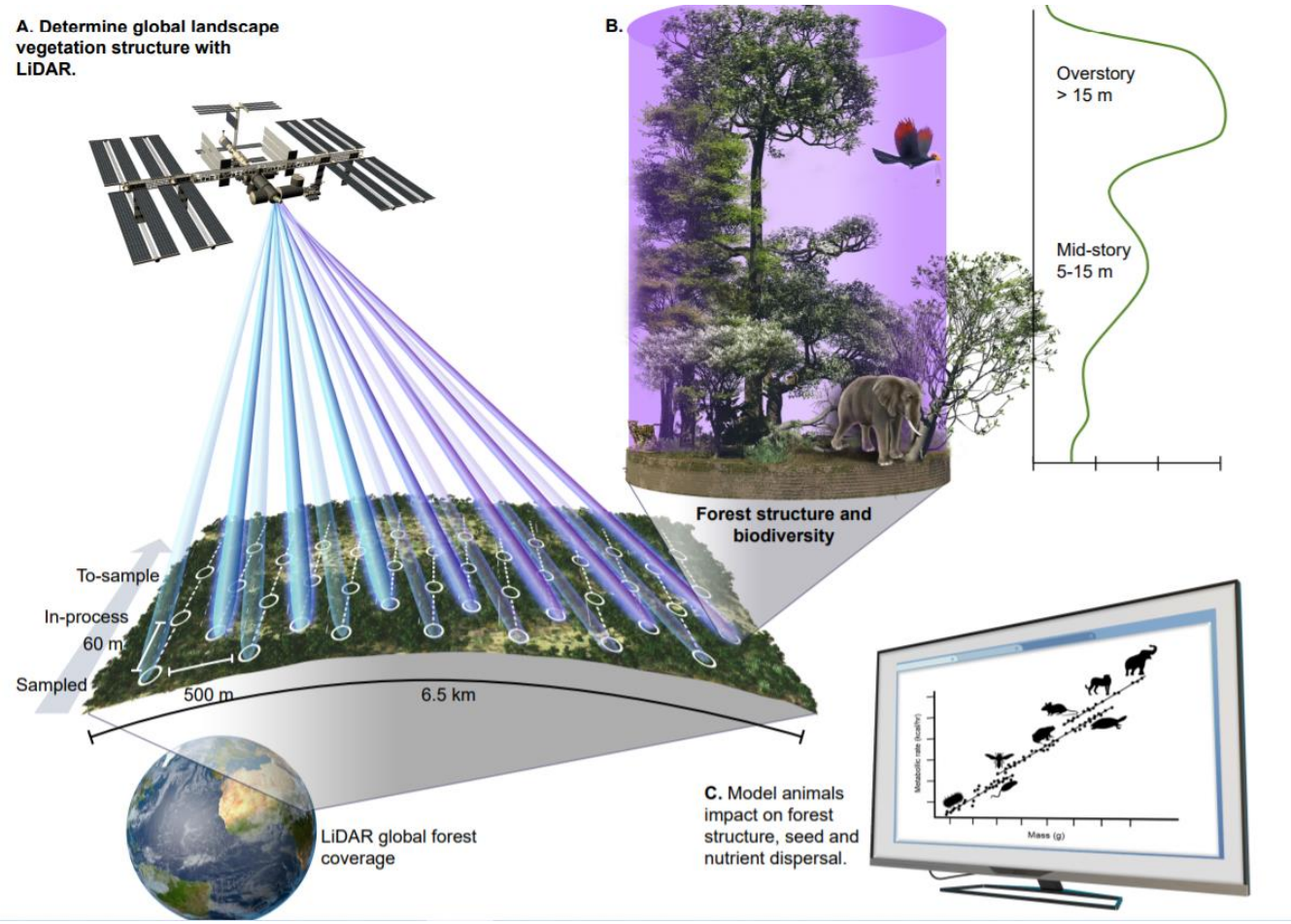
Putting animals into Earth System Science



Chris Doughty[1], Camille Gaillard[1], Jenna Keany[1], Andrew Abraham[1], Susana Baena[4], Scott Goetz[1], Patrick Jantz[1], Patrick Burns[1], Toby Jackson[2], Luca Santini[3], Mike Harfoot[4],

