

# Quarterly Newsletter

Issue 14, September 2016

## SuperSite and OzFlux Update

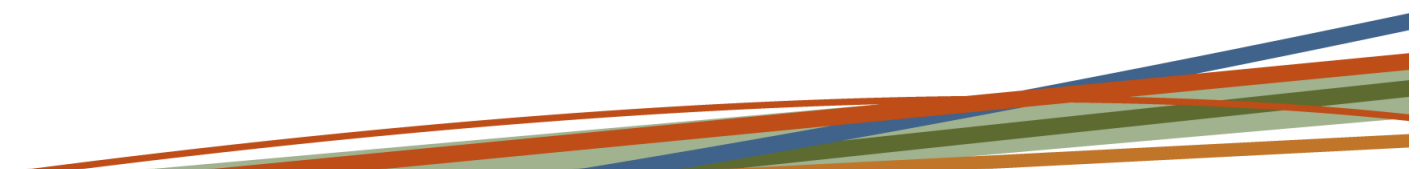
Welcome to the 14th edition of the TERN SuperSites/OzFlux and CZO AU Newsletter. There have been many changes over the last quarter. Due to the massive changes at CSIRO we have had to farewell Eva van Gorsel from OzFlux and SuperSites. We thank Eva for her efforts in directing OzFlux and developing the Tumbarumba SuperSite in difficult times. Suzanne Prober is taking on Eva's role as OzFlux Facility Director. Jacqui Stol is taking over the role of PI for the Tumbarumba Tall Eucalypt SuperSite and Will Woodgate is the PI for OzFlux activities at the site.

There have also been a number of changes at TERN Central with the resignation of TERN Director, Tim Clancy. We are fortunate to have Dr Beryl Morris from UQ step in as acting-Director until a replacement is recruited. Many of you will know Beryl who has attended all of the major TERN events over the years, sat in on EAC and over-seen the contracts from UQ to the organisations participating in TERN.

The TERN Advisory Board will be reformed with representatives of the major host institutions involved in running the Facilities in TERN. A Science Advisory Council will be formed to provide expert advice to the board (it will work as a sub-committee) and an Executive Group has been formed that comprises the Facility leaders (this has replaced the EAC). There will be a new User Reference Group comprising data users from different ecosystem science domains, TERN data people and general users of TERN infrastructure. The IIDDG will eventually be replaced once the TERN data systems have been merged – this process will commence once the future long term funding for TERN has arrived under the Roadmap. TERN's focus over the next quarter is preparing a compelling case for this NCRIS re-investment through the development of a detailed TERN strategic plan. Part of this process will involve modifications to TERN and facility logos and web pages to provide consistent branding and messaging from all facilities. The new vision will be to present TERN externally as a coherent set of research infrastructure that works inside a 'one TERN' framework – with the messaging around TERN infrastructure (rather than OzFlux or SuperSite infrastructure).

## SuperSite Central Update

The 2016-17 contract variations have been sent out with eight signed off on by institutions so far. The 2016-17 milestone deliverables are identical to the previous year with the addition of deployment of wood decomposition/termite baits that will be collected after 1 and 2 years. SuperSite Central has been busy lately with manufacture of 1506 Termite/Decomposition baits, which is well underway. This required cutting 470 m of pine into over 3000 segments before drying, weighing and bait construction. The question of wood decomposition will also be addressed by a number of SuperSites implementing the "[Tea Bag Index](#)" where specific brands of Rooibos and Green tea bags are buried for 60-9 days before retrieval, drying and weighing.





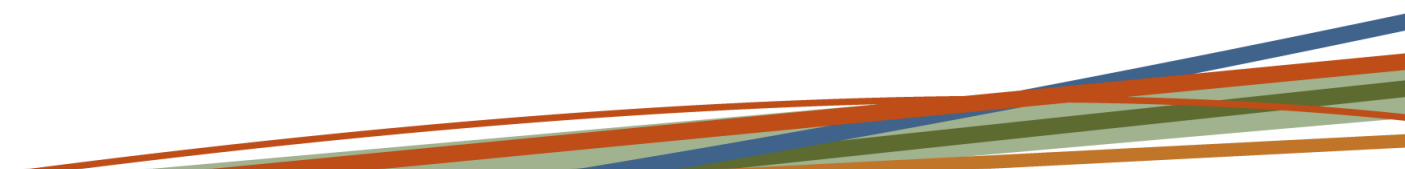
470 m of pine waiting to be cut up into Termite/Decomposition baits



Rebecca Woodrow building baits

Phenocameras and Acoustic recorders are showing their age and starting to fail in the field across multiple sites. With still no news about capital upgrade funding things are getting dire. Nico has been busy designing and constructing the first of the new Raspberry Pi based Phenocams which will be sent to SuperSites with camera failures for 6 months of field testing. The first unit has been built and the software systems are now undergoing the final stages of development. This will be the first item of sensor tech developed by TERN to cope with unique field conditions presented in Australia and stringent design requirements that came out of an ACEAS working group and AusCover / Phenomics input.

