

Tree species diversity and land-surface phenology in Zambia

John L. Godlee



THE UNIVERSITY *of* EDINBURGH
School of GeoSciences



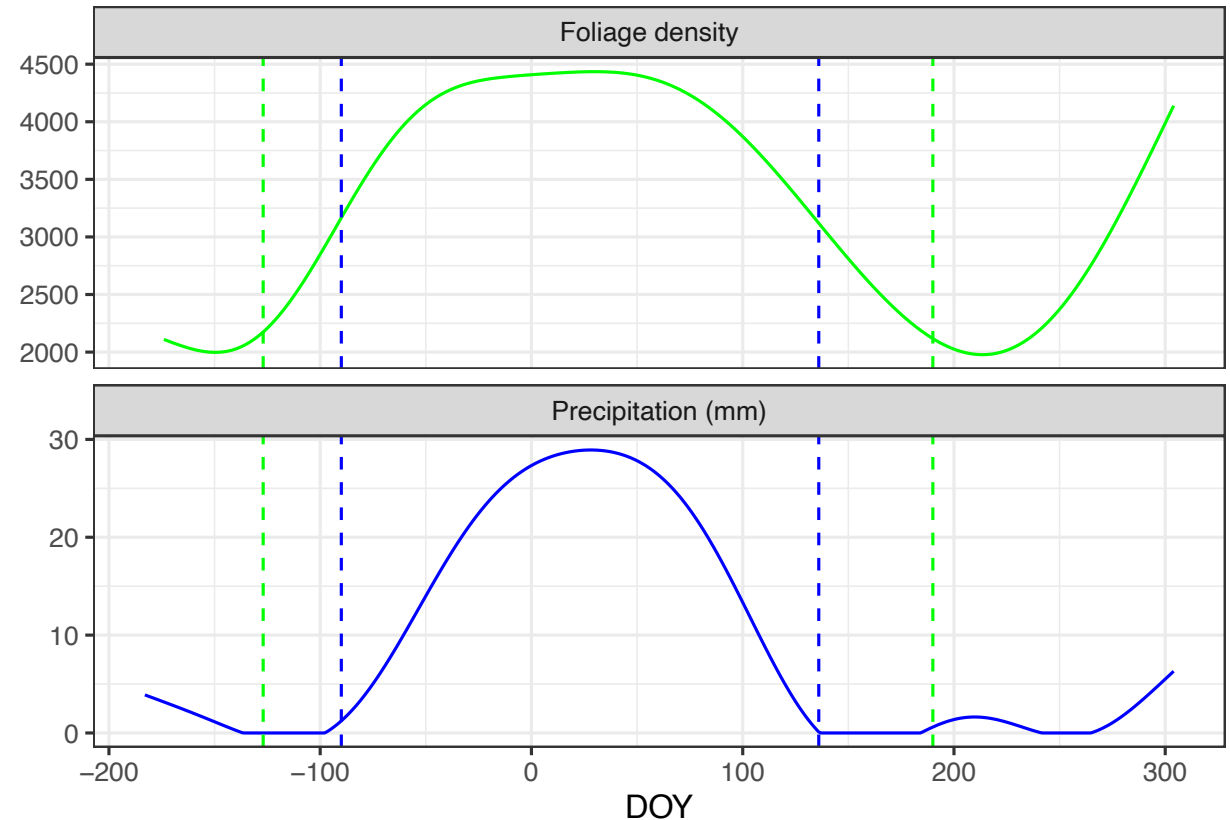
My background

- Used the SEOSAW database throughout my PhD
- Tree diversity and ecosystem function in southern African woodlands
- Worked with SEOSAW as a research assistant in 2020-2021
- Starting work on the SECO project in November, after I defend my PhD



