Monitoring rodent communities along an urbanization gradient in Cotonou, south Benin

Jonas ETOUGBETCHE

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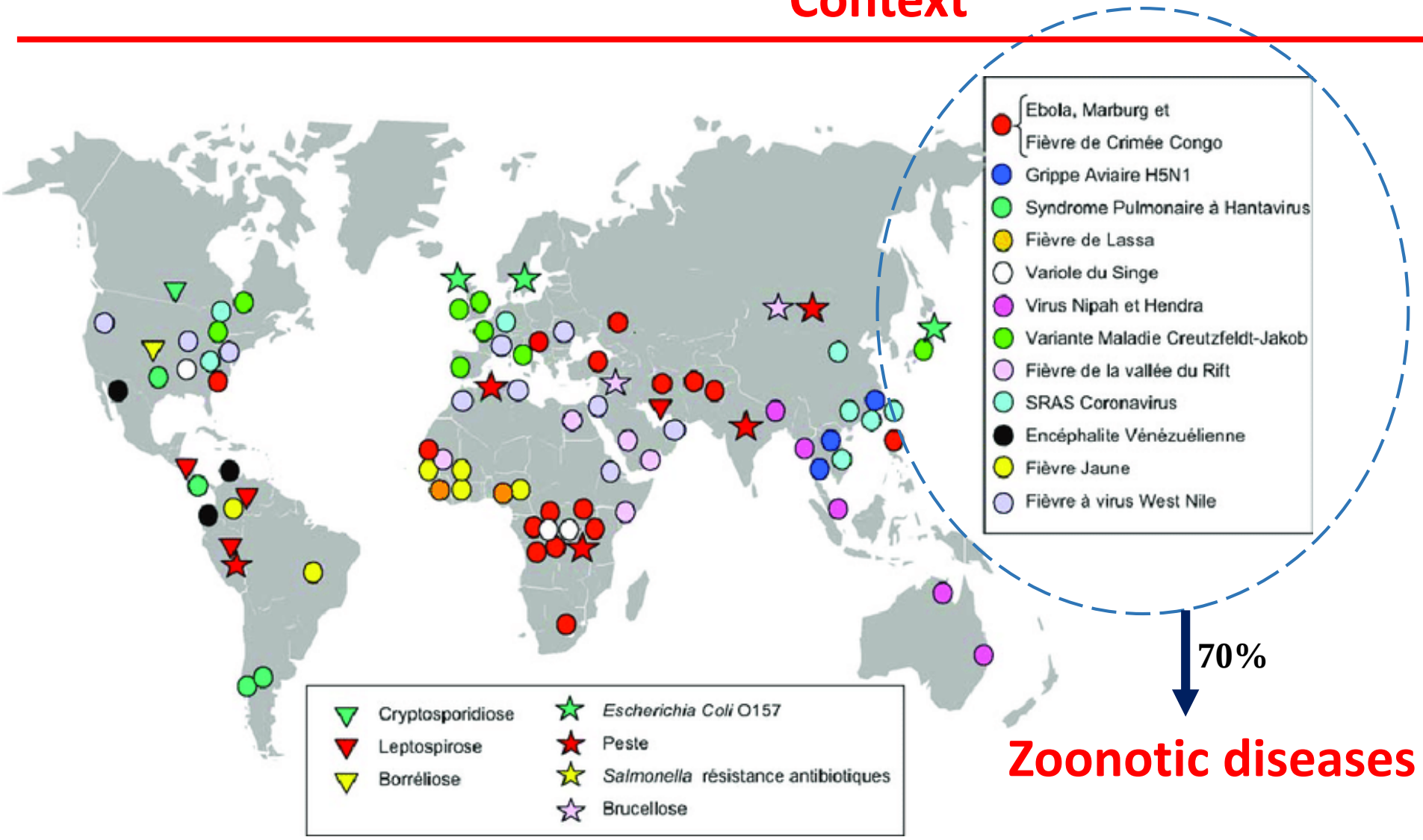
Context



70%

Zoonotic diseases

?

- **Infectious agent**
- **Spreading mode**
- **Transmission risks to human**
- **Severity of the caused disease**
- **Geographic distribution of the infectious agent**

Human populations concerned 2

Context

International exchange of people and goods

(Some) rodents species love living in the city

…

and this is a problem for human health

Context

Lagos, 2021

Cotonou, Ladji 2018

Cities of South countries

Growing slum areas

we live → we build→ we arrange

Context

Landscape density and complexity

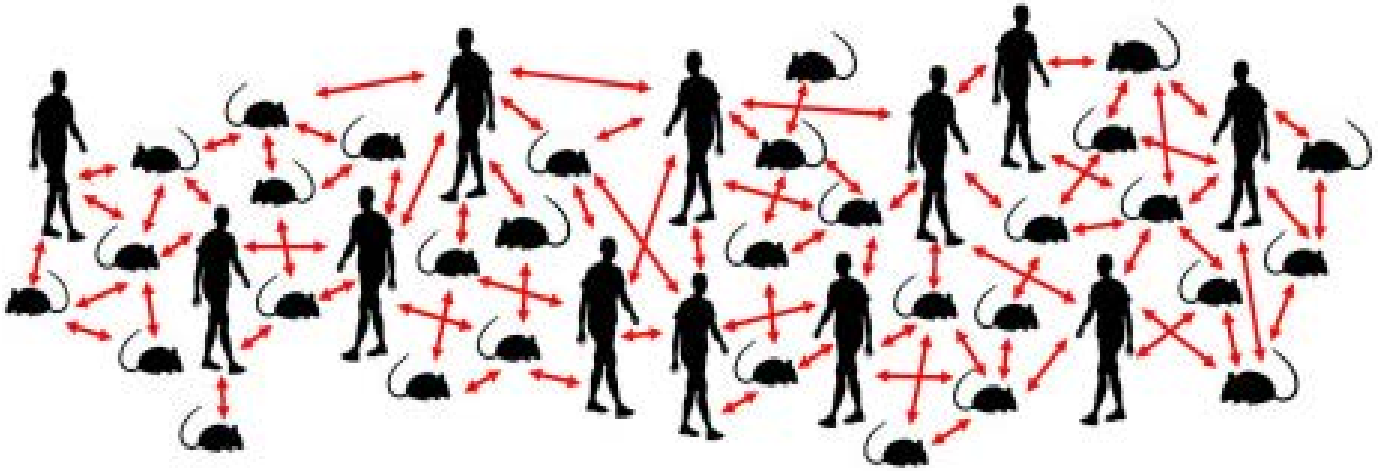
Reduced predation

Abundant and permanent resources (food stocks, waste, etc)

Rodents find shelter and food there.

Permanent reproduction

Context



High densities of both human and rodents

⇩

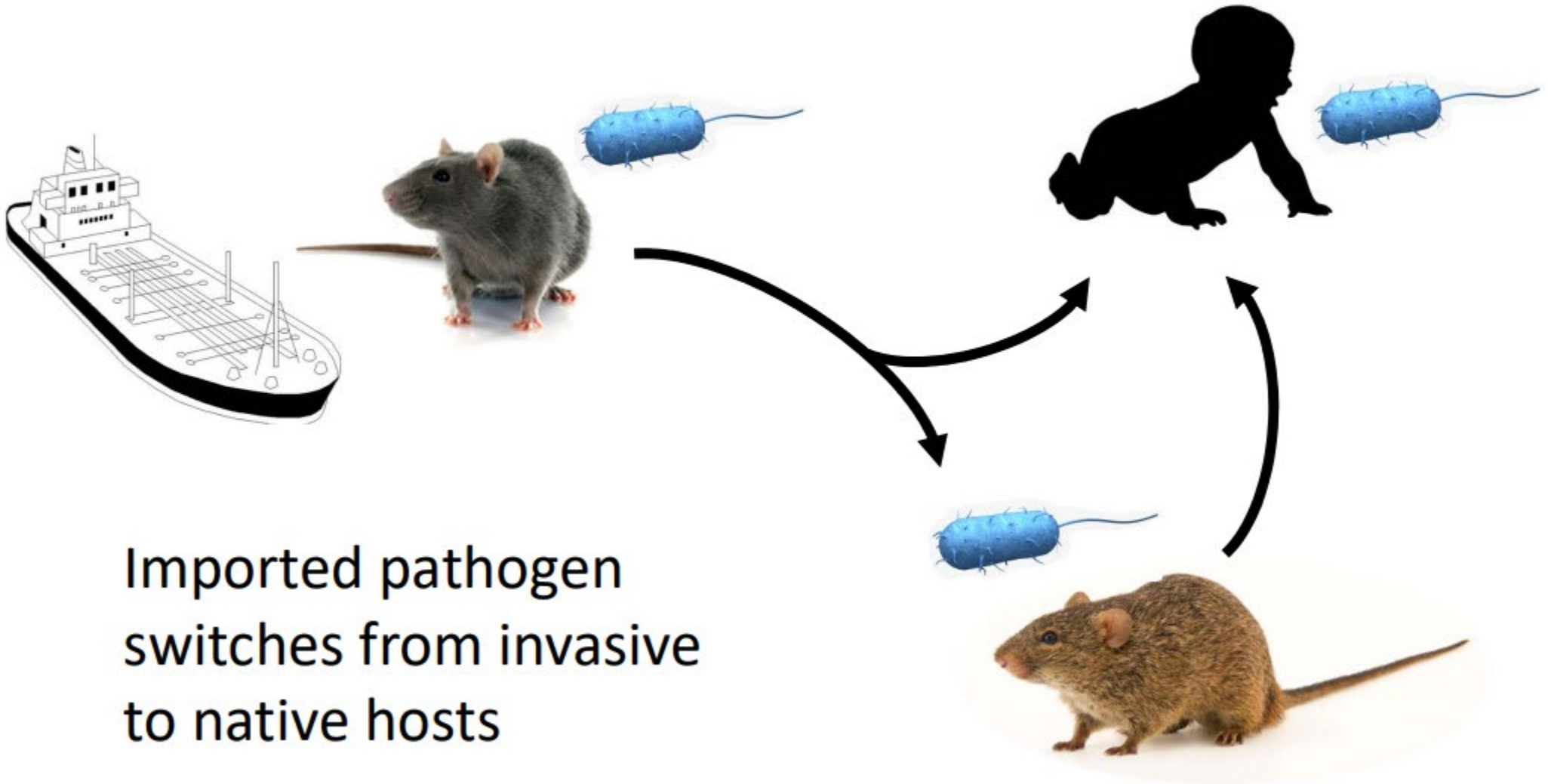
Enhanced risk of rodent-to-rodent and rodent-to-human transmission

