The Grand Challenge - 2019

University of Newcastle

'May Contain Seeds'

Final Report


THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA


SABE
SCHOOL OF
ARCHITECTURE
& BUILT ENVIRONMENT

TEAM NAME
Germinate

NAME OF PROJECT/PROJECT SHORT DESCRIPTION
'May Contain Seeds'

This research project investigates managing mosquito populations and their preferred habitats by increasing aromatic plant species which repel and confuse mosquitos. The plant species are propagated through non-conventional means via seed bombing to encourage student participation. The seed bombs are made in collaborative and educative community workshops with children and local school groups as an outreach project to extend our efforts beyond UON. Once the seed bombs are made, they fill a gumball machine dispenser ('Gumbo') which playfully invites students to buy a seed bomb and "chuck it" in the SABE courtyard. Once seed bombed, regular measurements of germinating plant materials are recorded and then as the plants grow and flourish, mosquito presence should dissipate. The evolution of the project and its progress is updated and disseminated through our website: *https://maycontainseeds.org/.* This is deliberate as we hope to share our knowledge and findings with others through open source means and knowledge exchange.

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THE PROBLEM

To understand and improve ways to socially and environmentally respond to the problem of nusance mosquito populations as they impact social spaces, recreational activities and pose major health risks to humans. Establishing a respectful way to coexist with mosquitoes in their habitats without impacting the surrounding ecosystem enchainments.

THE BIG IDEA

What happens if we increase the quantity of aromatic plants on campus in an attempt to repel mosquitoes while allowing humans and mosquitoes to maintain their intertwined ecosystems? Our preliminary research has uncovered that female mosquitoes are attracted to carbon dioxide, body odour and heat whereby providing sustenance (blood) and to produce eggs. Therefore, our idea is to test how the aromatic plants will help to manage mosquitoes by confounding their senses and inhibiting their host seeking stimuli. But rather than simply designing appropriate gardens in Callaghan's various settings, we also want to engage the campus community (students, staff and visitors) through the dispersal method of seed bombing. The seed bombs are initially housed in gumball machine dispensers, and are strategically located around campus, a pilot investigation was set up in the School of Architecture and the Built Environment (SABE) precinct.

Each seed bomb mix will take into account the adjacent planting context (native bush, cultivated lawns, etc.) and only disperse plants which are appropriate for their sites. Seed germinators (the campus community) will make a small donation in order to dispense a bomb for distribution. The funds raised will be donated to the affected wildlife of the recent NSW bushfires. Once dispersed, the seed bombs will naturally decompose providing a basis for plants to germinate. The plants are specifically selected for their seasonal aromas and for specific site conditions across diverse campus microclimates. We are proposing a potential long-term solution without the reliance on routine application of pesticides or toxins.

The plants are a natural, non-invasive and a respectful method of researching ways in which we can coexist with mosquitoes in our shared environments while actively engaging the community to participate in the research project more widely.

As global temperatures rise, our urban environment is in desperate need of more greenspaces. With this in mind, and as this increase in temperatures becomes apparent in our lived experience at our Callaghan University campus – we have explored ways in which guerrilla gardening can offer a sustained system of relief from the bothersome mosquito plagues and the potential diseases they carry. The preliminary research into the plant species that were found to deter mosquitoes indicates that those which have strong fragrances/exotic perfumes are most effective.

The following seed species were used:

- *Melissa officinalis* (Lemon balm)
- *Leptospermum liversidgei* (Lemon teatree)
- *Leptospermum petersonii* (Lemon teatree)
- *Corymbia citriodora* (Lemon scented gum)
- *Backhousia citrodora* (Lemon myrtle)
- *Origanum vulgare* (Oregano)
- *Mentha x piperita* (Peppermint)
- *Lavandula angustifolia* (French lavender)
- *Salvia officinalis* (Sage)
- *Ocimum basilicum* (Basil)
- *Tagetes patula* (Marigold bonita mix)
- *Chamomelum nobile* (Chamomile)
- *Origanum majorana* (Majoram)
- *Mentha puleguim* (Pennyroyal)
- *Cymbopogon citratus* (Lemon grass)
- *Rosmarinus officinalis* (Rosemary)
- *Nepeta cataria* (Catnip)

Another core foundation to the research project is to provide a platform for educating the wider community and participants on the important role mosquitoes play in the campus and world-wide ecosystems. Education programs such as seed bomb making workshops were set up to teach participants on the importance of sharing habitats with all living beings and strive to co-create sustainable built and urban environments. Another educative device employed is a mobile friendly website that provides access to the collected findings and outcomes of the project, and an extended list of plant species that may help reduce infestations of mosquitoes. Allowing users to have access to a portable instrument to access collected data and research helps strengthen the understanding of ways to manage and sustainably coincide in shared environments with other ecologies.

INTENDED OUTCOMES

Research

We anticipate we will have findings regarding mosquitoes and human environments generally, but we cannot predict how well the seeds will germinate, whether or not people will voluntarily participate, and ultimately the effect on both the humans' consciousness of our intertwining ecologies or the effectiveness of repelling mosquitoes.

Education

The project aims to provide a platform for demonstrating how mosquitoes play an important role in the campus ecosystem. It further identifies how they exist and offers a proposal for how we might be able to coexist with them. By interpreting and explaining the complex ecosystems at play as well as inviting participants to actively engage in remaking these environments, education and learning is embedded into the project. We intended to educate the wider community and actively invite them to participate in this project.

