# MUDDY RIVER POSTER SESSION

## A Virtual Presentation of Student Work

hosted by the COF Center for Sustainability and the Environment
and Wentworth Institute of Technology

April 14, 2020
6:30pm via Zoom

Colleges of the Fenway

WENTWORTH • INSTITUTE OF TECHNOLOGY •

# Winner in the “Greta Thunberg Room,” category: Sustainability

## “Existing Buildings”

--Delaney Blanchette, Terris Reddick, Keara Washburn
Wentworth Institute of Technology

Judges: Chuck Hotchkiss, Dean of the College of Architecture, Design, and Construction Management at Wentworth Institute of Technology, and Debra Shepard, Principal, Riverstone Sustainability

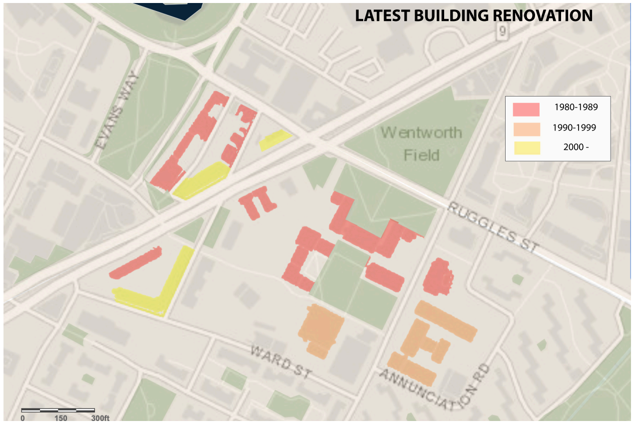
# Existing Buildings

Delaney Blanchette | Terris Reddick | Keara Washburn

## Overview

Our group primarily focused on the effects of flooding and promoting thermal comfort from increased temperatures due to Climate Change. We researched the different effects of flooding and increased temperatures and how they would affect the different buildings around campus.

## Campus Building Renovations



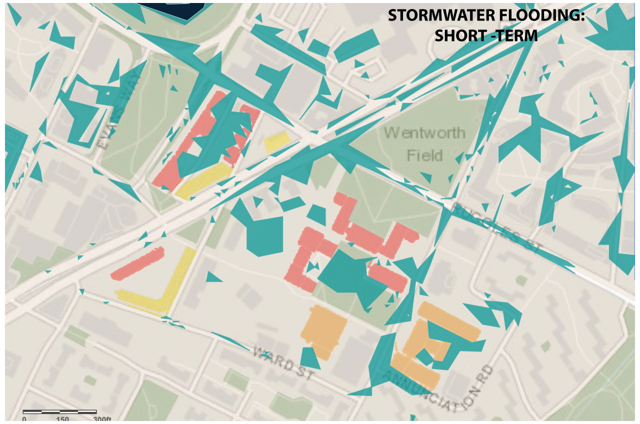

This map color codes the buildings on campus based on their most recent renovation. The latest renovation dates provide insight into the history of the buildings. For example, we can better understand the efficiency, resilience, and reliability of essential systems like HVAC, plumbing, and electricity. Even if these systems are kept maintained to running capacity, older machines require frequent maintenance. In the event of a natural disaster, this can prove troublesome if Physical Plant can't keep systems maintained.


*525 Apartments*

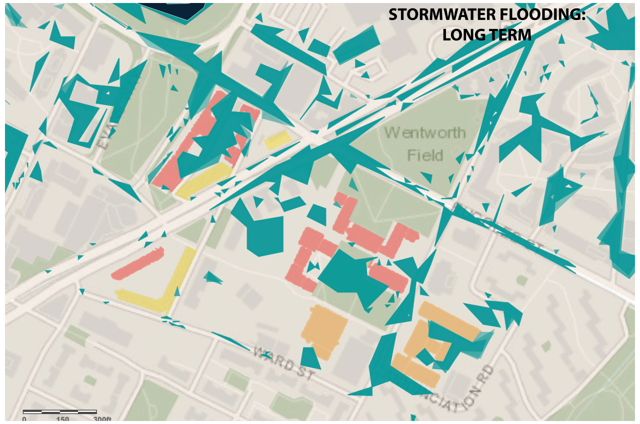

*Annex Central*

## Storm Water Flooding

Both maps show the increase in storm water flooding in the short term vs. long term future. These scenarios demonstrate a minimum of a 6 inch storm water increase. On high precipitation days, storm water can overwhelm storm drains leading to flooding. Overtime, cement will erode, allowing for more puddles and more flooding. Areas with lower elevations than its surrounding neighborhood can be a future hub for storm water flooding. These maps show where they can occur.

