# Regionalization of mammal assemblages in central African forests: determinants, sampling gaps, ongoing threats and conservation priorities

Davy Fonteyn, Cédric Vermeulen, Anaïs-Pasiphaé Gorel, Pedro Luiz Silva de Miranda, Simon Lhoest, Adeline Fayolle

LIÈGE université Gembloux Agro-Bio Tech

Ghent University Laboratory of Plant Ecology

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Lundi Forestier 22/11/2021

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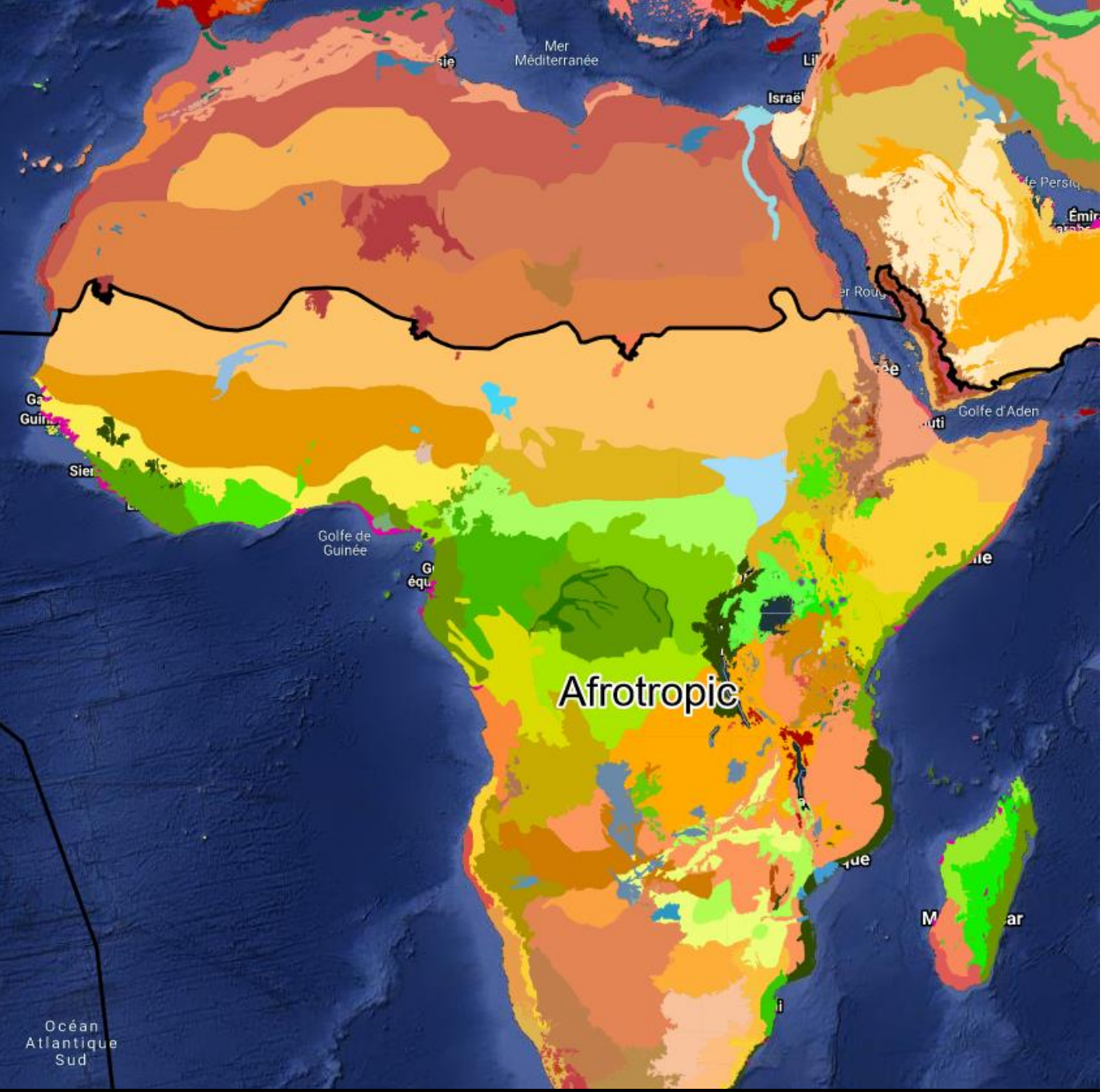
# A focus on the Afrotropical realm




Ecoregions from *Oslon et al. (2001), Dinerstein et al. (2017)*

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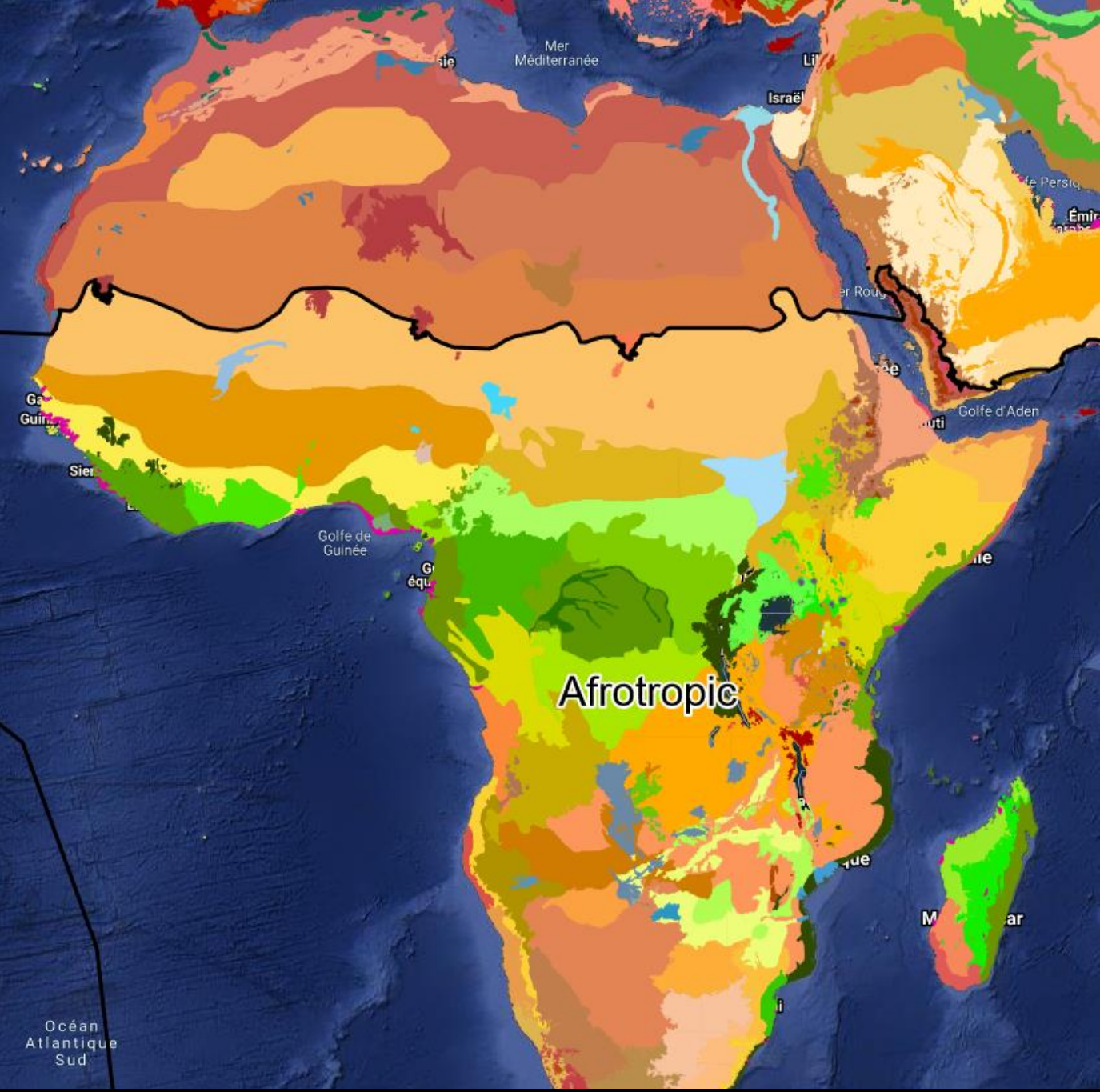


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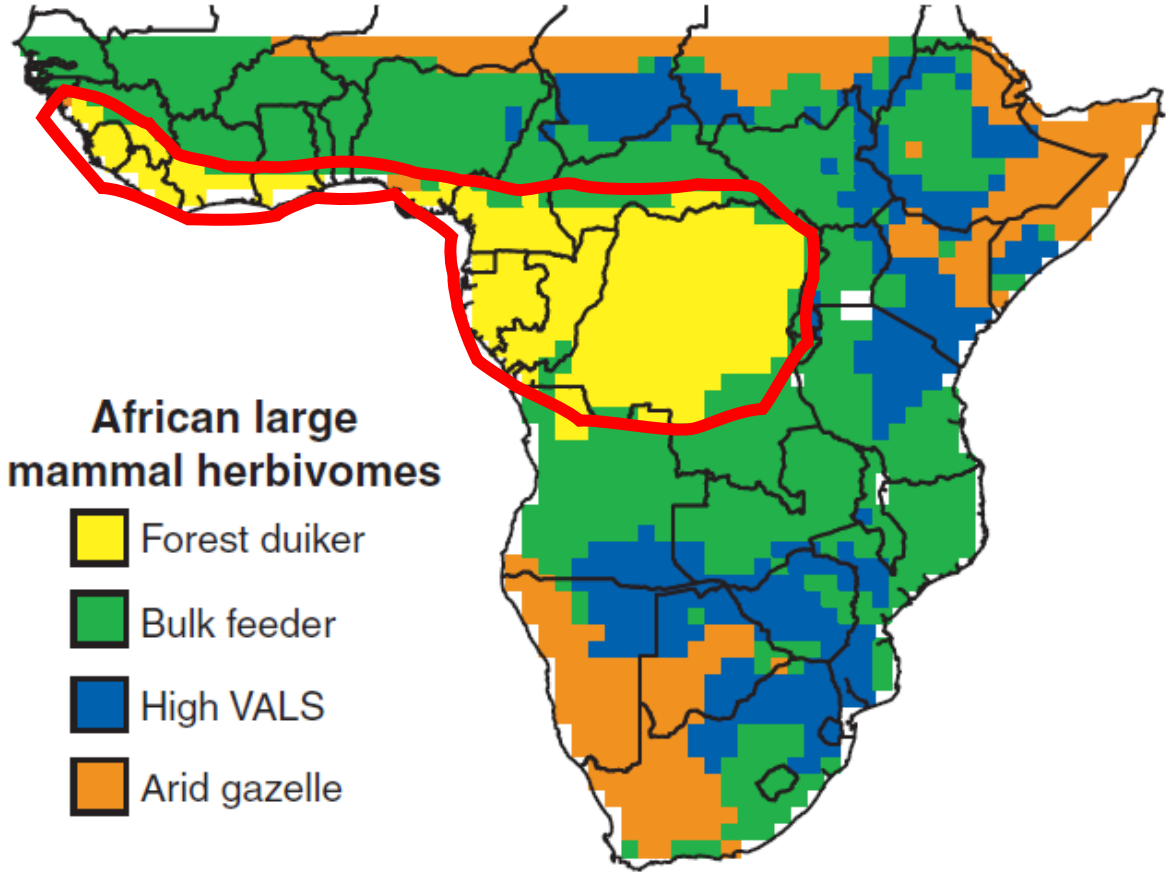


*Hempson et al. (2015)*

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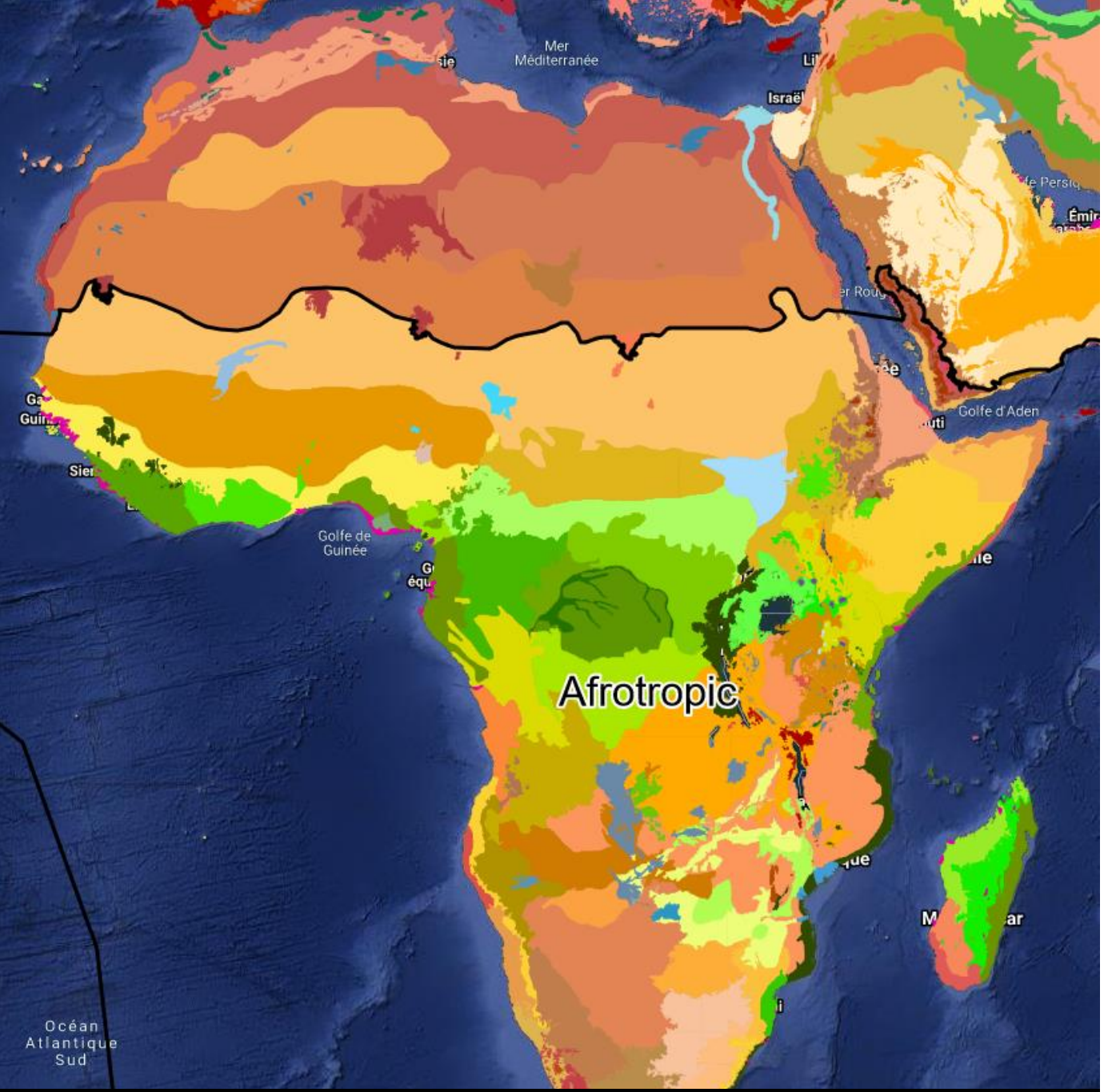


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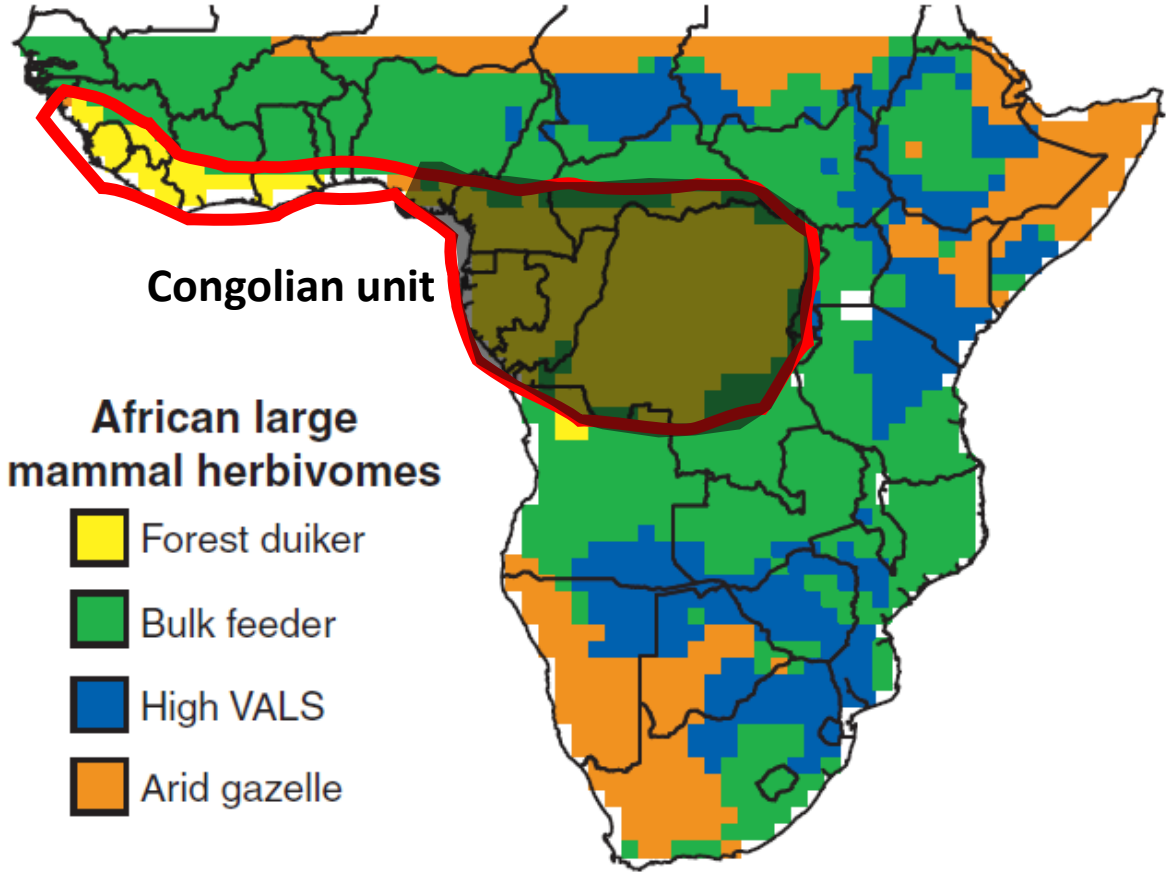


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# Study objective

# Identify the discontinuities in mammal assemblages within central African forests

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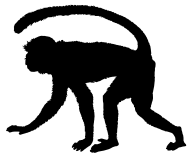
1 Is variation in mammal species composition congruent **across taxa** ?


?

?

