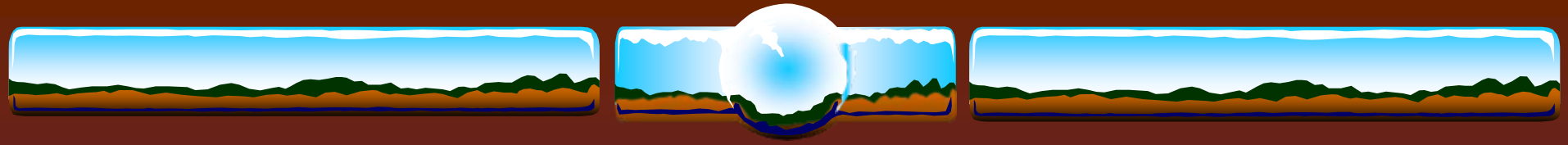
TWO TOWERS IN THE TROPICAL RAINFOREST : A DOUBLE CHALLENGE

Mike Liddell

Chemistry Department
James Cook University



MTSRF Project 5.ii.2

- **Sub-project 1: Is there a measurable change in carbon, water or sensible heat fluxes that can be attributed to climate change perturbing the rainforest?**
- **Sub-project 2: Are there changes in physiological behaviour or productivity in the rainforest that can be attributed to climate change.**
- **Sub-project 3: Determining the potential effects of changing climate on the fluxes of water and carbon through the soil profile.**
- **Sub-project 4: Examining the flowering and fruiting responses of the plant community to climatic stress.**
- **Sub-project 5: Climate variability vs resource driven variation in insect populations.**

Two Towers

Sub-project 1:

Fluxes vs Climate Change

Mike Liddell (JCU)

- **Station 1 : Cape Tribulation**

Based at the Australian Canopy Crane this station has been operating since March 2001.

- **Station 2: Cow Bay**

Based at the Daintree Discovery Centre has been in operation since December 2008.

Tower Locations

Satellite Imagery
Cape Tribulation
LANDSAT
80m resolution

- Both sites are in complex terrain.
- Only daytime flux data is being used for long term analyses.

Daintree Forest

- Pristine lowland rainforest at both stations.
- Complex Type 1A mesophyll vine forest
- Canopy height 25-35m – dependant on topography/soils.
- Leaf area index Station 1 ≈ 4 (Amazon 8-10)

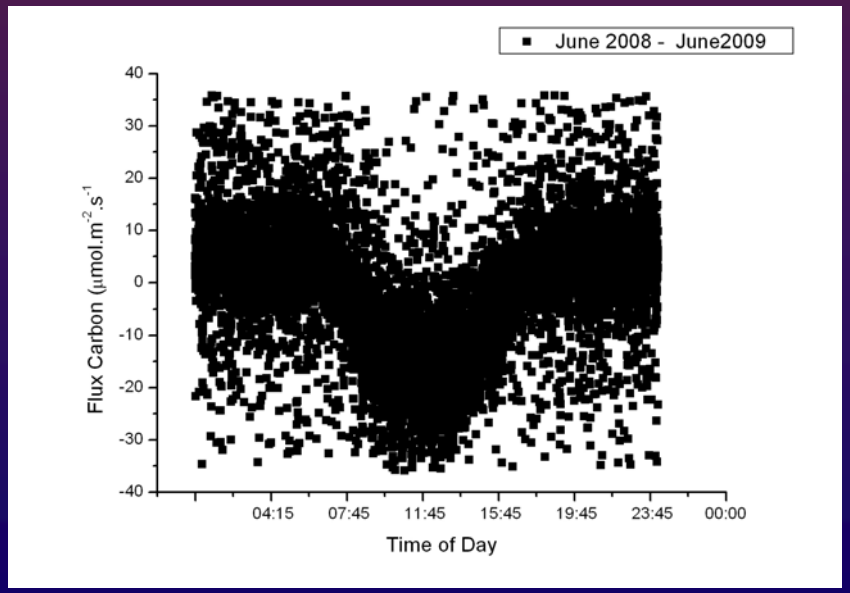
- High species diversity
  Station 1: 88 tree spp. in 1 Ha.
- Moderate stand density
  Station 1: 680 stems >10cm dbh in 1 Ha
- Significant species overlap between the two stations both in flora and fauna.