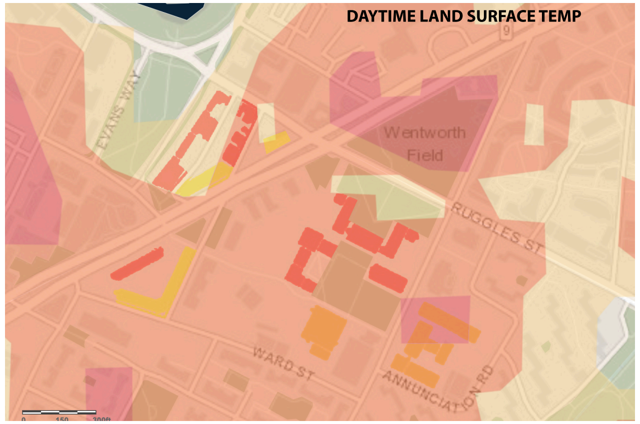



An example of a high risk flood area on campus is the Quad. The buildings at the most risk are the ones with basements, often where essential mechanical systems are housed. To mitigate flooding, moving essential systems into higher levels can save them from any basement flooding. A cheaper option would be to install barriers around any potential entrances to help prevent flooding, as well as reinforcing the bottom of exterior walls to not allow water in. This will work in the short term, but could prove troublesome in the long run if large amounts of flood water accumulates, permeates the ground, and then enters the basements through their floors or walls.




## Surface Temperature Map

This map illustrates the expected increase of surface temperature of at least 1.25º F. The colors show the areas that have the least amount of temperature increase, to the highest areas with the highest temperature increase. For example, there is a projected heat island over Sweeney Field. Cities are more susceptible to increased temperatures because buildings block heat from escaping at lower levels, thus affecting air quality.




In relation to campus, buildings that lack renovation updates in these zones, can cause problems with adequate ventilation and cooling. Notorious brick buildings such as residence halls (Baker, Vancouver, Louis Prang, Tudbury/Evans Way) and academic buildings (Annex, Wentworth, Wilson, Kingman, Rubenstein Halls) are known to be stuffy and poorly ventilated. This leads to uncomfortable, living environments on humid, hot days. One solution to this problem is to update HVAC systems and ventilation to benefit the entire building, rather than having a few scattered window AC units.


*Baker Hall*

*Evans Way*


*Wentworth Hall*

# Winner in the "E. O. Wilson Room," category: The Environment

## "Climate Café"

Caroline Bradley--MassArt
Madeline Dixon—Simmons University
Julia Sherwood—MassArt
Katherine Shapiro—Simmons University

Judges: Anna Aguilera, Associate Professor of Biology, Simmons University, and Michael Berger, Professor of Chemistry and Physics, Simmons University

# Mass Audubon Climate Café

*Systematic Issues in the Changing Climate*

Colleges of the Fenway | Mass Audubon — Protecting the nature of Massachusetts

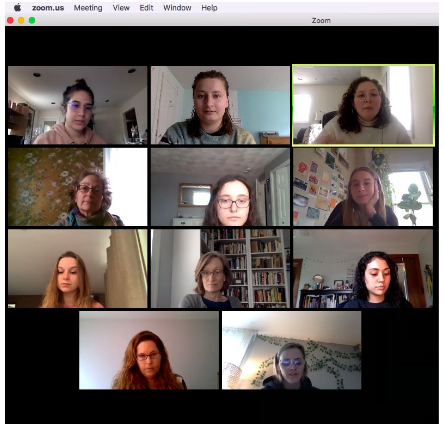
"Climate Change Café Goals:

- Get more people together, in more places, talking about climate change in a supportive and welcoming space;
- See what happens."

