THE PARTITIONING OF SAVANNA TREE-GRASS PRODUCTIVITY USING MULTIPLE FLUX TOWERS

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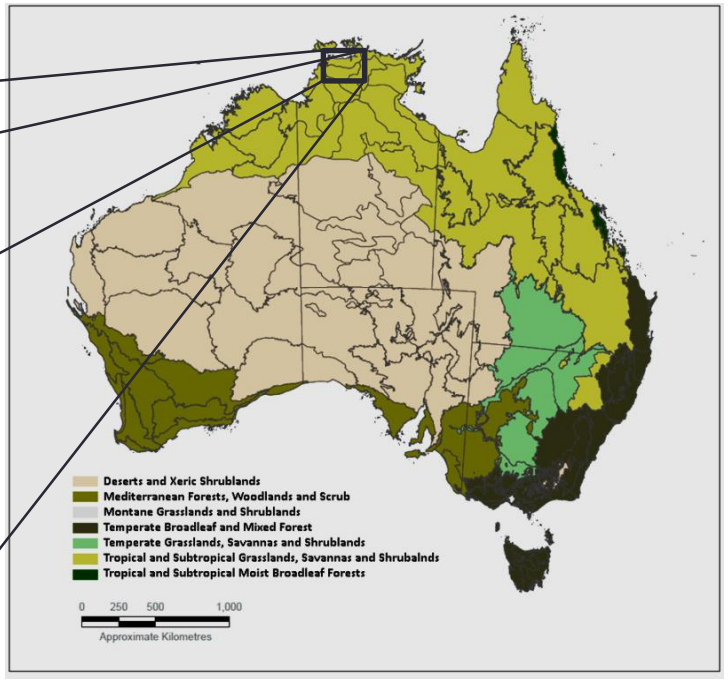
Outline

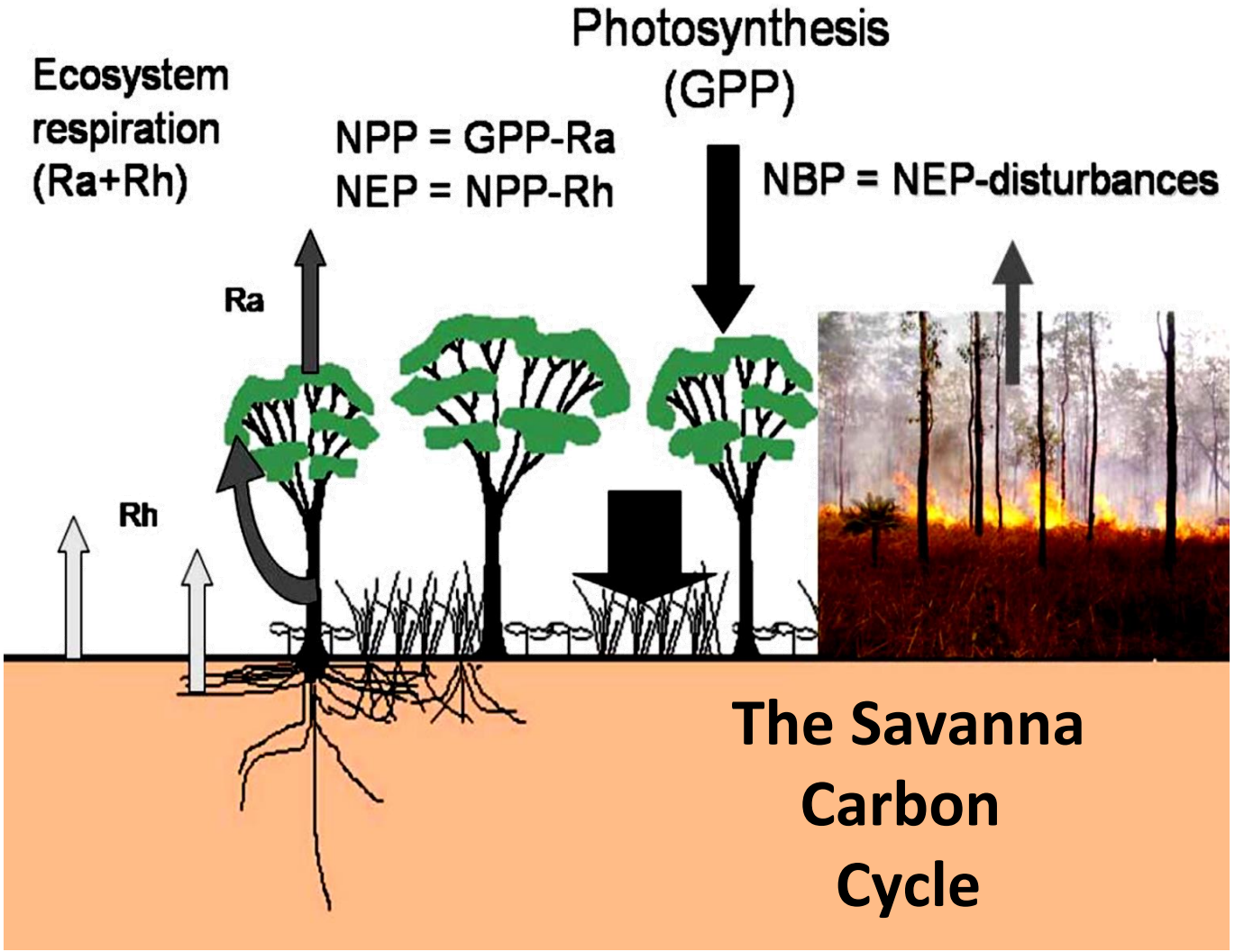
- Background
- Research Questions
- Site Information
- First Insights

Australian Savannas

- Cover 25 % of the continent
- Account for 33 % of terrestrial carbon storage
- Trees are C3 evergreen, grasses are C4 deciduous
- Fire the most important disturbance of structure and productivity, 1/3 of the savanna area burns each year
- Support only 2 % of Australia's population



Savanna Productivity



Source: Hutley & Beringer 2010

Research Questions

How does the grassy understory of an Australian tropical savanna contribute to annual gross primary productivity?