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# Identify the discontinuities in mammal assemblages within central African forests

1 Is variation in mammal species composition congruent **across taxa** ?

2 What are the environmental and spatial **determinants** of mammal species assemblages ?




# Identify the discontinuities in mammal assemblages within central African forests

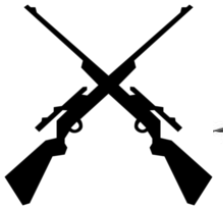
1. Is variation in mammal species composition congruent **across taxa** ?

2. What are the environmental and spatial **determinants** of mammal species assemblages ?

3. Are the identified districts well **protected** and what **threats** do they face?

SMART

IUCN



# Dataset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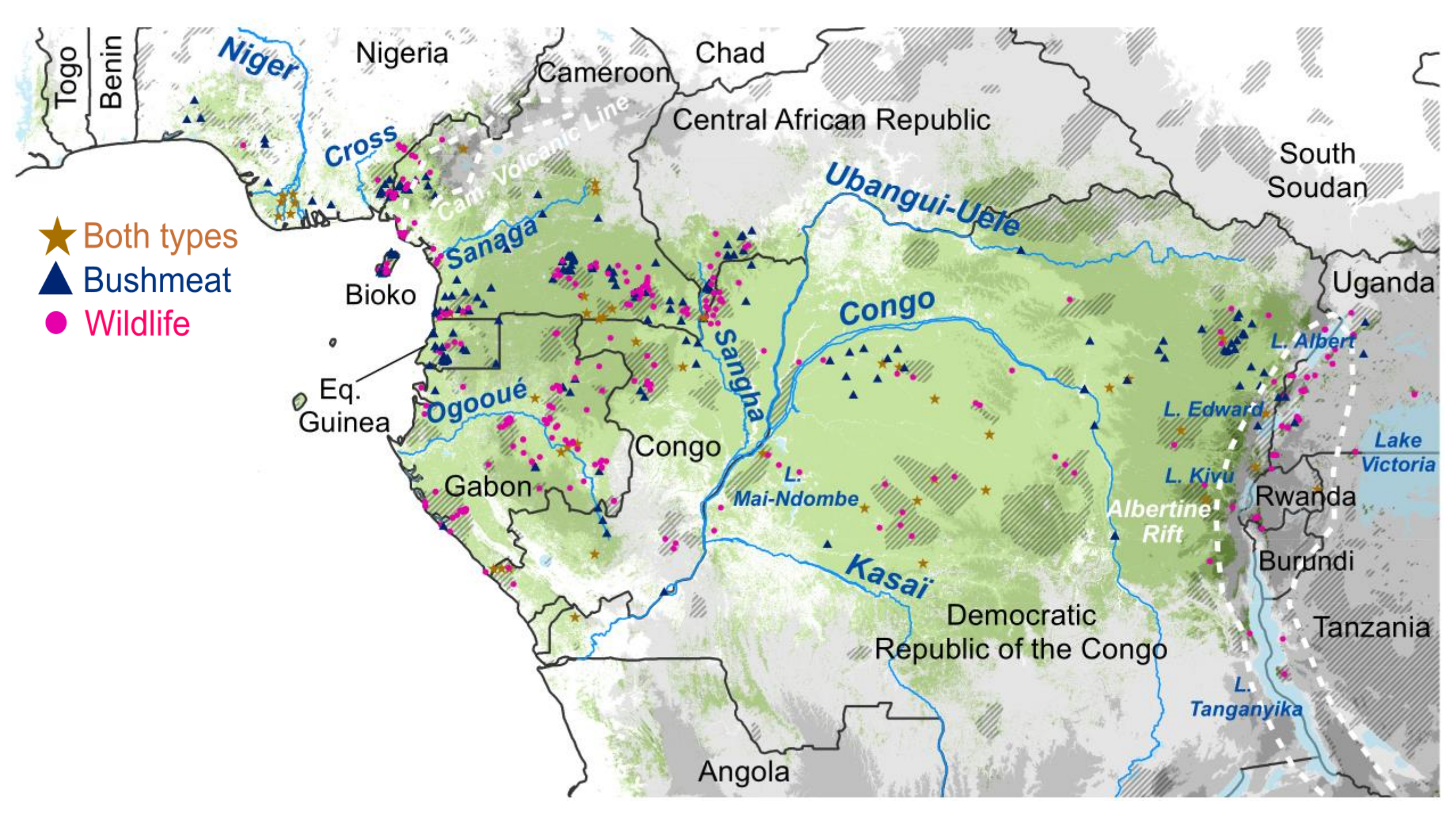
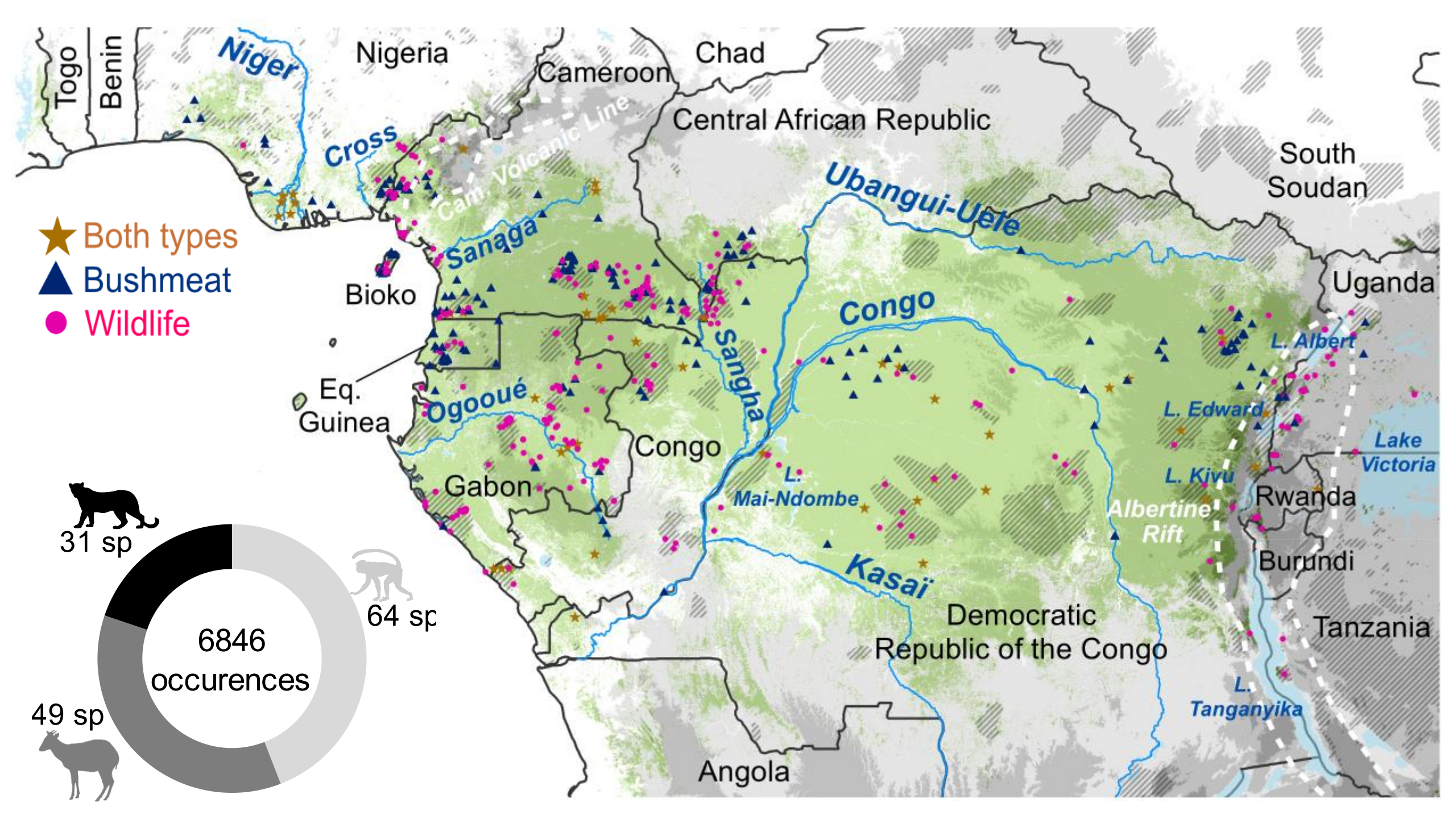

Both types
Bushmeat
Wildlife
Togo
Benin
Niger
Nigeria
Cameroon
Chad
Central African Republic
South Soudan
Uganda
Rwanda
Burundi
Tanzania
Democratic Republic of the Congo
Angola
Congo
Gabon
Eq. Guinea
Bioko
Cross
Cam. Volcanic Line
Sanaga
Ubangui-Uele
Congo
Sangha
Ogooué
L. Mai-Ndombe
Kasai
L. Albert
L. Edward
L. Kivu
Albertine Rift
Lake Victoria
L. Tanganyika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Burundi
Tanzania
L. Mai-Ndombe
Kasai
Democratic Republic of the Congo
L. Tanganyika
Angola
31 sp
64 sp
49 sp
6846 occurences


Results
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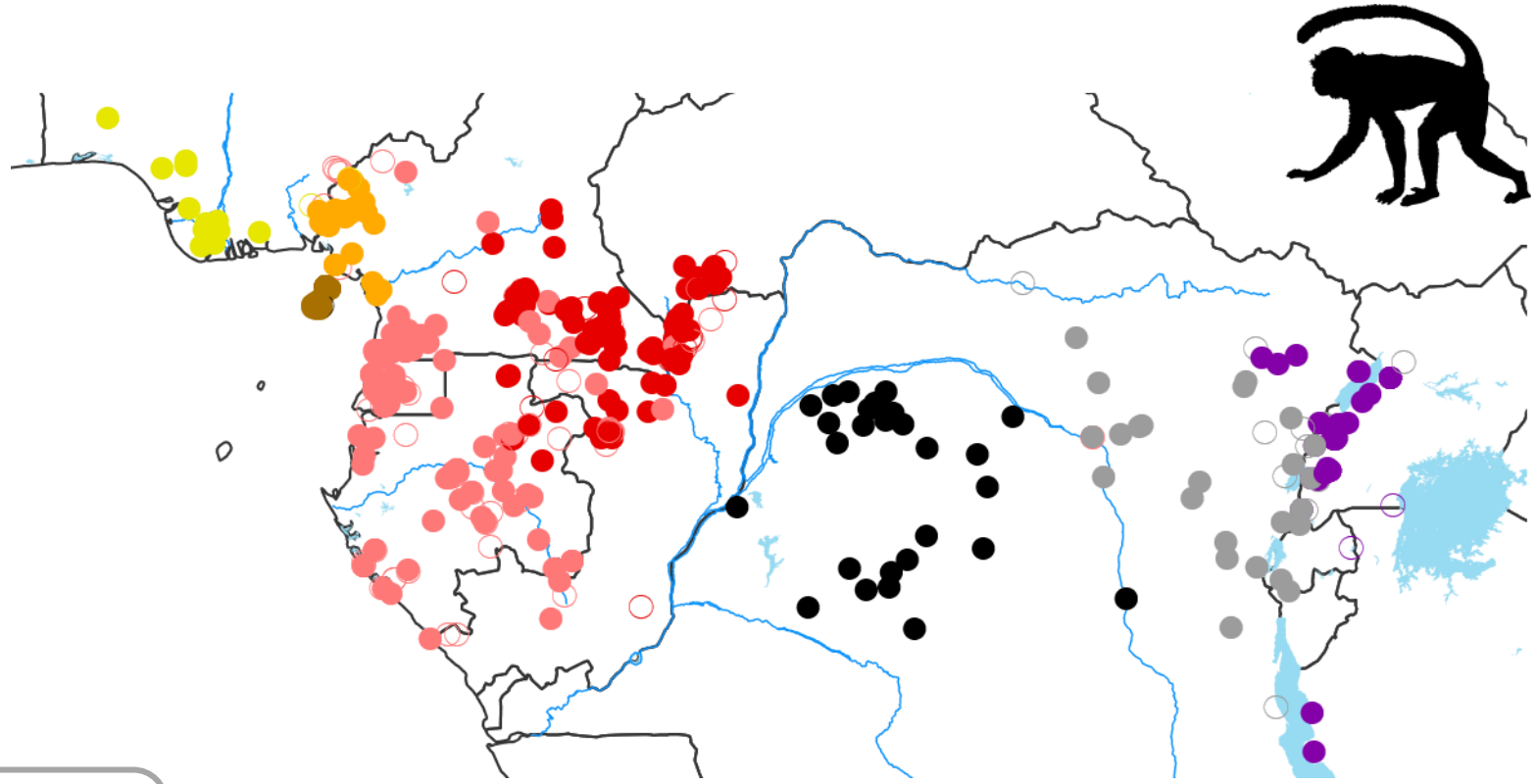
# Zoogeographical districts & indicator species

- Strong spatial pattern for primates

  ~ 8 distinct districts



Clustering using $\beta_{sim}$ indice

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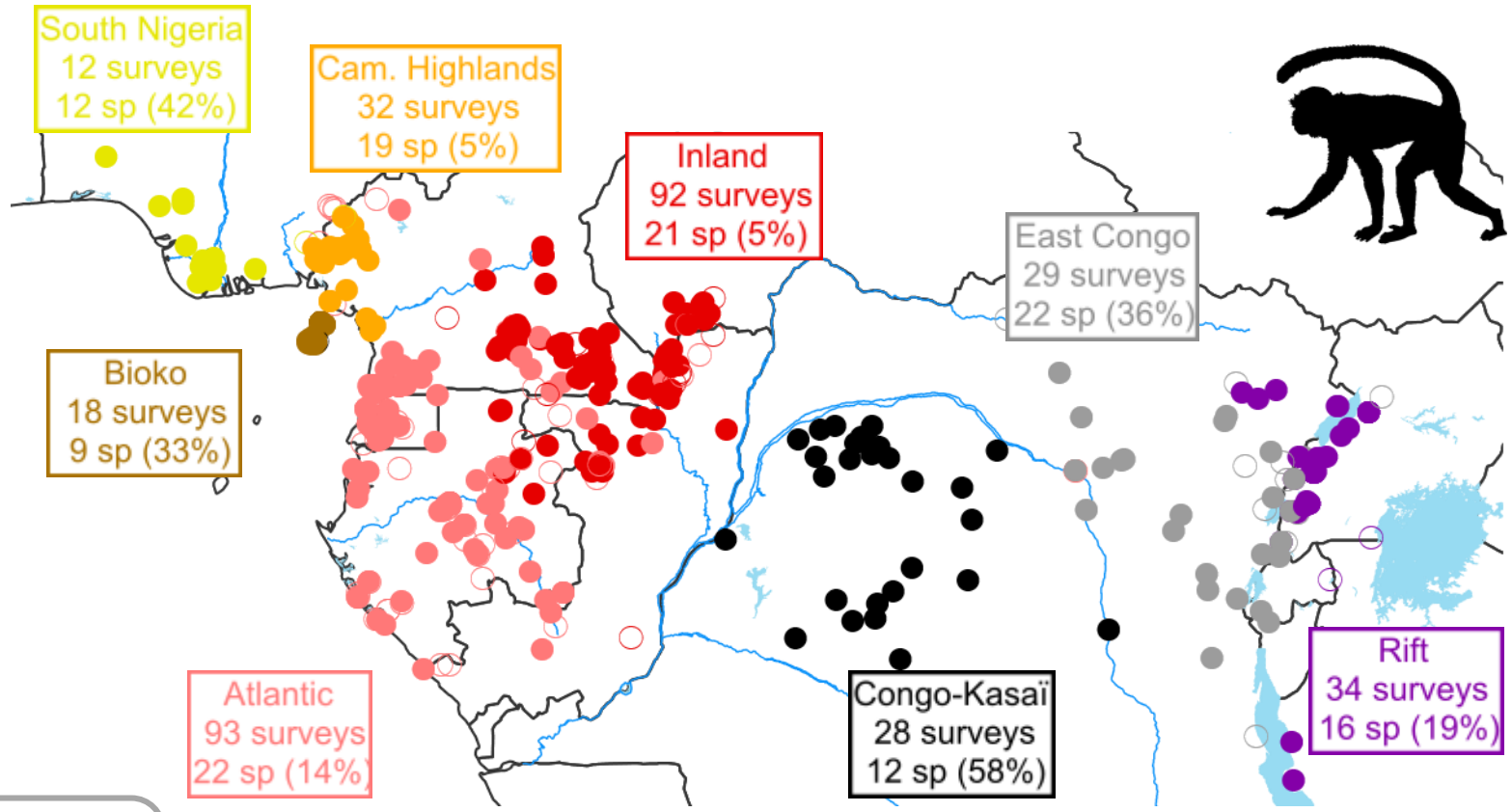


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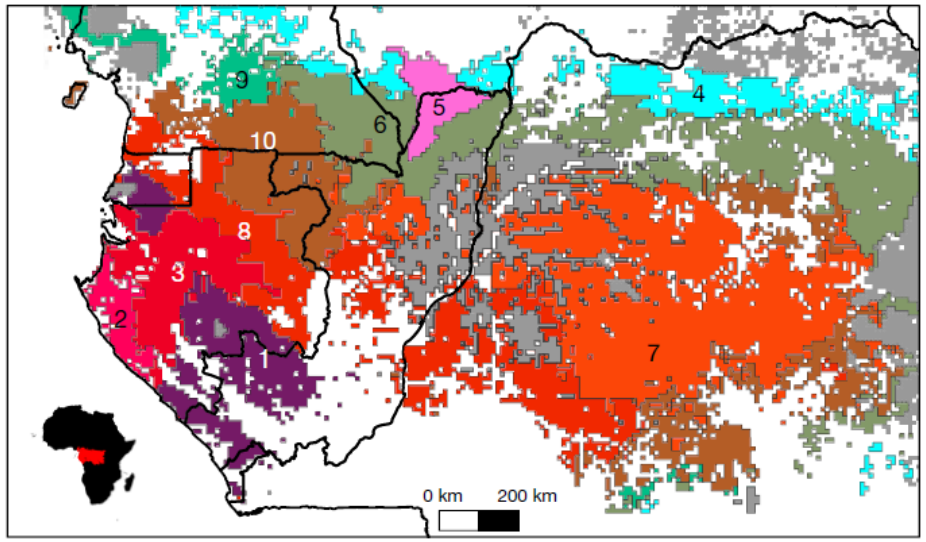
# Zoogeographical districts & indicator species

