

# Fluxing up the Deep North – an update

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# Outline

- Northern Tropical Transect – CDU, Monash, UTS
  - TERN OzFlux
  - ARC Discovery program - *Australian savanna landscapes: past, present and future* (Beringer, Hutley, Yu, Haverd *et al.*)
    - ❖ Dr Brad Evans – Project Research Fellow (MQ Uni)
  - ARC Future Fellow – Beringer.com
- Land Use Change – CDU, Monash, Melb Uni
  - ARC Linkage project – *Impacts of deforestation and afforestation on greenhouse gas emissions, and carbon and water resources*
    - ❖ Dr Mila Bristow - Project Research Fellow (MQ Uni)
  - ARC LIEF *Mobile Australian field isotope alliance (MAFIA)* JCU, ANU, CDU
- Tropical Savanna Super Site – CDU, Monash, NT Gov
- Carbon Farming Initiative: SOC and afforestation – Qld Gov, USC, CDU
- ARC DP - Deciphering pre-human records of vegetation from northern Australian savanna



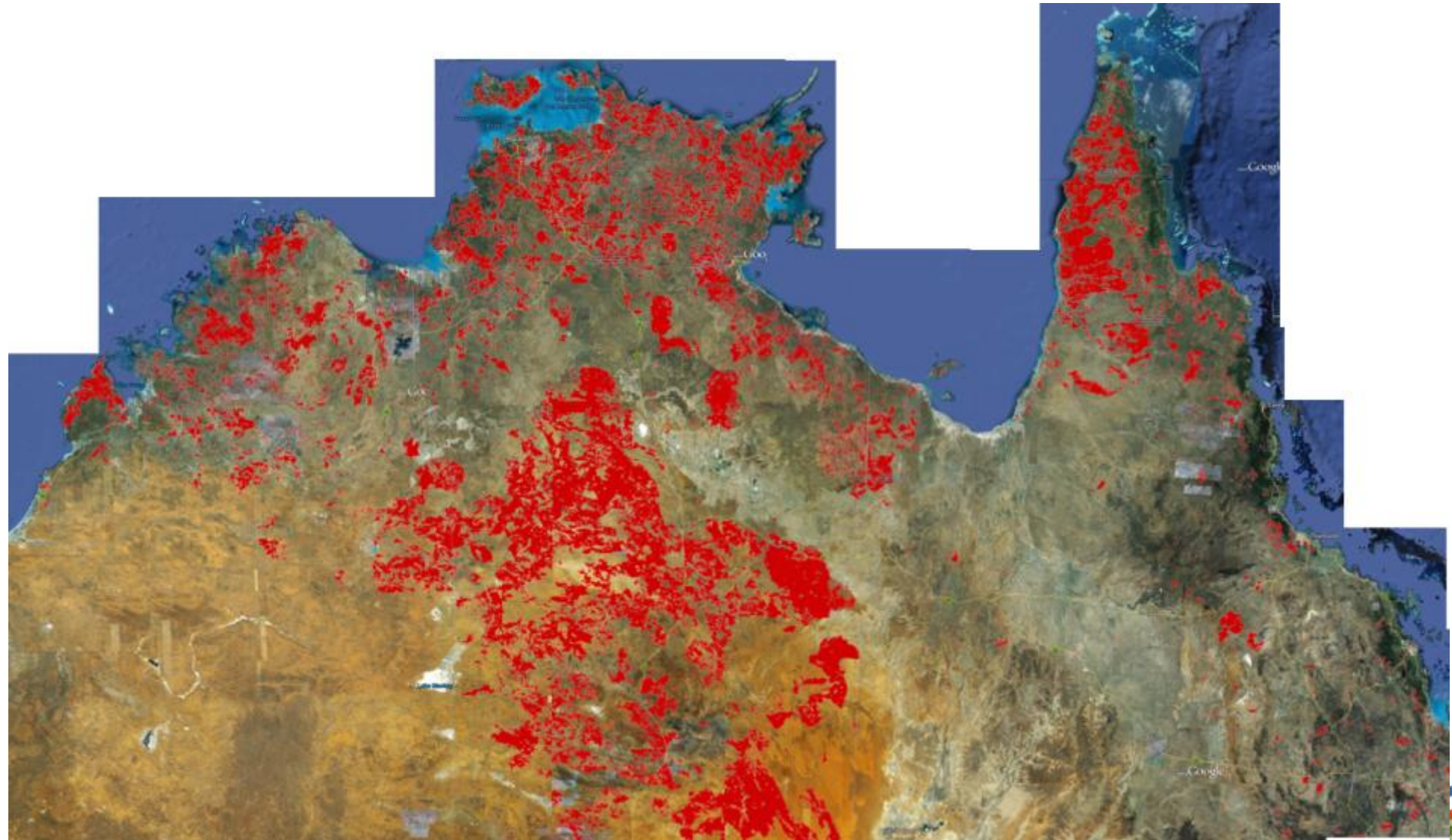
# Tropical savanna





# North Australian landscapes

## Savanna burning – 2011 fire scars



# North Australian Flux Network

# TERN OzFlux Facility

Adelaide River



Howard Springs



Fogg Dam



Daly River: Uncleared



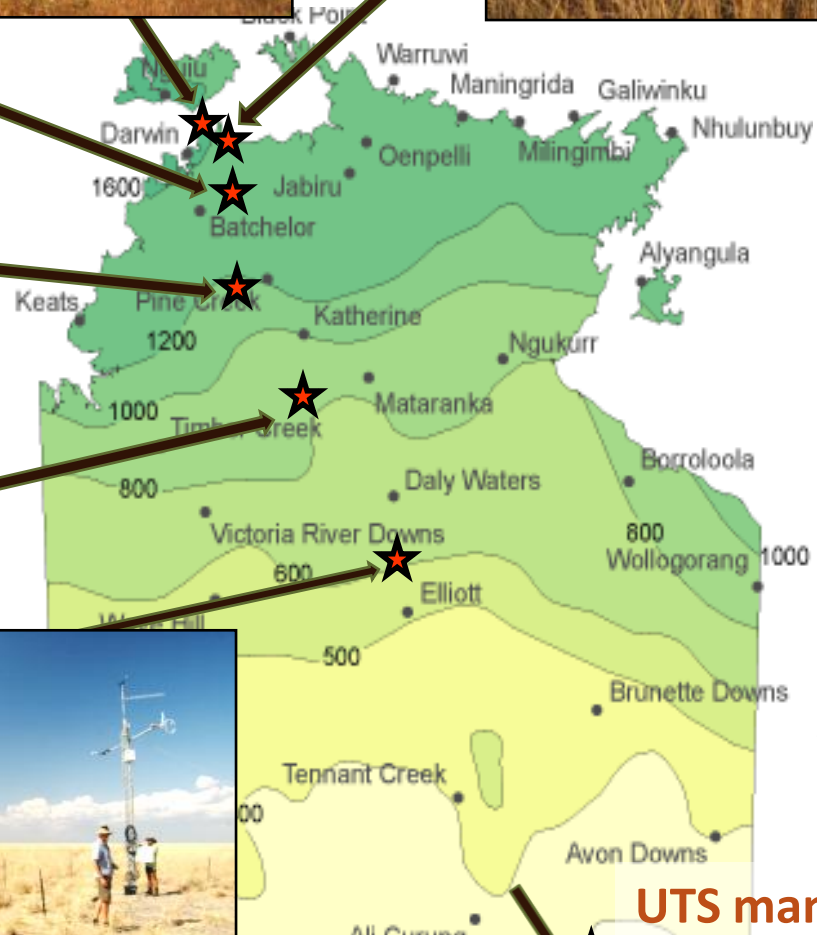
Dry River



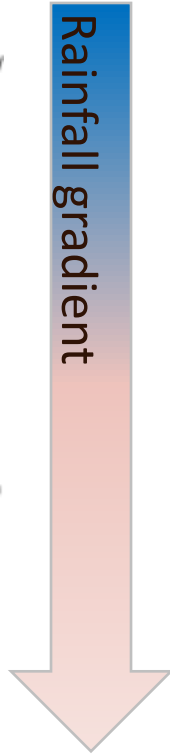
Sturt Plains



UTS managed ari  
zone tower



Rainfall gradient



Spatial patterns of mass and energy exchange

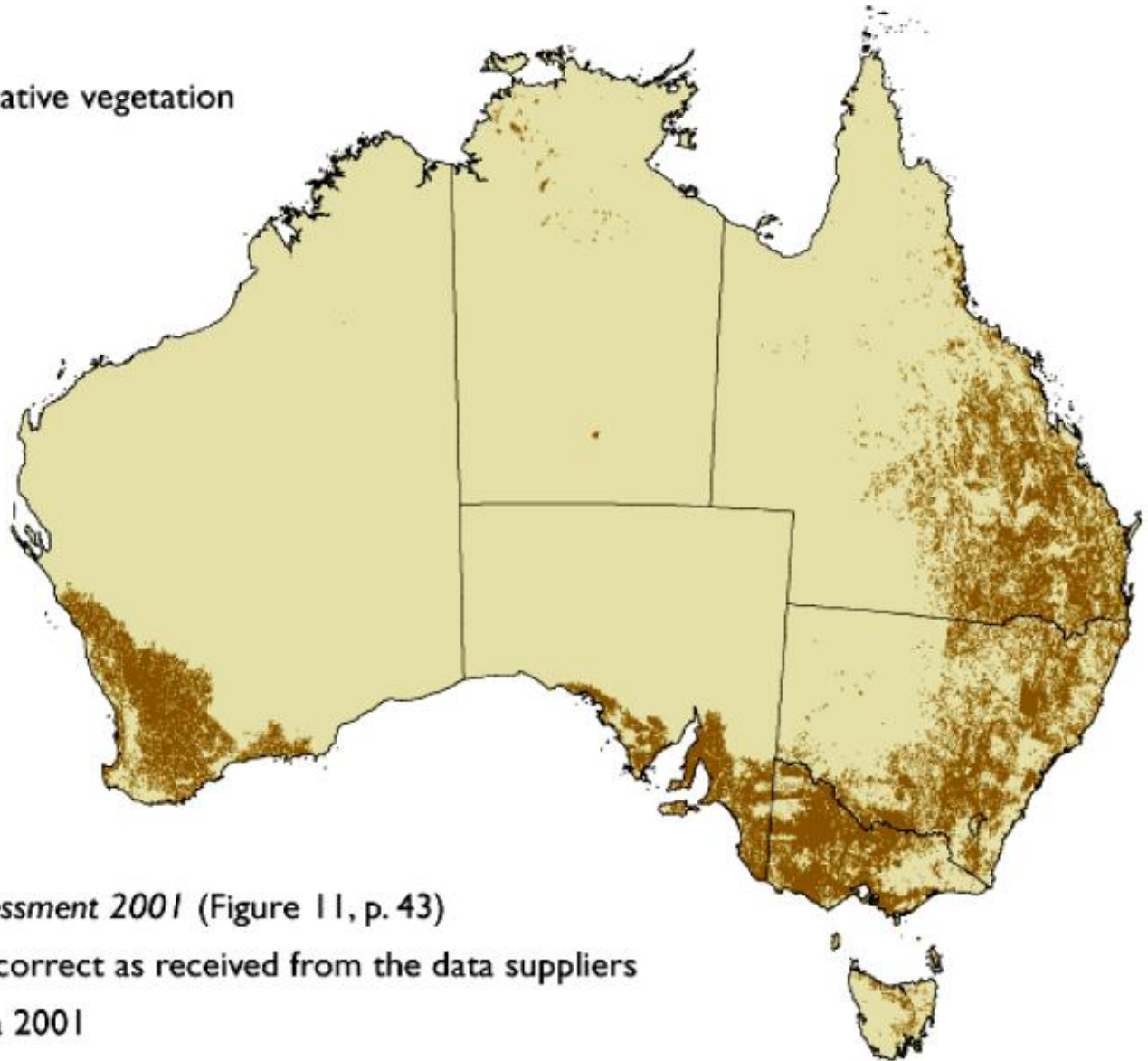
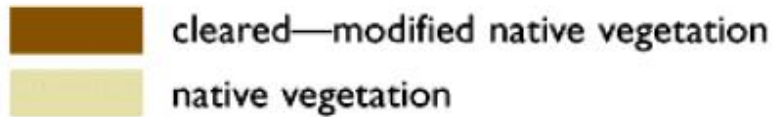


# Savanna land use change

- Savanna clearing and conversion to agricultural production – GHG emissions
- Afforestation and plantation establishment – impact on water balance and environmental flows?



