Quarterly Newsletter

Issue 13, May 2016

SuperSite and OzFlux Update

Welcome to the 13th edition of SuperSites/OzFlux/CZO AU Newsletter. While we are still in the midst of "interesting times" TERN continues to demonstrate the benefits of collaborative networks in ecosystem monitoring to the wider community and remains favourably compared to overseas efforts. We have received confirmation that the NCRIS funding for TERN for 2016-17 will be 2% more that 2015-16, which has then been passed down to the Facilities. What this means is that TERN is assured of another year of operation at subsistence level while the government gets prepared for longer term (10 year) funding of NCRIS platforms going forward. TERN's focus for the next 6 months will be on developing a strategic plan aligned to government priorities and 2016 National Research Infrastructure Roadmap, to take to the table for the next funding round. The exposure draft of this strategic plan will be circulated for comments in the next 1 – 2 months.

On the 31 May the TERN EAC was officially advised that Professor Tim Clancy has tendered his resignation from the position as TERN Director as of early August.

The interim Acting TERN Director will be Dr Beryl Morris from UQ who will act in the role until a new Director is appointed through a competitive recruitment process.

Changes to the TERN board are also underway with the Chair, Andrew Campbell stepping down to take up the role of Chief Executive of ACIAR.

The makeup of the TERN board will soon be changed to reflect the contributing partner institutions and a Science Advisory Committee will be formed with expertise in the range of scientific disciplines relevant to TERN.

The Australian SuperSites Network thanks Tim and Andrew for their support over the years both in the initiation and development of the SuperSites.

A reminder to keep the last week of June and the first week of July free for:

• OzFlux Workshop	27th June - 1st July	Calperum
• OzFlux Conference	4th - 7th July	Calperum
• SuperSite Face to Face meeting	8th - 9th July	Adelaide

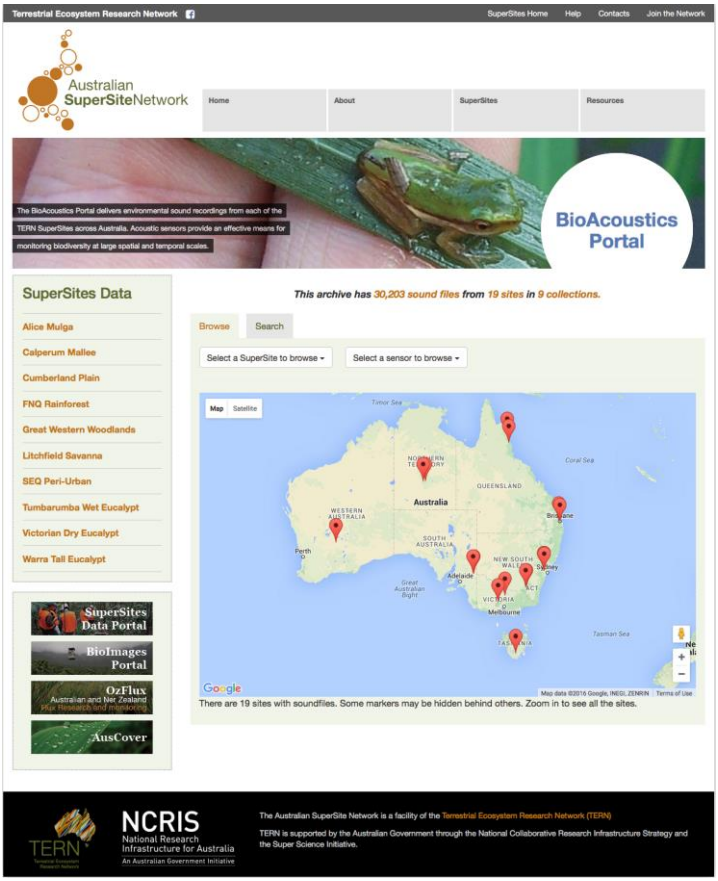
SuperSite Central Update

We have looked at ways of streamlining the management of SuperSite contracts, milestone deliverables, protocols, data templates and other documentation for 2016-17. The method selected is to use shared CloudStor folders on AARNET that have been set up and shared with PIs. Access to individual SuperSite folders should be transferable to technicians and others by the PIs.

In March, TERN hosted an international round table discussion on "Towards a Global Observatory" in association with the World Science Festival, Brisbane. There were leaders from ILTER, NEON, Korea (KLTER, KEON), Japan (JaLTER), US LTER, AnaEE, SAEON and the Philippines present or on Zoom. Mike Liddell and other TERN Facility and LTER leaders presented talks on the development of their respective networks. This was followed by a field trip to the SEQ SuperSite nodes of Samford and Karawatha that was followed by a day of talks on "Approaches to Terrestrial Ecosystem Data Management". Mirko Karan presented a talk on SuperSite protocols and data systems. Most of the talks on this last day were TERN people presenting to the internationals with the aim of improving international collaborations and heading towards some degree of network compatibility. All talks are available on the dedicated website. Talks were well received and discussions towards the end raised familiar issues to us that are also being faced by overseas networks. There is a plan for a major follow up

meeting of international ecosystem observatories in 2018 to be hosted by TERN and possibly held in Northern Australia. In addition TERN will participate in the international INTECOL meeting in Beijing in 2017.

Nearly all the SuperSite nodes have been added to the International Long Term Ecological Research site database with details of each site discoverable on their map and database. The last few sites will be uploaded soon.