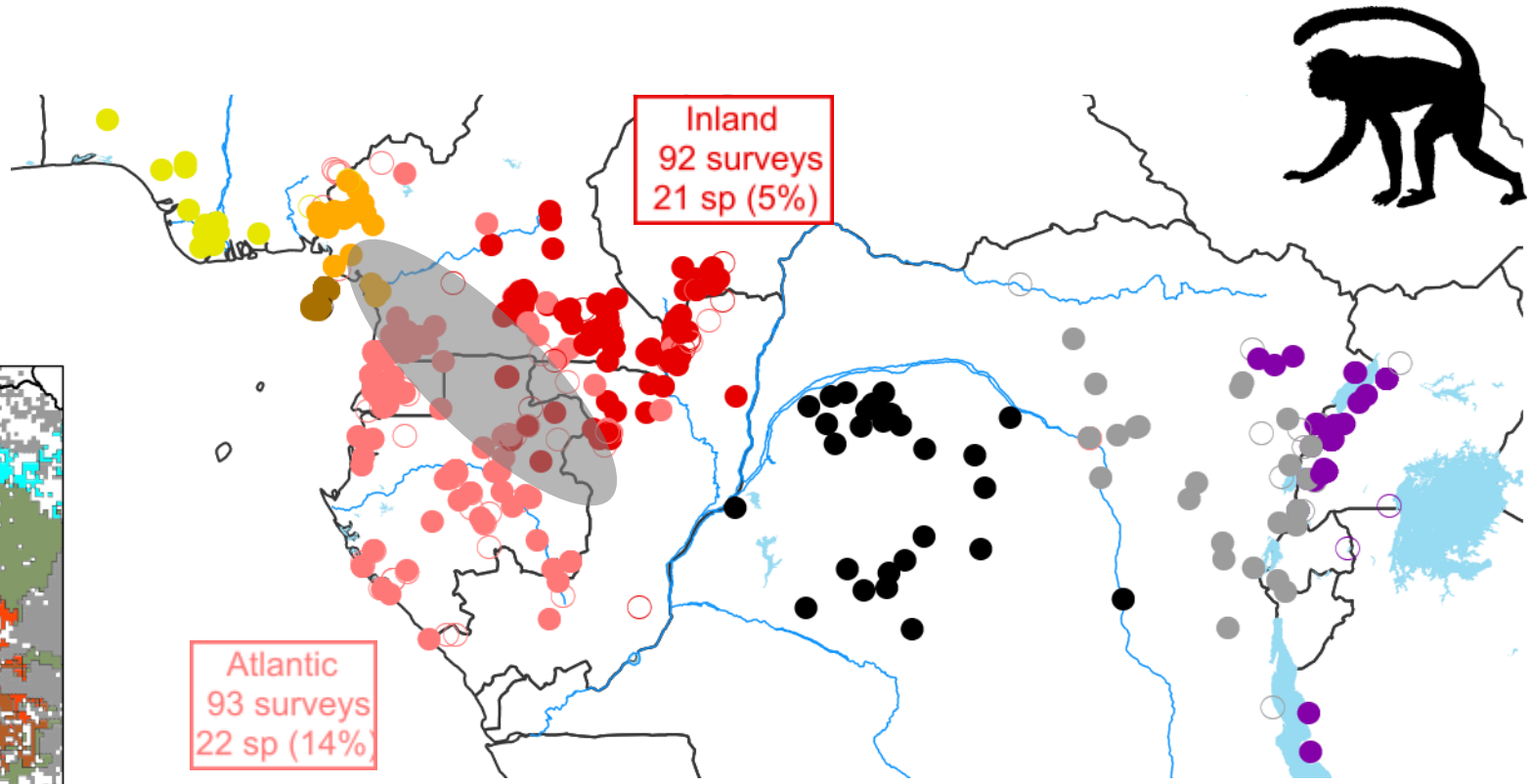
- Strong spatial pattern for primates

  ~ 8 distinct districts

- A transition area

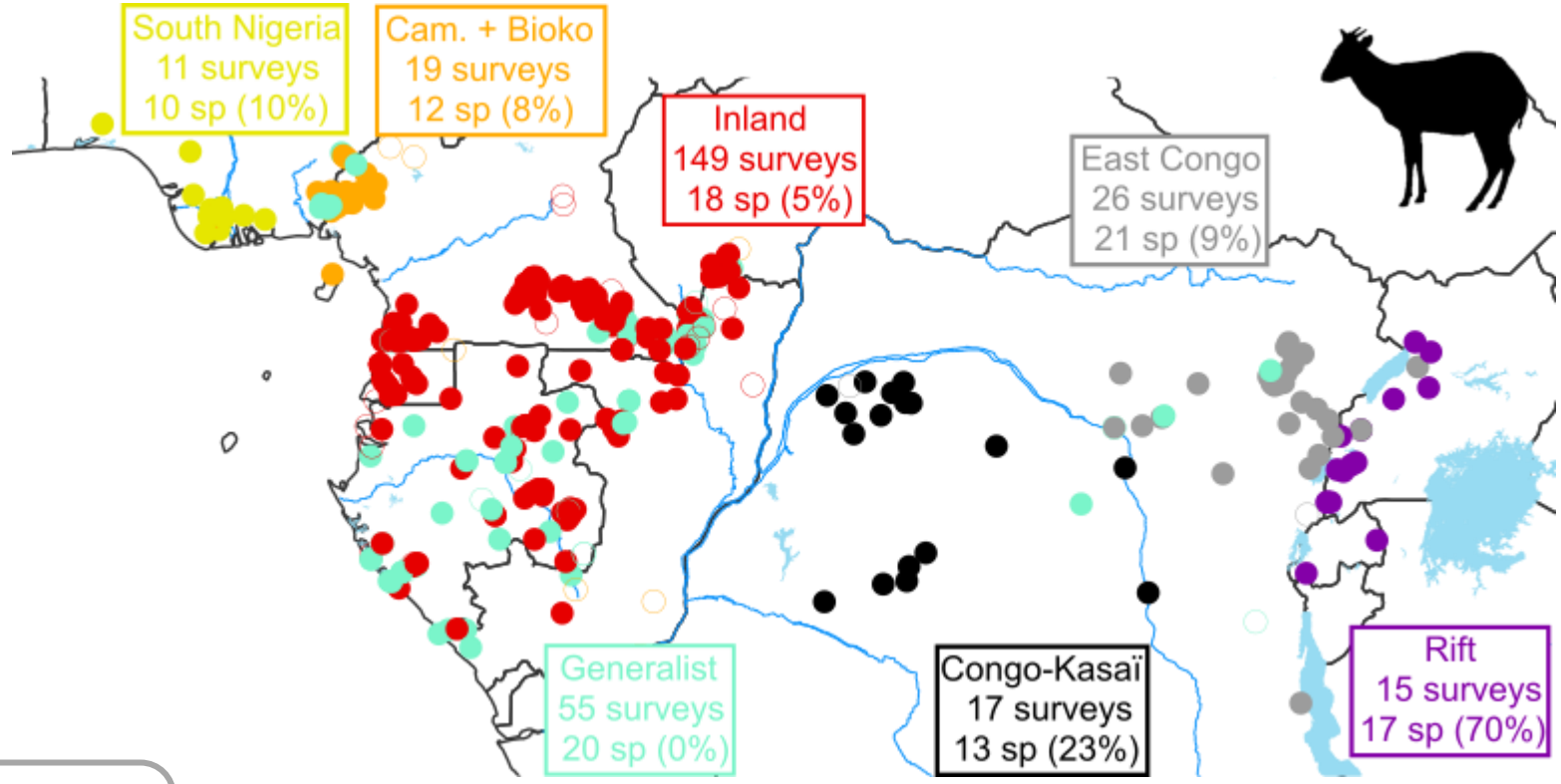



*Réjou-Méchain et al. (2021)*



# Zoogeographical districts & indicator species

- Highly congruent distribution patterns between primates and artiodactyls

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# Zoogeographical districts & indicator species

- Indicator species

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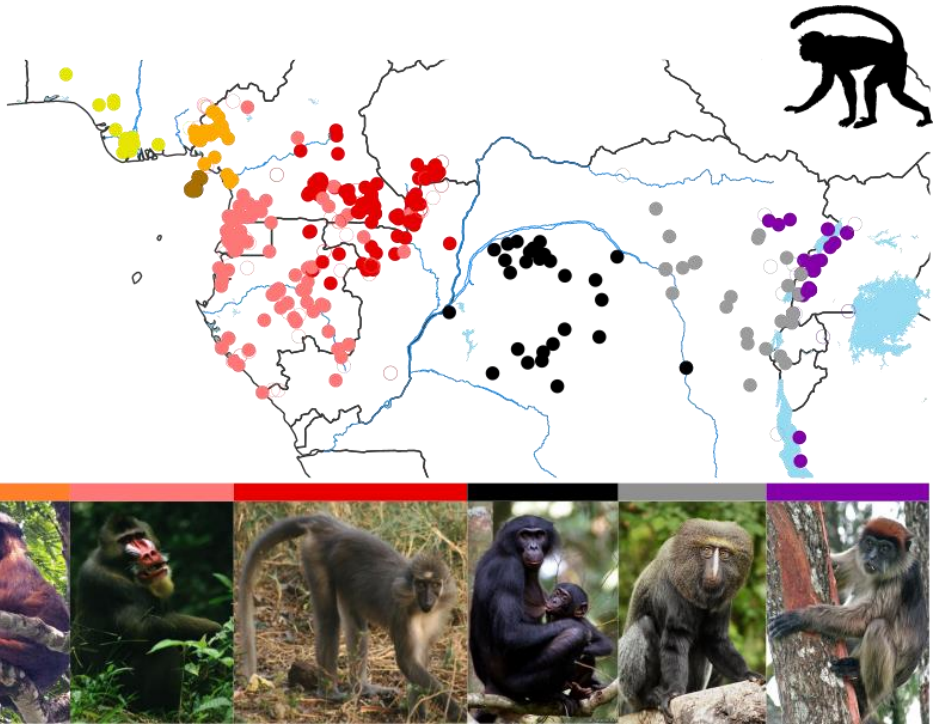

# Zoogeographical districts & indicator species

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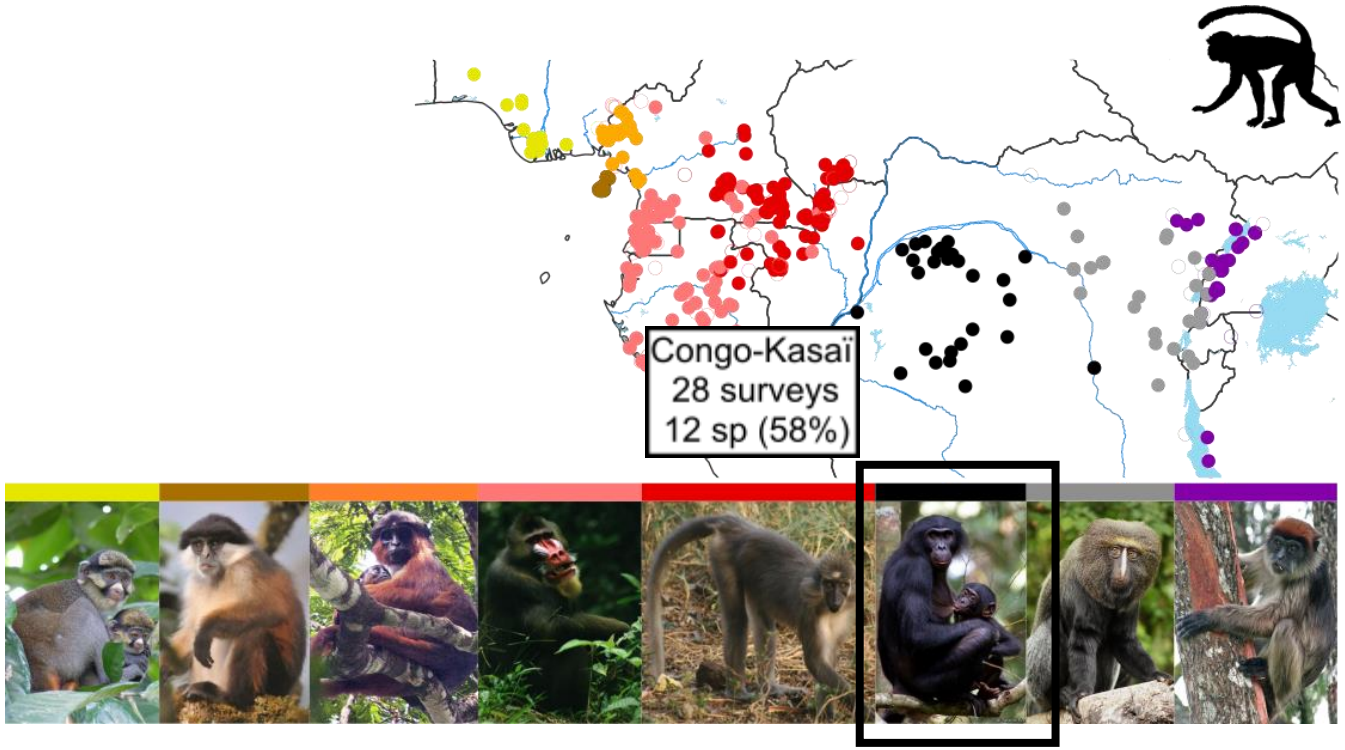

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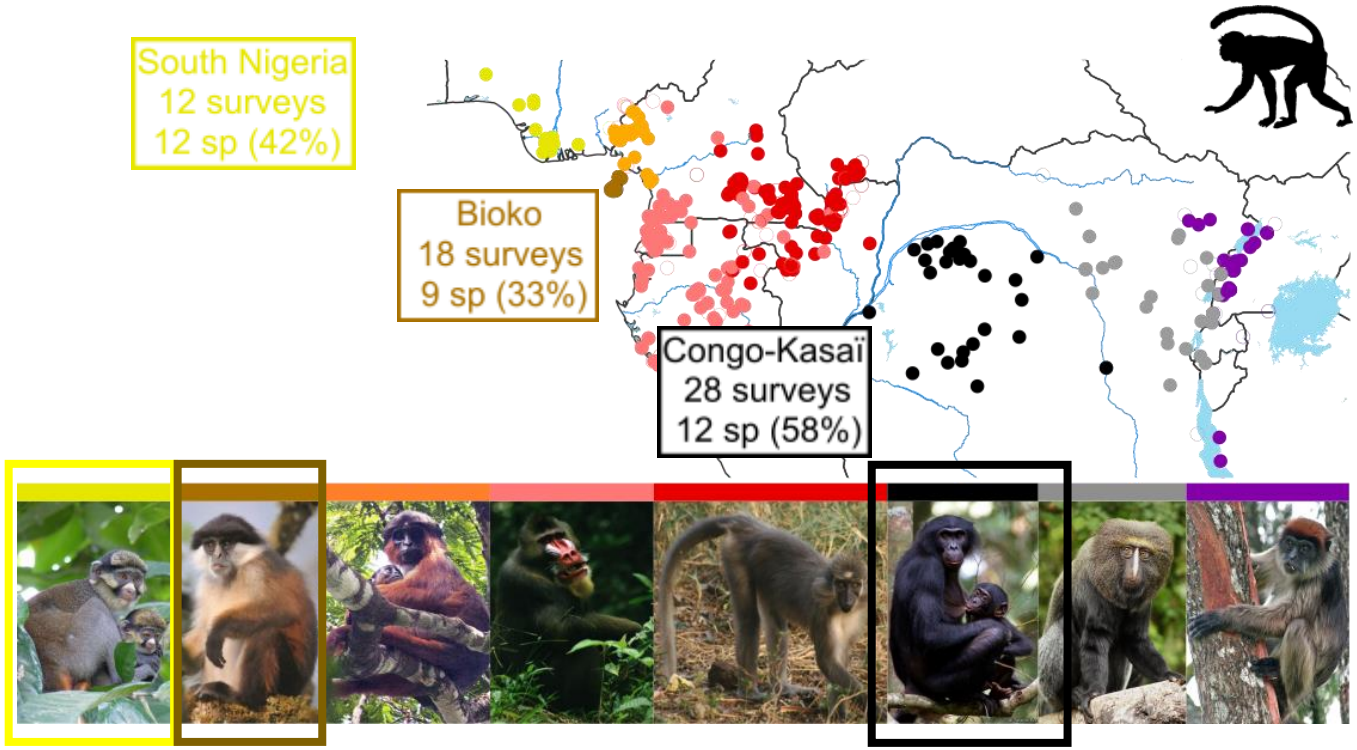

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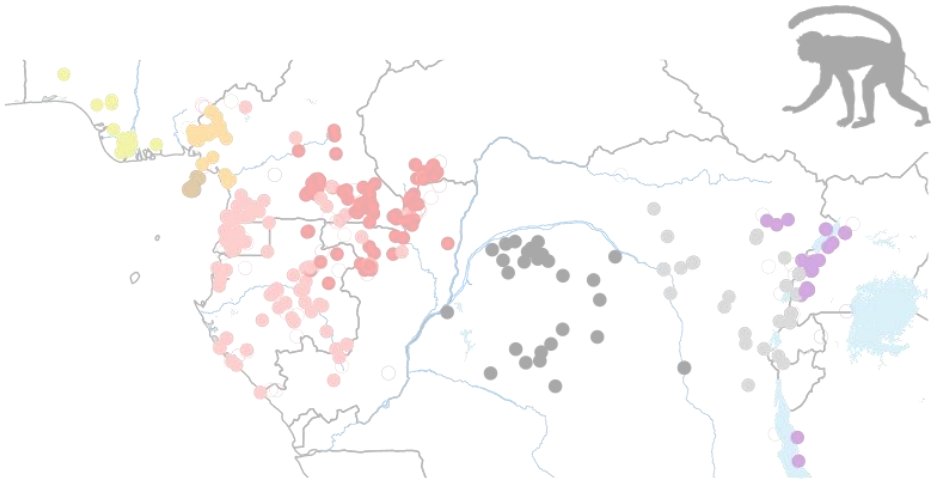