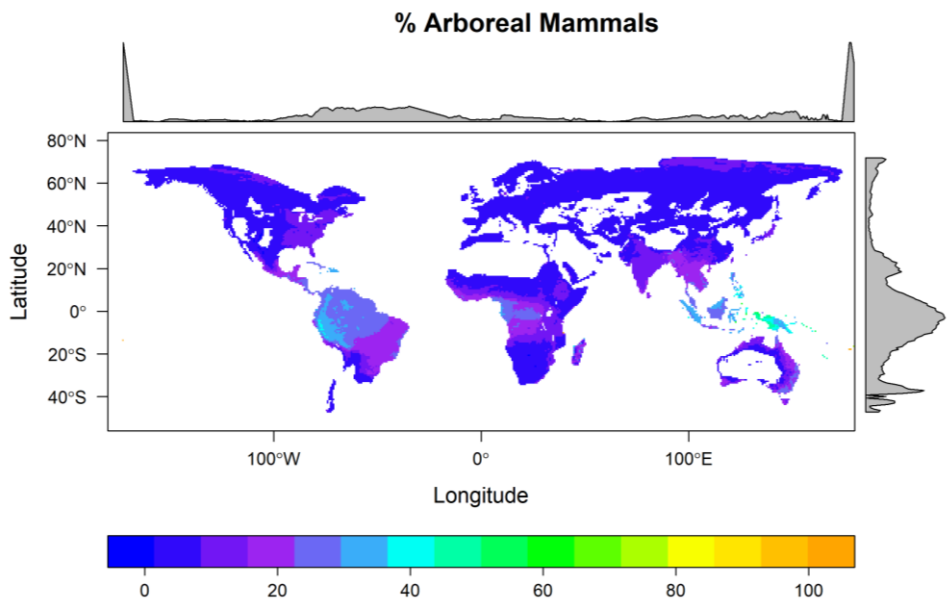
Northern Arizona University[1], Cambridge[2], Sapienza University [3], *UNEP-WCMC[4]*