1. *What are the drivers of change in GPP in savannas and do these vary between that of the overstory and understory? Does this vary seasonally?*

2. *How does LAI fluctuate seasonally? What are the main drivers of this change? What are the links between LAI and GPP of the canopy and understory?*

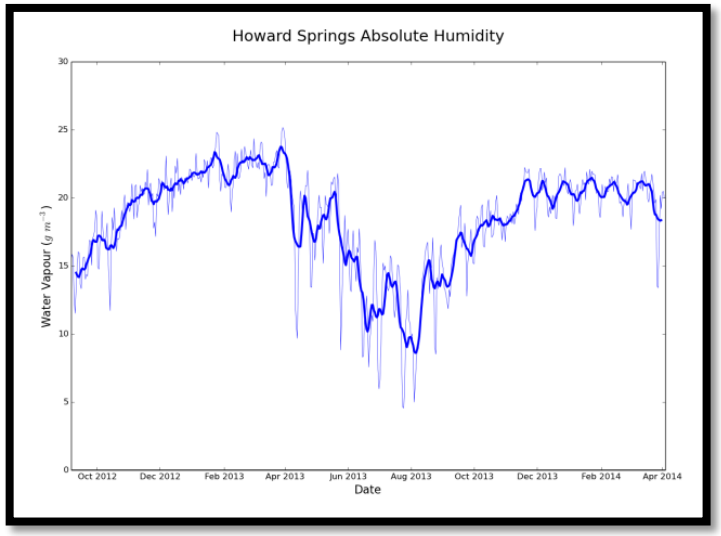
3. *What are the spectral properties of the understory? How does this relate to understory GPP, savanna GPP and LAI variability at an annual timescale?*

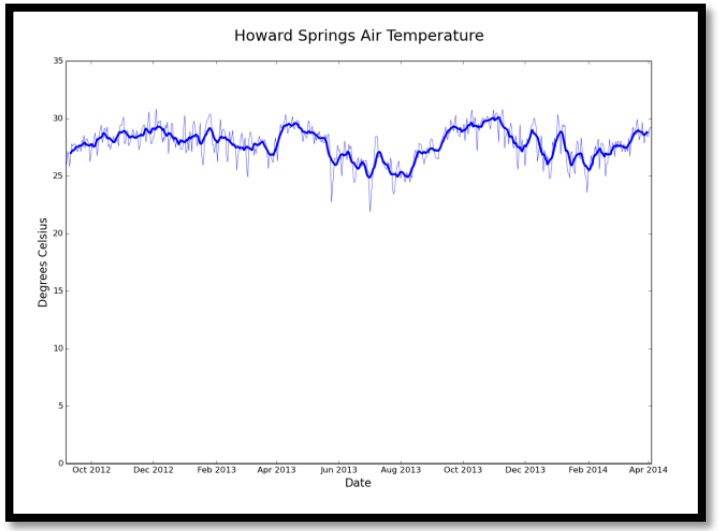
Study Site

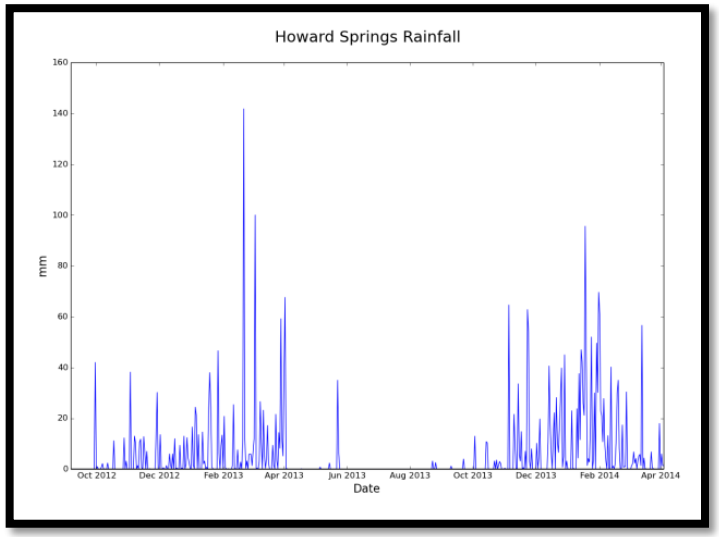
Howard Springs Research Site

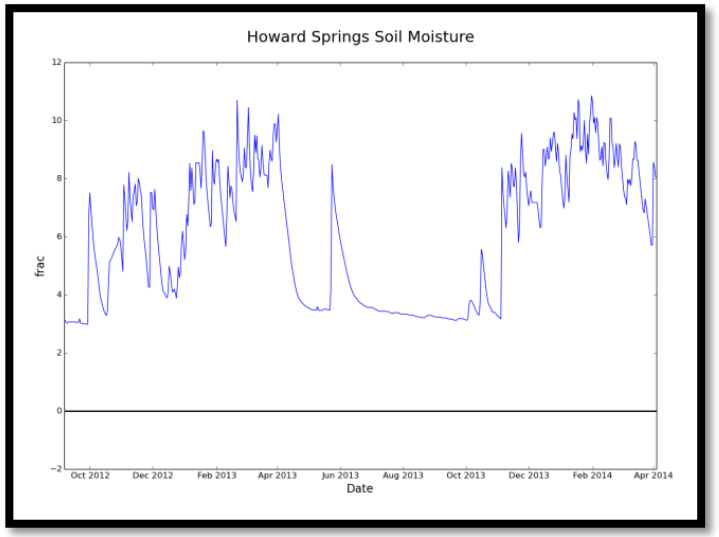
- Long-term (1982-2006) rainfall = 1782 mm
- Open savanna woodland dominated by eucalyptus woody overstory and C4 grassy understory
- Canopy height 14-16 m and coverage 50-60 %
- Wet Season: Dec-Apr, ~95 % rain falls
- Dry Season: May-Sep
- Transition: Oct-Nov
- Site is a listed OzFlux site (ozflux.org.au/)

