



Samford Ecological Research Facility 2019 Year in Review

About the Samford Ecological Research Facility

The Samford Ecological Research Facility (SERF) is a living laboratory for research and teaching in a range of ecological, engineering, built environment and educational programs relating to urban development, and its impact on ecosystems. Managed by the Institute for Future Environments (IFE) at QUT, the 51-hectare property is located in the Samford Valley about 23km northwest of Brisbane's CBD.

SERF is available for teaching and research projects consistent with the facility's mission of research, education, sustainability and long-term resource protection, including:

- vegetation and water studies
- cadastral and topographical surveys
- flora and fauna studies
- social impact assessments
- built environment projects.

This report outlines some of the key highlights from research, education, and engagement at SERF during 2019.



Research highlights

SERF continues to be a valuable resource for ecosystem research, providing opportunities to study dynamics of climate, soil, water, vegetation and fauna in a peri-urban ecosystem.

Ten years of ecosystem research



SERF is a part of Australia's Terrestrial Ecosystem Research Network (www.tern.org.au), which is a national monitoring network that collects data about Australia's environments. This year marked TERN's 10th birthday, and SERF's 10th year as one of the founding sites of TERN.

Over the past decade, the following ecosystem process data has been collected at SERF for TERN:

- measurements of energy, carbon and water exchange between the atmosphere and ecosystems using a flux tower
- structural vegetation attributes of vegetation, vegetation samples for genetic and carbon isotope analysis, herbarium specimens and seasonal changes in canopy cover.

This long-term data is particularly valuable, because it:

- enables investigation of ecosystem change and dynamics over time
- allows development and testing of sophisticated ecosystem models
- provides context for interpreting shorter term studies.

TERN data collected at SERF is used by researchers across Australia and the globe, and can be accessed online at www.portal.tern.org.au.



International Drought Experiment

As 2019 marked a significant milestone for one long-term ecosystem research activity, it also heralded the installation of a new long-term ecosystem study at SERF. Known as the International Drought Experiment (IDE), this activity forms a part of a larger global experimental network - DroughtNet – which aims to assess ecosystem sensitivity to drought.

Through the IDE, common research protocols, measurements and methods are used to assess the impact of drought on different ecosystems. SERF is just one site among many distributed across the world.

To conduct the experiment, we have installed a system of understory troughs that collect and divert rainfall from two experimental plots. This will simulate drought conditions in the plot area. Over the coming years, we will measure a range of soil and vegetation characteristics to examine how the forest responds to this simulated prolonged drought.





Site-based research

As well as international and national ecosystem research, SERF is home to many local research activities carried out by QUT researchers and visiting researchers from other Universities, government, and industry.

In 2019, new and ongoing research activities at SERF included:

- automated greenhouse gas measurement
- soil-atmosphere exchange and nitrogen cycling in Australian forests
- water quality, flow and nutrient dynamics
- soil moisture chemistry research
- studies of the impact of mealybug (*Hilicoccus nr summervillei*) on pasture grasses (contained in the SERF screen-houses)
- understanding behaviour of Queensland fruit fly to improve sustainable pest management
- density dependence in local foraging of Queensland fruit fly
- vegetation surveying and measuring vegetation health with Remotely Piloted Aerial Systems, Terrestrial LiDAR Scanning and manual methods
- surveys of threatened fauna to inform conservation activities using conservation detection dogs
- orientation and navigation behaviour of honeybees
- bioacoustic recording and studies of brown treecreeper (*Climacteris picumnus*), white-browed treecreeper (*C. affinis*), and white-throated treecreeper (*Cormobates leucophaea*)
- acoustic data for the Australian Acoustic Observatory as part of a national network of acoustic sensors to provide high-resolution spatial and temporal data on audible species.

Education highlights

SERF is a well-used resource for teaching and inspiring the next generation of scientists. In 2019, more than 300 QUT undergraduate students from first year to third benefitted from field trips to SERF. By undertaking field activities at SERF, the students learn valuable practical skills such as soil, vegetation and animal survey techniques, and have an opportunity to put their theoretical learning into a real-world context. Student activities included:

EVB102 Ecosystems and the Environment	Investigated the relationship between species diversity and habitat type by surveying the composition of the ant population in forest, edge and pasture habitat
BVB202 Experimental Design and Quantitative Methods	Visited SERF to design and apply different field experiments and techniques
BVB214 Vertebrate Life	Used leaf litter survey, pitfall traps and Elliot traps to find mammals and reptiles as part of study of Australian animal diversity and evolution
BVB223 Insect Life	Learnt and used insect collection techniques to examine and collect a variety of specimens from the site in insect traps
EGB274 Environmentally Sustainable Design	Site investigation and analysis to inform broader study and design of solutions for sustainability issues including sustainable transport, land planning, water and wastewater management and environmental impact assessment
EVB221 Remote Sensing of the Environment	Used aerial sensor technologies to collect imagery to measure biophysical properties of vegetation
BVB311 Conservation Biology	Undertook experiments using artificial bird nests and eggs to estimate the risk of bird nest predation at edge and interior forest locations
EVB304 Environmental Science capstone project	Designed and implemented a number of observational experiments to examine influence of edge effects on vertebrate fauna
EVB312 Soil and the Environment	Used the established soil pits at SERF to learn about the total profile depth, horizon depths, texture, colour, pH, electrical conductivity and structure to better understand the concept behind soil descriptions and soil survey techniques





As an extension of QUT's STEM outreach and education work, in 2019 we welcomed Year 11 biology students from Brisbane State High School (BSHS) for a week of field classes at SERF. This field activity forms part of the new nationwide science curriculum, and the students established and surveyed transects to record evidence of bandicoot activity. While only a pilot visit in 2019, we are looking forward to cementing this program as a key part of SERF's education activities and welcoming more BSHS students in coming years.