Activation

A key method by which this project is delivered is through engaging campus users directly. Inviting and allowing them to participate in the research project. In addition to this, the resulting planting adds colour, vibrancy and a light scent to our campus landscapes. This will, in turn reinvigorate a shrub layer dominated by turf and lomandra, which may encourage students to sit and study outside.

OUTCOMES

Testing the Project

The project was tested and prototyped rigorously to determine the most suitable approach for its various facets. The physical make up of the seed bomb was investigated to determine the best mixture for the 'bombs' to hold their shape to avoid breaking prematurely in the machine but still be able to break when dispersed. Further, the team held seed bomb making workshops to educate the community testing engagement strategies; analysed and collected data through pedestrian activity mapping techniques to find the optimum install location of the gumball machine in the SABE precinct and finally investigated user interaction through observation of the dispersal of the seed bombs by participants on campus.

Two test plots (1m x 2m) were set up around the SABE precinct to analyse and document how well the plants grew and measure their effectiveness. The project was documented through a visual diary to depict the plant growth over time and site monitoring across various times of day/before and after weather events was analysed. This site and species progess analysis continues as the plant species are still developing.

Testing Seed Bomb Mixture

Seed bomb tests conducted in a hypothetical scenario of the SABE precinct looked into what mixture out of three options would naturally decompose and germinate across a two-week trial period, whilst also providing scope to observe any unexpected phenomena.

The seed bomb test conditions were installed in a location where they received morning and afternoon sunlight, were watered at least every day or every second day and the environmental temperature ranged from 20 °c to 36 °c.

Three different mixtures were tested:
- Soil Bomb: Soil and clay mixed together and rolled into a ball, a hole established in the middle and seeds placed in the bomb and rolled back into a ball form. Leave to dry out before distribution.

- Clay Bomb: Clay rolled into a ball, a hole established in the middle and seeds placed in the bomb and rolled back into a ball form. Leave to dry out before distribution.

- Clay + Soil Pancake Bomb: Clay rolled out flat like a pancake and constructed into a bowl shape, place a pinch of soil and sprinkle of seeds and form into a ball shape. Leave to dry out before distribution.

Seed bombs that were tested:
1. Clay + soil pancake mix
2. Clay + soil pancake lemon
3. Soil lemon
4. Soil mix
5. Clay mix
6. Clay lemon

* *'Mix'* means a mix of lemon teatree, lemon scented gum and lemon balm mixed together and *'lemon'* is just the lemon balm by itself.

The mixture that delivered the best results was the soil bomb as it gave the bomb enough strength to hold its form together whilst retaining optimum water, it did not dry out, allowing it to eventually decompose. The bombs that were just clay dried out and hardened again if not watered every day. The clay + soil pancake took the longest to break down which in effect reduced the likelihood of the germination process. After all the bombs had been broken it took approximately three days before there was any visual indication of the plants beginning to germinate. Of the species tested, lemon balm was the most successful plant to germinate. Furthermore, a hypothetical globe environment was created to depict the globe of the gumball machine to see if the seed bombs would sweat inside the globe, but this test proved that they remained dried and unaffected.

The Workshops

Aimed to encourage our community to actively participate in helping test our pilot investigation and demonstrates how ecosystems, ecologies and greenspaces play an important role in our urban environment. The workshop showed participants the techniques to creating seed bombs, and offered them ways to reclaim their urban environment in an environmentally sustainable practice to reduce invading mosquito populations without poisoning other ecologies with the use of pesticides and chemicals, such as DEET, that will have a lasting effect on the surrounding environments, people and wildlife. We successfully set up two workshops with multi-disciplinary human service organisation Allambi Care and UoN staff and students, who got to experience how to make seed bombs and had to opportunity to ask any questions that they had about the processes, seed species and project.

CONCLUSIONS/CHALLENGES

We successfully involved two different community groups in the seed bomb making workshops, allowing us to educate students and children about the project, co-creating the surrounding environment with mosquitoes and the research of plant species. The drought significantly delayed the launch of 'Gumbo' and the seed bombs as this summer was significantly hot and dry reducing the chances of the seed bombs to germinate. Another delay in testing the activation of dispersal with the community was significantly impacted due to COVID-19 restrictions and people not being on campus.

However, during the launch of ‘Gumbo’; we filled spray bottles full of a blend of essential oils reflecting the plant species that we researched, these were used as a natural repellent to test if the strong fragrances did deter and confuse mosquito senses. The spray bottles did successfully deter mosquitoes and avoided users from feeling like they had a layer of a toxic insect repellent on their skin during the day. Additionally we set up two test plots set up in different locations as a control. These plots are still growing and are being studied to see if these areas are less affected by mosquitoes - any new findings will be updated on the website under ‘Project Performance’.

As a part of a student initiative, while they have been studying at home, they have asked if they can grow some of our mosquito deterring species at home and replant them when they return to the precinct in August. We are currently making kits for students who want their study buddy plants and we will be distributing them shortly. When students return to campus, we have also decided to implement micro bat box making workshops as the habitat of the micro bat has been significantly destroyed due to recent bush fires. Importantly, native bats eat mosquitos in large quantities, so our intertwining ecological systems will have yet another layer.

Please keep visiting: *https://maycontainseeds.org/*

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