Howard Springs Meteorology

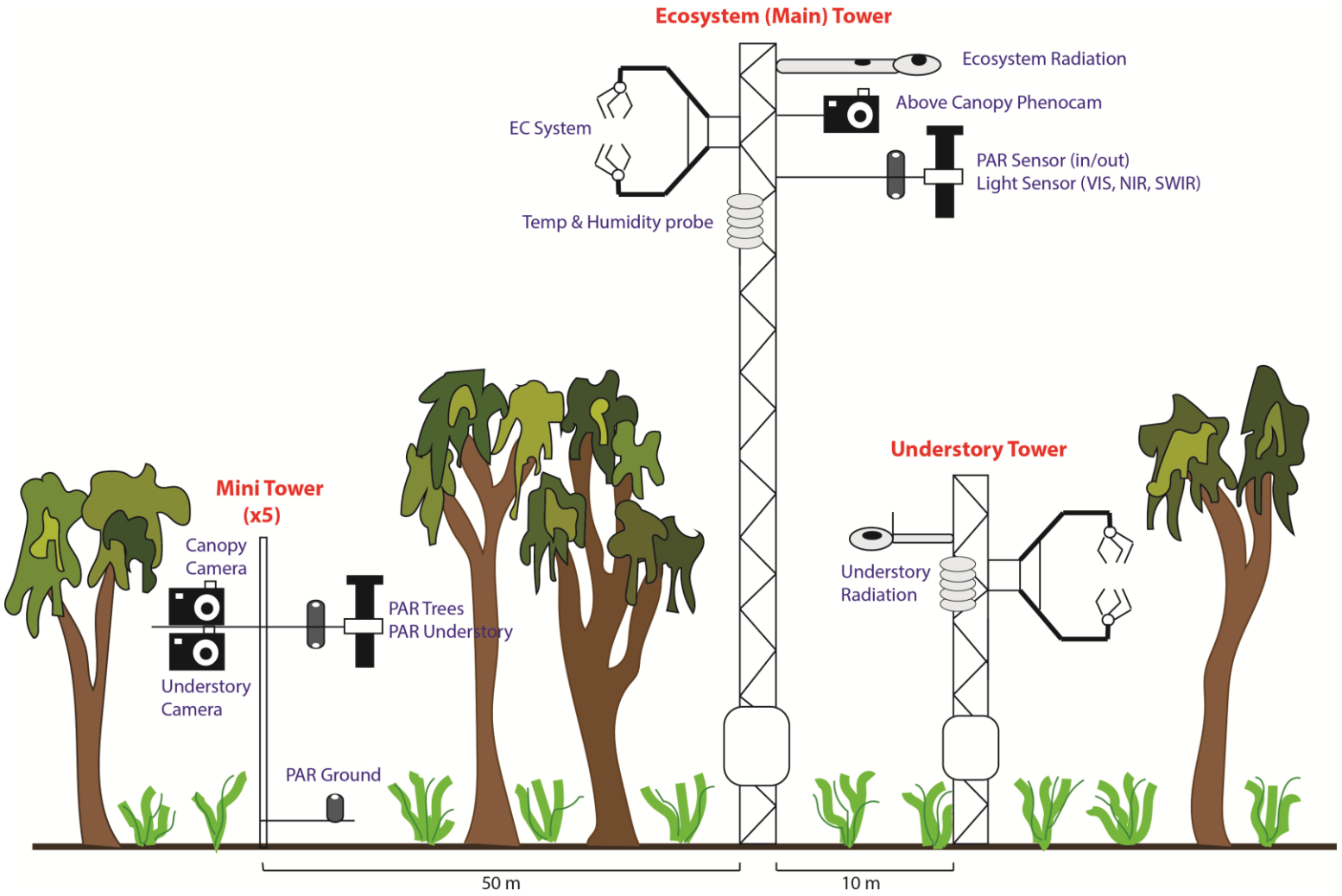






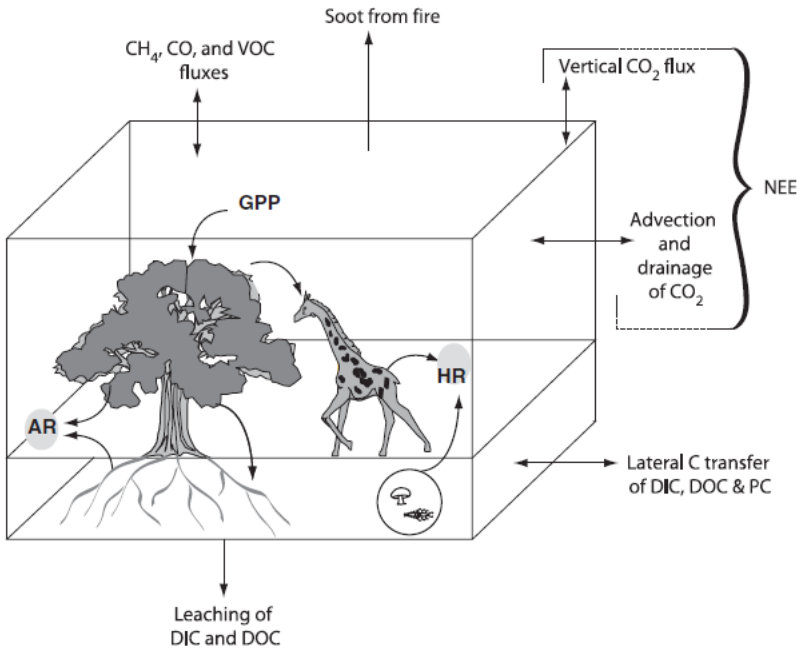


Plot Level Layout



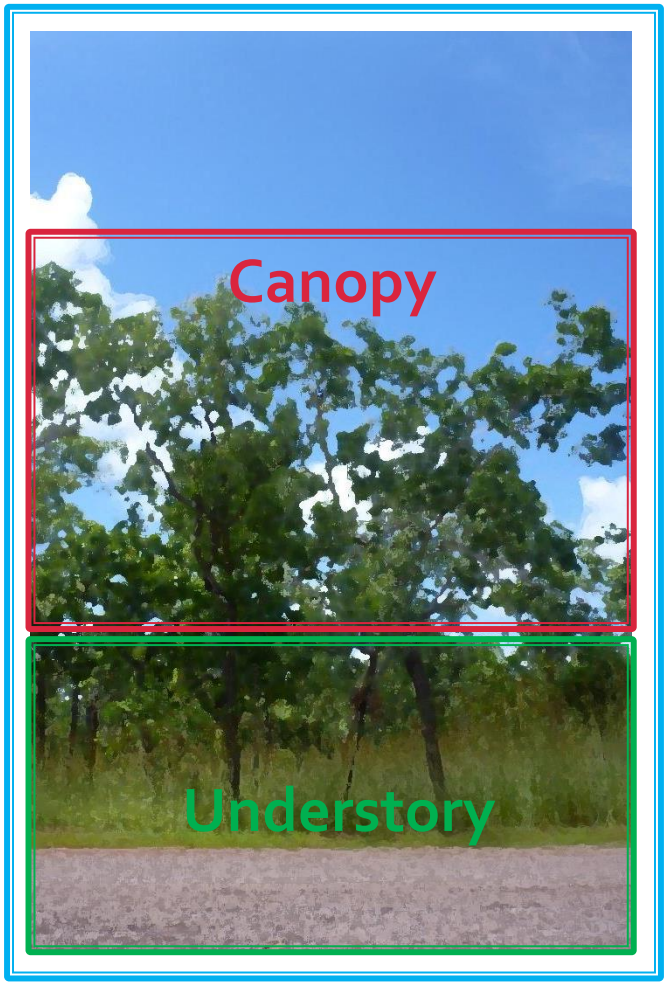
Flux Towers

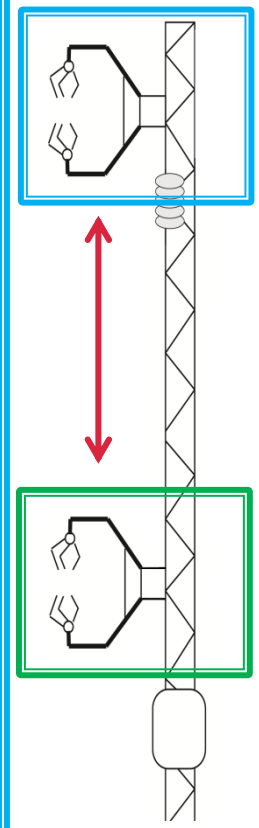
Ecosystem Carbon Balance



Chapin et al., 2006