⇩

Increased risk of epizootic episodes and zoonotic cases

Context

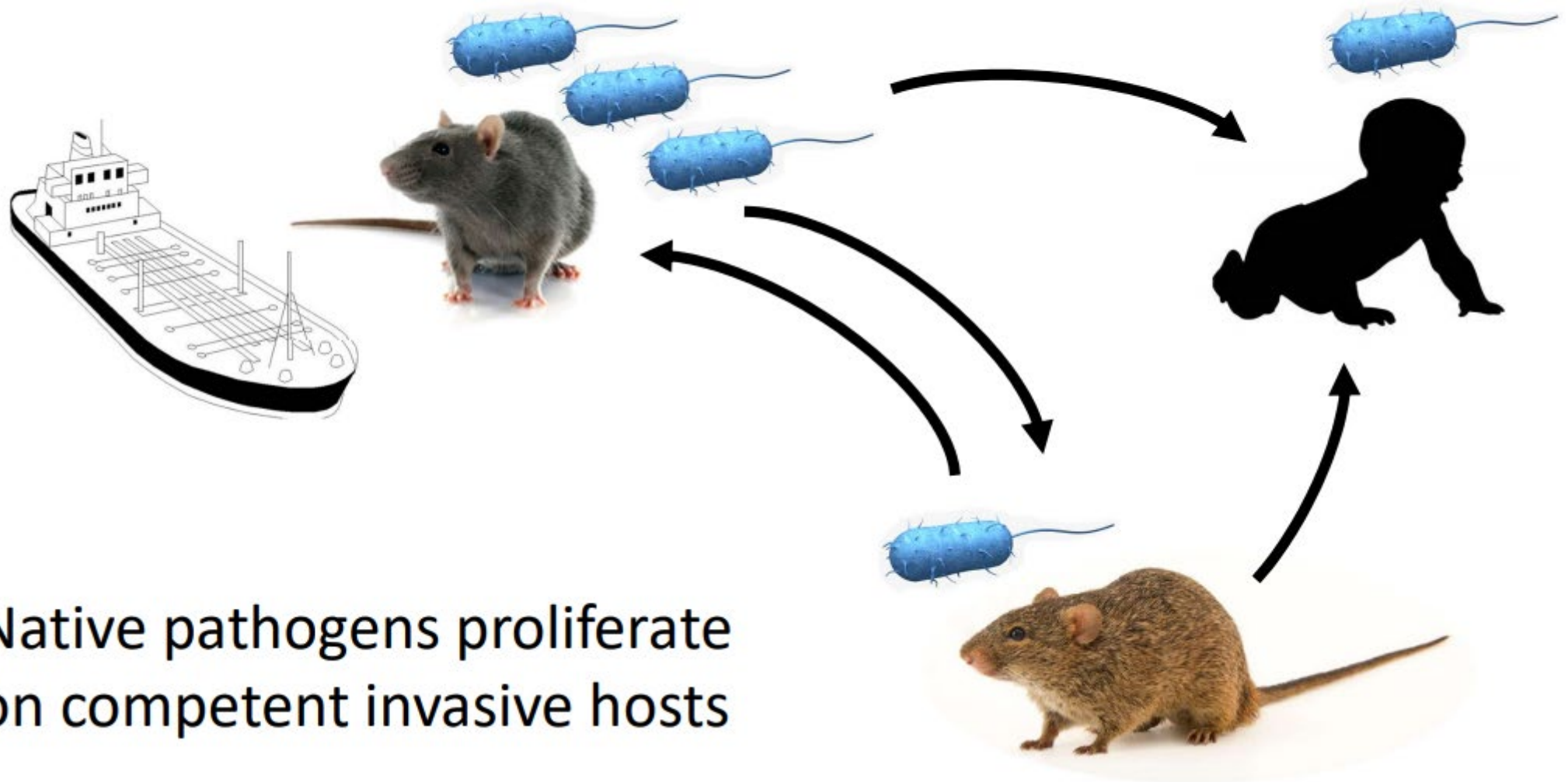
Bioinvasions, diversity and parasites: spill-over



Imported pathogen
switches from invasive
to native hosts

Context

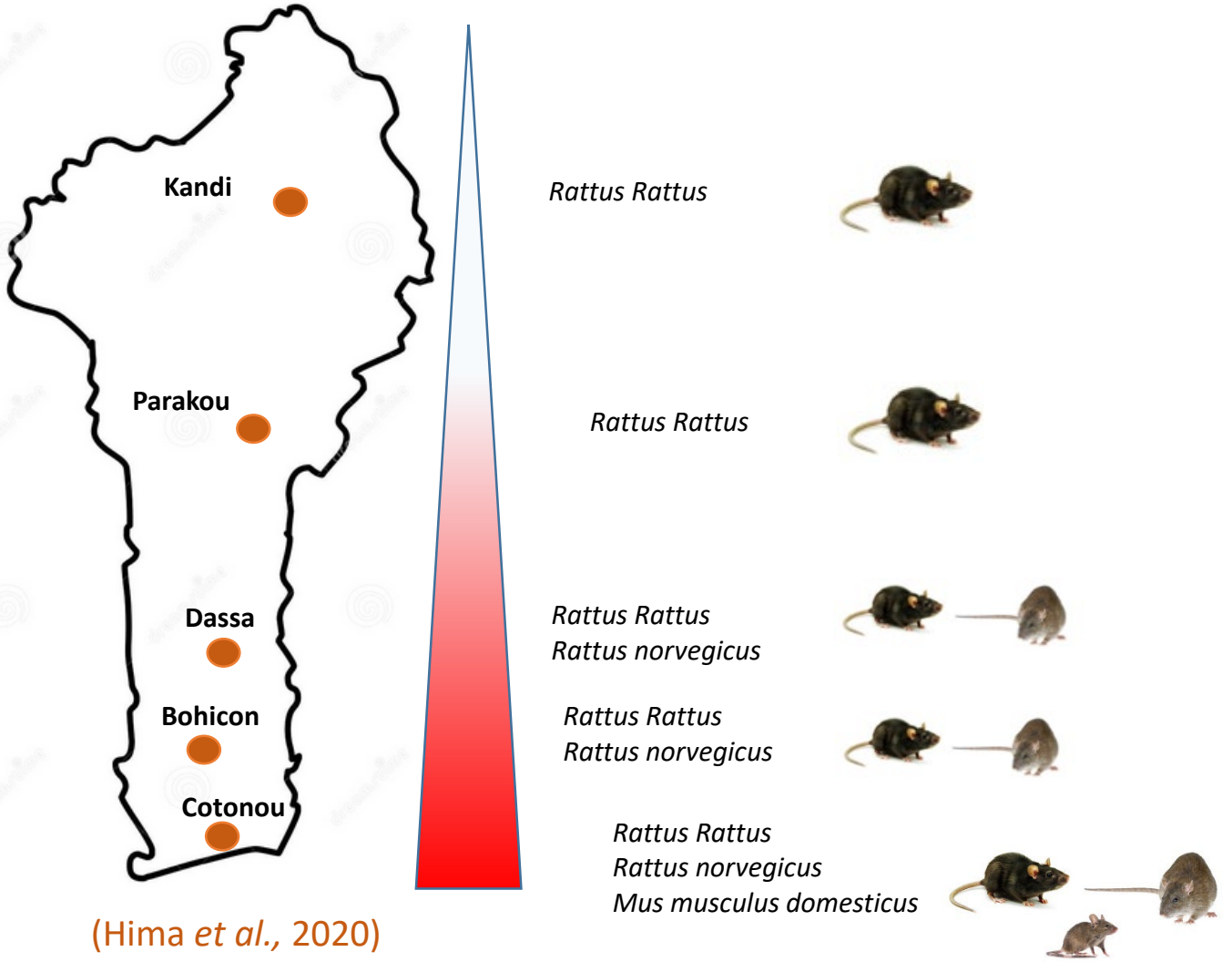
Bioinvasions, diversity and parasites: spill-back



Native pathogens proliferate
on competent invasive hosts

Context

Cotonou seaport, hypothetical introduction gate of invasive species in Benin



(Hima *et al.*, 2020)

Aims

(1) How quickly does urbanization lead to the establishment or replacement of cosmopolitan rodent host species that are a priori competent for many pathogens?