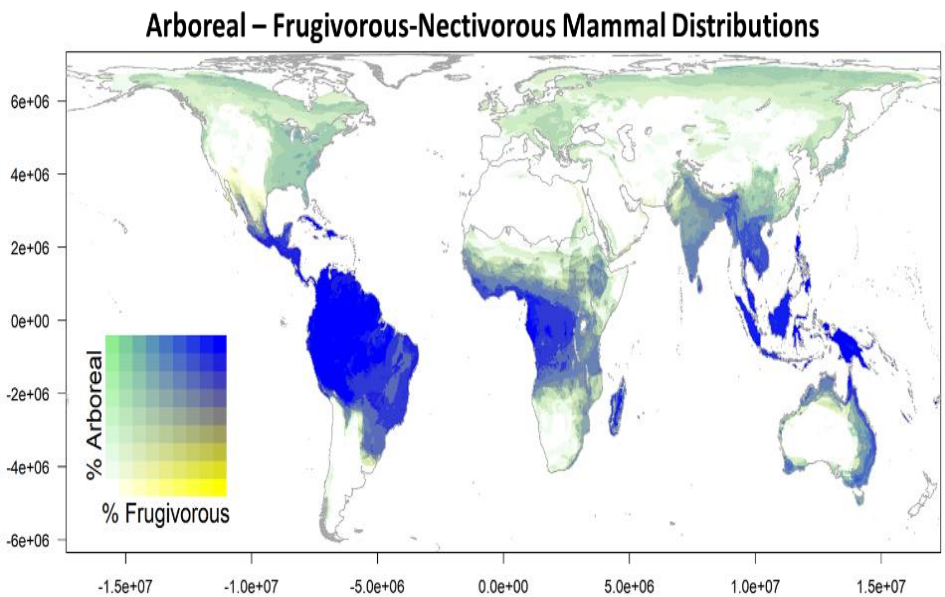
NAU Northern Arizona University

Ecological and Environmental Informatics

The Madingley Model

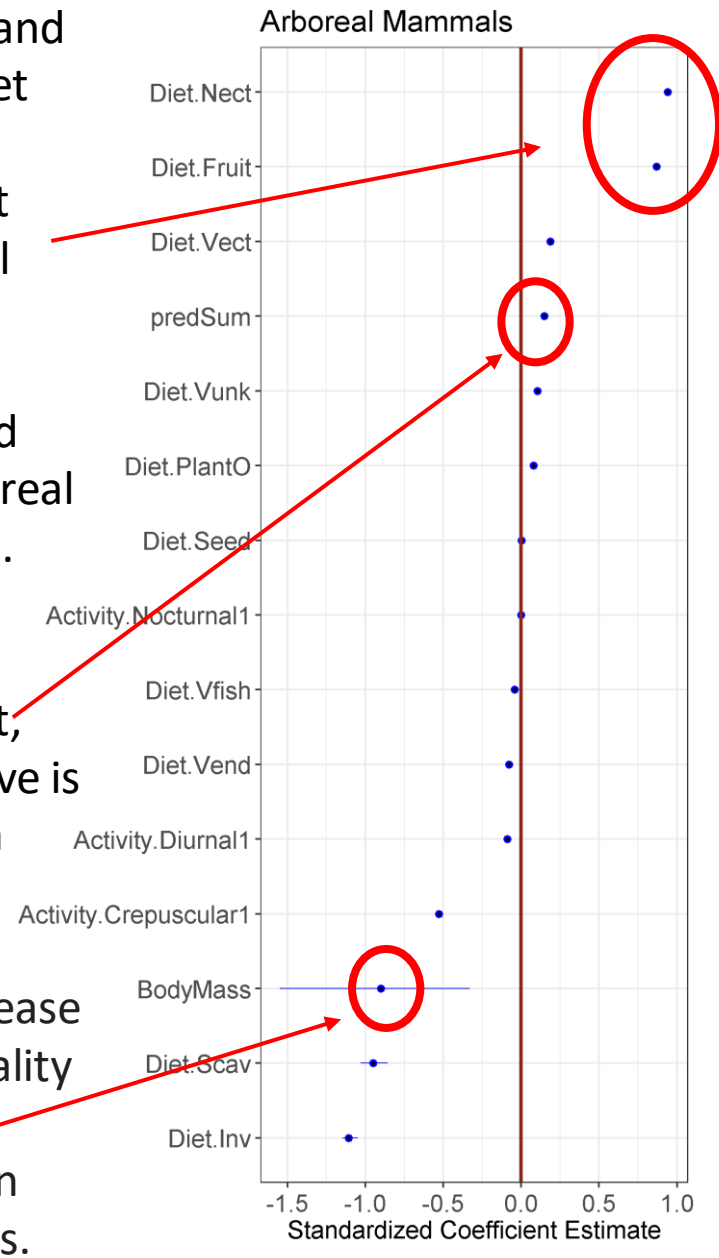
Traits driving arboreality?



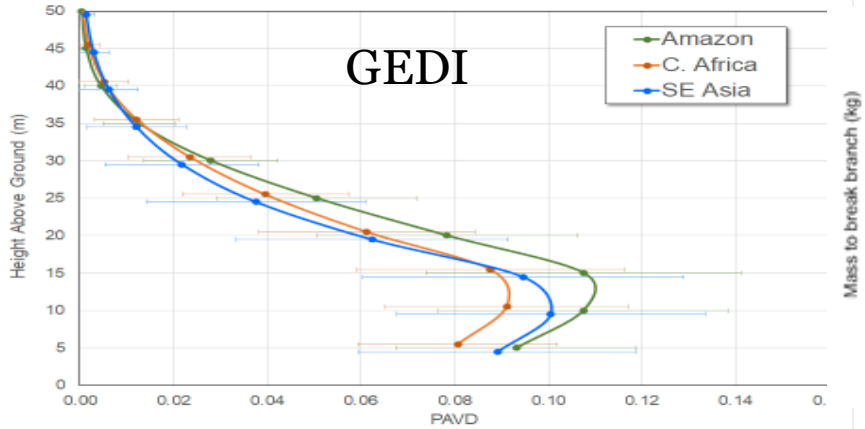


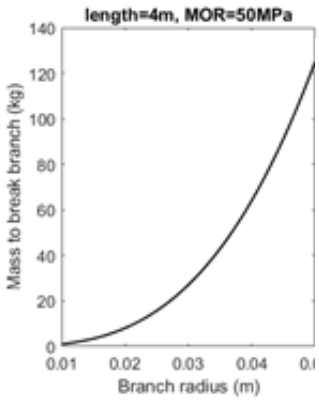
Jantz et al SI ERE

- % nectar and fruit in diet are most important functional traits positively associated with arboreal mammals.
- Less important, but positive is predation pressure.
- ~1% decrease in arboreality per kg increase in body mass.

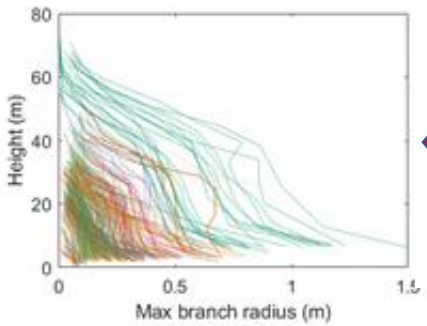


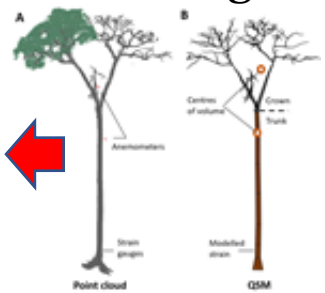
Arboreality + Vegetation Structure/GEDI in Madingley.