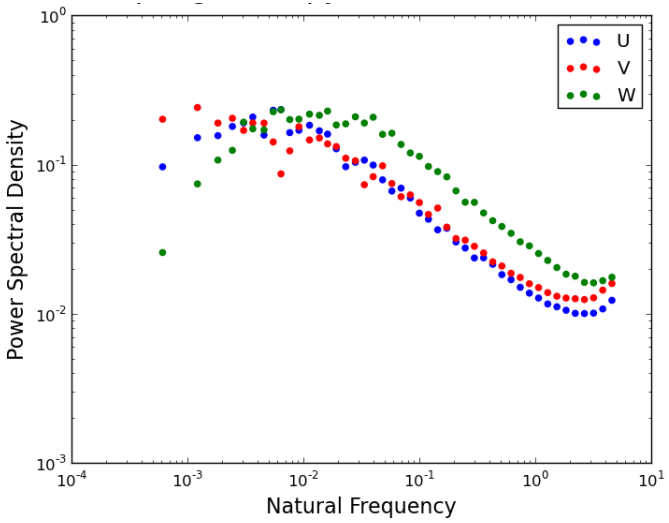
Ecosystem

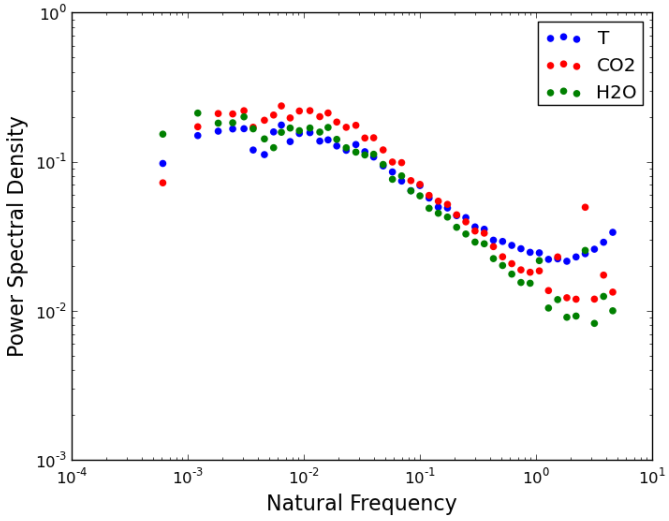




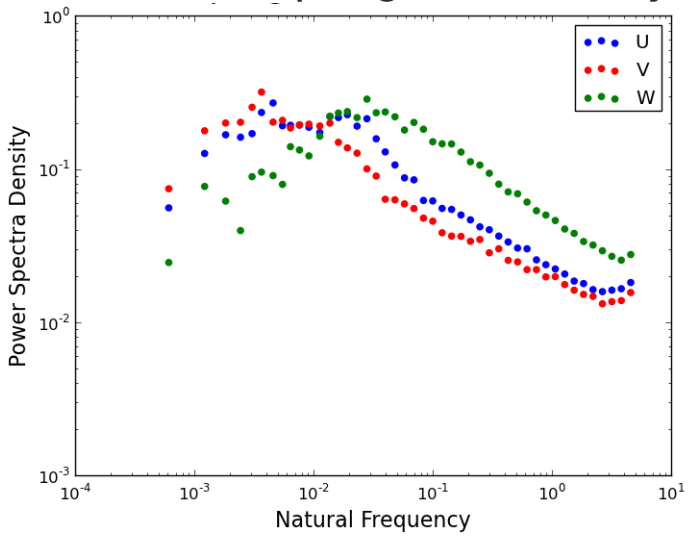
Spectra

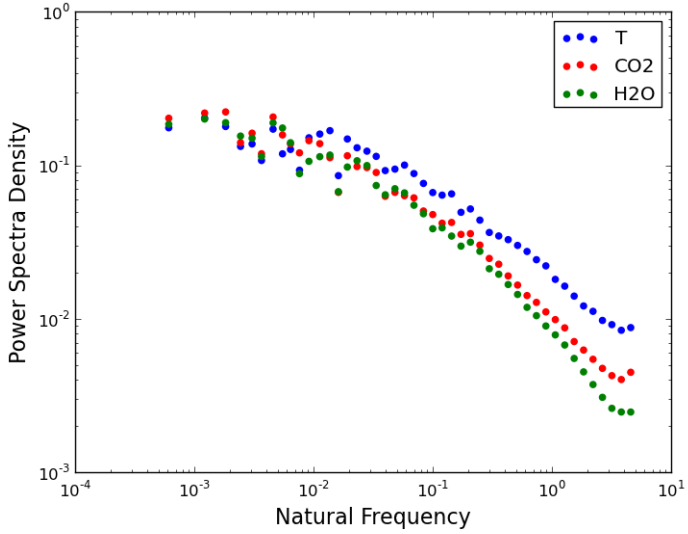
Howard Springs Ecosystem





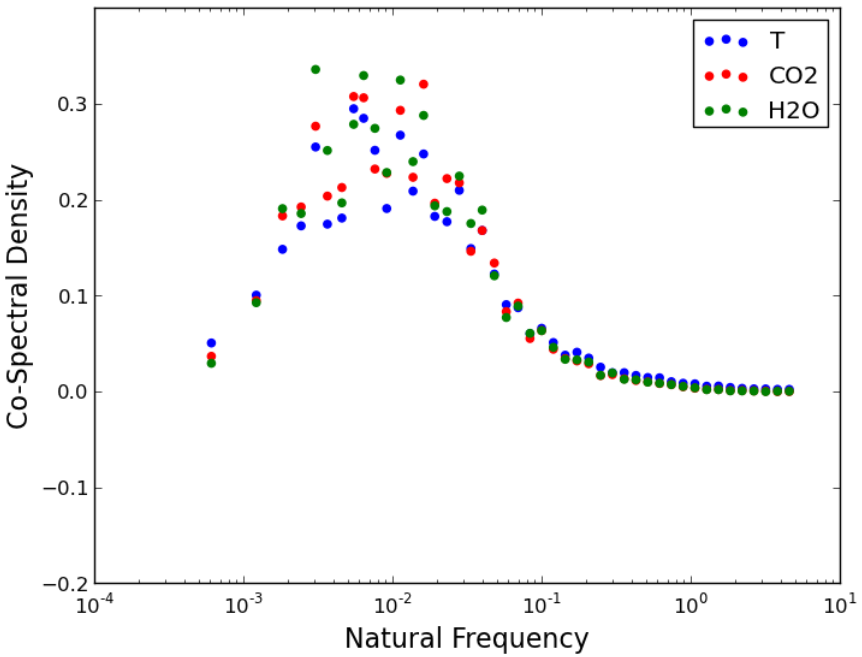