The SuperSites BioAcoustics Portal (http://bioacoustics.supersites.net.au/) is now up and running with over 30,000 sound files available for listening and download.

OzFlux Central Update

AGU and International Collaborations

It was wonderful to go to AGU this year and see the respect that the international community has for OzFlux. Eva gave an invited talk on "Research Highlights from OzFlux - the Australian and New Zealand Flux Research and Monitoring Network" which complimented Jason's talk on "Fire in Australian Savannas: from leaf to landscape". There were meetings with the SMAP team and it was good to hear that they appreciated collaborations with OzFlux because data handling, availability and accessibility made working with us very easy. A lot of praise was given to OzFlux during the town hall meeting where Ameriflux celebrated its 20th anniversary. Again it was the workflow with data collection and processing and our attitude towards sharing that were highlighted. Peter Isaac was awarded a prize (in absence) and a small gift that is still sitting in Eva's office and waiting to be delivered.

(Crowd) Funding and Support

Our effort to crowd fund (though supported by FluxNet) unfortunately has not been very successful (<2k). Funds raised will help towards the next meeting/conference in Calperum. On a more positive note we get further support for the meeting from LI-COR who are kindly sponsoring us. Talks with Campbell Scientific have led to a loan of a CO_2 profiling system in Warra – this is fantastic as we will finally be able to measure the change in storage term and get a better idea if advection occurs at the site. We have started talking with Earthwatch and opportunities for collaboration and development of relevant industry links with them. Thanks to Tim W. for lining this up. Earthwatch will also join us at the conference in Calperum.

Central Node

Many of you will be aware of the difficulties that CSIRO is going through. One of the two flagships most affected by job cuts is the Oceans and Atmosphere Flagship that is also leading OzFlux. Contrary to recent newspaper reports CSIRO has agreed and committed to continue to lead OzFlux into the future. To keep OzFlux in CSIRO, Suzanne Prober (Land and Water) has kindly agreed to take on the lead of TERN OzFlux and Craig MacFarlane will support her in that role. I am sure that she will do an excellent job. James has agreed to give OzFlux some continuity by staying on as Associate Director - thanks to James, Craig and Suzanne! During the upcoming OzFlux conference (and I am sure this will continue for longer) there will be some time set aside for discussions on the governance of OzFlux. OzFlux will have to decide on a governance rather than be dictated one through circumstance. There will be the need to find a governance that suits OzFlux and is in alignment with where TERN is heading to.

Special Issue

The OzFlux Special Issue in *Biogeosciences* closed on 5 May 2016. The handling editor, Georg Wohlfahrt, reported that 22 papers have been registered or submitted, and they can be viewed at http://www.biogeosciences.net/special_issue618.html as they become available in *Biogeosciences Discussions*.

The Special Issue will be dedicated to the memory of Ray Leuning, with a dedication also appearing in the introductory paper

CZO Central Update

Avon River Critical Zone observatory (AR-CZO)

Three new major research projects have started at the Avon River CZO this quarter:

Analysis of the spatial variability of water repellent soils

New equipment was installed at the Avon River CZO in order to monitor the spatial variability of water repellent soils. Water repellency is a major soil constraint in many of the Western Australian sandy soils. Despite many agronomic field trials the mechanisms of water repellency and its spatial geometries is still poorly understood. Thus, a new innovative study combining various techniques including thermal camera, electric resistivity tomography and EM-surveys was started at the Avon River CZO to better understand some of the physical behaviours of water repellent soils under wet and dry conditions. The study is conducted by Abdulkareem (PhD candidate), Gavan McGrath and Matthias Leopold (all UWA). Initial results document the potential to separate hydrophobic and hydrophilic soil patches by determining their thermal and electric properties. Undergraduate students from ENVT4401 (Advanced Land Use Management) were introduced to the CZO site and helped with the testing and sampling on the site.

Left: Monitoring of thermal properties on a site effected by water repellency. Right: Severe water repellent soil limiting infiltration of water.

Short term effects of salt tolerant plants on soil hydrology

Aline Renard, visiting exchange student from the University of Liège in Belgium, started a new monitoring program on the short term effects of plants on soil hydrology. Aline (supervised by Dr Sarah Garré and A/Prof Matthias Leopold) started a time-lapse survey using a combination of electric resistivity tomography and classic soil mapping to monitor changes in soil hydrology and salt concentrations at a site affected by dry land salinity. The study aims to better understand short term effects of management strategies such as ripping, drainage and the planting of salt tolerant tree species.

The 3000-Dam paddock at the Avon River CZO, an area affected by salinity. Various plant species have been planted to reduce the water table and decrease the salinity level at this site.

Fluxes of soil gas in an agricultural context

Scaling of fluxes from point to landscape has been a challenge for researchers but we will use the CZO framework to address this. To investigate the spatial representativeness and temporal resolution of CO2 emissions to scale from point to landscape a new Masters student Topoyomae Izack Makoi will undertake chamber based measurements of soil fluxes and the main drivers (soil temperature and moisture and a suite of various soil biogeochemical parameters). This will be complimented by eddy covariance flux towers and landscape modelling in the future. He will also utilise high-resolution electrical resistivity tomography in the Critical Zone Observatory (CZO) site at University of Western Australia's (UWA) Ridgefield Future Farm near Pingelly in Western Australian wheatbelt region. The project is jointly supervised by Prof Jason Beringer, Dr Suman George and Dr Matthias Leopold.