An article in the OzFlux Biogeosciences special edition is another output of that ACEAS working group on phenocams. Caitlin Moore *et al.* <http://www.biogeosciences.net/13/5085/2016/>.



The SuperSites Bioimages Portal is now up and running at <http://bioimages.supersites.net.au/>. Some refinements will be needed so please have a look and send any suggestions to Mirko.

Mirko attended the National Climate Change Adaptation Research Facility (NCCARF) meeting in Adelaide in July. A wide range of climate change topics were covered as NCCARF heads to the end of its initial funding in mid-2017. There may be opportunities for TERN in the national carbon stocktaking required by the recent Paris agreement and interactions with the newly formed CSIRO Climate Response and Adaptation Unit.

## OzFlux Central Update

The OzFlux special issue closed last May with 22 submissions. Most of these are now coming close to publication. Well done all.

This year the TERN OzFlux Workshop and conference was held at Calperum in the Riverland. Both were highly successful and well attended events, and we enjoyed a tour around the local woodlands and mallee. The meetings were followed by the SuperSite face-to-face meeting in Adelaide. One outcome of the Calperum meeting was re-establishment of the OzFlux Steering Committee. We welcome back Helen Cleugh as Chair. All PIs and a number of observers are invited to the meetings. Positions are currently held as follows:

Current appointments as of 4 August 2016 are:

Steering Committee Position	Appointee 4 August 2016	
Chair	Helen Cleugh	CSIRO O&A
Facility Director	Suzanne Prober	CSIRO L&W
Science Director	James Cleverly	University of Technology Sydney
Secretary	Craig Macfarlane	CSIRO L&W
Comms (1) joint SuperSites	Mirko Karan	James Cook University
Comms (2) OzFlux external	Anne Griebel	Western Sydney University
Comms (3) OzFlux conference	Lindsay Hutley	Charles Darwin University
Central Node representative	Peter Isaac, Ian McHugh, Cacaelia as available	Independent, Monash Univ, Flinders Univ
Collaboration & science links	Jason Beringer	University of WA
Industry engagement	Wayne Meyer + Subcommittee*	University of Adelaide

\*Wayne Meyer (Agriculture, Water) reporting for subcommittee comprising Michelle Ganes (Agriculture), Tim Wardlaw (Forestry), Peter Cale (Education and Outreach), Jason Beringer (Educational development, goals and opportunities), Mike Liddell (Tourism)

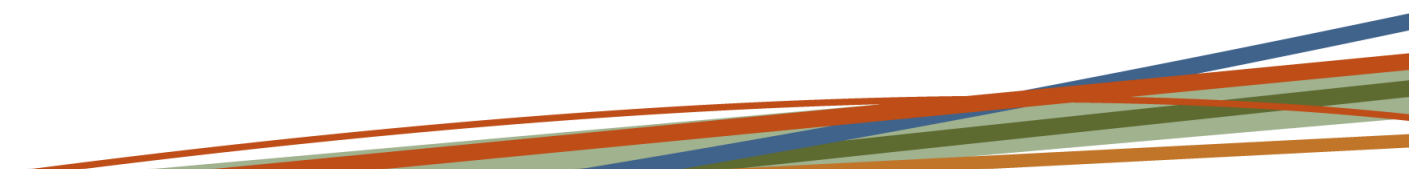
Contract variations are currently in preparation, with the first off the mark sent out last week and others to come soon.

The **National Agricultural Nitrous Oxide Research Program** (NANORP, a national network looking at nitrous oxide emissions) have recently published a special issue that may be of interest to the OzFlux community. <http://www.publish.csiro.au/nid/85/issue/8011.htm>

From 2009 to 2016, Peter Grace provided science leadership and coordinated the Nitrous Oxide Research Program (NORP) and the National Agricultural Nitrous Oxide Research Program (NANORP). NANORP was a major initiative with \$50M cash and in-kind investment across 23 separate projects. The NANORP involved federal government, all state governments (except SA), CSIRO, multiple universities from across Australia and RDCs with major investments by grains and dairy and supported by the cane, horticulture and cotton industries. This was the largest coordinated nitrogen R&D program ever funded by the federal government focusing on nitrogen cycling in agricultural systems. The NANORP focused on increasing nitrogen use efficiency in agricultural systems whilst reducing nitrous oxide, a potent greenhouse gas which in an excellent measurable indicator of inefficiencies in the soil nitrogen cycle. Leadership of this program required an expert knowledge of the complex interactions of the soil carbon, nitrogen and water cycles and impacts on plant production.