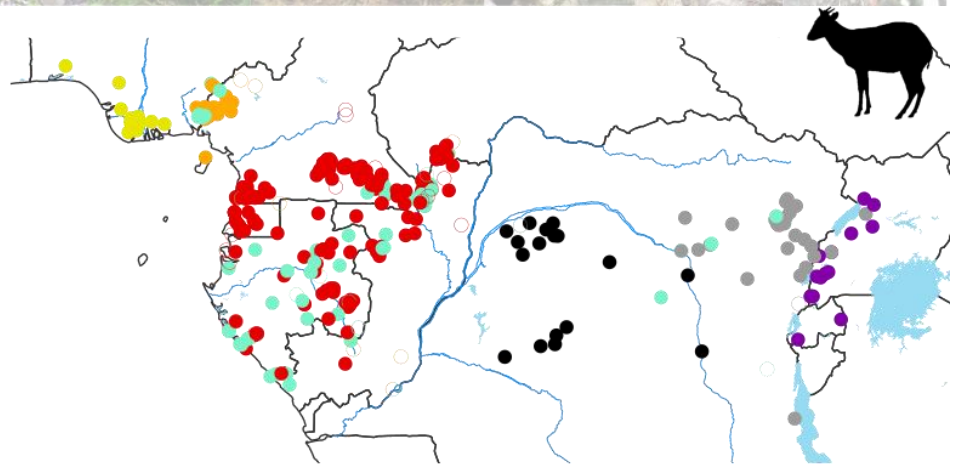

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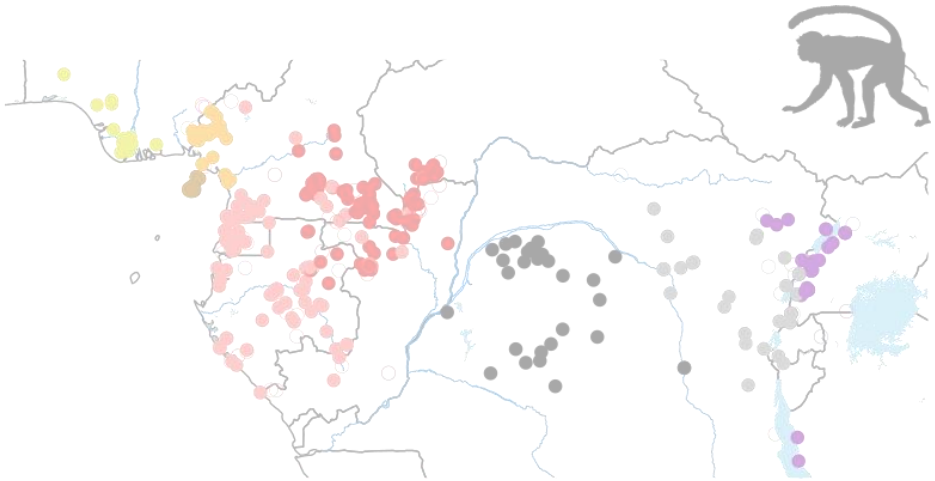
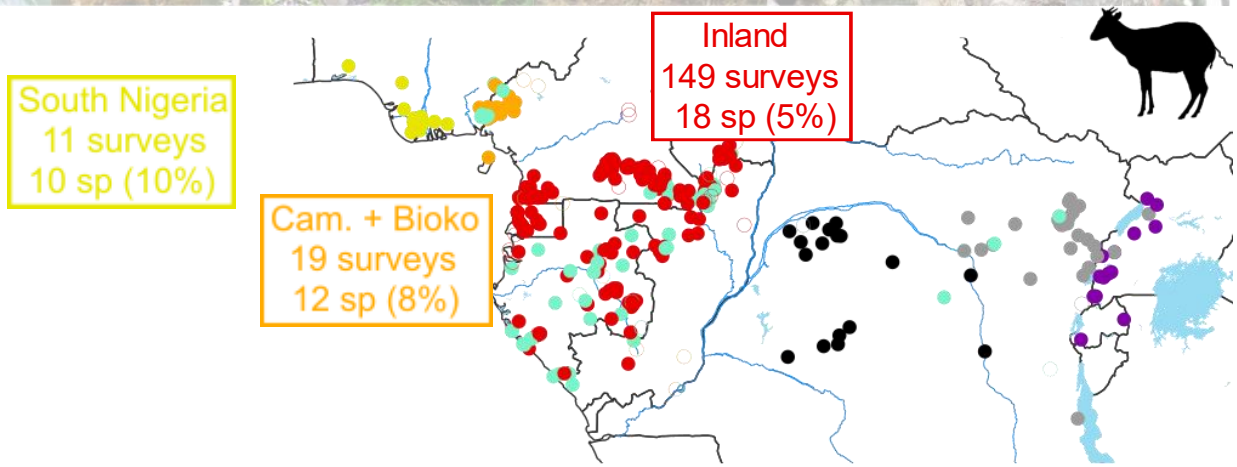
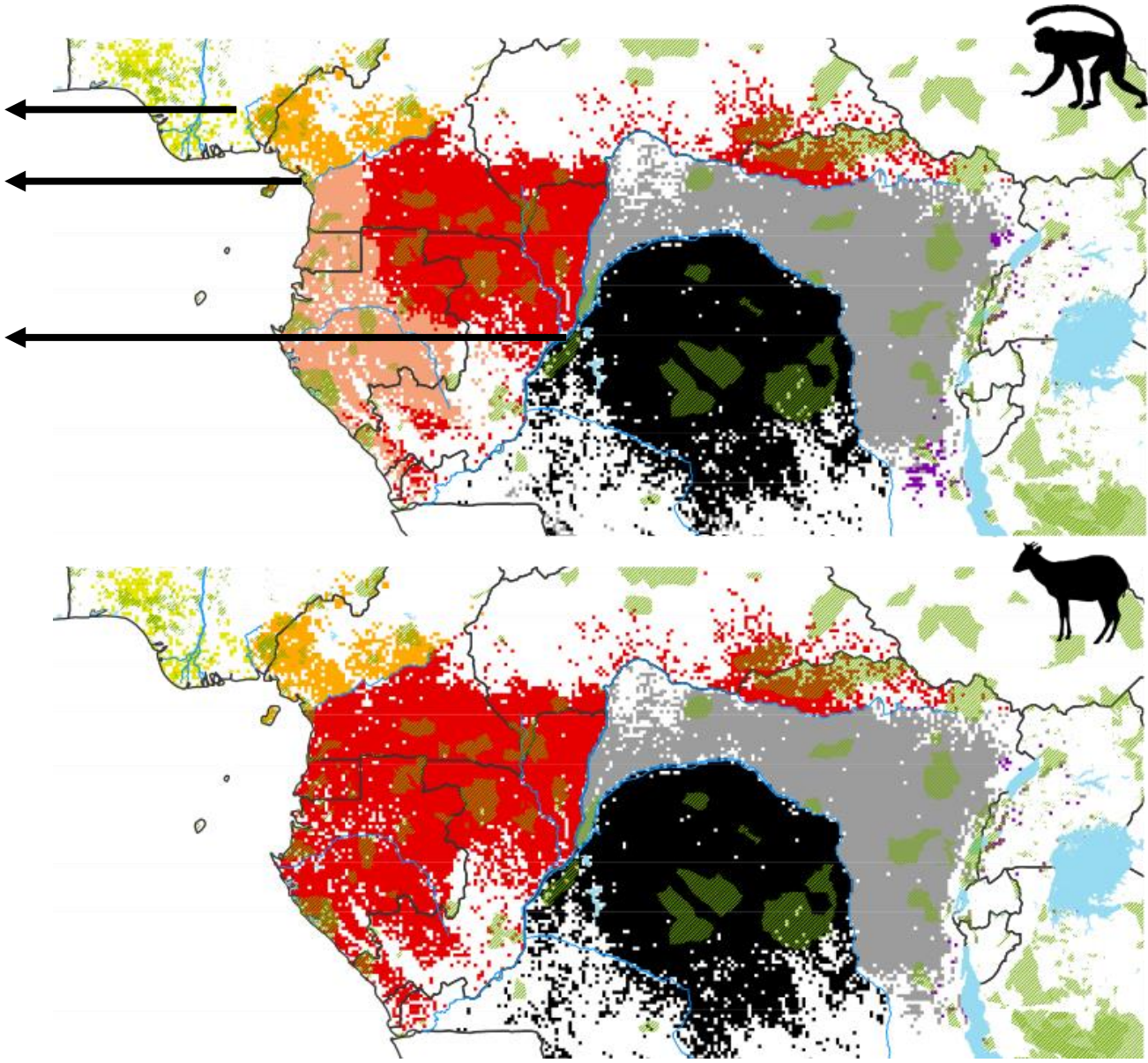





# 2 Environmental determinants

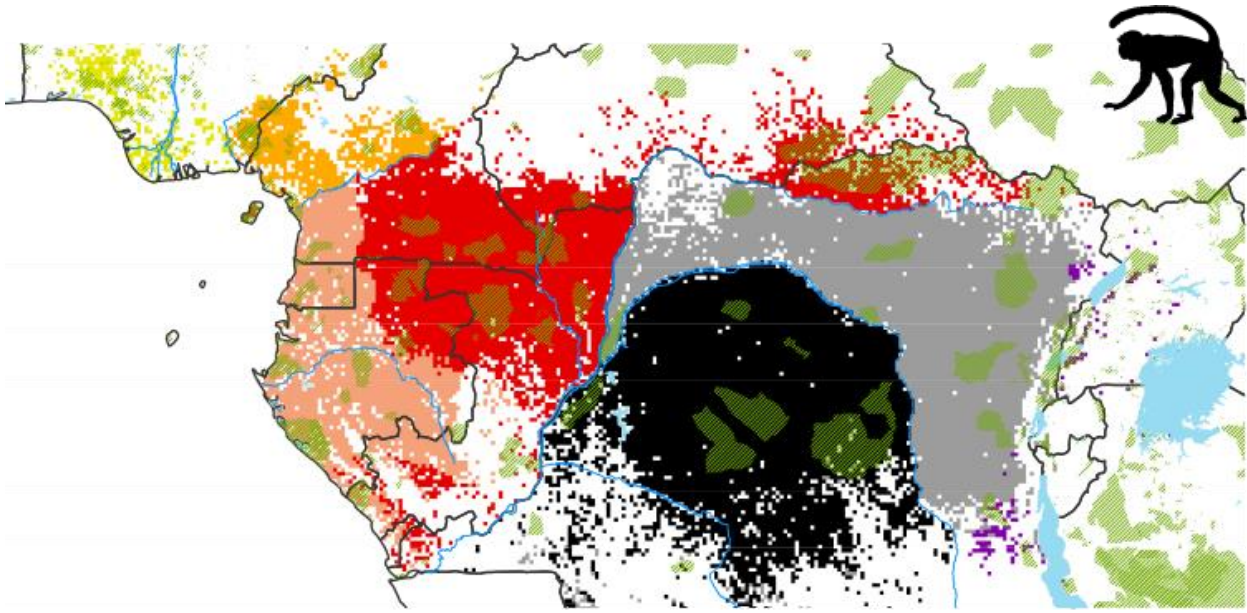
- Important influence of rivers

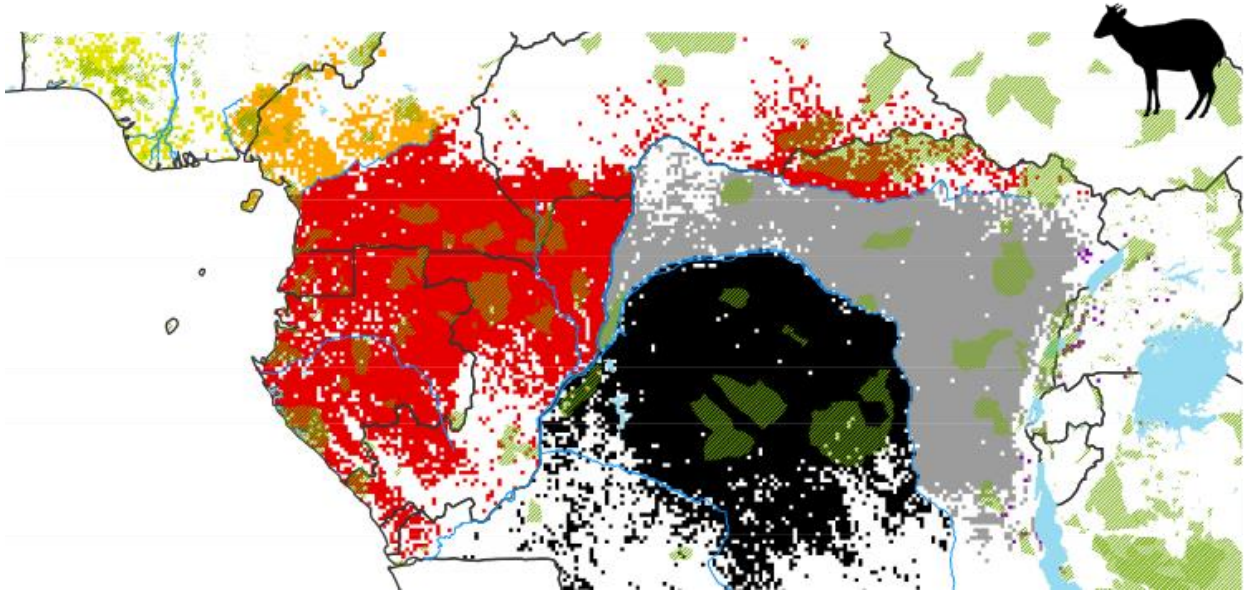



Random forest models

# 2 Environmental determinants

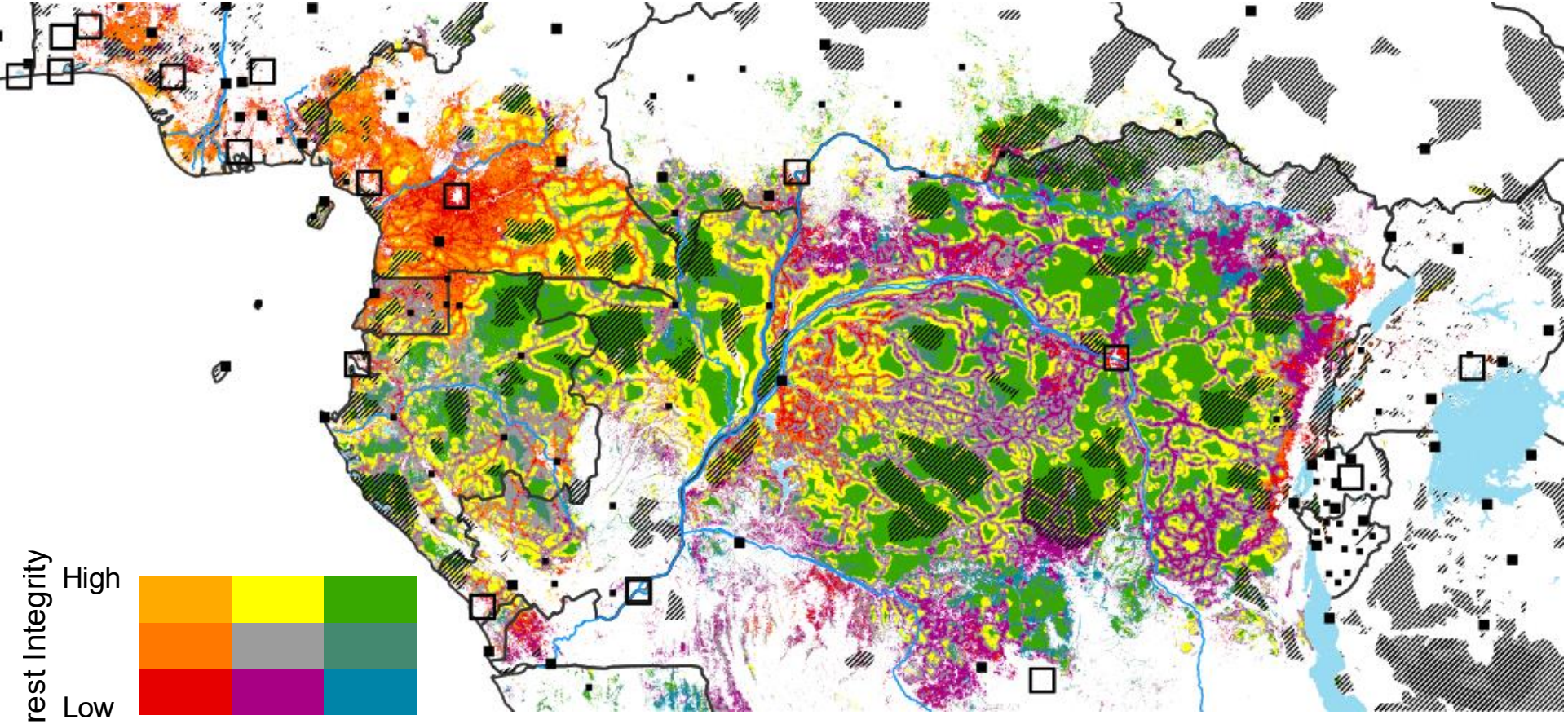
- Important influence of rivers
- Annual precipitation & insularity for primates





Random forest models

# 3 Protection levels & threats



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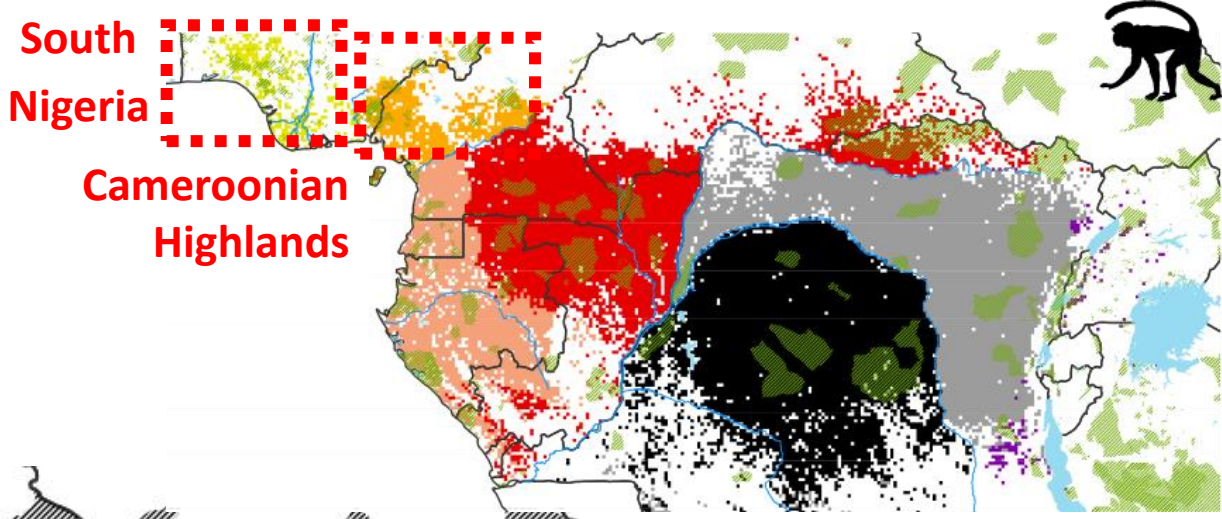


