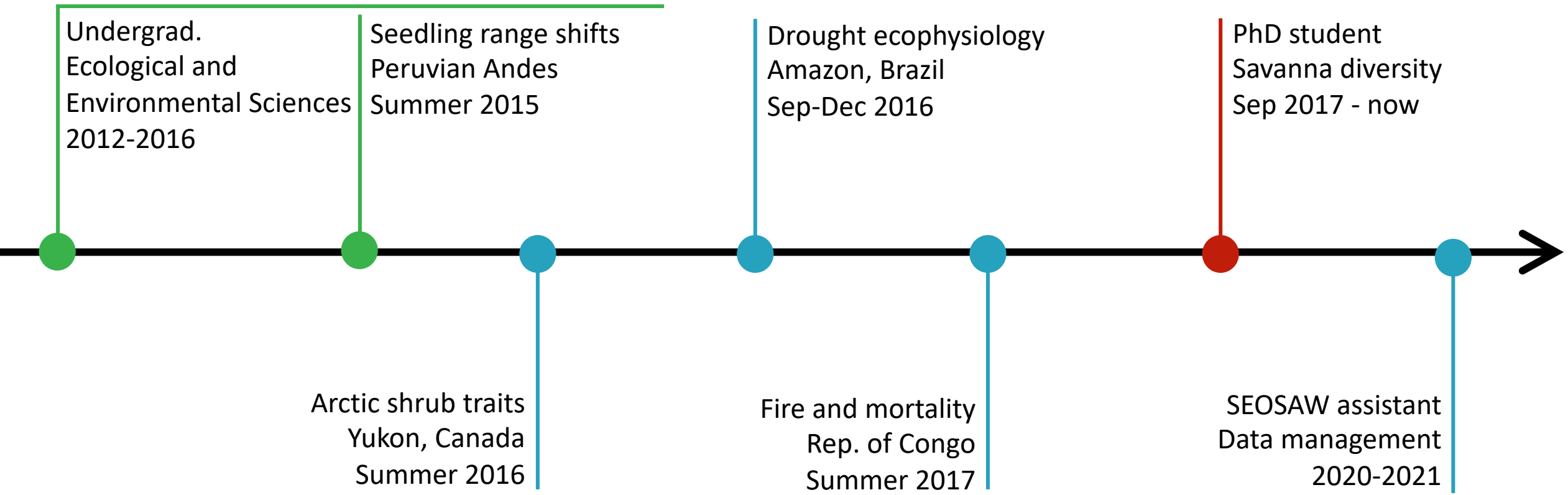
Previous work, Research interests, SECO prospects

John L. Godlee

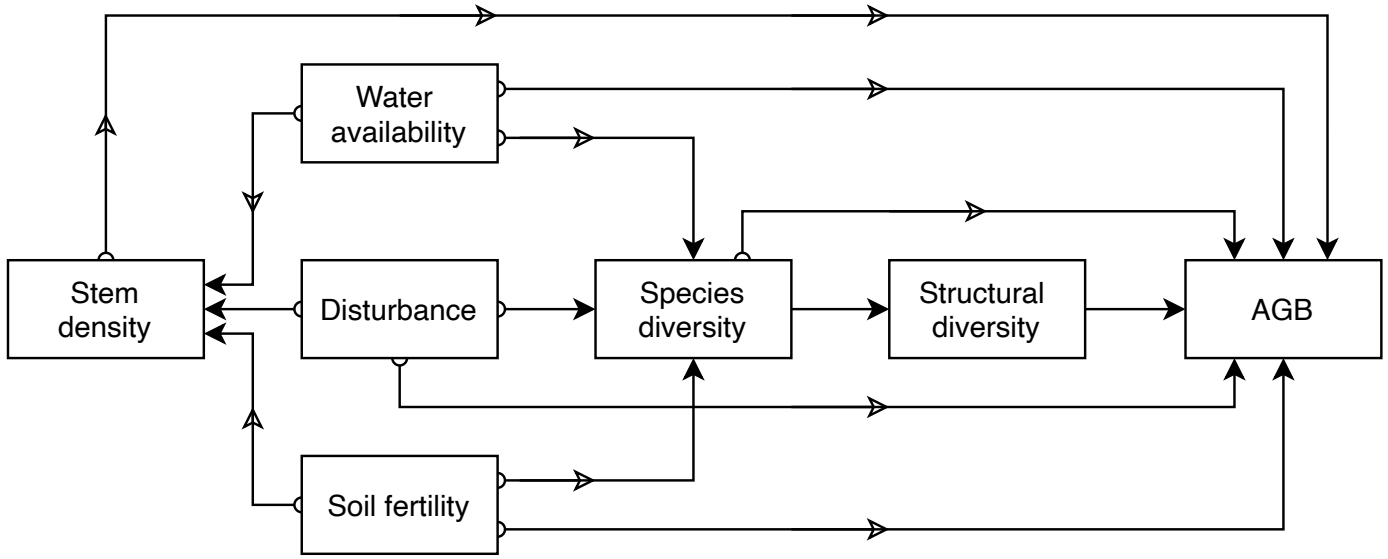
THE UNIVERSITY of EDINBURGH
School of GeoSciences