### The real world impact

The practical management strategies to increase nitrogen use efficiency developed as a direct result of the NORP and NANORP research equated to \$114 M in annual savings to Australian producers, and an additional \$13 M in carbon credits. The added value of the NORP and NANORP was the official reduction in nitrous oxide emissions from soils (of 25 %), information which is now engrained in Australia's national greenhouse gas inventory. The real value of both these programs is twofold. The identification of viable, practical nitrogen management strategies (e.g. use of nitrification inhibitors in sub-tropical dairy production systems) that increase productivity and profitability, and a new found impetus in R&D to reduce the large gaseous nitrogen losses from our soils.



## CZO Central Update

### Main Range Critical Zone Observatory

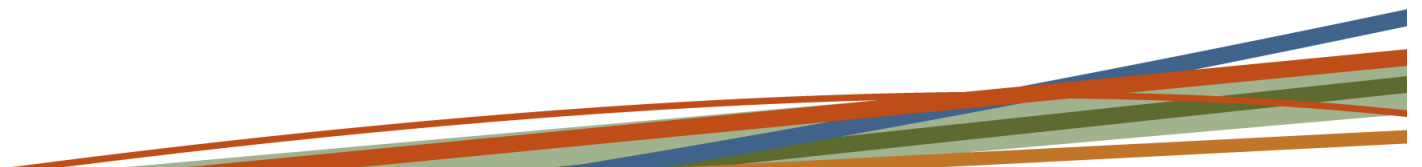
Vegetation mapping and monitoring is continuing, with focus on the role of tree fall gaps and climate variability in influencing long term floristic change. Another mapping and monitoring campaign involving around 20 students and volunteers was led by Steven Howell (PhD candidate, UQ) in April to complete the first full round of vegetation measurements across the 400 x 400 m main plot area, and data analysis is ongoing with plans to present preliminary results at the Ecological Society of Australia conference in November.

Another international cross-CZO research project is underway – Dr Talitha Santini (UQ) recently returned from a week-long field trip to the Appalachian Mountains, working with Dr Ashlee Dere (University of Nebraska-Omaha) and students to characterise the composition and functions of microbial communities in shale-derived soils along a climosequence stretching from Pennsylvania to Alabama. Additional samples from shale outcrops at the Main Range CZO will help to disentangle the roles of biota and climate in driving weathering and nutrient cycles in shale-derived soils, building on Dr Dere's visit to the Main Range CZO in 2015. Samples for root density and morphology were also collected to evaluate the role of different vegetation systems in controlling erosion rates at sites across the US and Australia. A short article featured on the US CZO website describing this work is available at: <http://criticalzone.org/shale-hills/news/story/collaborators-begin-erosion-experiment-and-microbial-characterization-study/>



*The US shale climosequence field team at Shale Hills CZO in Pennsylvania. From left to right: David Johnson, Sam Nath, Sara Parcher, Joe Warth, Ashlee Dere, and Talitha Santini.*

The first international cross-CZO publication involving the Main Range CZO was presented at the Goldschmidt geochemistry conference in Yokohama, Japan in June, presenting the results of Dr Dere's visit to the Main Range CZO in 2015 as part of the international shale climosequence that she has been investigating. Dr Josh Larsen (UQ) will be presenting results from his research into the export of silicate weathering products from the Main Range CZO watersheds at the 2016 American Geophysical Union conference in San Francisco.

