TERN
OzFlux
Land-Atmosphere Observatory

Critical Zone Network Australia
Flora, Fauna & Society
Soils
Water
Bedrock
The zone that sustains terrestrial life

TERN
SuperSites
Ecosystem Change Observatory

Quarterly Newsletter

Issue 15, January 2017

SuperSite and OzFlux Update

Welcome to the 15th edition of the TERN SuperSites/OzFlux and CZO AU Newsletter.

We have been holding off on the release of this edition due to the on-going NCRIS Roadmap exercise. When the draft Roadmap was released there was a mixed response from the TERN community to the Environmental systems component of the Roadmap. All welcomed the approach that was suggested towards strong integration of remote sensing, field data collection and predictive modelling. The detail was somewhat lacking and where there was detail TERN did not feature strongly. The response from TERN to the roadmap has been measured and not highly critical but rather pointing out the value of long-term data sets, the need for field data in addition to sensors and the need for capital investment in sensors (not just operating). Overall the consensus seems to be that TERN remains in the mix at this stage.

Functionally TERN is operating with the new TERN Executive in place, this continues to meet on a monthly basis. Bek Christensen is back at TERN Central as Science Partnerships Manager 3 days a week, with Mark Grant still working remotely to deliver our newsletter, website, and other comms needs. In the TERN office Catherine Stubb's is now capably holding the fort. In addition to the new TERN logos in due course you will note a change in the front pages of the SuperSites and OzFlux web-pages and portals as we ensure that the Facilities all look more like 'one TERN'. The TERN Executive works with the TERN Scientific Advisory Committee (chaired by Steve Morton) who are a sub-committee of the TERN Board. The SAC will be meeting to discuss future directions the day before the first meeting of the new TERN Board which will be on 10th of March.

SuperSite Central Update

It has been a busy time for SuperSite Central since the annual SuperSites face-to-face meeting in July, with a range of cross-SuperSite and network-wide activities initiated or progressed. These include a data sharing project within the International Long Term Ecological Research (ILTER) network, international decomposition experiments (termite baits and Tea Bag Index), development work towards a 1-day Earthwatch-SuperSites program and working with the 'Committee on Earth Observation Satellites, Working Group on Calibration and Validation' to use our sites for ground calibration/validation of satellite data.

ILTER - Bottom Up Initiative: Mike Liddell presented a project brief to the ILTER Conference in South Africa. The project is looking at matching datasets from SAEON, JaLTER and TERN (Tumbarumba/Warra/LTERN). The aim is to identify issues (discoverability/metadata/protocols/data format) that need to be addressed to allow greater inter network data comparisons.

Wood decomposition experiment: Termite baits sent to 9 sites so far. Should get the remainder built and sent out by the end of the year. Jeff Powell (WSU) was successful in getting a grant for metabarcode sequencing of wood decomposing fungi trapped in termite baits.

Tea bags for "Tea Bag Index" experiment sent out and will be deployed at 10 sites at/near Core 1 ha plots. These have also deployed at a range of other plots (Nutrient network, RAPELD etc).

Fernando Camacho from the Committee on Earth Observation Satellites, Working Group on Calibration and Validation, Land Product Validation Subgroup is interested in putting SuperSites in a list of "*Super Characterised sites*" (https://lpvs.gsfc.nasa.gov/) for Cal/Val purposes. They are interested in vegetation structure, LAI, LiDAR, albedo. Grant submitted.

The new bespoke Raspberry Pi phenocams are completed with the first unit now undergoing field testing in the Daintree. Once it is established that this one is stable, they will be progressively deployed to other sites that have indicated they have had failures. As both the hardware and software is new in these systems they will be true beta-test versions to iron out bugs and take feedback before building a larger number of units to replace across the network.

The Biodiversity and Climate Change Virtual Laboratory (BCCVL) is interested in accessing our photopoint images by machine-machine transfer. To do this we need to ensure a machine readable format in our database (standardised file naming). I have updated the Photopoint protocol to ensure the use of the "input.csv" file provided with the protocol in your CloudStor folders. This will allow a script to change the camera file names to a standard format, after uploading to the BioImages staging area. To facilitate machine to machine transfer Alvin has begun work with the BCCVL and Atlas of Living Australia on developing an API to exchange data from our data systems with theirs, starting with plot data.