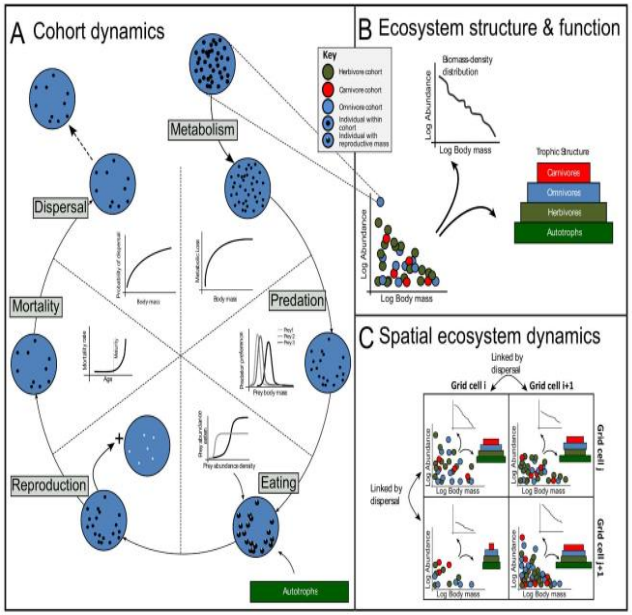




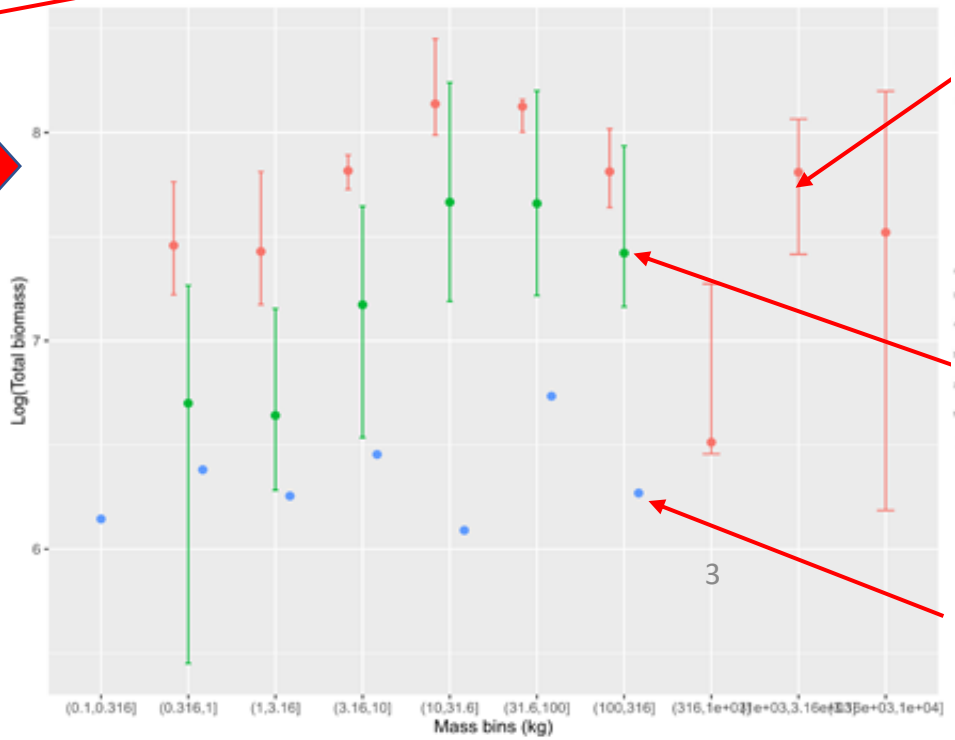
Terrestrial Lidar Scanning

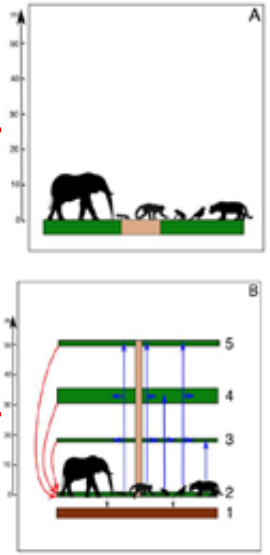






Total biomass



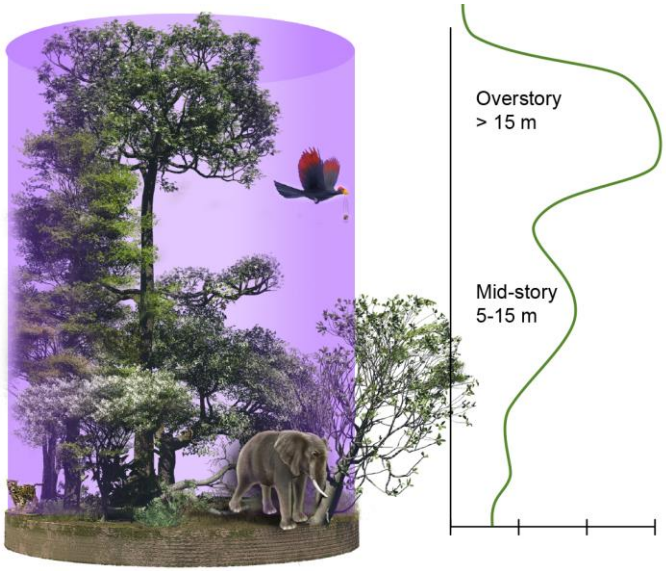


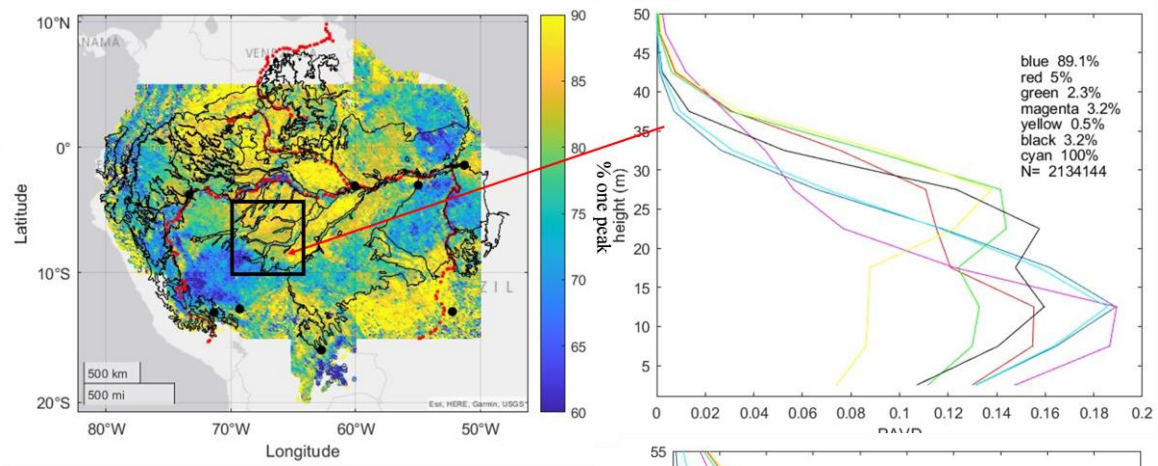
Tetradensity