Left: Izack Makoi during initial soil mapping. Right: Dr Suman George surveying with the mobile CO_2 gas analyser at the Avon River CZO.

Main Range Critical Zone Observatory

Two major vegetation mapping field trips were completed over the summer, led by Steven Howell (PhD candidate, UQ), to re-measure existing vegetation plots and build a long-term picture of changes in the structure and floristics of the subtropical rainforest and eucalypt vegetation at the Main Range CZO. The field trips were well attended and several follow-up trips will be completed later this year to complete mapping across the 400 x 400 m main plot area.

An unmanned aerial vehicle (UAV) will be deployed in the coming months to collect high resolution aerial images and multispectral data for the site, and future work will include assessing the utility of these data for estimating biomass production, species distributions etc. in Australian subtropical rainforest species by pairing this with the on-ground vegetation measurements.

Publications from research visits last year (Dr Ashlee Dere, University of Nebraska-Omaha; Mr Reggie Walters, Boise State University) are in progress, with the first publication from this work scheduled for the Goldschmidt 2016 geochemistry conference in Yokohama, Japan in late June. Talitha Santini will be representing the Australian CZO network at the Joint Critical Zone Observatory-NEON-EarthCube Biogeochemistry workshop in late August 2016 to develop an international approach to characterisation of biogeochemical cycling in the Critical Zone.

Inclusion of perennial pasture grasses for pasture improvement

In this project, a 11 ha degraded pasture at UWA Farm Ridgefield near Pingelly which includes salt-affected patches, has been sown with perennial and annual pasture species. Soil characteristics can influence the distribution of pasture plants. This in turn, can affect the abundance of arbuscular mycorrhizal (AM) fungi in their roots. Therefore, the distribution of pasture species during establishment and maintenance phases of pasture re-development is being carried out in relation to soil characteristics (Ahmed Alsharmani, PhD student with LK Abbott, M Leopold and Z Solaiman). An evaluation of relationships between the types of AM fungi present in roots of the each perennial and annual pasture species and the underlying soil characteristics is in progress. The inclusion of perennial grass species in pastures in this district is not common practice. This project is investigating their role in restoring pasture productivity during the establishment and maintenance phases of the pasture over three years in collaboration with Evergreen Farming (Phil Barrett-Lennard) with the support of Wheatbelt NRM.

Avon River CZO joined the e-connected grain belt program in WA

The e-connected grain belt project is initiated and led by the Department of Agriculture and Food in Western Australia (DAFWA) and provides an online platform for growers on improved understanding al weather variability and soil moisture. Multiple weather stations and moisture probes are installed throughout the wheat belt of WA to form a new network in order to improve soil moisture prognosis models. Wheatbelt NRM (Dr Guy Boggs) and UWA (M Leopold) applied and were recently selected to join the program. Installation and measurements will commence in April 2016.

News from around the SuperSite and OzFlux networks

Alice Mulga

New projects and collaborations planned or started include:

- Direct decomposition of senescent Spinifex leaves in litterbags
- Calibration of understorey LAI measurements (hummock clippings)
- Detection of photodegradation through partitioning eddy fluxes: a global analysis (proposal in preparation, led by Susanna Rutledge, University of Waikato, Hamilton, New Zealand)

Data-sharing:

- NASA SMAP
- 84 downloads from FLUXNET2015
- Yuhan Rao, University of Maryland USA & NOAA; radiation study
- Manabu Segawa, Ishikawa Prefectural University Japan
- Alexander John Norton, University of Melbourne Australia; satellite fluorescence study

Recent visitors to the site included: Rachael Nolan, Tonantzin Tarin Terrazas, Rolf Faux, John Gallegos (new PhD student on non-SuperSite project in NSW), Kendal Fairweather (volunteer), Rachel Gray (volunteer), Marco Alvarez Rodriguez (volunteer).

Activities during the last quarter included:

- Plant ecophysiology project, measurements of 11 co-occurring species, summer data collection continues January–February:
  - Leaf-level gas exchange
  - Leaf water potential
  - Water source determination using stable isotopes
  - Xylem vulnerability to cavitation
  - Pressure-volume analysis
  - Stomatal conductance as a function of leaf water potential
- OzFlux data from AU-TTE is now up to L6 January–November 2015 (GPP, ER, PD determined using conditional correlation analysis).
- Band dendrometers at AU-ASM serviced and catalogued
- Gradient measurement sensors (Ta, RH, WD) re-calibrated at AU-ASM and to be installed at AU-TTE.
- All three soil moisture arrays (Mulga, tussock grass, hummock grass) repaired and functioning at AU-TTE.
- Measurements from NDVI sensor at AU-ASM have been integrated into the flux dataset.
- Summer collection of SuperSite datasets (Acoustic recordings, phenocam images, canopy LAI, etc) planned for the latter half of February.

Calperum Mallee

OzFlux system working well. Insect and ant collection are ongoing. Above ground dry matter estimates have been updated, and ground based images for developing leaf area have been processed. Phenocams on tower not working. Two years after the fire of January 2014, stems and juvenile foliage from lignotubers are approaching 2 m in height. Some eucalypt seedlings that grew after the fire have persisted despite the dry conditions. One to two percent of mallee trees that were burnt have died with no regrowth from the existing lignotuber.