(2) At what rate is urbanization accompanied by a reduction in local biodiversity?

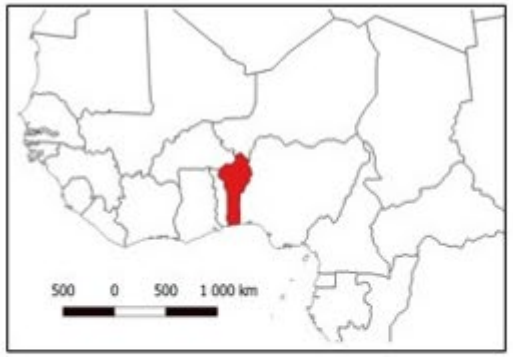
(3) Does urbanization mean increasing circulation of rodent-associated infectious agents, especially cosmopolitan rodents?

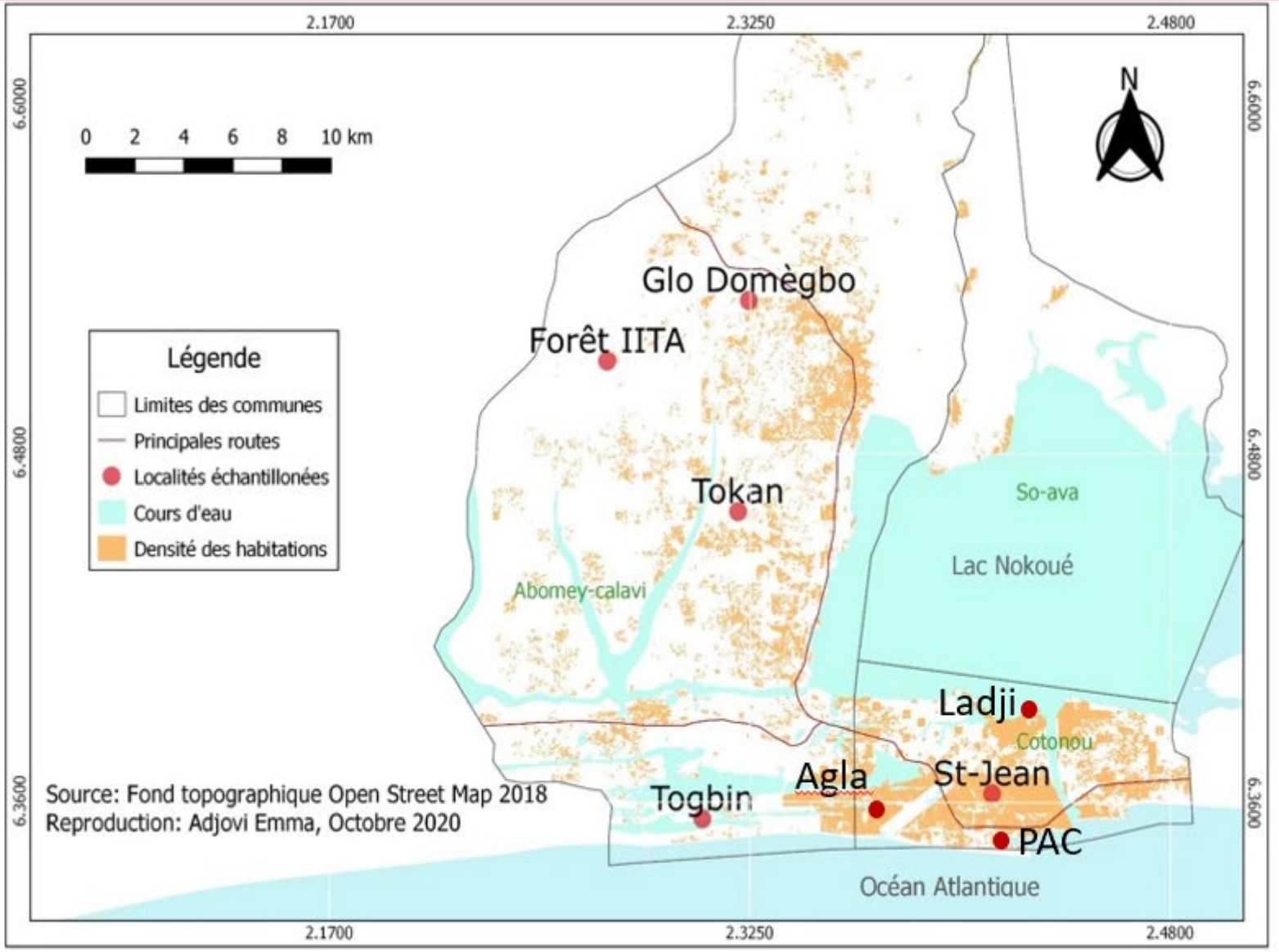
(4) In which context is zoonotic risk highest (i.e., urban, peri-urban or forest/rural contexts) ?

(5) Which types of pathogens and host species (viruses, bacteria, protozoa; direct, environmental or vector-borne transmission) are most impacted by urbanization ? in which way?

(6) How possible introductions of zoonotic pathogens of allochthonous origin imported via the involuntary introduction of rodents disembarked from ships evolve in the surrounding urban environment.