  - [Climate & Mind]

## OUR VISION

## *Adapting to COVID-19 with a Virtual Climate Café*




- 8 Participants
- 4 Hosts
- 3 Breakout Rooms
- Great Conversation

**MAJOR THEMES:**

Buying Practices | Ethical Dilemma | Individualism | Community-Based Solutions | Self-Awareness | Consumer Behavior | Environmental Racism | Social Justice | Farm Subsidies | Systematic Issues | Fossil Fuel Industry | Multiplier Effect

Caroline Bradley, MassArt | Madeline Dixon, Simmons | Katie Shapiro, Simmons | Julia Sherwood, MassArt

# Winner in the “Bill McKibben Room,” category: Cultures of Sustainability

## “Muddy Water Initiative: Walk, Run, Roll”

Runming Dai—MassArt

Meredith DiSessa—MassArt

Cole Rich—Emmanuel College

Judges: Kristian Demary, Lecturer in biology, MassArt, and Meghan Doran, Assistant Director for Service Learning, Simmons University

# MUDDY WATER INITIATIVE:
## WALK, RUN, ROLL

Colleges of the Fenway · EMMANUEL COLLEGE · MASSART MASSACHUSETTS COLLEGE OF ART AND DESIGN

RUNMING DAI, MERI DISESSA, COLE RICH

An all-ability outdoor event that aims to strengthen an environmental community along the Muddy River.

- Participate various kids activities
- Select a course that works for you
- Explore the beauty of the Muddy River ecosystem
- Gather for activities at the Time Out Market
- Join other members of the community to celebrate local green space
- Partner with other local community advocacy groups

Over the course of this semester, Runming, Meri and Cole worked with the Muddy Water Initiative to create the "Walk, Run, Roll for the Muddy" event. They reached out to community partners, designed a series of visual elements and an interactive website, and planned an engaging event accessible to all members of the community.


MUDDY WATER INITIATIVE

The Muddy Water Initiative is a community-based environmental clearinghouse advocating for and raising awareness about the Muddy River, Boston's premier urban waterway.

# Winner in the "Rachel Carson Room," category: Water

## "Landscape and Hardscape"

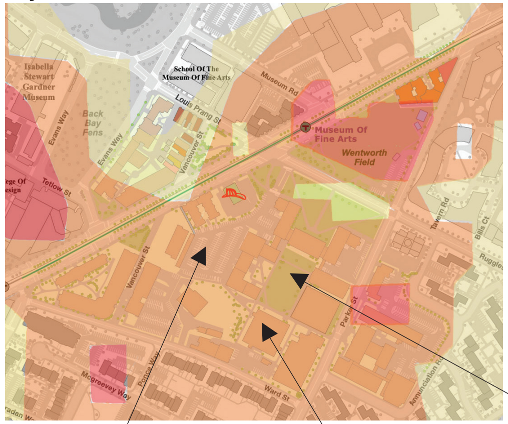
--Rebecca Vooys, Kevin Tan, and Kevin Xiao

Wentworth Institute of Technology

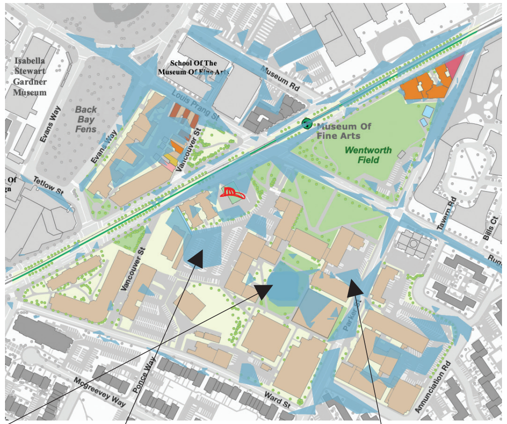
Judges: *Nancy Stern*, Assistant Professor of Pharmacy Practice, MCPHS University, *Jonathan Ripley*, Professor in the Dept. of Humanities and Social Sciences at Wentworth Institute of Technology, and *Lana Dvorkin-Camiel*, Professor of Pharmacy Practice, MCPHS University

# Landscape and Hardscape

### *Daytime Land Surface Heat Map*




### *Stormwater and Sea Level Rise Flood Map*




## *Overview*

Over time rising sea levels, increased stormwater and elevated heat levels will cause lasting damage to the Wentworth campus and environment if proper precautionary measures are not put into place. Wentworth currently utilizes bioswales and permeable pavers for stormwater management, but they are not carried out to their full potential. The following diagrams map out which areas of the campus will be most affected by increased heat and flooding over a roughly 30 year time frame. Although it will be a slow progression to the results shown, there will still be damage and inconvenience along the way. Below each map are solutions Wentworth can implement to their landscape and hardscape in order to mitigate risk of flooding and increased heat levels.

