


Inference, fragmentation, conservation and genomics INFRAGECO

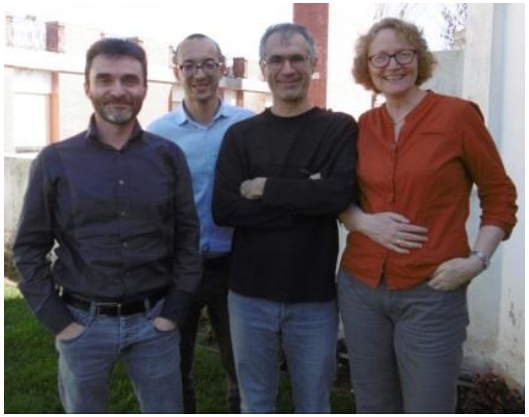
Lounes CHIKHI (Partner 1)

Funded projects final conference, 12-13 November 2019, Brussels

BiodivERsA COFUND Call (2015-2016)

« Understanding and managing biodiversity dynamics to improve ecosystem functioning and delivery of ecosystem services in a global change context: the cases of soils and sediments, and land- river and sea-scapes »

CONSORTIUM DESCRIPTION



*Partner 1 (**coordinator**): **Dr Lounès CHIKHI***
Instituto Gulbenkian de Ciência, Portugal, Funded by FCT

*Partner 2 **Dr Guillaume BESNARD***
Lab. Evolution & Diversité Biologique, Toulouse, France, Funded by ANR

*Partner 3 **Pr. Ute RADESPIEL***
Institute of Zoology, Univ. Vet. Medecine Hanover, Germany*, Funded by FMER*

*Partner 4 **Pr. Olivier MAZET***
Institut Mathématiques de Toulouse, France, Funded by ANR

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

Agence Nationale de la Recherche ANR

Federal Ministry of Education and Research


INFRAGECO PROJECT DESCRIPTION


To study the consequences of habitat loss and fragmentation on genetic diversity using comparative analyses, genomic data and statistical modelling. To develop simulation and inferential tools. To visit schools, train students, conservationists and inform authorities

Madagascar as a **model region** (first humans < 5000-10,000 years)

Habitat Loss and Fragmentation (10-20% of the total area is forested)

Genetic and genomic data (**RAD-seq**, msats, etc.)

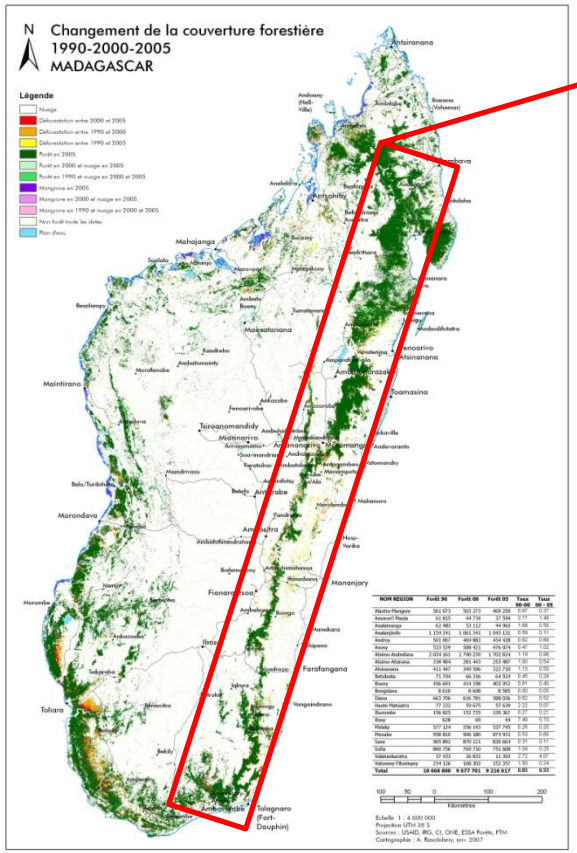
Comparative approach (**lemurs, rodents, Oleacea *Noronhia***)

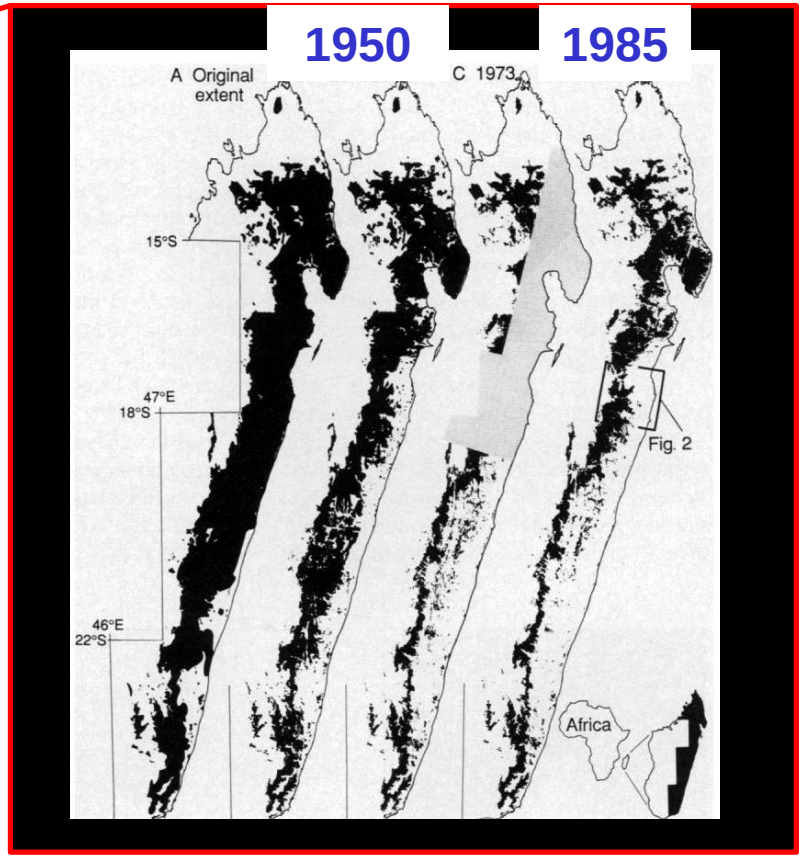
Identify recent and ancient **barriers to gene flow**

