

Samford Ecological Research Facility 2020 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 QUT's Institute for Future Environments (IFE), the 51-hectare property is located in the Samford Valley about 23km northwest of Brisbane's CBD. This report outlines some of the key highlights from research, education, and engagement at SERF during 2020.

2020 reflections

Looking back on this unique and challenging year, we are sincerely grateful for the continued interest and support from the local Samford community, and the efforts of our research and education users.

Like everyone, we had to adapt our plans for this year in response to the rapidly changing circumstances around us. Despite this, we have still been able to continue with many activities – and even introduced some new ones – thanks to the creativity and flexibility of our team and all of the people who work at and use SERF.

As this year ends, we look forward to the opportunities that a new year offers to continue growing activities at SERF to give life to Pat Marks' vision. We hope to share many new and interesting stories with you next year. Until then, please enjoy reading about our highlights at SERF this year.



*Dr Bek Christensen,
Research Infrastructure
Specialist (Ecology)*



*Marcus Yates,
SERF Site Technician*

Research highlights

SERF continued to support a wide range of research activities in 2020, with minimal disruptions caused by COVID-19 restrictions.

Pasture pests



SERF has three screenhouses that were refurbished at the start of the year so they could be used to grow grasses that are being used in vital QUT research into the causes of pasture dieback.

Having spread rapidly in recent years, pasture dieback is an increasing concern for livestock producers in Queensland and northern New South Wales. Some producers whose properties have been affected by pasture dieback have had their stock carrying capacity reduced by as much as 30 per cent.



With funding from Meat and Livestock Australia, Associate Professor Carrie Hauxwell is leading QUT's research into pasture dieback. Carrie has found that mealybugs play a significant role in causing pasture dieback. In addition to studying the extent of this causal role, Carrie is also investigating ways to control mealybugs and identifying grass varieties that may be resistant to the insects.

Mealybugs are soft-bodied scale insects that attack pastures, cereal crops and turf grass in Australia and around the world. They are typically covered in a soft, waxy coat that gives them a white 'mealy' appearance.

"There are a lot of things out there that kill grasses, but our research into the mealybug (*Heliothrips haemorrhoidalis*), as well as historical records of its presence in Queensland causing dieback as early as 1926, strongly indicate they might be a working agent in dieback," Carrie said.

"We're looking at how mealybugs kill grasses and running tests on possible controls. The treatment will also provide insights into whether the mealybug causes dieback by observing if the grass recovers or not."



Conservation genetics of Australian treecreepers

More than just singing, birds have a range of acoustic signals they use to communicate for a range of reasons like alerting others to danger, and finding a mate. The role of acoustic signals in finding a mate is particularly interesting because this can influence population genetics and the formation of new species. Over time, changes can accumulate in acoustic signals in separate populations of the same or similar species of birds meaning they don't 'recognise' each other's signals if they are brought together.

To understand the importance of acoustic signals in more detail, QUT PhD student Brendan Doohan is examining the calling characteristics of two Australian treecreeper species, with SERF as one of his main study sites.

Brendan is looking at the way morphology, genetics, and song vary in populations of the Brown Treecreeper (*Climacertis picumnus*) and White-throated Treecreeper (*Cormobates leucophaea*) at different locations in south east Queensland.



Brendan's work will help to understand the geographic boundaries of unique subspecies. As the boundaries of species are expected to change in future because of climate change, this work will also help to understand the potential implications for future populations.

Multi-scale mapping of above ground biomass

Above-ground biomass is all of the living and dead vegetation biomass above the ground level, including the stems, trunks, leaves, branches and seeds of plants. It is a Global Climate Observing System Essential Climate Variable and a critical measure to help monitor changes in carbon emissions globally.

University of Queensland PhD student Ana-Patricia Ruiz Beltan has been using SERF as a field site in her research, examining different techniques for measuring above-ground biomass.

SERF is the ideal site for Ana Patricia's work, because of the detailed and long-term measurements of trees that have been taken at the TERN ecosystem process vegetation plot at SERF. In addition to these traditional field measures, Ana Patricia is using unoccupied aerial system-based Light Detection and Ranging (LiDAR), Terrestrial Laser Scanning, satellite imagery and machine learning algorithms to create novel models of above-ground biomass. Ana Patricia's SERF measurements will be used to calibrate and validate future measurements of above-ground biomass from current and future satellite missions such as NASA-GEDI, NISAR and BIOMASS.



Site-based research

Other research activities at SERF throughout 2020 included:

- automated greenhouse gas measurement
- soil-atmosphere exchange and nitrogen cycling in Australian forests
- water quality, flow and nutrient dynamics
- soil moisture chemistry research
- vegetation surveying and measuring vegetation health with Remotely Piloted Aerial Systems, Terrestrial LiDAR Scanning, and manual methods
- surveys of threatened animal species to support conservation activities using conservation detection dogs
- International Drought Experiment
- The Australian Acoustic Observatory using a national network of acoustic sensors to provide high-resolution spatial and temporal data on audible species
- new research led by the Department of Environment and Science investigating ways to use UAVs to measure the growth and yield of pasture grasses.