Santini et al
2018

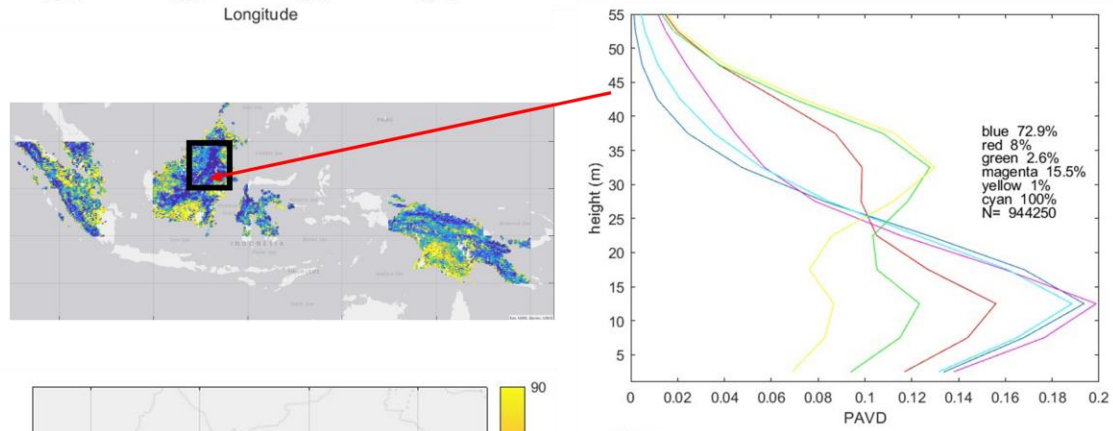
Gaillard et al SI ERE

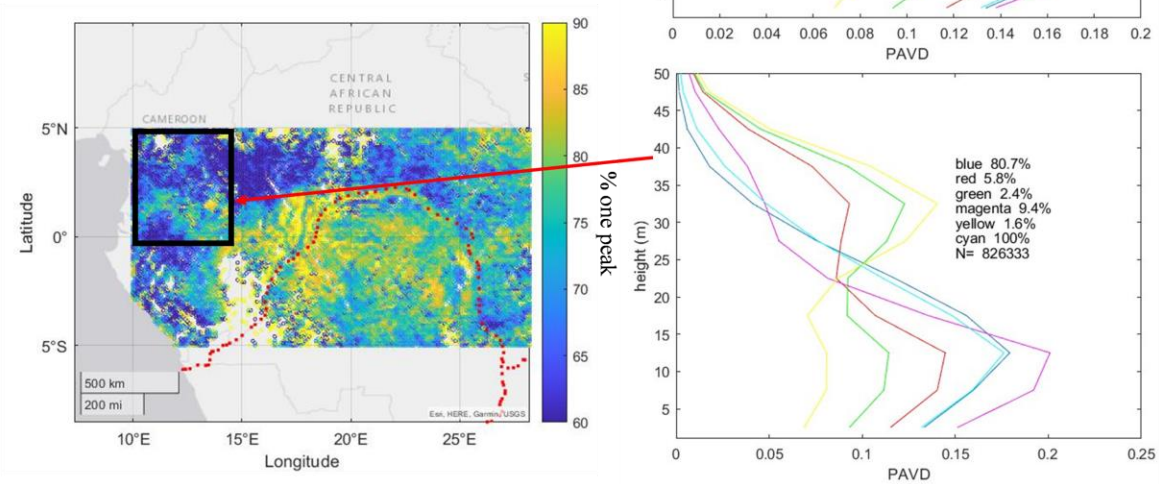
Mass bins

How does forest structure impact animal abundance?









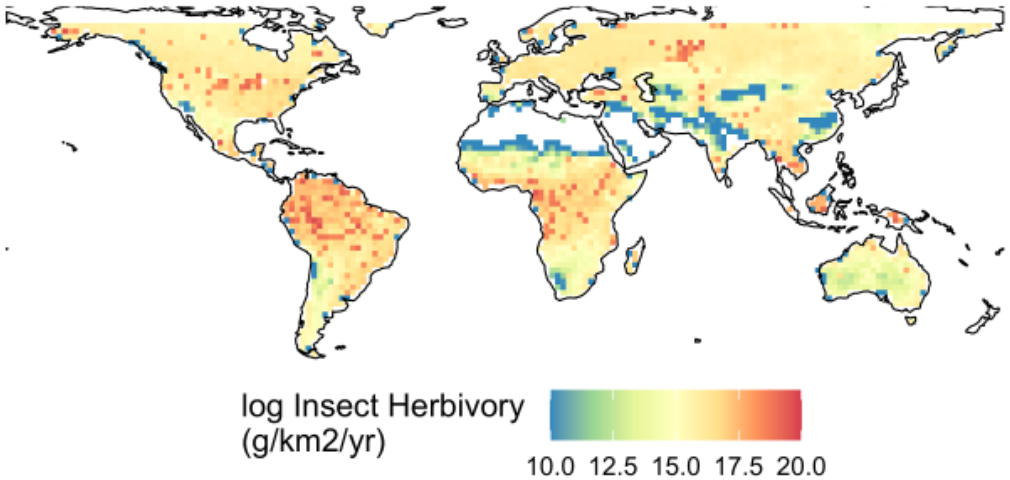
Run Madingley for different forest structure types.