Demographic inference integrating population structure

Spatial simulations software for inference and prediction

INFRAGECO PROJECT DESCRIPTION



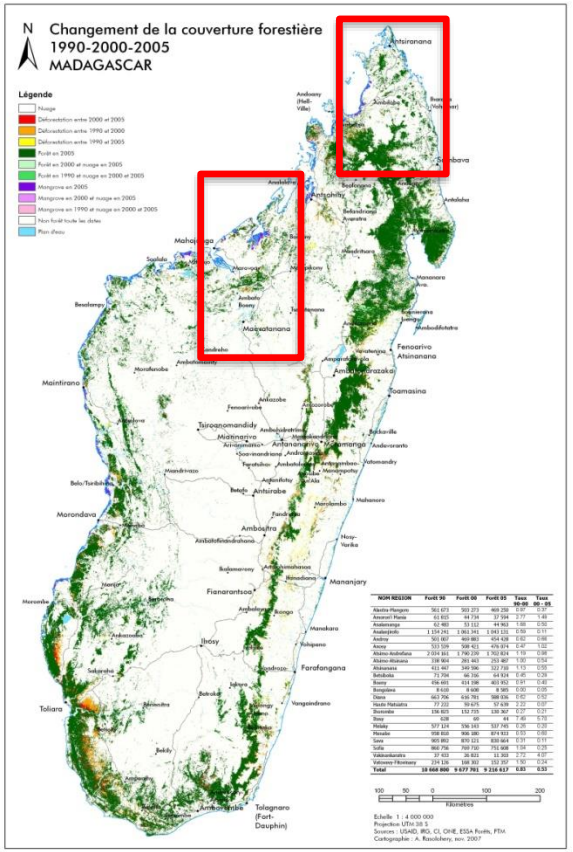


INFRAGECO PROJECT DESCRIPTION

Two main study regions
(and subregions)

Madagascar as a model
(first humans < 5000- 10,000 years)

Habitat loss & fragmentation
(10-20% of the area is forested)

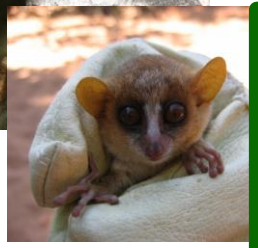


INFRAGECO PROJECT DESCRIPTION

Genetic and genomic data
(RAD-seq, msats, etc.)

Comparative approach
(lemurs, rodents, *Noronhia*)

(**endemic** – i**nvasive**)



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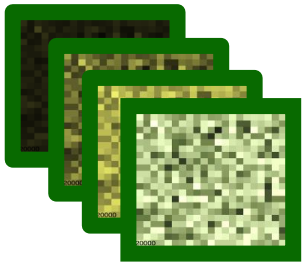

