

Samford Ecological Research Facility 2016-2017 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. Seventy per cent of the SERF property is covered with vegetation, which provides refuge to native plants and animals under increasing pressure from urbanisation. The vegetation is protected and classified under the *Vegetation Management Act 1999 (Qld)*.

SERF is managed by QUT's Institute for Future Environments (IFE). It is used for research, teaching and learning programs involving many 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.

Since 2012, SERF has been classified as a South-East Queensland Peri-urban Grassland Supersite as a facility of the Terrestrial Ecosystems Research Network (TERN) and part of the Australian Supersite Network. Operating under the National Collaborative Research Infrastructure Strategy (NCRIS), TERN is a nationwide Australian Government network of research infrastructure that allows systematic, automated ecosystem monitoring.

Ecological monitoring

Professor Peter Grace, Dr David Rowlings and Dr Clemens Scheer from IFE have continued the environmental monitoring and data collection of carbon dioxide and water flux using the OzFlux Station and weather monitoring station.



Many of the ecological research studies occurring at SERF are quite long term, including activities associated with automated greenhouse gas measurement (Dr David Rowlings and Dr Clemens Scheer), water quality, flow and nutrient dynamics (Dr Martin Labadz and Dr David Rowlings) and soil moisture chemistry research (Dr David Rowlings).

Unmanned aerial vehicles

The SERF property has been in high demand for trialling the use of unmanned aerial vehicles (UAVs, or drones) for remote sensing applications. IFE's Research Engineering Facility has been engaged by researchers to carry out several UAV missions at SERF to train QUT technical and research staff and test integration of various payloads and sensor technologies. These missions included wildlife, air quality, preparation for Great Barrier Reef surveys, and agricultural and environment surveys with thermal, high-resolution RGB, hyperspectral and multi-spectral camera systems.

Flight tests of UAVs were conducted at SERF to develop autonomous control systems for survey mapping applications. PhD student Ajmal Natheer's research has focused on the use of autonomous multi-rotor UAVs capable of detecting agricultural weed pests and acting on the detected target. This work has enormous potential for precision biosecurity applications.

Undergraduate student Tyler Kersnovski has investigated the use of autonomous UAVs for pipeline tracking and gas detection. The SERF property was used to conduct preliminary ground tests, later extending to multiple flight tests with a quadrotor UAV.



Vegetation and fauna surveys

Observation and measurement of changes in flora, fauna and biophysical processes over time within important ecological communities is useful for gauging not only environmental variability, but also the significant impact of urban development. As part of the ongoing monitoring of the South-East Queensland Peri-urban Grassland Supersite, Research Assistant David Tucker has continued to conduct a range of vegetation and fauna surveys within the one-hectare plot. Flora are measured for several structural vegetation attributes, sampled for genetic and carbon isotope analysis, and some have been 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. Masters student Dez Wells visually surveyed a two-hectare ecological sample area using acoustic sensors to determine the abundance of bird species. Solar acoustic monitoring instruments are also installed on-site, with data uploaded to the TERN Supersite data portal periodically throughout the year.

Insect behaviour

Since their installation in November 2012, SERF's three insect enclosure screen houses have been extensively used by QUT researchers studying the behaviour of insects. Many experimental studies have focused on the Queensland fruit fly, *Bactrocera tryoni*. Lona van Deldon tested experimental fruit fly lure traps in the enclosures prior to field testing in the open environment, while PhD student Aeadd Muhmed began a new study on the ecological and behavioural aspects of the wasp *Diachsmimorpha kraussii*. This wasp is a larval parasitoid of the Queensland fruit fly, and the study will investigate its host foraging behaviour and the role of learning in the host location experience.



Education

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

Environmental sciences

The SERF property's unique mix of native forest and pasture lands provides students majoring in environmental sciences with the opportunity to assess ecosystem change and the impact of human factors on the environment. Students studying unit course *EVB102 Ecosystems and the Environment* examined the composition of ants in forest, edge and pasture habitats to determine whether species diversity is related to habitat type.

A field trip conducted for students in unit course *EVB201 Global Environmental Issues* compared weed abundance in edge and interior habitats to demonstrate the consequences of habitat fragmentation and edge effects. Soils play a critical role in ecosystem function in a changing environment and students enrolled in unit course *EVB212 Soils and the Environment* had the opportunity to learn soil sampling and surveying methods crucial to an understanding of the complexity of environmental systems.



Biological sciences

With its diverse range of wildlife, SERF is the perfect setting for students majoring in the biological sciences to examine animals in an environmentally natural system. Students in unit course *BVB202 Experimental Design and Quantitative Methods* visited SERF to study the site's flora, fauna and ecosystem ecology using a variety of field survey methods, including line transect and quadrat methods.

SERF's abundant insect population has enabled students studying unit course *BVB223 Insect Life* to collect insects and inspect insect traps to examine a variety of specimens from the site, thus contributing to their understanding of field entomology. Likewise, students in unit course *BVB214 Vertebrate Life* conducted a field vertebrate study looking for reptiles and mammals in leaf litter, pitfall traps and Elliot traps as part of an examination of Australian animal diversity and evolution.