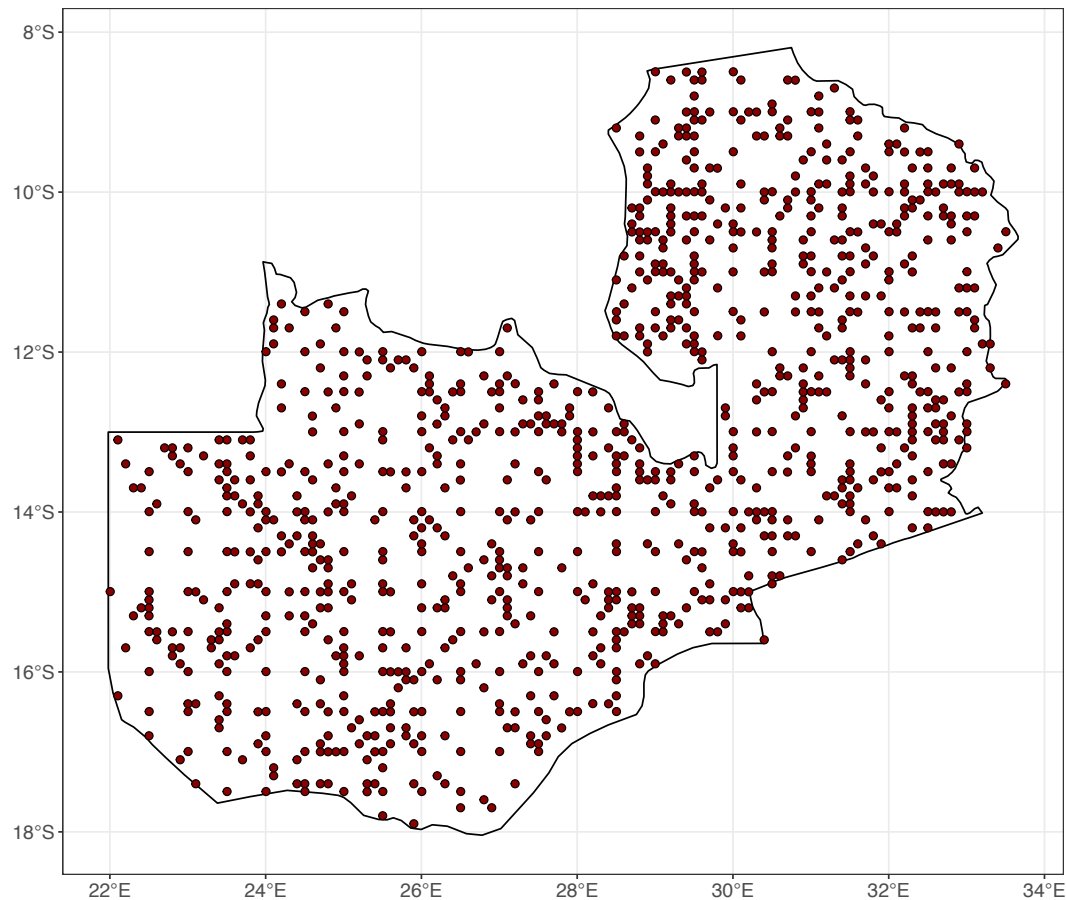
Land-surface phenology

- Seasonal timing of foliage production
- Correlated with gross primary productivity
- Used by earth system models to estimate productivity
- Pre-rain green-up common in the dry tropics
- **How does species diversity affect phenology in southern African woodlands?**