# Land use in Australia today



## Data source:

*Australian Native Vegetation Assessment 2001* (Figure 11, p. 43)

Data used are assumed to be correct as received from the data suppliers

© Commonwealth of Australia 2001



# Land Use Change – *Impacts of deforestation and afforestation fluxes of C and water*

**Herald Sun**  
Stories start here.



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Last Updated: October 20, 2011

## Top End key for food bowl

Andrew Bolt | Herald Sun | September 21, 2011 12:00AM | 25 comments

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Harness the wet. Use available land. Only then will we be able to double food production, says Andrew Bolt. Herald Sun

**The Australian**

2011

National Affairs

## Tony Abbott's plan for northern foodbowl

- by: Sid Maher
- From: The Australian
- September 17, 2011 12:00AM

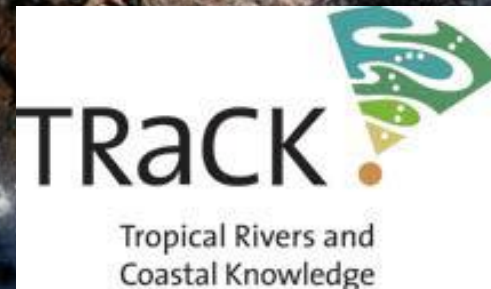
### TARGET RIVERS IN COALITION PUSH FOR DAMS





# North Australian water resources

**>60% of Australia's  
water resources**



# LUC Program - Savanna clearing and GHG

## Red Dirt Melon Farm (RDMF) Flux Tower

Daly River: uncleared savanna



Red Dirt Melons Farm – converted savanna



Rainfall gradient



Australian Government

Australian Research Council



# RDMF Tower - Expansion of an established water melon farm



- 3 plots cleared in March 2012
- 3 plots remain intact savanna

Catherine, NT

- 12 chambers in each plot
- 36 flux measures per treatment
- Measures start Oct 2011

# Savanna clearing and GHG

- Flux towers on paired sites
- Non-CO<sub>2</sub> program
- Track emissions from LUC
- Scale up to annual sink/source





# Tools used: standing biomass



- Need to know stocks as well as fluxes
- How much biomass in the savanna?
- Fire emissions calculations

# Non-CO<sub>2</sub> fluxes, soil C & N stocks with LUC



- Temporal and spatial sampling of soil efflux CO<sub>2</sub> and non-CO<sub>2</sub> and drivers
- Replicated cleared and uncleared plots
- NO<sub>3</sub>, NH<sub>4</sub> pool size and net nitrification
- Soil physico-chemical characteristics



# LUC phases

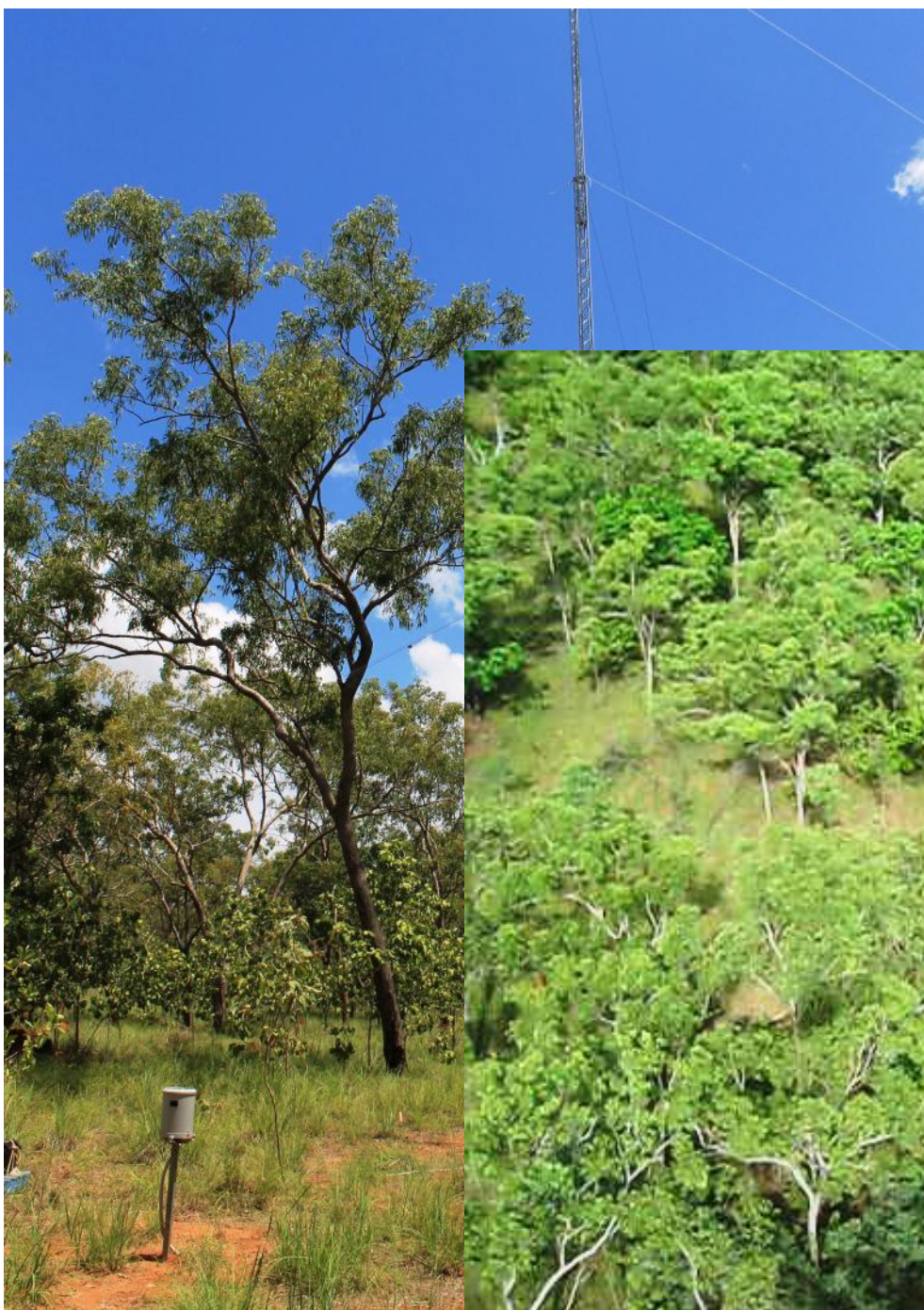
- Tower install pre-clearing
- Late dry season, Sep 2011
- Uncleared site running