It has become apparent that the acoustic recorder microphones will degrade in the field over time at various rates, so data uploaders are encouraged to have a listen to the last recording when downloading data to check for sound quality. If unsure, listen to files from when the SM2 or SM3 was new and compare the noise floor and high frequency response to the latest recording (on good headphones in a quiet room). It is likely all sites will need to replace their microphones. Jason Wimmer did it every year at SEQ.

Faunatech Austbat (http://www.faunatech.com.au/products/songmeterdetails.html) can supply replacement microphones. Advice from Faunatech (Barb Young; goodgear@faunatech.com.au) is that the SMX-II microphone is the current version for SM2 Wildlife acoustic recorders. The SM3 acoustic recorder has two microphones available, the SMM-A1 microphone that is the same as the built-in microphone and the latest SMM-A2 model that has a better signal to noise ratio.

OzFlux Central Update

Some highlights for OzFlux since the last newsletter include:

The OzFlux Special Issue of Biogeosciences has been released with 21 articles available online at http://www.biogeosciences.net/special_issue618.html.

New TERN OzFlux logos have been produced and the website edited, as an interim measure, to make its appearance more consistent with other TERN websites.

The new OzFlux Steering Committee Meetings have started with meetings held on the 4th of August and 18th Nov 2016.

Work is in progress to develop one-day Earthwatch expeditions at SuperSites, for the corporate market, that would collect supplementary data within the footprint of OzFlux towers. These will be targeted at SuperSites that are readily accessed from major cities. Proposed protocols include measuring Diameter at Breast Height and height of stems not covered in the standard monitoring (DBH 1- 10 cm or 5 - 10 cm) and / or Coarse Woody Debris assessments.

The 2017 OzFlux conference will be held Western Sydney University, Hawkesbury campus in conjunction with the SuperSites Face-to-Face meeting with the dates yet to be decided.

An ARC-Discovery grant was awarded to Pendall, Tjoelker, Arndt, van Gorsel, Haverd and Davidson (US), titled "Temperature sensitivity of soil respiration and its components." The aim is to improve a predictive understanding of soil respiration across a transect of temperate Eucalypt-dominated SuperSites (Whroo, Cumberland Plain, Tumbarumba, Wombat, Warra) that form the Southeast Australian Temperate Transect (SATT).

News from around the SuperSite and OzFlux networks

Alice Mulga

SuperSite monitoring continues as normal. Next campaign in December 2016.

Termite/fungal baits deployed at Alice Mulga SuperSite.

Calperum Mallee

SuperSite monitoring continuing as normal. A phenocam failed and has been replaced. Acoustic recorders to get 128 Gb cards to extend recording time. Flood plain inaccessible for next couple of months due to floods.

David Chittleborough has moved to Byron Bay but will still be involved with Calperum.

Earthwatch Student Challenge for years 10-12 was run in December with another planned for March. These expeditions will collect a range of information on the health of the semi-arid ecosystems by the Murray River at Calperum.

Cumberland Plain

Infrastructure / monitoring status

- Spring 2016 LAI photos & analysis done, permanent photo points done (but photos from plot centre point NSEW, instead of to plot corners so need to be repeated)
- Spring 2016 Understorey vegetation survey done
- Completed vegetation mapping campaign across woodland area surrounding supersite, producing detailed mapping of LAI, basal area, Eucalypt/Melaleuca composition based on airborne LiDAR remote sensing (Nov 2015 by UNSW School of Aviation). This will be related to archived Landsat imagery to create image time series for the greater supersite area (possibly going back several decades).
- Termite baits and tea bags deployed

Termite/fungal baits deployed at Cumberland Plain.

- Sap flux sensors instrumented on Eucalyptus trees with and without mistletoe infestation.
- We need to replace the SM2 acoustic sensors.
- Canopy storage fluxes of CO_2 at our site are commonly equal to or greater than turbulent fluxes and make a significant impact on NEE calculations. This is a reminder that all flux towers located in forests with closed canopies should be operating profile systems, or at least using the one-point estimate of canopy storage in the NEE estimates.

New staff/students

- Anne Griebel now fully operational after recovering from a nasty knee injury.
- Daniel Metzen has started working part time as a research assistant.