### *Cool Pavement*

There are a variety of cool pavement options that can be utilized to lower heat island effect. Cool pavements reduce heat absorption and have lower surface temperatures. Products such as colored asphalt or resin based pavements, which utilize clear tree resin to bind the aggregates, can be utilized to increase reflectivity. These products can work particularly well in low-traffic areas, like Wentworth's sidewalks and parking lots. Cool roofs apply the same principle of reflectivity to reduce heat absorption. Other pavement such as porous asphalt, block pavers or vegetated permeable pavers not only utilize lighter colors for reflectivity, but will reduce total surface area and in turn reduce heat absorption. Pavers would likely work best on Wentworth's sidewalks and would also prevent flooding.

### *Green Roofs*

Adding vegetation to the top of buildings can assist in reducing heat island effect. The vegetation absorbs the incoming radiation and uses the heat energy for evaporation and photosynthesis. By shading the roof it reduces sun exposure and heat gain, resulting in reduced cooling costs. This in turn reduces greenhouse gas emissions from cooling systems. During winter months, the vegetation will provide additional insulation, reducing the strain on building heat systems. Again, this will in turn reduce energy use from heating systems, providing an economic and environmental benefit. In addition to their heat island benefits, they help manage stormwater. They can reduce stormwater runoff, lightening the load of storm drains.

### *Shading Vegetation*

Shade tolerant plants are quite an efficient means to combat heat waves and heat islands. Growing much broader, thinner leaves, these trees catch more sunlight relative to the cost of producing the leaf. They are usually more reliant on soil nutrients compared to others. Although it may be hard to implement large shade-tolerant trees within the city, having a few may result in a much cooler area, especially during the summer months. In regions such as Wentworth, the quad and green areas along walkways are definitely places to be considered. Having that shade in the summer and during heat waves can certainly appeal to incoming pedestrians. In addition to these shade vegetations reducing the need to build infrastructures to accommodate for heat waves, plant-life can also benefit the campus life and atmosphere.

### *Planting Vegetation*

A collection of trees, shrubs, and other plants can help aid in managing runoffs, and stormwater. In addition, their leaf canopies help reduce erosion caused by rain water. Naturally roots take up water and help create conditions within the soil that promote infiltration, as well as filter out pollutants. Optimally, these green areas would be placed in locations that are prone to flooding. With that in mind, Wentworth is considered to be sea level, thus by adding more vegetation around the campus there will be a lessened chance of these areas flooding. Furthermore, local green areas can provide a much healthier atmosphere. Apart from cleaner air, plant-life is associated with improving mental health and function; primarily in productivity, creativity, and memory retention.

### *Porous Pavement*

Allows rainwater to drain through pavement, resulting in less flooding from uneven pavement from high traffic areas from vehicles. Asphalt roads for vehicles succumb to being cracked and deformed overtime when used daily, thus resulting in pools of water accumulating on the surface. Since asphalt is also a dark, man made surface, it traps and retains heat more often. By putting down porous pavement, the dry season will be cooler with this pavement. For wet seasons it will reduce the runoff for floods and reduce the need for storm drains. Having natural dirt & grass allows water to be absorbed into the earth, thus putting porous pavement is a compromise to having man made structures while maintaining eco-friendly status with the surrounding area.

### *Stone Basins*

Provides rainwater drainage while maintaining a non-urban look to the landscape. A dry stream system to alleviate heat and add moisture to the air during summer. Instead of having storm drains, having a dry river bed allows water & runoff to slowly go through the channel and percolate the riverbed. Rivers are naturally winding channels, so it allows water to flow slower during storms compared to storm drain channels. Stones do not contribute much to the heat island effect compared to regular concrete storm drain paths.

Kevin Tan | Rebecca Vooys | Kevin Xiao

# 2019-2020 Mini Grant Recipient

Arielle Wilson
MassArt

“Bee Hotels”

MAKE YOUR VERY OWN

# Bee Hotel

## SUPPORT URBAN POLLINATORS

BEES POLLINATE AN ESTIMATED 130 AGRICULTURAL CROPS IN THE US . BEE POLLINATION ADDS APPROXIMATELY 14 BILLION DOLLARS ANNUALLY TO IMPROVED CROP YIELD AND QUALITY.