Monitoring of eight observatory sites in southern Benin





PAC

Urban

Agla

Ladji

Saint-Jean

Peri-urban

Togbin

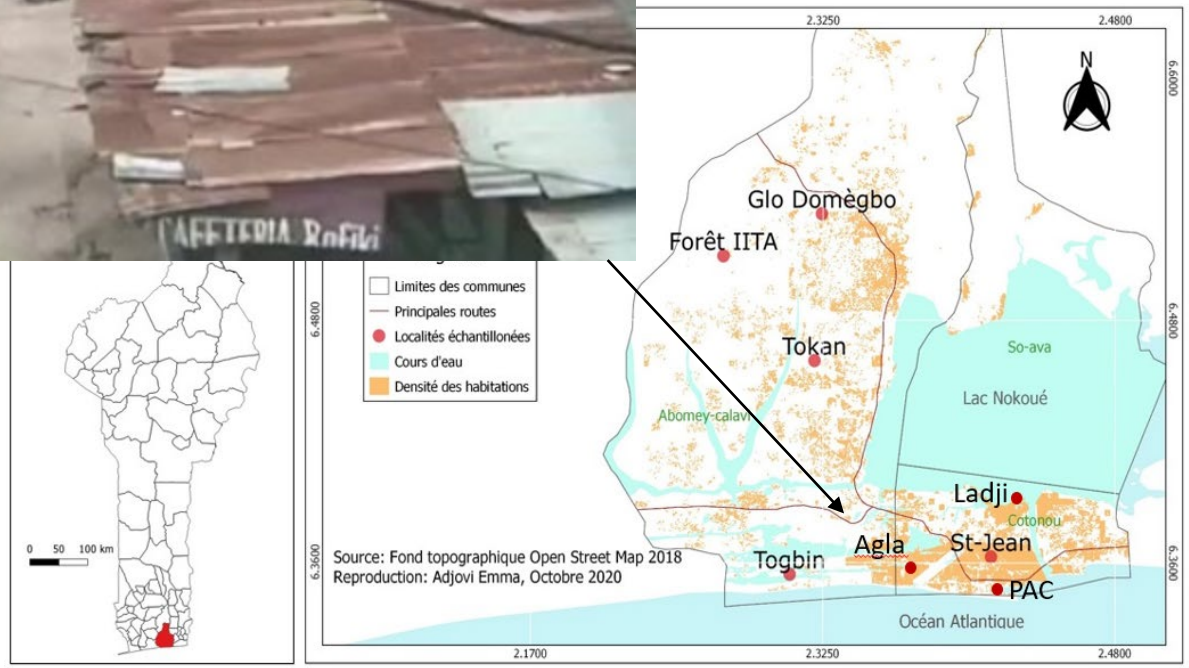
Tokan

Glo-domègbo

Rural/forest

IITA forest

Monitoring of eight observatory sites in southern Benin



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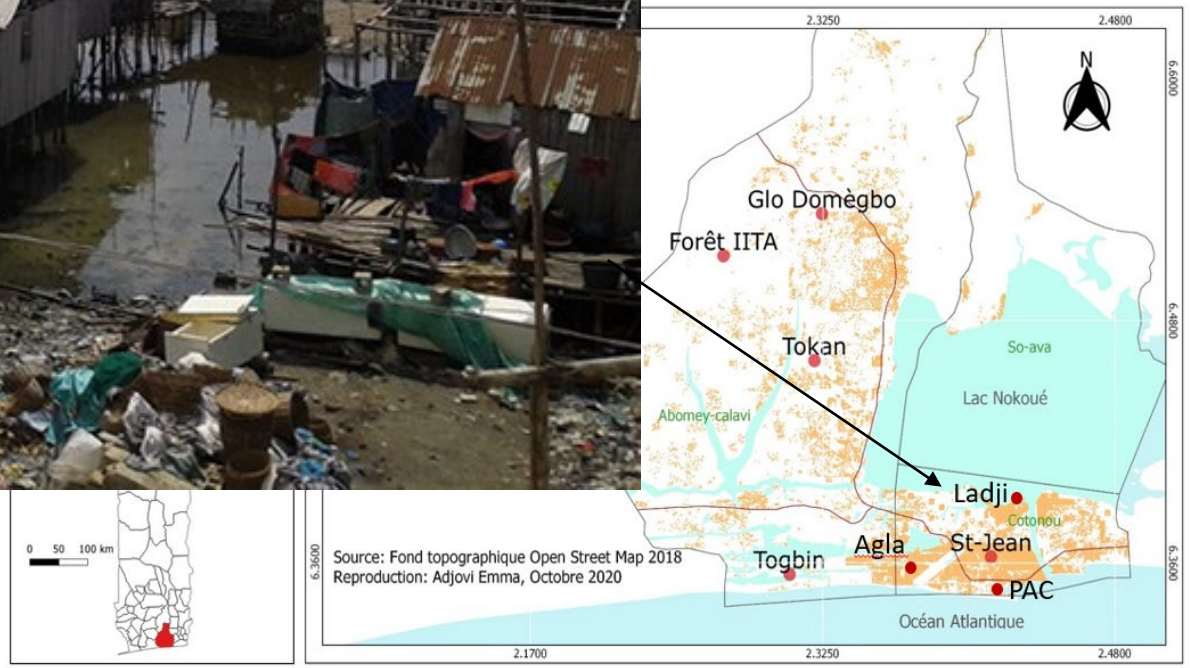

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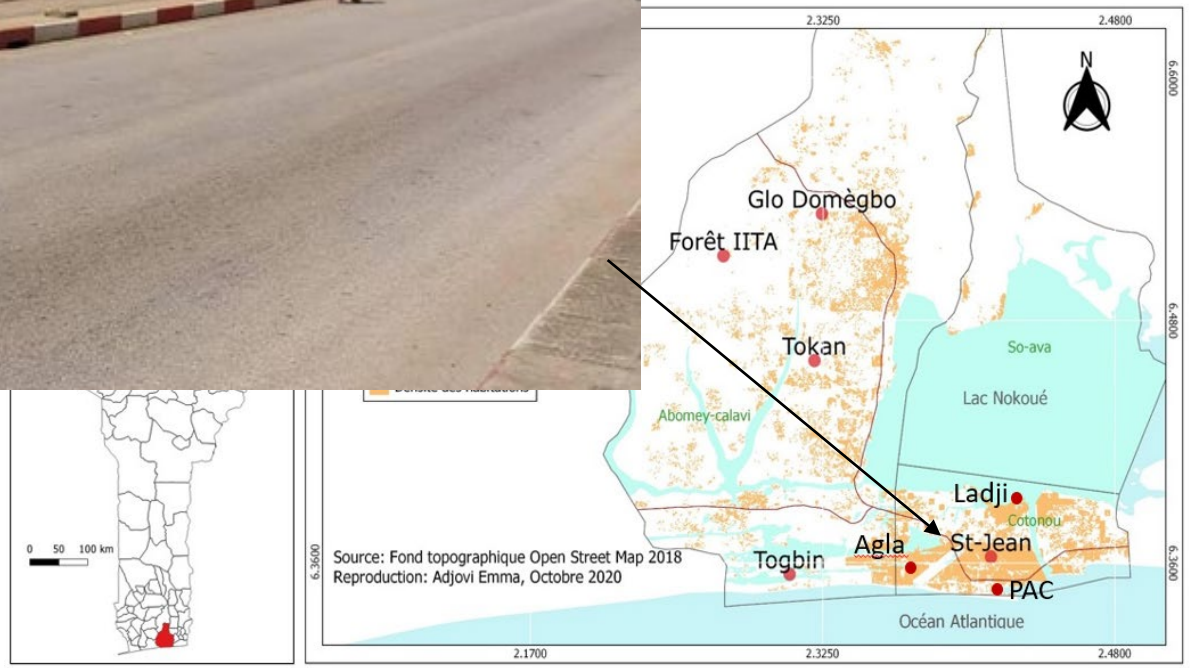

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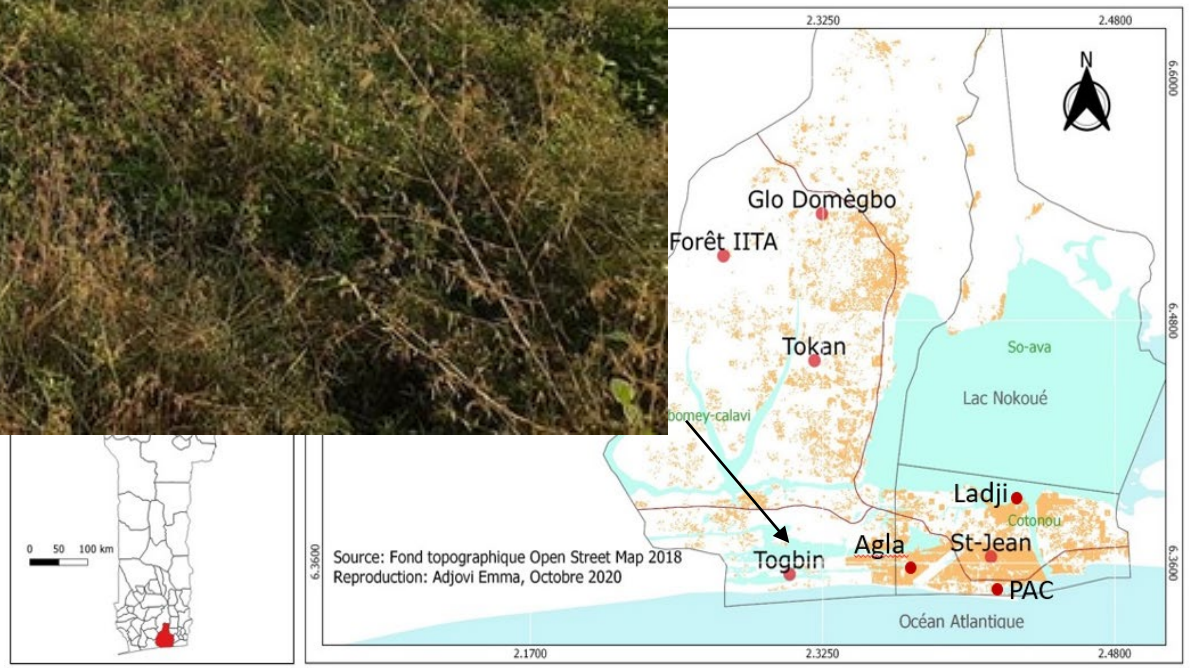

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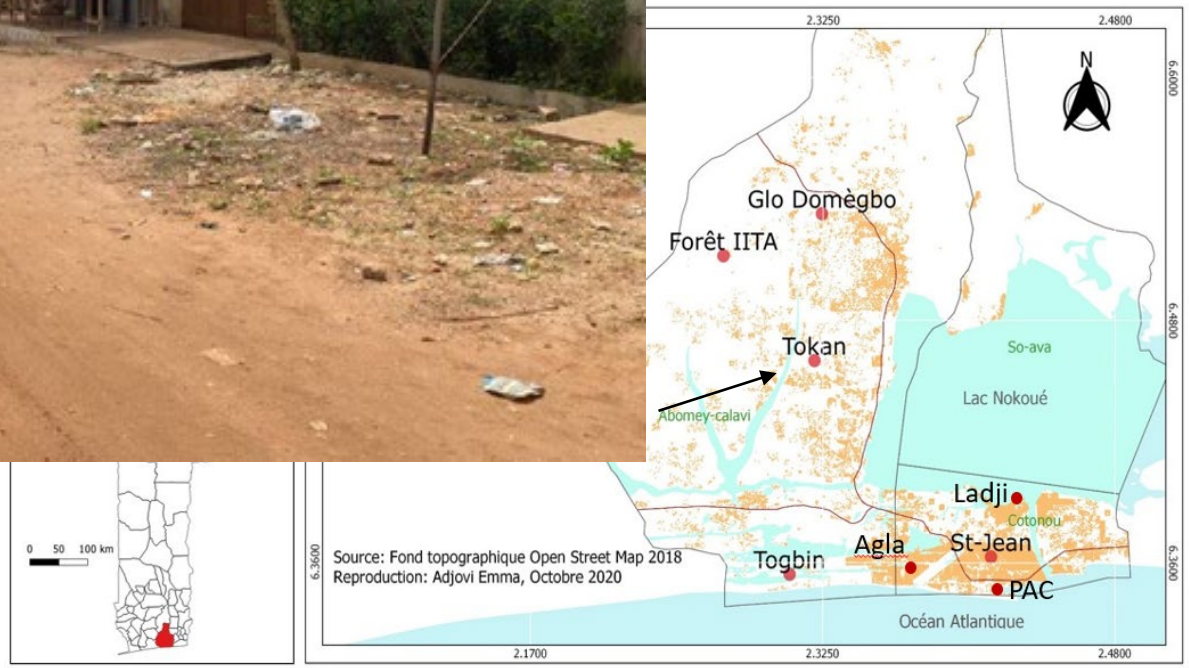