Howard Springs Understory



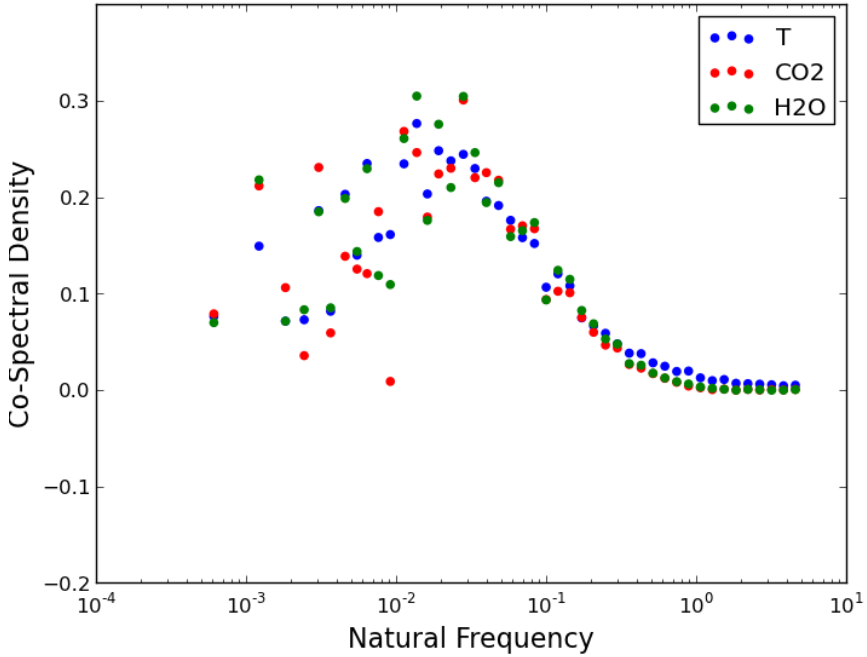


Cospectra

Howard Springs Ecosystem



Howard Springs Understory



Understory Seasonality

Growth Begins (Nov)

Early Growth (Dec-Jan)

Peak Growth (Feb/Mar)

Seeding (Mar)

Senescence/Curing (Apr-Oct)