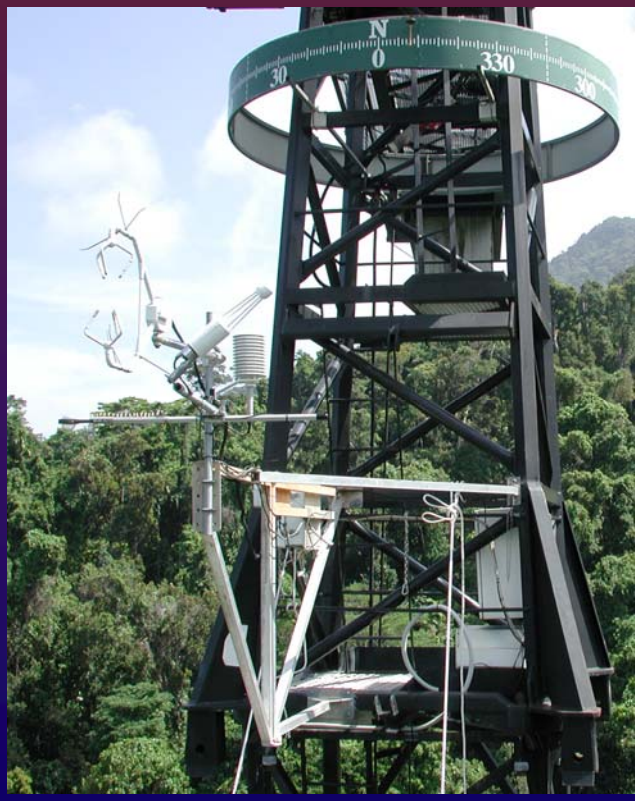
Discovery Tower

- 23m walk-up tower
- 12m mast
- System went on-line Dec 2008
- Remote access via LogmeIn
- A few issues to date with power supply, data storage.

Crane Tower

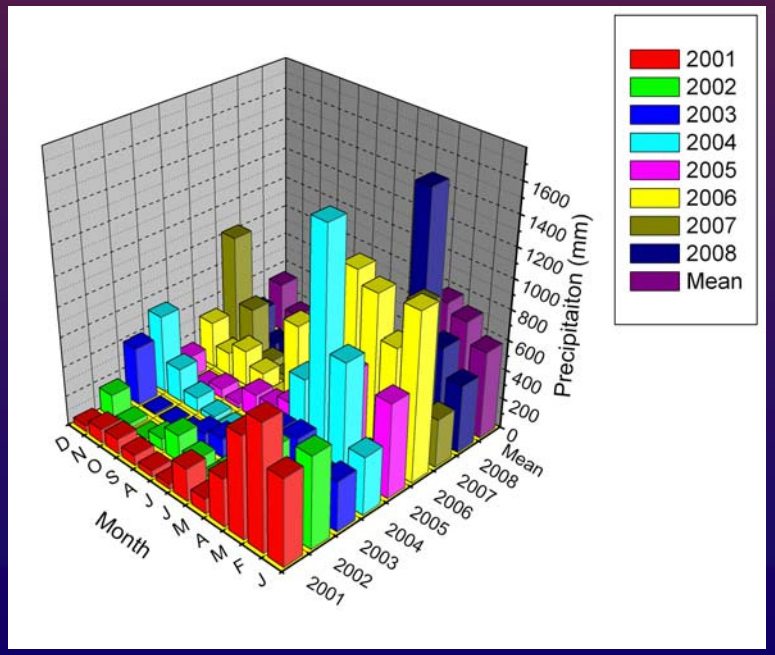
- Running since 2001. Due to be upgraded to the same set-up as the Discovery Tower.
- Comparable data obtained in 2009 from the two systems: Fc, H, LE.

