



FNQ Rainforest Supersite

How the Fluxes link to the other components.

Presentation by :

Associate Professor Mike Liddell

James Cook University

email: michael.liddell@jcu.edu.au

ph: 07 4042 1275

TERN is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and the Super Science Initiative.



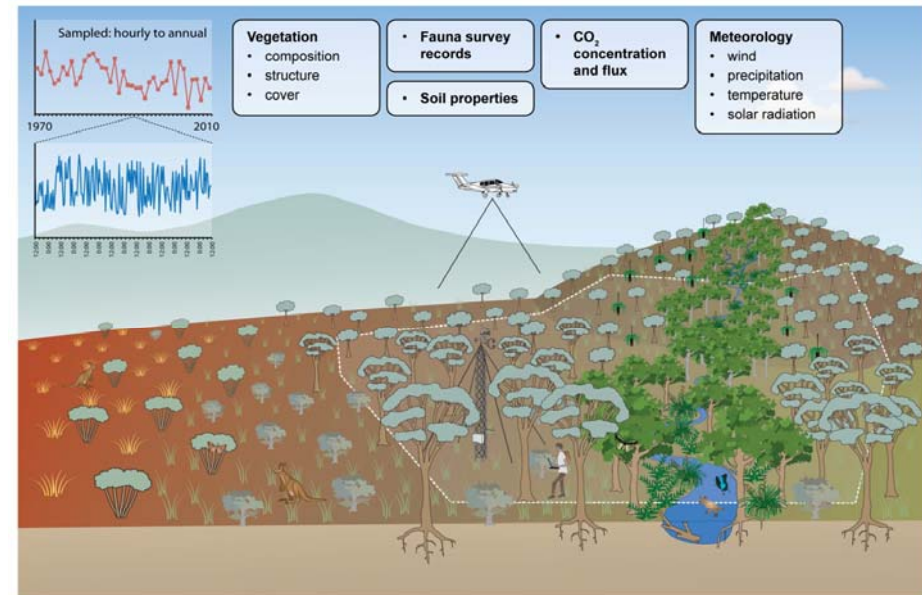


What is a Supersite?

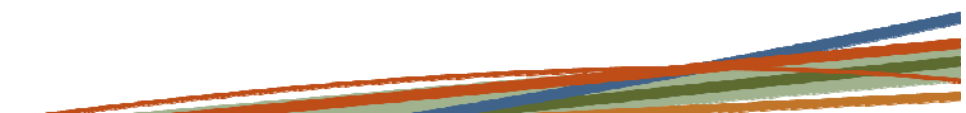
- Intensive field station in a **typical and important biome**
- Building(s) and physical instrumentation.
- Scientists and technical support staff.
- Transect (ecological gradients/contrasts, 10km - 400km)

Core activities

- Ozflux system
- Plant physiological and soil measurements
- Long term vegetation monitoring
- Long term faunal monitoring



TERN graphic of Supersite functionality

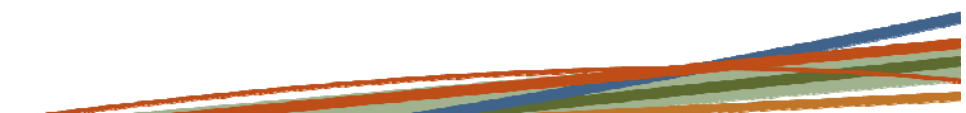




Australian Supersite Network

Aim of the Facility

- Establish a **nationally consistent** network of **Supersites**.
- Provide data streams with **high temporal/spatial resolution**.
- Provide a **comprehensive suite** of ecosystem measurements (vegetation dynamics/stocks, biodiversity, microclimate, fluxes, hydrology and biogeochemistry)
- Provide **process based information** on ecosystem function.
- Provide key data for **Scaling/Integration** and **Auscover**
- To **serve land managers, scientists** and inform the **public**





Chowilla Supersite
Eddy Flux system



Key Ecosystem Questions being Addressed

Question 1 What are the current stocks and fluxes of energy, carbon, water and nutrients between the terrestrial (and aquatic) ecosystem components and the atmosphere/hydrosphere/geosphere?

- 1a. response to management/disturbance/inter-annual variability?
- 1b. **key processes** that determine ecosystem/non-biosphere exchanges?
- 1c. key processes expected to respond to **future environmental change**
- 1d. **general trends** across the network?

Question 2 What are the current patterns and dynamics of terrestrial biodiversity (and aquatic)?

- 2a. response to management/disturbance/inter-annual variability
- 2b. biodiversity response to future environmental change?
- 2c. **general patterns Δ abundance/biodiversity** across the network?



