

## **Merging crop pollination with remote sensing to better understand the spatial variability in Australian tree orchards**

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In Australia, a national project “Multi-scale monitoring tools for managing Australian tree crops: Industry meets innovation” is well underway with a number of outcomes produced that are relevant to global macadamia production. The project has two objectives: 1) map the location and area of every commercial avocado, mango and macadamia orchard (over 2 ha), and 2) evaluate technologies as a farm-level decision support tool using satellite imagery and on-ground sensor systems for mapping fruit yield and quality, tree health and pollination efficiency. Outcomes of the first objective will provide crucial information on grower demographics, yield forecasting, biosecurity and post disaster management. Initial findings for the second objective have demonstrated the potential of remote sensing for mapping yield parameters and tree health across macadamia, mango and avocado orchards.

Pollination services, delivered by insect pollinators, are a key driver in yield and quality variability within macadamia crops. Satellite sensor systems offer significant opportunities to support the identification of spatial variations of pollinator distribution and pollination at the regional, farm and within block level. This PhD project (i) uses innovative high resolution spatial mapping technology with on ground pollinator surveys and measures of pre- and post- pollination success to develop our understanding of the interactions between macadamia tree health, pollinator community composition and pollination success, (ii) investigates the importance of surrounding local and landscape factors to pollinators within macadamia orchards, and (iii) investigates how spatial variations found may be associated with fruit quantity and quality.

To date, pollinator surveys have been conducted in seven macadamia orchards in 2015 and six macadamia orchards in 2016 across the Bundaberg region during peak flowering. In 2015, abundance of flower visitors ranged from 0-21 flower visits per survey and species diversity ranged from 0-3 species per survey. In 2016, abundance ranged from 4-52 flower visits per survey and diversity ranged from 1-8 species per survey. While honey bees (*Apis mellifera*) were the most common flower visitor in both flowering seasons across the region, pollinator community composition differed between individual blocks within the region.

Preliminary data does not show any obvious trends, however, further collection and analysis of data is required to determine whether there are consistent or variable patterns regarding tree health of orchard species, location or temporal scale. The findings may allow growers to quickly evaluate their orchards to make predictions of pollinator distribution and yields in their specific orchards.