University of Vermont

Bittersweet Pollinator Garden

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**Introduction**

 The Bittersweet Pollinator Garden is a student-run project focused on strengthening the University of Vermont’s bee campus certification and pledge to sustainability. Over the course of three semesters, the Bittersweet Pollinator Garden’s implementation from grant writing to secure funds to meeting with the UVM Landscape Committee to get permission for building, the project was completely run by students Caitlyn Williams and Liza Bryan.

 Goals for this project were focused around implementing native, perennial flora to attract a diverse group of pollinators ranging from bees and butterflies to bats, among other species. In addition to serving as pollinator and bird habitat, the Bittersweet Garden is also a place for pollinator education and advocacy. The goals of this project are as follows:

1. Create a pollinator and bird friendly garden with 100% native perennial plants.

2. Create an interactive space for people to come and sit, study, socialize, relax, and interact with a pollinator green space.

3. Educate visitors about pollinators and bird friendly green spaces and why they are important.

4. Involve and engage the Burlington community and UVM students, faculty, and staff.

5. Inspire individuals to plant their own pollinator/bird-friendly green spaces (even if only a single bush or balcony plant)

 In addition to promoting the connection between humans and natural spaces in the city of Burlington, this garden will showcase what a pollinator/bird friendly backyard can look like. The purpose of this is to inspire and encourage visitors to plant similar species in their yards and adapt some of the same practices. Ideally the more time people spend in our garden, the more they will appreciate its effect on their welfare, and the more they’ll care about its importance for bird and pollinator biodiversity. By promoting an alternative to mowed lawns and unused grassy areas, we hope to encourage people to adopt practices and plant species that encourage bird and pollinator restoration. Over the past few decades, the world has seen a sharp decline in pollinator and bird biodiversity, signaling a harrowing shift in our global ecosystem. Researchers around the world, from Germany to California, have alerted us to the drastic fall of pollinator populations and diversity. To counteract the untold devastations of biodiversity loss of our pollinators and birds, encouraging the upkeep of their welfare by planting native species will be a pillar in pollinators and our continued survival.

 This project’s seeds were sown on a UVM travel study class to Copenhagen, Denmark, where the class was structured around urban sustainable transitions, transforming green spaces supporting wildlife being amongst those transitions. In Copenhagen, there is a small school called The Green Free School (Den Gronne Friskole) centered around nature-based education and interaction with food systems and pollinators, where students are given a plot of land to till and care for. Here, students are taught the importance of the intricate connection between humans and the pollinators that sustain us, that we can only progress forward with pollinators by our side. This school in the heart of Denmark’s bustling capital perfectly symbolized the grassroots level infrastructure and movements that empower people to take sustainability into their own hands, by planting gardens and reshaping green spaces to support wildlife.

 The Environmental Program at the University of Vermont advocates, educates, and nurtures not just pollinator advocacy, but strengthens the intention of its students, building the courage and confidence to practice sustainability anywhere and everywhere. This project also embodies the Environmental Program’s mission. From studying abroad in Copenhagen to studying the fundamentals of plant and soil science, the Bittersweet Garden provides us with an opportunity to draw from diverse skills and knowledge gained from courses in the Environmental Program and work independently and collaboratively in environmental problem-solving.

**Background: Field of Study**

This interdisciplinary project has many relevant environmental fields that we are drawing ideas, information, and guidance from. These fields include the more physical aspects of our garden; native perennial species, no till agriculture, biodiversity restoration, and habitat patch networks. Focusing on the more social elements of the project, we’ve included in our research: green spaces, reference group behavior, and the importance of nature for the human psyche.