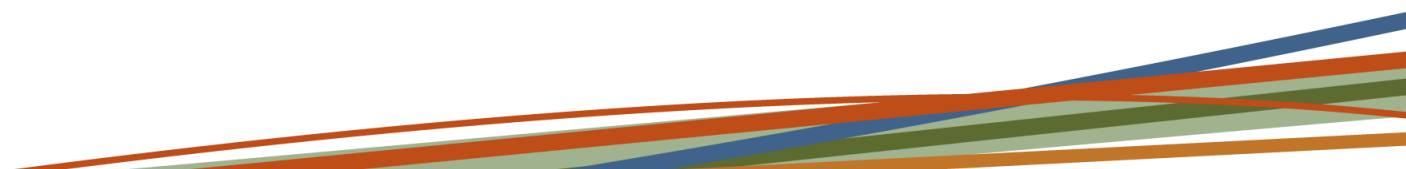


## Avon River Critical Zone Observatory (AR-CZO)

2016 has been a busy year for the Avon River CZO (WA) with the publication of the first journal paper led by an Australian CZO (Gleeson *et al.*, 2016; doi.org/10.1016/j.scitotenv.2016.05.185). Our paper, published in *Science of the Total Environment*, describes environmental drivers of the soil microbiome at the AR-CZO. In this study we characterised the structure and function of the microbial community along two distinct transects down a lateritic hill (Avery Hill) at the AR-CZO located in the south-west of Western Australia where it forms part of the Darling Range. Here some of the most ancient and highly-weathered soil parent material in the world can be found and, as one of the oldest unglaciated regions on Earth, the soils are nutrient poor and most are the result of soil formation and erosional processes associated with the underlying granitic Yilgarn Craton. This location is Australia's only global biodiversity hotspot and has exceptionally rich flora, however, the microbial diversity is currently poorly characterised. This hotspot is one of just five Mediterranean-type ecosystems in the world with native plants that are well adapted to the nutrient-poor lateritic soils and it is here we have focused our study. Our particular site represents a unique weathering profile where the dissection of the landscape and resultant lateral erosion has led to a geomorphic change whereby deep and ancient weathering zones are exposed at the near surface along the degraded hill slope. Ancient weathering processes (> 1 Mio years) have led to physical and chemical soil properties which are likely still influencing present day microbial communities and their functions. Spatial soil sampling revealed the contrasting distribution patterns of simple soil parameters such as pH (CaCl<sub>2</sub>) and electric conductivity. These are clearly linked with underlying changes of the critical zone architecture and were identified as major drivers of microbial spatial variability in terms of bacterial and archaeal community composition but not abundance. We showed that the weathering and erosion history of ancient Western Australia affects the surface pedology and has consequences for microbial community structure and function.



*Prof Oliver Chadwick (UC Santa Barbara, US), Dr Deirdre Gleeson (UWA), Dr Tim White (Penn State, US) and Dr Matthias Leopold (UWA) on Avery Hill at the AR-CZO. Photo taken during the UWA CZO Workshop held in April 2014 at the University of Western Australia.*



# News from around the SuperSite and OzFlux networks

## Alice Mulga

The Termite/Decomposition experiment was deployed in the July campaign. Next campaign in December 2016.



Termite/Decomposition baits deployed (yet to be covered with shade cloth) at the Alice Mulga SuperSite.

Infrastructure/monitoring status:

- OzFlux data from AU-ASM is processed through August 2016 (L6)
- OzFlux data from AU-TTE is processed through July 2016 (L5)
- Winter collection of SuperSite datasets (Acoustic recordings, phenocam images, canopy LAI) and termite baits deployed
- Ongoing experiments at AU-TTE: biomass loss in *Triodia* (Spinifex, hummock grass) due to photo-degradation via leaf decomposition bags; calibration of understory LAI and measurement of canopy LAI in individual *Corymbia* trees
- Ongoing measurements: lateral tree growth (band dendrometers) and litterfall collections at AU-ASM

Recent visitors to the SuperSite included: James Cleverly and Rolf Faux (July 2016).

## Calperum Mallee

Activities during the last quarter included:

- Seedling tracking using photography from UAV
- LAI data collection
- Baseline soil respiration data collection
- Invertebrate Malaise trapping
- Any surveys redone

Soil data will be collected for *Callitris* woodland plot. Faunal trapping with Elliot traps and bird surveys are ongoing.



Unregulated water flow into the river system inundated the Calperum Floodplains at the end of August.

## Cumberland Plain

Bird surveys were completed in March and Leaf Area Index completed in April. Annual vegetation biomass survey (DBH-H), understory vegetation and mistletoe infestation assessment completed by UAV.

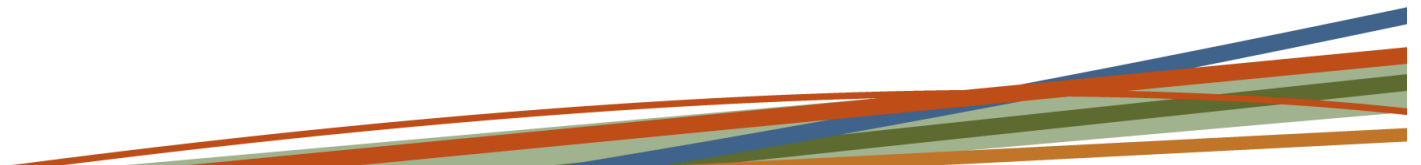
PhD student (Alexis) working on flux measures, vegetation, mistletoe and light use efficiency.

Anne Griebel has started a postdoc with Elise Pendall, includes work on sapflow and mistletoe.

Aiming to install camera traps on site. The Termite/Decomposition experiment was deployed in September.



Termite/Decomposition Bait Station at Cumberland Plain.