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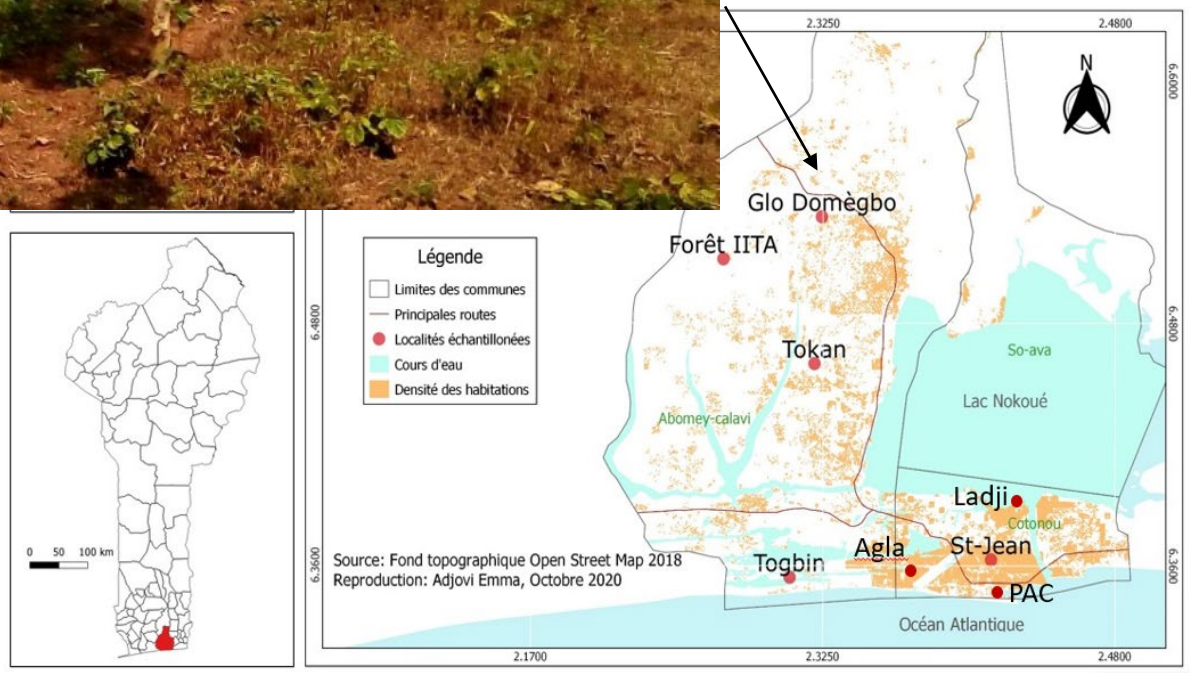

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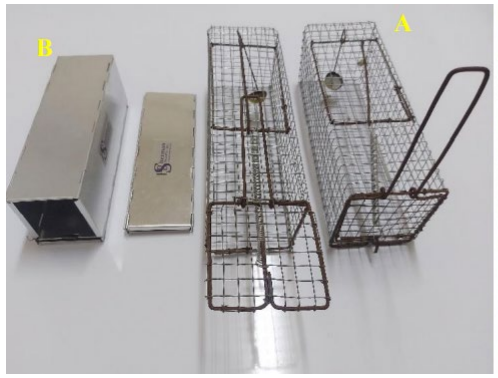
Sampling of rodents

Trapping campaigns

Trap installation under a bed

Trapped rodent in Ladji

Autopsy session



Sherman, locally made wire mesh traps and tubes with data matrix

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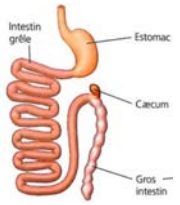
Screening of rodent-borne pathogens



→ Morpho identif / PCR? → Helminthes

→ PCR → *Rickettsia spp.*
Yersinia pestis

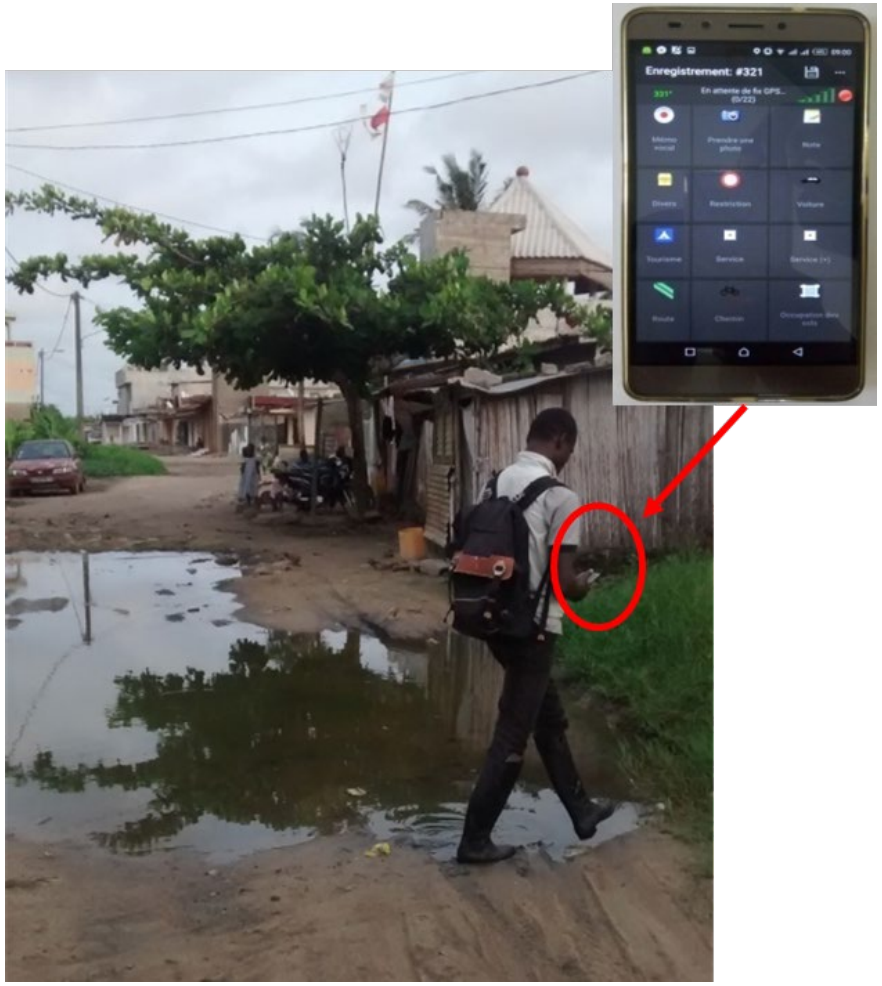
→ qPCR → *Toxoplasma gondii*

→ qPCR + Sequencing + MST → *Leptospira spp.*

→ qPCR + meta 16S sequencing → *Trypanosoma lewisi*
Bacterial pathobiome

→ ELISA + RT-PCR → Hantavirus and virus lassa

Mapping of trapping sites



Fine mapping of the landscape units (landcover/landuse)

Digitization work of the occupation units of different monitored localities

Preliminary results

Cricetomys gambianus

Crocidura spp.