# LUC phases

- Wet season 2011/12





- Clearing, March 2012

LUC phases





# LUC phases

- Post-clearing debris, April





- Curing and decomposition, regrowth, May-August 2012

## LUC phases





- Fire event, 16 August 2012



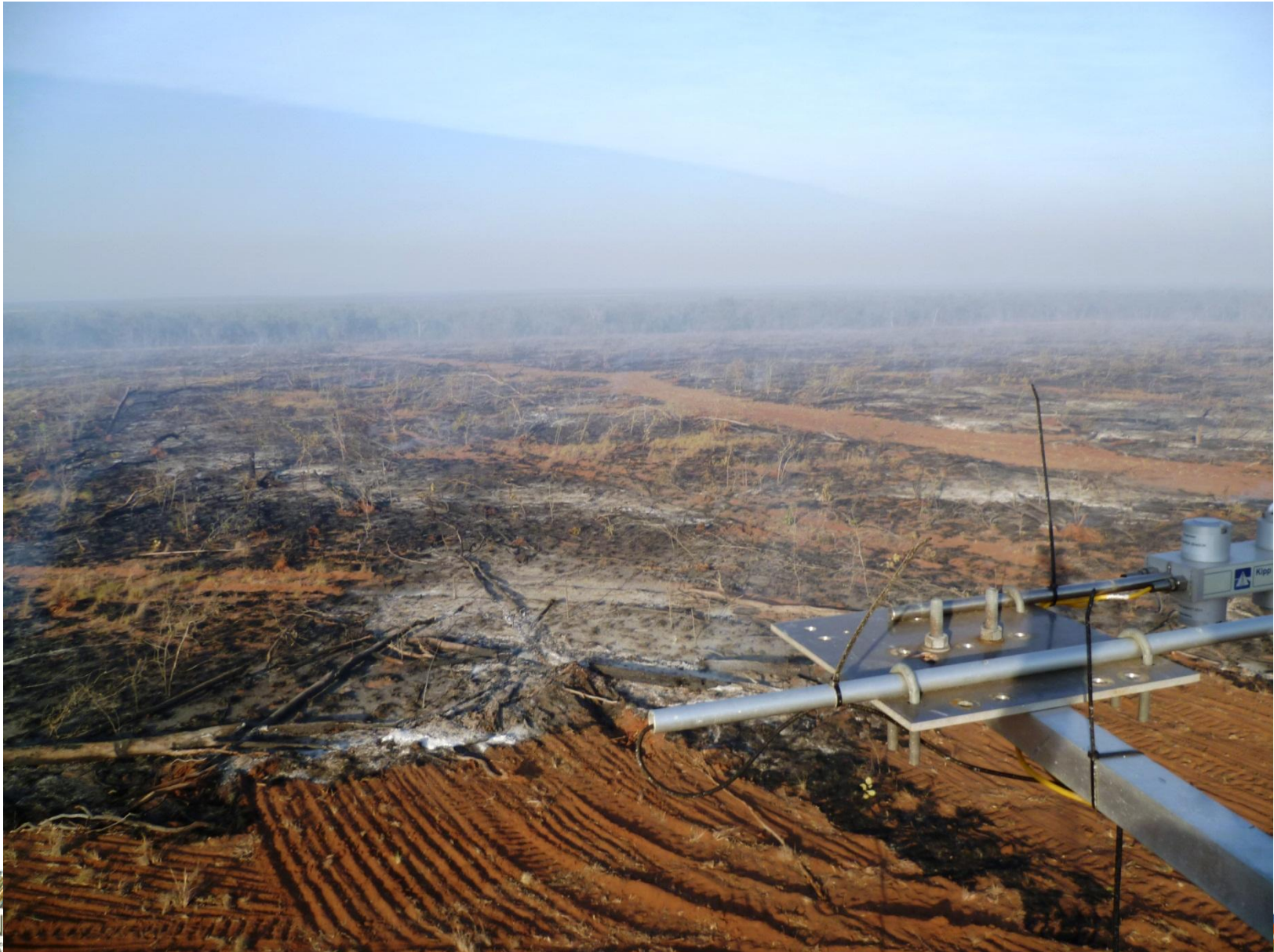
## LUC phases





- Post-fire, stock-pile, re-burn,  
August

## LUC phases





- Post-fire, debris removal, late dry season, September-October

## LUC phases

RDMF 2012/09/30 03:59:21





- Early wet season, re-growth,  
December to Feb 2013

## LUC phases





- Wet season, re-growth, site preparation

## LUC phases





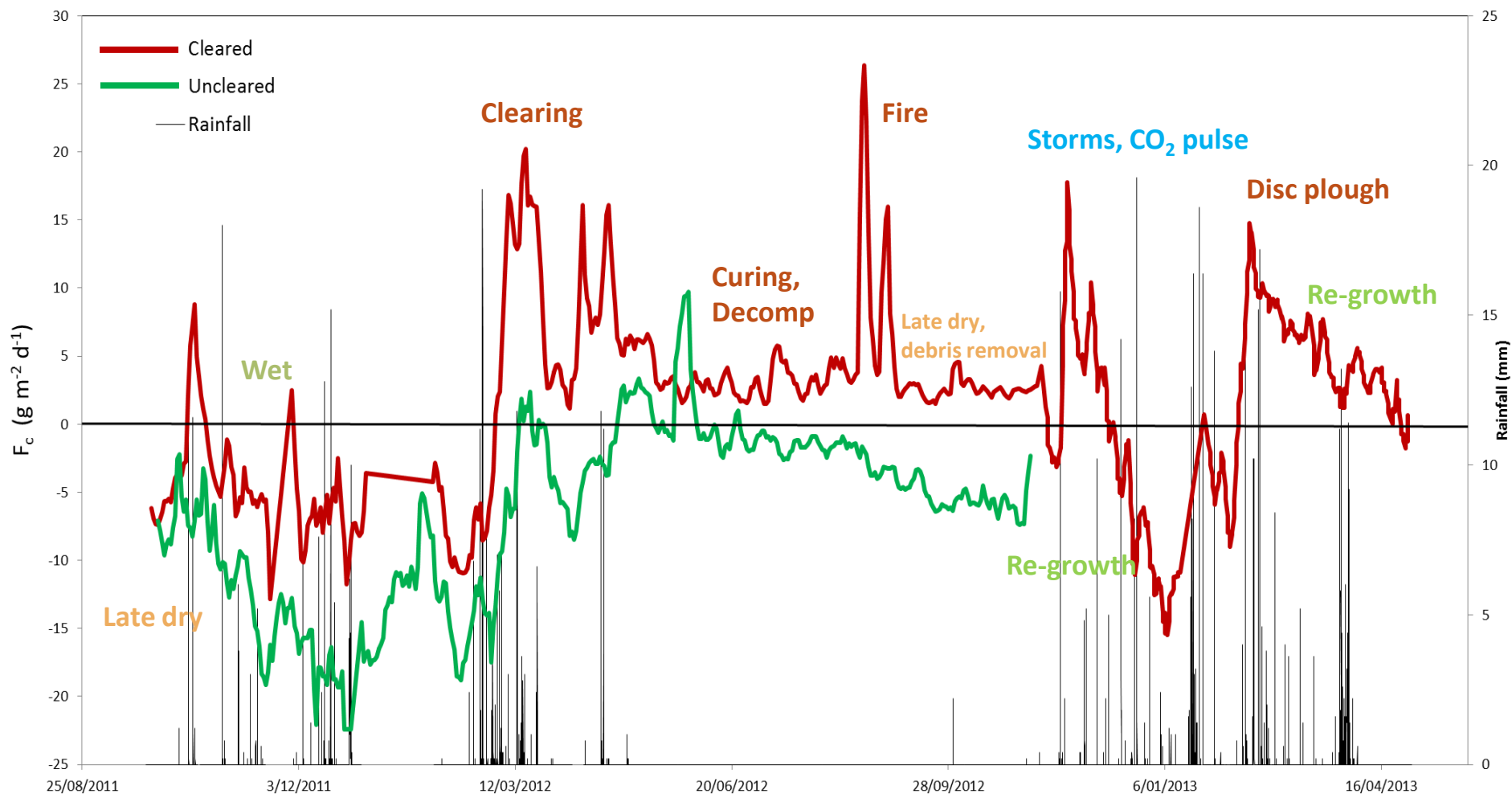
- Dry season, site preparation, disc ploughing, June
- Final prep and planting August 2013