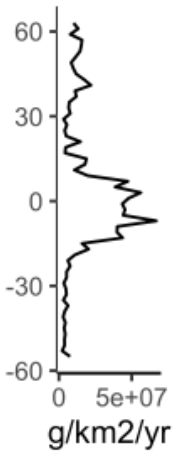
Run for different logging scenarios

Run for how forest elephants impact forest structure

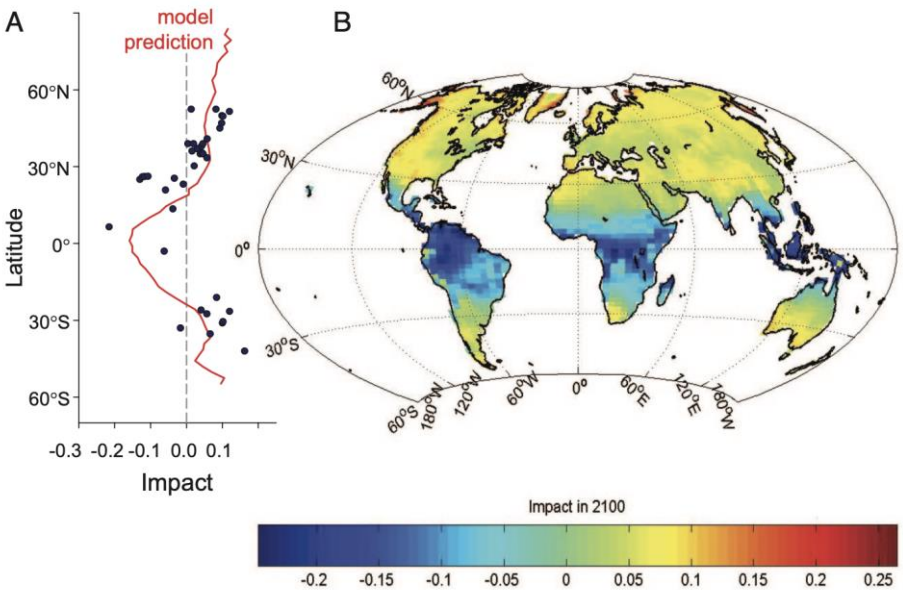
Doughty et al. a and b SI ERE

Trophic cascade of changes to insect abundance?