**Habitat Restoration with Native Perennials:**

An ecosystem consists of complex, dynamic, and constantly evolving relationships between the plants, animals, insects, and fungi in a biological community. They develop over millions of years and rely on the presence of specific organisms to be balanced; when this harmony is disrupted, the effects are felt throughout the ecosystem. “Our local insects and pollinators have a specialized network of relationships with native plants created over 100 million years” (Dwood, 2020); the larvae depend on the edible leaves of the plants, while the plants depend on the pollinators for the successful production of their seeds. Having evolved in the *local* environment with the *local* pollinators and the *local* fauna and flora, native perennial plants are better suited for, and promote diversity within, the local ecosystem. Non-native species and genetically altered cultivars offer little nectar and less habitat for our pollinators, yet they’ve taken over our landscapes! Even plants we know to be native have been selectively bred for specific colors, shapes, and sizes. Beebalm, for example, has many cultivar variations such as Garden View Scarlet and Raspberry Wine have longer bloom times but are not as attractive to pollinators. We’ve cut down forest and filled in meadows to seed monocultures of non-native grasses for residential lawns, and we’ve planted swaths of cultivars and exotic ornamentals in our cities and neighborhoods. Over the past century, “[t]he continental U.S. lost a staggering 150 million acres of habitat and farmland to urban sprawl” (Audubon Society, 2017). Hardier and better adapted to climate change, native flora provide a critical ecological role for wild pollinators and birds and offer a tangible way that we can all fight climate change (Krupp, 2021). Native plants more easily form ecological connections with microbes and fungi in the soil making them more drought resistant. Through these interactions with local flora and fauna, native species more easily form reciprocal, mutually beneficial connections with individuals in their ecosystem. A carefully evolved system of checks and balances between species ensures that no one species overtakes an entire area. This ensures space for more individual species, a more biodiverse ecosystem as a whole, and thus a healthier plant and soil environment with more sequestered and stored carbon. Native species also sequester more carbon than non-natives according to an article from PennState (Kreye, 2020). This garden consists of entirely native perennial plants and will serve to promote the biodiversity and health of our local Burlington ecosystem.

**Pollinators:**

Insects are the largest and most diverse group of organisms on Earth (The Biodiversity Group, 2021). Found in almost every environment on the planet, insects play critical roles in the ecosystems they are a part of; their role as pollinators cannot be understated. Successful pollination allows plants to produce seeds. This ensures the continuation of that species, all of its ecosystem functions, and a reoccuring food source for pollinators. As far as their impact on humans, the Food and Agriculture Organization estimates that “[m]ore than three-quarters of the world's food crops rely at least in part on pollination by insects and other animals,” and that between “$235 billion and $577 billion worth of annual global food production relies on direct contributions by pollinators'' (Lumpur, 2016). The protection and creation of pollinator-friendly spaces is critical to ensuring the health of our local ecosystem, the global environment, and our economy.

The Bittersweet Pollinator Garden, consisting entirely of native perennials, will provide pollinators with the vital resources they need. In addition to relying on native plants for nectar and pollen as adults and on for their leaves as larva, pollinators seek shelter in these plants at different times of the year. Kate Kruesli, a multi-decade native plant gardener, writes that “hollow plant stalks, rotting logs, and fallen leaves all might be a happy insect home. Unfortunately, that’s what traditional gardening has taught many of us to “clean up,” remove, or mulch over!” (Dwood, 2020). An important aspect of this garden is its minimal upkeep and maintenance from year to year in an attempt to attract more pollinators to the natural feeding and nesting sites in our garden. The bee home we have created consists of natural plant material and will provide hollows, cracks, and crevices for burrowing insects to find refuge in. The image below comes from an article on the Burlington Parks Recreation Waterfront site about rewilding our home lawns. The soil in the Bittersweet backyard is well-drained sandy loam and, without any lawn or wood chips for mulch, provides a substantial habitat for ground nesters.