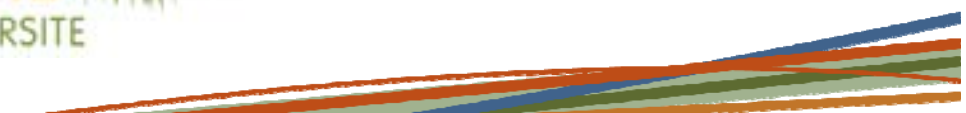


FNQ RAINFOREST SUPERSITE

(AKA. RAINFOREST BIODIVERSITY DEMONSTRATOR SUPERSITE)

Assoc. Prof. Mike Liddell

James Cook University



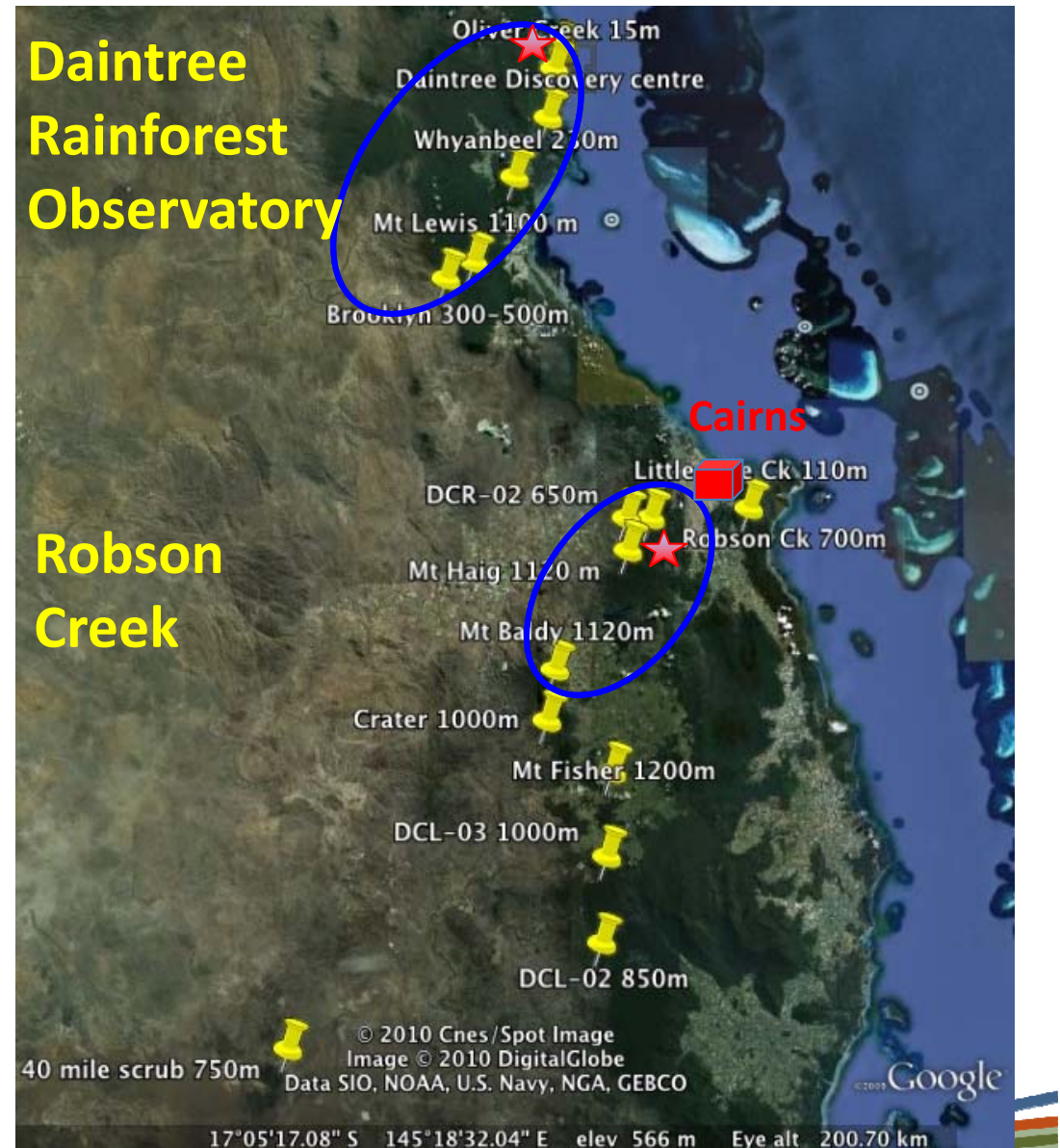


Wet Tropical
Rainforest
(Upland / Lowland)

Robson Creek /
Daintree Rainforest
(base nodes)

Major clines in
Altitude
Rainfall
Temperature

FNQ Rainforest





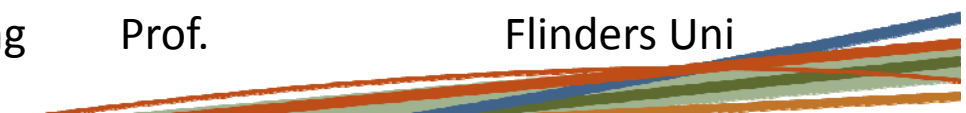
Partners

Wet Tropical Rainforest
 Robson Creek (Upland)
 Daintree (Lowland)

Mike Liddell (JCU)