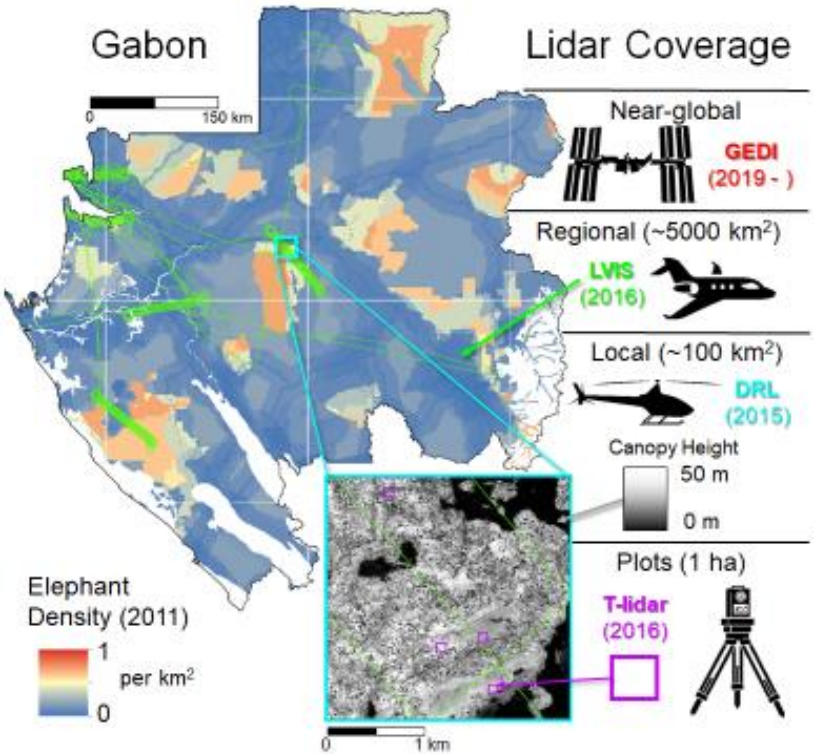


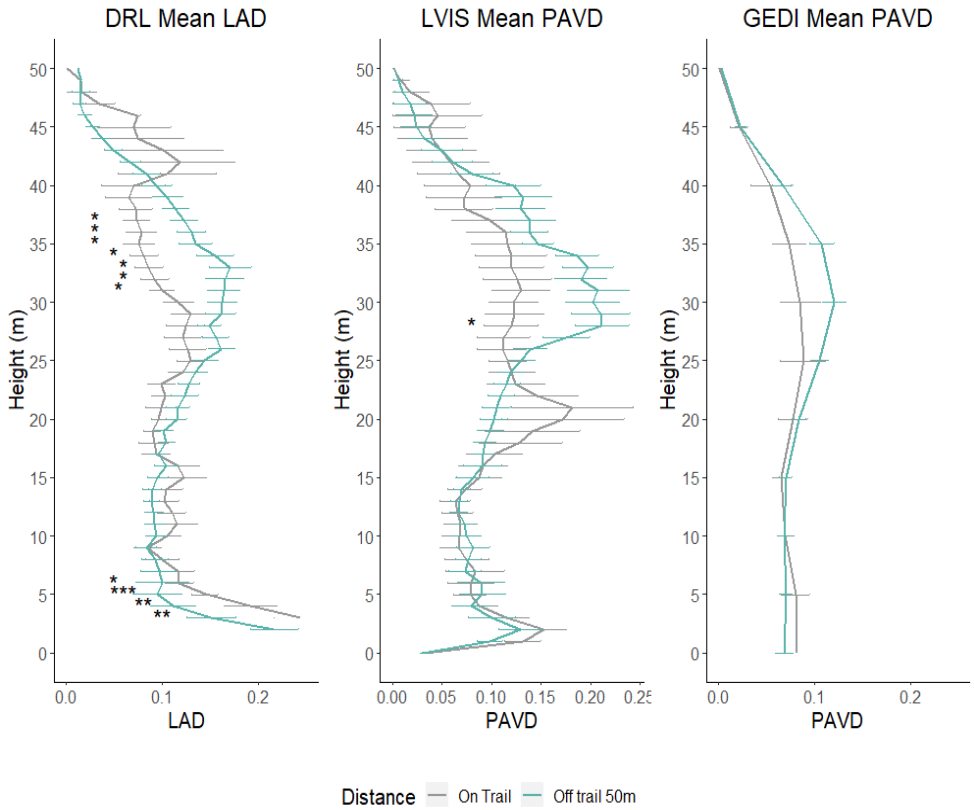
- Validate Madingley insect abundance predictions
- Modify insect abundance based on Deutsch et al. (2008)
- Assess ecosystem impacts on:
    - Total animal biomass
    - Functional diversity
    - Trophic skew



Abraham et al SI ERE

Ecosystem engineers impact Vegetation Structure





Lidar:

- Airborne DRL - 2015
- T-lidar – 2016
- Airborne LVIS – 2016
- GEDI - 2019 to present

Forest elephants impact vegetation structure.