***(Image 1: An example of a backyard in Burlington with ground nesting sites)***

**Birds:**

The world is seeing a colossal loss of bird population and diversity unlike anything recorded in modern natural history. A report published by the journal *Science* claims that wild bird populations in the US and Canada have declined by almost 30% since 1970 (Rosenberg et. al, 2019). That means that more than 1 in 4 birds have disappeared in the last 50 years. This staggerly high loss of birds is pervasive throughout all biomes of North America; grasslands, shores, boreal forests, arctic tundras, and both western and easter forests. Grassland bird populations alone have decreased by more than 50%, and researchers claim that habitat loss is likely a ket driver; “particularly agriculture intensification and development” (Axelson, 2019). Ken Rosenburg, an applied conservation scientist at Cornell Lab of Ornithology states that “[t]hese bird losses are a strong signal that our human-altered landscapes are losing their ability to support birdlife” (Axelson, 2019). It is for this reason that a major focus of our garden is on the restoration of bird habitat, and, good news for us, plants for bugs are plants for birds. In addition to feeding on the seeds, nuts, and berries of native perennial species, “they need LOTS of soft caterpillars, high in protein and fat, to make eggs and raise their young to adulthood” (Dwood, 2020). If birds can’t find enough insects and caterpillars to feed to their hatchlings, or if they can’t refuel while migrating, their populations decline. Vermont is right on the Atlantic Flyway and sees upwards of 260 species per year (State of Vermont, 2021), making it a crucial pitstop for migratory birds to rest, refuel, and breed. With the hasty development of forests and fields into residential areas and the popularity of non-natives and cultivars, birds are losing their habitat and food sources faster than ever. Attempting to slow this alarming trend, Vermont organizations and residents have worked with Audubon and other collaborators to create more bird friendly habitats. Audubon’s Bird Friendly Maple Project is a good example of this: partnering with 20 different maple farms across the state, Audubon has helped farmers manage their sugar bushes in more bird-friendly ways; increasing the diversity of tree species and encouraging varied habitats (Audubon Society, n.d.). Additionally, through Audubon’s Champlain Valley Bird Initiative, they have worked directly with “landowners, foresters, and other partners to “promote bird friendly habitat management and conservation actions on over 16,000 acres” (Audubon Vermont, 2015).

By planting a space with entirely native perennials, we are joining the collection of individuals and organizations working to promote more bird-friendly habitat. Urban and suburban areas are crucial in reclaiming native habitat for birds and insects. Doug Tallamy, a leading entomologist, professor, and expert in pollinator habitat restoration is a key driver in the rewilding of our residential areas. He calls it a “bringing home” of our national parks because if we replaced *half* of the lawned area in the US with native plants, this natural habitat could be more than the combined size of the National Parks of the Adirondacks, Yellowstone, Yosemite, Grand Tetons, Canyonlands, Mount Rainier, North Cascades, Badlands, Olympic, Sequoia, Grand Canyon, Denali, and the Great Smoky Mountains (YouTube, 2020). It might not seem like one yard can make a difference, but when more people get involved and grow their own native plants, added together, the impact can be huge.

**Community Engagement:**

The planting of this garden, in addition to promoting and sustaining healthy ecosystems, will serve as a way for Burlington residents and UVM students to come together as a community. By working together to pull up sod, remove bushes and raised garden beds, and plant each perennial, our community will have a chance to share this experience and become closer. After the garden has been planted, this communal space will be an area of socialization, respite, and enjoyment for anyone in the Burlington area. Not only will it provide a place for community members to interact with each other, but it will showcase what a backyard pollinator/bird friendly habitat can look like! The purpose of this is to inspire and encourage visitors to plant similar species in their yards and adapt some of the same practices. Ideally the more time people spend in our garden, the more they’ll appreciate its effect on their welfare, and the more they’ll care about its importance for bird and pollinator biodiversity. By promoting an alternative to mowed lawns and unused grassy areas, we hope to encourage people to adopt practices and plant species that encourage bird and pollinator restoration.

**Habitat Corridors in Cities:**

As we attempt to popularize natural areas in our city for bird and pollinator biodiversity, we come across one of the key concepts relevant to our projects; habitat patch networks. Habitat corridors provide continual, connected habitat space for wildlife in urbanized environments, and the idea behind a habitat patch network is very similar. Instead of a grassy bridge over a highway or a strip of wooded areas connecting two forests, a habitat patch network provides a discontinuous set of habitat patches for avian pollinators and birds. These green spaces act as places of refuge with food, water, and shelter for resting. As this concept relates specifically to green spaces in cities, each one of these gardens, backyard native spaces, or small natural areas helps restore pollinators and bird habitat. Even spaces as small as 4x6ft can attract pollinating insects, alternatively called “pollinator pockets”, individuals don’t need a large space to make a difference (University of Illinois citation). An urban farmer in St. Louis, Missouri speaks about what’s important in city rewilding:

*[What’s important is] individuals creating as healthy of an ecosystem as they possibly can. Even if that means just a small, little, 10’ x 10’ lot in somebody’s front yard or not even a front yard just some lot down the street that nobody’s doing anything with. We live in a big city and a lot of times people think that it’s divided from the natural ecosystem -- that it’s separate from the natural ecosystem and it’s not. We’re animals just like anything else, the city that we live in is an ecosystem. So individuals taking responsibility for that and trying to make it as healthy as possible for themselves and everything else that lives in it [is important] -- ‘cause it’s not just us.* (Burr, 2016).

