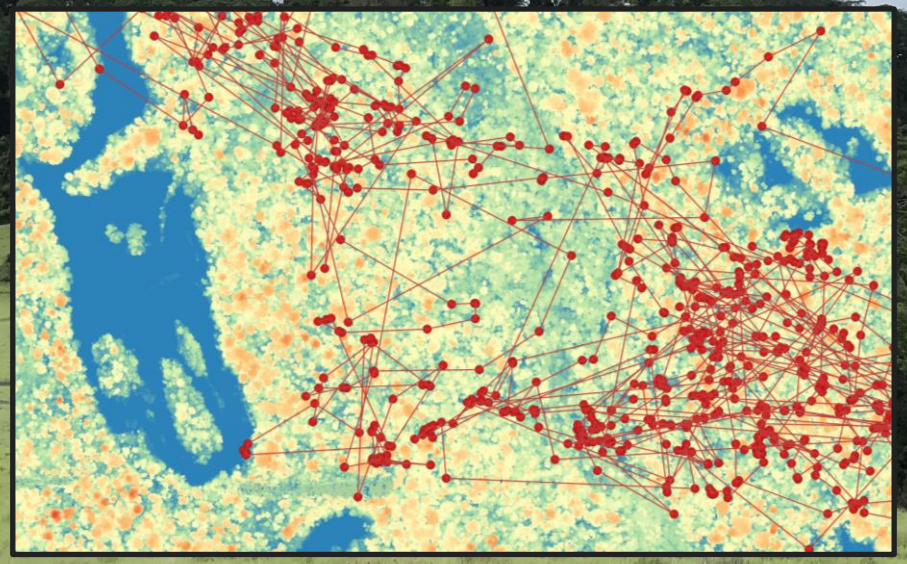
Seed dispersal to canopy gaps in the Congo Basin and implications for grassy ecosystems



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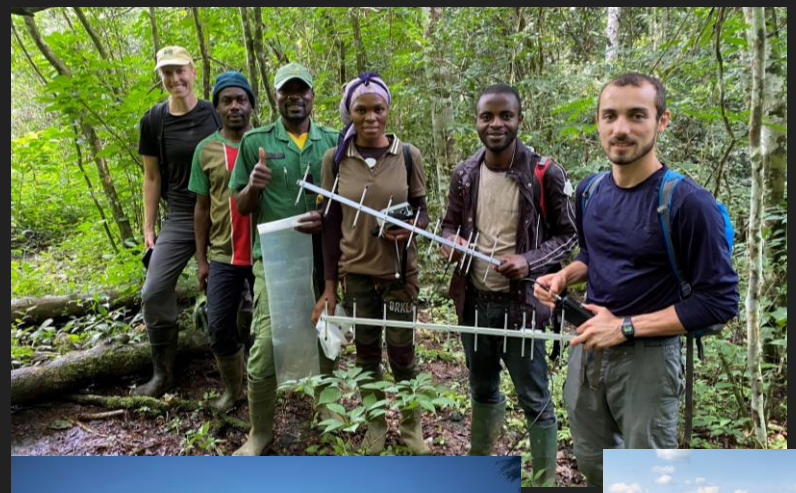
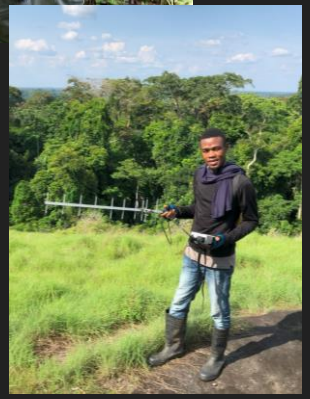
Contributors





Open-canopy ecosystems in Congo Basin rainforests

- Includes savanna ecotone, bais, and inselberg grasslands
- Often isolated within densely forested areas
- Important focal areas for animal activity

Red River Hog (*Potamochoerus porcus*)

Vegetation structure

- Energetic costs
- Predation risk

Animal behavior

- Herbivory
- Seed dispersal

Ecosystem functioning

Russo et al. 2023 *Ecol. Lett.*

Dja Faunal Reserve, Cameroon

- Cameroon’s largest protected area (526 km^2)
- Mature tropical lowland rainforest
- At least 312 tree species, ~90% are dispersed by vertebrates

Questions

1) How do large canopy gaps influence the movements of seed-dispersing animals?

2) How does movement behavior near canopy gaps influence spatial patterns of seed dispersal?

Inselberg habitat: “Rocher Bouamir”

Track movements of seed-dispersers

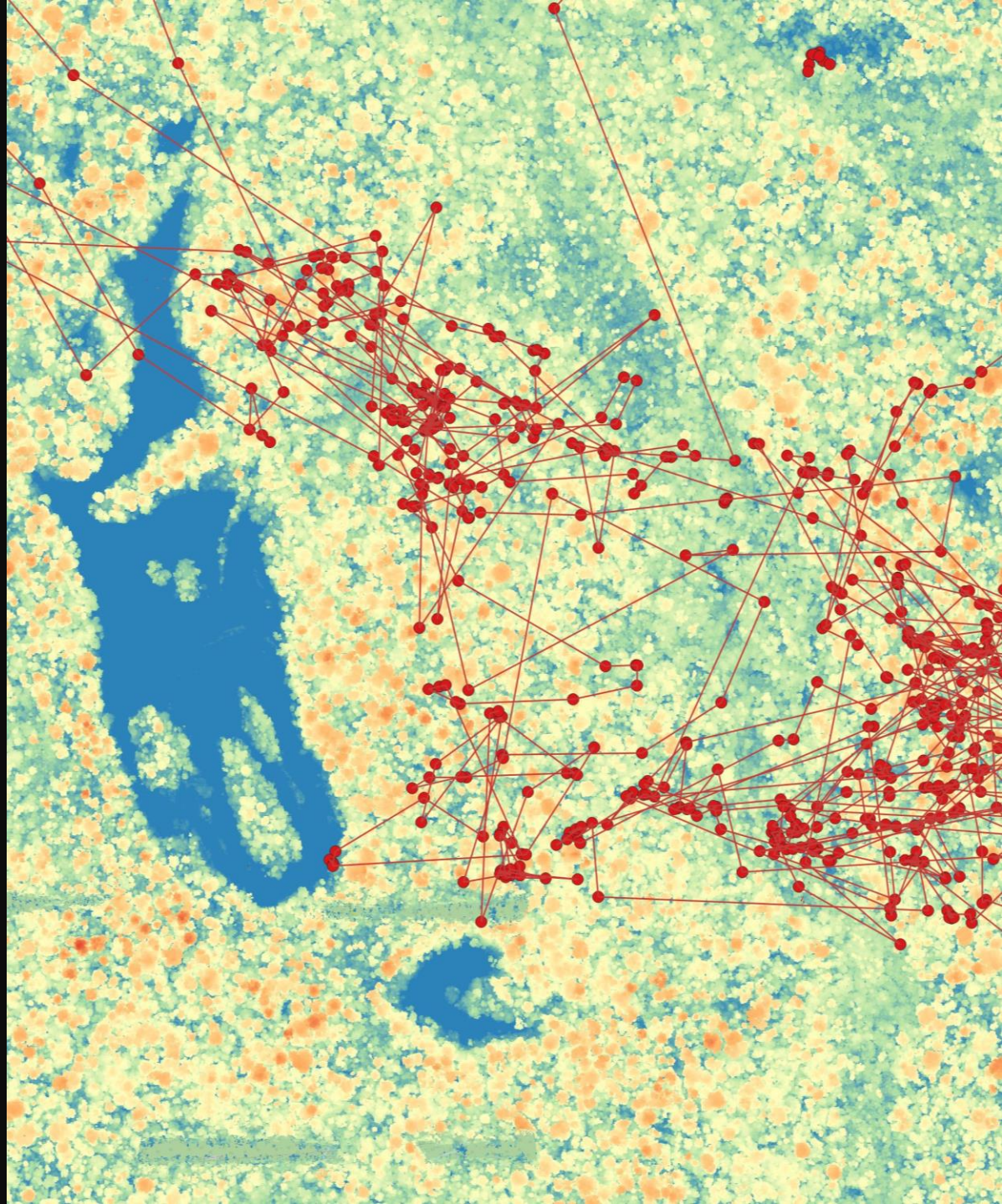
Black-casqued hornbill
(*Ceratogymna atrata*)