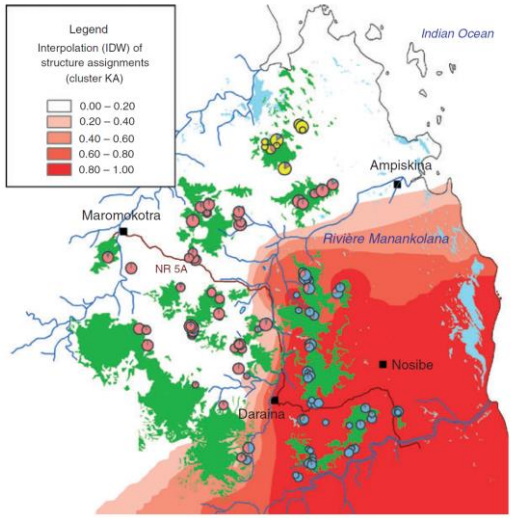

Identify **recent and ancient barriers** to gene flow

Demographic history inference integrating population structure

Spatial simulations for **inference** and **prediction**

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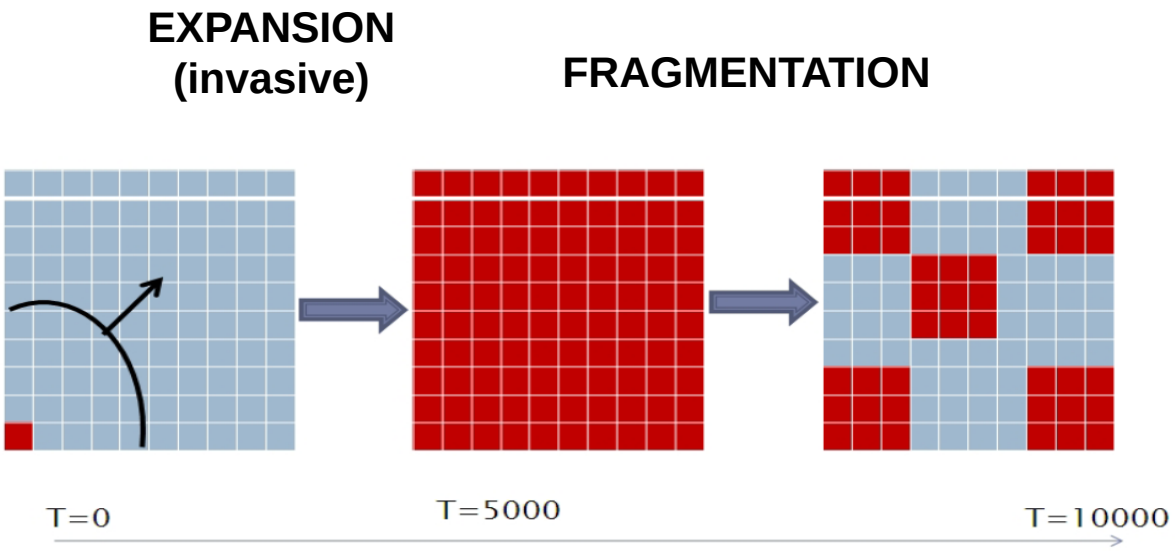
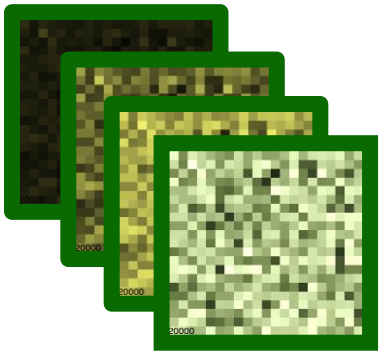




Spatial simulations for **inference** and **prediction**


INFRAGECO PROJECT DESCRIPTION


Work Packages

- Sampling and Coordination - LC
- Genotyping and Genomics - GB
- Critical Features of Ecological Networks - UR
- Spatial Simulations of HL&F - LC
- Stochastic Modelling and Statistical Inference - OM
- Dissemination – LC

Tasks : 15 Tasks (sub WPs)

Milestones: 22 across the six WPs

Deliverables: 29 across the six WPs

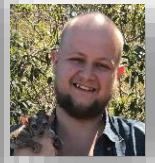

SCIENTIFIC OUTPUTS

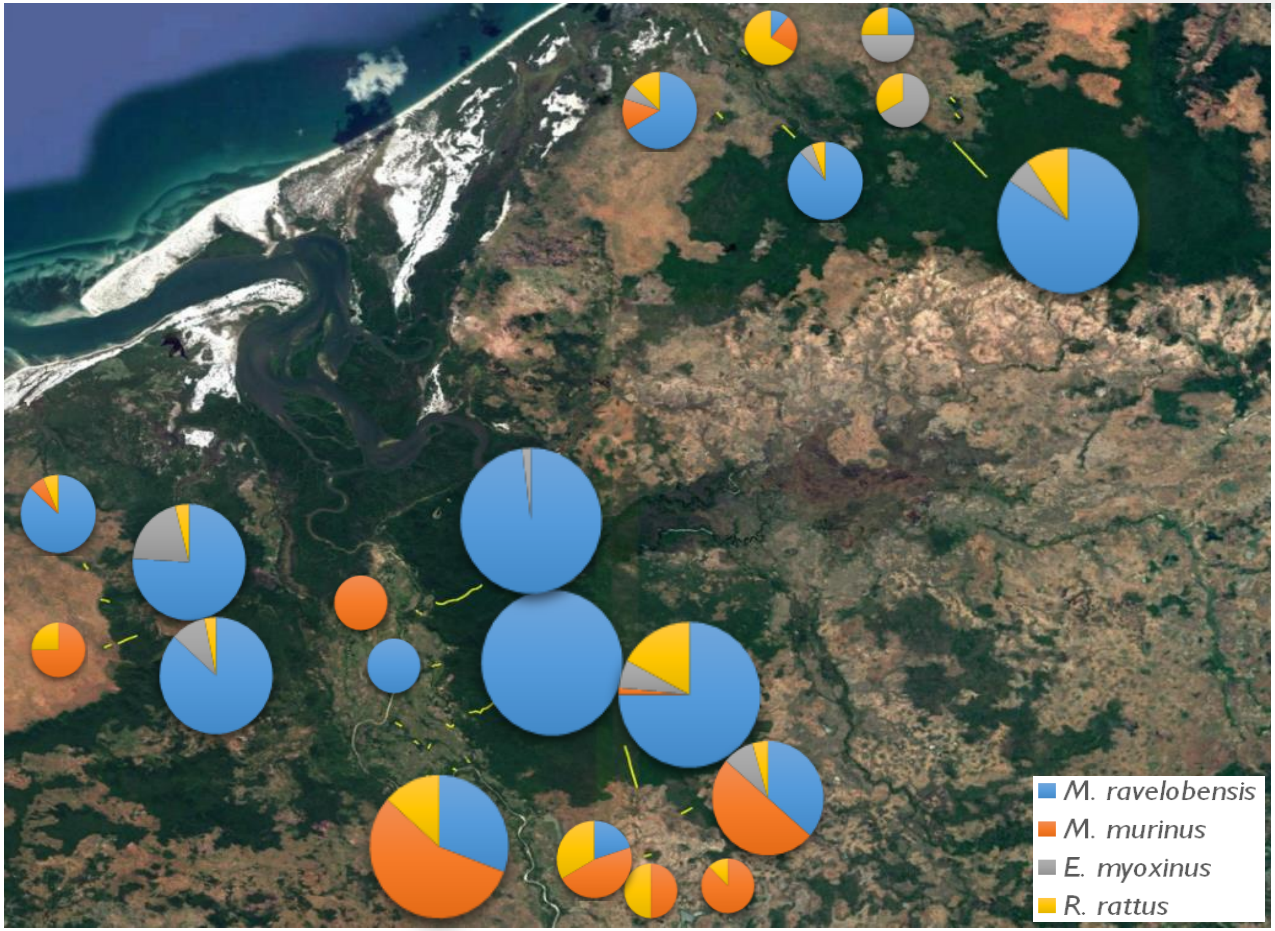
- **> 1000 animals** and **> 2500 plants sampled**
- **> 900 individuals RAD-seq-ed** across all species (**to be finished**)
- **3 theoretical articles** published (one was expected) + 2 additional to be submitted
- 11 articles published (**9 peer-reviewed**) + 3 submitted + 3 in prep.
- **Two simulation software** (final stages -- as expected)
- **Theoretical advances:** extensions of **the IICR concept (inverse instantaneous coalescence rate)**: clarifies connection between **population structure and population size change** ➔ makes it easier to infer **ancient connectivity**