## FNQ Rainforest

### Robson Creek

All vegetation and avian monitoring is up to date. Coarse woody debris and seedling survey conducted by School for Field Studies in February. CSIRO carried out some destructive biomass determination on shrubs and tree ferns as part of routine site maintenance and started a shrub leaf longevity experiment. Ant traps were deployed again this year.

UQ project for Robson Creek 'Time-Series Methods for Monitoring Woody Vegetation Change in Cloudy Conditions' has commenced with visiting researchers from UQ and the Queensland Department of Science, Information Technology, and Innovation who carried out a Terrestrial Laser Scanning campaign with associated AusCover protocols in early September. This work was part of Jenny Mahuika's Masters studies.



Stuart Phinn and Peter Scarth carrying out Terrestrial Laser Scanning at Robson Creek.

### Daintree

At the Daintree Rainforest Observatory (Cape Tribulation) data has been collected for Leaf Area Index, Photopoints and Coarse Woody Debris. Ant traps were deployed again this year. The drought experiment that was initiated through an ARC grant to Susan Laurance is now being taken over as a long term experiment at the DRO under the JCU umbrella. A course 'Stable Isotopes in Biosphere Systems (SIBS)' was run from 17-24 July on site this brought academics and postgrads from around the country and overseas to workshop stable isotopes in environmental, biological and palaeo research. The Daintree Discovery Centre (Cow Bay) changed owners in August after 30 years under the expert leadership of Pam and Ron Burkett. The new owners the Aboriginal Development Benefits Trust are very passionate about the mission to educate the public on environmental conservation and are keen to see TERN remain involved with activities at the site. OzFlux and phenocam image collection remains on-going.

### Great Western Woodlands

A real-time web page for GWW has been set up on the University of WA website:

<http://www.see.uwa.edu.au/research/land/GWW/>

Henrique Togashi has completed his PhD thesis including a chapter on GWW.

Renae Boyd from University of WA has begun an honours project studying facilitation of woodland understorey by Salmon gums, supervised by Richard Hobbs, Craig Macfarlane and Suzanne Prober.

### GWWL-Credo

Credo "Lodge" development: DPaW have installed two new dongas, with 4 bedrooms with en-suite facilities, specifically for use by rangers and scientists. A veranda, decking, fire pits and landscaping are planned.

### Flux tower, weather station, plant physiology

#### Main flux tower

- We have had an uninterrupted data stream from main tower for the past year, and now have 3.5 years of data from GWWL which are beginning to tell an interesting story. The site switched dramatically from positive to negative C balance in mid-2015. We believe this is a result of drought earlier in 2015; we assume that the switch was delayed until the site ran out of water 3 months later. Rainfall has returned to average levels, but the woodland is still in negative carbon balance owing to increased respiration without recovery of C fixation. We suggest this is due to leaf shedding under stress – respiration has increased as leaves decompose, while return to normal C fixation is slow even under normal rainfall, potentially due to fewer leaves being available for

immediate C capture. Craig gave a talk on this at the recent OzFlux conference.

- Data processing is up to date to mid-March when modem stopped communicating.

#### *Understorey flux tower*

- Equipment failure (external temperature sensor on the IRGA) has resulted in substantial data loss in the last six months. The part has been replaced and the IRGA was re-installed on 12<sup>th</sup> May.
- So far, very little flux data has been collected from this tower at all owing to the IRGA previously being used to keep the main tower running when the power cable on the main-tower IRGA failed.

#### **Phenocams and songmeters**

The ground-level camera was converted from its original power supply to a lead-acid battery and solar panel in September 2015. The cameras have been very unreliable with lots of lost data but were all working on the December 2015 visit. Conversions to more reliable power supply and replacement of 'dead' cameras seems to have fixed problems for now. Images are uploaded on the relevant portal.

Overstorey cover images and five-point photopoints were collected at the main salmon gum plot on the March 2016 field trip. Cover images have been analysed. Results and images uploaded to respective portals.

Data downloaded from dendrometers on all four plots during March 2016.

Ground water depth was sampled on March 2016 field trip. There has been little change in depth to water over whole measurement period.

#### **Biological monitoring:**

##### *Gimlet fire-age plots:*

Work is ongoing to characterise fire age distribution in western portion of GWW.

##### *Sandplain plots:*

- First draft of manuscript on the SWATT Sandplain plots has been prepared by Neil Gibson.
- Remainder of SWATT plots are to be converted to AusPlots in September
- Sampling for an ATN wide isotope study will be undertaken then too (no species occur across the full gradient but will choose wide ranging species such as *Triodia*).