Mastomys natalensis

Main native species

Rattus rattus

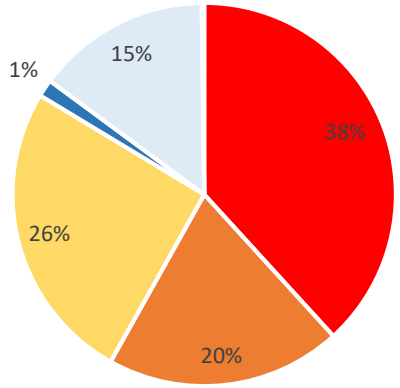
Mus musculus

Rattus norvegicus

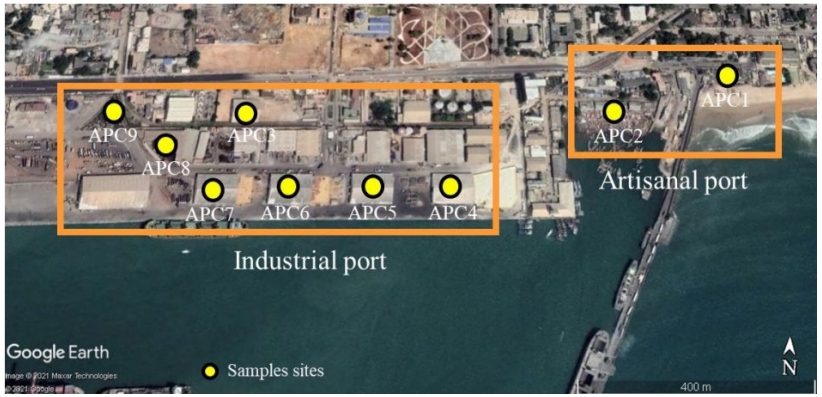
Invasive rodents

Preliminary results

PAC 2017- 2020

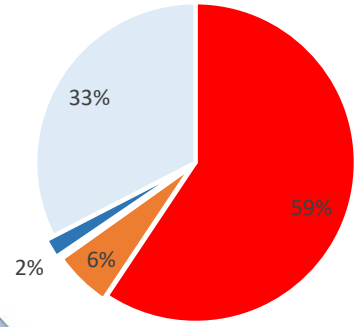


R. rattus *R. norvegicus* *M. m. domesticus* *M. natalensis* *C. olivieri*

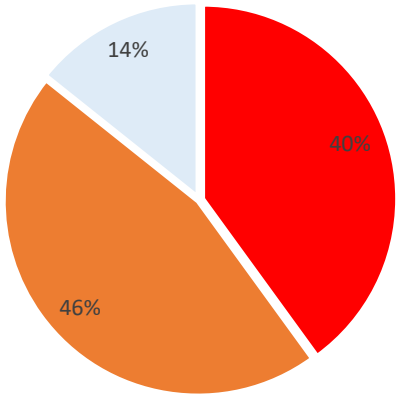


About 85% of invasive species in APC

Ladji 2016-2018



Ladji 2021



R. rattus

R. norvegicus

M. m. domesticus

M. natalensis

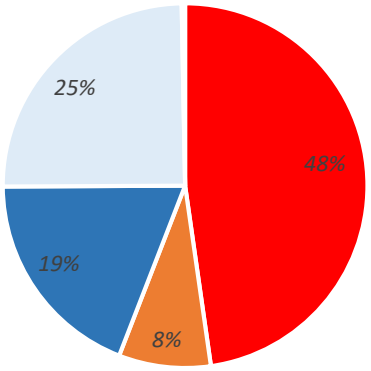
C. olivieri

Nanomys sp.

C. gambianus

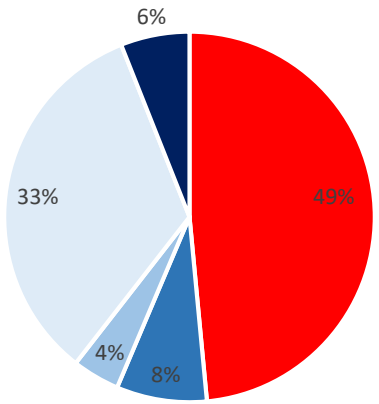
Preliminary results

AGLA 2016 - 2018



20% *M. natalensis* probably due to presence of bushy

Saint-Jean 2016-2018

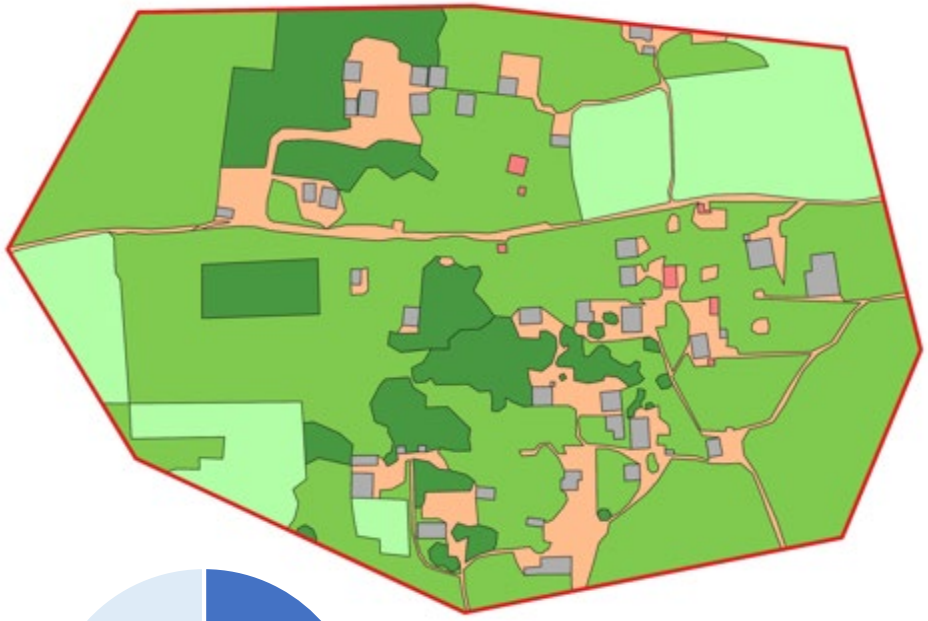


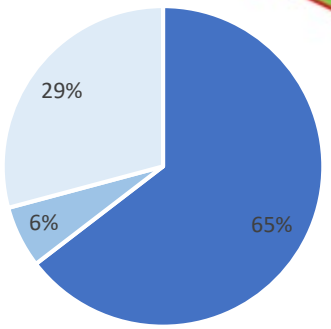
4 natives species and just *R. rattus* as invasive despite the disparition of vegetation cover

- *R. rattus*
- *R. norvegicus*
- *M. natalensis*
- *P. derooi*
- *C. olivieri*
- *Nanomys sp.*
- *C. gambianus*

Preliminary results

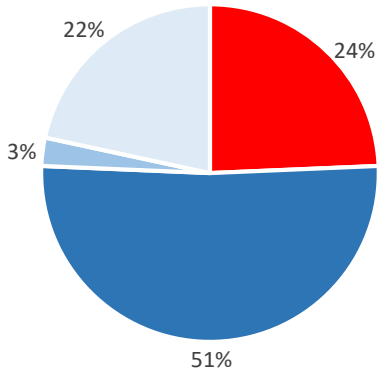
Glo 2019



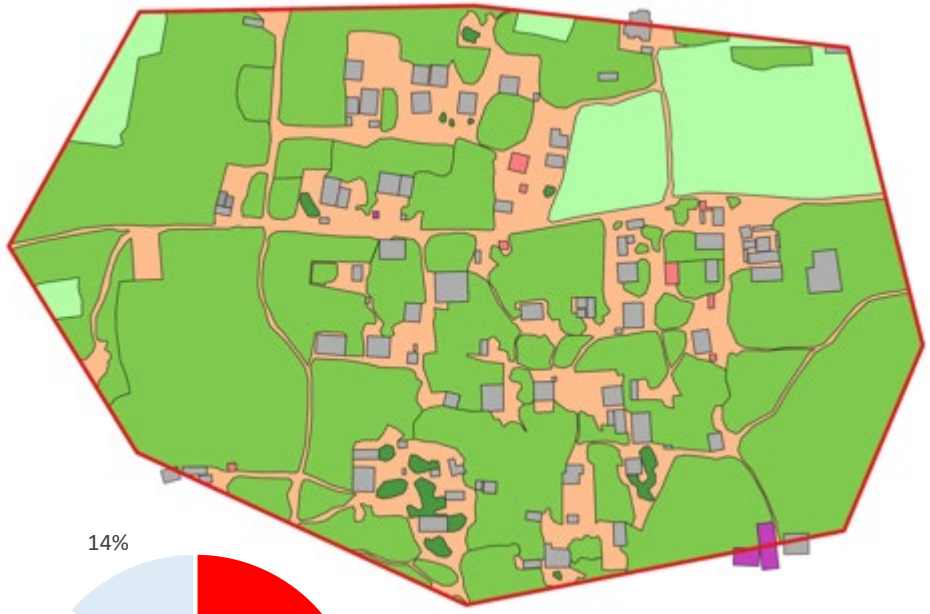


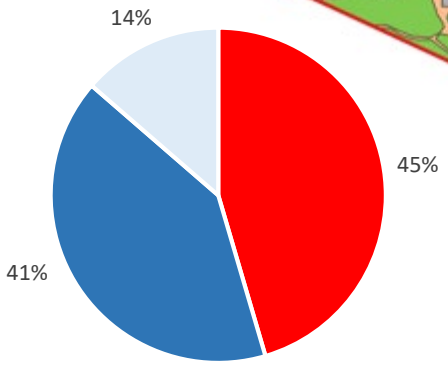
Glo 2021

?