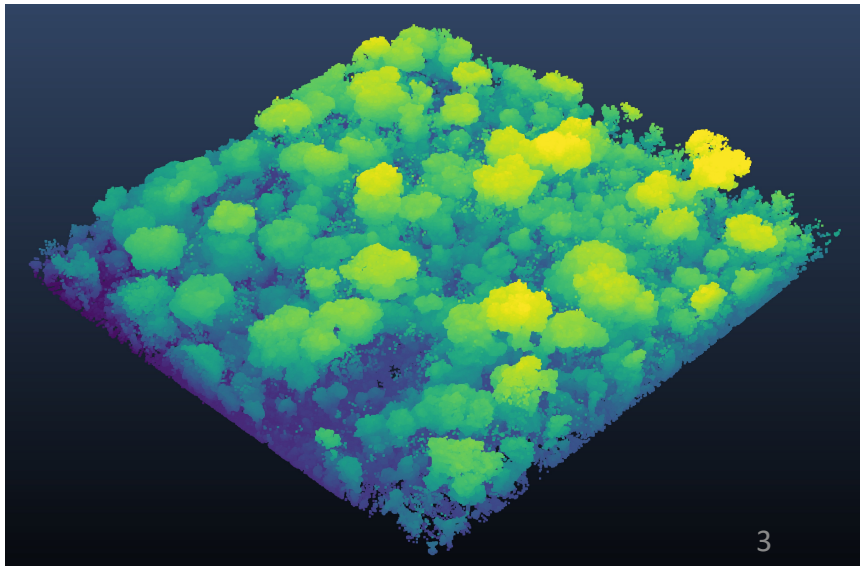
Academic background



PhD thesis: Savanna biodiversity and biomass

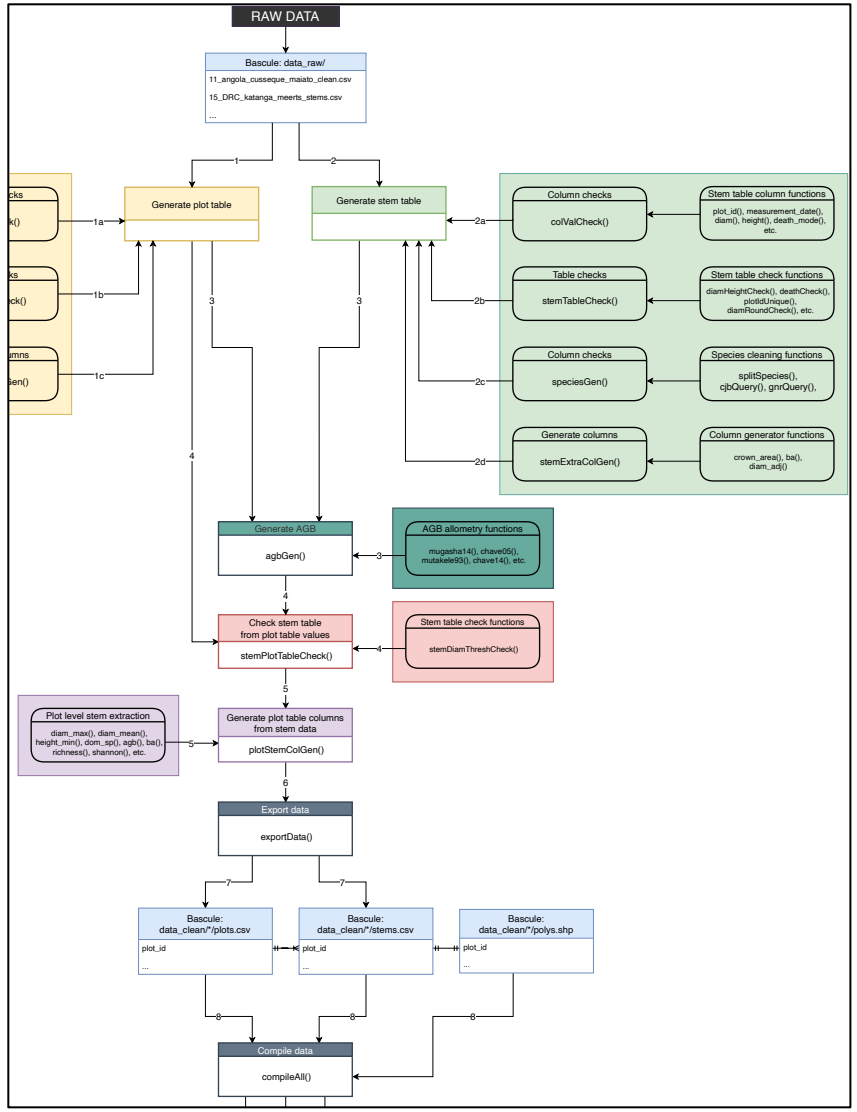
1. Diversity - biomass modelling (Godlee et al. in rev: New Phyt.)
    - Stem density mediates biodiversity effect
2. Species composition and phenology
    - Vegetation specific responses on senescence
3. Terrestrial LiDAR and canopy structure
    - Species mingling determines canopy complexity
4. Diversity of Bicuar National Park (Godlee et al. 2020)
    - Dry miombo-Baikiaea mosaic