New projects / collaborations

- ARC-Discovery awarded to Pendall, Tjoelker, Arndt, van Gorsel, Haverd and Davidson (US), titled "Temperature sensitivity of soil respiration and its components." We plan to study respiration across a transect of temperate Eucalypt-dominated SuperSites.
- Anne Griebel has set up a sap flux project near the core hectare to quantify how mistletoe infestation affects the water relations of *Eucalyptus moluccana* and *E. fribrosa*.

Visitors to SuperSite

- Prof Ivan Janssens, University of Antwerp, Belgium

FNQ Rainforest

Robson Creek

SuperSite monitoring proceeding as normal.

Recent visitors to the SuperSite included Akira Kato and the remote sensing group from Chiba University who were using TLS and UAV at Robson Creek to map gaps in the canopy. Prior to this in November a Queensland remote sensing group including Prof. Stuart Phinn (UQ, TERN AusCover) and Peter Scarth (DSITI, TERN AusCover) were on site once more, this time supporting their PhD student Jenny Mahuika in collecting TLS data in the core 1Ha.

Mike Liddell, Akira Kato and members of the Chiba University remote sensing team at Robson ck.

Security around the tower has been upgraded as there was an unauthorised entry to the tower resulting in damage to the fence (wire cutting tools were used).

Daintree

The Cape Tribulation node now has a reinforced concrete weir installed in the creek (Thompson Ck) adjacent to the core 1 ha to facilitate monitoring of water flow and water quality. An YSI-EXO-2 sonde has been installed (funded by JCU infrastructure), Starflow Doppler flow sensor and an ISCO automated water sampler installed. All the equipment will be used by an Imperial College student (Alice Farrelly) undertaking a study program at the DRO as part of her degree.

Weir and Sonde equipment installed in the creek at the DRO.

Microphones on the SM2 acoustic recorder have been replaced as the sound recording quality was deteriorating. The Drought experiment is continuing and is being looked after by JCU-DRO now that the ARC funded component of the experiment has completed. Steve William's faunal transects have been delayed but will be starting again soon.

Recent visitors included students from Carey Baptist Grammar High School - carrying out a range of bird and vegetation monitoring, and a mini-project on characterising cassowary habitat

Cow Bay

The Daintree Discovery Centre at Cow Bay was sold to a traditional owner investment group the Aboriginal Development Benefit Trust at the start of August 2016. ADBT have kept the current management, staffing largely intact and will continue their involvement with JCU and TERN. A camera trap is being installed to facilitate tourist understanding of nocturnal fauna on site.

Great Western Woodlands

Infrastructure / monitoring status

Credo

- Credo "Lodge" operational, with 8 rooms and en suites. DPaW will also be booking these out to paying guests so need to book early for field work.
- Widening use of the Field Studies Centre e.g. by community groups

Flux tower, weather station, plant physiology

Main flux tower

1. Uninterrupted data stream from main tower since last meeting. The site has returned to positive carbon balance.
2. Lost comms to main tower as a result of my efforts to extend comms to second tower. Will hopefully fix this in December.
3. Main tower have need an IRGA head swap with fresh chemicals in March 2017.
4. Data processing up to date to mid-September 2016 when last data was obtained.

Understorey flux tower

1. No activity on data processing for understorey tower owing to lack of time.
2. Hoping to extend comms to US tower in December.

Phenocams

1. Ground-level camera and oblique tower camera were working in September 2016, but nadir tower camera seems to have failed. It will be replaced in March 2017. Images uploaded to relevant portal.

1 ha vegetation plots

1. Overstorey cover images collected and five-point photopoints collected at core 1 ha (salmongum plot) on September 2016 field trip. Cover images have been analysed. Results and images uploaded to respective portals.
2. All dendrometers working and downloaded at all four plots. Data archived. Batteries of dendrometers will need replacing on March 2017 field trip. We will also remove flaked bark and re-install dendrometers.
3. All litter traps working at all four plots but data files not up to date.
4. Both sapflow sites have had their sensors re-installed (salmongum in Sept 2016 and gimlet in March 2016) and both are now fully operational.