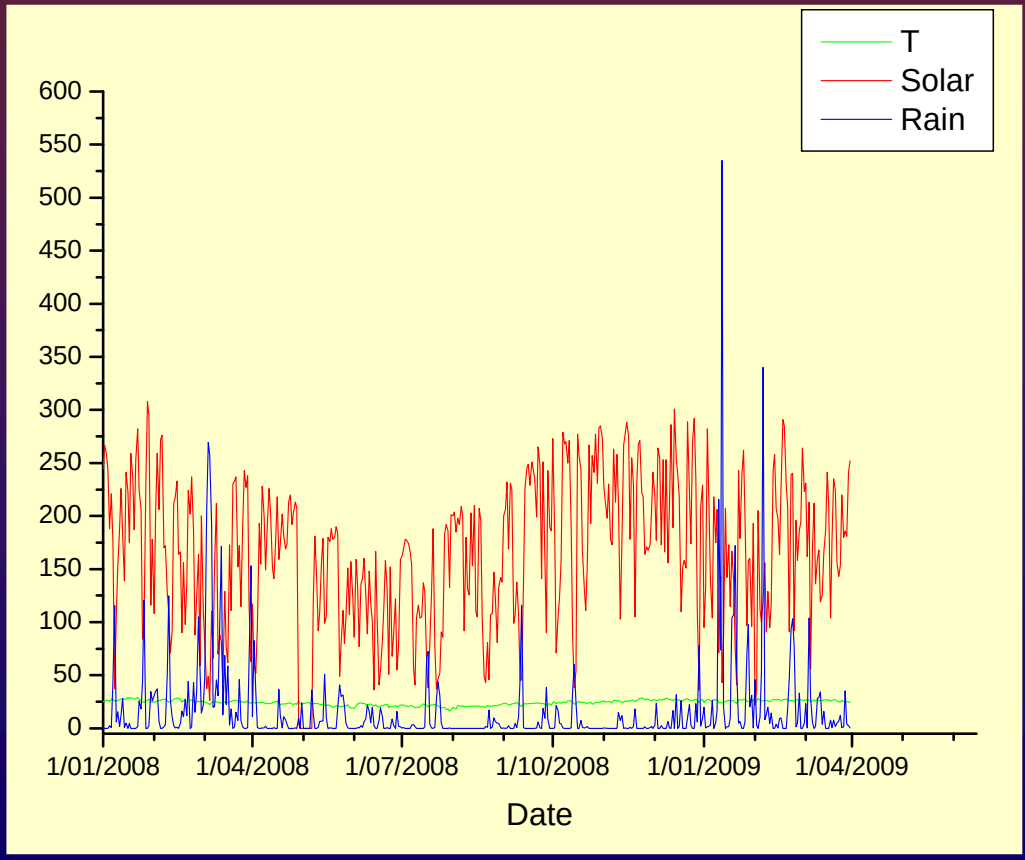




Micromet Data

- Cape Tribulation. AWS running since Jan 2000.
- Discovery Tower. AWS running since Jan 2008.

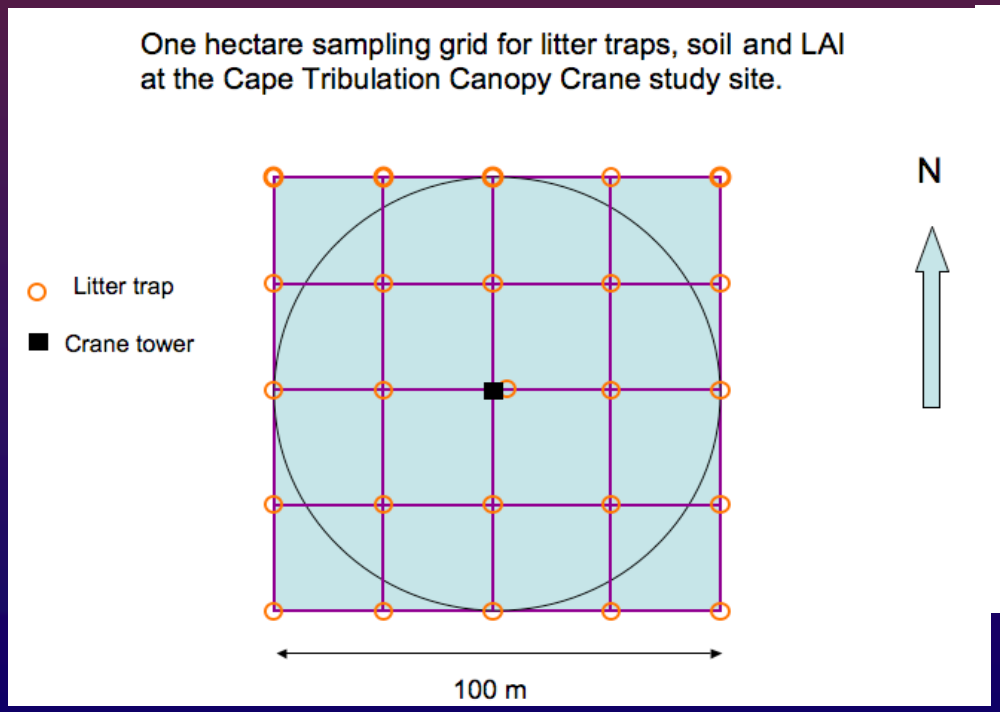




Sub-project 2: Physiology vs Climate Change

Will Edwards (JCU)

- Grid network was established at the start of 2007



Total Litter Fall

Fine litter: fall, average amount, and disappearance in

Forest formation and place	(a) Fine litterfall (t ha^{-1} $year^{-1}$)
Lowland evergreen rain forest:	
Mulu, Sarawak: ridge	7.7
valley alluvium	9.4
Pasoh, Malaya	10.6
Penang, Malaya	7.5
Manaus, Brazil	7.6
Lowland semi-evergreen rain forest:	
Barro Colorado, Panama	13.3
Kade, Ghana	9.7

Mainly from Whitmore (1984*a*, Table 10.8); Anderson and Swift in Sutton *et al.* (1983, Table 1)
† Heaney and Proctor (1989)