New collaboration planned with Jennifer Peters, UWS - "Assessing Forest Vulnerability to Drought across Australia" - planning 2 field campaigns (summer & winter), taking plant physiology measures

Planning for the OzFlux workshop, conference and Supersite meeting in Renmark and Adelaide during 27 June – 8 July is underway.

Cumberland Plain

Activities during the last quarter included:

- Uploaded 2 years of our flux data to the new Fluxnet synthesis data product which was published at the end of last year.
- Presented a poster at AGU on seasonal changes in fluxes at our site.
- Established survey of mistletoe infected trees in the core hectare and surrounding area for ongoing monitoring of growth and mortality
- Preparing manuscript on remote sensing detection of mistletoe infestation impacts on canopy temperatures (Wouter Maes' project)
- Started new project with PhD student related to mistletoe disturbance effects on ecosystem C and H_2O fluxes

- Started new project with a Masters student on land-use change effects on soil organic matter chemistry and enzyme activity
- Applied for NSW Gov NCRIS co-funding (under RAAP program) to expand our monitoring capacity over the rest of the Cumberland Plain woodland area using UAV-based remote sensing and mobile flux tower.
- November 2015 – UNSW LiDAR flight free of charge.
- Acoustic recording all working
- Bird survey done mid-December and data uploaded
- Phenocams are having problems – we need to install new ones – what's the plan?
- Next LAI, DBH, photopoint campaign will be in March

FNQ Rainforest

Robson Creek

Access was cut off for a little over 2 months due to road closures (bridge replacements), but were no significant impacts on monitoring.

All equipment running smoothly, except phenocams and CSAT on flux tower, the later was swapped out with a fault and returned to the US for repair. Probably invertebrate attack. Data was lost on the logger reading the YSI sonde in the creek due to a major CS200 software fault (interested people contact Nico for details).

Visitors to the site included: Keryn Paul, Stephen Roxburgh (CSIRO), Mike and Karen Joyce (JCU), Akira Kato and colleagues from Chiba University in Japan on repeat visit, carrying out TLS scans and drone photogrammetry. Collaboration set up with the CSIRO-JCU remote sensing group. Melissa Fedrigo, (JCU-CSIRO joint venture post-doc) is working on lidar to biomass for 1 year using Warra and Robson Creek site data.

Jennifer Mahuika, an MPhil student working with Stuart Phinn (UQ) will carry out remote sensing studies in the near future.

Daintree

A new site manager was appointed and started in March, Dr Michelle Schiffer. Michelle has a a PhD in Evolutionary Biology from La Trobe University and Post-doctoral work at CNRS in France. More recently she has been in charge of the Drosophila transect run by Ary Hoffman (UniMelb).

Around 20 researchers per month currently visit the site. Ray Mears was found filming at the end of 2015 for his new TV series 'Wild Australia'. Steve Backshall (Deadly 60) has been on site filming his new series 'Fierce'.

New collaboration planned with Paul Dennis (UQ) on leaf microbiology.

Great Western Woodlands

GWW SuperSite activities and issues over the October-February period included:

- Carl Gosper led a third field trip towards characterising the fire age distribution in gimlet woodlands across the western half of the GWW
- Processing of NutNet floristic and biomass data underway
- Repair of some damaged gutters on Drought Net rain-out shelters

There have been 78 downloads of GWW data from FluxNet since 5 Jan 2016.

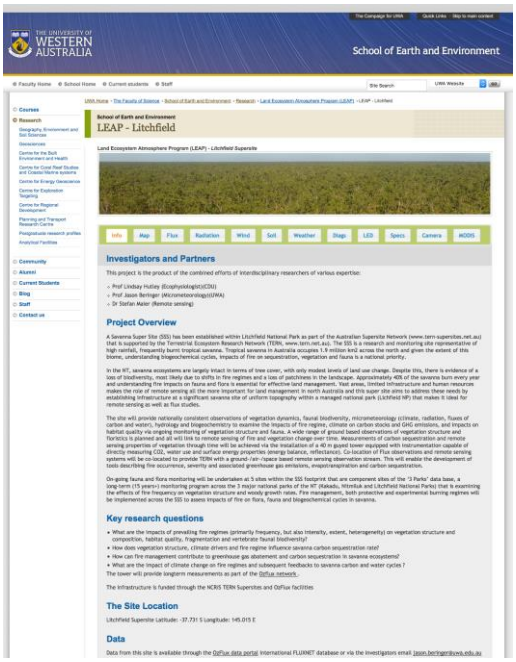
WA Department of Parks and Wildlife have added visitor accommodation to the Credo site.

Litchfield Savanna

Ian Marang (PhD candidate, Sydney University), Matt Northwood, Brad Evans and Jason Beringer installed 5 soil moisture monitoring stations for the SMAP program. Overstorey and understory phenocams have also been installed. Potential for further airborne campaign JPL/SMAP looking at fluorescence and vegetation structure. Potential 2018 campaign along NATT for NASA satellite program, involves Manish Verma Caltech JPL

(https://www.researchgate.net/profile/Manish_Verma21).