Fire

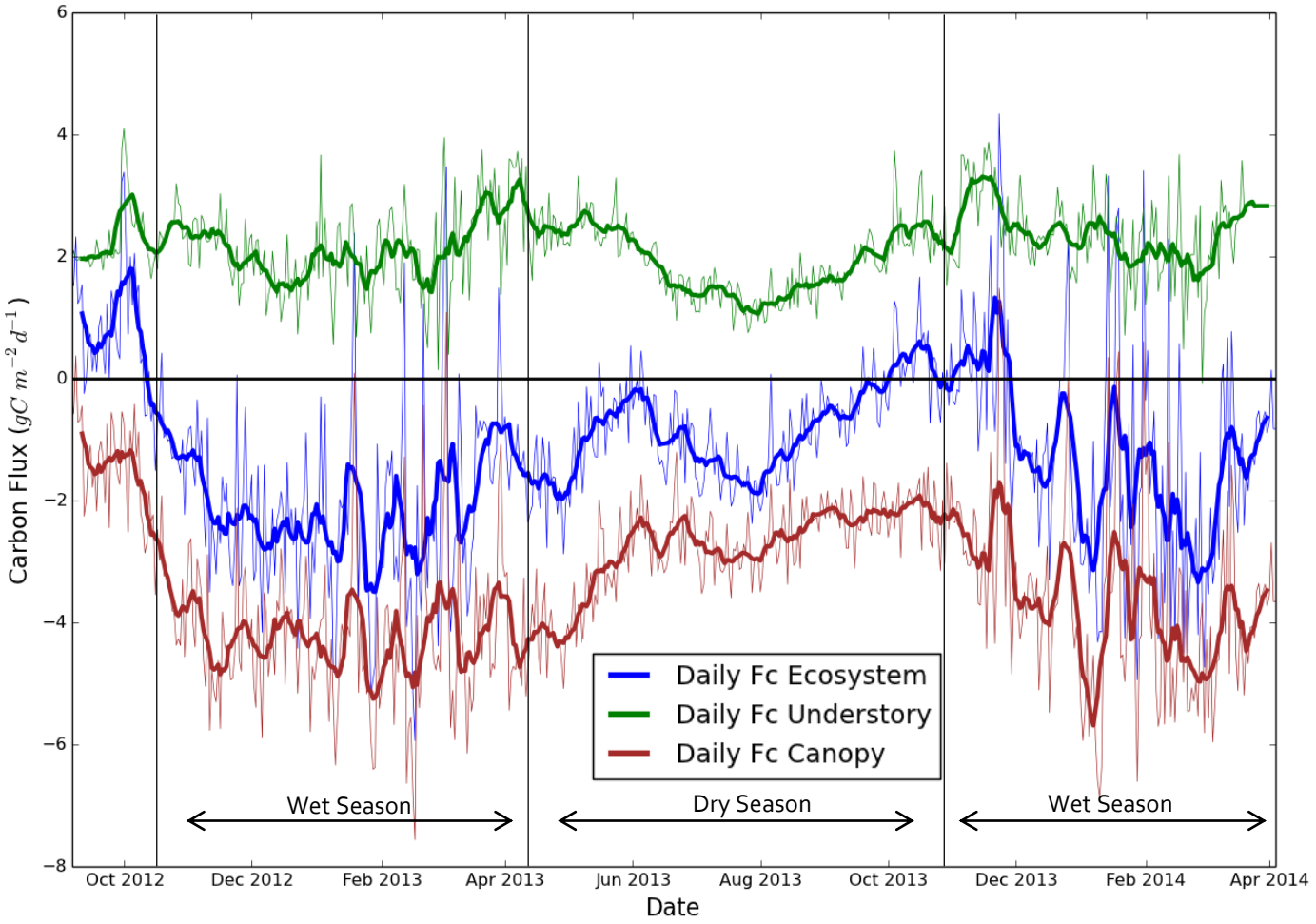
Howard Springs NEE

Ecosystem:
-5.2 t C ha^{-1} y^{-1}
= C sink

Understory:
+9.4 t C ha^{-1} y^{-1}
= C source

Canopy:
-14.6 t C ha^{-1} y^{-1}
= C sink

NEE = GPP-Re

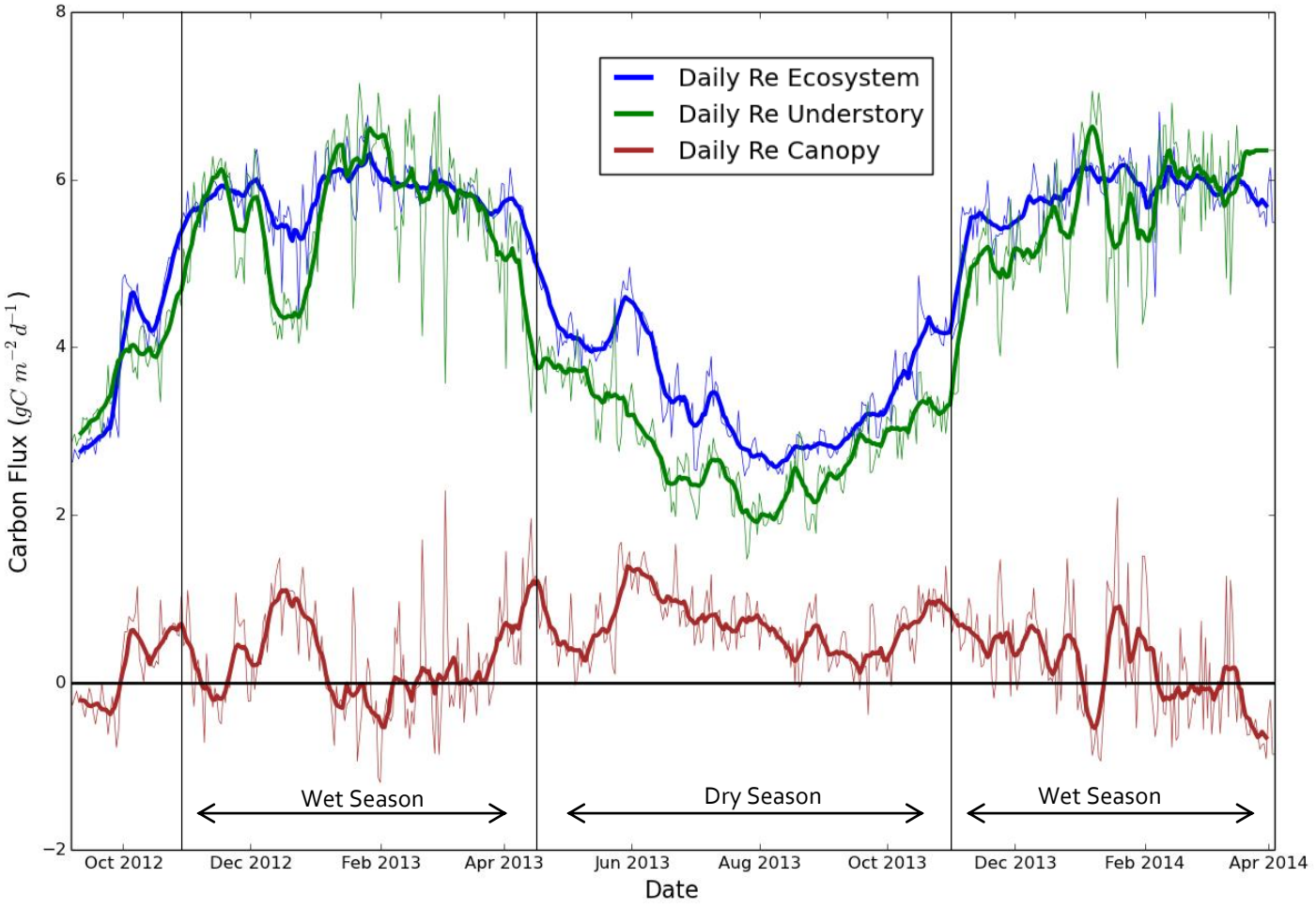


Howard Springs Re

Ecosystem:
21.1 t C ha^{-1} y^{-1}

Understory:
19.5 C ha^{-1} y^{-1}
~ 92 %

Canopy:
1.6 t C ha^{-1} y^{-1}
~ 8 %

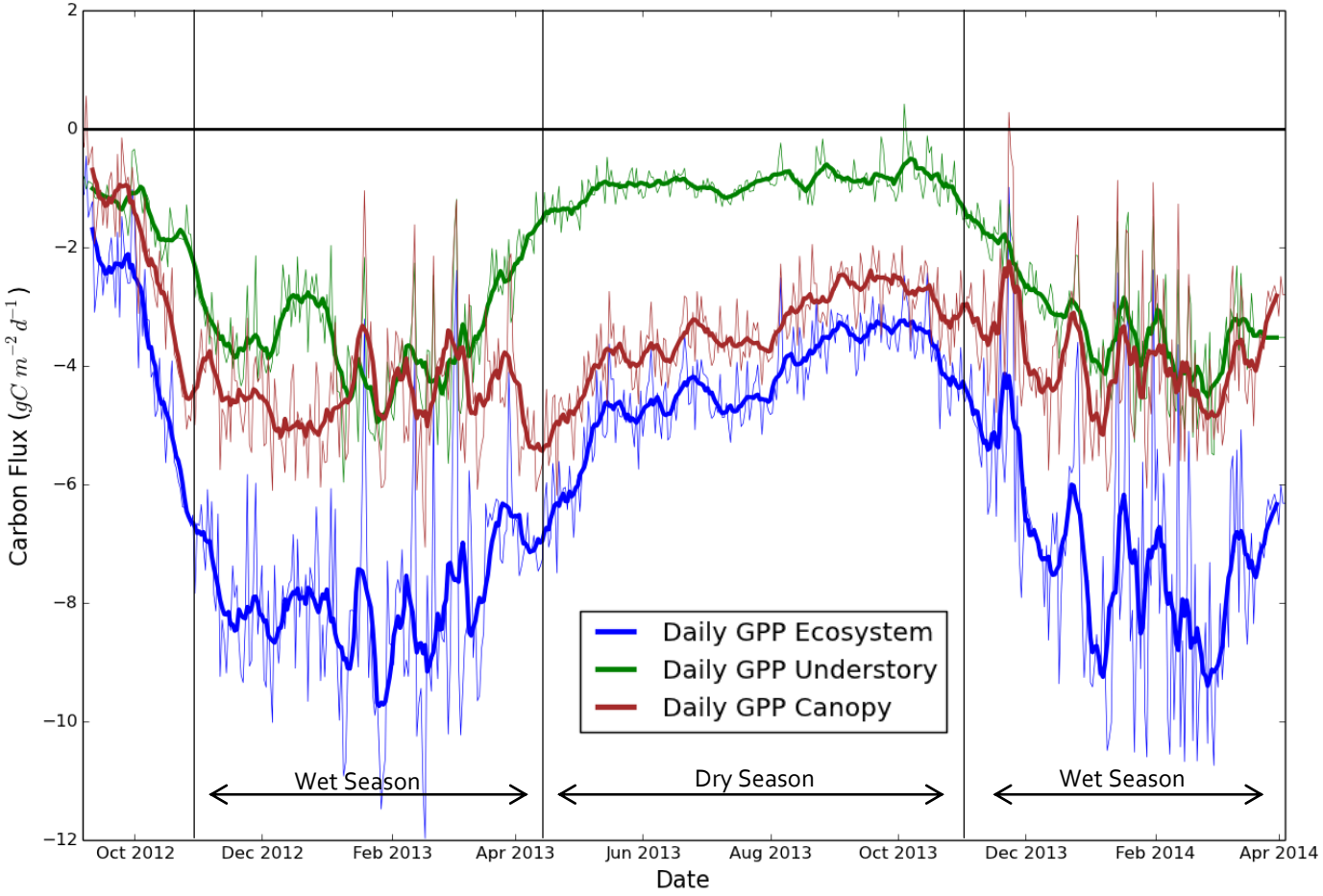


Howard Springs GPP

Ecosystem:
26.3 t C ha^{-1} y^{-1}

Understory:
10.1 t C ha^{-1} y^{-1}
~ 38 %

Canopy:
16.2 t C ha^{-1} y^{-1}
~ 62 %



Seasonality

	Wet Season (Nov-Mar)		Dry Season (May-Sep)
GPP ($g\ C\ m^{-2}\ d^{-1}$)	7.59	Ecosystem	4.28
	3.43 (**45 %**)	Understory	0.92 (**21 %**)
	4.16 (**55 %**)	Canopy	3.37 (**79 %**)
Re ($g\ C\ m^{-2}\ d^{-1}$)	5.85	Ecosystem	3.36
	5.67 (**97 %**)	Understory	2.70 (**80 %**)
	0.18 (**3 %**)	Canopy	0.66 (**20 %**)
NEE ($g\ C\ m^{-2}\ d^{-1}$)	- 1.74	Ecosystem	- 0.92
	+ 2.24	Understory	+ 1.78
	- 3.98	Canopy	- 2.70