##### *Nutrient Network*

- Plots maintained and fertiliser treatments re-applied in May, N-deposition stations collected for transfer back to the US.
- Ongoing measurement and outputs from NutNet (see publications list), including a number of add on studies this year

- SP attended a workshop in Argentina on legume responses to nutrient addition in the NutNet experiment, and visited a NutNet site in the Pampas

#### *GWWL-DroughtNet*

We are still working on processing the DroughtNet floristic and biomass data collected last September

All 20 DroughtNet plots were sampled with the Zebedee ground-based LiDAR instrument for biomass estimation in March 2016. Data not processed yet.

15 bluebush shrubs that were photographed and destructively harvested for biomass measurements in March 2016 were also sampled with the Zebedee. These are being analysed.

During the Argentina trip, SP visited a DroughtNet site in the Pampas with Drought-Net coordinator Laura Yahdjian (University of Buenos Aires)

#### **Litchfield Savanna**

Flux tower working well with 1 year of data collected. A Skye multispectral system with 4 bandwidths has been installed.

Wingscapes phenocams have been installed. Both acoustic samplers running.

The profiling system at Howard Springs OzFlux site will be moved to Litchfield in 2017. The 5 minitowers installed within the 5 km x 5 km area are operating (soil moisture, PAR, upward and downward phenocams, multispectral radiometers) but the SMAP satellite has failed.

CDU undergraduate Ecosystem Function unit is being taught on site with recurring vegetation surveys in areas with higher and lower fire frequencies.

Australian Council of Deans of Science met in Darwin and visited Litchfield.

Sean Levick from the Max Planck Institute will be carrying out a high resolution ground Lidar campaign at Litchfield.

A student from University of Sydney is working on light use efficiency site data with Brad Evans.

#### **SEQ Peri-urban**

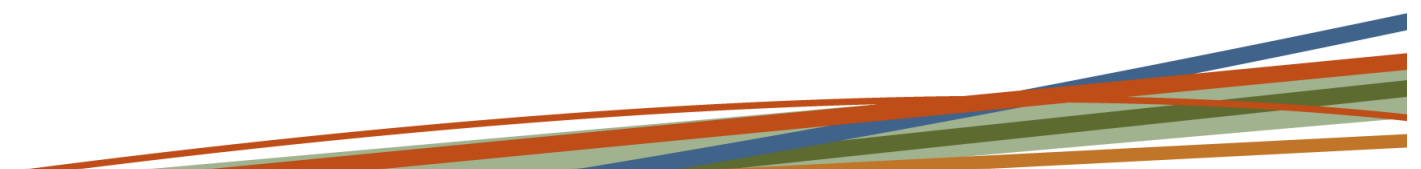
##### **Samford**

Soil GHG has been collected over 18 months across the 52 ha block to create a baseline dataset.

Ongoing data collection includes: GHG fluxes, sonde and argonaut.

##### **Karawatha**

Researchers have been accepted into the "Teatime 4 Science" project by Judith Sarneel. We'll be looking at decomposition at our 32 PPBio plots at Karawatha (our Supersite) and also at additional locations.





A scientific manuscript has been submitted to Australian Mammalogy titled, "Fine scale changes in spatial habitat use by a low-density koala population in an isolated peri-urban forest remnant". The work was conducted at Karawatha Forest Park.

## Tumbarumba Wet Eucalypt

New management team for Tumbarumba are: Jacqui Stol (PI), Mark Kitchen (Deputy PI) and William Woodgate (OzFlux).

Recent activities on site included:

### Phenocams

- Tower and Canopy based

### Ancillary

- Installation of 3 wireless sapflow and dendrometers in February (growth increment and crown conductance of *E. delegatensis*)

### PAR Sensor network

- Duplicated in partially logged area

### Ongoing tower remote sensing

- Hyperspectral, thermal imagery ~3 times/day
- Ancillary measurements: sky images (sky conditions) and irradiance

### Leaf level processes and site characteristics

- Licor 6400 measurements:  $A_i$ ,  $AC_i$  curves & spot measurements (focus on carbon assimilation and fluorescence)
- SPAD measurements for leaf index chlorophyll content
- ASD measurements for leaf, bark, understorey and ground cover spectra
- Leaf disk sampling for pigment analysis (Chlorophyll, xanthophyll cycle etc. via HPLC),
- Leaf disk sampling for leaf Nitrogen and Carbon content & isotopes

### Structural measurements from laser scanning

- 1ha plot scanning with Riegl (600 million points), DWEL, CBL, and Zebedee laser scanners
- Top of tower scanning with Riegl (canopy structure as seen by hyperspectral)
- Ground cover characterisation (point transects)

### Derived products / analysis

- Site scale modelling of fluorescence via the SCOPE model
- LUE and GPP from tower hyperspectral imagery
- AGB in the 1ha plot from volumetric tree reconstructions (+ comparison with allometrics)
- 3D reconstructed supersite forest (fully parameterised) for ingesting into a 3D radiative transfer model
- Understorey density (from Zebedee laser scanner)

## Victorian Dry Eucalypt

### Wombat

Wombat experienced a number of instrument failures in the last couple of months. The SM2 acoustic recorder was hit by a high current in the power converter which caused melting/smouldering of dessicant packet and a data gap. The recorder has been repaired and has been re-installed on the tower. Wombat Flux also experienced irregular data gaps in the CO<sub>2</sub> data. This was related to issues with the sonic anemometer and the CO<sub>2</sub> analyser on the flux tower. Both instruments have been sent in for maintenance and have been repaired. Leaf Area Index photo points have been collected in January and July.