## LUC phases





# LUC flux time series – CO<sub>2</sub> + non-CO<sub>2</sub>





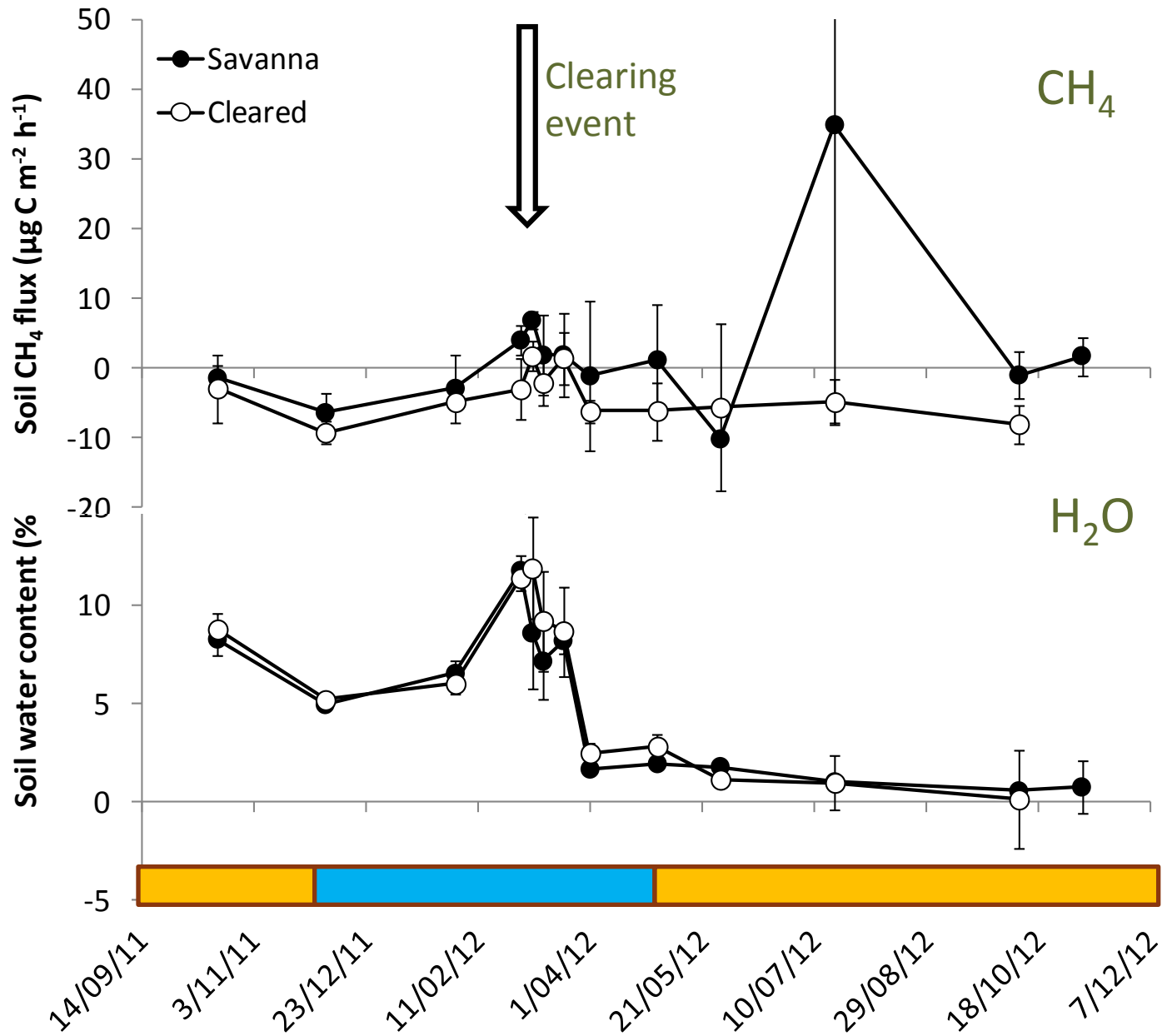
- Melon production

## LUC phases

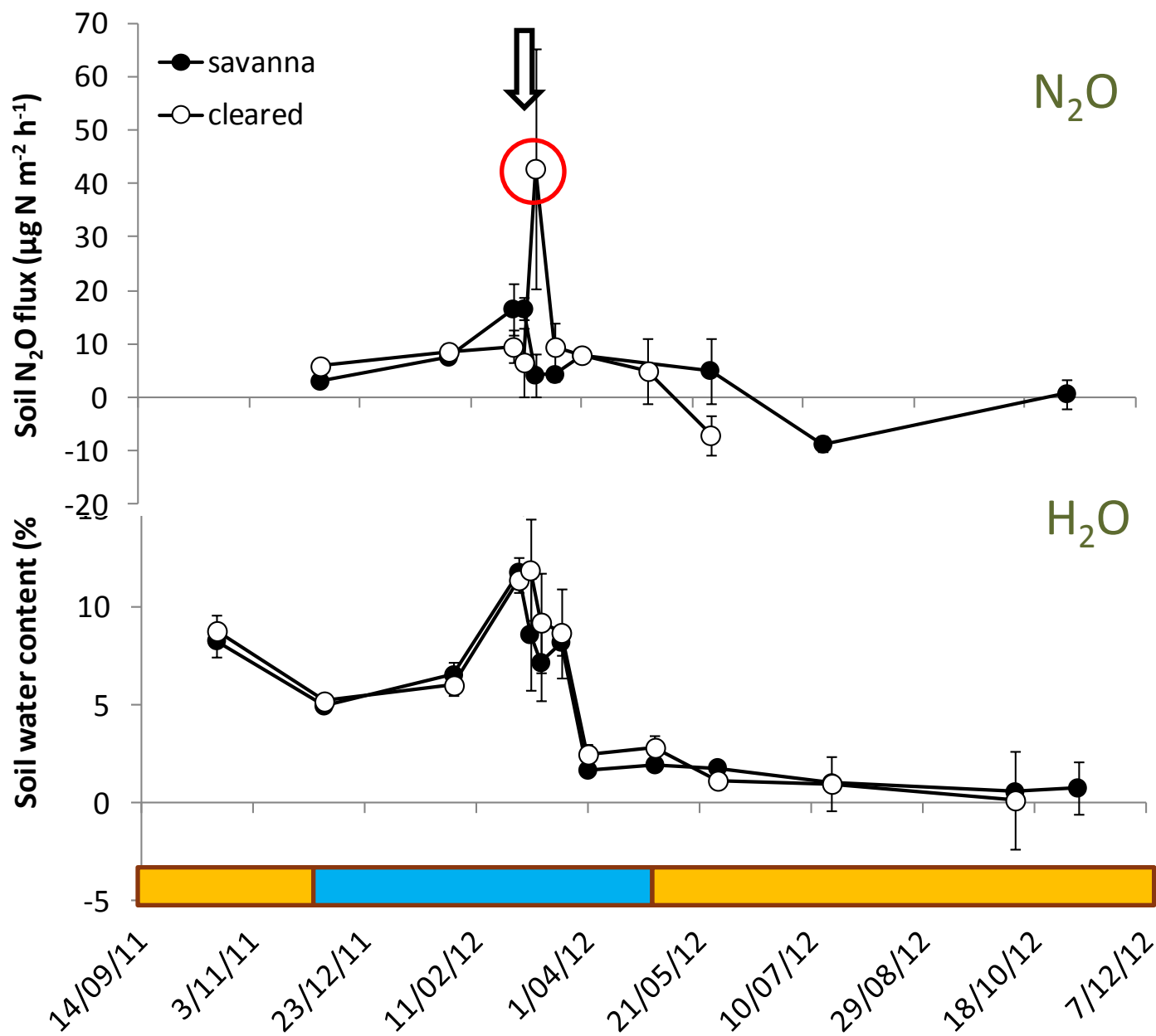




# Soil methane flux in relation to soil moisture change

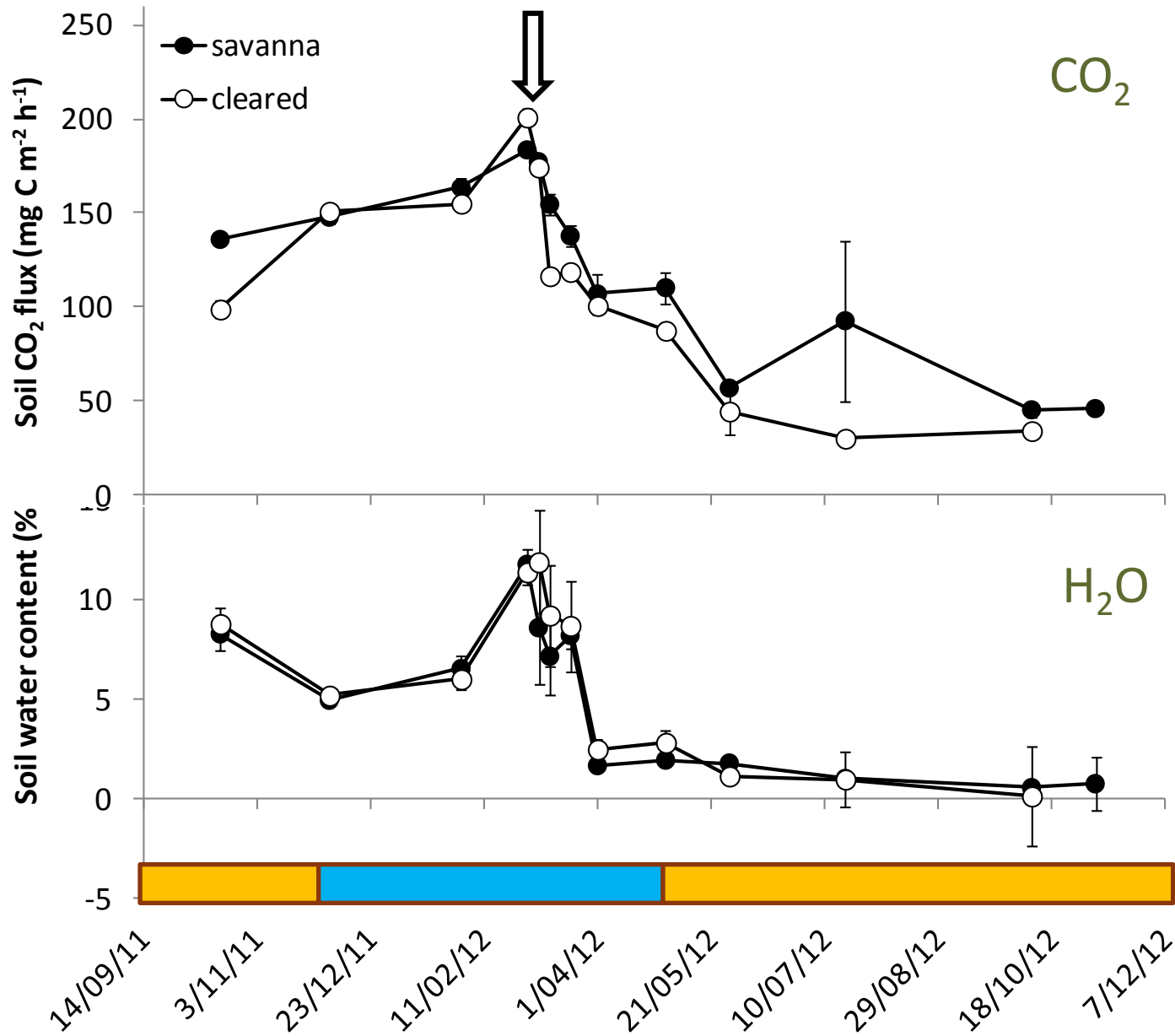


## Soil nitrous oxide flux in relation to soil moisture change

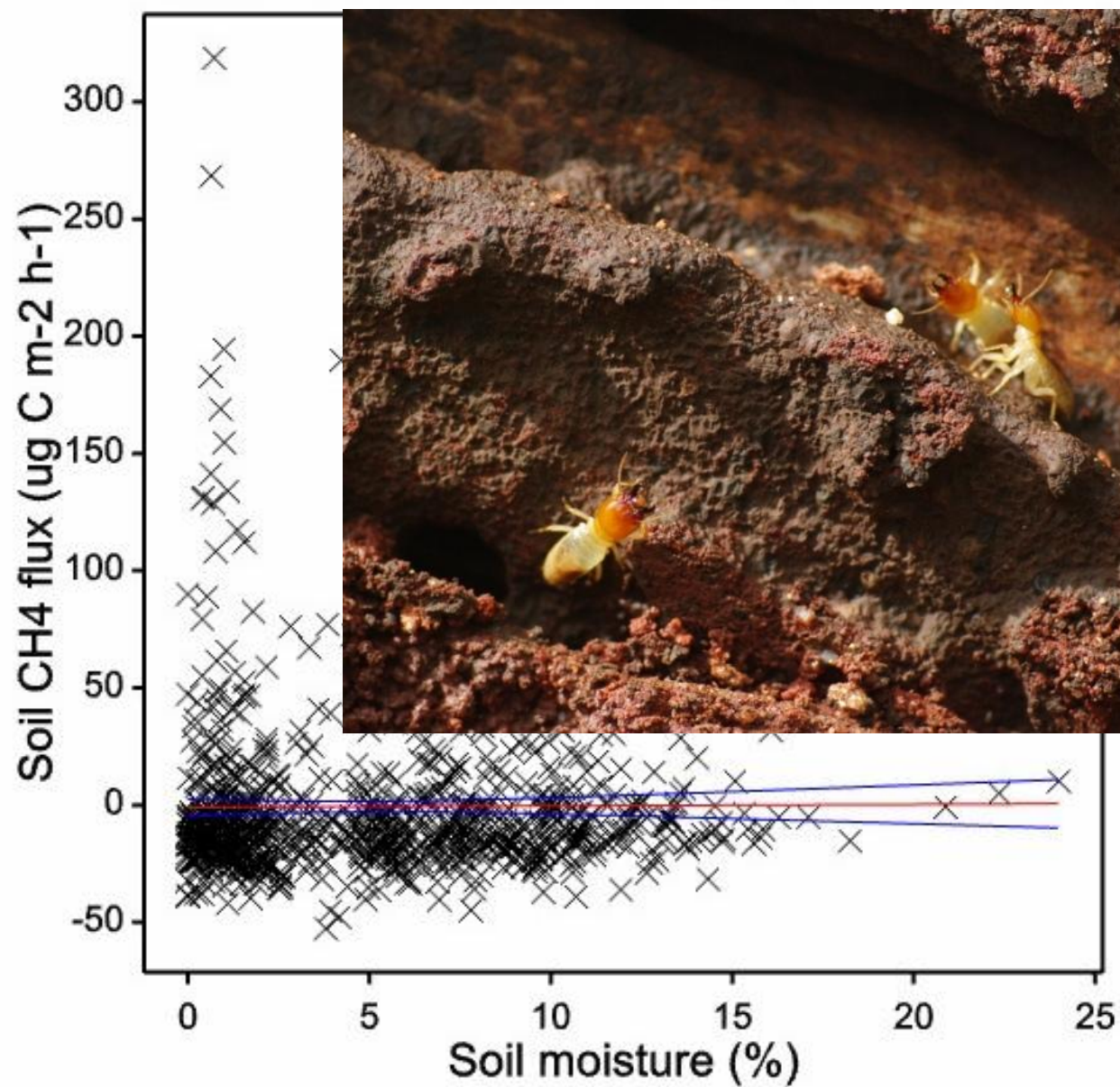