Total Litter Fall 2007

12.35 tonne/ha/yr

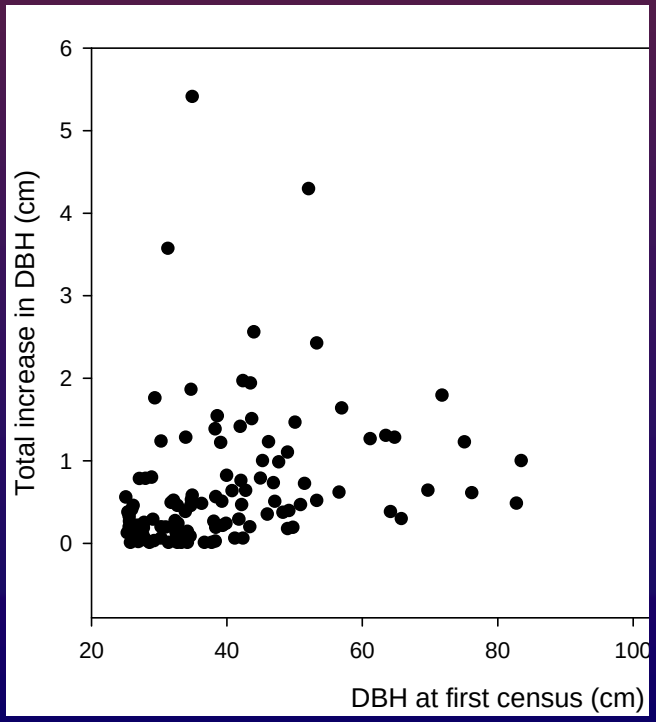
Total Litter Fall 2008

10.97 tonne/ha/yr

Woody material 35% 2007 21% 2008

Dendrometer Bands

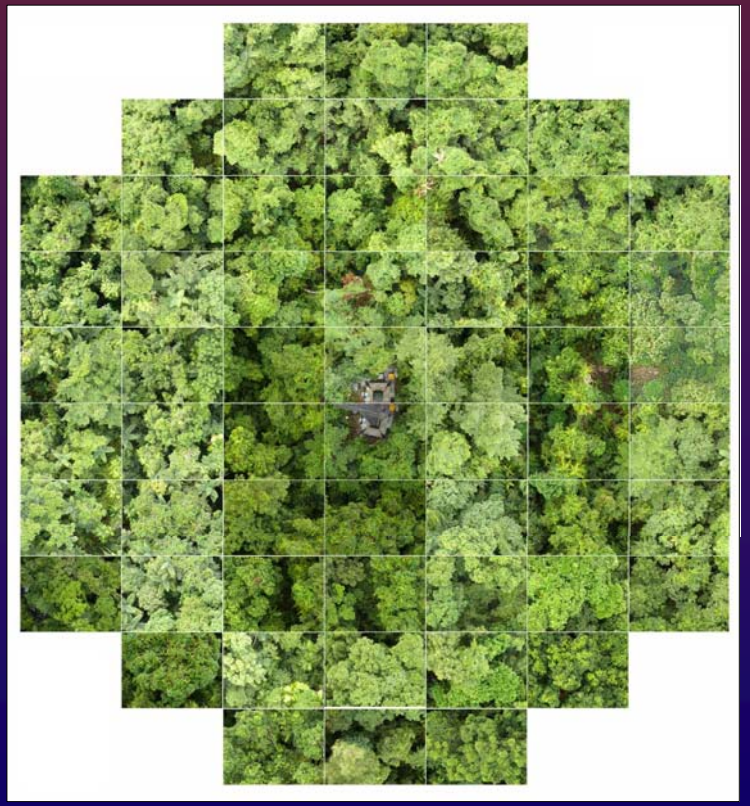
- Dendrometer bands were placed on 170 trees with DBH >25cm March 2007
- Data collected so far March 2007, March 2008, Sep 2008, March 2009
- There are differences between species in their increase in DBH
- Converted to AGB there are significant differences between families in their ability to store biomass.
- So far no indication of interannual variations related to climatic variation.



Canopy Cover

- LAI photos taken at each of litter traps to establish variations in canopy cover from the ground.
- Latest site value (2009) was 3.9
- Prof. Peter Hietz (Vienna) using photographic overlays to investigate changes in canopy cover from above the canopy.

April 2009
Trap 2



Sub-project 3: Soils vs Climate Change

Paul Nelson (JCU)

- Soil pit was installed in mid 2007
- 3 Depths 0.1m, 0.75m, 1.5m
- Sensors:

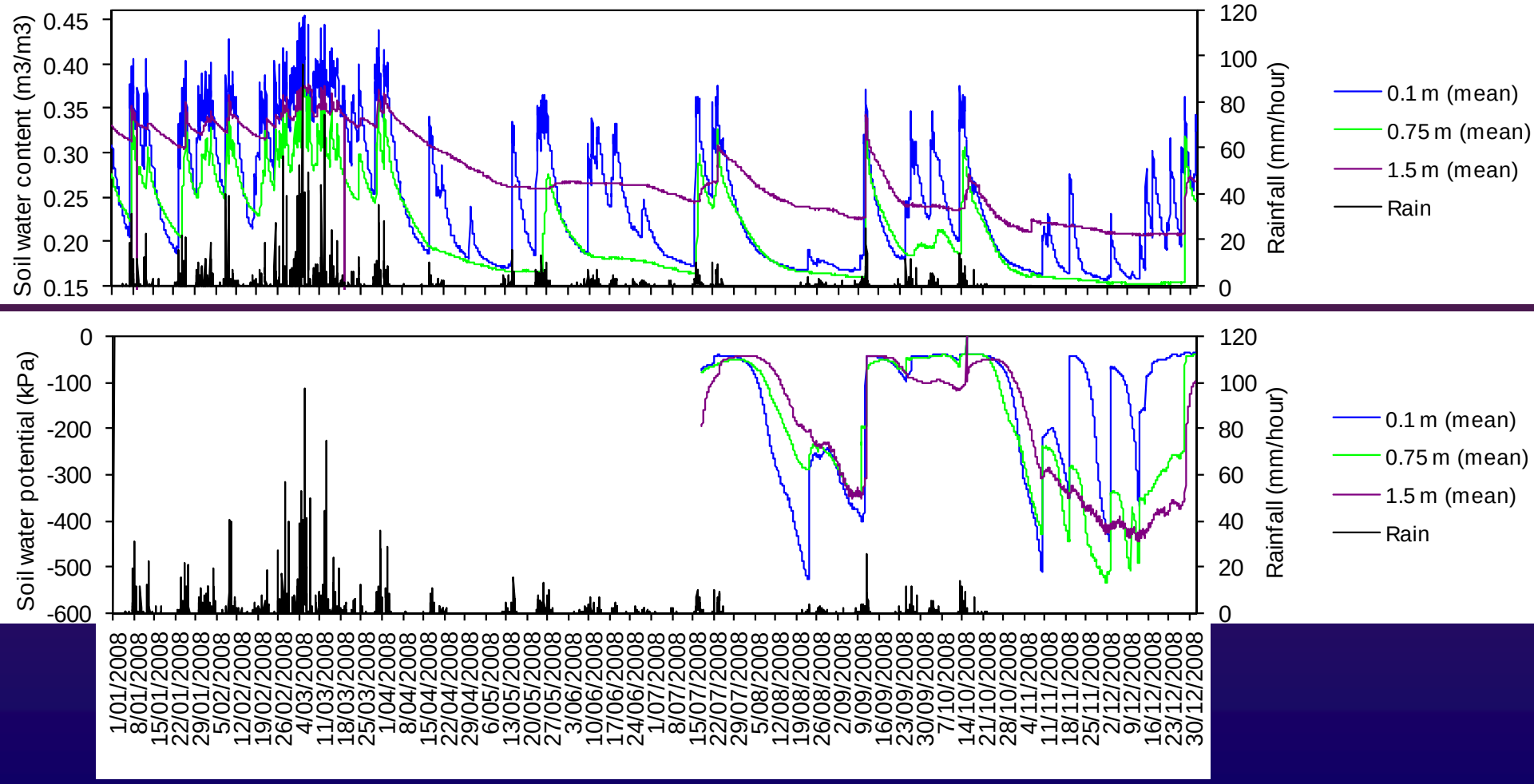
  Temperature (thermocouple)

  Water content (TDR probes)

  Water potential (Gypsum blocks)
- Vacuum system

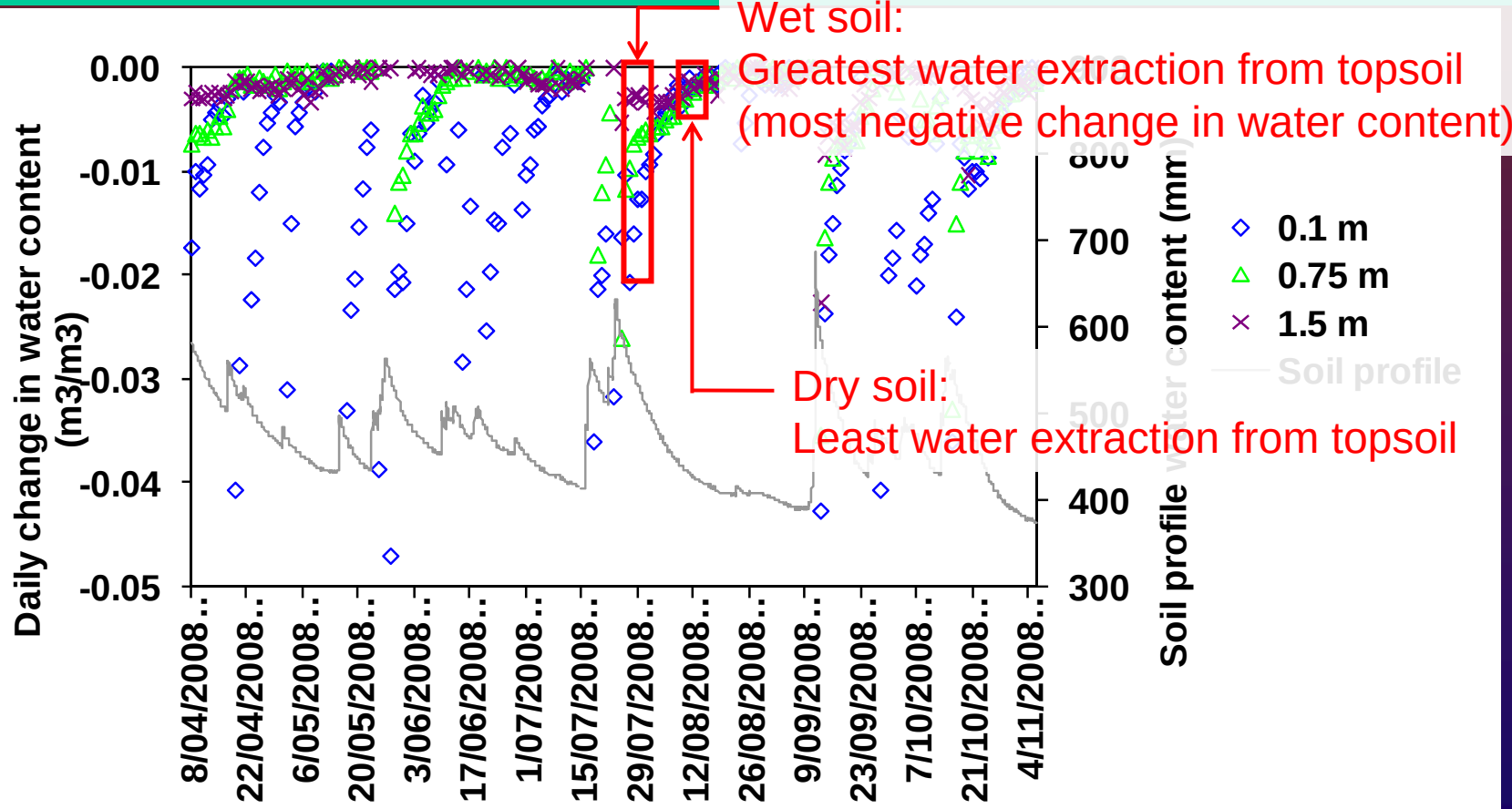
  Used to collect water infiltrating through the profile for measuring DOC movement