(+) = Source, (-) = Sink

Phenocams add to the story

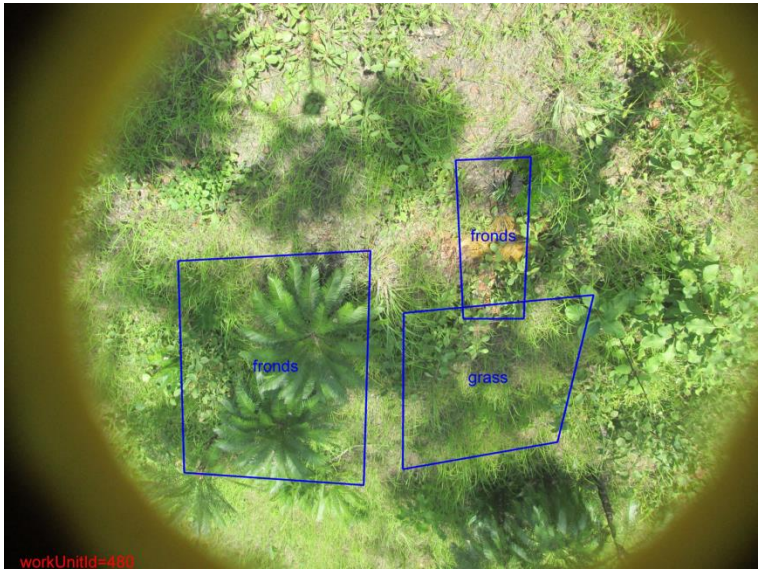
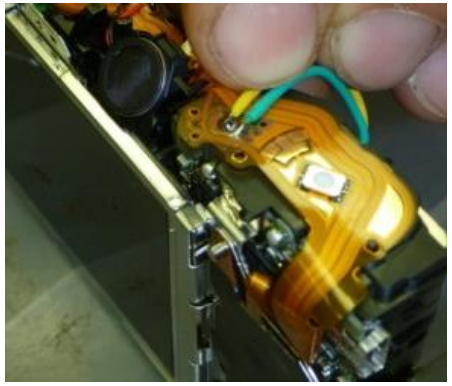


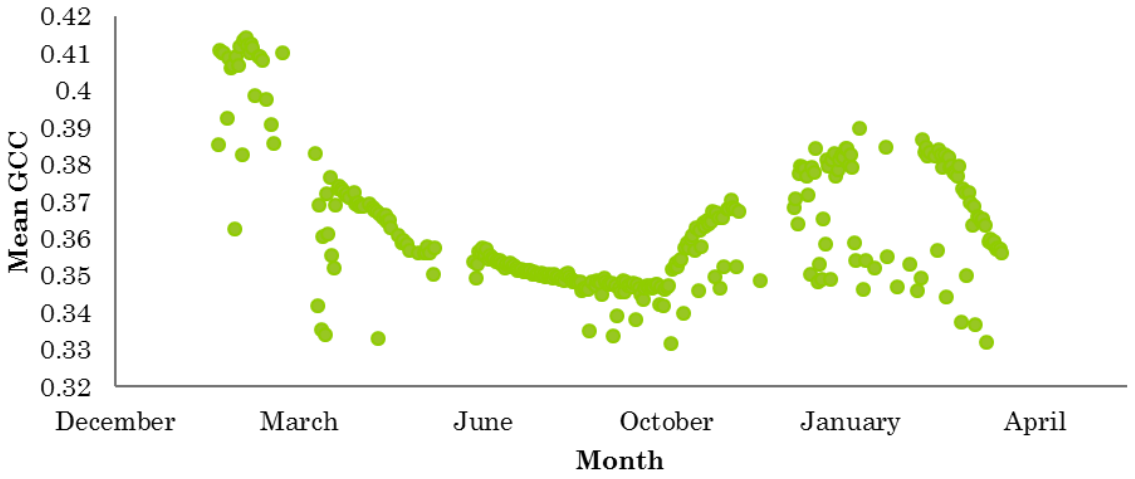
Image from E. Ring



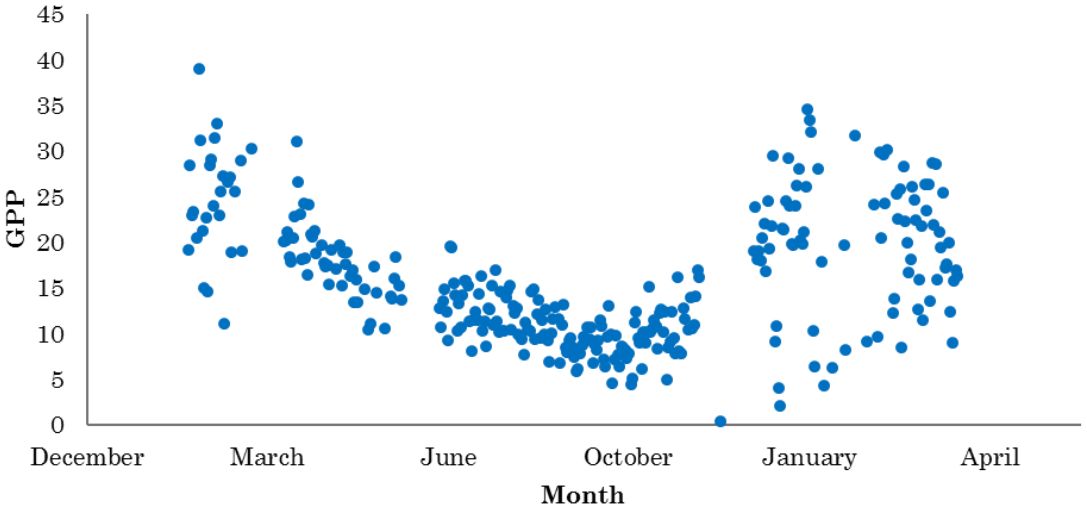
GPP and GCC

Phenocam Green Chromatic Coordinates (greeness)

GCC = G/(R+G+B)



Tower Ecosystem GPP



Figures from E. Ring

What's Next?

- Further validation of understory data, re-check GPP and Re estimates and publish results
- Process LAI datasets to investigate the variability at Howard Springs – both seasonal and spatial variability in the canopy and understory. Do these plot level measurements agree with the MODIS LAI product for the savanna?
- Process the spectra data to investigate the spectral variation of the understory. We will draw links between leaf chemistry (chlorophyll content) and plant level spectra in order to create a spectral map of the understory. This will then be used to relate to MODIS spectra of the savanna.
- Finish my PhD thesis!

Thanks!