SCIENTIFIC OUTPUTS

- **Tentative new species** of mouse lemurs
- **Extension of species distributions** of mouse lemurs
- **Biodiversity hotspot for Noronhia**
- **Variable species-specific response of** mouse lemurs to **habitat fragmentation**
- **First genetic study** of the only **open habitat** Noronhia species (***Noronhia lowry)***
- ***Noronhia lowry***: **extreme structure on cpDNA** and **no structure in nuclear DNA**
- ***Noronhia lowry*** to be used for **reforestation**
- **New results on genetic edge effect (spatial simulations)**
- **New measures of edge effect correlate with genetic diversity**
- **Parasitic load has a complex relation with edge and fragmentation**

Distribution mouse lemur species in Mariarano

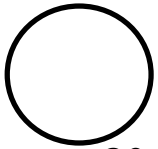



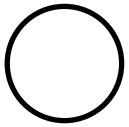



- *M. ravelobensis:* i the largest forests

- *M. murinus:* in forest fragments
- *E. myoxinus:* rare everywhere

- *R. rattus:* in forest fragments

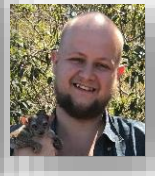

n > 30

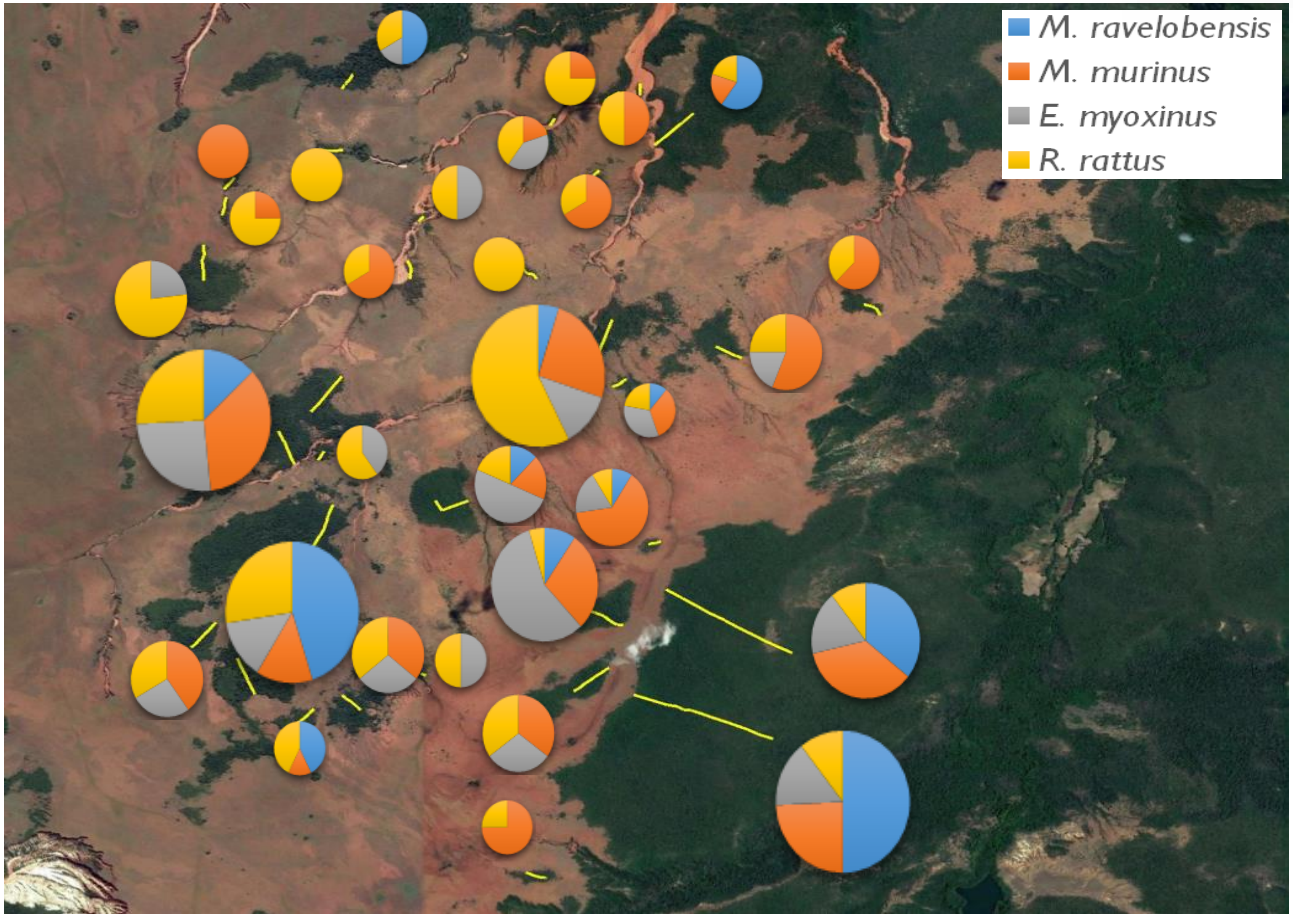

30 ≥ n > 20


20 ≥ n > 10


n ≤ 10

Distribution of species in Anbanjabe (Ankarafantsika)