Water uptake in 2008



Some rainfall data missing for Apr-May and Nov-

Water uptake depth



Water uptake from groundwater

- Installed 3 bores to measure uptake from groundwater
- Bedrock at 12-33 m depth
- Watertable at 10-13 m depth (July 2008- April 2009)
- Marc Le Blanc (JCU) is in charge of this part of the sub-project.

Sub-project 4: Phenology vs Climate Change

Caroline Gross (UNE)

SkyRail

- 5km transect using Cairns Skyrail
- Long term project : 10 years + initiated under MTSRF with co-funding from SkyRail Foundation.

- Digital images – 12 MP
- Monthly sampling
- Select species will be chosen that have a sensitivity to extinction & various breeding systems

Phenology so far (T23-24)

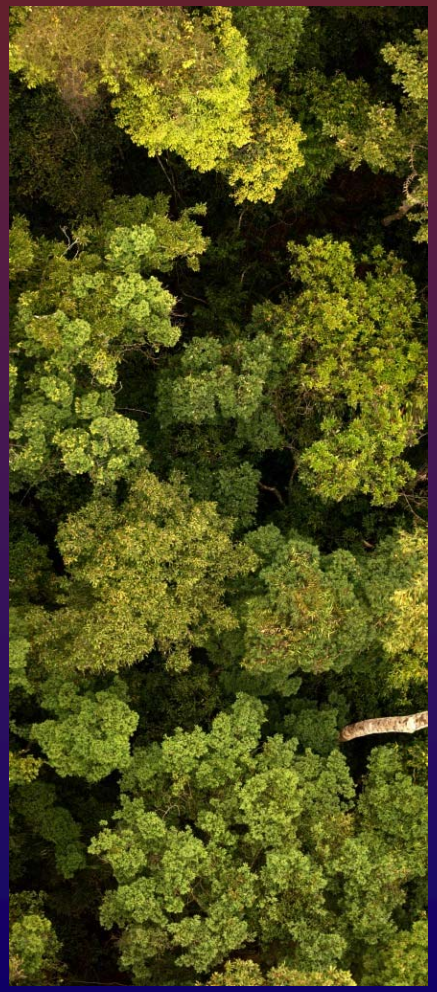
Jan 09

Feb 09

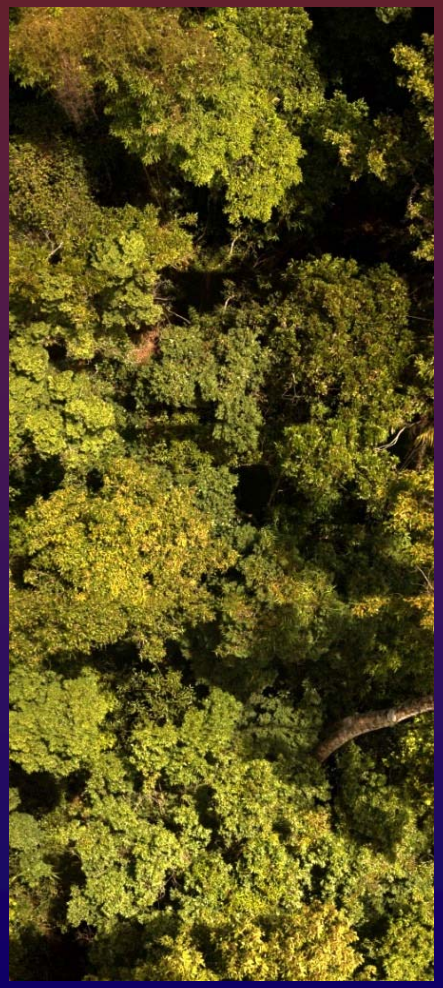
Mar 09

Apr 09

Digital Stitching (T7-T8)