Glo 2022



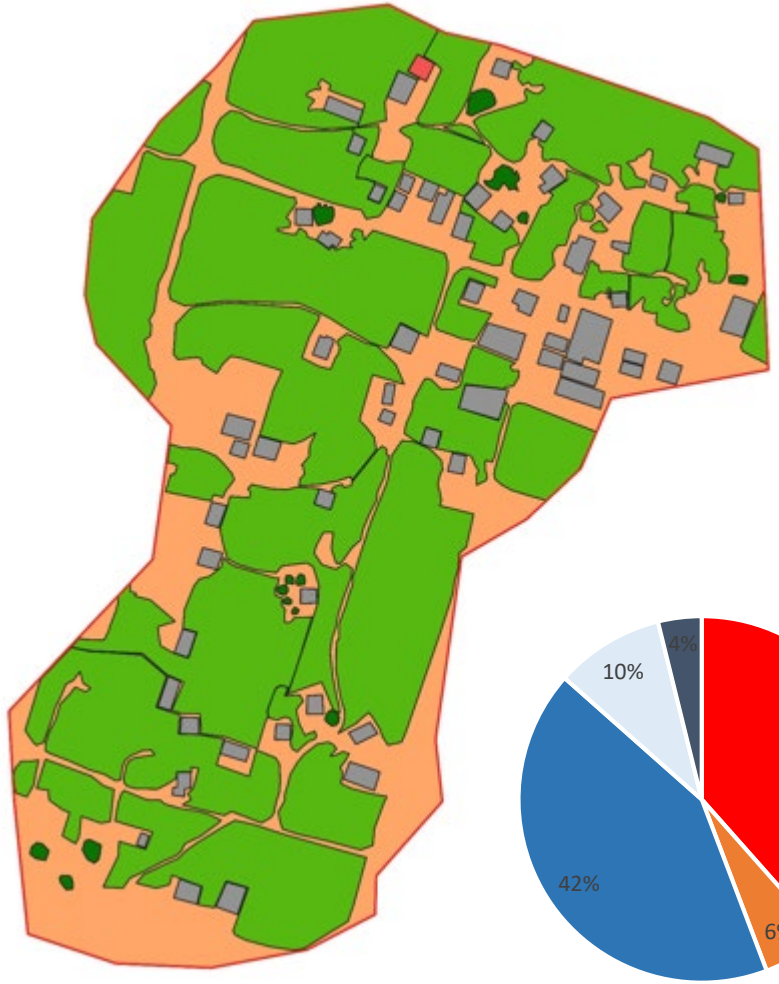


Establishment and spread of *R. rattus* in just 3 year

M. natalensis | *C. olivieri* | *P. derooi* | *R. rattus*

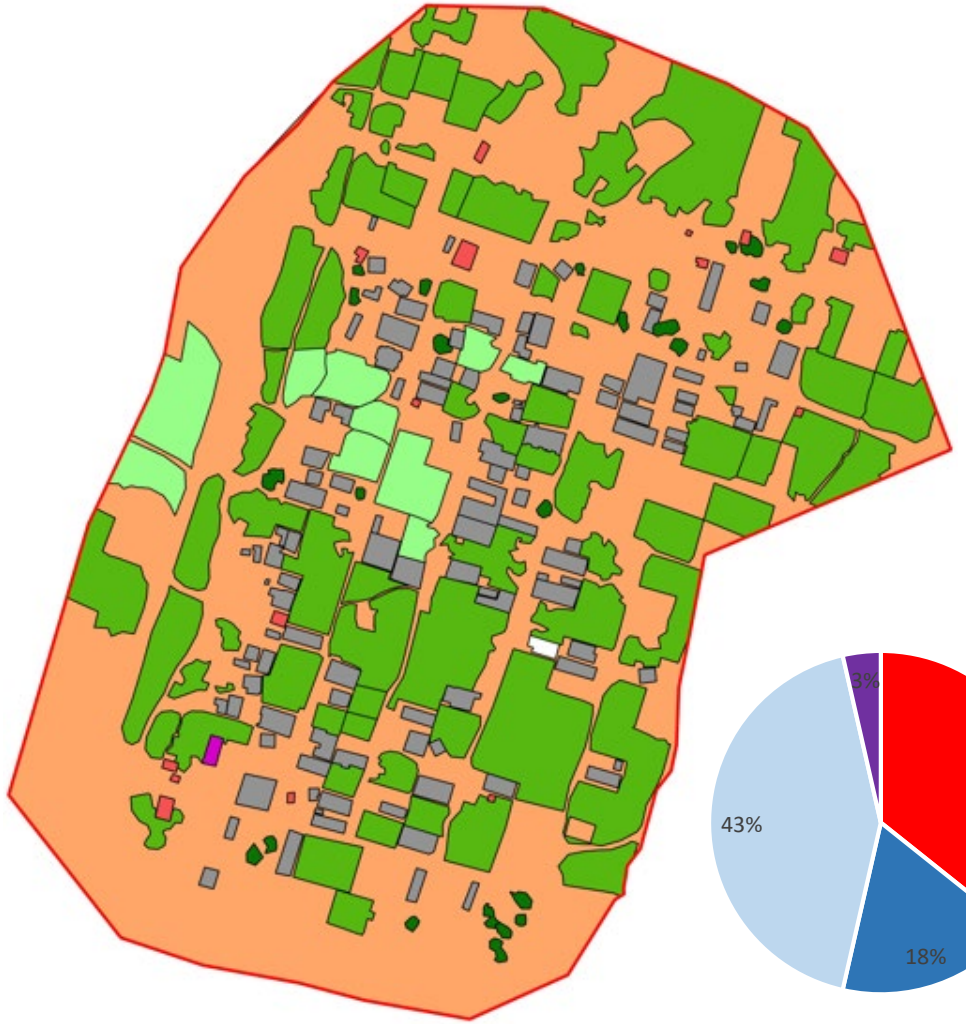
Preliminary results

Tokan 2020



R. rattus R. norvegicus M. natalensis C. olivieri C. gambianus

Tokan 2022



R. rattus M. natalensis C. olivieri Nanomys sp

R. rattus

R. norvegicus

M. natalensis

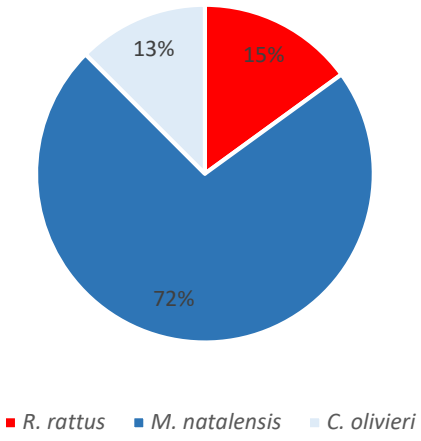
C. olivieri

C. gambianus

Nanomys sp.

Preliminary results

Togbin 2017



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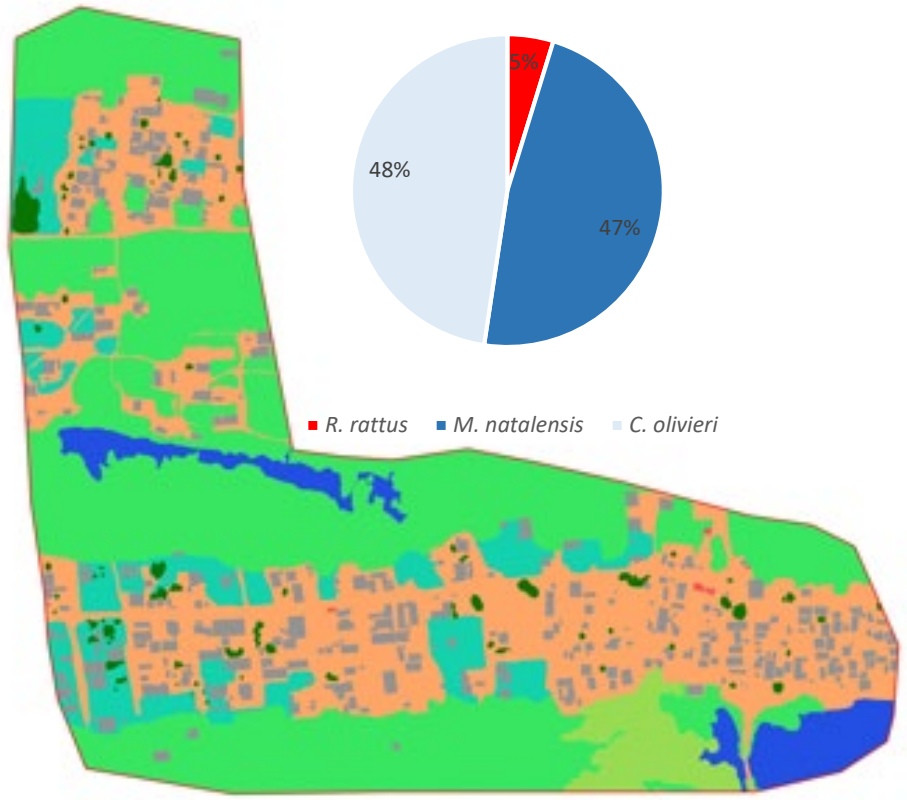
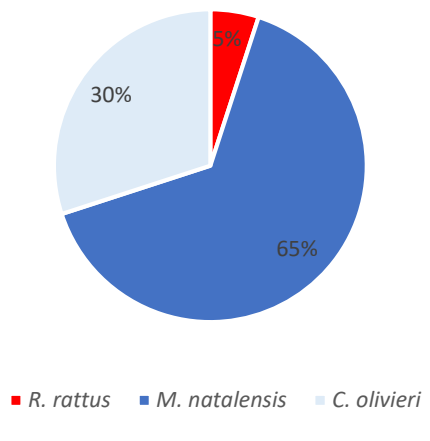
Togbin 2020



Togbin 2022



?