How do these changes impact animal abundance?

Keany et al in prep and poster

Provide RCP scenarios and EBVs to key stakeholders in Gabon, Peru, and Brazil

- Scenario planning for climate change, selective logging, extinctions, trophic loss, land use change.
- EBV Madingley results available for scientists, the public or policy makers as a map and a time series PDF.
- Available in five languages

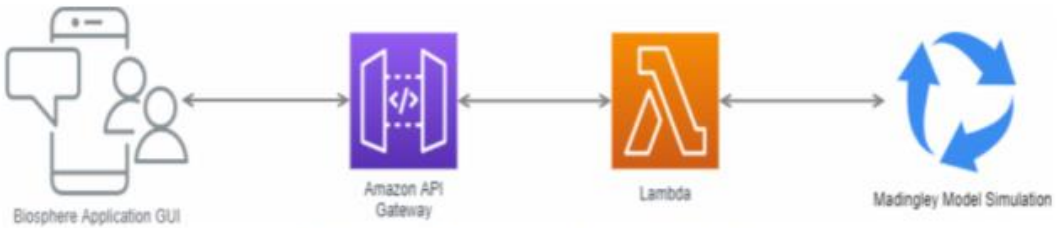
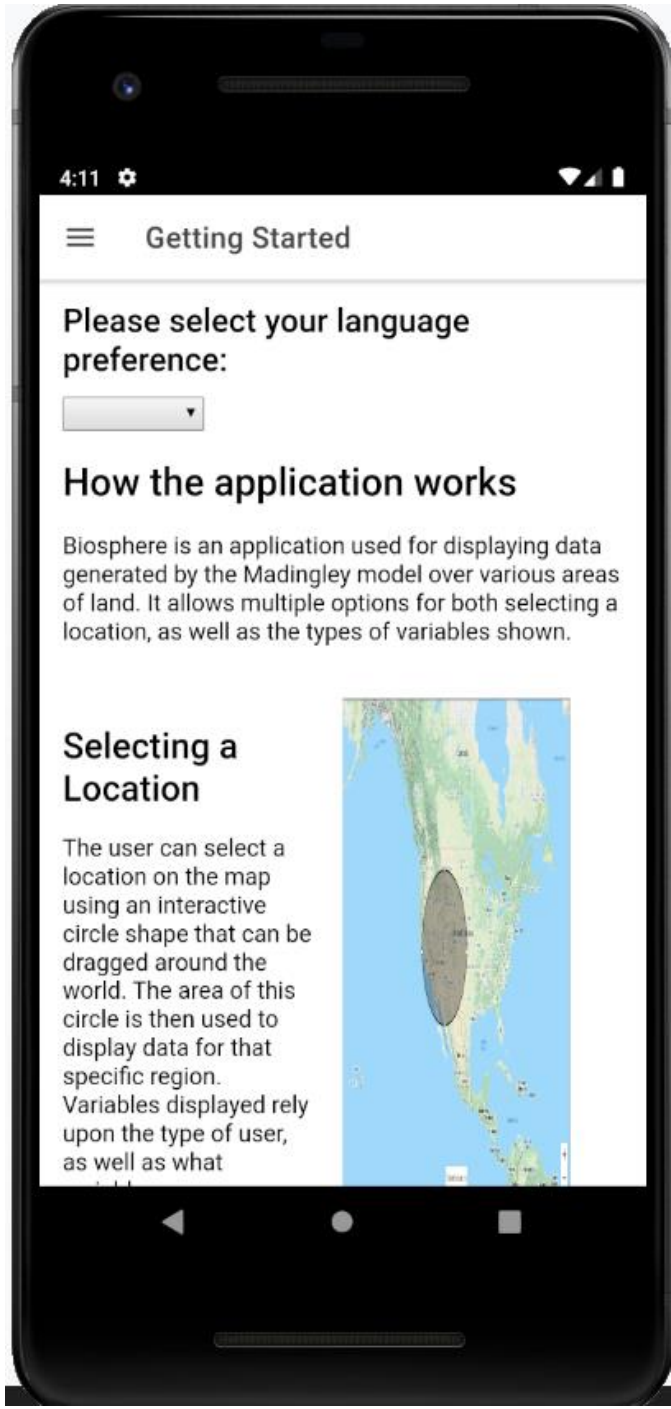


figure 4.1.3 - Application Data Flow Chart



Questions?

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camille.gaillard.t@gmail.com

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