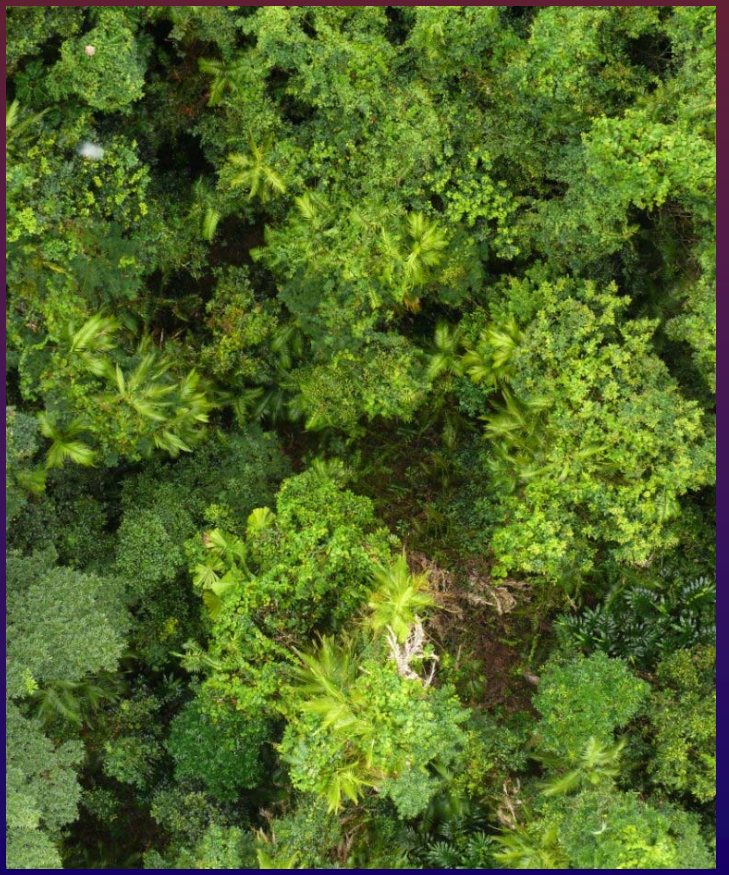
Feb
09



Mar
09

Phenology Crane Site

- Phenological events are recorded monthly using the crane which begain in Jan 2009
- Budding, flowering and fruiting events are recorded as presence or absence.
- Photography was too hard and so visual presence/absence is being used.



Sub-project 5: Insect populations vs Climate Change

Nigel Stork, Peter Grimbacher (UniMelb)

Aims:

- To document the temporal variability of the leaf litter inhabiting insect fauna
- To test if seasonal fluctuations are due to changes in the quantity or quality of organic input from the canopy above and / or are related to climatic fluctuations