Bird survey is planned for mid-May to mid-June, soil survey July August. Sensor issues have been resolved. Monitoring and vegetation data are being collected, acoustic recording is running. A CO_2 profiling system will be installed on the flux tower by the end of 2016. Potential project with UWS looking at tree stress/ground water dynamics. The Australian Council of Environmental Deans and Directors annual meeting is hosted by Charles Darwin University this year and the meeting will be held in Litchfield National Park. Discussion of teaching and research direction in environmental science and management is the theme with a focus on northern issues and the Savanna Supersite will be showcased with a tour of the site. Our first SuperSite Steering Committee Meeting was held 17 March at Litchfield Parks NT head office.



LEAP website for Litchfield (http://www.see.uwa.edu.au/research/land/litchfield)

SEQ Peri-urban

Samford

Acoustic uploads are up-to-date. Monthly bird surveys have been carried out up to Dec 2015. LAI, photopoints, panoramas, photosphere images have been collected, CWD was assessed in November, and ant traps were collected in Nov. Seedling transect were surveyed in December 2015. Microblitz soil samples collected. Summer flower and fruit transects and species list.

Recent visitors to the site included a group of international scientists as part of World Science Festival as part of a TERN hosted international round table discussion on "Towards a Global Observatory". There were leaders from ILTER, NEON, Korea (KEON), Japan (JaLTER), US LTER, AnaEE and the Philippines present.

Karawatha

PPBio plot comparison to core 1 ha underway.

Ant data has been collected on the supersite and surrounding plots for comparison; we are continually collecting acoustic data (uploaded to Jan 2016); we've resampled the canopy using DCM photography (Feb 2016) and we collected MicroBlitz soil samples on the plot and 31 other plots in Karawatha.

Tumbarumba Wet Eucalypt

Reaching for the canopy, and getting there: March saw a variety of Australian researchers descend on Tumbarumba to investigate diurnal canopy stresses and productivity. The campaign was aimed at linking leaf level measurements of photosynthetic rate, fluorescence, pigment content and reflectance to the crown and site scale via remote sensing and flux data. The highlight of the trip was accessing to top of the canopy, up 50 meters, via an elevated work platform attached to a 32 tonne travel tower (see photos below).

A big thank you to all those involved in the planning and undertaking of the fieldwork, namely: Will Woodgate, Eva van Gorsel, Arancha Cabello-Leblic, Steve Zegelin, Dale Hughes (CSIRO); Lola Suarez (RMIT); Raymond Dempsey (JCU); and Alex Norton (UoM). Future planned fieldwork at Tumbarumba includes scanning the 1 ha SuperSite plot with Terrestrial Laser Scanners, including OzDWEL, to reconstruct the site in 3D.

Top : Lola, Raymond, Will and Mic on board the platform; middle: Lola taking leaf measurements at the top of the canopy; bottom: reaching sky high

Victorian Dry Eucalypt

Wombat

Measurements:

Bird survey has been completed. With decreased funding being available and students completing we are not able to maintain the current high frequency of auxiliary measurements. We have decommissioned sap flux measurements and automated dendrometer measurements, Vegnet measurements are also on hold.

A planned burn that was scheduled for November last year has not been carried out. Given recent changes to planned burning in the state following the Lancefield incidents it is unclear if Wombat flux will be burned in the near future.

Projects & Papers:

Two ARC Discovery projects have been submitted this round that both involve the Supersite. One on ecosystem respiration, one on methane uptake.

Both Nina Hinko-Najera and Anne Griebel will submit their PhD theses shortly.

Merryn Smith (PhD student) has successfully completed field work on non-structural carbohydrate dynamics on *E. obliqua*, annual measurements of NSC concentrations in all tree organs, response of NSC to resprouting.

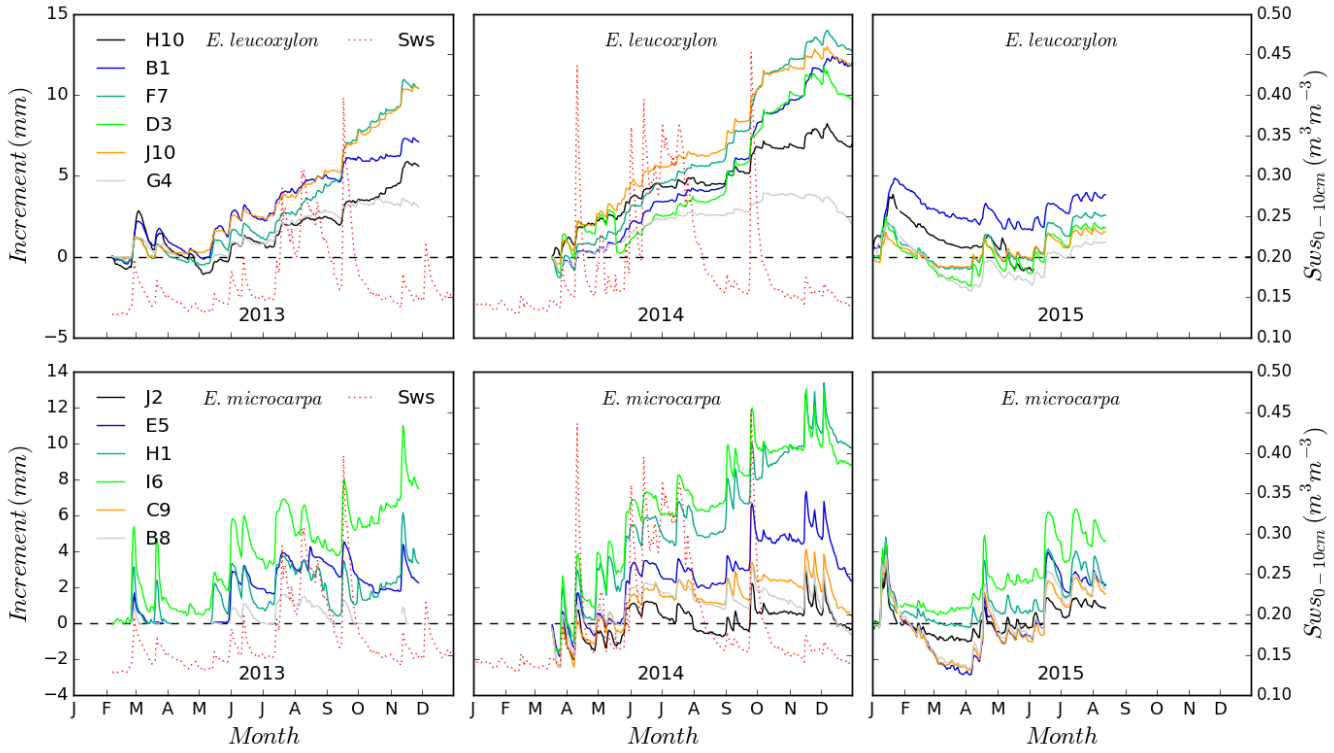
Carola Pritzkow (PhD student)is conducting field work on seasonal variation water relation traits in *E. obliqua* at the same forest. She is also studying variation of water relation traits in different *E. obliqua* populations across a rainfall gradient around Wombat.