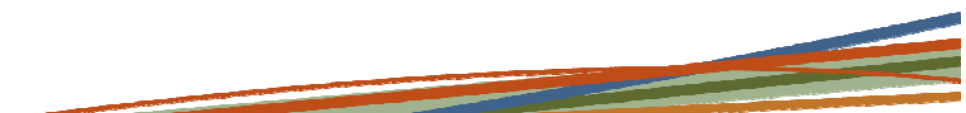
Investigator	Role	Position	Organisation
<u>Mike Liddell</u>	Fluxes, Micromet	Asso. Prof.	JCU
Steve Williams	CTBCC faunal transects	Prof., CTBCC	JCU
Michael Bird	Freshwater geochem	Prof, Fed. Fellow	JCU
Paul Nelson	Soils, Hydrology	Sen. Lect.	JCU
Marc Le Blanc	Hydrology	Sen. Lect.	JCU
Dan Metcalfe	Veg. survey, phenology	Senior Scientist	CSIRO Sust. Eco.
Dave Westcott	Avian monitoring	Senior Scientist	CSIRO Sust. Eco.
Roger Kitching	Invertebrate monitoring	Prof.	Griffith
Pete Green	Seedling dynamics	Lect.	La Trobe
Owen Atkin	Plant physiology	Prof.	ANU
Jorg Hacker	Airborne remote sensing	Prof.	Flinders Uni





Relevance/benefit to environmental science research and management

- ❖ The FNQ Rainforest Supersite will focus on **two representative transects** in the Wet Tropics rainforests. The transects span the **lowland** and **upland** rainforests. A **process based** understanding will be developed.
- ❖ These rainforests are recognised as a **major repository of Australian terrestrial biodiversity** and they are under threat from climate change.
- ❖ **Longevity** is required and a MOU with WTMA/DERM will ensure a route to this.





Key Research Questions

- ❖ How are the **biota** (esp. locally endemic species) **changing in range and abundance** (incl. plant community dynamics), and what are the drivers of change?
- ❖ What are the fundamental **vertical and lateral energy, carbon, water and nutrient stocks and flows** in the tropical forests of far north Queensland and are these stocks and flows likely to change significantly in the future?



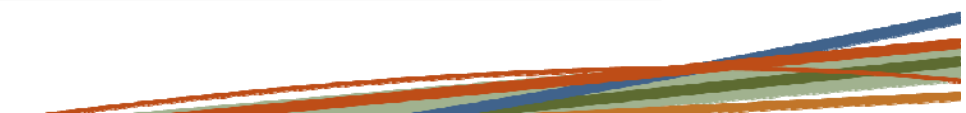
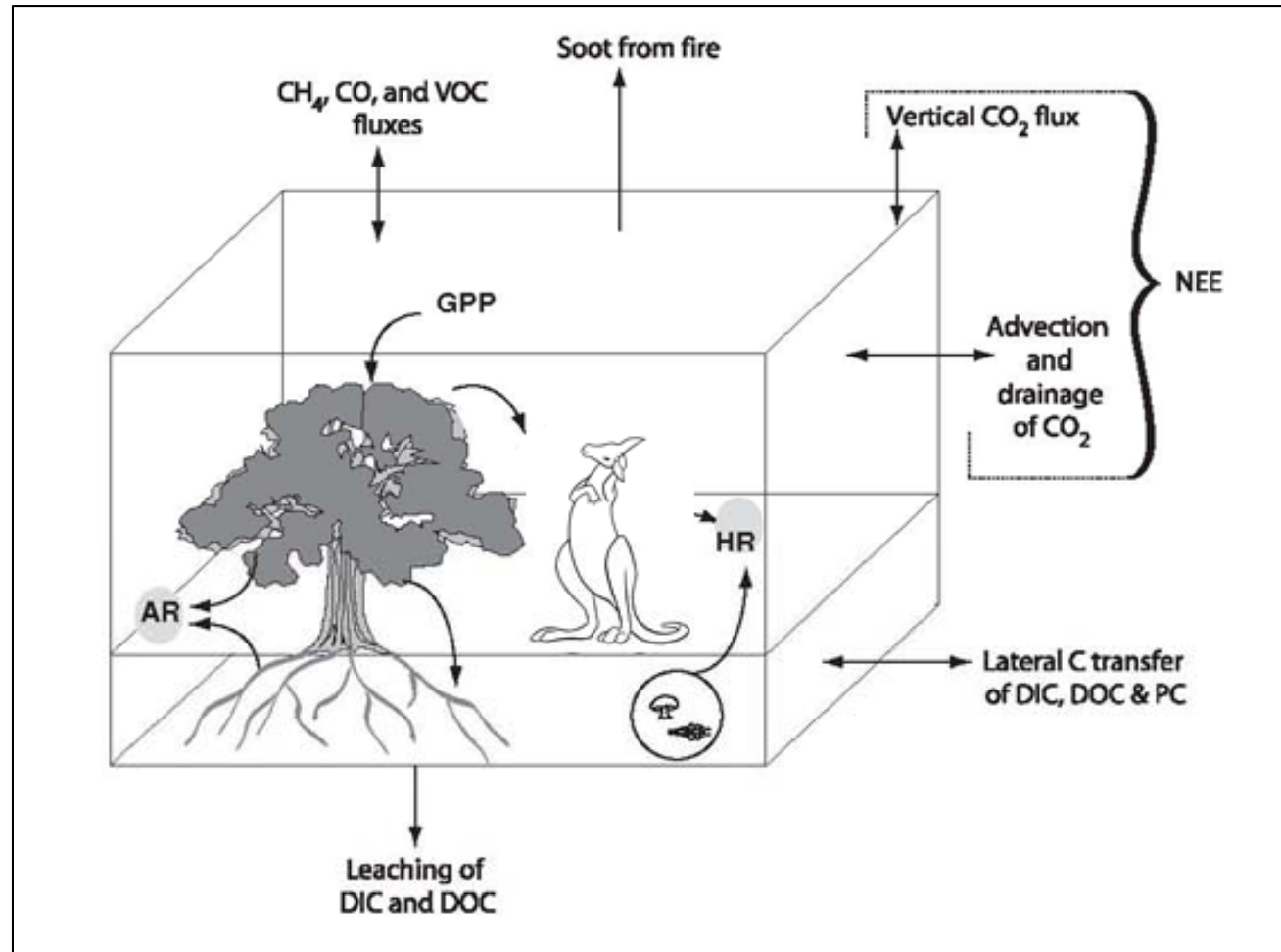
DAINTREE RAINFOREST OBSERVATORY