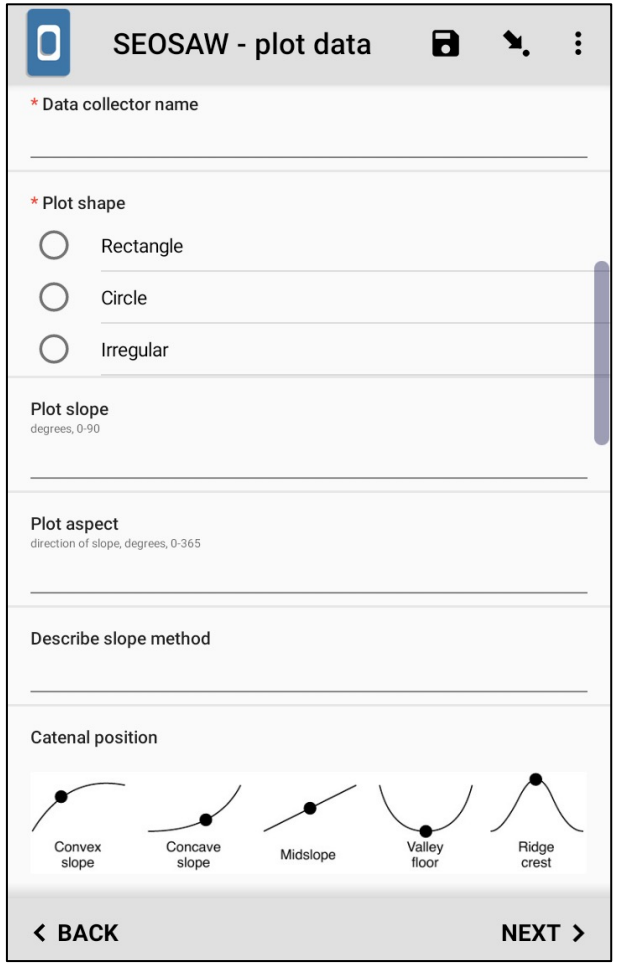


SEOSAW: nuances of phyto-demography data

Data processing workflow



Digital data collection



Accessible documentation

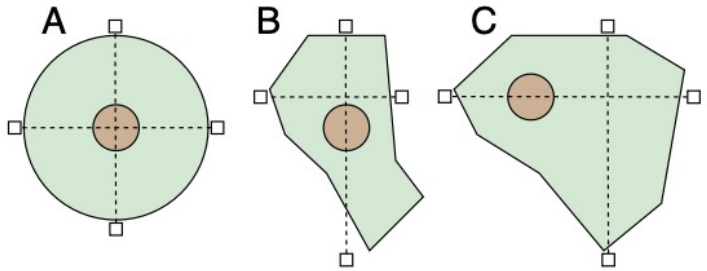


Figure 3: Schematic diagram showing a top-down view of tree canopies, with the trunk marked in brown, demonstrating measurement of perpendicular tree canopy diameters (dashed lines). Note that for trees B and C, the maximum diameter extents do not overlap the tree trunk.

Canopy volume of angiosperm trees is mostly modelled as an ellipsoid using perpendicular canopy dimensions (a and b), and the canopy depth (c):

$$V = \frac{4}{3}\pi abc \quad (8)$$