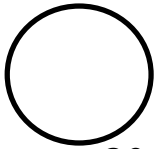



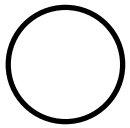
- *M. ravelobensis:* in largest fragments

- *M. murinus:* everywhere

- *E. myoxinus:* everywhere

- *R. rattus:* in fragments


n > 30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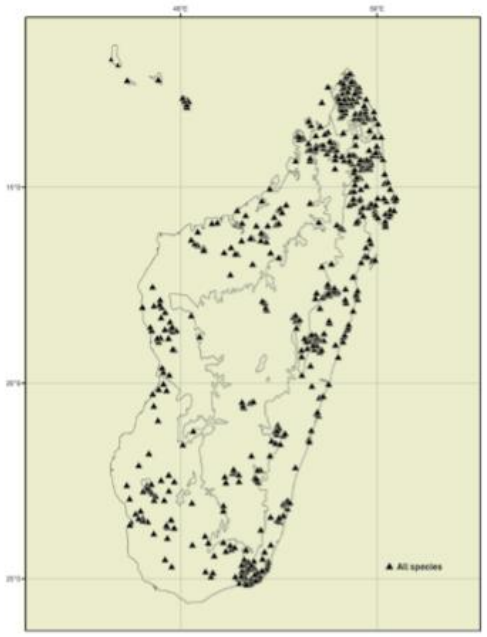
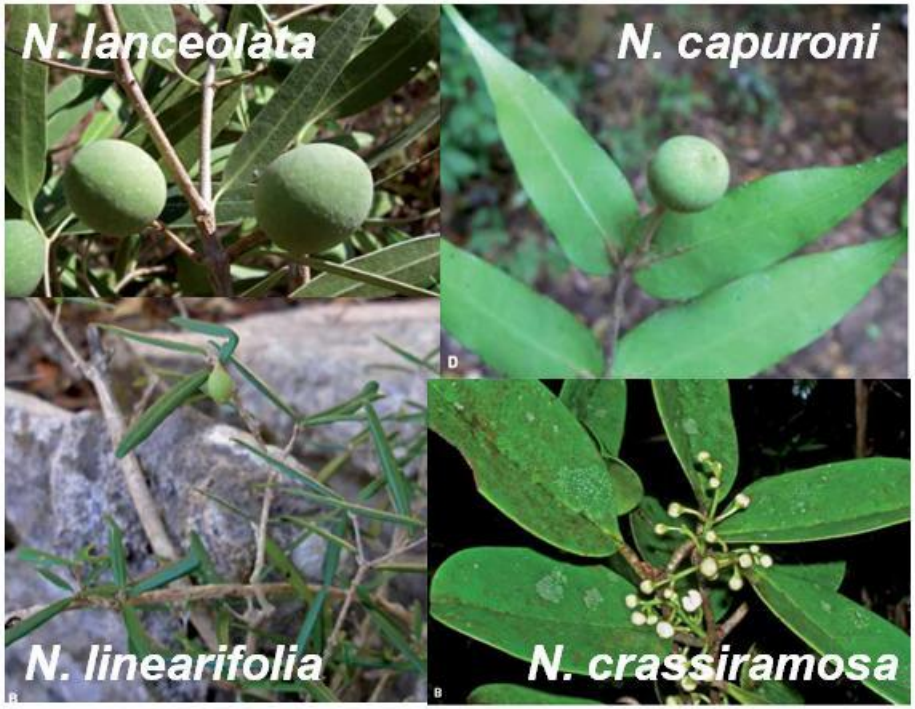


Noronhia as a case study

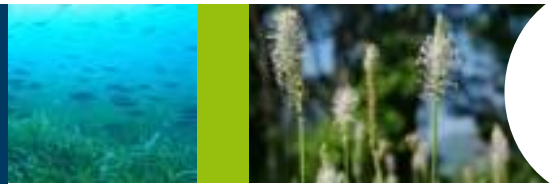
- « Recent » radiation (Miocene) …

- Great variability morphologique (fleur, feuille, fruit, taille…)