1 ha plots biological monitoring:

*termite baits installed

*acoustic monitoring ongoing

*floristic monitoring repeated this spring for Salmon gum plot

Gimlet fire-age plots:

*Ongoing work to characterise fire age distribution in western portion of GWW

*2 lay articles prepared

Sandplain plots:

•ATN project in development – Isotope work AKA Stefan work on TREND- Will analyse for a community slope along the SWATT 480 samples from 53 sandplain taxa and for targeted slopes 50 Salmon gum sample (from Judith Harvey's MSc), and 60 Gimlet samples (15 sites) from Byrne and colleagues climate adaption work.

•SWATT Technical report cleaned and about to be submitted to AEKOS for posting.

•SWATT beta analysis by Neil Gibson et al submitted and under review

Nutrient Network:

*Spring monitoring completed for Nutrient Network

*Also completed leaf microbiome sampling at Nutrient Network sites

DroughtNet:

- New Onset HOBO automatic weather station installed in September 2016. Two raingauges are now active at the site: a HOBO raingauge and a second ICT gauge on a separate logger and power supply as back up.
- All 20 DroughtNet plots were photographed for biomass estimation in both September 2016. Images not processed yet.
- All 20 DroughtNet plots were sampled with the Zebedee ground-based LiDAR instrument for biomass estimation in September 2016. Data not processed yet.
- Another ~10-12 bluebush shrubs were photographed, sampled with the Zebedee and destructively harvested for biomass measurements on the September 2016 field trip. These have not been analysed.
- Floristics surveyed
- Soil moisture measured
- Teabags inserted

"Tea Bag Index" tea bags deployed at GWW.

Additional projects

*Student project: Renae Boyd (UWA) Assessing if understorey vegetation benefits from canopy/overstorey through shading, microclimate, nutrients etc.

1. 10 day field trip in September 2016 to establish plots for project on facilitation of understorey plants by overstorey, and to conduct spring measurements. Summer measurements planned in December 2016.
2. 15 plots established in five groups of 'bare', 'current overstorey cover' and 'past overstorey cover'.
3. Installed HOBO pendant loggers for air temperature.
4. Soil sampling for bulk density and soil chemistry.
5. Ground cover and litter estimates.
6. Foliage sampling for stable carbon isotopes.
7. Fisheye images for radiation modelling.
8. Light response curves (LI-6400).
9. Dark-adapted chlorophyll fluorescence.

*Jennifer Peters, Western Sydney University PhD student, supervised by Brendan Choate, undertaking a project on 'Characterization of Hydraulic Thresholds of Drought Induced Mortality in Forests across Australia. Jennifer is currently conducting a 3 week campaign at Credo, as part of a wider study across SuperSites.

*Garry Cook and Adam Liedloff, CSIRO Darwin: Drivers of woodland structure and dynamics across Australia: root zone vs light limitation.

Litchfield Savanna

SuperSite is running well but communications are down which has been diagnosed as a faulty modem which will be replaced next trip.

Recent visits to Litchfield include staff from CDU funded by the NESP's Threatened Species Hub (Prof Mike Lawes, Dr Brett Murphy, Dr Leigh-Ann Woolley) and students, looking at arboreal mammal density in relation to tree stand structure (tree age and hollow tree density) and fire.

New Projects / Students

- NESP Threatened Species Hub Arboreal mammal density in relation to tree stand structure and fire. A survey will be designed taking into consideration the distribution of habitat, tree species distribution and existing 3 Parks plot locations that have previously sampled fauna.
- Mr Grigorijs Goldbergs is another CDU PhD student working at the Supersite and he will be establishing a second 1 ha vegetation plot in addition to the current plot.

SEQ Peri-urban

Samford

Data collected at Samford 11/2/16-17/11/16

- Acoustic data, most of 2016
- Bird survey data, 2015
- Autumn, winter and spring (2016) LAI images
- Phenocam images (Liam Grace to upload)
- Ant trapping, March and November 2016 (November samples to be sent to Darwin next week)
- Winter flowering and fruiting data
- Species and functional traits list updated
- Set up teabag decomposition experiment: 2 sites, to be collected January 2017
    - SuperSite
    - Forest CO_2 automated chambers site
- Consolidating all Samford Ecological Research Facility data, including SuperSite datasets and other data collected within the SuperSite boundaries (soil moisture, CO_2), into central database to be accessible to researchers 2017
- Annual SERF community information session (October 2016) detailing SuperSite activities
- Pollen monitoring instrument added to the flux tower.