SEOSAW recommended sampling strategy

Measure trunk diameter on every stem >5 cm DBH and tree height on every tree with at least one stem >5 cm DBH.

Measure perpendicular canopy diameters and canopy depth on all living trees with at least one stem >20 cm DBH.

5 Woodland canopy traits

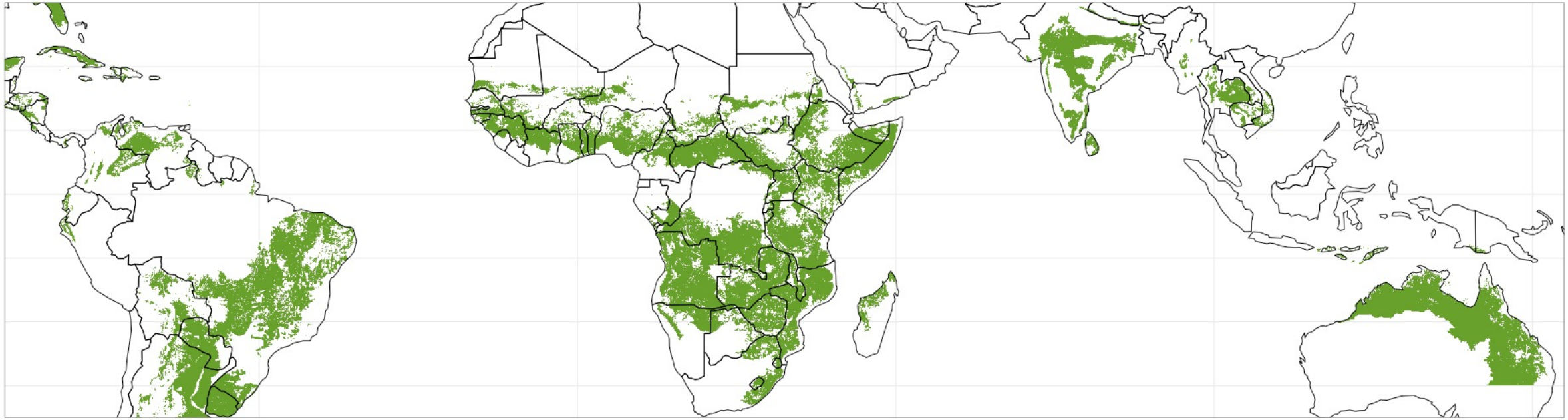
Woodland canopy traits can be used to understand the understorey light environment, tree-tree competition, estimate productivity, and are useful to ground-truth remotely sensed data such as airborne LiDAR or tree-cover data products. Woodland canopy traits are collected at the scale of the woodland landscape, rather than the individual tree level.