Alison Bennett has started a research project as part of her Master of Environment studies on growth dynamics of eucalypts.

Two publications will be submitted to the OzFlux special issue: one on CO_2 flux data and one on automated chamber measurement of methane fluxes at Wombat and Warra.

Whroo

Currently most of the site equipment is operational. There have been some issues with the measurements of soil moisture probes in a new depth profile that are currently being rectified. We will be installing some new mounting hardware (mounting arm with a retractable dolly for mounting of eddy covariance and ultimately radiation equipment) before winter to ease maintenance tasks and instrumentation replacement. We are also designing new leaf litter traps to replace the previous units, which tended to be degraded by UV. Current analysis also suggests that drainage-driven advection is a significant nocturnal process at the site. Such drainage flows can be sensed with sufficiently sensitive instrumentation, so we plan to install a vertical array of



2D sonic anemometers (drainage flow velocities are generally < 0.5 m s^{-1}; the currently installed cup anemometers cannot measure flows < 0.5 m s^{-1}, whereas 2D sonic anemometers have a precision of ~0.01 m s^{-1})

Two rounds of bird surveys have now been completed for the site by Inka Veltheim, and ancillary measurements – including LAI (hemispheric photo method), dendrometry and litterfall - are ongoing.

We are currently working on two papers for the site. The first (title: 'A 3-year record of ecosystem-atmosphere carbon exchange from an 'ideal' Eucalypt woodland site: corrections, uncertainties and controls') is close to completion. The second paper compares interactions of carbon and water exchanges between the wooded Whroo site and a neighbouring cleared pasture (Riggs Creek).

Preliminary analysis of logging dendrometer data suggests a great deal of variation across the site that does not appear to be closely related to tree size class, but there is a clear short-term response to variations in soil moisture that is particularly pronounced in the dominant tree species (*Eucalyptus microcarpa*, > 90%), but much less so in the second-most dominant tree species (*Eucalyptus leucoxylon*). Since the soil moisture measurements are at 0.05 m depth, this may suggest that *E. microcarpa* sources water from closer to the surface (see Figure above).

Warra Tall Eucalypt

All instruments on flux tower except 2-D sonic anemometer (wind speed and direction measurements still available from C-Sat3) were functioning correctly. Two soil moisture probes were not functioning correctly. Span gas for calibration was found not to be accurate and will be replaced by a gravimetrically-prepared span gas. All CO_2 concentrations measured in the period will need to be corrected and the fluxes recalculated (with EddyPro) once the new calibration span gas is installed.

Thirty-minute records for meteorological data and water / energy fluxes 98% complete for period; 30 minute data for CO_2 fluxes 86% complete for period; 30 minute data for soil measurements 100% complete for period.

Core 1 ha plot: On-going monthly collection of insects in four flight-intercept traps. Hemispherical images taken 22nd December have been processed to calculate LAI. Data still to be uploaded onto portal. Aerial nadir and oblique phenocams have been operating (presumably) for the full period. Data will be downloaded at next scheduled tower campaign (April 2016). Ground-obliqua phenocam installed on 3/11/2015 and has been recording continuously since then. The images collected in the first 42 days have incorrect date-stamp (dd/mm transposed). Acoustic recorder operated throughout the period with no data gaps.

Hydrology: – Vandalism at Warra Weir on weekend of 3rd October and again one month later. Datalogger stolen, wiring pulled out and instruments thrown into creeks. No data from Warra or Swanson Creeks since then as we

await instrument checks and repairs. Ongoing collection of stream flow, turbidity, water temperature and water conductivity measurements from King Creek.

Silvicultural Systems Trial: 10-year post-harvest remeasurement of vascular plants in the two Aggregated Retention treatments was done. Ongoing monthly collection of ground-active beetles in the two control plots. Sorting and pinning of beetles from control plots continues and is almost completed (for period 2004-14). Annual survey of birds in the control plots was done.