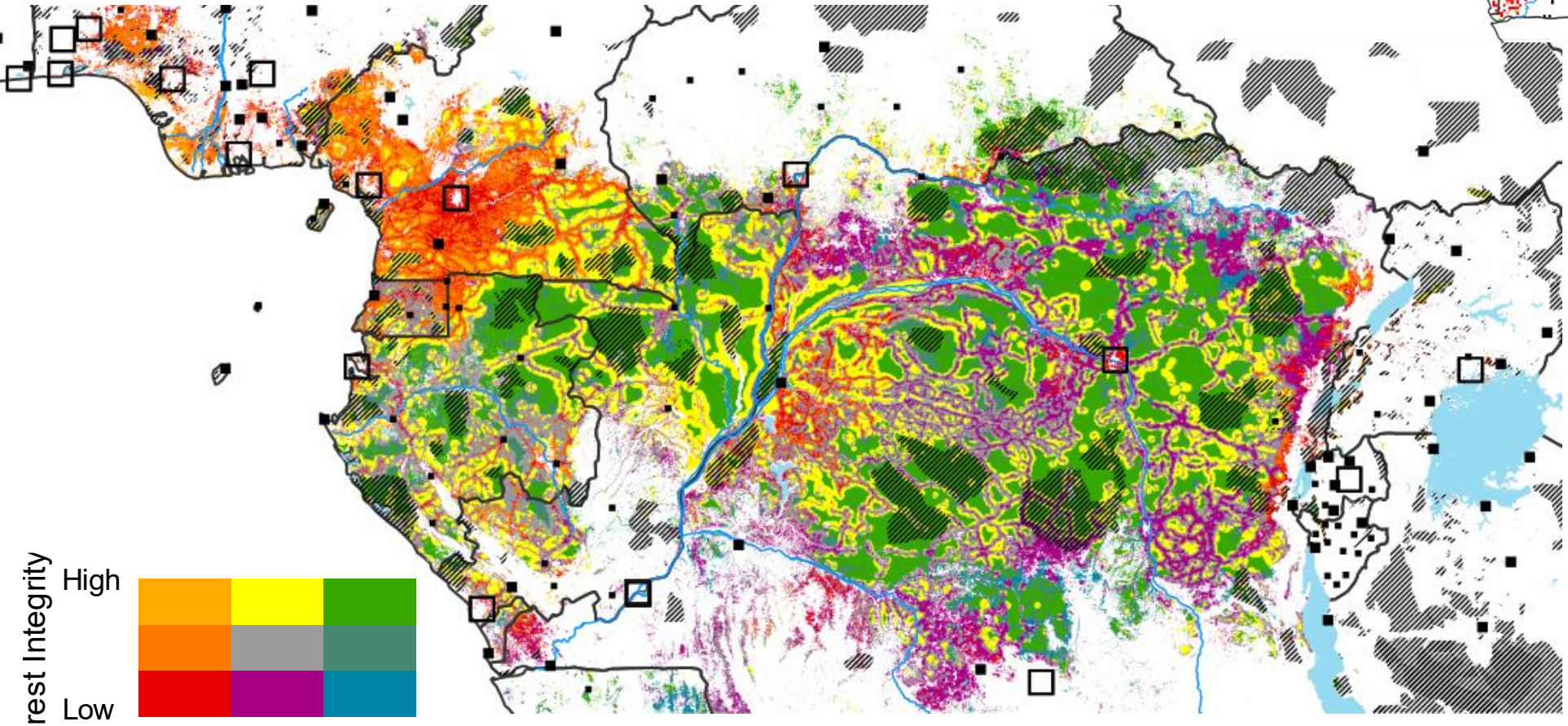

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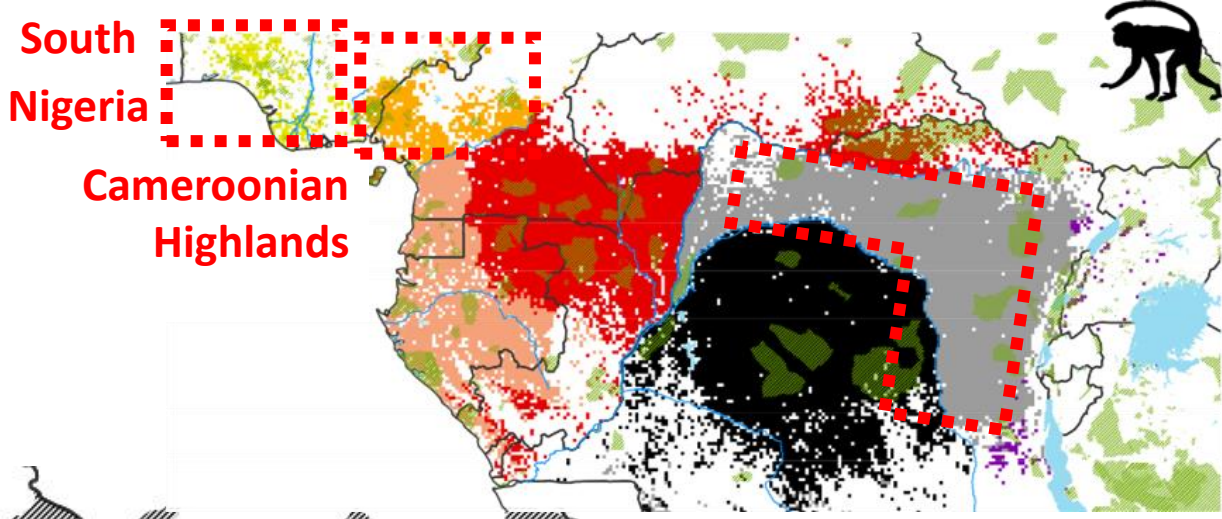


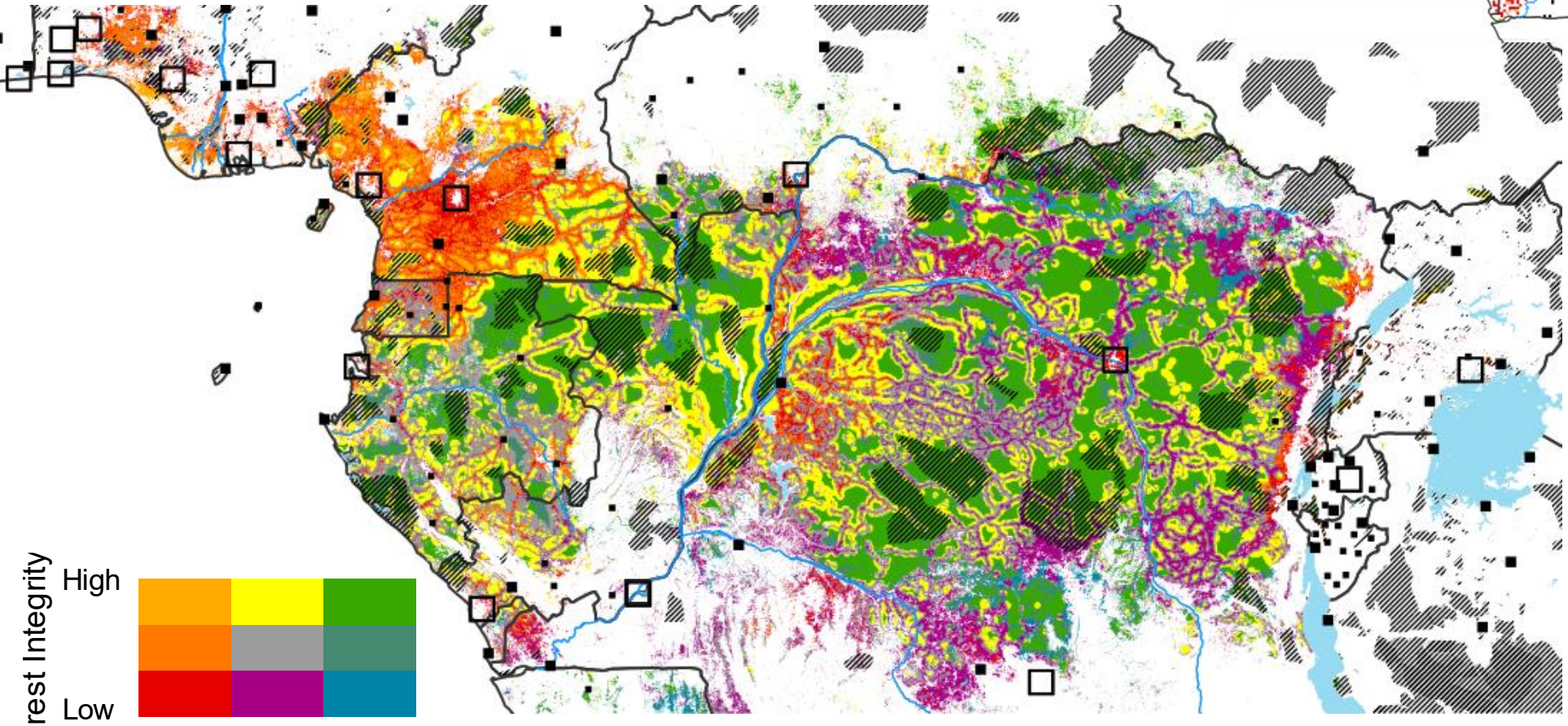

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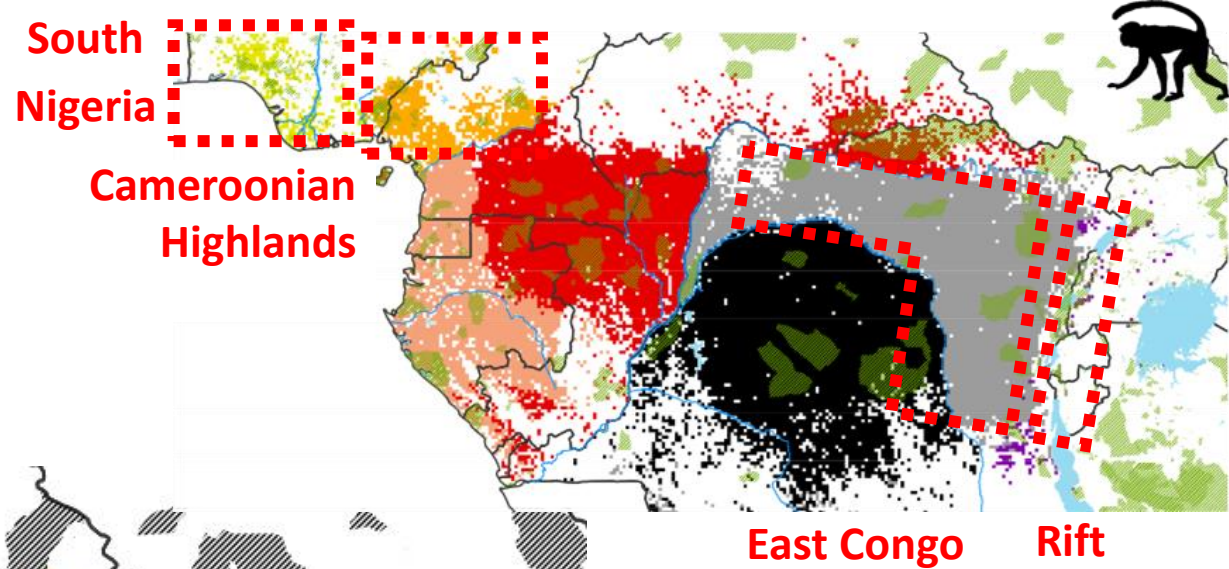


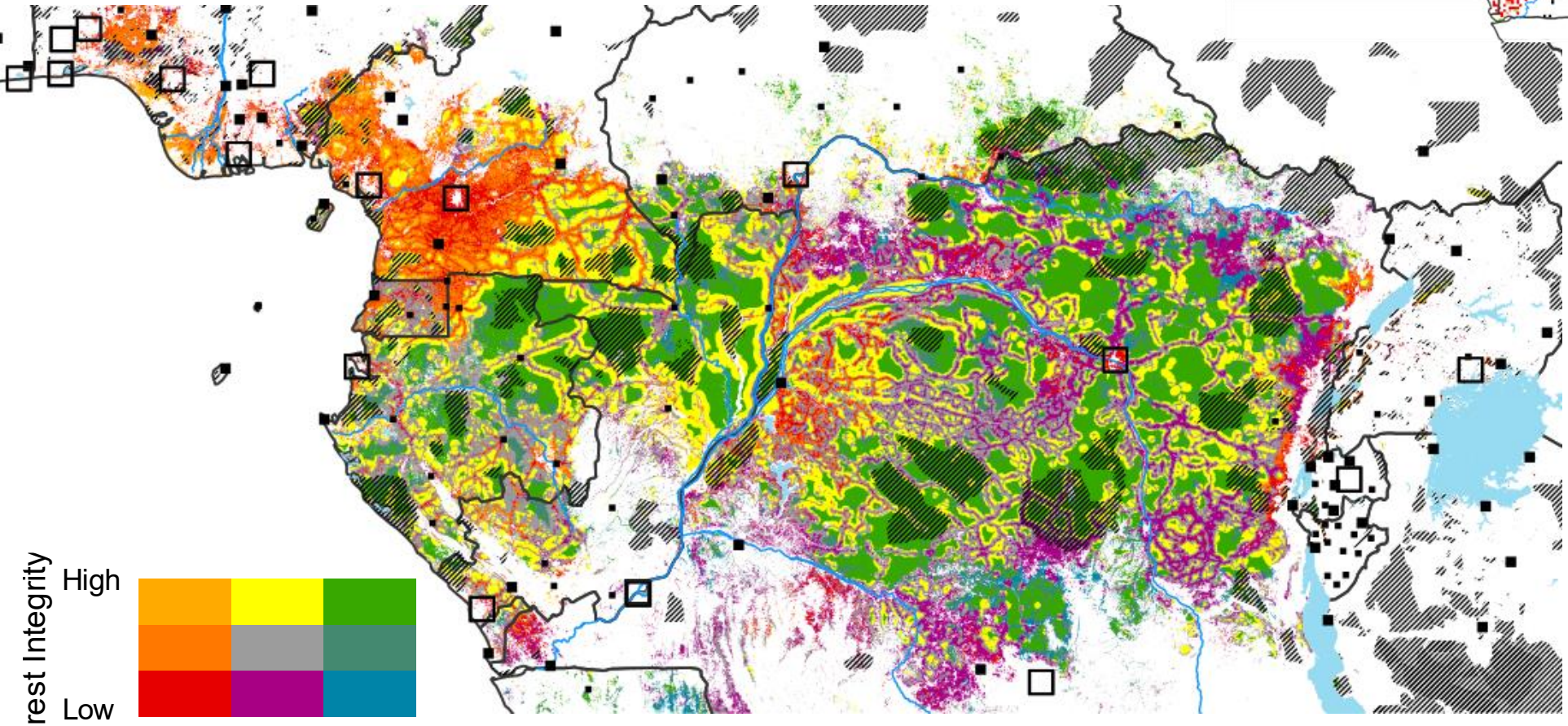

# In conclusion


Is variation in mammal species composition congruent **across taxa** ?

Congruent regionalization for primates and artiodactyls

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What are the environmental and spatial **determinants** of mammal species assemblages ?

Structuring role or rivers

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Congruent regionalization for primates and artiodactyls


What are the environmental and spatial **determinants** of mammal species assemblages ?

Structuring role or rivers


Are the identified districts well **protected** and what **threats** do they face?

Priority districts identified

# Thank you !

Davy Fonteyn, davy.fonteyn@uliege.be

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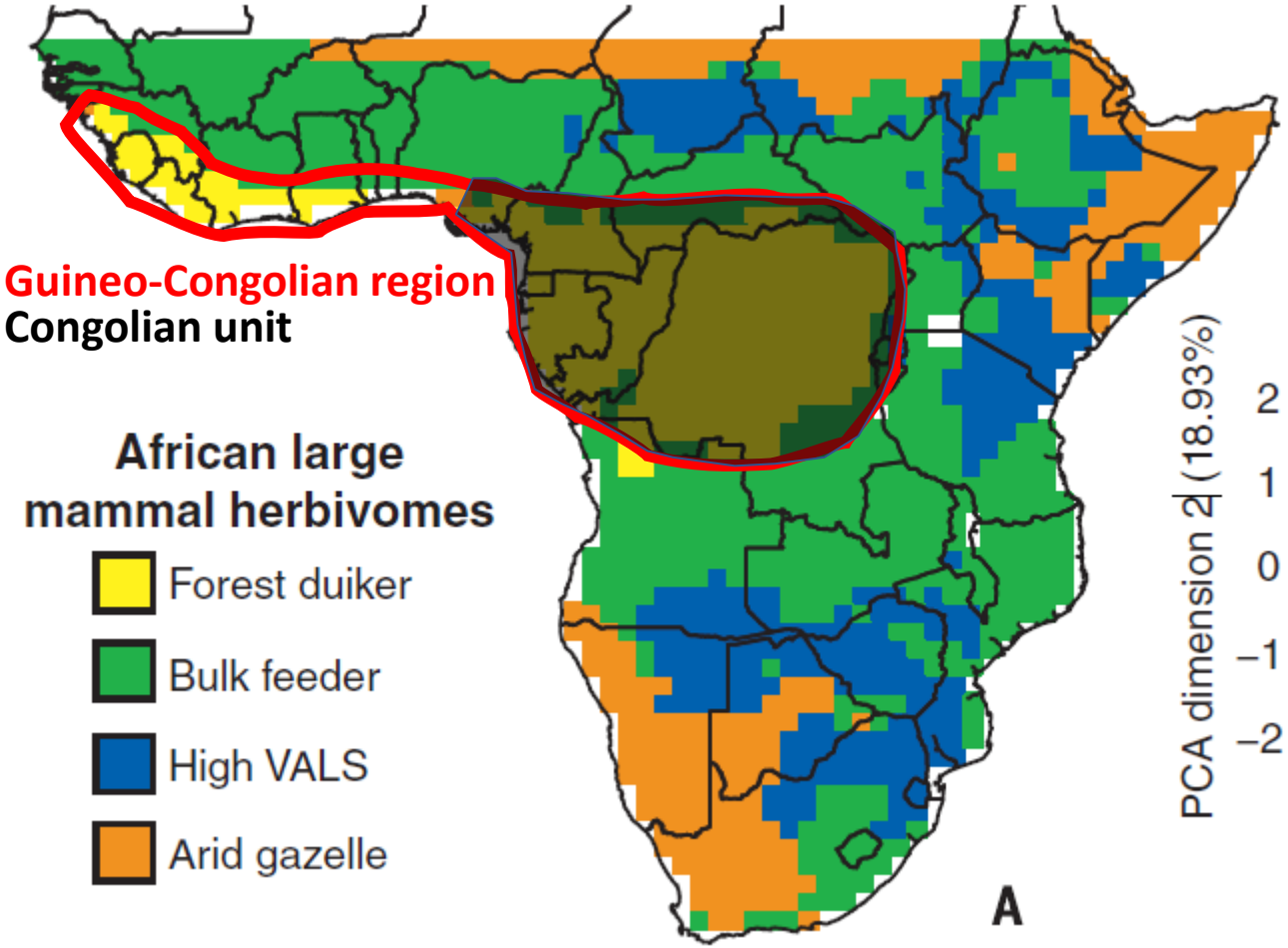
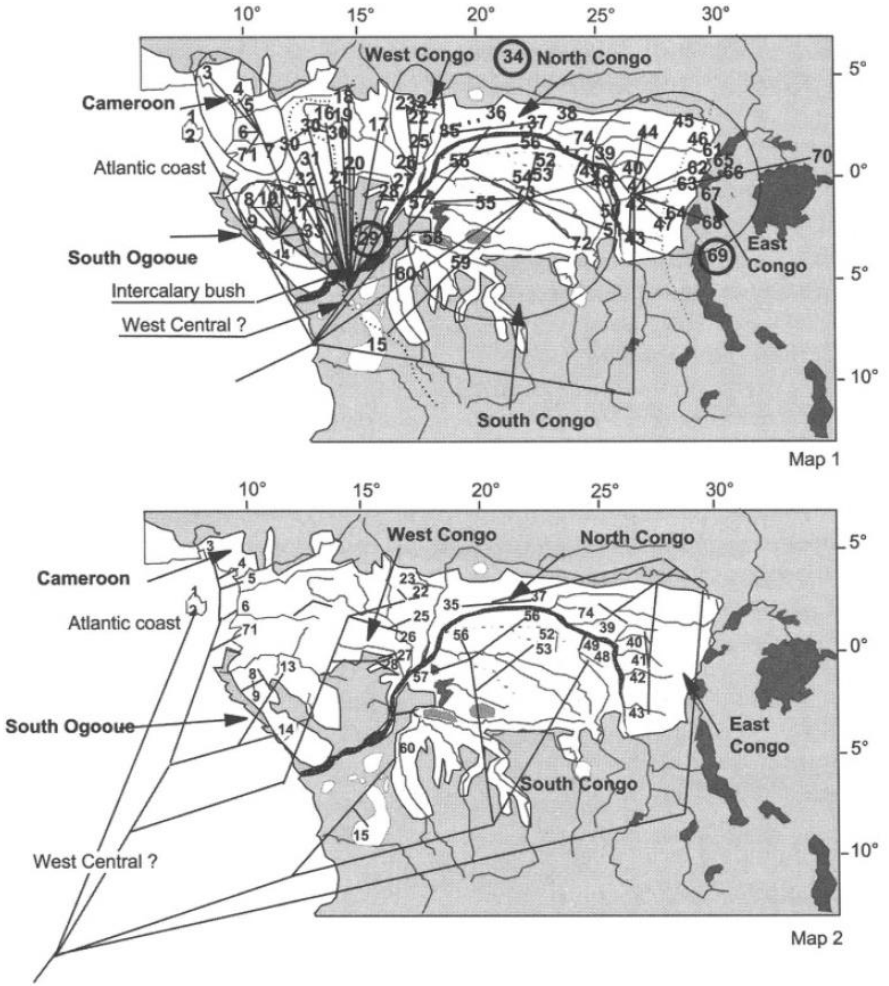
# A focus on the Afrotropical realm