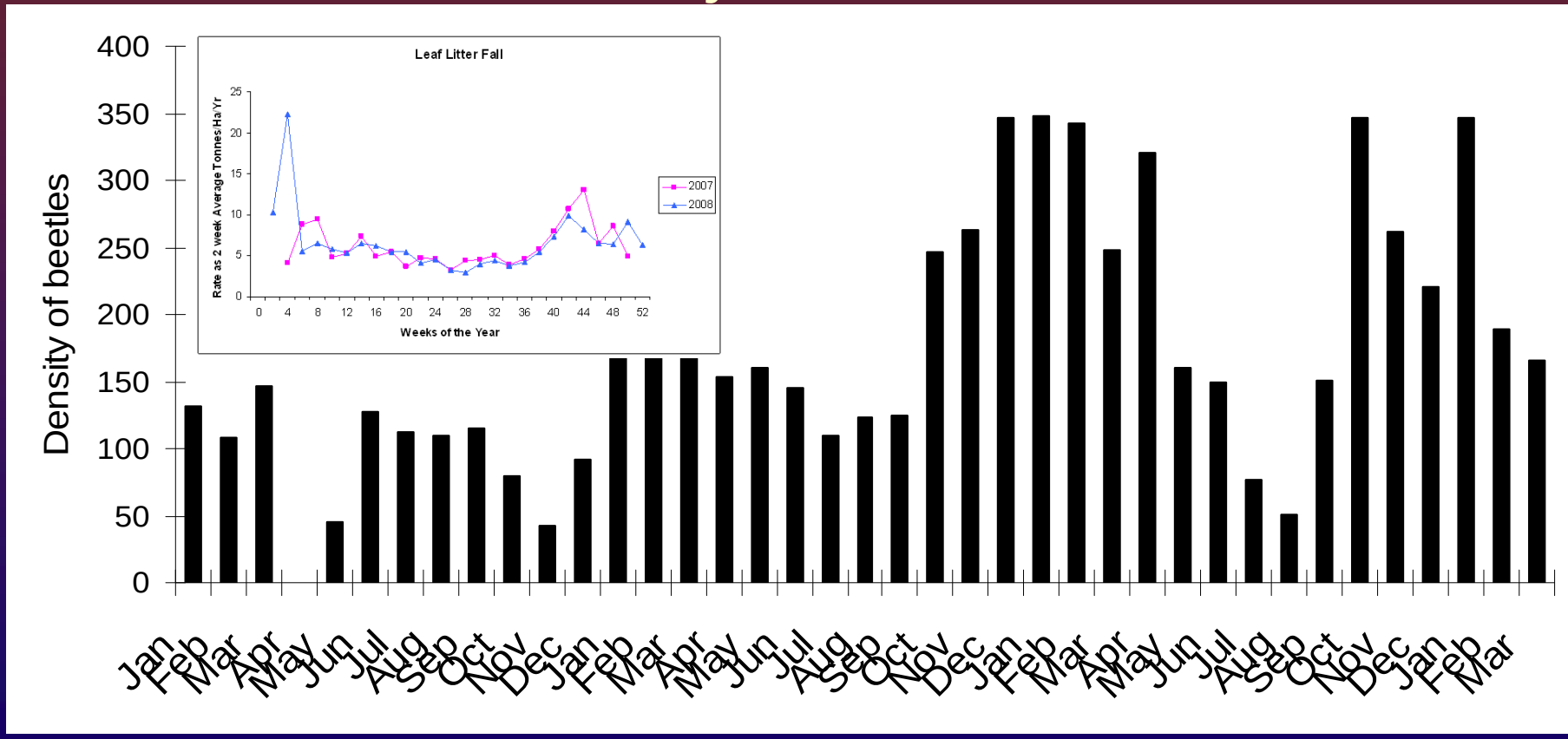
Methods

- Collect insect fauna inhabiting leaf litter at the Cape Tribulation site on a monthly basis over several years

- Standardised volume (5 litres)

Numeric Results

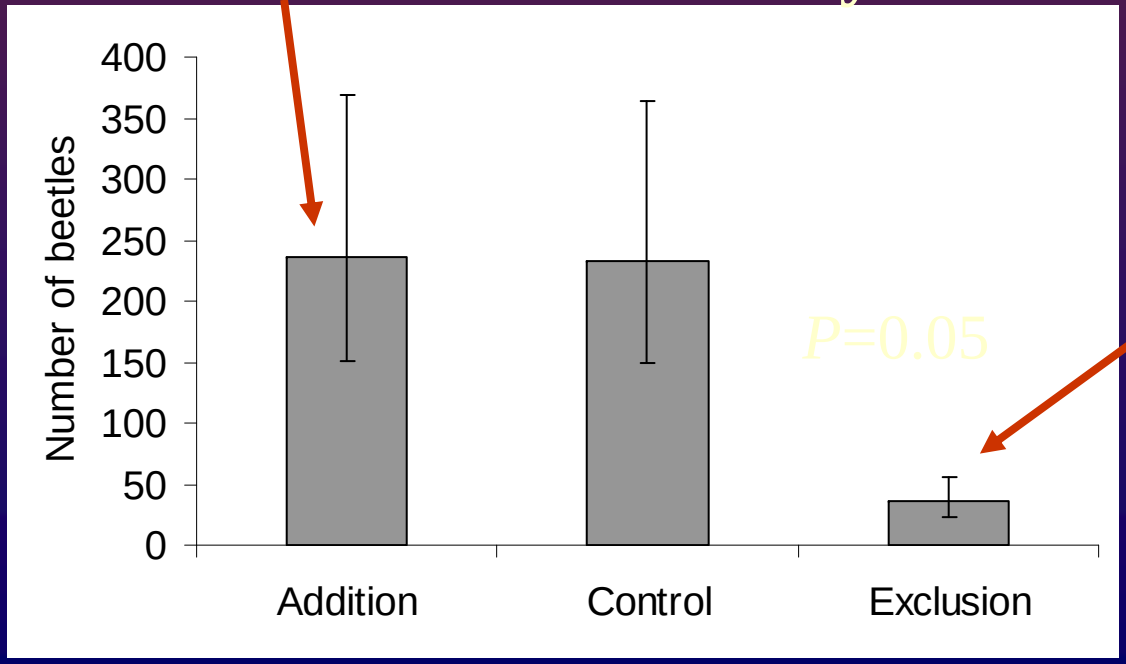
Leaf litter beetle density over time



Litter Manipulation

The amount of available leaf litter is a factor controlling beetle abundance.

- **Further data collection (Leaf litter volume and quality, climatic data)**
- **More analyses to conduct**



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