Table 1: Common woodland canopy trait metrics.

Metric	Unit	Description
Gap fraction	%	Proportional coverage of plant canopy material as viewed from a single point with some given angular field of view. Canopy closure = 1 - gap fraction.
Canopy cover	%	Proportional coverage of plant canopy material per unit ground area covered.
Leaf Area Index	$m^2\ m^{-2}$	Single-sided area of leaf (LAI) per unit ground area .

SECO: Vegetation lineages, adaptive potential

≈ SECO working region : Avitabile et al (2016) + Dinerstein et al. (2017)



Drivers of change:

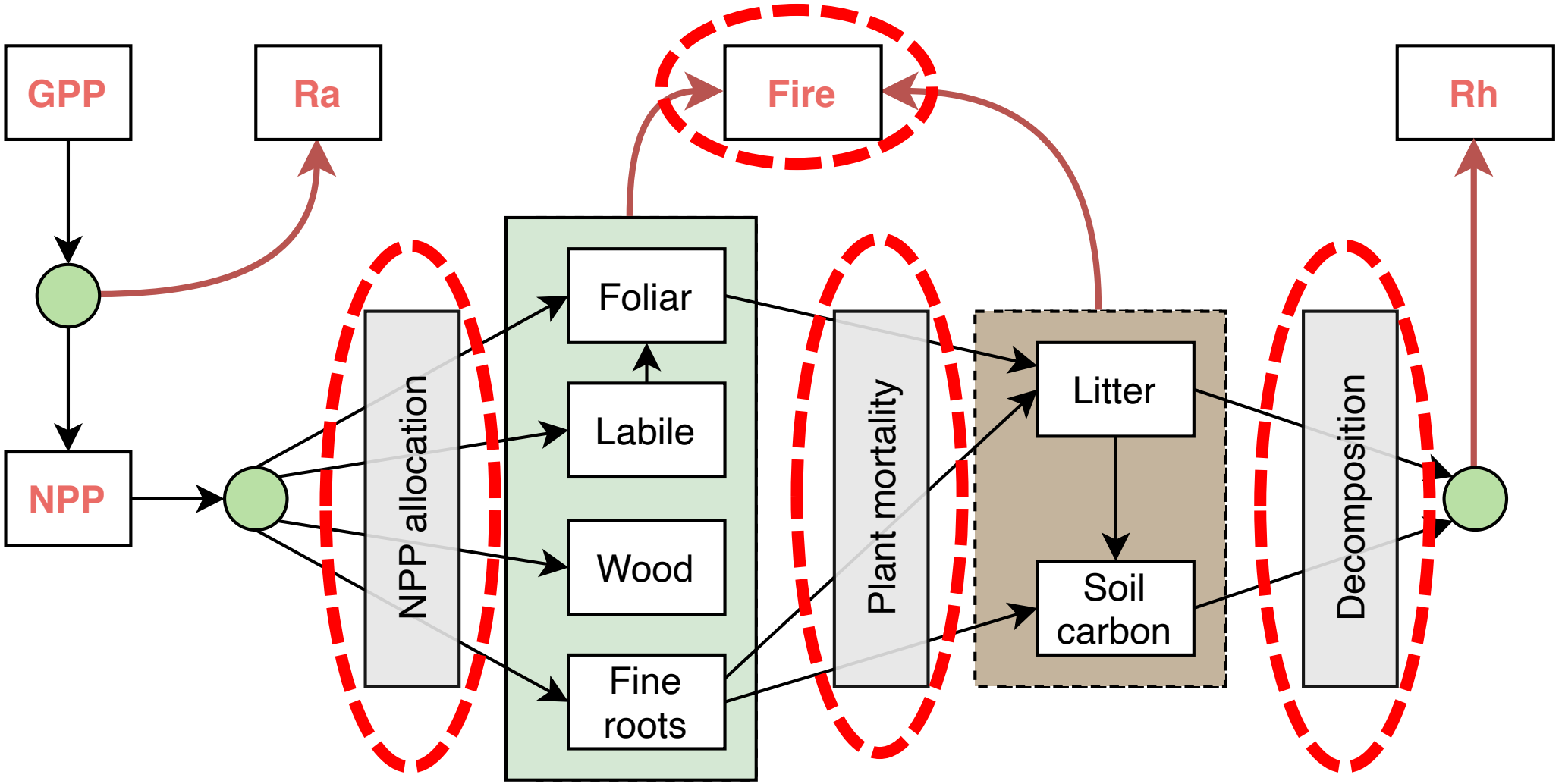
- CO_2 enrichment
- Rainfall - total, seasonality
- Temperature increase
- Reduced fire?