White-thighed hornbill
(*Bycanistes albotibialis*)

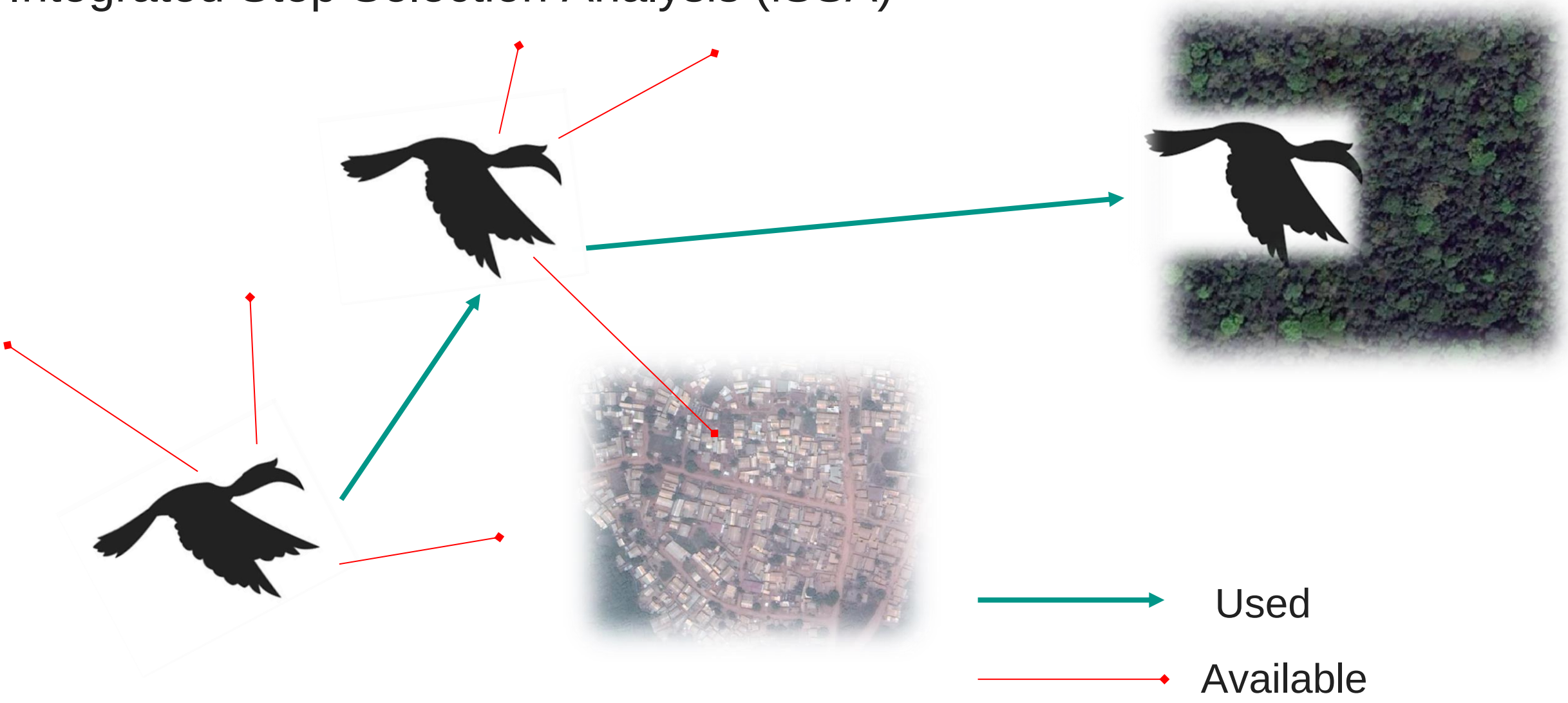
Hammer-headed bat
(*Hypsignathus monstrosus*)

How does vegetation structure influence bird and bat movements?

- Using Light Detection and Ranging (LiDAR)
- Relate movements to measures of:
  - Height
  - Cover
  - Complexity