Anne Griebel and Nina Hinko-Najera both completed their PhD projects at the flux site and had their degree conferred in September! Anne has started a new job as a research fellow with Elise Pendall at Western Sydney University and Nina will take over as the Wombat Flux site coordinator in October.

### Whroo

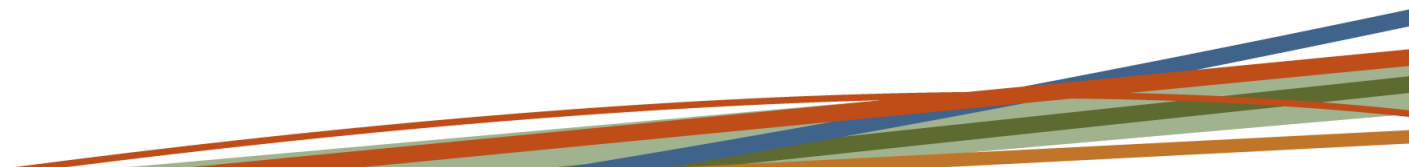
Ian McHugh has a new role as technical support for OzFlux Central.

Jason is assessing the possibility of moving the Whroo tower and monitoring site to WA into similar vegetation and climate at Boyagin. The site is a similar forest type (Wandoo woodland) with a 17 m canopy with slightly higher precipitation. This site would be paired with the UWA Ridgfield, Future Farm site. It is hoped that agreement will be given to leave the Whroo core 1 ha clearly marked and to leave the flux tower footings in place permanently. This will leave the site able to be re-instated in a decade and another 4 years of data collected. Decisions will be made early next year.

## Warra Tall Eucalypt

*Infrastructure and data:* Programming issue in IRGA electronics box has been resolved - now getting full set of flux and meteorological measurements from Flux tower. Two soil temperature probes currently malfunctioning otherwise all soil measurements are being taken. Flux profiling system has been installed and is providing ongoing data. Solar panels installed and are now providing sufficient additional charge to maintain expanded instrumentation at the flux site. All instrumentation on Warra Weirs hydrology study providing ongoing data stream - problem with turbidity measurements may require purchase of new sondes.

Phenocams are all working. Winter Leaf Area Index and photopoints still to be measured. Acoustic recorder continuing to provide uninterrupted 44kHz data stream according to the current Supersite schedule.



*PhD projects currently being conducted on site:* Jessie Buettel (UTas) - modelling spatial patterns of tree species in tall eucalypt forests (AusPlots Forests plots); Beshu Yadav - modelling floristic and structural attributes from LiDAR; James Furlaud (UTas) - fuel load accumulation/litterfall as a function of time since fire in wet eucalypt forests; Jennifer Peters (WSU) - drought vulnerability of Australian tree species; Scott Whitemore (UTas) - algorithms for bird song recognition and Li Mingzin - insect metabarcoding.

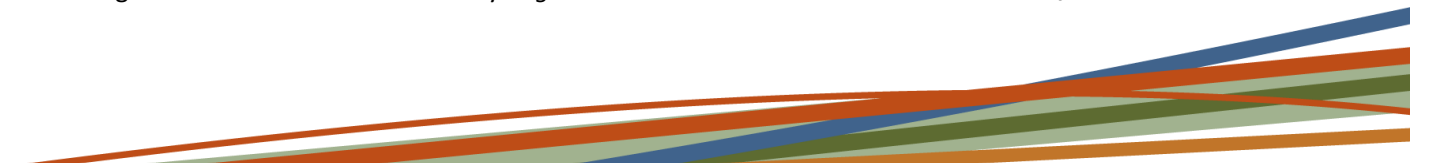
*Masters projects currently being conducted on site:* Shawn Grey (UMelb) - dendrochronological examination of understorey dynamics in tall, wet *E. obliqua* forest.

*Honours projects currently being conducted on the site:* Laura van Galen is measuring and describing mature forest attributes (floristics, structure) to develop metrics and evaluate the potential of Lidar data to model these metrics across the landscape.