Engagement highlights

As usual, SERF hosted many visitors and events throughout 2019. TERN celebrated the 10th anniversary of its establishment under the National Collaborative Research Infrastructure Strategy (www.ncris.gov.au). While TERN's work commenced in 2009, the official launch event wasn't held until early 2010 – and was hosted at SERF. It was fitting then that TERN's Advisory Board returned to SERF in July this year to celebrate TERN's the decadal milestone. As well as enjoying some birthday cake, this visit was a good opportunity for the board to see and hear first-hand about the positive impact SERF continues to have on ecosystem research and education.



SERF welcomed several local visitors during the year, including the Samford branches of Probus Association of Queensland and Native Plants Queensland (NPQ), in tandem with their visit to the Samford Eco-Corridor project. Peter Storer, President of NPQ Samford Branch described the visit as "...perfect in every way, from the glorious weather to the great presentations, and the guided walk to see the various vegetation types. It was a great privilege to visit the facility and see first-hand the wonderful research that is undertaken there. Samford is so lucky to have QUT doing such fabulous research in our valley."



As well as locals, SERF was pleased to host international visitors. During 2019, SERF hosted an annual visit from Environmental Science students from Michigan State University and a delegation from South Korea, with representatives from Kyungpook National University and the Korean Long-Term Ecological Research Network. This delegation visited Queensland ecology field sites like SERF as part of early planning for a future International Ecology School that would facilitate education and international field experiences for undergraduate students throughout the East Asia Pacific.



Revegetation

QUT students and staff got their hands dirty and their spirits high at the annual SERF planting day held in June, rehabilitating a pocket of former pasture at SERF with 522 native trees, plants and shrubs.

The area was cleared of its native vegetation in the early 1900's to make way for small crops and grazing. Less than 10 per cent of this vegetation remains in south-east Queensland and is listed as endangered.

The riparian forest zones are incredibly important, rich, diverse communities of plants found on the banks of creeks and rivers, providing habitat for birds, amphibians and ground mammals. They also act as filters to improve water quality. By re-introducing native species that were once present in large populations, QUT is contributing to the enhancement of the region's biodiversity.

In addition to boosting biodiversity and increasing habitat for fauna, reforestation increases sources of seed, removes carbon dioxide from the atmosphere, improves water quality and reduces erosion. The tree planting day is an annual event initiated, funded and organised by QUT Facilities Management in partnership with IFE.



Operations and management

The SERF team

Marcus Yates has continued in his role as SERF Site Technician, and is the heart and soul of the place. Everyone who visits or works at SERF deeply appreciates and benefits from Marcus' keen enthusiasm, local knowledge and experience. SERF experienced a significant management change with the departure from QUT of Dr Juan Cooper, Distributed Sites Manager. Juan oversaw SERF for the past seven years, and QUT extends its heartfelt gratitude to Juan for his contributions to the facility throughout this time.

The management of SERF is now led by Dr Bek Christensen, QUT's joint Research Infrastructure Specialist (Ecology) and Manager of Research Infrastructure Support. Bek is an ecologist who has worked in research and policy across university, government and non-government organisations, and she is incoming President of the Ecological Society of Australia. She has extensive experience in research infrastructure strategy and management at both national and institutional levels. Previously, she worked in the leadership team of TERN and she currently sits on the advisory board for the Atlas of Living Australia. Bek is well placed to work closely with QUT's ecosystem researchers to connect them with the tools and opportunities available at SERF, and through the national research infrastructure.



Marcus Yates, Site Technician



Dr Bek Christensen, SERF Manager

People of SERF

Marcus Yates: Site Technician	Sarah Carrick: Research Assistant	Dr Keith Armstrong: Creative arts, social and ecological justice	Dr Lucy Reading: Groundwater hydrologist
David Tucker :Research Assistant	Julie Renwick: Research Assistant	Associate Professor Felipe Gonzalez: Aerial robotics and automation	Marina Scarpelli: PhD student, ecoacoustics
Dr Bek Christensen: SERF Manager	Dr Clemens Scheer: Visiting scientist, land-use change and agricultural management	Dr Fernando Vanegas: UAV exploration, artificial intelligence and image processing	Associate Professor David Rowlings: Soil scientist
Professor Jennifer Firn: Restoration ecologist, co-lead of DroughtNet experiment	Christian Brunk: Research Associate, environmental science and management	Dr Katharina Merkel: Fruit fly biology and management	Associate Professor Carrie Hauxwell: Microbiology, agricultural biotechnology, ecology
Associate Professor Susan Fuller: Ecologist, ecoacoustics	Professor Peter Grace: Sustainable agriculture, nitrogen use efficiency and greenhouse gas emissions	Associate Professor Grant Hamilton: Conservation and agriculture using technology and advanced analytics	Liam Grace: Research Assistant
Dr Andrew Baker: Mammal ecologist	Andrew Fletcher: Remote sensing scientist	Professor Paul Roe: Ecoacoustics	Dr Anthony Ariyanayagam: Structural fire engineering
Stephane Gomes Batista: PhD student, conservation biology, Antechinus	Professor Anthony Clarke: Fruit fly biology and management	Ashantha Goonetillake: Water and environmental engineering	