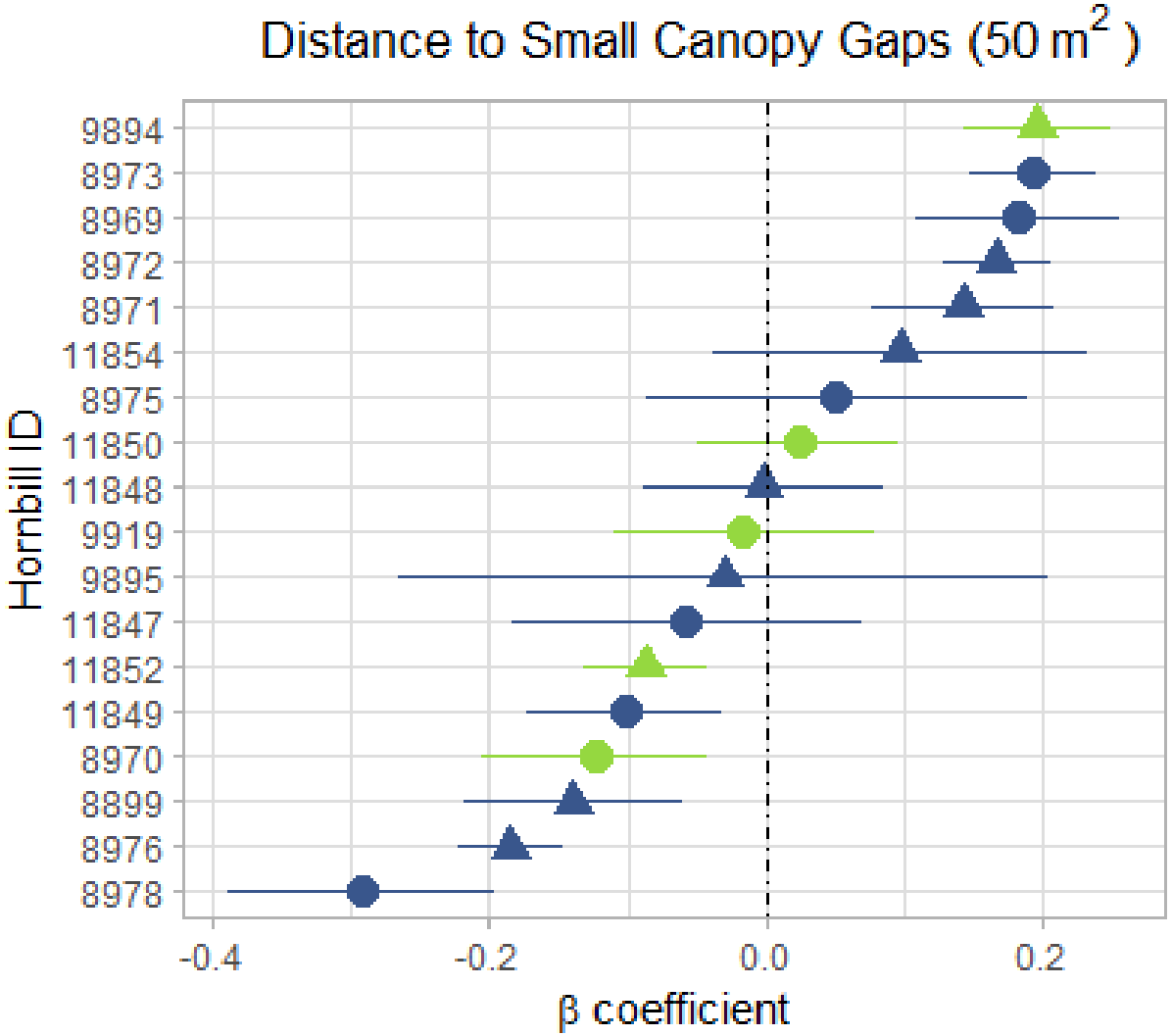


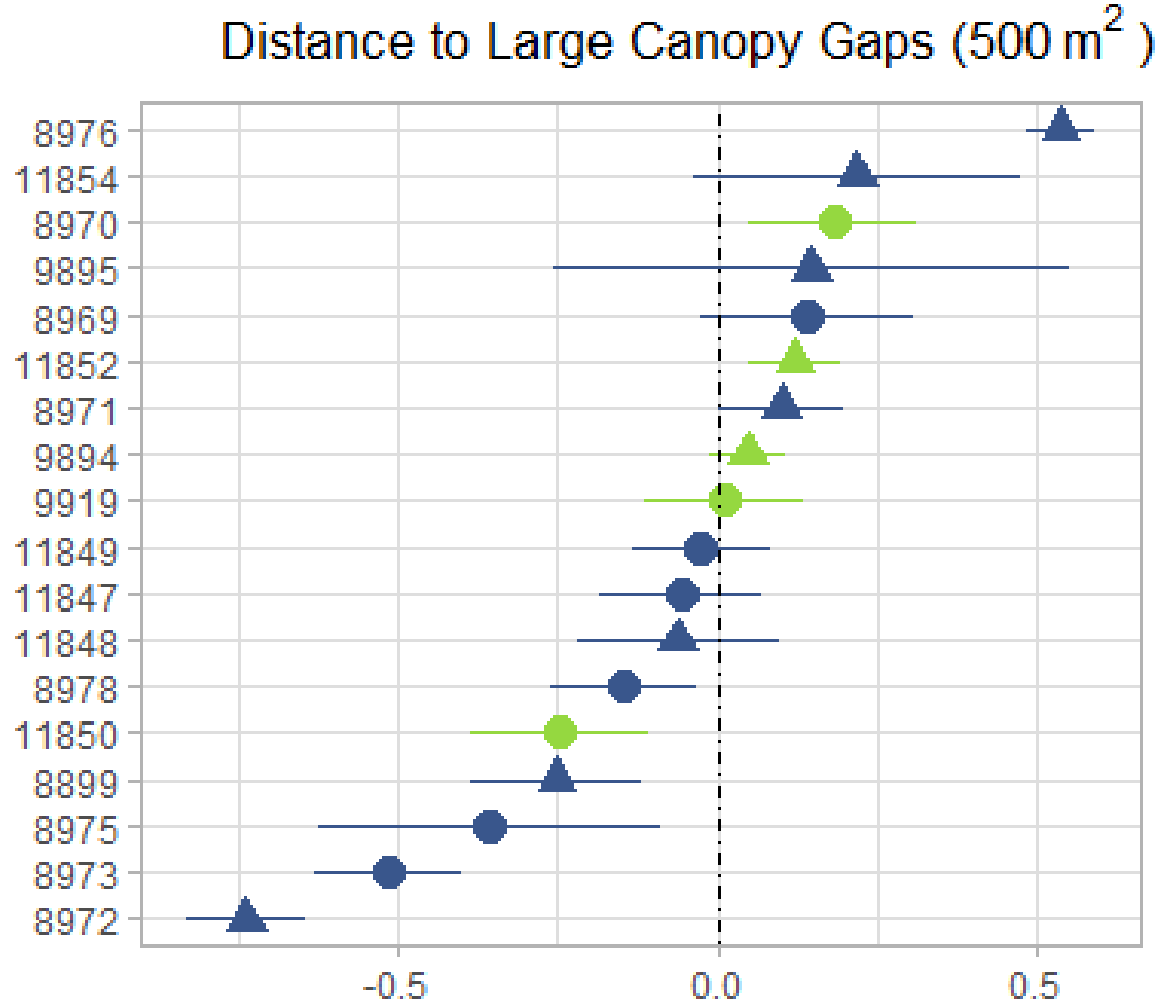
Integrated Step Selection Analysis (iSSA)



$$\breve{w}(x) = \exp(\boldsymbol{\beta_1} * Height + \boldsymbol{\beta_2} * Canopy\ Gap + \boldsymbol{\beta_3} * Vertical\ Complexity)$$

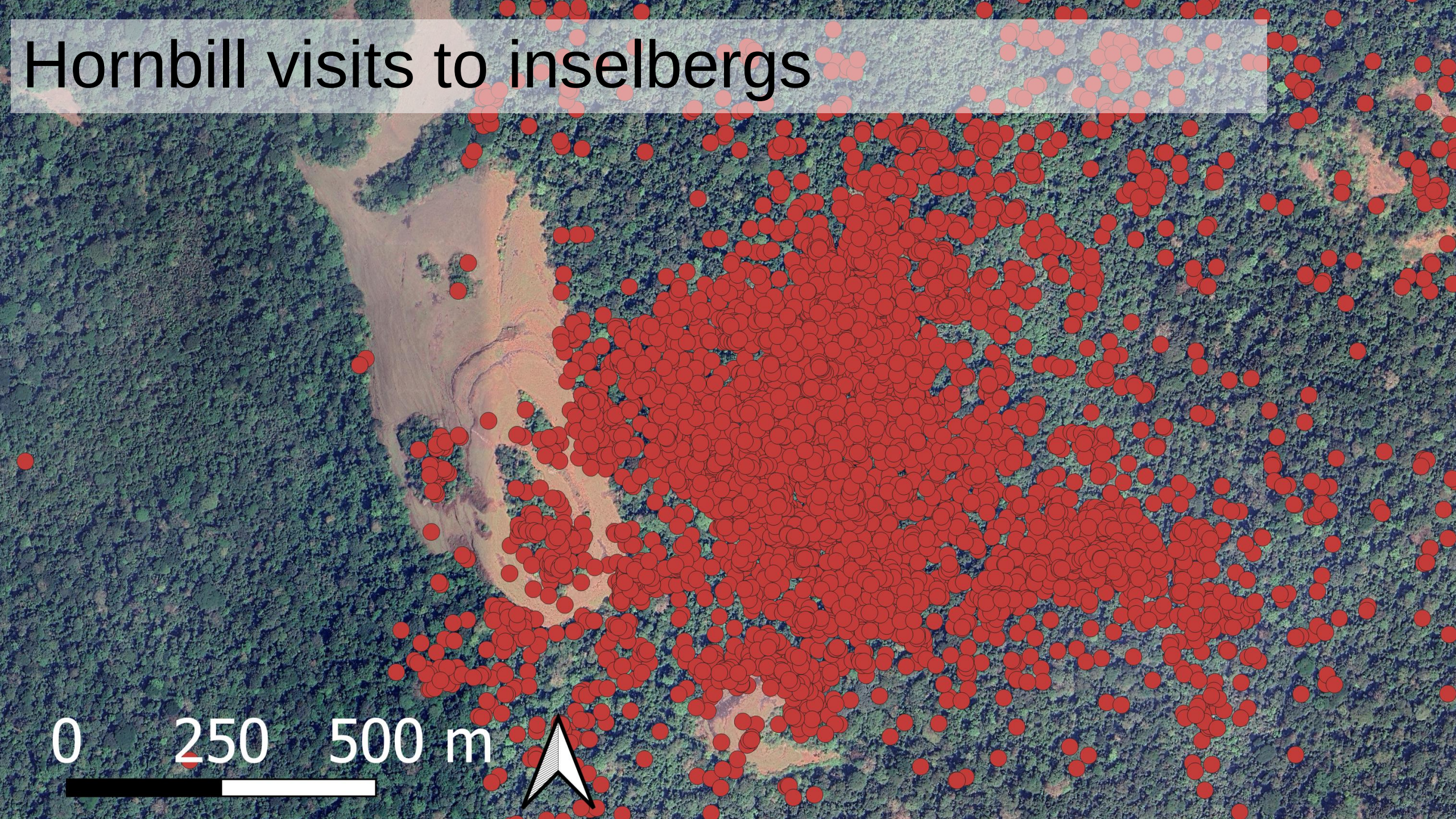
Hornbills can be gap “specialists” or “avoiders”