Daintree Rainforest Observatory

A Process Based Understanding of Fluxes



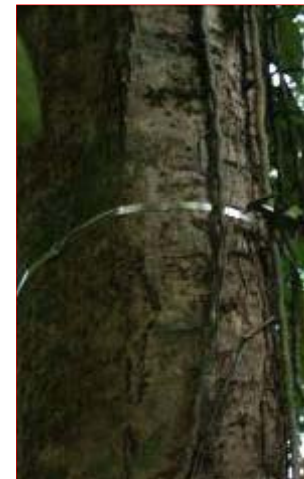
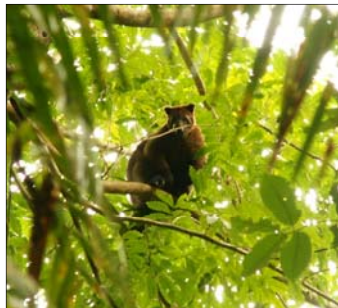


Daintree Rainforest Observatory

Current Activities / Progress

TERN-1

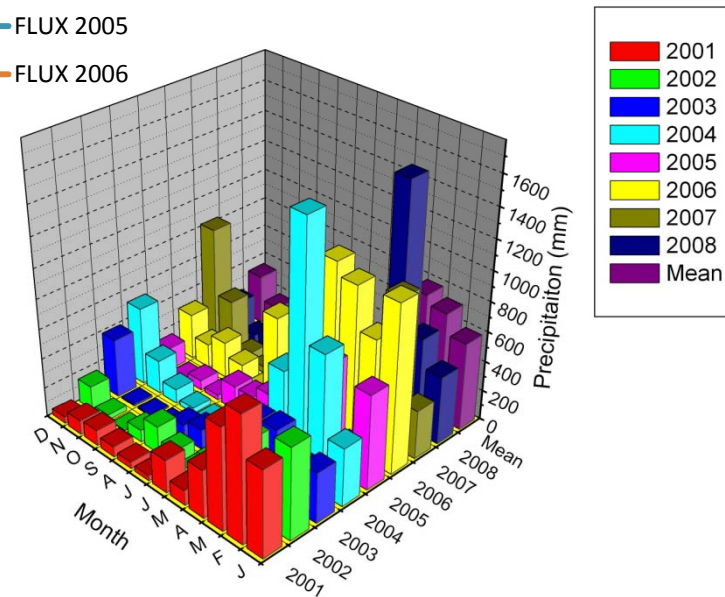
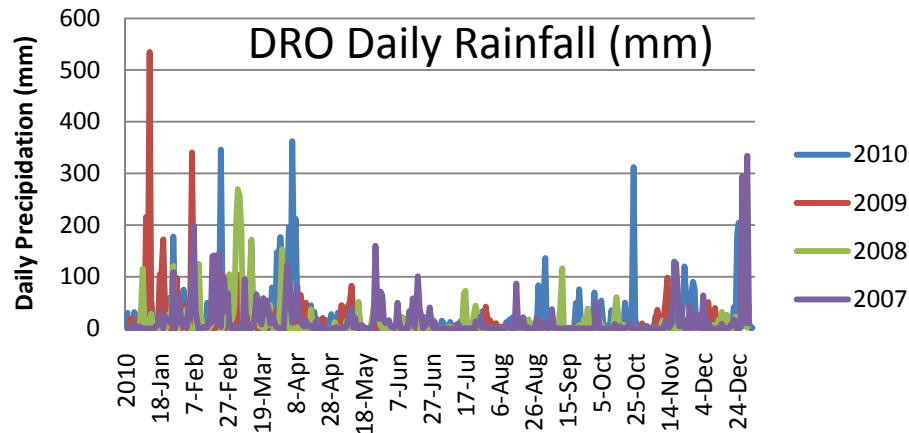
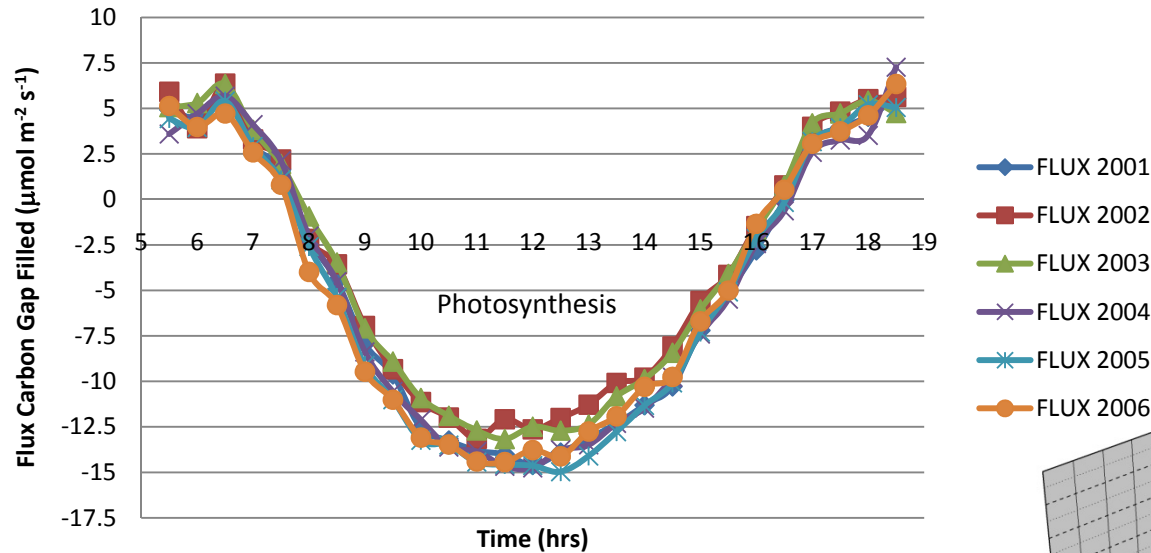
- ❖ **Sub-project 1: 1 Ha Census Plot.**
>10cm dbh. 2000 started, 3 census – last 2010.
- ❖ **Sub-project 2: Canopy faunal abundance.**