# Soil carbon dioxide flux in relation to soil moisture change



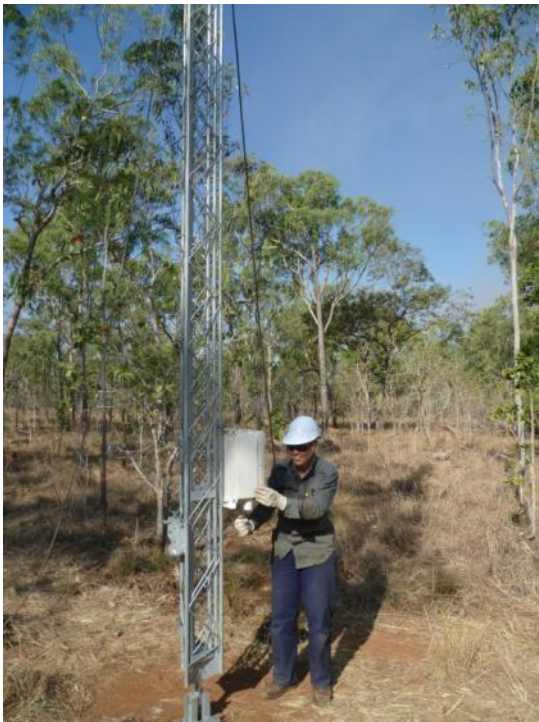
## Soil methane at a chamber level





# CO<sub>2</sub> from clearing: comparing cleared and uncleared tower sites

- Equivalent to 31.4 t C ha<sup>-1</sup> (or 115.4 t CO<sub>2</sub>-e ha<sup>-1</sup>)
- Equivalent to 12 years of carbon sequestration



# LUC and water resources - afforestation

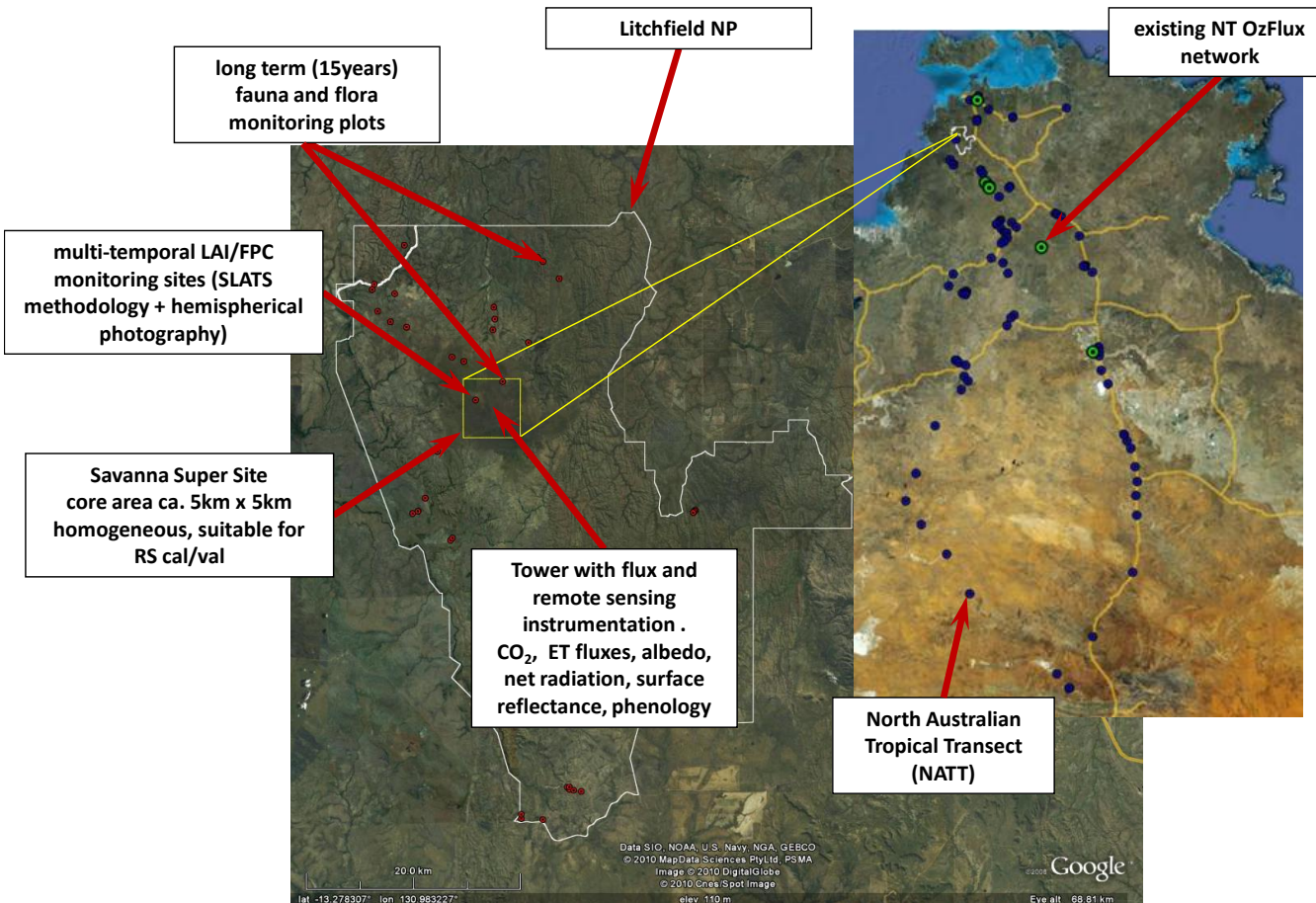
- Savanna v pasture v plantation forestry
- Preliminary modelling of water balance

*Summary of water balance components for contrasting land uses in the Douglas-Daly catchment, NT using the 3PG2 forest growth model. This modelling is described in Section 4 of this report. All units are  $\text{mm y}^{-1}$ .*

Water balance components	African mahogany plantation	Tropical savanna	Improved pasture
Rainfall	1286	1260	1260
Canopy Transpiration	637	270	898
Understory transpiration	n/a	392	n/a
Interception	90	64	56
Soil Evaporation	180	184	191
Total evapotranspiration	907	910	1157
Runoff/drainage	403	379	74
$\Delta\text{Soil}$	24	30	-28



# Savanna Super Site – Litchfield NP



- Fire and fluxes
  - Remote sensing savanna structure – tree:grass dynamics
  - TERN OzFlux
  - TERN AusCover
- 
- Progress:
    1. AAPA clearance
    2. Soil testing
    3. LiDar
    4. Vegetation surveys, LAI comparison

# Savanna Super Site – Litchfield NP

