

Samford Ecological Research Facility

2015/2016 Annual Report

Research, education, outreach and operations

The Samford Ecological Research Facility (SERF) is a 51-hectare property located in the Samford Valley, west of Brisbane. The property was generously bequeathed to QUT by renowned Queensland entomologist Dr Elizabeth Nesta Marks AO. SERF is used for research, teaching and learning programs about diverse subjects including soil, water and air quality; groundwater systems; microbiology; plant biology; invertebrate and vertebrate biology; ecology; ecosystem monitoring; population management; vegetation and soil mapping; geographic information systems; sustainable building techniques and experimental design.

Research

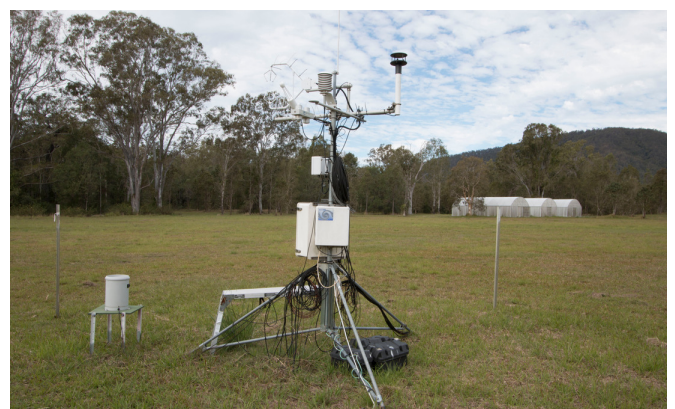
SERF is a unique facility that gives QUT researchers and students opportunities to investigate the climate, environment, soil, water, vegetation and wildlife of a peri-urban ecosystem. Research activities at SERF during 2015/16 included ecological monitoring, unmanned aerial vehicle use, insect behaviour studies and vegetation and fauna surveys.

Ecological monitoring

SERF has been part of the Australian Supersite Network, a facility of the Terrestrial Ecosystems Research Network (TERN) since 2012. This is a nationwide Australian Government program of systematic, automated monitoring of ecosystems. SERF continues to host the National Collaborative Research Infrastructure Strategy TERN South-East Queensland Peri-Urban Grassland Supersite.

Ecological monitoring and research activities included:

- environmental monitoring and data collection of carbon dioxide and water flux using the OzFlux Station and weather monitoring station (Professor Peter Grace, Dr David Rowlings and Dr Clemens Scheer)
- automated greenhouse gas measurement (Dr David Rowlings and Dr Clemens Scheer)
- water quality, flow and nutrient dynamics (Dr Martin Labadz and Dr David Rowlings)
- soil moisture chemistry research (Dr David Rowlings).



Vegetation and fauna surveys

Seventy percent of the SERF property is covered with vegetation, providing refuge to native plants and animals under increasing pressure from urbanisation. The vegetation is protected and classified under the *Vegetation Management Act 1999*.

Over time, observation and measurement of changes in flora, fauna and biophysical processes within important ecological communities helps to gauge environmental variability and the significant impact of urban development.

Research Assistant David Tucker has continued to conduct ongoing monitoring of a range of vegetation and fauna surveys within the one hectare plot established at SERF as part of the Australian SuperSite Network/TERN. Flora are measured for structural vegetation attributes, sampled for genetic and carbon isotope analysis and collected as herbarium specimens. Seasonal changes in canopy cover along parallel transects have also been monitored.

Fauna surveys of bird species using acoustic and visual methods have been a major research focus at SERF. Recording environmental sounds using remote 'song meters' has revealed birds as the dominant audible species at SERF (Jason Wimmer). Visual surveys of a two-hectare ecological sample area using acoustic sensors also determined the abundance of bird species (Masters student Dez Wells).

Rapid biodiversity-assessment methods (such as acoustic sensing) have become highly desirable in comparison to traditional full-scale field assessments. Field survey methods including pitfall trapping and ground searching (spotlight/call triangulation) have been compared with remote acoustic survey results in the detection of frog species (VRES students Leah Gustafson and Brendan Doohan). The tadpole population in Samford Creek has also been sampled to examine the gene flow, movements and habitat use by the stream associated frog *Mixophyes fasciolatus* in riparian corridors and large remnant forest patches in the Samford Valley (Masters student Andrew Schwenke).



Several undergraduate student projects used thermal imaging technologies in fauna surveys. Projects included using line transect surveys with a thermal imaging camera to detect heated models that mimic the general mammalian body temperature of living organisms (Honours student Jessie Mckee) and investigating the use of infrared thermography to detect animals as part of Integrative Biology Capstone field experiments (undergraduate students Lillie Gill, Sam Mylne and Russ Beddoes).

Dr E.N. Marks Sustainability Award 2015

Since 2008, QUT's Institute for Future Environments has presented an annual award to recognise a QUT undergraduate student for a high quality research project that both maintains the environmental integrity of SERF and engages the university and the wider community.

The 2015 Dr E.N. Marks Sustainability Award was presented to **Russell Beddoes**, for his research project examining the effect of interference in thermal images and the detection errors this could lead to for ecological surveys. The research was carried out both in controlled laboratory conditions and in the field at the Samford Ecological Research Facility. Russ has since become a welcome addition to QUT's Quantitative Applied Spatial Ecology research group and will be commencing his Masters studies in 2017.

Insect behaviour

Three insect enclosure screenhouses were installed at SERF in November 2012, and have been extensively used by QUT researchers for studying insect behaviour. Many experimental studies have focused on the Queensland fruit fly, *Bactrocera tryoni*.