Daintree Rainforest

Carbon Fluxes and Drought

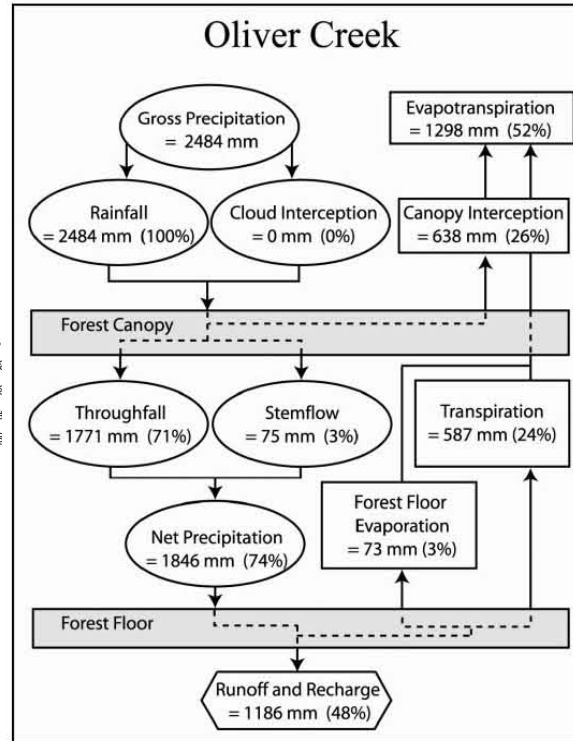
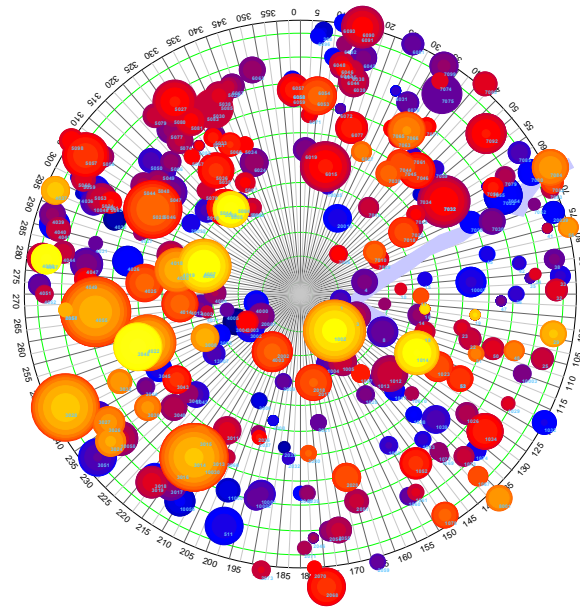


Monthly Rainfall (mm) at the Cape Tribulation BOM station (data courtesy of BOM)



Daintree Rainforest

Fluxes : Plants



Average water balance components for Oliver Creek, Daintree Rainforest. Precipitation input pathways are shown in ellipses, evaporative losses are shown in rectangles and runoff/recharge losses are shown in hexagons. Percentages of gross precipitation are shown in brackets (McJannet, Wallace)