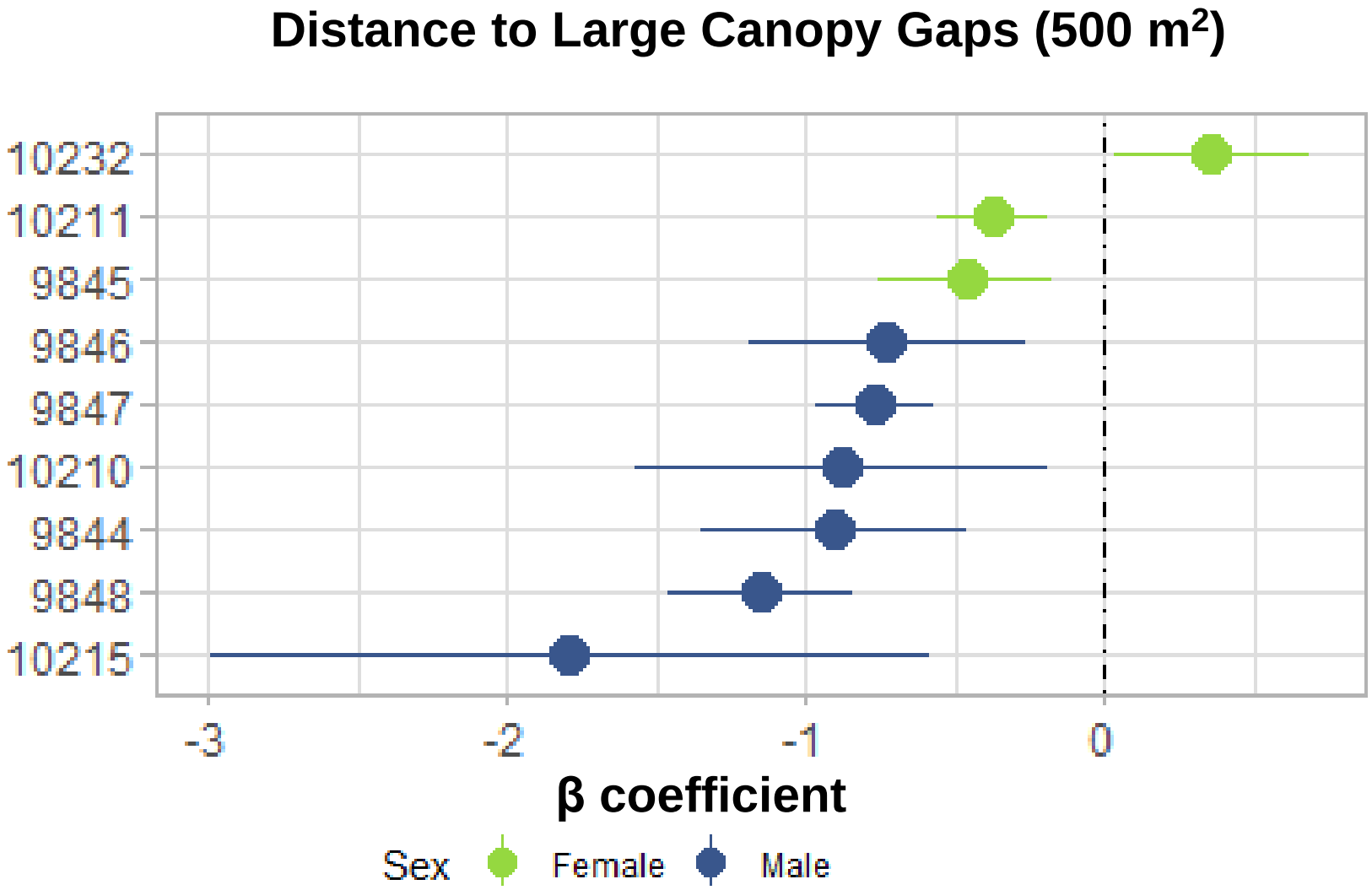


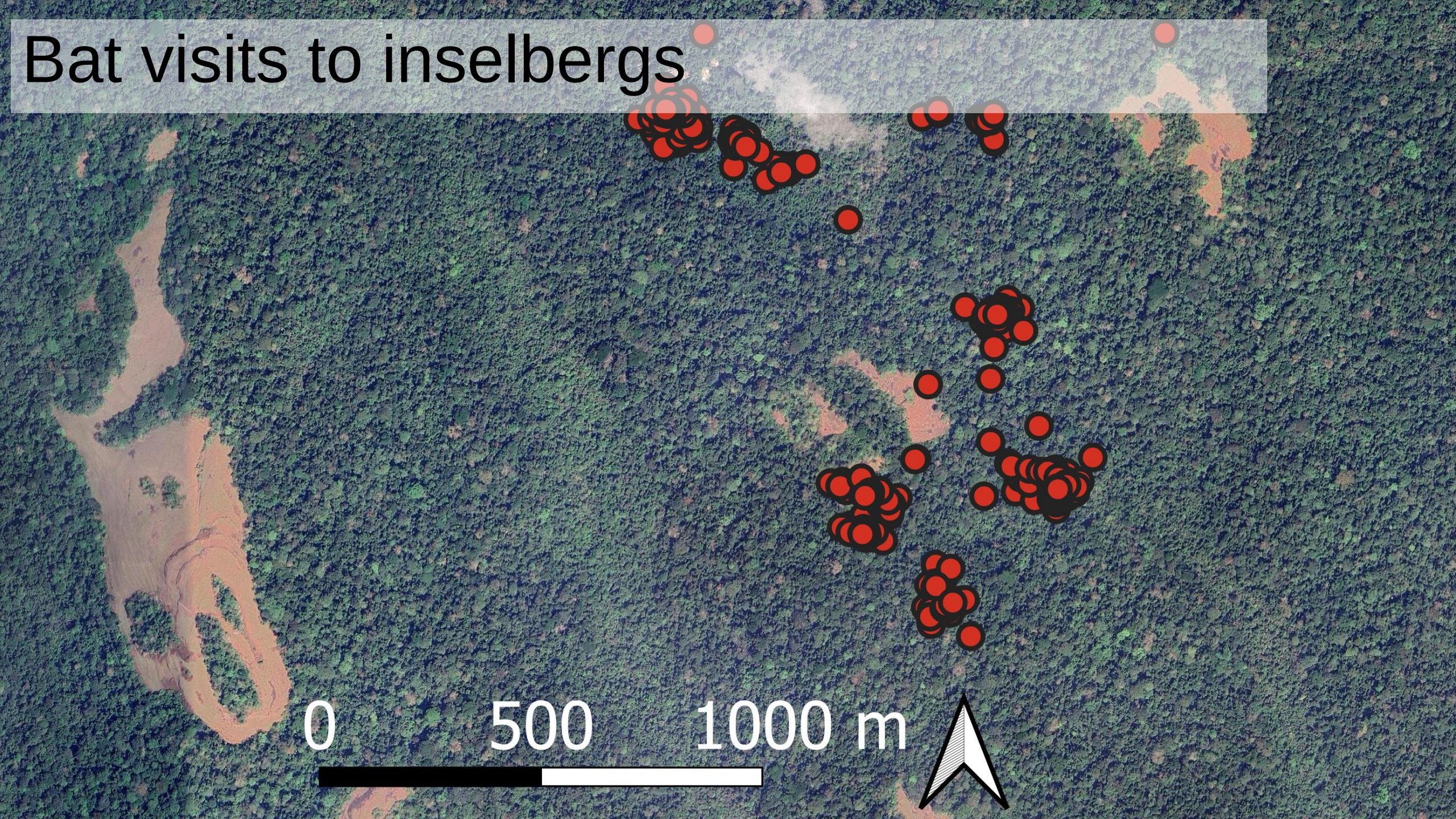
Species BCH WTH Sex Female Male

Russo et al. 2024 *J. Anim. Ecol.*


Hornbill visits to inselbergs
0
250
500 m

Hammer-headed bats prefer areas close to canopy gaps



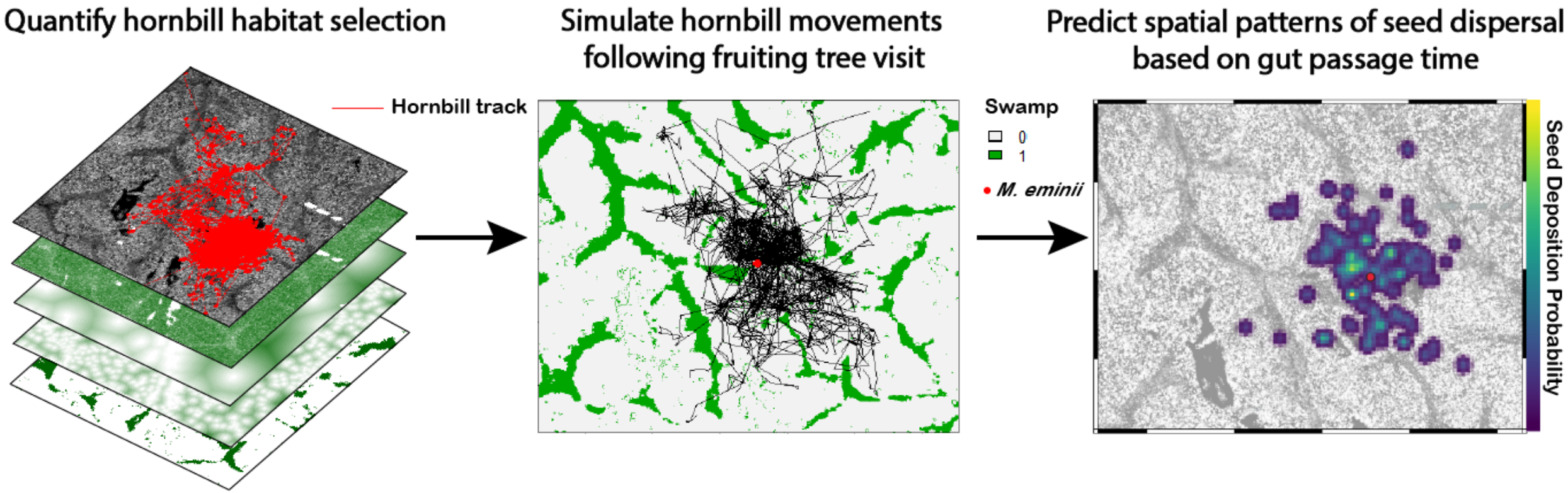

Bat visits to inselbergs
0
500
1000 m

Questions