*International projects currently using site:* Paul Herbert (University of Guelph) - Global Malaise Study; Sebastian Siebold (Munich Technical University) - global climate drivers of woody decomposition by invertebrates; Adriana de Palma (Natural History Museum, London) - global PREDICTS (Projecting Responses of Ecological Diversity in Changing Terrestrial Systems) meta-analysis of land-use impacts on biodiversity.

## Recent Publications

- Azmi M, Rüdiger C, Walker JP. 2016. A data fusion-based drought index. *Water Resources Research*. DOI: 10.1002/2015WR017834.
- Chen C, Cleverly J, Zhang L, Yu Q, Eamus D. 2016. Modelling seasonal and inter-annual variations in carbon and water fluxes in an arid-zone *Acacia* savanna woodland, 1981–2012. *Ecosystems* **19**:625–644. DOI: 10.1007/s10021-015-9956-8.
- Cleverly J, Eamus D, Luo Q, Restrepo Coupe N, Kljun N, Ma X, Ewenz C, Li L, Yu Q, Huete A. 2016. The importance of interacting climate modes on Australia's contribution to global carbon cycle extremes. *Scientific Reports* **6**:23113. DOI: 10.1038/srep23113.
- Cleverly J, Eamus D, Restrepo Coupe N, Chen C, *et al.* 2016. Soil moisture controls on phenology and productivity in a semi-arid critical zone. *Science of the Total Environment* **568**: 1227-1237. DOI: 10.1016/j.scitotenv.2016.05.142
- Cleverly J, Eamus D, Van Gorsel E, Chen C, Rumman R, Luo Q, Restrepo Coupe N, Li L, Kljun N, Faux R, Yu Q, Huete A. 2016. Productivity and evapotranspiration of two contrasting semiarid ecosystems following the 2011 global carbon land sink anomaly. *Agricultural and Forest Meteorology* **220**:151-159. DOI: 10.1016/j.agrformet.2016.01.086.
- Fest B, Hinko-Najera N, von Fischer JC, Livesley SJ & Arndt SK. 2016. Soil methane uptake increases under continuous throughfall reduction in a temperate evergreen, broadleaved eucalypt forest. *Ecosystems* **1-12**. DOI: 10.1007/s10021-016-0030-y
- Haverd V, Smith B, Raupach M, Briggs P, Nieradzki L, Beringer J, Hutley L, Trudinger CM, Cleverly J. 2016. Coupling carbon allocation with leaf and root phenology predicts tree–grass partitioning along a savanna rainfall gradient. *Biogeosciences* **13**:761-779. DOI: 10.5194/bg-13-761-2016.
- Karan M, Liddell M, Prober S, Arndt S, *et al.* 2016. The Australian SuperSite Network: a continental, long-term terrestrial ecosystem observatory. *Science of the Total Environment* **568**: 1263-1274. DOI:10.1016/j.scitotenv.2016.05.170
- Ma X, Huete A, Moran S, Ponce-Campos G, Eamus D. 2015. Abrupt shifts in phenology and vegetation productivity under climate extremes. *Journal of Geophysical Research: Biogeosciences* **120**:2036-2052. DOI: 10.1002/2015JG003144.
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**Associated new publications (performed elsewhere, but of interest to OzFlux, SuperSites and Critical Zone Observatory science):**

Zhao W, Liu B, Chang X, Yang Q, Yang Y, Liu Z, Cleverly J, Eamus D. 2016. Evapotranspiration partitioning, stomatal conductance, and components of the water balance: A special case of a desert ecosystem in China. *Journal of Hydrology* **538**: 374-386. DOI: 10.1016/j.jhydrol.2016.04.042.

## Upcoming Events

### **29-30 September 2016**

EUROGEO Conference 2016, Malaga, Spain. See [website](#) for details.

### **9-13 October 2016**

ILTER Open Science Meeting, Kruger National Park, South Africa. See [website](#) for details.

### **26-29 October 2016**

11th International Long-Term Ecological Research - East-Asia-Pacific Regional Network Regional Conference (2016 ILTER-EAP), Ho Chi Minh City, Vietnam. See [website](#) for details.

### **9-10 November 2016**

GEO XIII, St Petersburg, Russia. See [website](#) for details.

### **28 November - 2 December 2016**

ESA Annual Conference, Fremantle, Western Australia. See [website](#) for details.

### **12-16 December 2016**

AGU Fall Meeting, San Francisco, USA. See [website](#) for details.

### **20-25 August, 2017**

The 12th International Congress of Ecology, Beijing, China. See [website](#) for details.

**The next issue of the Newsletter will be published in December 2016.**  
If you have any news articles, photos, upcoming events, etc that you would like included please email [shiela.loyd@jcu.edu.au](mailto:shiela.loyd@jcu.edu.au)

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