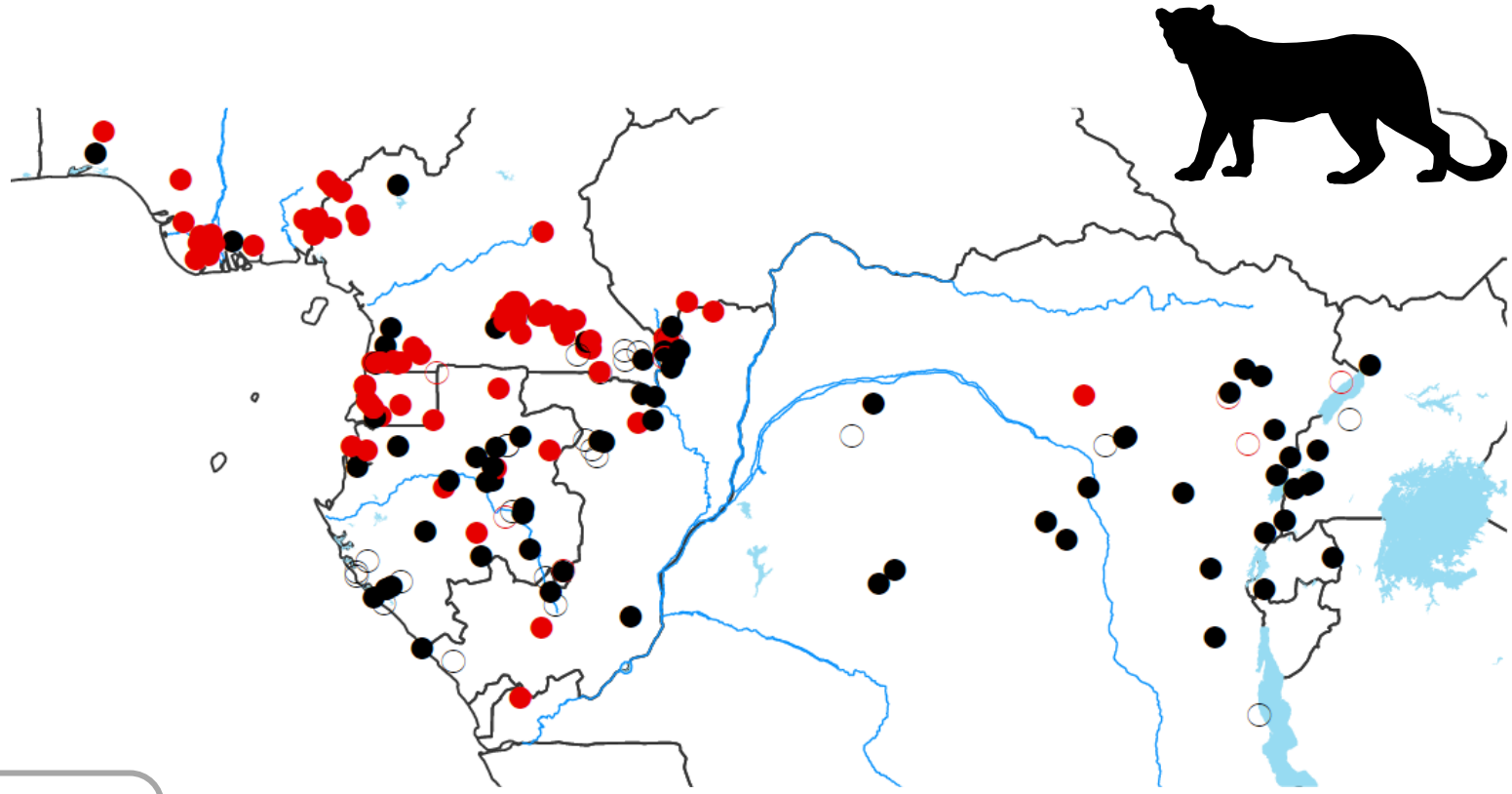

*Hempson et al. (2015). A continent-wide assessment of the form and intensity of large mammal herbivory in Africa*




*Colyn et Deleporte (2004)*

# Zoogeographical districts & indicator species

- Highly congruent distribution patterns between primates and artiodactyls but not for carnivores

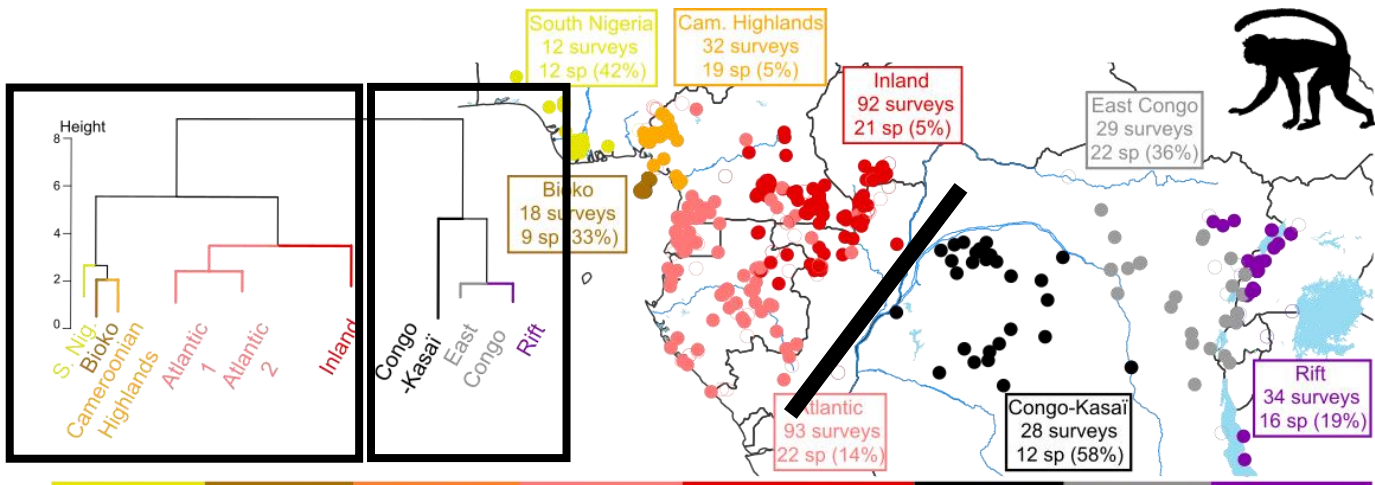


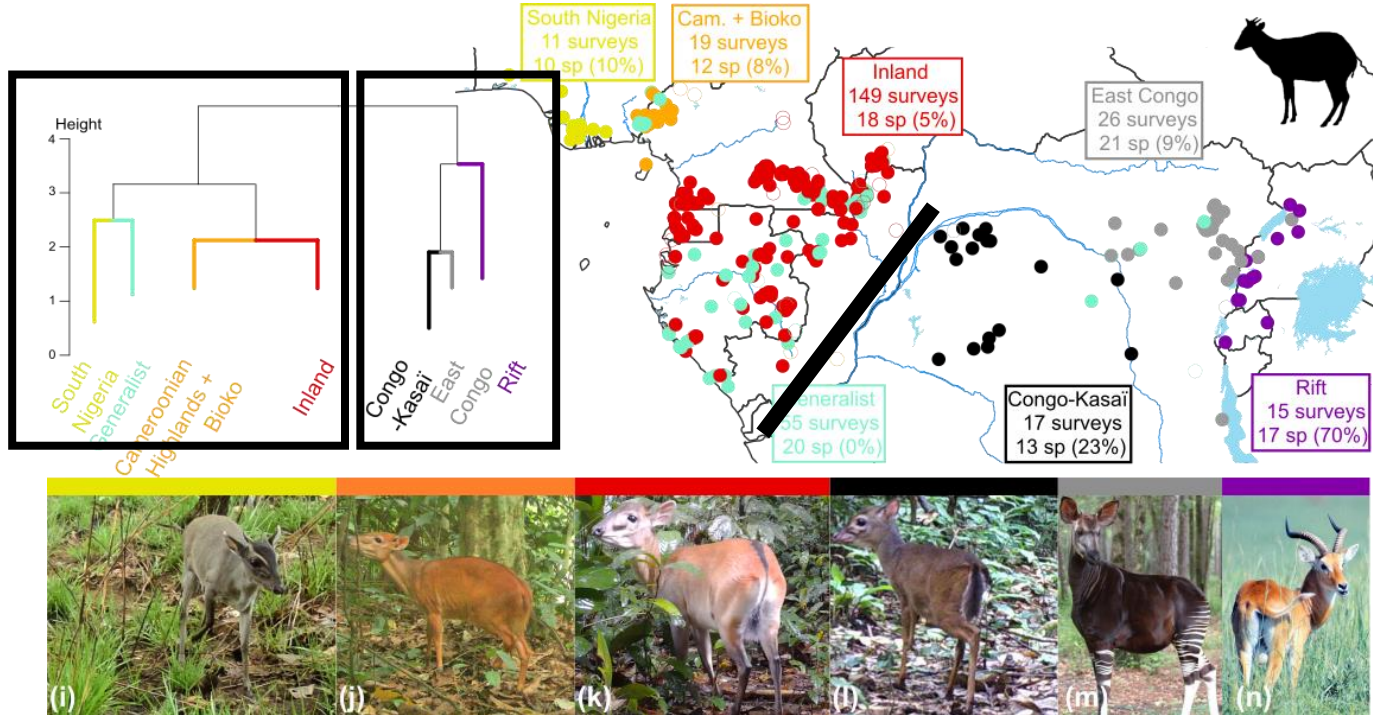
Clustering using $\beta_{sim}$ indice

# Zoogeographical districts & indicator species

- Highly congruent distribution patterns between primates and artiodactyls

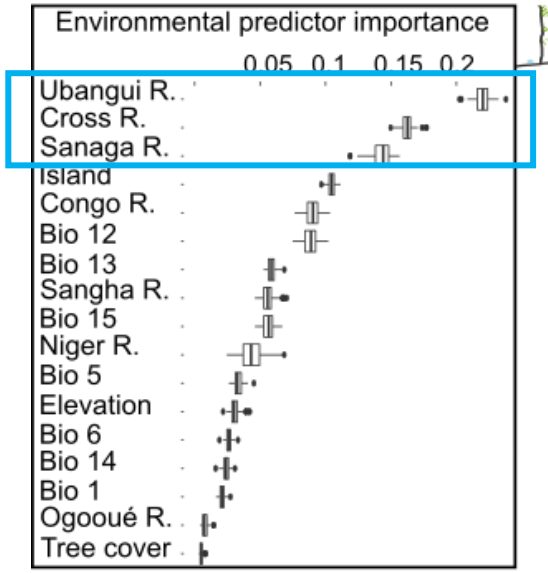
- Major split located on the Ubangui-Congo river system

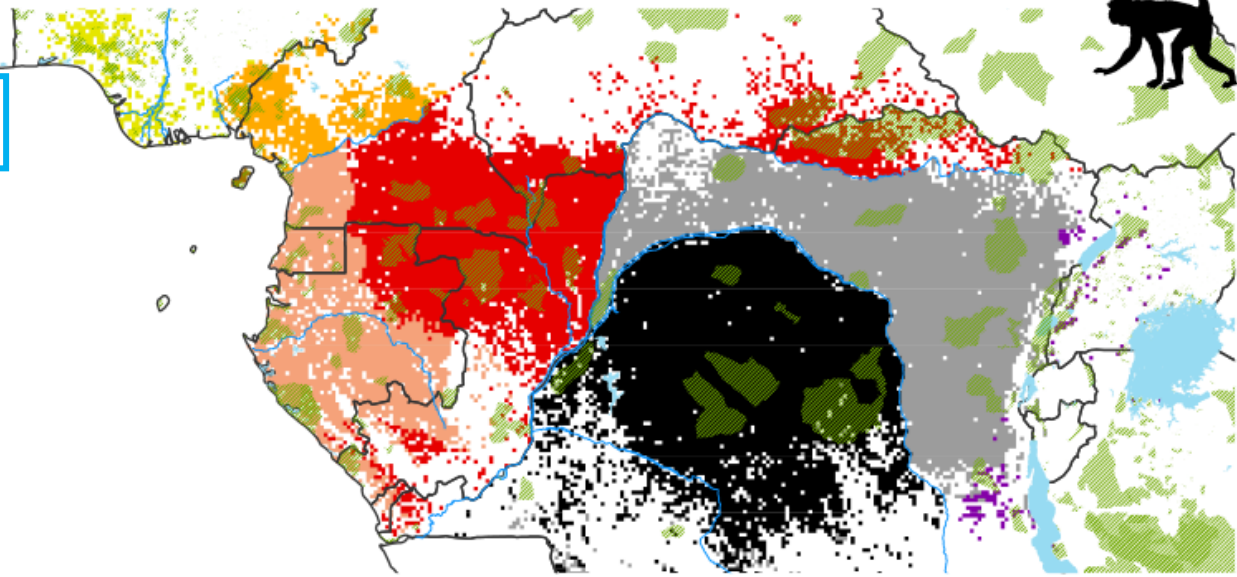


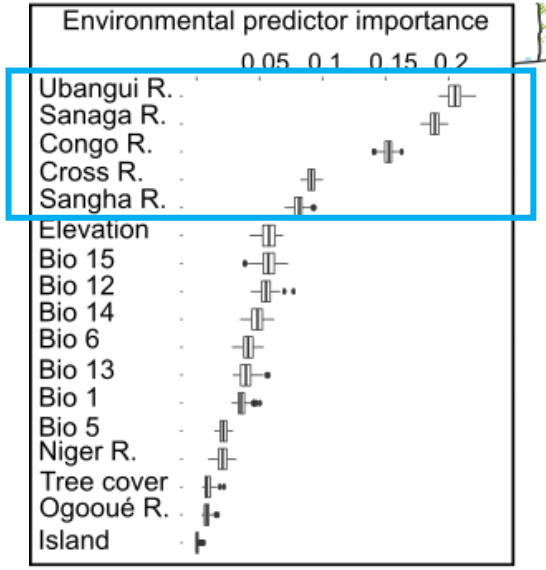



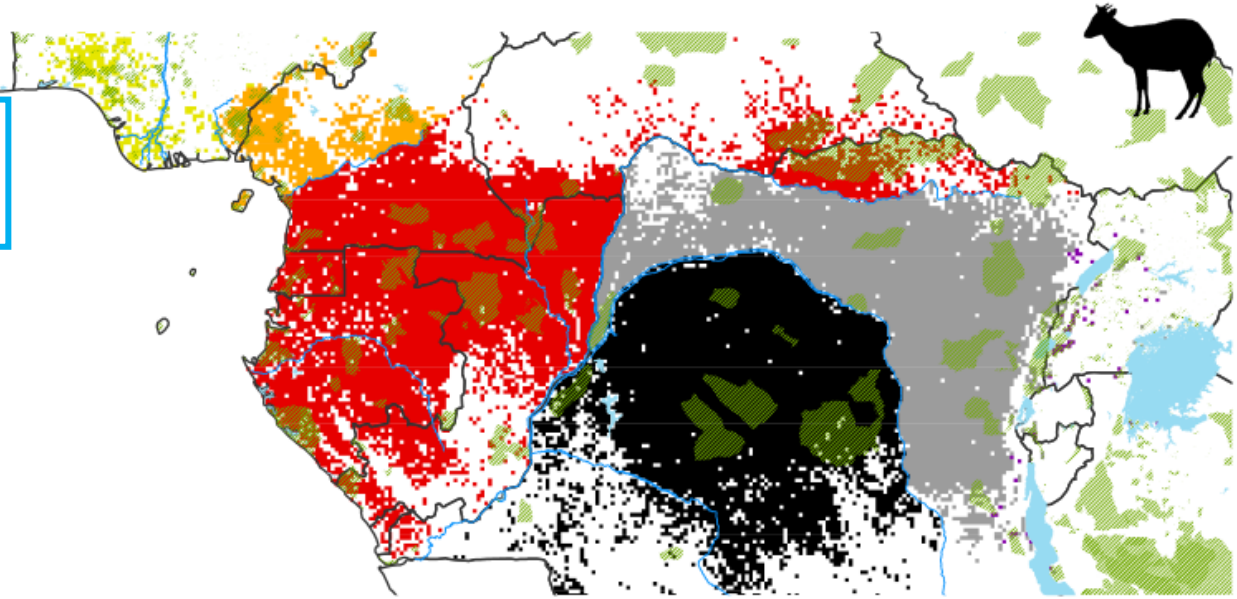
# 2 Environmental determinants

- Important influence of rivers





Bio 1 = Annual Mean Temperature; Bio 5 = Max Temperature of Warmest Month; Bio 6 = Min Temperature of Coldest Month; Bio 12 = Annual Precipitation; Bio 13 = Precipitation of Wettest Month; Bio 14 = Precipitation of Driest Month; Bio 15 = Precipitation Seasonality