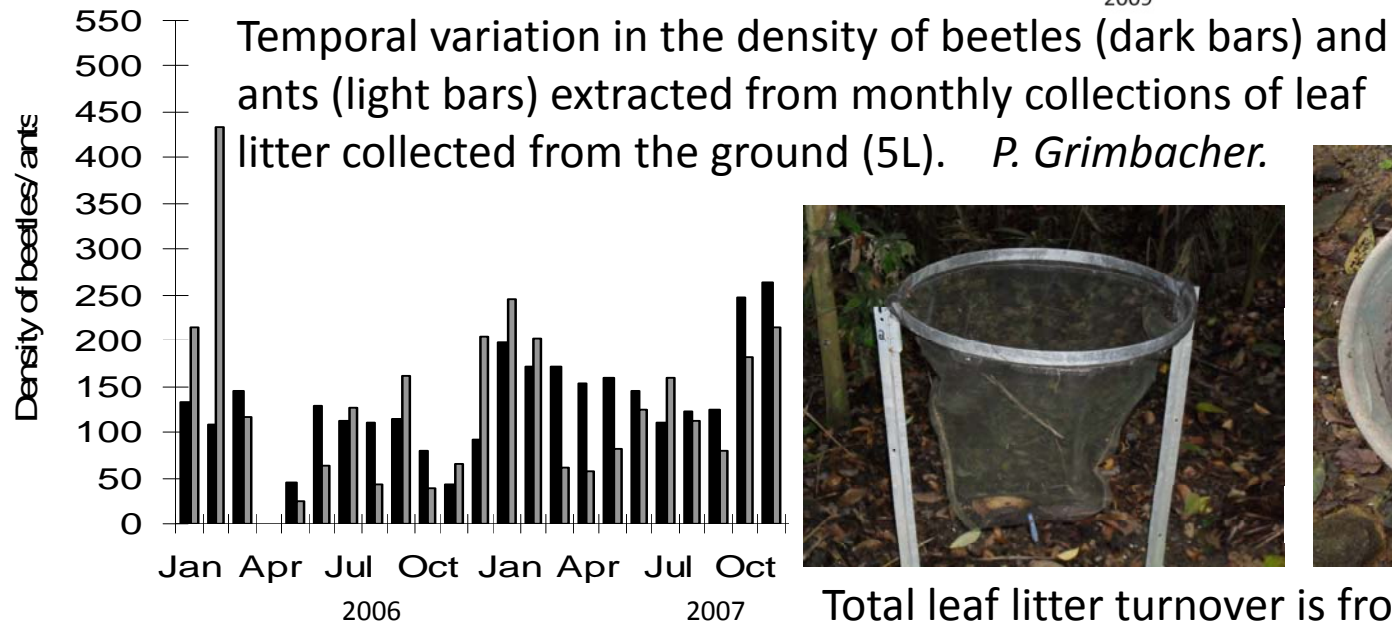
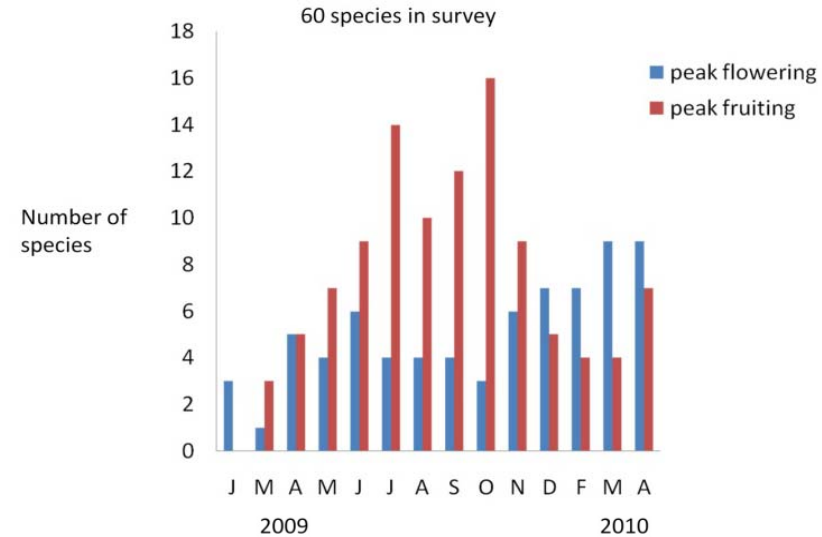


Daintree

Fluxes : Plants, Animals



Flowering and fruiting phenological spectrum for 57 tree species at the DRO. *C. Gross.*



Total leaf litter turnover is from 0.5 t/ha/mo dry season to 2.5 t/ha/mo wet season.