1) How do large canopy gaps influence the movements of a community of seed dispersers?

2) How does movement behavior near canopy gaps influence spatial patterns of seed dispersal?

Predict spatial patterns of seed dispersal



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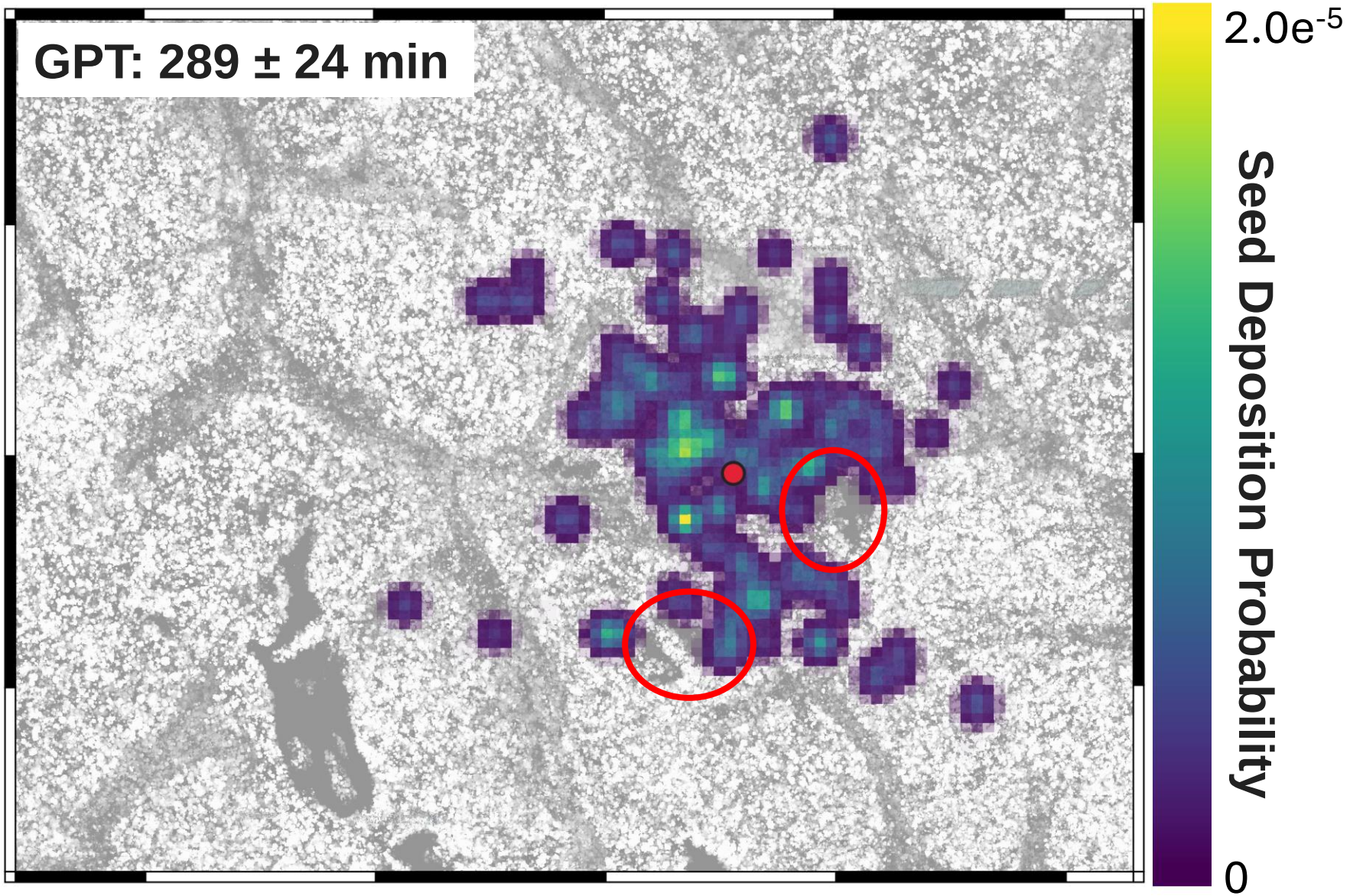
Seed shadow produced by black-casqued hornbills