Random forest models

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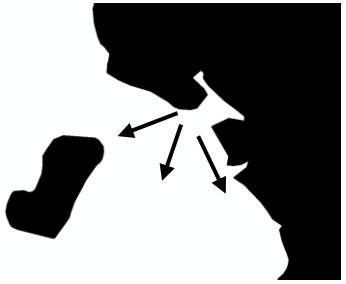
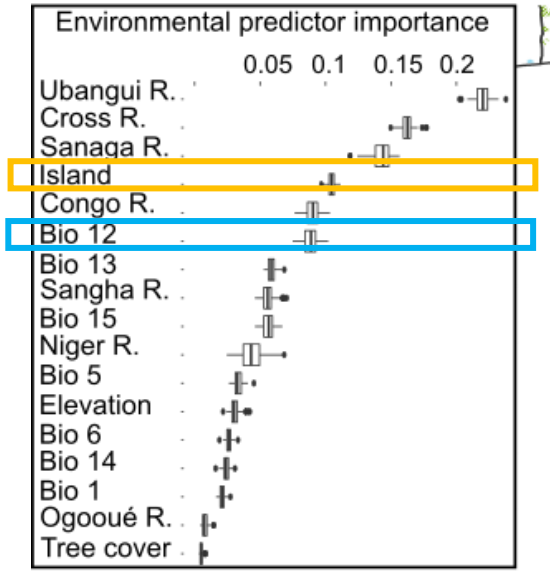
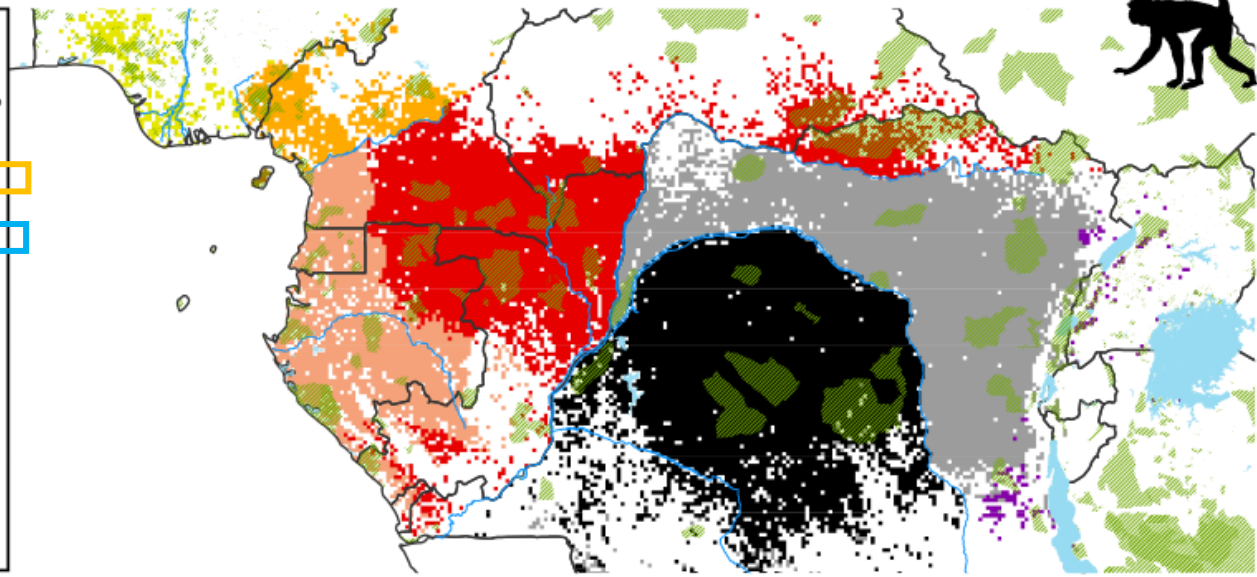
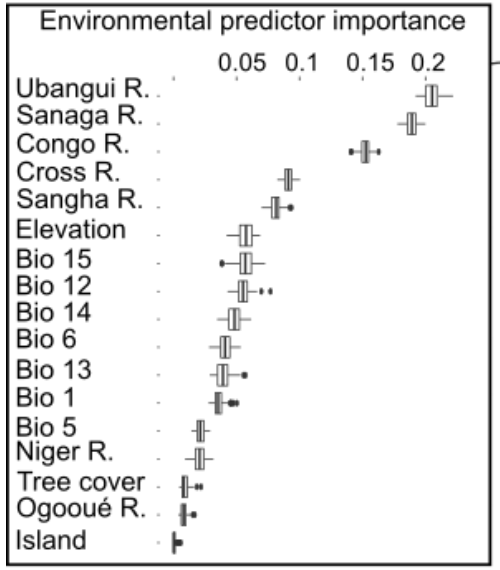
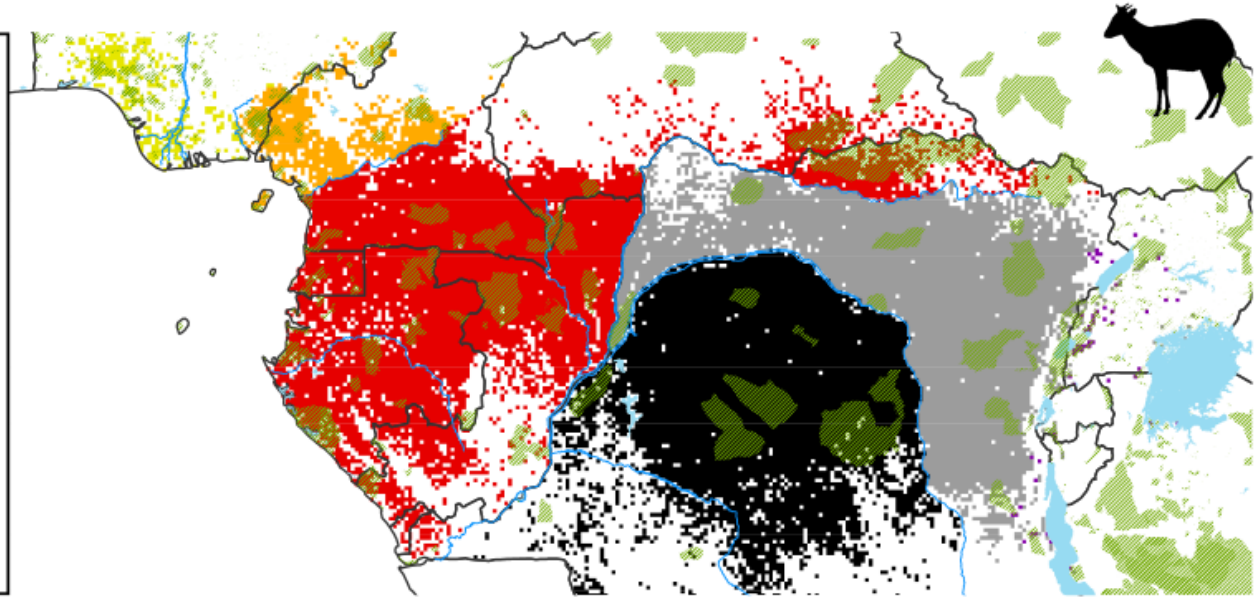


Random forest models





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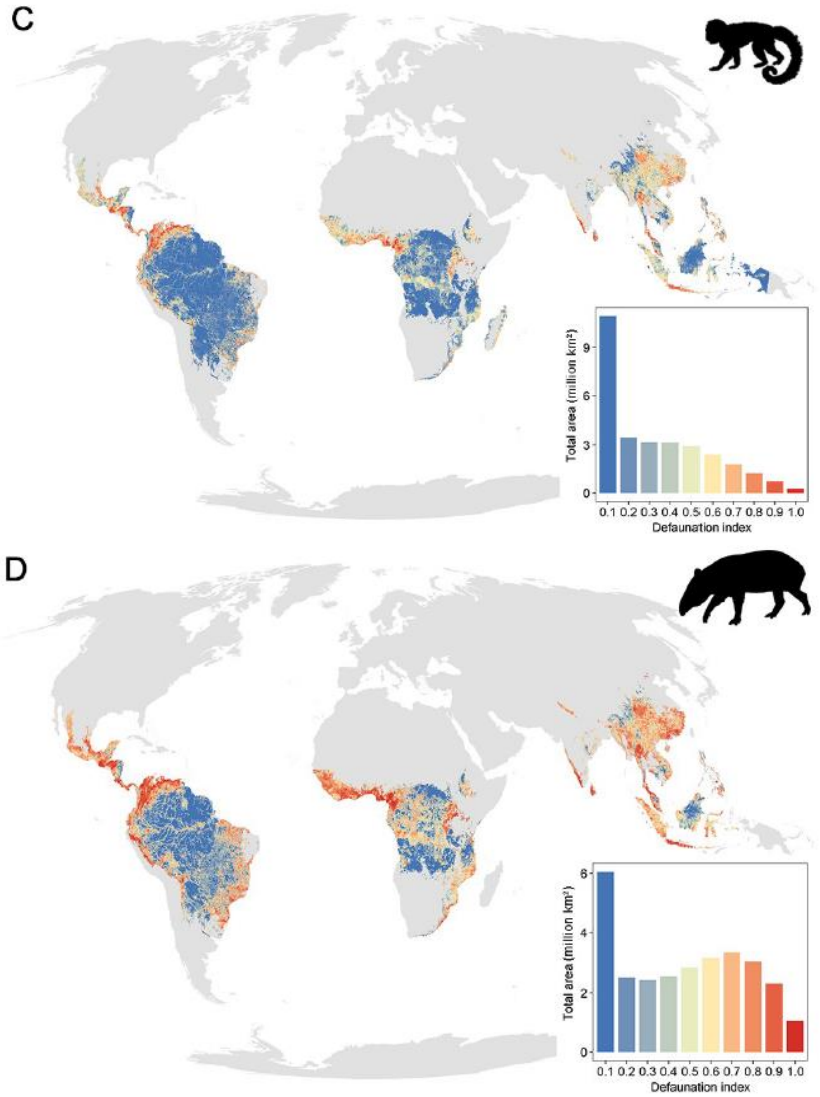
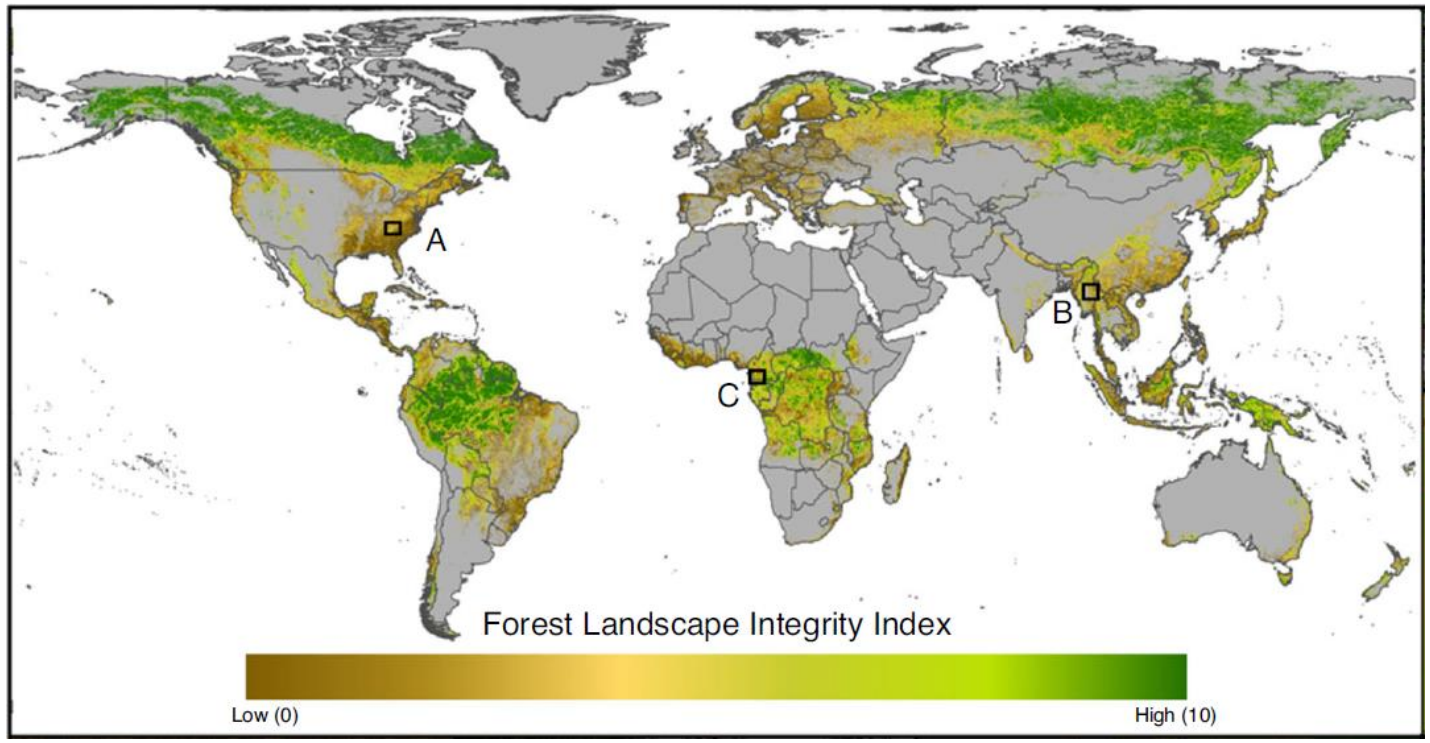
# 3 Protection levels & threats




*Benítez-López et al. (2019)*




*Grantham et al. (2020)*

# 3 Protection levels & threats

| Order / District | Total area in km² (proportion in protected area, in %) | | $\overline{DI}$ | $\overline{FLI}$ |
|---|---|---|---|---|
| **Primates** | | | | |
| South Nigeria | 40,740 | (16.2) | 0.16 | 0.44 |
| Cameroonian Highlands | 83,577 | (17) | 0.24 | 0.79 |
| Bioko | 1,474 | (66.7) | 0.53 | 0.62 |
| Atlantic | 250,319 | (12.7) | 0.47 | 0.80 |
| Inland | 521,576 | (18.6) | 0.59 | 0.88 |
| Congo-Kasaï | 640,134 | (12.5) | 0.61 | 0.75 |
| East Congo | 549,079 | (11.2) | 0.61 | 0.75 |
| Albertine Rift | 18,181 | (37.2) | 0.42 | 0.63 |
| **Artiodactyls** | | | | |
| South Nigeria | 40,862 | (16.5) | 0.16 | 0.44 |
| Cameroonian High. + Bioko | 84,929 | (17.7) | 0.24 | 0.79 |
| Inland | 771,895 | (16.7) | 0.55 | 0.85 |
| Congo-Kasaï | 649,928 | (12.4) | 0.61 | 0.75 |
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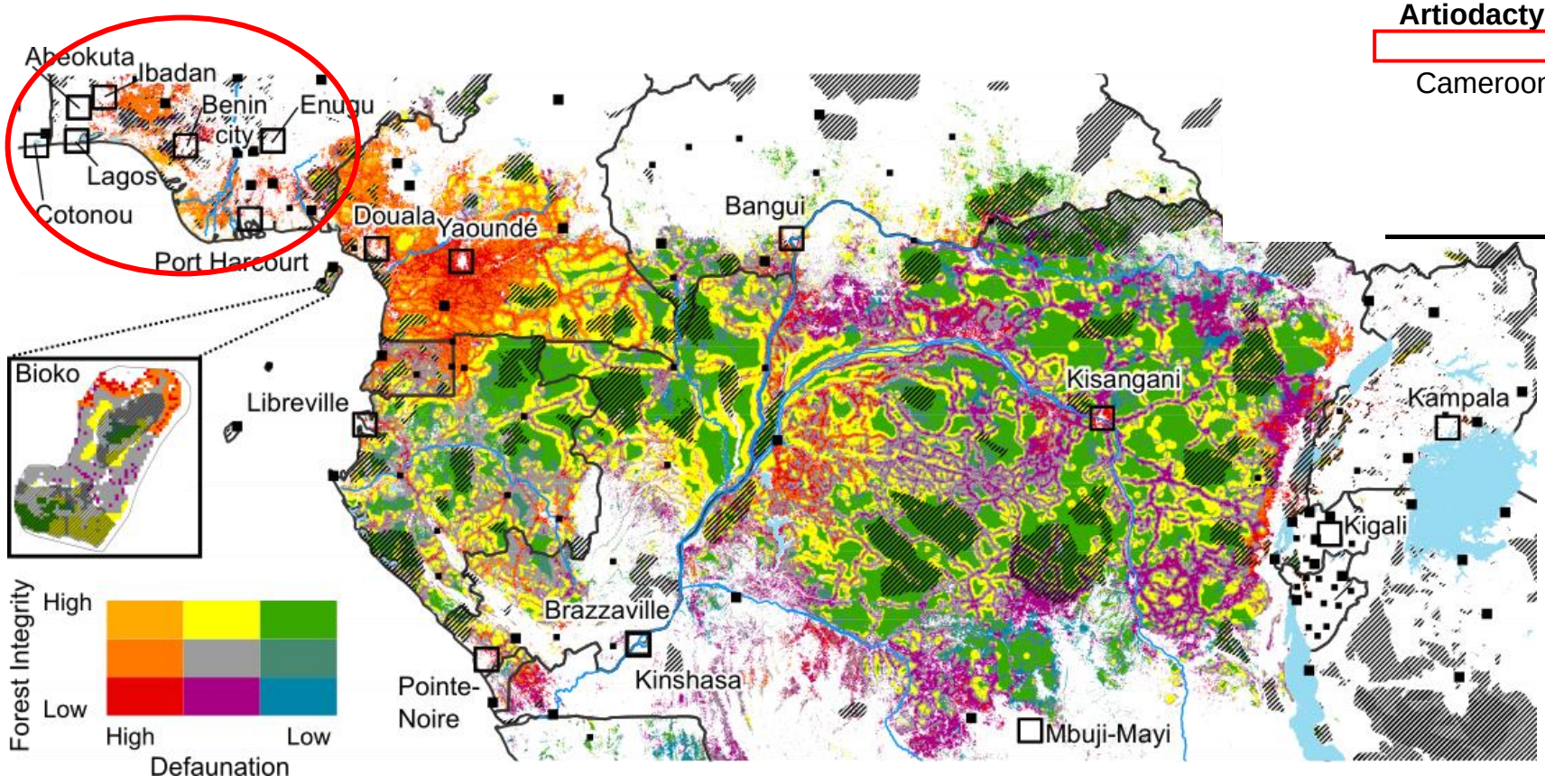
| Albertine Rift | 7,255 | (62.7) | 0.37 | 0.53 |