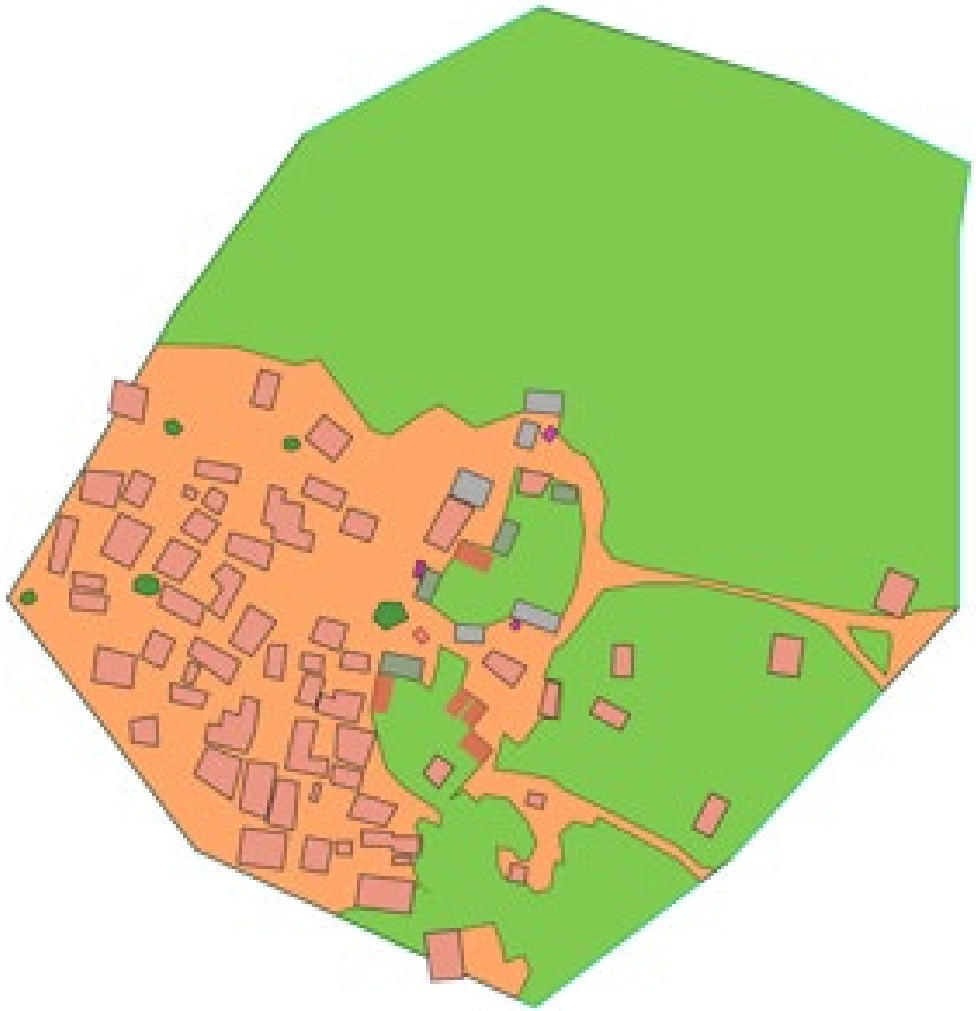
M. natalensis

C. olivieri

R. rattus

Preliminary results

IITA forest 2020



?

100% *R. rattus* in the concessions around the reserve

Preliminary results

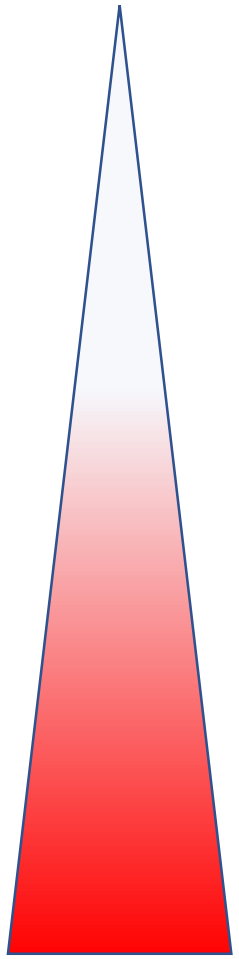
Urbanisation Gradient

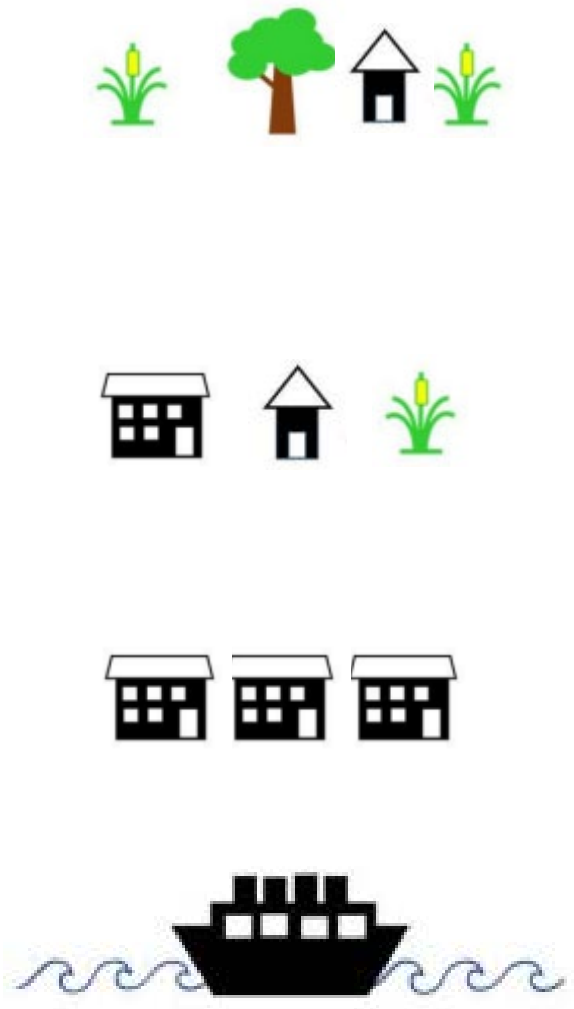
Rural/forest
IITA forest

Peri-urban
Glo-domègbo
Tokan
Togbin

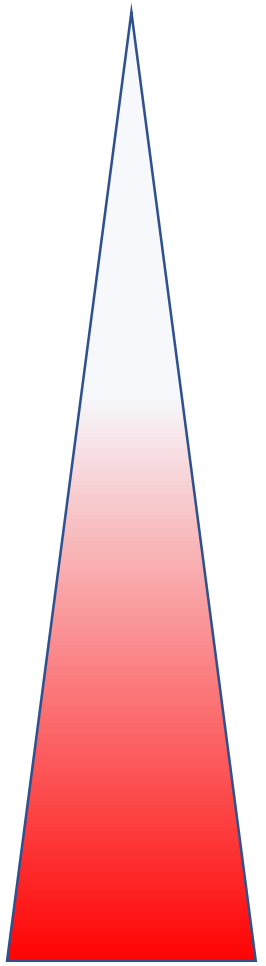
Urban
Ladji
Agla
Saint-Jean

APC





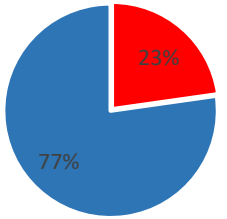
Invasion gradient

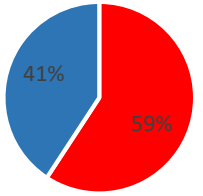


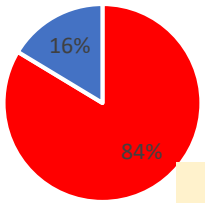
Native / Invasives

?

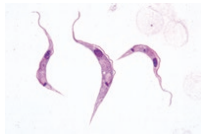
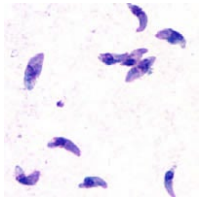
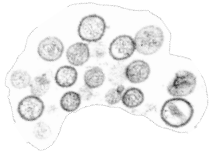
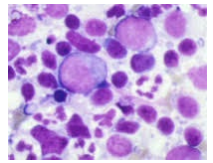
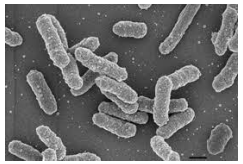
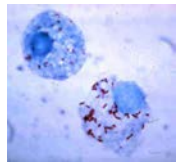
?







Preliminary results

	Trypanosoma spp.	*Leptospira spp.*	*T. gondii spp.*	*Hantavirus*	*Bartonella spp.*	*Y. pestis.*	*Rickettsia spp.*
							
Rural/forest							
IITA forest		?		?		?	
Peri-urban							
Glo-domègbo							
Tokan							
Togbin							
Urban							
Ladji (2016-2018)	61.5%	14.1%	12.2%			?	
Agla (2016-2018)	38%	11.4%	10.3%				
Saint-Jean (2016-2018)	82.4%	0.4%	18.4%				
APC			17%	37.5%			

How will parasitic prevalence change over time in different urban contexts?

Perspectives

(1) Update small mammal trapping data in urban neighborhoods (Agla, Ladji and Saint-Jean)

(2) Maintain regular monitoring of small mammal communities in growing suburban neighborhoods

(3) Screen all pathogens in different urbanization contexts

(4) Update small mammal trapping data along the Cotonou - Niamey axis

THANKS

Institut de Recherche pour le Développement
FRANCE

ÉCOLE POLYTECHNIQUE D'ABOMEY-CALAVI