- ***Maesopsis eminii* (Londo)**

Russo et al. 2024 *J. Anim. Ecol.*

Significance

- Animals can disperse seeds to open-canopy ecosystems in Congo Basin rainforests
- Canopy gap specialists may be a contributing factor to woody encroachment in forest-savanna mosaics
- Open-canopy ecosystems in Congo Basin rainforests need more research attention

Acknowledgments

Permissions/ Logistics	MINFOF
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	Mbembo Luc
	Mbengue Moise
	Ngong Antoine
	Obam Lundi
	Mekok Alfred
	Doumba Olivier
	Mevoula Bertrand
	Samuah Harvilange
Students	Tegueu Prudence
	Tekam Antoine
	Hongie Mandela
	Nshom Docas Looh
	Tegebong Valorian
	Ninying Benedicta

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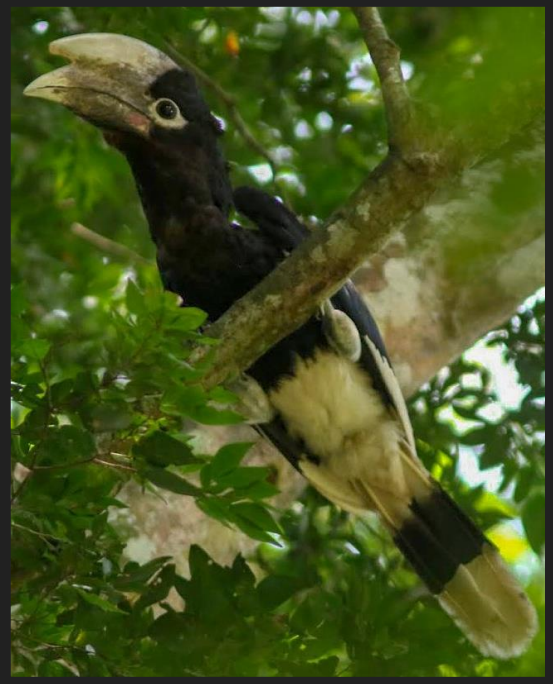
2022-05-14 14:00:14
3.20°N
3.19°N
3.18°N
3.17°N
Latitude
0 km
1 km
2 km
N
12.78°E
12.80°E
12.82°E
12.84°E
12.86°E
Longitude
Names
X8971
X8970
X8972
X8973
X8975
X8976
X8978
X8898
X8969
X8899

Compare movements between assemblages

Black-casqued hornbill
(*Ceratogymna atrata*)
Local names: Mango, Dúo

White-thighed hornbill
(*Bycanistes albotibialis*)
Local names: Kata, Dóm

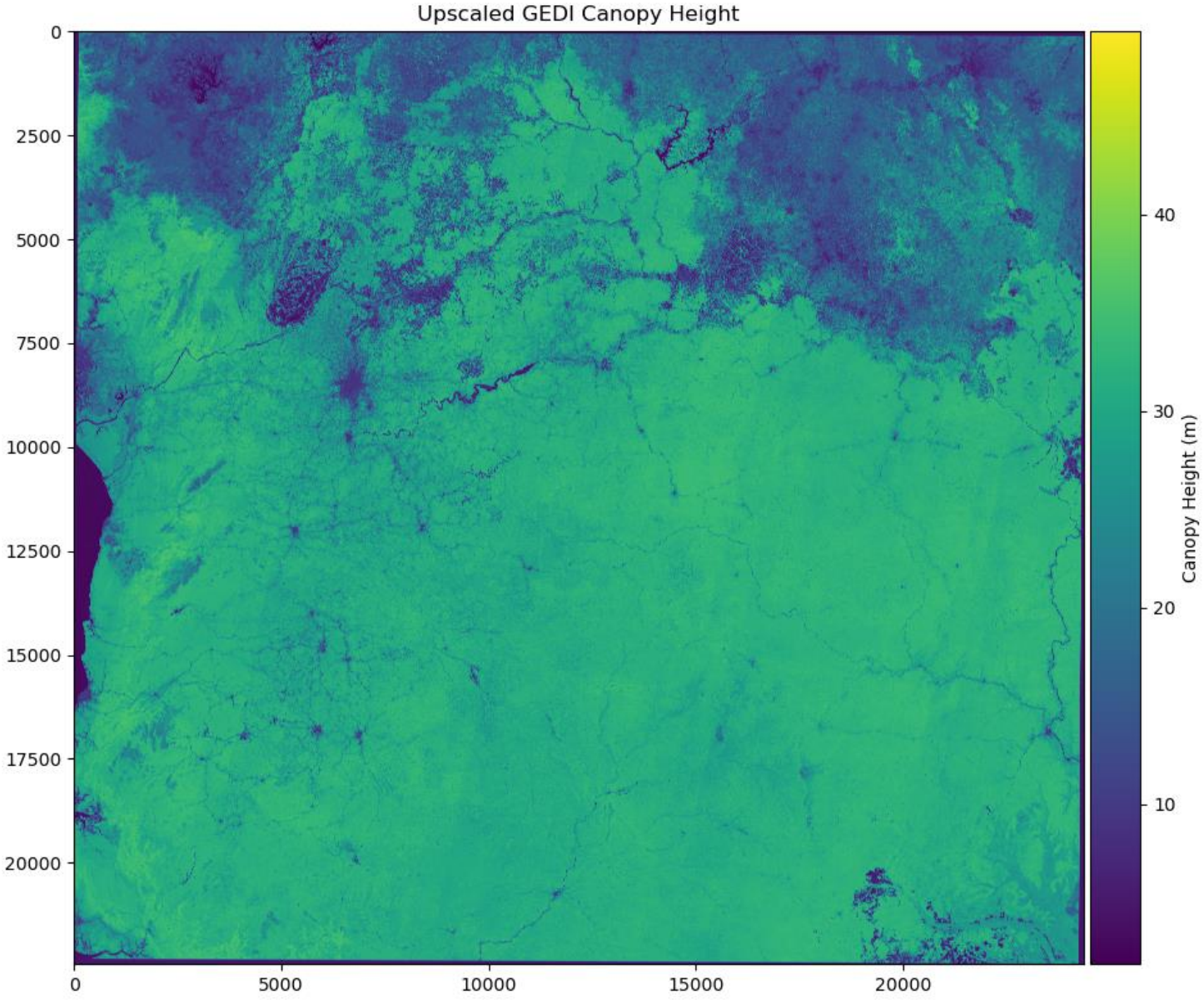


Great blue turaco
(*Corythaeola cristata*)
Local name: Kulungu

Hammer-headed fruit bat
(*Hypsignathus monstrosus*)
Local name: Li'bongbalo

Upscaled lidar metrics using GEDI

- Upscaled using:
  - Landsat 8
  - ALOS/PALSAR
  - Copernicus DEM
- Validated canopy height estimates with GEDI
- Related upscaled canopy height to hornbill movements