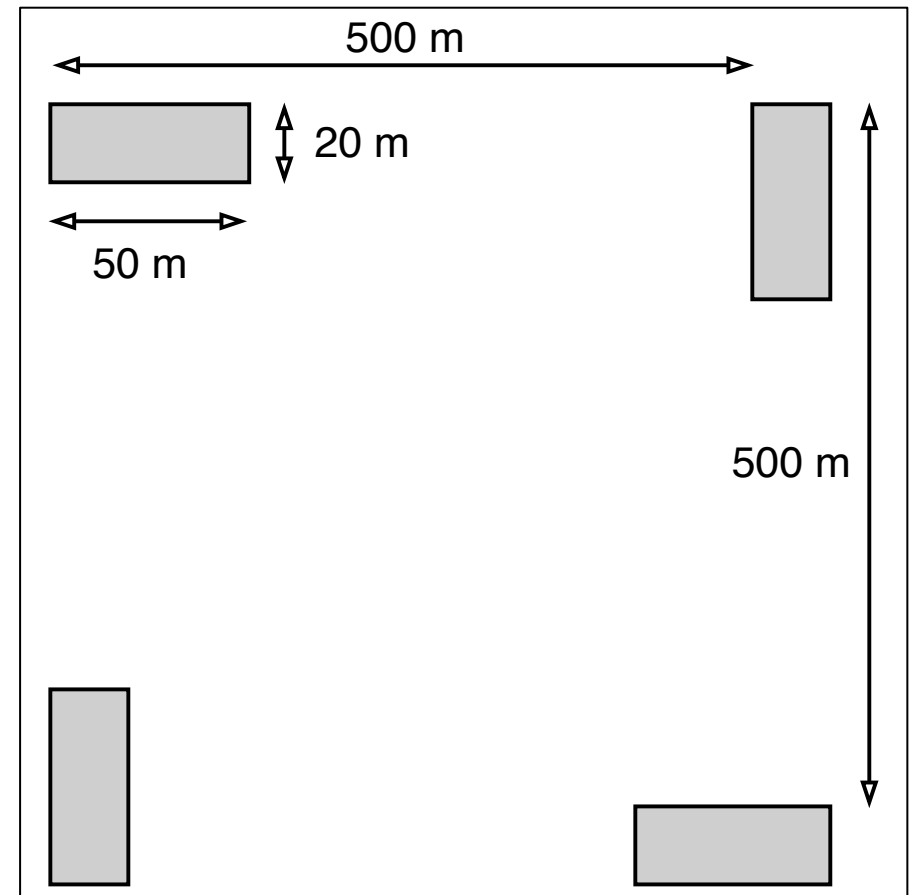


Zambian Integrated Land-Use Assessment