Biogeographic variation among continents:

- No true SDTF in Africa?
- Tall evergreen trees in Australia
- Fewer nitrogen fixers in SE Asia
- Species rich neotropics
- Variation in C_3/C_4 grass dominance and C4 origin
- Herbivory pressure low outside Africa

Dexter et al. (2015)
Esquivel-Muelbert et al. (2018)
Lehmann et al. (2014)
Wigley et al. (2016)

SECO: constraining the carbon cycle

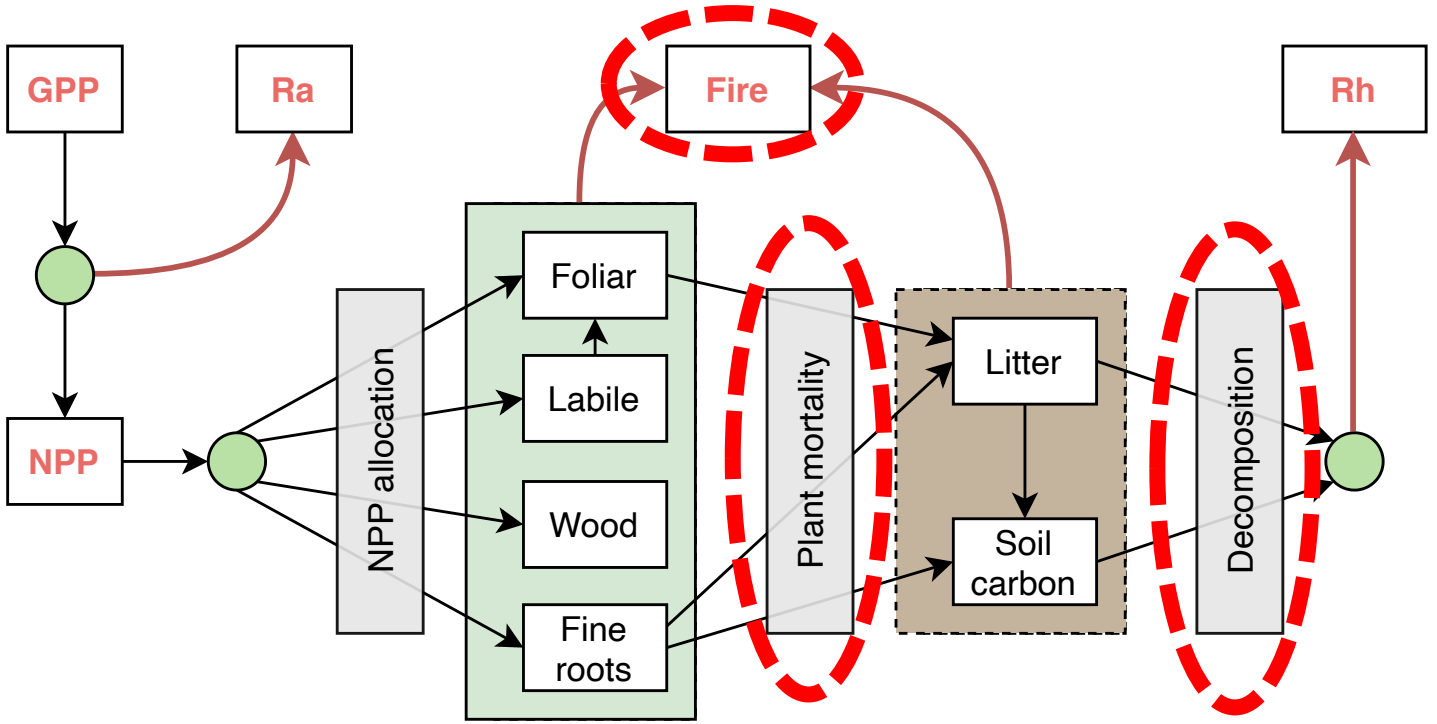


Bloom et al. (2016)