Seed dispersal to canopy gaps in the Congo Basin and implications for grassy ecosystems

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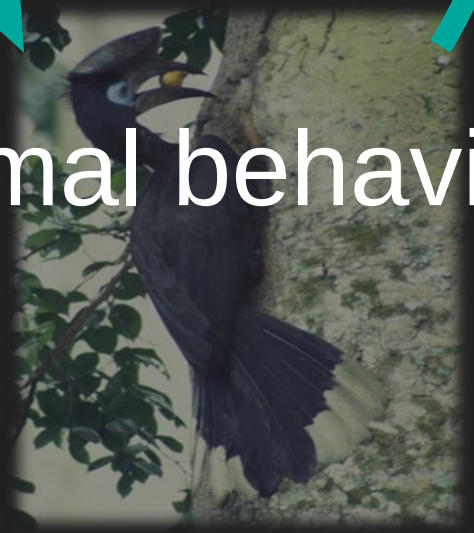
Vegetation structure



Animal behavior

Ecosystem functioning

Inselbergs

- Rocky outcrops with a thin layer of soil, covered by grass
- Important grazing sites for large herbivores like forest buffalo
- Distinctive plant communities at ecotones; frugivores gather at these sites

Russo et al. 2024 *J. Field Ornith.*

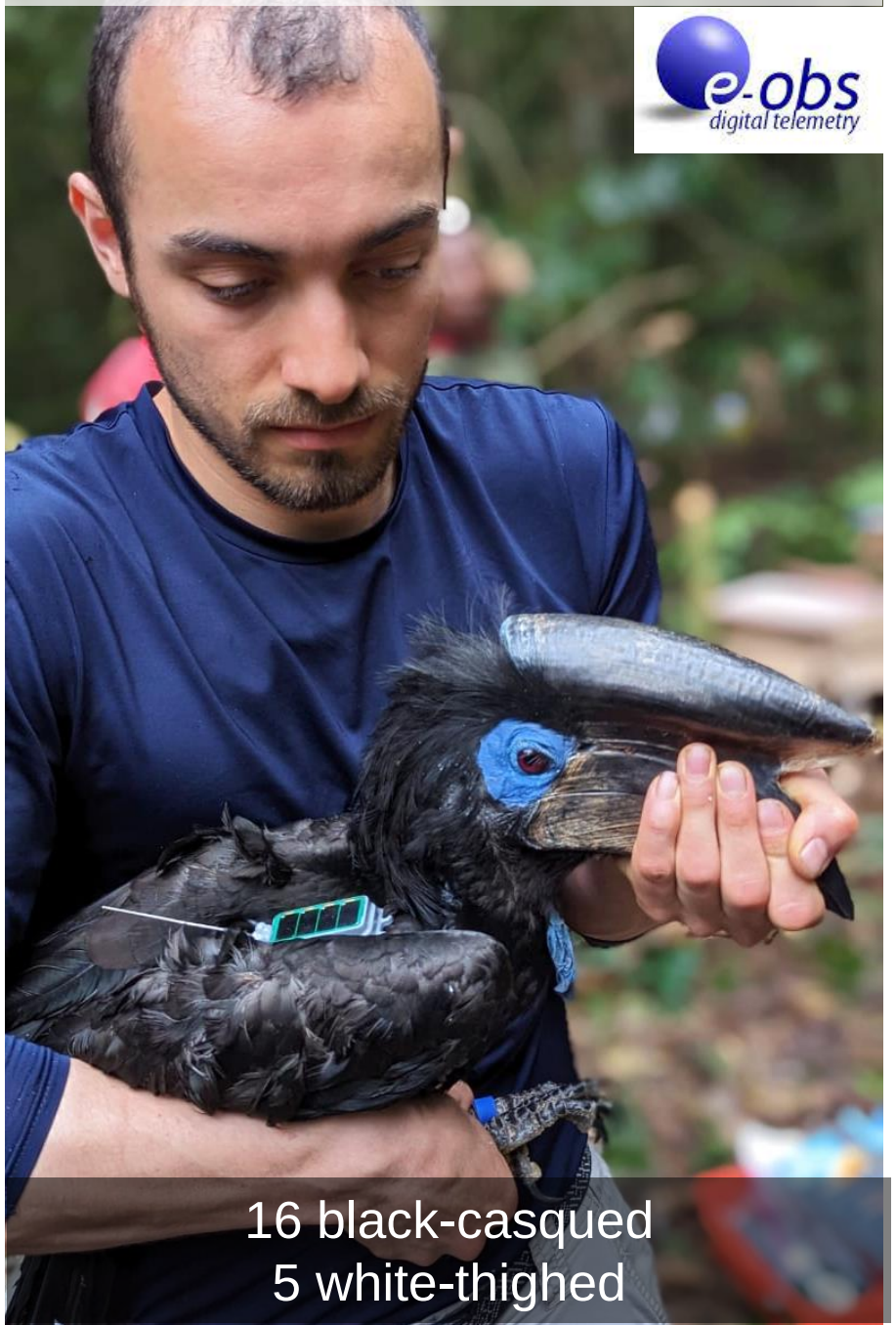
Live demonstration

- https://www.youtube.com/watch?v=Yl040eykTPo
- 5:40

1) Capture hornbills

Russo et al. 2024 *JFO*