As the popularity of pollinator spaces grows and more people plant native species in their yards, the Burlington community will collectively create a city-wide ecosystem capable of supporting a diversity of pollinator and bird species. According to Andrea Burr, a research fellow at the Center for Sustainability at Saint Louis University, aside from untapped ecological potential, “urban areas afford diverse nesting sites ranging from bare soils, plant stems, trees, and leaf piles to cavity-nest sites located in walls, fences, porches, and building crevices.” Cities can function as biological havens for the abundance and richness of pollinator and bird species. Planting areas of native flora throughout our urban community is one of the most effective ways to rehabilitate pollinator and bird habitats; “[f]ragmented and disturbed metropolitan environments serve as patchy yet vital resources” for native biodiversity (Burr, 2016). This garden will become a part of the Burlington-wide natural area network, providing food and shelter for pollinator and bird species alike.

**Reference Group Behavior:**

Through the exposure of non-traditional land-use practices like the replacement of lawns with naturalized, native plants, we aim to be a part of a collective shift in the social behavior of our community. Recasting the urban landscape as a refuge for birds and insects is a task that takes more than the education of pollinator importance; it takes a collective change in community norms and priorities. This is where we would like to introduce a theory that sociologists call “reference group behavior”. A reference group is a group of people, typically one we are or want to be a part of, that we rely on “to understand [social norms](https://www.thoughtco.com/why-a-norm-matter-3026644), which then shape our values, ideas, behavior, and appearance” (Crossman, 2019). We look to our reference group to gauge what is “normal” or “expected” of us, and in regards to where we live, this can dictate what we value in the appearance of our property. In fact, a study on the challenges that face urban green space management found that “80% of surveyed respondents reported it was their ‘duty’ to uphold neighborhood landscape norms” (Aronson, 2017). Residential lawns are all too common in suburban environments and it’s often the desire to fit in and uphold community norms that keeps individuals from changing their yards. Andrea Burr writes that these “[i]nternalized beliefs, manifested as an ‘ecology of prestige’ in which those group beliefs, values, and norms are translated into value-laden public landscaping choices” (Burr, 2016). Joining the trend of rewilding our backyards, our pollinator garden will serve as an example for an alternative “norm” for Burlington backyards. If normalized in a public space, people are more likely to bring it to a private. Burlington’s Open Space Protection Plan is a program that seeks to do just this. Identifying “under-served areas of the city and determining the best places for open space protection and related open space amenities like community gardens and park lands” (City of Burlington, 2014), this program aims to bring more natural spaces into the public spaces of Burlington. Prioritizing bird and insect restoration over the outdated aesthetic of turf grass, our pollinator garden is one small part of the collective shift towards a rewilding of our urban spaces. Individual, neighborhood, and community customs and norms are what drive peoples’ decisions and actions. It is thus the reference group theory that makes it so important for UVM to showcase what a native perennial garden can look like. In order to make no-mow zones, rewilded areas, and pollinator gardens the new norm for Burlington yards, our Bittersweet pollinator garden is a critical step for UVM to take as a community leader.

**Transforming Lawns into Habitat:**

 A current trend in the field of bird and pollinator restoration is the shift away from monoculture lawns and landscapes. Rather than implementation on a governmental scale, this shift is largely carried out by small community groups, local initiatives, and dedicated individuals. Urbanization and the increased intensity of our agriculture are two of the leading causes of bird and pollinator decline. The past hundred years has seen a colossal expansion of our urban landscapes, “[f]ields and forests are replaced with biological deserts made up of millions of acres of concrete, lawns and an array of ornamental trees and shrubs imported from around the world” (Rubinoff, 2021). These landscapes are a result of both convenience and socially conforming behavior. Sociobiologists refer to human’s preference for vast areas of low-cut grass as “savannah syndrome” (Lynch, 2020), and coupled with reference group behavior, it’s no wonder that big mowed lawns have become the norm. But they don’t have to be! Countries around the world are slowly seeing a public rise in awareness of the importance of biodiversity, and a grassroots movement to “bring natives back” has inspired individuals to take action in their own front lawns. Minnesota’s Lawns to Legumes pilot program offers residents “workshops, coaching, planting guides and cost-share funding for installing pollinator-friendly native plantings in residential lawns” (Lawns, 2019). Missouri’s Invasive Plant Task Force led an initiative to replace peoples’ non-native callery pear trees with native species; providing free replacement trees, participants had only to show pictures of each tree they cut down to receive a new native to plant (Barker, 2021). In California, the state offers a rebate of $1.75/sq ft of turf lawn replaced with either native vegetation or artificial grass (State of California, n.d.). Incentivising citizens to get rid of their grassy lawns, this program cuts down on the state’s water usage and brings more native plants into urban landscapes. Here in Burlington, evidence of this movement can be seen in residential lawns, street margins, protected natural areas, public parks, and community gardens. Community members are embracing the “messiness” required for year round insect and bird habitat. Online natural area maps are becoming more popular and can provide a sense of community stewardship between strangers in the same county or city. Although a top-down, governmental approach to the implementation of native plants is still lacking nation-wide, community groups, individual states and cities, environmental organizations are stepping up to encourage the restoration of these vital habitats.