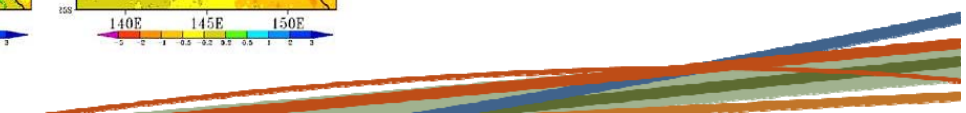
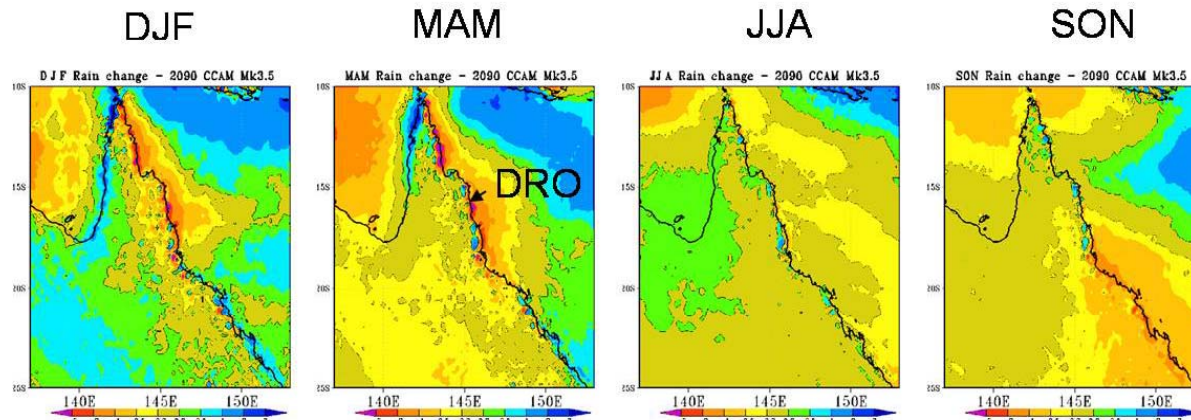
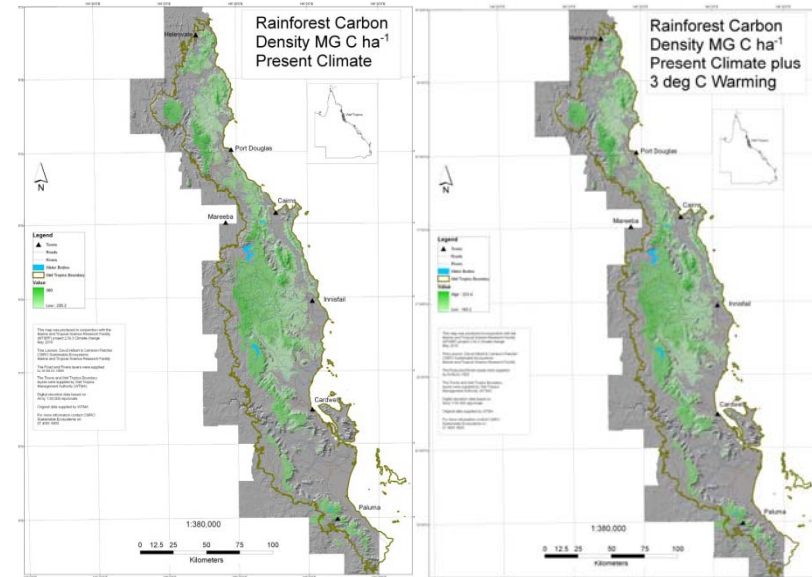


Daintree

Modelling – Climate Change

The potential C stock of rainforests in the Wet Tropics bioregion in the current climate and after 3 degrees of climate warming. The colour scaling is different between plots (a) 235-360 t C ha⁻¹, (b) 193-324 t C ha⁻¹ (*Source: Hilbert 2010*)

Season Rainfall changes (mm/day) from downscaled simulations from the Mk 3.5 GCM to 1 14km grid. (*Source: Suppiah 2010*)





Daintree

Remote Sensing Links

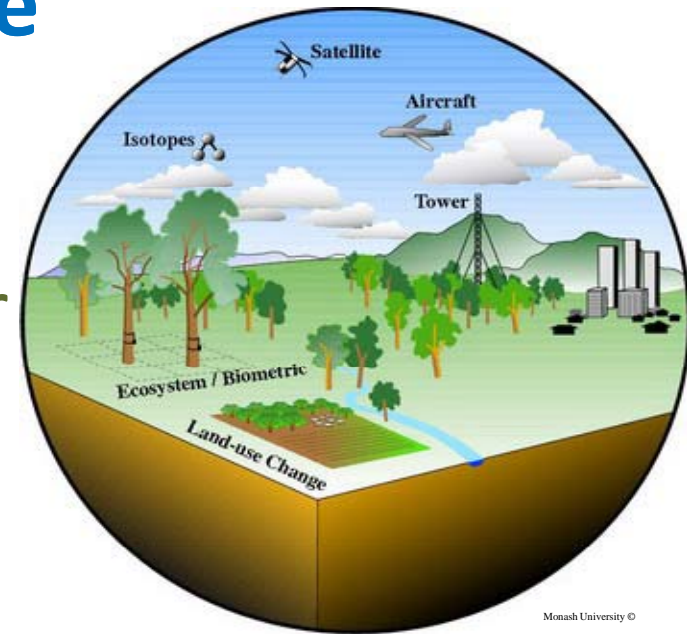
Four Supersites have been nominally selected for Auscover Cal/Val work.

- FNQ Rainforest – Qld*
- Warra – Tas*
- Chowilla – SA*
- Great Western Woodlands – WA*