While COVID-19 put a dampener on many plans, it also gave us some time to explore new ideas and connections. For the SERF research community, this meant the opportunity to connect with national environmental research infrastructure projects through a series of webinars in June, July, and August. We were pleased to have representatives from the Atlas of Living Australia, Terrestrial Ecosystem Research Network, and Integrated Marine Observing System join us (virtually) from Canberra, Adelaide, and Hobart to share their work and talk about the ways that QUT researchers and students can get involved with these major national initiatives.





Education highlights

Since it was established as a research facility, SERF has also been a well-used resource for teaching. By undertaking field activities at SERF, students at a range of levels and studying a variety of topics are able to learn valuable practical skills, and have an opportunity to put their theoretical learning into a real-world context. While many of QUT's undergraduate topics were able to take advantage of SERF prior to limitations on group gatherings and movement, some other topics were prevented from using SERF as they usually would. However, this didn't stop SERF from playing a role in teaching, as our teaching staff developed video content and other ways to bring SERF to the students.



This year was also the first year that SERF was used for a Creative Arts course. The Situated Creative Practice students visited SERF to learn about research at the site, and discover more about their local environment. This inspired their exploration of climate change and environmental protection issues, and culminated in the production of a [video](https://www.youtube.com/watch?v=xTId9nLaBUE) (www.youtube.com/watch?v=xTId9nLaBUE) and [online content](https://www.youtube.com/watch?v=VJJbEM5wglE) (www.youtube.com/watch?v=VJJbEM5wglE) documenting their work.

Brisbane State High School students continued their visits to SERF in 2020 as part of their Year 11 and 12 Biology classes. This field activity forms part of the nationwide science curriculum, and the students established and surveyed transects to record evidence of bandicoot activity.



An exciting first in 2020 was the visit of the Year 4 class from the local Samford Steiner School. This was not only the first visit from the Steiner School to SERF, but for any primary school. The students visited the heritage-listed Slab Hut to learn more about their local history, and also explored the forest to learn more about the local flora and fauna. They also showed off their impressive knowledge of Australian animals by playing a game of Guess Who, identifying a wide range of animals just by listening to their calls and receiving a few clues from the SERF staff.

QUT undergraduate courses that used SERF in 2020

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. While students were unable to visit SERF in person, the surveys were carried out by academic staff who used videos to involve the students.
BVB311 Conservation Biology	Undertook experiments using artificial bird nests and eggs to examine the risk of bird nest predation. While students were unable to visit SERF in person, the experiments were carried out by academic staff who used videos to involve the students in the experiment.
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
EVB304 Environmental Science capstone project	Designed and implemented a number of observational experiments including using UAVs to measure vegetation characteristics, and acoustic recorders to examine bat activity in different habitats.
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
KBY301 Situated Creative Practice	Visited SERF to learn about the local environment and scientific research projects to use as inspiration for final year creative arts projects



QUT STEM Camp 2020: Ecology with Drones

SERF is a key attraction for some of QUT's high school education activities, including the annual STEM Camp for high-achieving Year 11 students. This year, the students were involved in QUT-led research that is using UAVs with thermal imagery to help find koalas.



Engagement highlights

Thanks to the amazing communication team at QUT's Institute for Future Environments, SERF's website received a much-needed overhaul this year. The new website is much brighter and more interesting - you can check it out at www.qut.edu.au/ife/serf.

The media spotlight also turned its attention to SERF throughout the year.

- In March, we welcomed the *Totally Wild* team from Channel 10 to showcase our work with Brisbane State High.
- Many of the local community would also have seen SERF's International Drought Experiment gracing the front page of *The Village Pump* in May.
- ABC TV's *Landline* team also visited later in the year to feature QUT's pasture dieback research. You can watch it back at: www.abc.net.au/landline/grass-killer-mystery:-mysterious-dieback-of/12492678)

The SERF team have commenced work with QUT's Visualisation and eResearch team to create a new 'Digital SERF' that we hope to have available early in 2021. Digital SERF will be an interactive online experience that enables people to tour SERF in 3D, learn more about the environment and history of the site, and explore the wide range of research and education activities. We will grow and develop this platform over time, and are excited at the opportunities it will provide to connect even more people with SERF.

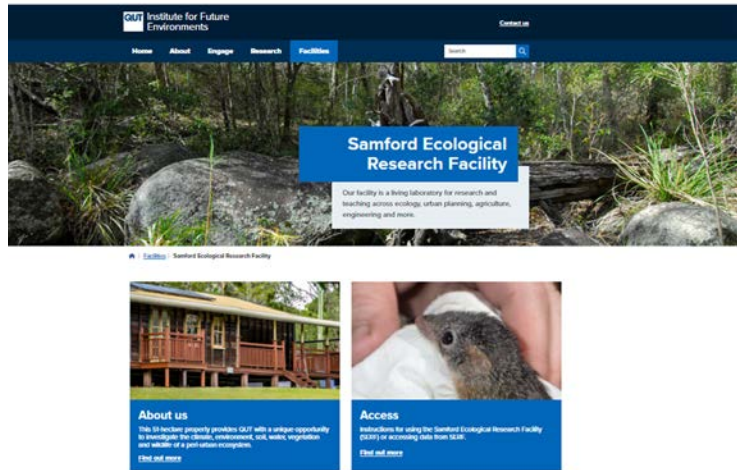


Image credit: QUT Visualisation and eResearch / Research Engineering Facility



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