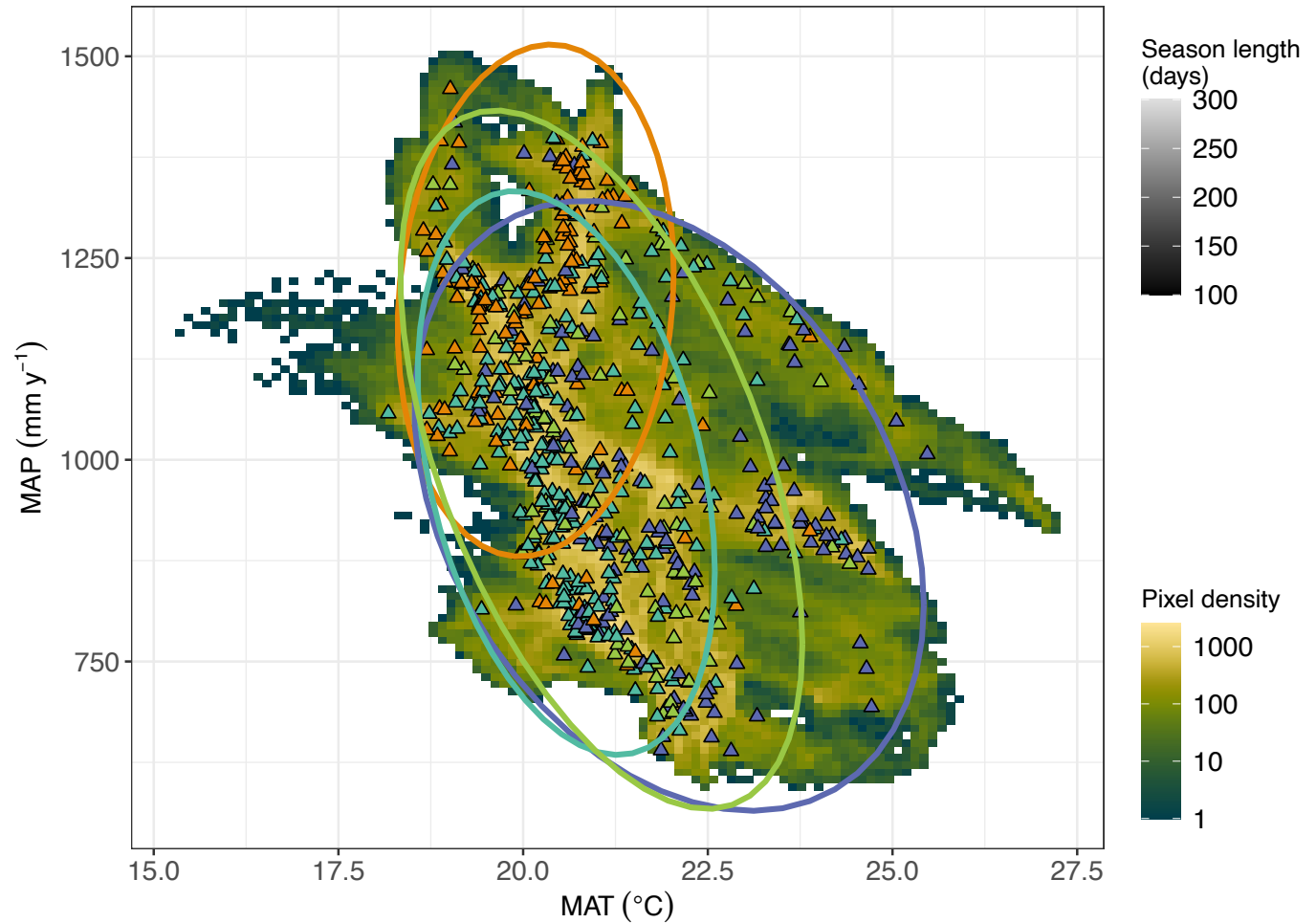
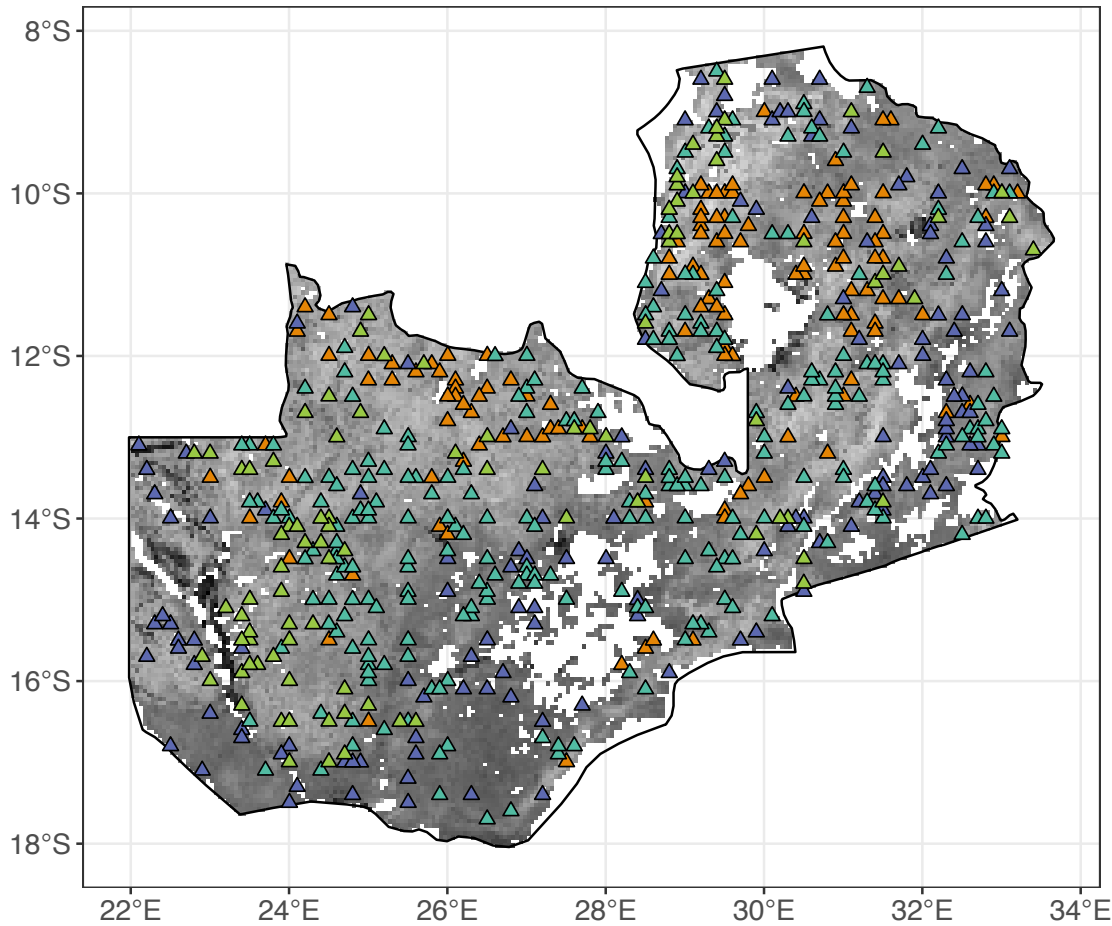
Map of sites within Zambia