SECO: constraining the carbon cycle

Mortality:

- Complex mortality dynamics: resurrection, resprouting, partial mortality.
- Resprouting behaviour and mortality following drought and fire.
- Specific mortality patterns by:
  - Demographic group
  - Conservative/acquisitive economics
- Physiological limits of different vegetation types

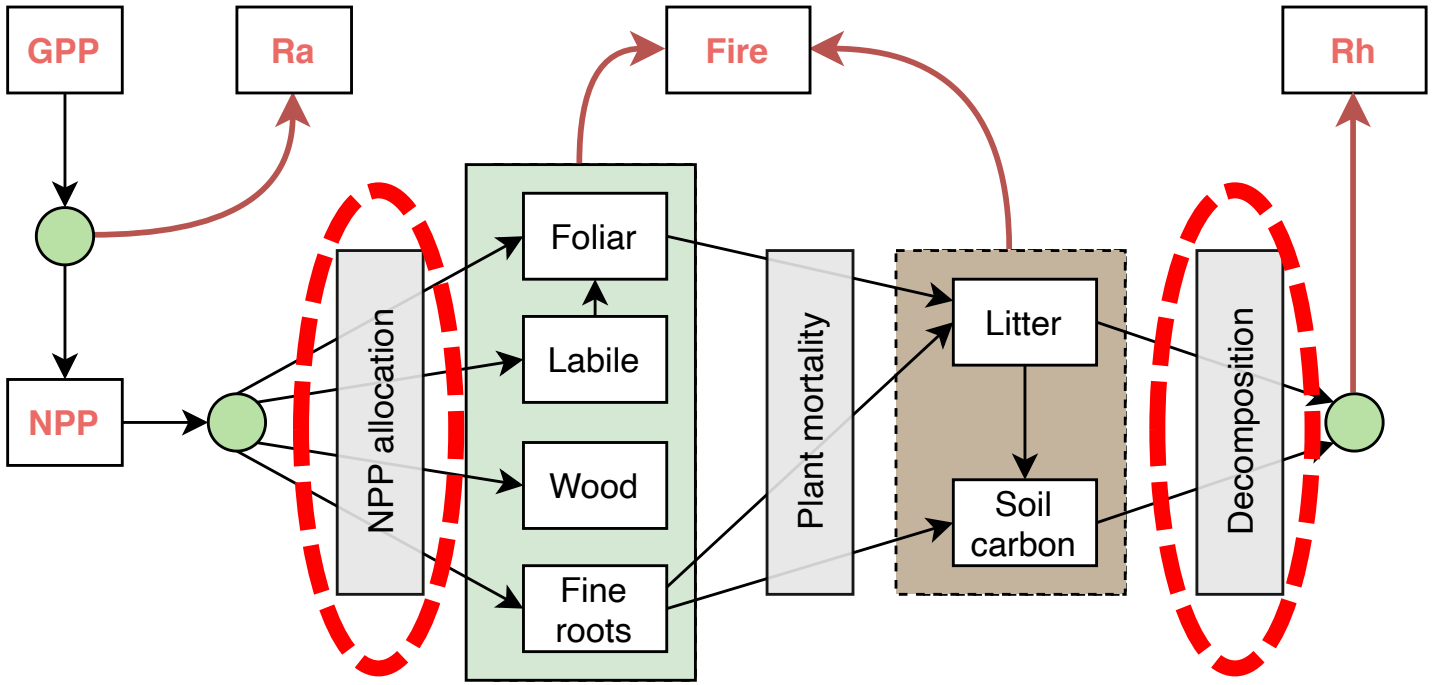


Ahlstrom et al. (2015)
Whitley et al. (2017)

SECO: constraining the carbon cycle

Root:shoot ratios:

- Poorly parameterized root:shoot ratios
- Fire strategy alters carbon allocation to roots
- Identify biogeographic variation in root:shoot ratio
- What environmental conditions promote root growth?