- High species diversity



Hong-Wa (2016) *Boissiera* 70



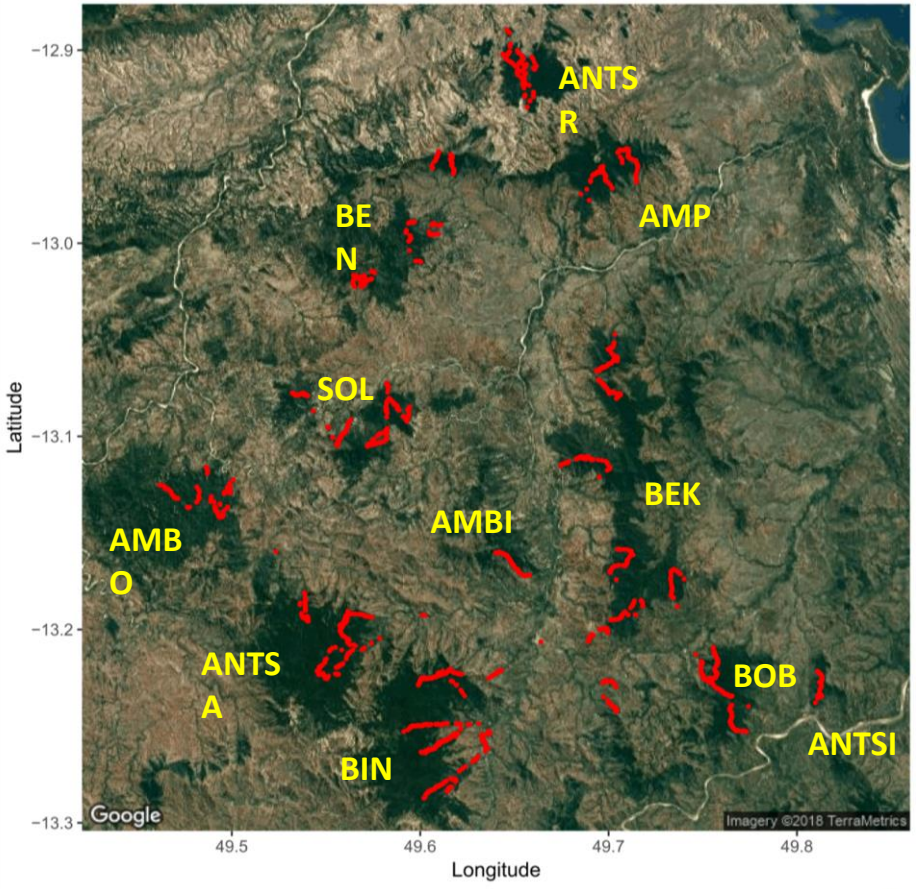

SCIENTIFIC OUTPUTS

Noronhia field work in the « Loky-Manambato »

- ✓ **Sampling transects**
  - **Habitats types**
  - **Altitude**
  - **Forest size**
- ✓ **>2500 N*oronhia***
- ✓ **~30 species**