BOM Climate Station: Full set of daily records of minimum and maximum temperatures, daily rainfall, 9:00 am and 3:00 pm relative humidity wind speed and wind direction. Rainfall over period 67% of long term average; monthly average maximum temperatures highest on record for October and December 2015; monthly average minimum temperatures close to average for each of the three months.

Large (very) tree has fallen across the road about 200 m short of the flux tower. This has prevented vehicle access to the base of the tower. Tree removal will require a large excavator. Currently waiting for one to become available.

Steel boom gates on Warra and South Weld Roads that were destroyed by vandals have been replaced.

Recent Publications

Apgaua DMG, Ishida FY, Tng DYP, Laidlaw MJ, Santos RM, Rumman R, Eamus D, Holtum JAM & Laurance SGW. 2015. Functional Traits and Water Transport Strategies in Lowland Tropical Rainforest Trees. *PLOSOne*. doi: 10.1371/journal.pone.0130799

Arndt SK, Irawan A & Sanders GJ. 2015. Apoplastic water fraction and rehydration techniques introduce significant errors in measurements of relative water content and osmotic potential in plant leaves. *Physiologia Plantarum* **155**: 355-368.

Arndt SK, Sanders GJ, Bristow M, Hutley LB, Beringer J & Livesley SJ. 2015. Vulnerability of native savanna trees and exotic *Khaya senegalensis* to seasonal drought. *Tree Physiology* **35**: 783-791. doi: 10.1093/treephys/tpv037

Bissett A, Fitzgerald A, *et al.* 2016. Introducing BASE: the Biomes of Australian Soil Environments soil microbial diversity database. *GigaScience* **5**:21. doi: 10.1186/s13472-016-0126-5

Cernusak LA, Barbour MM, Arndt SK, Cheesman AW, English NB, Field TS, Helliker BR, Holloway-Phillips MM, Holtum JAM, Kahmen A, McInerney FA, Munksgaard NC, Simonin KA, Song X, Stuart-Williams H, West JB & Farquhar GD. 2016 Stable isotope enrichment in leaf water of terrestrial plants. *Plant, Cell and Environment* (accepted). doi: 10.1111/pce.12703

Cleverly J, Eamus D. 2016. Droughts and flooding rains: it takes three oceans to explain Australia's wild 21st-century weather. The Conversation, https://theconversation.com/droughts-and-flooding-rains-it-takes-three-oceans-to-explain-australias-wild-21st-century-weather-56264

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, Maes W, Li L, Faux R, Santini NS, Rumman R, Yu Q, Huete A. In review. Soil moisture controls on phenology, productivity and evapotranspiration in a semi-arid critical zone. *Science of the Total Environment*. **Submitted to the CZO special issue: Landscape evolution and intensification in Australia: The Living Critical Zone perspective**

Cleverly J, Eamus D, Van Gorsel E, Chen C, Rumman R, Luo Q, Coupe NR, 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

Cleverly J. 2016. Postcards from the field. *EOS. Transactions of the American Geophysical Union* 97:C3.

Eamus D, Zolfaghar S, Villalobos-Vega R, Cleverly J, Huete A. 2015. Groundwater-dependent ecosystems: recent insights from satellite and field-based studies. *Hydrology and Earth System Sciences* **19**: 4229-4256. doi: 10.5194/hess-19-4229-2015.

Fest BJ, Wardlaw T, Livesley SJ, Duff TJ & Arndt SK. 2015. Changes in soil moisture drive soil methane uptake along a fire regeneration chronosequence in a Eucalypt forest landscape. *Global Change Biology* **21**: 4250-4264. doi: 10.1111/gcb.13003

Gosper C, Prober SM & Yates CJ. 2016. Continental-scale syntheses of Australian pyromes – misclassification of south-western eucalypt woodlands misinforms management. *Journal of Biogeography.* Online: doi: 10.1111/jbi.12693

Gosper C, Prober SM, Yates CJ & Scott J. 2015. Combining asset- and species-led alien plant management priorities in the world's most intact Mediterranean climate landscape. *Biodiversity and Conservation* **24**: 2789-2807. doi: 10.1007/s10531-015-0973-x

Grace JB, Anderson TM, Seabloom EW, Borer ET, Adler PB, Harpole WS, Hautier Y, Hillebrand H, Lind EM, Partel M, Bakker JD, Buckley YM, Crawley MJ, Damschen EI, Davies KF, Fay PA, Firn J, Gruner DS, Hector A, Knops JMH, MacDougall AS, Melbourne BA, Morgan JW, Orrock JL, Prober SM & Smith MD. 2016. Integrative modelling reveals mechanisms linking productivity and plant species richness. *Nature.* **529**: 390. doi: 10.1038/nature16524

Griebel A, Bennett LT, Culvenor DS, Newnham GJ & Arndt SK. 2015. Reliability and limitations of a novel terrestrial lidar scanner for continuous monitoring of forest canopy dynamics. *Remote Sensing of Environment* **166**: 205-213. doi: 10.1016/j.rse.2015.06.014

Griebel A, Bennett LT, Metzen D, Cleverly J, Burba G & Arndt SK. 2016. Effects of inhomogeneities in flux footprints on

the interpretation of seasonal, annual, and interannual ecosystem carbon exchange. *Agricultural and Forest Meteorology* **221**: 50-60. doi: 10.1016/j.agrformet.2016.02.002