Karawatha

Continued SM3 Acoustic sensors 2hrs each side of sunrise and sunset, at 44 KHz

Termite baits will be deployed in February, 2017

New honours student (Jo Davis, supervised with Prof Darryl Jones) working on frog species distribution and abundance and the impacts of roads in the peri-urban environment at Karawatha.

Tea Bag Index project has been expanded to include all 33 LTER plots at Karawatha, to be deployed in February 2017.

New project monitoring water quality between Logan and the Logan River will commence in 2017.

Tumbarumba Wet Eucalypt

New projects / collaborations

ILTER Bottom Up Initiative (BUI) project aims to find impediments to "practically and efficiently using data from LTER networks across continents to answer scientific questions of global significance which require the use of long term data sets". This BUI is "Data Integration Across Continents: Understanding Changes in Biodiversity, Carbon and water under climate change (UCBC)". For this initiative extant data will be used to assess the extent to which changes in biodiversity and biogeochemical cycling of carbon are being driven by water availability and climate change across the different

biomes. This will include data from Tumbarumba, Warra, LTERN, JaLTER and SAEON.

Visitors to SuperSite

Darius Culvenor (to re-establish PAR sensor network and reconfigure it; details in infrastructure/monitoring status)

Infrastructure / monitoring status

- Deployed the Termite / Fungal decomposition baits
- Checked acoustic recordings are 44KHz; new larger cards capable of holding enough data for longer time between visits, but still fast enough to do transfer to HDD on site. Data uploaded to 'data.bioacoustics.supersites.net.au'
- First set of LAI photo's required completed earlier in the FY; had meeting with Arantxa Cabello-Leblic who described processing and upload process, but still need to work through this
- 5 point photos for 2016 will be done in December
- Phenocam data retrieved and uploaded
- Re-establishment of the PAR sensor network; now measuring up & down fluxes at ground level (fAPAR) - ancillary node measurements include temperature and relative humidity
- Removed VegNET sensors for re-modification to monitor understorey dynamics instead of canopy dynamics due to limited range
- Purchased BF5 diffuse-to-total radiation sensor (PAR wavelengths) to be installed on top of the tower next month
- New NAS system for Hyperspectral data seems to be working well, but data final storage and checking systems still being bedded down
- Had a few issues with Windows 10 Anniversary update interrupting data collection; cause enormous downloads over NextG network, but seems sorted now. Lack of Windows 7 updates also seemed to be causing Hyperspec software issues; seems sorted now

Victorian Dry Eucalypt

Wombat

Nina Hinko-Najera started her position as the new site coordinator for the Victorian Dry Eucalypt Supersite in October. Nina will also be responsible for the operation and data submission of the Wombat Flux tower.

New projects include:

TERN Supersite PI's Elise Pendall and Stefan Arndt, together with Mark Tjoelker, Erik Davidson, Eva van Gorsel and Vanessa Haverd were awarded an ARC Discovery project to investigate the "Temperature sensitivity of soil respiration and its components". The project will involve measurements in a range of southern TERN Supersites and will start in early 2017. Postdoc for this project will be hired in early 2017 and will be based at WSU.

New rainfall exclusion experiment set up in the Wombat Forest. Leonards Hill, regrowth site (mainly *Eucalyptus obliqua*), 5-8 m tall trees. Should run for 2 years. Should be part of DroughtNet. Focuses on water relation trait variation and plasticity. The research project aims to investigate how seasonal or extended drought influence tree function in eucalypt trees. The project has installed small rainfall interception shelters in the Wombat Forest near Melbourne in Victoria. The shelters consist of plastic troughs that are suspended above the ground and intercept part of the rainfall. The shelters reduce the amount of rainfall available to the trees and introduce a moderate level of drought stress. The stress is in line with the level of drought to be expected under changing climatic conditions. We monitor tree physiological variables in order to assess how the trees adjust to the drought conditions. The project outcome is a detailed assessment of the vulnerability of eucalypt trees to lower rainfall conditions and a better understanding of how eucalypts adapt to drought. Six 14*14m plots have been established in the field, three control plots and three treatment plots. The rainfall interception shelters were installed in the three treatment plots, imposing a moderate drought. This set-up will lead to an approximate 50% reduction of rainfall on site. Every 2-3 months leaf and/or branch (branch diameter ~1cm) samples will be collected of six *Eucalyptus obliqua* trees per treatment and control plot. The rainfall exclusion project is part of the PhD of Carola Pritzkow.