Most species are micro-endemics

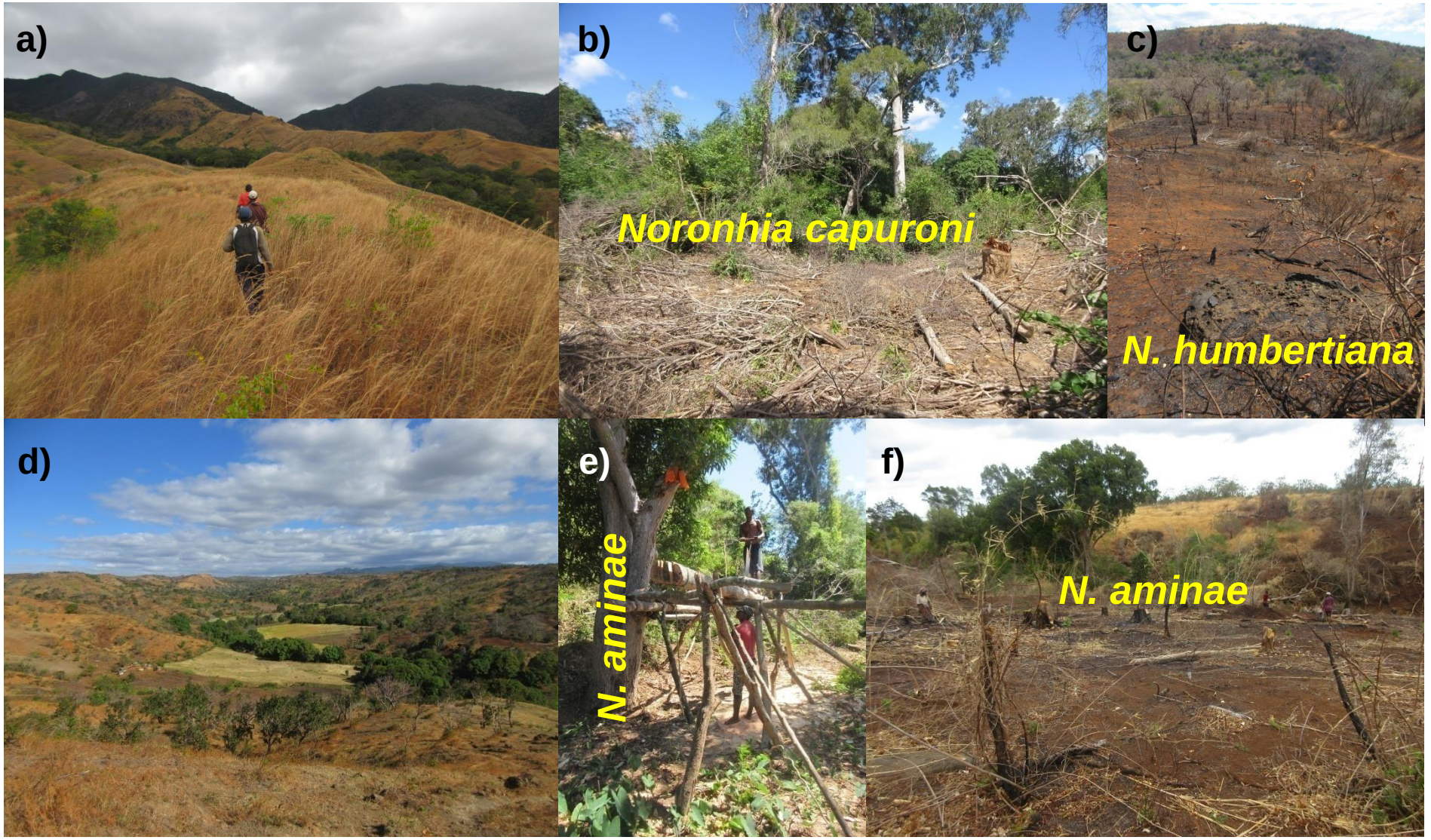
Many sympatric species



FANAMBY

Université de Mahajanga

Noronhia exploited for wood and charcoal



Noronhia lowryi

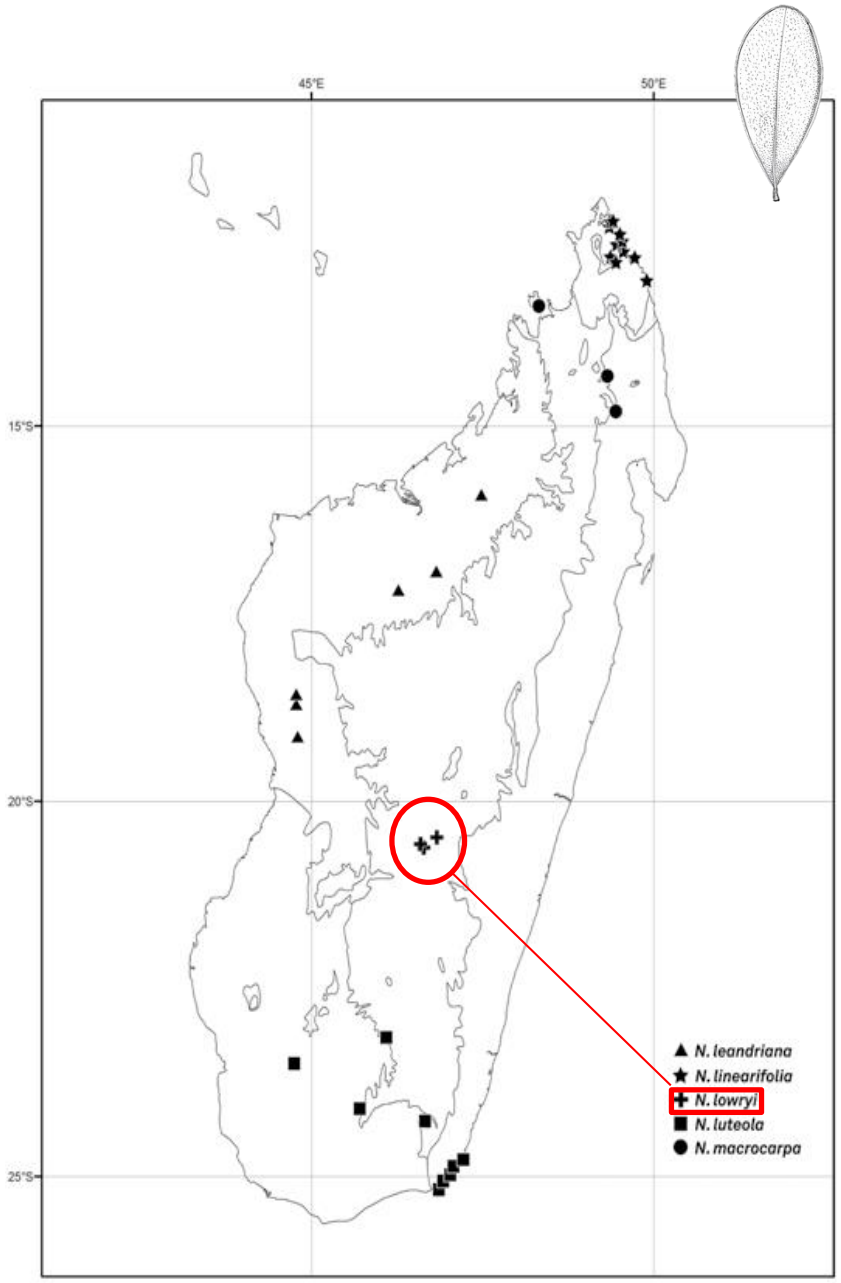
Hong-Wa C. 2016. *Boissiera*

Recently described :