Herr A, Dambacher JM, Pinkard E, Glen M, Mohammed C & Wardlaw T. 2016. The uncertain impact of climate change on forest ecosystems – How qualitative modelling can guide future research for quantitative model development. *Environmental Modelling & Software*. **76**: 95-107. doi: 10.1016/j.envsoft.2015.10.023

Huete A, Ma X. 2016. Rising extreme weather warns of ecosystem collapse: study. The Conversation, https://theconversation.com/rising-extreme-weather-warns-of-ecosystem-collapse-study-54898. Photo credits: Cleverly J (from Alice Mulga SuperSite)

Leff J, Jones W, Prober SM, Barberan A, Borer ET, DeLorenze EJ, Firn J, Harpole WS, Hobbie SE, Hofmockel KS, Knops J, McCulley RL, La Pierre KJ, Risch AC, Seabloom EW, Schuetz M, Steenbock C, Stevens C & Fierer N. 2015. Consistent responses of soil microbial communities to elevated nutrient inputs in grasslands across the globe. *PNAS* **112**: 10967-10972. doi: 10.1073/pnas.1508382112

Mitchell PJ, O'Grady AP, Pinkard EA, Arndt SK, Blackman CJ, Brodribb TJ, Duursma R, Fensham RJ, Hilbert DW, Nitschke CR, Norris J, Roxburgh S, Ruthrof KX & Tissue DT. 2016. Towards an ecologically relevant definition of drought and its impacts. *Global Change Biology* (accepted 2 Dec 2015)

Nolan R. 2015. Tonantzin, "Outstanding in the Field" Second prize, Ecological Society of Australia photo competition. Photo credit: Nolan R

Nolan RH, Resco de Dios V, Boer MM, Caccamo G, Goulden ML, Bradstock RA. 2016. Predicting dead fine fuel moisture at regional scales using vapour pressure deficit from MODIS and gridded weather data. *Remote Sensing of Environment* **174**: 100-108. doi: 10.1016/j.rse.2015.12.010

Nolf M, Creek D, Dursma R, Holtum J, Mayr S & Choat B. 2015. Stem and leaf hydraulic properties are finely coordinated in three tropical rain forest tree species.. *Plant, Cell & Environment* **28**: 2652–2661. doi: 10.1111/pce.12581

Pfautsch S, Harbusch M, Wesolowski A, Smith R, Macfarlane, C, Tjoelker, MG, Reich, PB & Adams MA. 2016. Climate determines vascular traits in the ecologically diverse genus *Eucalyptus*. *Ecol Letters* **19**: 240–248. doi:10.1111/ele.12559.

Pfautsch S, Macfarlane C, Harbusch M, Wesolowski A, Smith R, Boer M, Tjoelker MG, Reich PB & Adams MA. 2016. Vessel diameter and related hydraulic traits of 31 *Eucalyptus* species arrayed along a gradient of water availability. *Ecology* (submitted).

Prober SM, Yuen E, O'Connor M & Schultz L. 2016. Ngadju kala: Australian Aboriginal fire knowledge in the Great Western Woodlands. *Austral Ecology* (in review).

Rammig A, Mahecha MD. 2015. Ecology: Ecosystem responses to climate extremes. *Nature* **527**: 315-316. doi: 10.1038/527315a. Photo credits: Cleverly J

Scott, R.E.; Neyland, M.G.; Hovenden, M.J. (2015) Variable-retention harvesting in Tasmania: regeneration success? *Australian Forestry* **78(4)**: 232-242. doi: 10.1080/00049158.2015.1077693

Tng DYP, Apgaua DMG, Campbell MJ, Cox CJ, Crayn D, Ishida FY, Laidlaw MJ, Liddell MJ, Seager M & Laurance SGW. 2016. Vegetation structure and floristics of a lowland tropical rainforest in northeast Australia. *Biodiversity Data Journal* (submitted).

Zolfaghar S, Villalobos-Vega R, Cleverly J, Eamus D. 2015. Co-ordination among leaf water relations and xylem vulnerability to embolism of Eucalyptus trees growing along a depth-to-groundwater gradient. *Tree Physiology*. doi: 10.1093/treephys/tpv039

Zolfaghar S, Villalobos-Vega R, Zeppel M, Eamus D. 2015. The hydraulic architecture of Eucalyptus trees growing across a gradient of depth-to-groundwater. *Functional Plant Biology* **42**: 888-898. doi: 10.1071/fp14324

Staff Changes

Anne Griebel is finishing her PhD at Melbourne University and will be moving to Western Sydney University from April. Benedikt Fest will be assisting with the management of the Wombat Forest node of the Victorian Dry Eucalypt SuperSite.

Upcoming Events

6-8 June *2016*
Ecoacoustics Congress 2016. Michigan, USA. See website for details.

27 June - 1 July 2016
OzFlux Data Workshop, Calperum.

4-7 July 2016
OzFlux Conference, Calperum

4-9 July 2016
2016 GEO BON Open Science Conference, Leipzig, Germany. See website for details.

25-27 July 2016
5th International Conference on Earth Science and Climate Change, Bangkok, Thailand. See website for details.

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.

9-10 November 2016
GEO XIII, St Petersburg, Russia. See website for details.

The next issue of the Newsletter will be published in July 2016. If you have any news articles, photos, upcoming events, etc that you would like included please email shiela.lloyd@jcu.edu.au

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