The screenhouses have been used to investigate how male and female Queensland fruit flies find each other to mate and the importance of host fruit presence (PhD student, Ms Thilini Ekanayake). Experimental fruit fly lure traps have also been tested in the enclosures prior to field testing in the open environment (Lona van Deldon). A new study began on the ecological and behavioural aspects of the wasp, *Diachasmimorpha kraussii*, which is a larval parasitoid of the Queensland fruit fly. The study will investigate the wasp's host foraging behaviour and the role of learning experience in the host location experience (PhD student Aead Muhmed).



Unmanned aerial vehicles

The use of unmanned aerial vehicles (UAVs or 'drones') in the field of ecological research is increasing. QUT's Australian Research Centre for Aerospace Automation (ARCAA) carried out a number of drone missions at SERF to train QUT technical and research staff and test the integration of various payloads and sensor technologies. Test flights were used during integration of the multispectral camera on a multirotor UAV to conduct live-streaming via Skype of thermal imagery. Undergraduate students were also trained in the use of a fixed-wing UAV fitted with a multi-spectral camera for the planning and data capture for producing future high-resolution data products. The utility of this training and methods development will be to quantify changes in vegetation growth over large spatial and temporal scales.



Animal ethics compliance

The QUT University Animal Ethics Committee inspected the SERF site on 7 September 2015 as part of their obligation to monitor all activities related to the care and use of animals for research purposes. The Committee was informed that very little animal research or teaching activity was conducted at SERF. It was recommended that an interim report be provided by SERF for alternate years when no formal inspection was scheduled. SERF was also asked to consider and advise on any effect related to the use of UAVs on wildlife and birds.

Education

SERF continues to play a significant role in QUT's educational programs and provides diverse opportunities for students to conduct experiments in the field and gain practical research experience.

Many students from QUT's Science and Engineering Faculty visited SERF to study the site's flora, fauna and ecosystem ecology using a variety of field survey methods. Students in course *BVB202 Experimental Design and Quantitative Methods* used transect and quadrat methods to measure tree density while students in course *EVB102 Ecosystems and the Environment* learned soil survey methods.

With its diverse range of wildlife, SERF is the perfect setting for students to examine a number of animals. Students in course *BVB223 Insect Life* collected insects and inspected insect traps to examine a variety of specimens from the site, contributing to their understanding of field entomology. Students in course *BVB214 Vertebrate Life* conducted a field vertebrate study looking for reptiles and mammals in leaf litter, pitfall traps and Elliot traps.

As in previous years, urban planning students conducted a site appraisal of SERF to prepare a fictional concept planning proposal for a long-term sustainable residential development. Students in course *ENB274 Design of Environmentally Sustainable Systems* were required to incorporate the natural resource values of the site into their proposal to minimise any development's impact on the site's flora and fauna.



Outreach

SERF is not just a facility for QUT academics and students. Every year, it is visited by a broad range of people, including researchers from other institutions, politicians and public servants.

Visitors during 2015/16 included descendants of Georg Atthow who purchased the SERF land and lived in the Slab Hut and representatives from TERN SuperSite, Millen Farm Group and Samford Museum.

SERF also held a public information session on 15 October 2015 to provide an overview of the university's site activities and research projects. At the evening, speakers included Field Technician Marcus Yates, Research Assistant David Tucker, Principal Research Fellow (Autonomous Systems) Dr Matt Dunbabin who spoke about UAV research and Dr Paul Cunningham who discussed fruit fly research at SERF.



During 2015/16, SERF's research was featured on several media programs. Our ecoacoustics research was highlighted on both ABC Catalyst (12 July 2016, Dr Susan Fuller and Jessie Cappadonna) and Scope, a children's science show (10 September 2016, David Tucker). SERF's water monitoring research was also featured on Totally Wild, a children's wildlife show (1 June 2015, Dr Martin Labadz).

Operations & management

During 2015/16, improvements continued to be made to SERF's infrastructure and natural habitat and involved weed eradication, revegetation, a controlled burn off and maintenance of The Barracks building.

SERF Site Technician Marcus Yates, with the assistance of Charlie Sparks of Forestry Maintenance Systems, has progressed the arduous task of eradicating of the estimated 88,500 woody perennial environmental weeds identified within the 35 forested hectares at SERF. The weeds concentrated on, in order of density, included *Lantana camara* (Lantana), *Ochna serrulata* (Mickey Mouse bush), *Senna pendula* (Eastern Cassia), *Asparagus africanus* (Climbing Asparagus Fern), *Asparagus aethiopicus* (Ground Asparagus Fern), *Celtis sinensis* (Chinese Elm) and *Corybia torrelliana* (Cadagie).

Re-vegetation of areas on either side of the main entrance after road works has now been completed. After waiting for optimum weather and subsoil moisture conditions for plants to be established, a variety of plants, shrubs and trees native to the Samford area were planted.



After advice from the Rural Fire Brigade, a controlled burn off of old tree debris located on the pasture land near the south western boundary of the SERF property was carried out on 11 February 2016. The burn off reduced the fire hazard posed by stacks of old dry timber and to enable the entire pasture area to be slashed regularly. Firefighters remained on site until the area was safe to leave. A patch of debris was left untouched to provide a continued refuge for small birds in the pastured area.



Weather-exposed parts of The Barracks received maintenance including oiling of the veranda flooring and staining of timberwork around the decks. Insulation of the garage workshop roof was also carried out to complement an upgrade of the wall shelving, and installation of a hygienic stainless steel bench with accompanying sink. This workshop is well used by researchers for equipment maintenance and field study sample preparation.

2016/2017 goals

- Continue establishing the SERF herbarium.
- Complete the weed eradication program by June 2017. As of August 2016, approximately 85% or 31 hectares of forest at SERF had been cleared of woody perennials weeds.

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