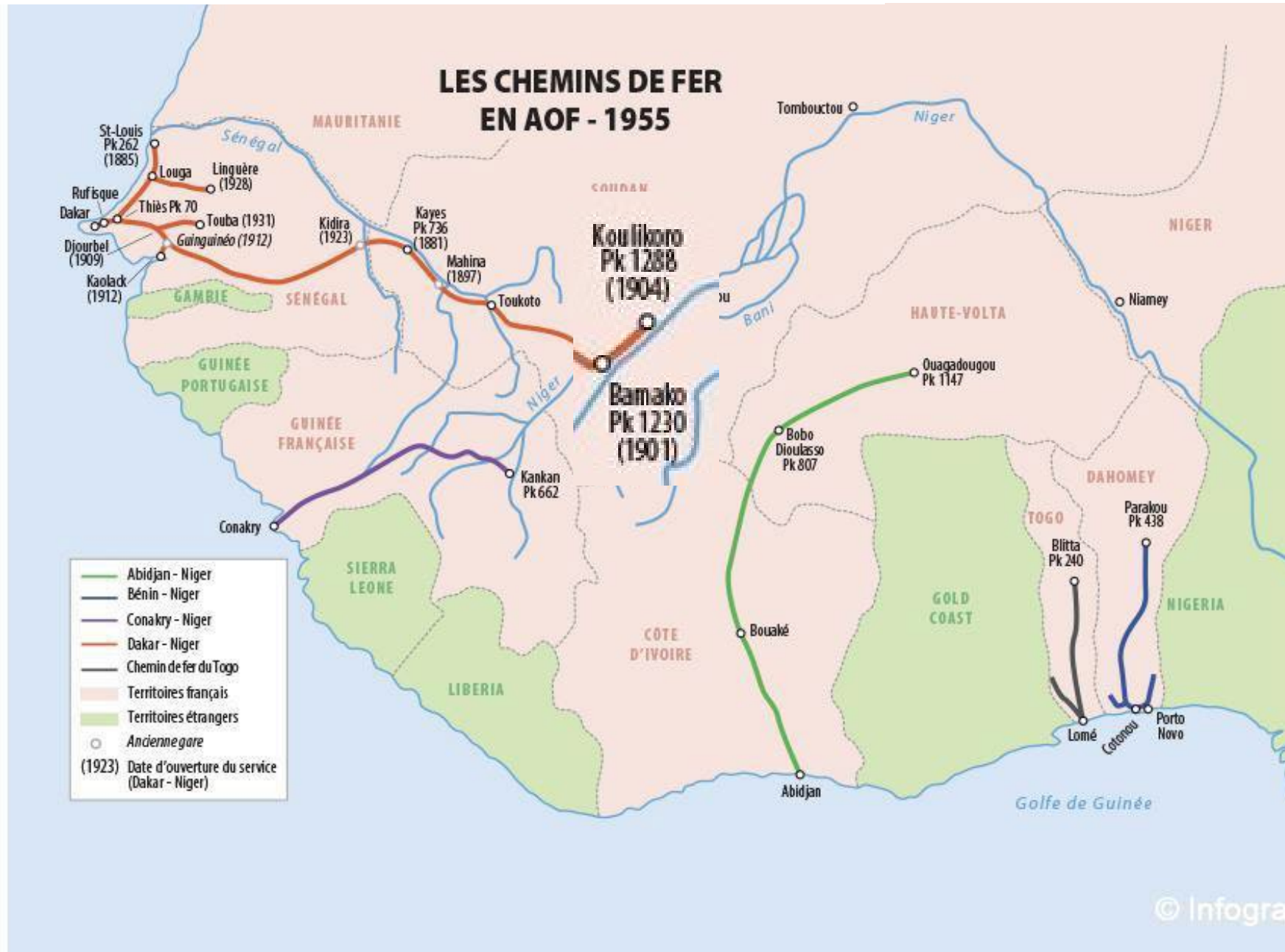# Tempo and mode of colonization by invasive species: the way of the water
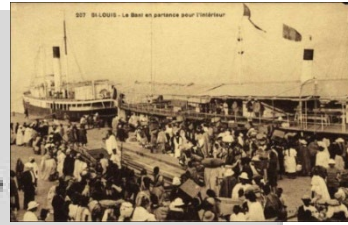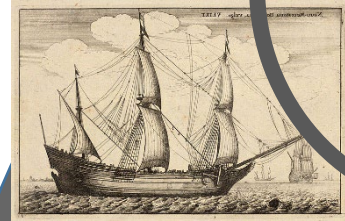
Organisation des principaux transports du bassin du fleuve Sénégal (vers 1930) (Bruckmann 2017)
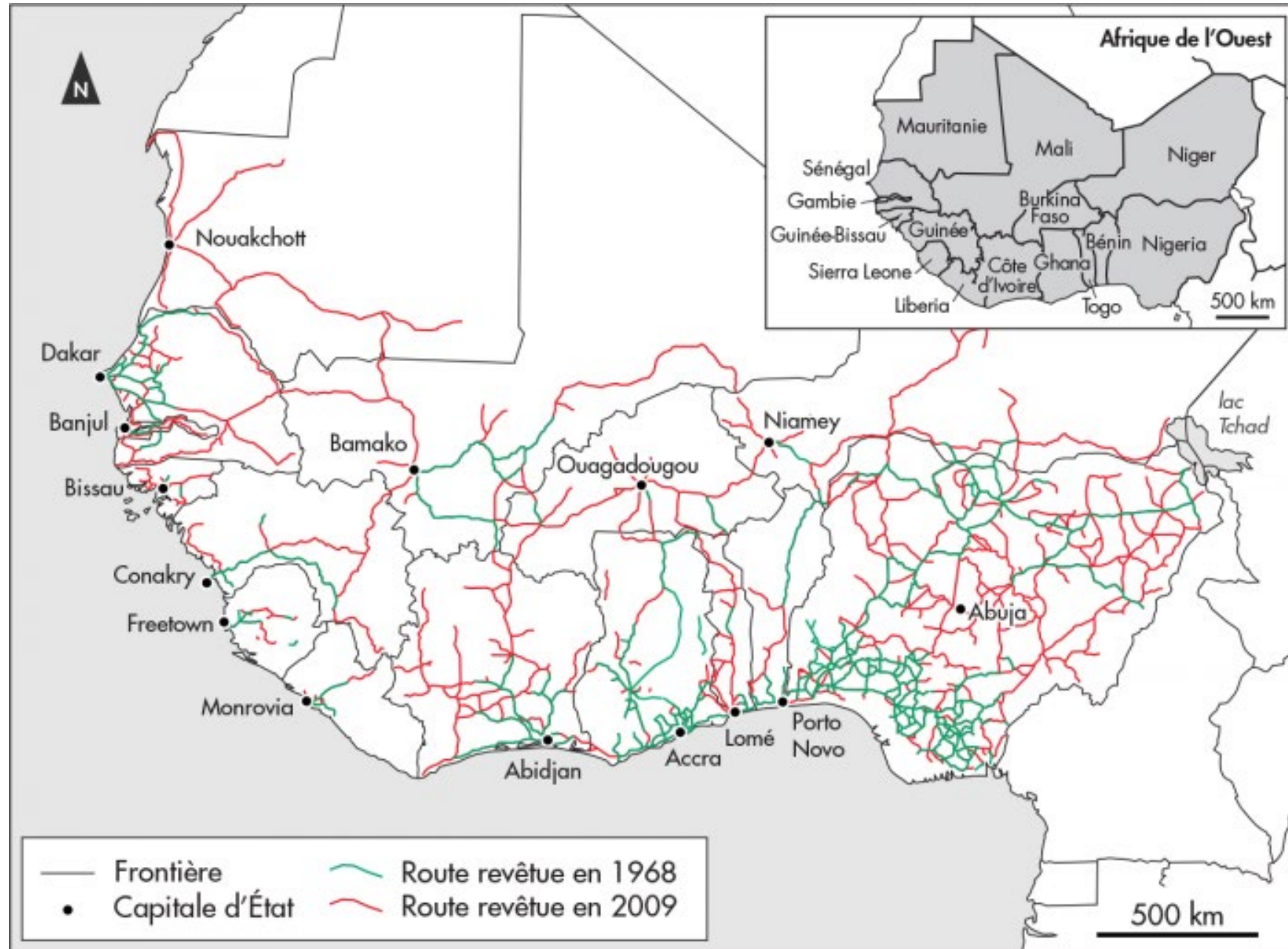
Pays du Golfe de Guinée

Tempo and mode of colonization by invasive species: the railroad

LES CHEMINS DE FER EN AOF - 1955

Tempo and mode of colonization by invasive species: the railroad

Lombard et Ninot (2010)

Colonization pathways of by invasive alien species

Railway

Paved road

MAURITANIA

MALI

Tombouctou

NIGER

SENEGAL

Niger

THE GAMB

Niamey

BURKINA FASO

GUINEA-BISSAU

GUINEA

Bamako

Kainj Reservoir

NIGERIA

SIERRA LEONE

ENIN

Abaja

GHANA

Lokaja

CÔTE D'IVOIRE

LIBERIA

Asaba

Cotonou

TOGO

Atlantic Ocean

CAMEROON

Berthier et al. (2016)

Perspectives

- Analyze species habitat preferences (based on micro-habitat description & 2009 census data)

- Sample peripheric quarters (those where KAP survey questionnaires have been conducted)

- Analyze biological samples for parasite / pathogen detection (gastrointestinal helminths, bacterial screening, Seoul virus...)

- Analyze biological samples for genetic studies of structure, invasion routes, anticoagulant resistance... → Test hypotheses on colonization sources / routes

- Provide feedback to quarter populations (via traditional and administrative authorities)

Merci de votre attention