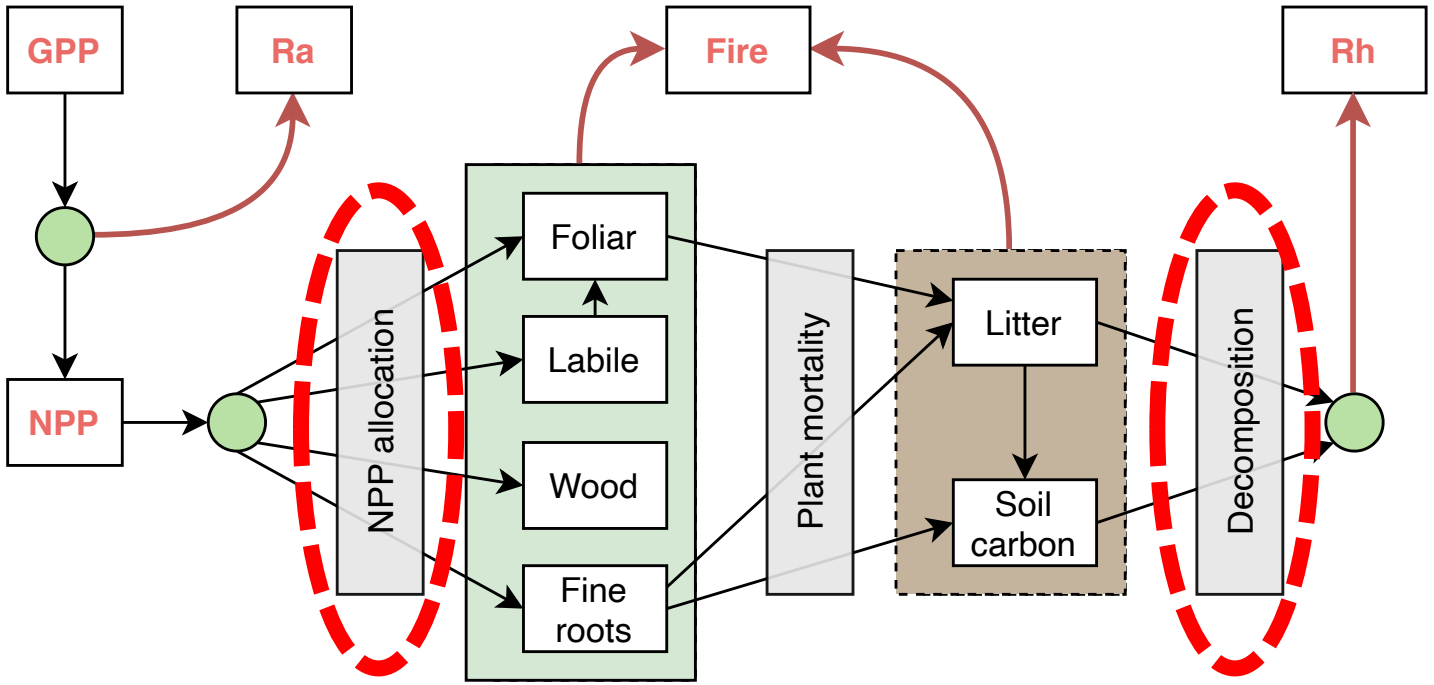


Case et al. (2020)
Haverd et al. (2016)
Ledo et al. (2018)
Whitley et al. (2017)

SECO: constraining the carbon cycle

Leaf traits and growth strategy:

- Noisy savanna LAI signal due to grass. Phenological variation in grass:tree LAI signal
- Leaf carbon allocation informs nutrient cycling and decomposition.
- Terrestrial LiDAR and leaf samples to estimate leaf carbon. Scale up with environmental data and phylogenetics.



Atkin et al. (2017)
Onoda et al. (2011)
Wigley et al. (2016)

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