# 3 Protection levels & threats

| Order / District | Total area in km² (proportion in protected area, in %) | | $\overline{DI}$ | $\overline{FLI}$ |
|---|---|---|---|---|
| **Primates** | | | | |
| South Nigeria | 40,740 | (16.2) | 0.16 | 0.44 |
| Cameroonian Highlands | 83,577 | (17) | 0.24 | 0.79 |
| Bioko | 1,474 | (66.7) | 0.53 | 0.62 |
| Atlantic | 250,319 | (12.7) | 0.47 | 0.80 |
| Inland | 521,576 | (18.6) | 0.59 | 0.88 |
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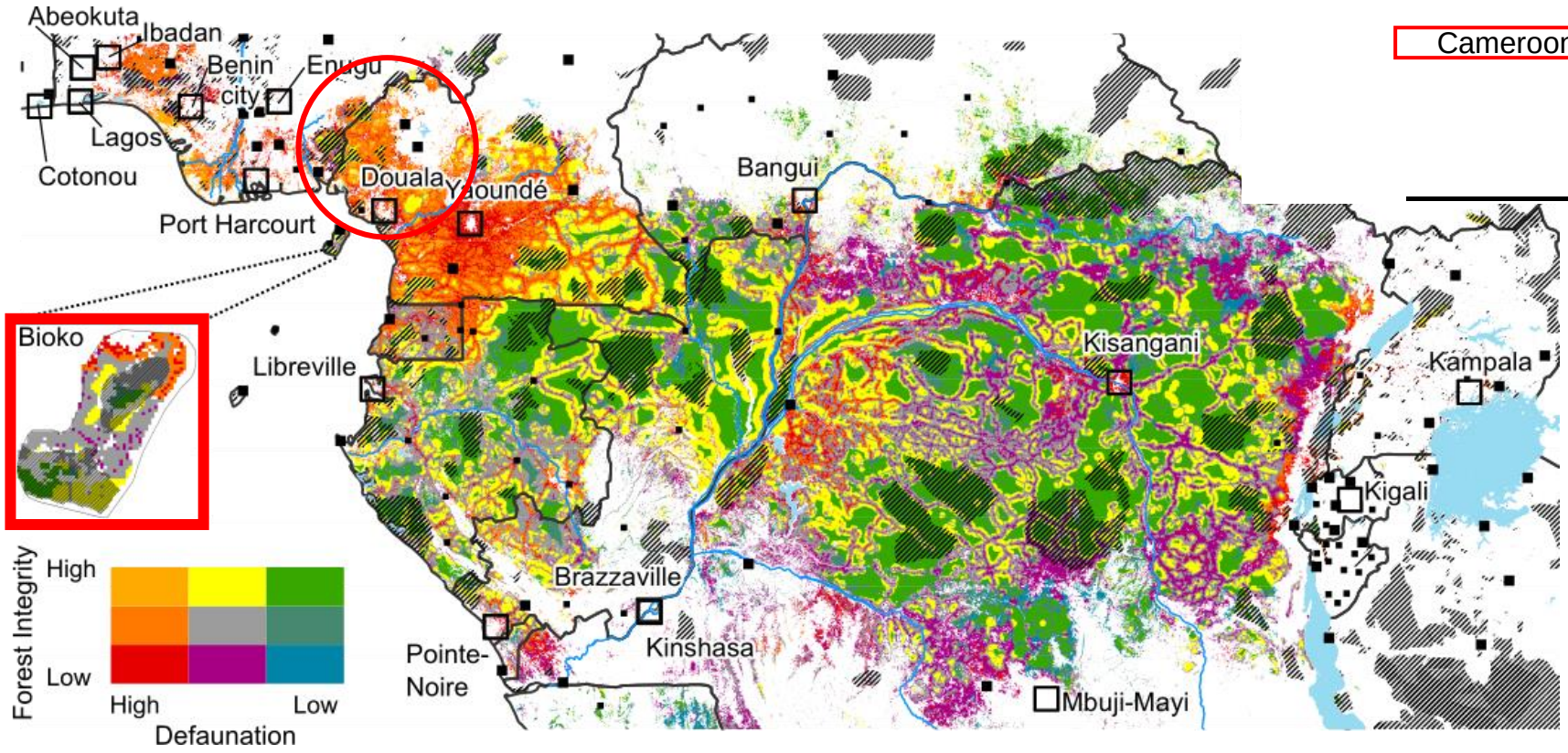

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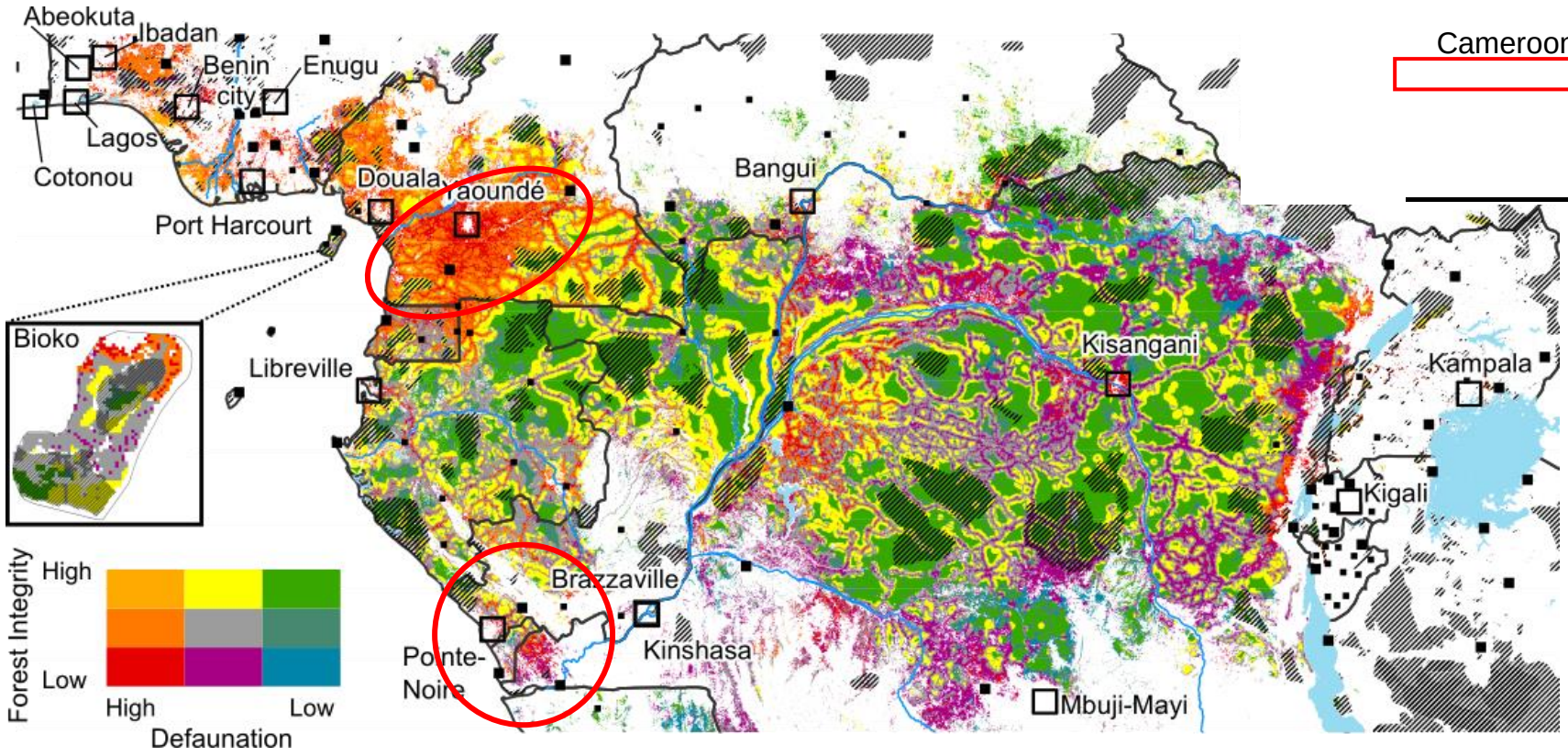

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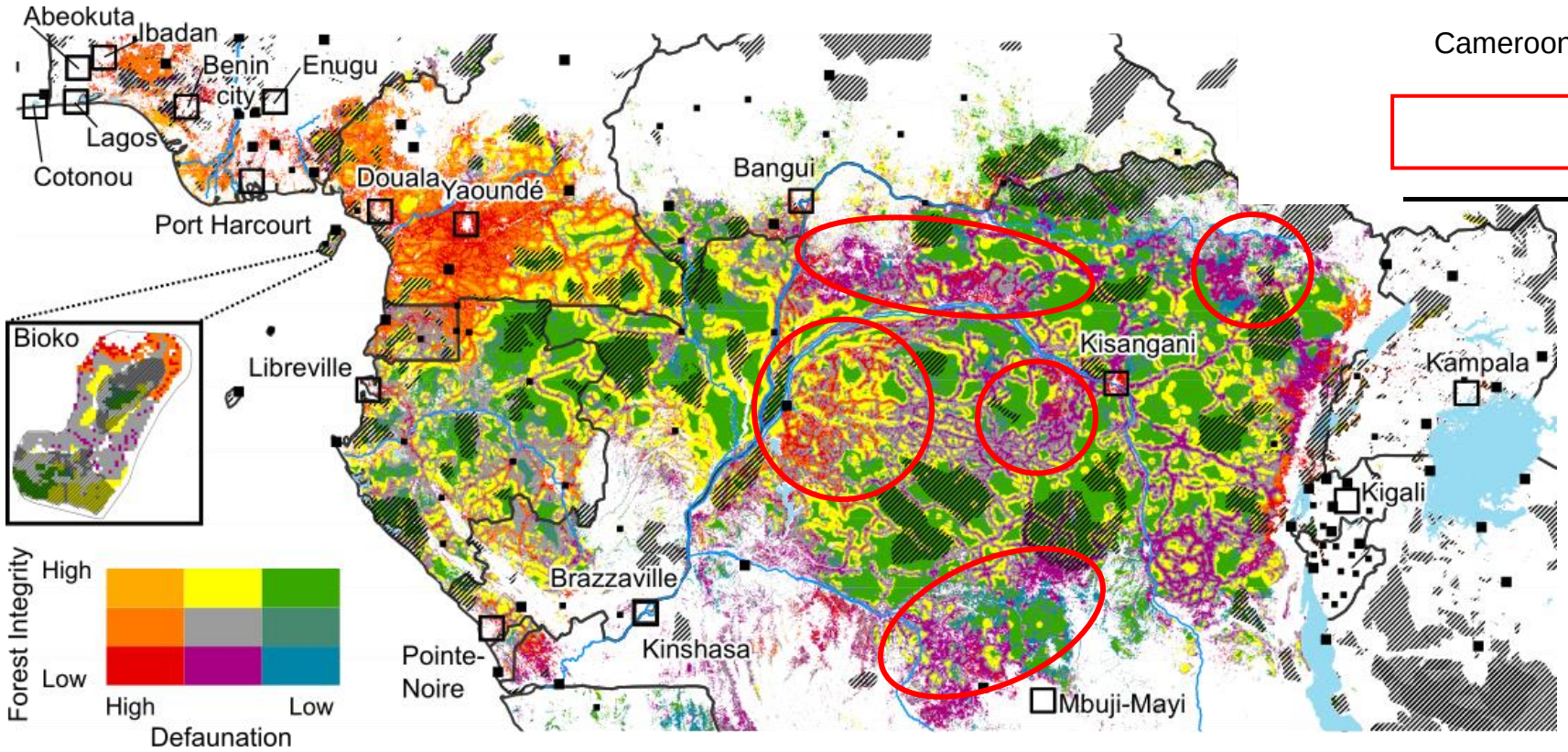

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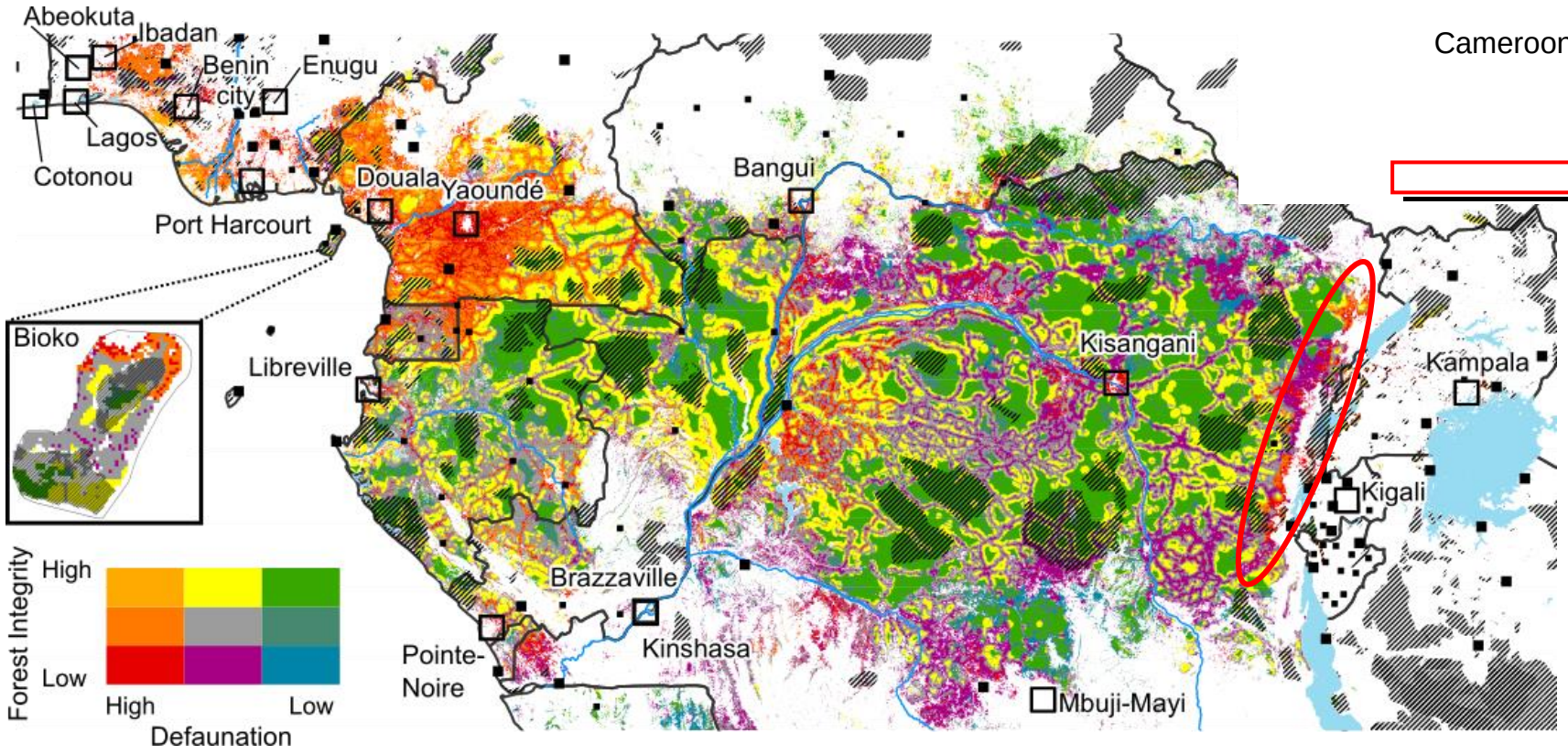
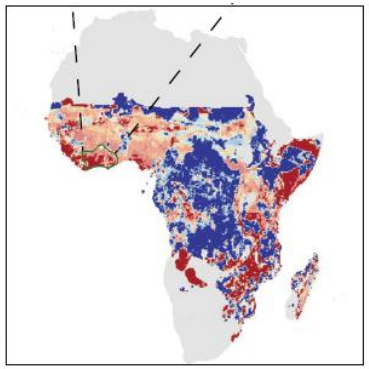
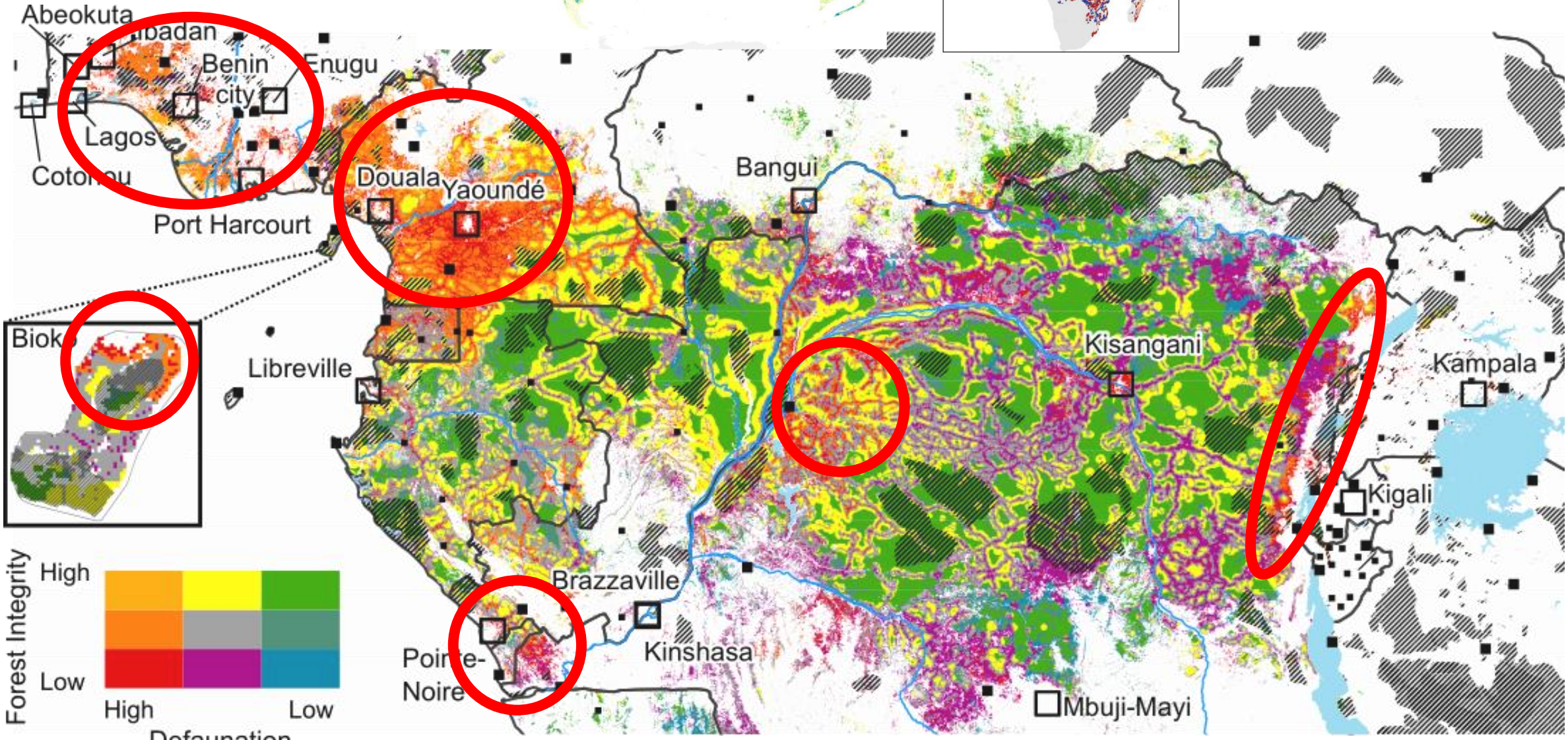


# 3 Protection levels & threats

*Mair et al. (2021)*



*Gallego-Zamorano et al.(2020)*



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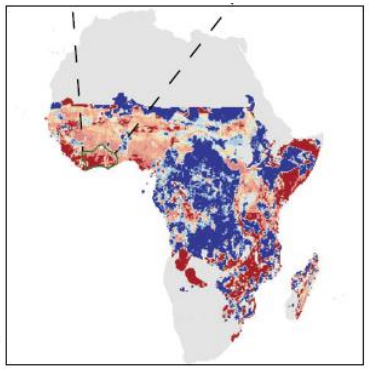

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