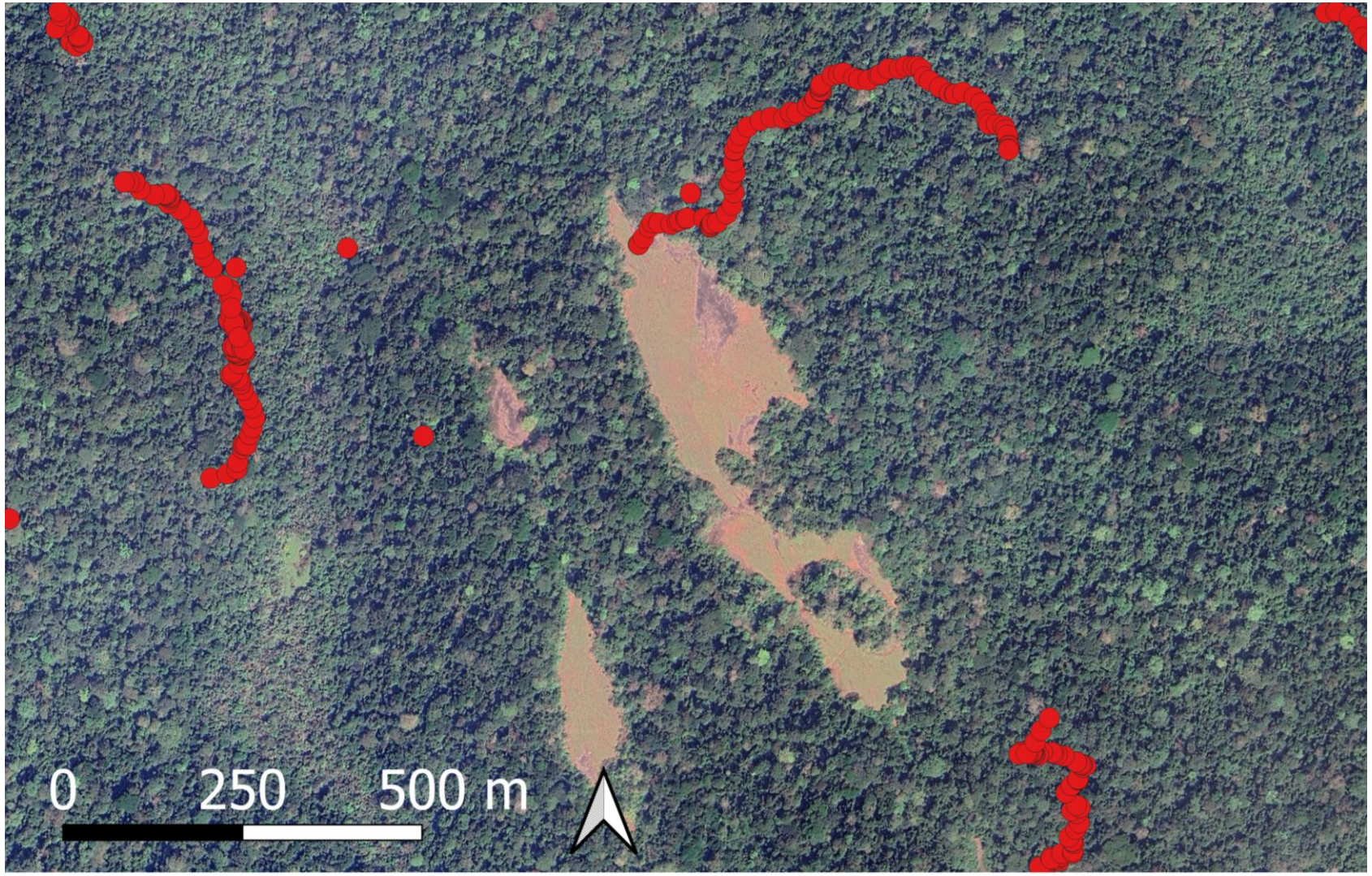
2) Attach GPS transmitter

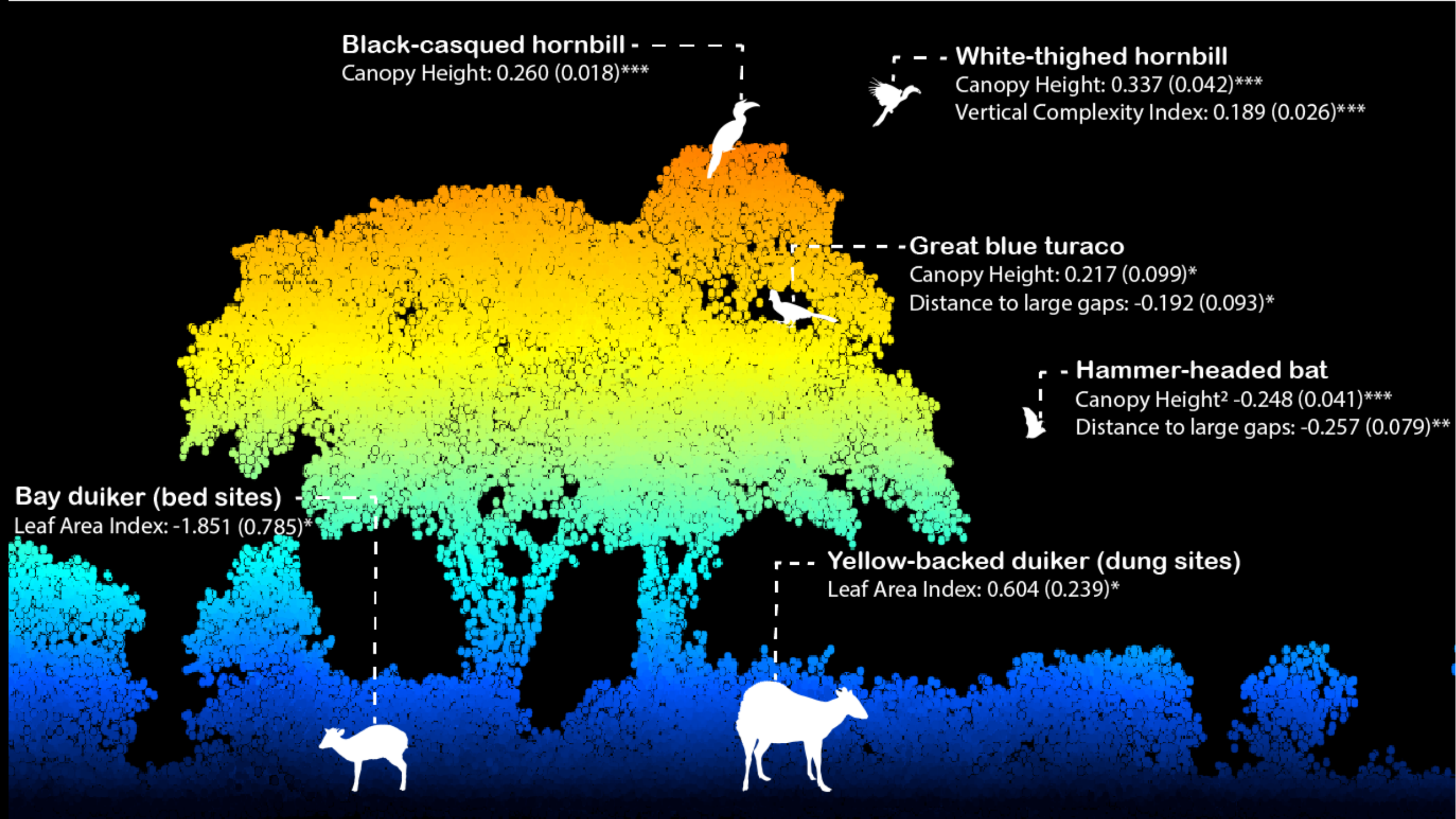


16 black-casqued
5 white-thighed

3) Download GPS data

Grey-cheeked mangabey




Black-casqued hornbill
Canopy Height: 0.260 (0.018)***
White-thighed hornbill
Canopy Height: 0.337 (0.042)***
Vertical Complexity Index: 0.189 (0.026)***
Great blue turaco
Canopy Height: 0.217 (0.099)*
Distance to large gaps: -0.192 (0.093)*
Hammer-headed bat
Canopy Height² -0.248 (0.041)***
Distance to large gaps: -0.257 (0.079)**
Bay duiker (bed sites)
Leaf Area Index: -1.851 (0.785)*
Yellow-backed duiker (dung sites)
Leaf Area Index: 0.604 (0.239)*