SERF is also home to several invasive species, and students enrolled in unit course *BVB321 Invasion Ecology* completed a field trip that required them to estimate the density of invasive species (plants, animal signs) and use thermal imagery to detect mammalian invasive species.

Engineering

Access to the SERF property's flora and fauna has enabled students majoring in civil or environmental engineering to build skills in planning for sustainable urban development. Students in course *ENB274 Design of Environmentally Sustainable Systems (EGB274 Environmentally Sustainable Design)* were required to visually survey and observe plants 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. *EGB380 Environmental Law and Assessment* students undertook a mock development assessment, which included an ecological vegetation condition survey at SERF to understand more about the adverse consequences of human activity and government development planning regulations.

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, Federal, State and local government representatives and public servants.

Visitors

SERF played host to members of the Queensland Bushfood Association (QBA) on 1 March 2017. The QBA aims to promote the growth and use of Australian native food plants, to share interest and knowledge, and to establish co-operative relationships with organisations with similar aims. Site Technician Marcus Yates took the QBA group of 14 people on a tour of the SERF property, pointing out and discussing native plants and their properties and uses. As is usual for visits to SERF, the tour finished with morning tea and conversation on the Barracks verandah.



Media coverage

Scope, a children's science show, filmed two segments at SERF including an interview with David Tucker about acoustic sensors (aired 10 September 2016, Network 10) and an interview with Grant Hamilton about invasive ecology and Myrtle Rust (aired 28 January 2017, Network 10).



Local community information session - 2016

Each year QUT hosts a local community information session at SERF to enable Samford residents and the broader community to learn more about the work being done at the property. The session includes an overview of the University's activities at SERF, information about exciting research projects and developments, and an opportunity for community members to ask questions.

In 2016, the information session was held on 20 October and featured presentations from QUT researchers, and media coverage of activities conducted at SERF.

Site Technician Marcus Yates provided an update on maintenance and upgrades made to SERF during the year. Researcher Lona van Deldon presented a summary of research at SERF involving the development of fruit fly lures. Media clips from several television shows were displayed, including water quality with Dr Martin Labadz (Network Ten - Totally Wild) and eco acoustics research with lecturer Susan Fuller (ABC – Catalyst).

Dr E.N. Marks Sustainability Award

QUT student Russ Beddoes was announced as the winner of the 2015 annual award. Russ gave an overview of his research into the capability of infrared thermography (thermal imaging) for detection of animals.



L-R Russ Beddoes receiving his award from Dr Juan Cooper

Operations and management

Governance and staffing

In November 2016, IFE welcomed its new Director of Research Infrastructure, **Sach Jayasinghe**. Sach oversees the IFE Research Infrastructure capability portfolio, which includes the Central Analytical Research Facility, Research Engineering Facility, Visualisation and eResearch group and the distributed sites, which include SERF.



Melanie Fitzgerald joined the group in an administration support role, while Natalie Sukic and Lexie McGourty, who were both responsible for support to the distributed sites, left the Research Infrastructure group to take up other roles within QUT.



Natural habitat

Charlie Sparks and Prue Macfarlane of Forestry Maintenance Systems returned in May 2017 to continue with the eradication of woody perennial environmental weeds identified within the 35 hectares of forest at SERF. The delayed start was, in part, due to inconvenient weather and the local tick population. The weeds subject to eradication efforts, 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). We can report that the control activities were very successful and will enable Marcus Yates to manage any regrowth of weeds in the future.

Following a recent flood and inspection of the property fences, a significant number of environmental pest weeds were discovered in the north-western corner of the property bordered by the Samford Creek. Marcus Yates surveyed the land, identifying all local native trees to retain. With the help of a local contractor, the land was selectively slashed in early August 2016 and Marcus then followed up with more focused weeding prior to replanting with a range of native species. Planting will be with ground covers, shrubs and trees native to the Samford area and compatible with the site location, which is prone to local flooding during wet weather events.

Infrastructure

The 50-metre gravel pavement section of the site's main drive after the paved entrance received some long overdue attention in April 2017. Recent heavy rains had caused significant erosion and ruts to form making vehicle accessibility difficult. The contractor AVCON reshaped the existing surface and compacted it with a roller before applying 6m³ of Type 2.3 material. The final surface was spread, rolled and compacted to produce a much safer and aesthetically pleasing entrance to the Facility.



Regulatory compliance

The QUT University Animal Ethics Committee inspected the SERF site on 7 February 2017 as part of their obligation to monitor all activities related to the care and use of animals for research purposes. The committee was advised of the animal activity being conducted at SERF that requires animal ethics approval. Some of the animal work falls outside the scope of the Australian Code, as the projects related to insects only and thus do not require UAEC review. It was noted that animal and bird surveys and observational studies do require review and approval by the committee. Activities that involve the use of UAVs also have the potential to affect wildlife, particularly birds of prey.

2017-2018 goals

Over the next 12 months, several key goals have been identified to further improve the operations and amenity of the SERF property, including:

- completion of the SERF herbarium
- continuation of activities to reduce and control woody perennial pest weed populations.

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