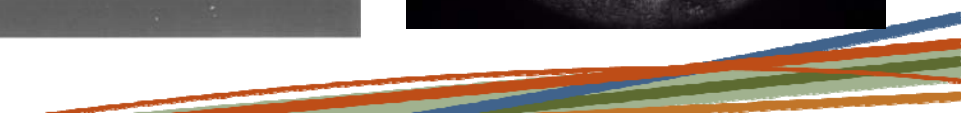
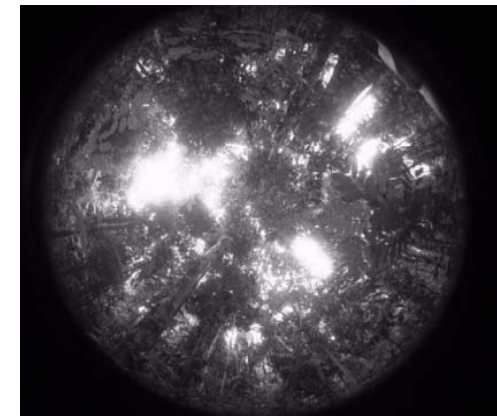
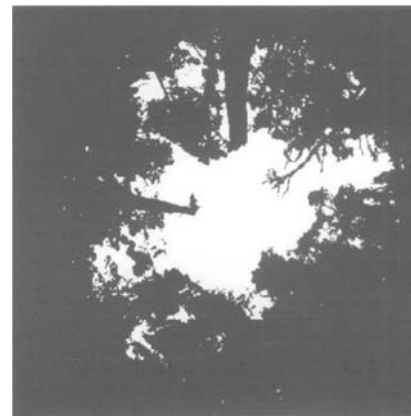
Hemispherical photos from DRO

a) February 1999 and b) November 2002

(Steve Turton)



Courtesy: Jason Beringer

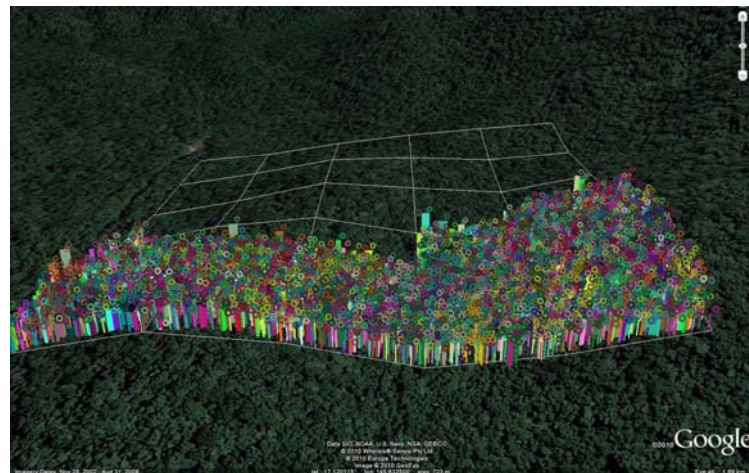




Robson Creek

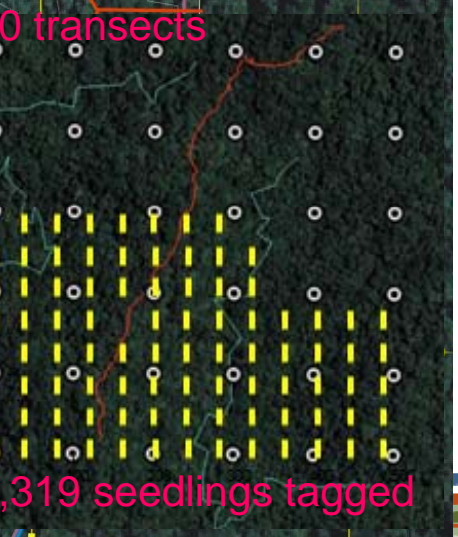
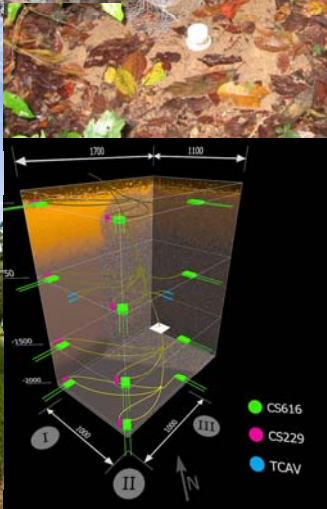
TERN-1

- ❖ **Sub-project 1:** Forest dynamics inventory plot.
25 Ha Census Plot (500m x 500m). >10cm dbh.
- ❖ **Sub-project 2:** Seedling dynamics transects.
- ❖ **Sub-project 3:** Insect biodiversity.
- ❖ **Sub-project 4:** Fauna transect biodiversity.
- ❖ **Sub-project 5:** Forest/atmosphere
CO₂/H₂O/Energy exchange.
Soil measurements.
Microclimate.





Robson Creek : Current Activities





Robson Creek : Progress

TERN-1

- ❖ **Sub-project 1:** >10Ha surveyed, >6000 trees in 7Ha.
- ❖ **Sub-project 2:** 169 transects, >7000 seedlings
- ❖ **Sub-project 3:** >1600 moths, > 250 morphospecies.
- ❖ **Sub-project 4:** 3 transects, 200-300 vertebrates/site.
- ❖ **Sub-project 5:** Weatherstation, soilpit, bore installed

Robson Creek : Future

TERN-1/TERN-EIF

- ❖ **Sub-project 1:** Complete plot/Phenology/ Avian.
- ❖ **Sub-project 2:** Complete seedling dynamics transects.
- ❖ **Sub-project 3:** Expand insect biodiversity surveys.
- ❖ **Sub-project 4:** Fauna biodiversity/new equipment.
- ❖ **Sub-project 5:** Complete flux tower.
- ❖ **Sub-project 6:** Freshwater water quality.