Plot layout within site

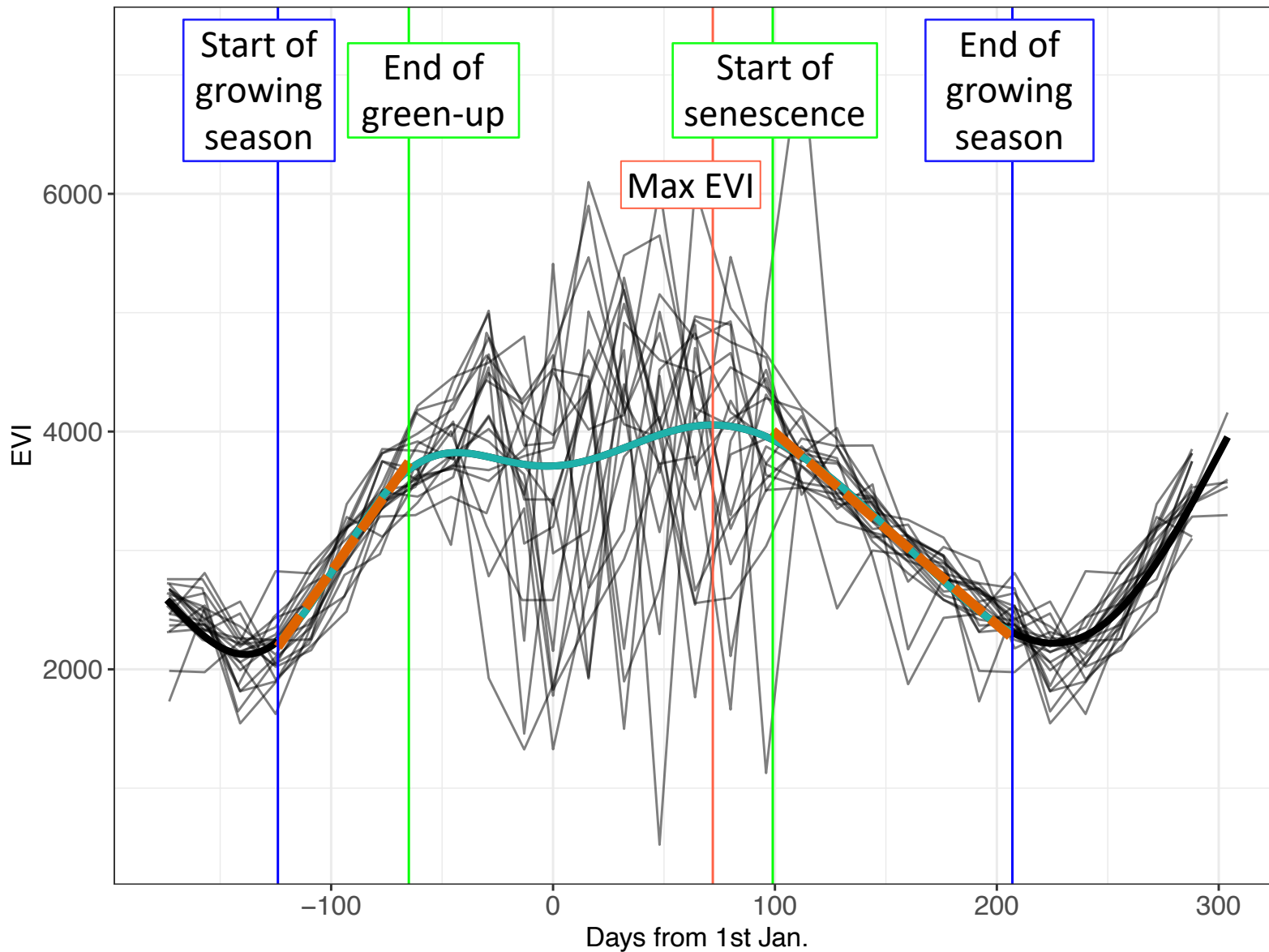


Zambian Integrated Land-Use Assessment



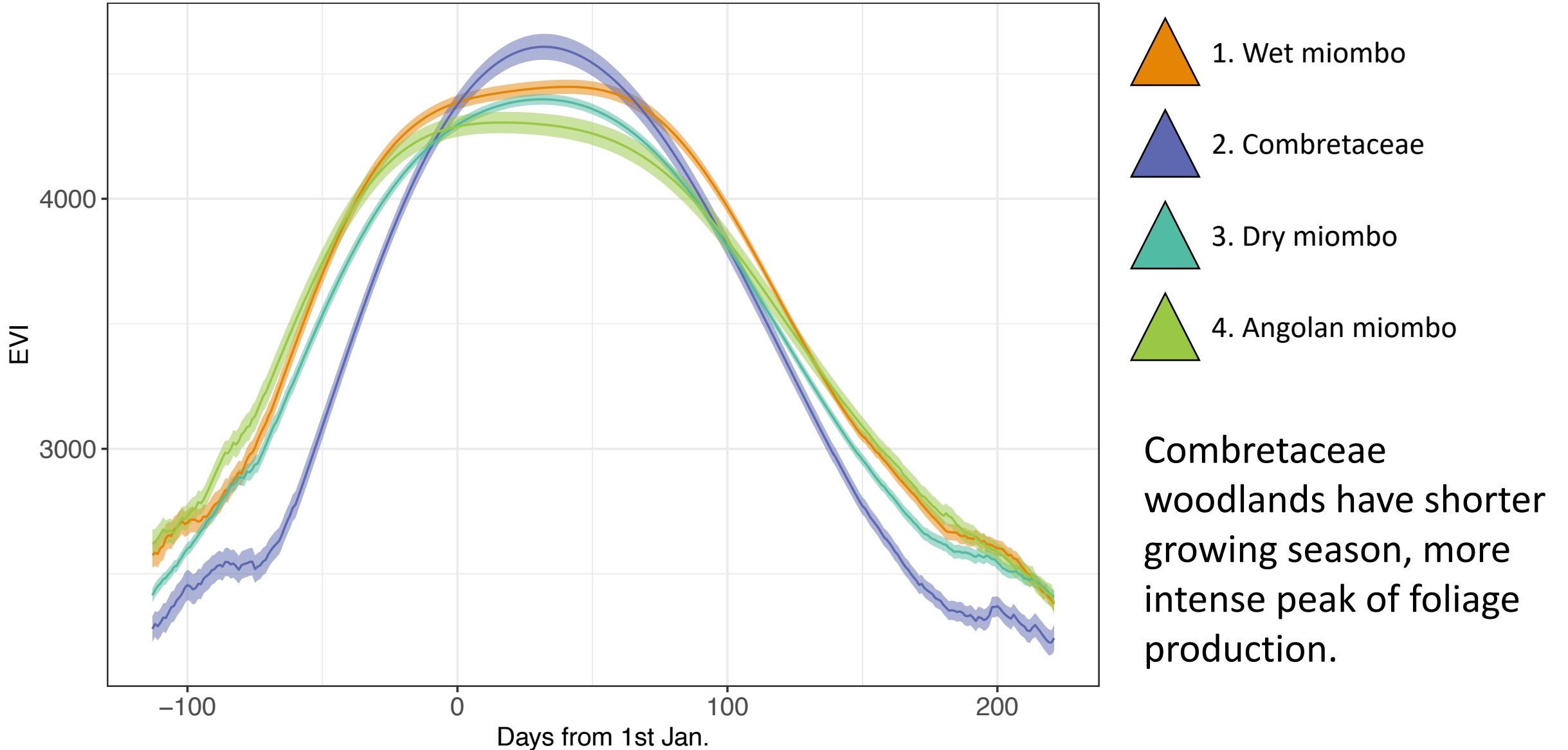
1. Wet miombo 2. Combretaceae 3. Dry miombo 4. Angolan miombo