BEE POPULATIONS HAVE BEEN DECREASING STEADILY ACROSS THE GLOBE OVER RECENT YEARS, AND WITH A GINORMOUS 44% LOSS BETWEEN 2015 AND 2016 IN THE U.S. ALONE

## It Is Easy

1. MAKE OR USE A WEATHERPROOF BOX WITH ONE OPEN SIDE

2. SLIDE BAMBOO SHOOTS INTO THE BOX SO THE HOLLOW PART IS FACING OUT TOWARDS YOU

3. SECURE TO SOMETHING STURDY, ABOUT 3 FEET OFF THE GROUND IN A SUNNY SPOT

4. PLACE SOME WET CLAY CLOSE TO THE HOTEL SO THE MAMMAS CAN KEEP THEIR EGGS SAFE

5. AFTER ALL THE BABY BEES LEAVE THEIR HOME, CLEAN OUT THE BAMBOO SHOOTS AND CLEAN THEM FOR THE NEXT SEASON

## ALL YOU NEED:

BAMBOO SHOOTS (ABOUT 8" LONG EACH)

A WOODEN BOX WITH ONE OPEN SIDE

WET CLAY IN AN OPEN CONTAIER

A SUNNY SPOT

A SECURE PLACE TO ATTACH THE HOTEL TO

To Learn More visit

https://thehoneybeeconservancy.org/2017/12/09/bee-hotels/

https://www.livekindly.co/the-importance-of-bees/

# 2019-2020 Mini Grant Recipient

## Kristin Kim, MCPHS University

Sarah Sohn, Allen Amedume, Emma Giddens, Marina Youssef, Lawrence Dahm, Junyup Song, Jiarui Zhang, Adarema Opara

## "RepharmMe"

# RepharmMe

**BACKGROUND:**

- 67,000 retail pharmacies in the United States.
- Average-paced pharmacy fills around 300-350 prescriptions daily.
- Each individual prescription requires a plastic vial, paper leaflet, paper sticker, paper label, paper receipt, etc.
- Medication stock bottles are made of high quality plastic that has high recycle value.

**ABOUT THE TEAM:**

- Team of pharmacists with experience in community, institutional, industry pharmacy. .

**PROBLEM:**

- 4 billion medical prescriptions are filled annually utilizing non-recycled paper, plastic, and supplies.
- United States generates around 38.5 million tons of plastic waste yearly, only of which 1.68 billion was recycled for another use.

**GOAL:**

- Reduce the pharmaceutical industry's carbon footprint

**OBJECTIVE:**

- Recycle the pharmacy-generated waste into the pharmacy's new paper and plastic supply.

MASSACHUSETTS COLLEGE of PHARMACY and HEALTH SCIENCES

# 2019-2020 Mini Grant Recipient

## Aurora Goodland, Simmons University

## “The Influence of Water Availability on Co-invader Interactions: Oriental Bittersweet and Japanese Barberry”

Working with faculty members Viktor Grigoryan (Simmons), Vikki Rodgers (Babson) and Anna Aguilera (Simmons)

# The Influence of Water Availability on Co-invader Interactions: Oriental Bittersweet and Japanese Barberry

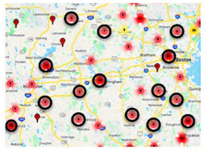

Aurora Goodland[1], Viktor Grigoryan[1], Vikki Rodgers[2] and Anna Aguilera[1]

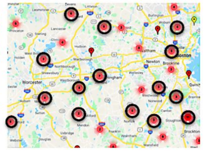
1. Simmons University, Boston, MA 2. Babson College, Wellesley, MA



*Abstract*

Invasive species are notorious for their negative impact on native biodiversity, often placing stress on communities that have co-evolved for hundreds of years. Considering that several invasive species are found at any given invasion site, it is important to consider how the competitive interaction between invasives can shape community structures. This study looks at the interaction between two invasive plants, Oriental bittersweet and Japanese barberry, which are often found growing together in Massachusetts. Specifically, the impact of interspecific versus intraspecific competition on the growth of each invader is compared using data from a field experiment in Waltham. Moreover, this study considers whether or not this interaction would become exacerbated or altered in drought conditions by implementing varying water treatments (ambient, semi-drought and drought). Our data reveals that while Japanese barberry grows significantly less in drought conditions, Oriental bittersweet is able to thrive despite any water limitations. Further, we suggest that in drought conditions, both species are more successful when growing in interspecific as opposed to intraspecific treatments. Moving forward, we hope to construct a mathematical model, the mathematical analysis of which will predict if the long term interaction between these plants would result in competitive coexistence or exclusion. Overall, with the foreboding inevitability of climate change, it is especially important for us to conserve healthy ecosystems in order to maximize their resilience. By understanding how these particular co-invaders interact, we can better conceptualize how to take targeted action in order to restore local areas.