Installation team (from left: Philipp Nauer, Chris Szota, Martin Pount, Thomas Haden, Stefan Arndt, Carola Pritzkow).

Rainfall exclusion set up at Wombat.

The flux tower equipment at the Wombat Flux tower was down for the last few months. We had issues with the CSAT3 anemometer and also with the Licor LI7500. Both instruments have been repaired and are ready to be re-deployed. We also had to re-fit new batteries into the remote area power system.

ICT sap flow/Psychrometer to continually measure hydraulic conductance. Results have been mixed as instrument stops working when it gets wet.

Whroo

SuperSite monitoring is proceeding as normal. Permitting process for the new Boyagin site has been slow but due to proceed next week with a meeting of traditional owners. The aim is to move the infrastructure from Whroo to Boyagin in Feb/Mar 2017.

Warra Tall Eucalypt

Scott Whitemore (UTas) has commenced his PhD study on call-classification algorithms from bioacoustics data: this is the bird bioacoustics component of ARC Linkage (New approaches for sustainable forest management)

Liu Minxing arrived at UTas from China and has commenced PhD study of the insect metagenomics component of ARC Linkage (New approaches for sustainable forest management).

Infrastructure / monitoring status

- Flux tower – all instruments working well, data processed to OzFlux QC -L3 lodged on portal up to September 2016.
- 3-G model has been installed on the top of the flux tower and reliability of data transmission is being monitored by Entura
- Established new photopoints for LAI photographs in Core 1-ha – moving from 36-point fisheye to 81-point standard lens photographs.
- Acoustic recorder operated continuously over period. Records to April 2016 have been uploaded onto Bioacoustics Portal.
- Sondes installed in Warra and King Creeks have been refurbished with new turbidity sensors installed.
- Seven Frontier Laboratories acoustic recorders have been installed along a 300 m transect anchored to the Core 1 ha plot. Wildlife Acoustics recorders have been co-located with three of the recorders. Will be undertaking intensive bird surveys in December to get a large library of time-matched bird ID / acoustic records to use as training data for evaluating algorithms to classify acoustic data. Will also have data to allow the two makes of recorders to be compared.
- phenocam data downloaded. One camera fail (data)
- LAI moving to 81 point DCP, difficulty of light conditions for DHP

New projects include:

- Warra is the anchor for the Southeast Australian Temperate Transect (SATT) established by Elise Pendall for a successful ARC Discovery project: Improving predictive understanding of temperature sensitivity of soil respiration and its components in Australian temperate forests.
- ILTER Bottom Up Initiative (BUI) project aims to find impediments to "practically and efficiently using data from LTER networks across continents to answer scientific questions of global significance which require the use of long term data sets". This BUI is "Data Integration Across Continents: Understanding Changes in Biodiversity, Carbon and water under climate change (UCBC)". For this initiative extant data will be used to assess the extent to which changes in biodiversity and biogeochemical cycling of carbon are being driven by water availability and climate change across the different biomes. This will include data from Tumbarumba, Warra, LTERN, JaLTER and SAEON.

Recent visitors to the site included:

- August 2016 - Forest Education Foundation hosted ca. 20 environmental studies students from Hobart College
- September 2015 - Mark Hunt - Staff and students from the ARC Training Centre for Forest Values
- November 2016 - Warra included in a 3-day Earthwatch Institute workshop on managing Natural Capital for Agribusiness executives from NAB. (x25)

Earthwatch-NAB excursion to Warra

Recent Publications

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Upcoming Events

12-16 December 2016
AGU Fall Meeting, San Francisco, USA. See website for details.

9-13 January 2017
2017 Australia New Zealand Society of Ecological Economics Conference, Adelaide. See website for details.

2-3 February 2017
2017 Australasian Ecoacoustics Workshop, Brisbane.
See website for details.

7-10 February 2017
Australian Meteorological and Oceanographic Society Conference, Canberra. See website for details.

26-30 June 2017
Open Repositories 2017 Conference, Brisbane. See website for details.

21-25 August, 2017
The 12th International Congress of Ecology, Beijing, China. See website for details.

The next issue of the Newsletter will be published in April 2017. 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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