Deriving metrics from MODIS

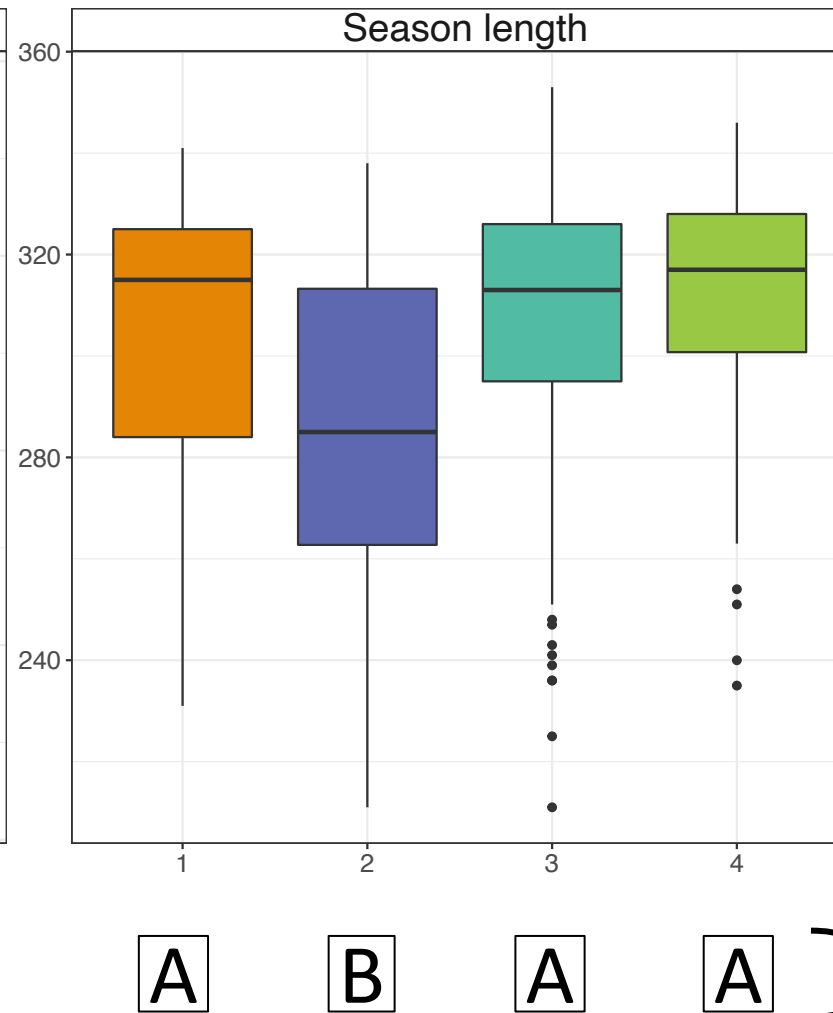
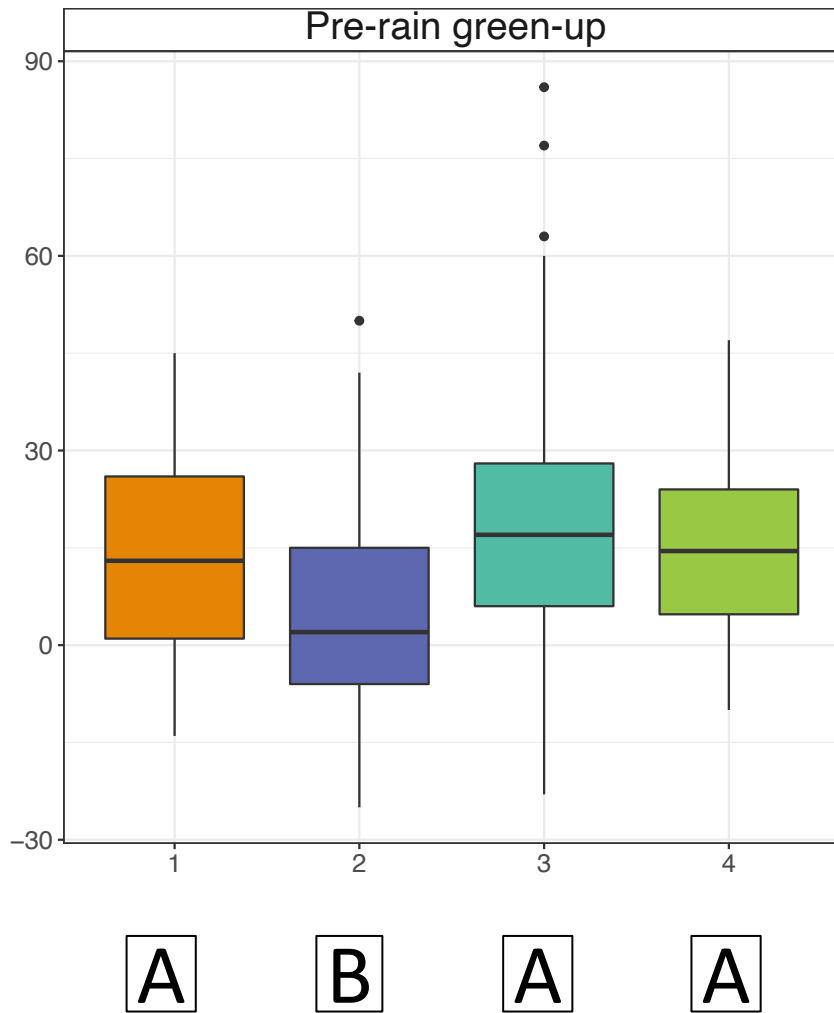