These maps are provided by the Invasive Plant Atlas of New England (IPANE), which relies on citizen scientists to provide plant data that is reviewed by state verifiers. The left image shows the distribution of Oriental Bittersweet, while the right shows the distribution of Japanese Barberry.

## Field Experimental Design

**3 Precipitation Treatments:**

Drought (50% Rainfall)
Dry (75% Rainfall)
Ambient (100% Rainfall)

**3 Invasion Treatments:**

Oriental Bittersweet
Japanese Barberry
Both (co-invasion)

**3 Experimental Blocks (36 Total Sub-Plots)**

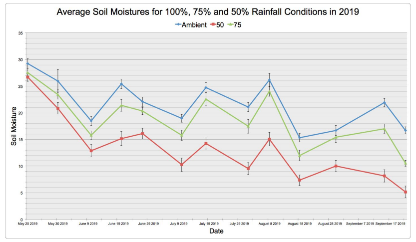



Figure 1: Soil moisture values were recorded every two weeks from June through September 2019. A three-way ANOVA for the 2019 season confirms that soil moisture was significantly associated with rainfall treatment (df = 2, f = 180.175, p = .000). This assures that for the 2019 growing season, rainfall treatments were effective.

## Results

***When each competitor was grown together in drought conditions, Oriental bittersweet grew taller, and Japanese barberry produced less above-ground biomass. While this suggests that the former is a better competitor in drought, Japanese barberry exhibited greater mortality when growing with conspecifics.***

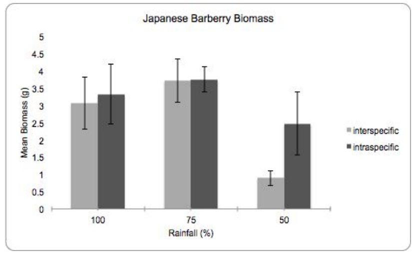



Figure 2: This graph displays the means and standard errors of Japanese Barberry above-ground focal plant biomass. It appears as though interspecific competition dramatically reduces Japanese barberry's growth in drought conditions, but not in other rainfall conditions. Meanwhile, there is not much variation in biomass between intraspecific treatments.

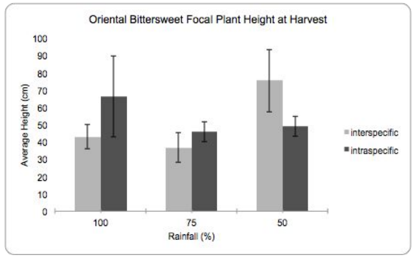
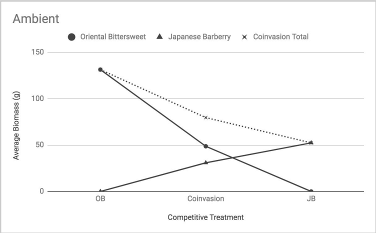
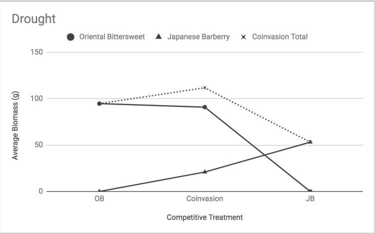



Figure 3: This graph displays the averages for height measured at harvest, and standard errors, for Oriental bittersweet focal plants. In 50% rainfall, it appears that Oriental bittersweet grows taller when in the presence of Japanese barberry. Meanwhile, there appears to be no variation between height in intraspecific treatments.

Figures 4 & 5 (below): The total aboveground biomass for each of subplot was summed for each rainfall treatment, the average and standard errors being displayed in these De-Wit diagrams. In monoculture plots, Oriental bittersweet produced less biomass in drought conditions. However, it produced a lot more biomass when in the presence of Japanese barberry in drought. This would suggest that either Japanese barberry facilitates Oriental bittersweet growth in drought conditions, or that when resources are limited, Oriental bittersweet tries to elicit a strong competitive response by increasing its above-ground biomass.




## What's Next?

*Mathematical Modelling*

A mathematical model could be used to answer several questions:

1. How do the dynamics of these interactions change with drought?
2. What could these interactions look like after many years? Are they approaching a stable equilibrium?
3. How does initial population size effect possible outcomes?