- **Only *Noronhia* savanah species**

- Endemic in Itremo à Ibity
- Sols quartzites

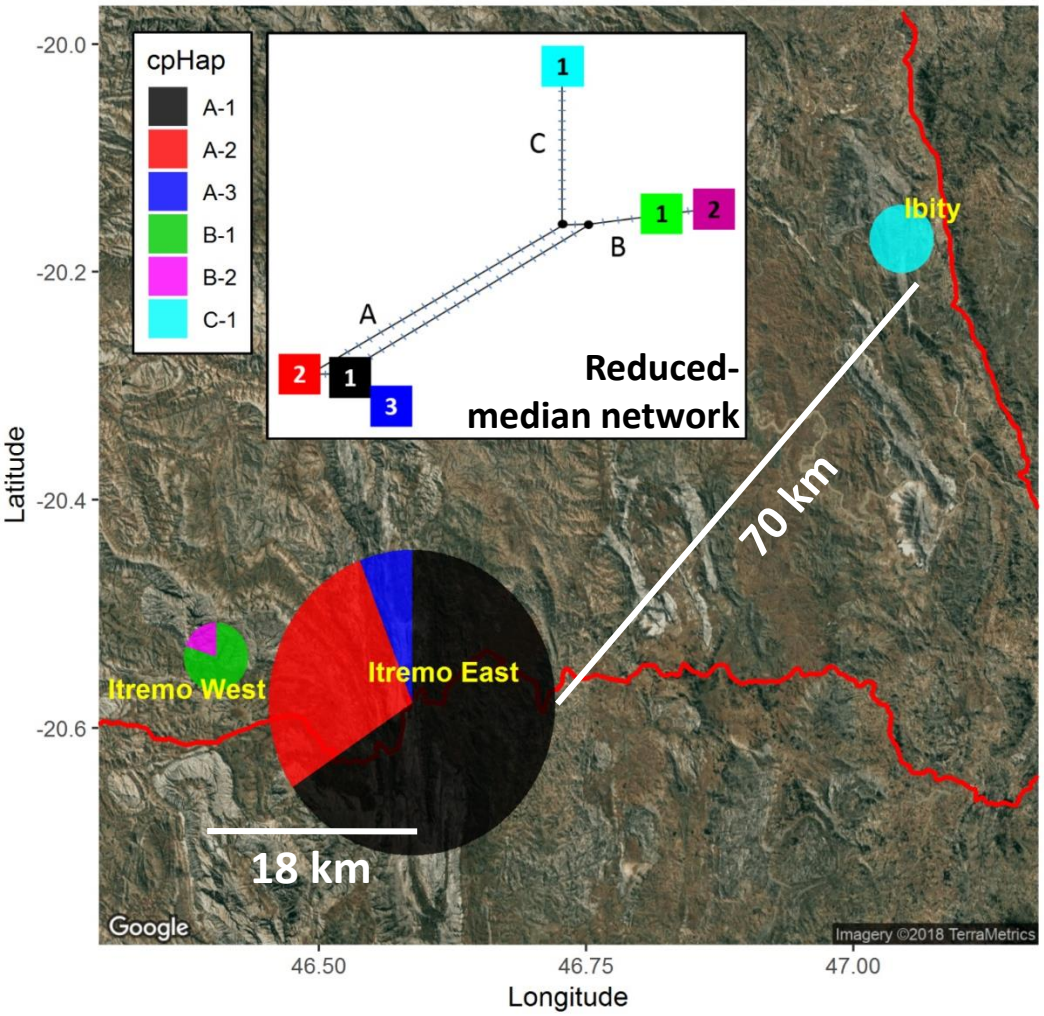
- Rare, threatened(EN)
- Restoration Programmes (Ibity, MBG)



Noronhia lowryi **: savanah**

(Itremo-Ibity, Centre Madagascar)

Extreme genetic differences in maternal genome (chloroplastic)



Few very divergent alleles

One lineage per population

No genetic exchange (maternal side)

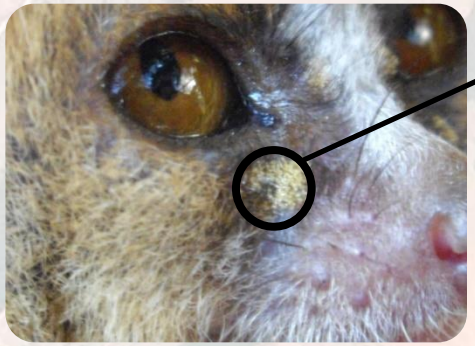
BUT

No genetic differentiation on the nuclear

J. Salmona *et al.* (in press)

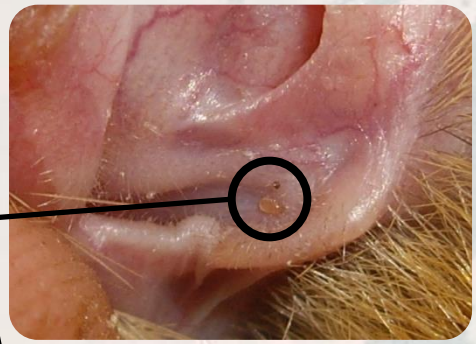
Ectoparasites

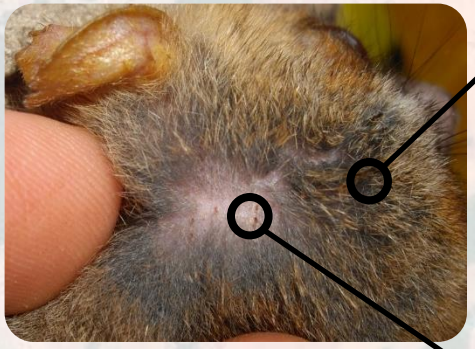
ticks



thrombiculidae

acariens





acariens
predators

lice


SOCIETAL / POLICY OUTPUTS


IUCN Primate Specialist group in 2018: Conservation status of all lemur species

Symposia at the ATBC (**Association for Tropical Biology and Conservation**) meeting in **Madagascar** July-August 2919

Visits at **schools** in Madagascar 2018-2019 + Portugal + France

Masters students from Mahajanga trained in the field and for data analysis

University lectures in Antananarivo and Mahajanga

One Malagasy PhD student + One Malagasy post-doc (U. Radespiel)

Three European PhD students within INFRAGECO or significantly involved

INFRAGECO WEBSITE: http://www.infrageco-biodiversa.org

Madagascar Stakeholder meeting 5 August 2019

SOON: Science and Music in Feb. 2020 (Fundaçao Gulbenkian)

SOCIETAL / POLICY OUTPUTS

School visits

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INFRAGECO
Sifakas - Simponas - Propithèques

Misaotra betsaka tompoko

Research consortium: INFRAGECO

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ACKNOWLEDGEMENTS

Agence Nationale pour la Recherche (France)

Fundaçao para a Ciência e a Tecnologia (Portugal)

Federal Ministry of Education and Research (Germany)