- MODIS EVI
 - 2010-2020
 - 250 m spatial resolution
 - 16 day interval
- Smoothing with General Additive Model (GAM)
- Start of growing season: first day EVI slope exceeds half of max slope for >20 days. Vice versa for end of growing season
- Lag between start of growing season and start of rainy season

Effects of tree species composition



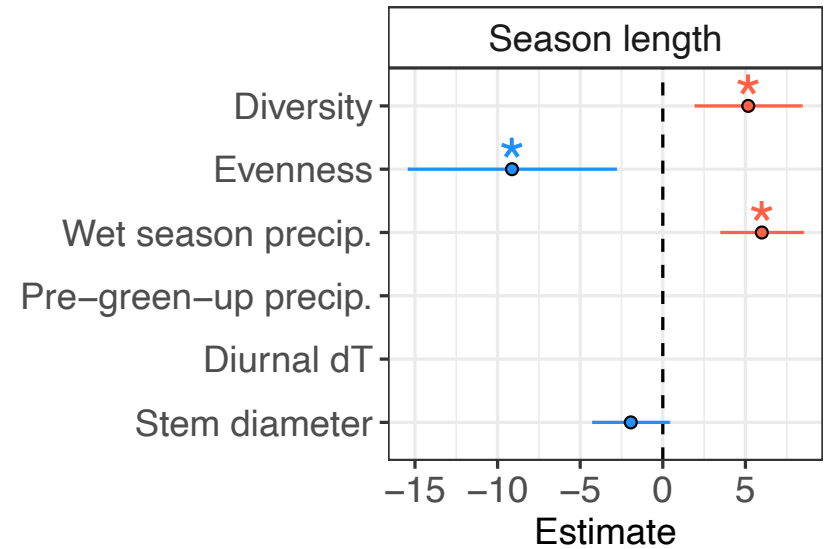
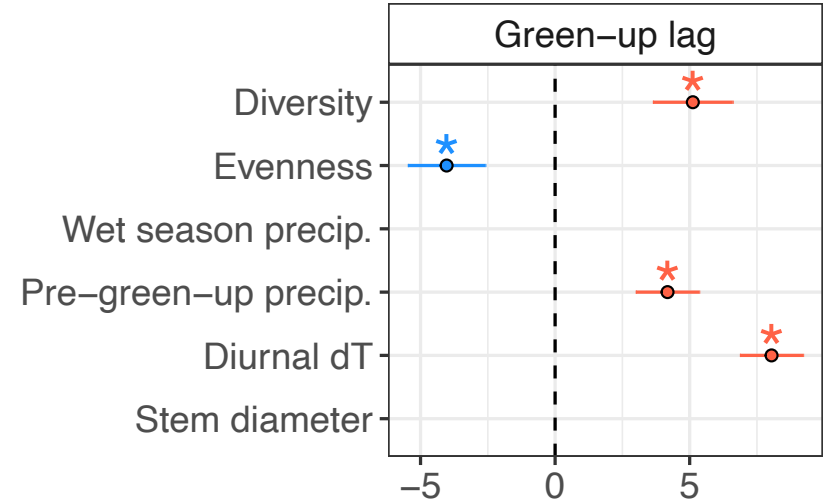
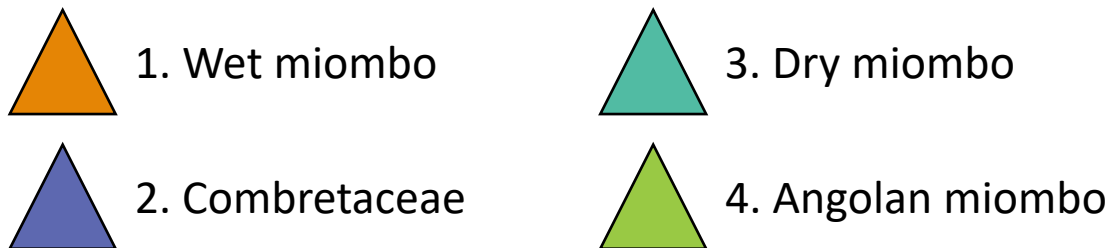
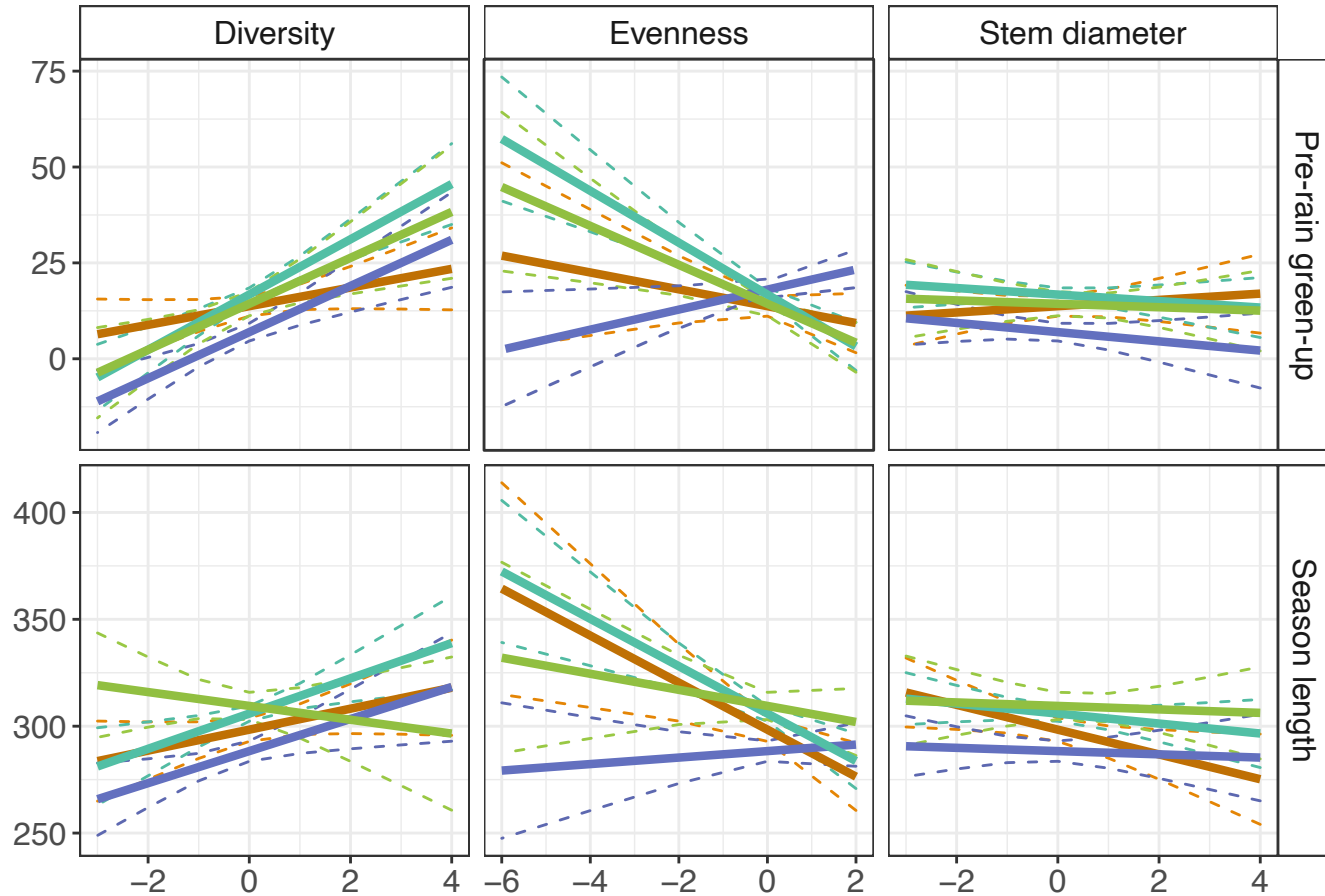
Effects of tree species composition



- 1. Wet miombo
- 2. Combretaceae
- 3. Dry miombo
- 4. Angolan miombo

} Tukey groups

Effects of tree species diversity



Implications

- A positive effect of biodiversity on ecosystem function, measured by "green-ness".
- Negative evenness effects imply a dominant role of keystone species in miombo woodlands, i.e. Detarioideae.
- Diverse woodlands provide greater habitat value, more resilient to seasonal variation in precipitation.
- Plots with larger trees extend the growing season.