 One of the key leaders in this movement is the Audubon Society. Audubon has paired with local initiatives across the country to encourage native plantings for insect and bird habitat. The Audubon society of northern Virginia has created a project called “Audubon at Home” which supports property owners and managers in restoring local natural habitat and biodiversity. Their Wildlife Sanctuary Program partners trained naturalists with property owners to provide “information, on-site consultation and recommendations to help [them] establish and nurture sustainable natural habitat in [their] backyard, neighborhood, school, church, park or business in spaces that range from a small corner of [their] yard to many acres” (Audubon at Home, 2020). Similarly, Audubon has created a Backyard Habitat Certification program in Portland Oregon that brings the community together. Residents who support native plants and wildlife, reduce their pesticide use, or have stormwater management systems in place can fill out an application and become an active member of this program. Ranked in order from “platinum” to “in progress,” their website shows a map of the area over a number of years, tracking the growth and progress of the program. As an individual, it’s easy to perceive one’s efforts as solitary, however Audubon’s programs seek to support the unseen community of fellow backyard habitat “restorers.” By pairing with local environmental groups and individual stewards, the Audubon Society is a leader in the fields of both backyard habitat restoration for birds and insects, and community building and education for greener urban landscapes.



**(Image 2: 2017 Site Inventory Map of Portland Oregon’s *Backyard Habitat Certification Program*)**

As individuals, we have more agency in pollinator conservation than we might initially think. On the importance of a single garden plot or gardener, in his book *Bringing Nature Home*, Professor Doug Tallamy writes;

*For the first time in history, gardening has taken on a role that transcends the needs of the gardener. Like it or not, gardeners have become important players in the management of our nation’s wildlife. It is now within the power of individual gardeners to do something that we all dream of doing: to make a difference. In this case, the 'difference' will be to the future of biodiversity, to the native plants and animals of North America and the ecosystems that sustain them.* (Audubon at Home, 2020).

**Sponsoring Organization**

 The Environmental Program at the University of Vermont has hosted the physical space for the Bittersweet Garden, at the back of the program’s headquarters, the Bittersweet Building. Sustainability is at the core of UVM, especially in regards to pollinators and ecosystem restoration, other projects like the Jeffords Garden show that UVM is dedicated to transforming it’s campus to sustain all life. This dedication has awarded the University of Vermont with the title Bee Campus, awarded through the Xerces Society. The Bittersweet Garden is possible because of the University’s campus management plan promoting and planning for sustainable transitions on campus.

 The environmental program is a steward of those sustainable transitions, facilitating student engagement and interest, facilitating the opportunities for students to participate and decide what some of those transitions look like. The opportunities that the university and the program offers allows for these kinds of projects to flourish, creating a unique space that has allowed the Bittersweet Garden to come to life.

 This project is also possible through the Audubon Society through their bird planting initiative, the Audubon came forward with funds to aid in buying plants that are both beneficial to pollinators and birds. In addition, the Sustainability Campus Fund and the Apis Fund at the Gund Institute awarded the projects with funds.

**Methods**

This project allowed us to take on the role of project managers, from landscape designing, organizing plant species lists, contacting volunteers and specialists, and writing grants. The Bittersweet Pollinator Garden has been a herculean effort, our tasks included:

* Meeting with and writing a grounds proposal for approval for planting from the Landscape and Sub-landscape committees.
* Grant writing for financial support from the Sustainability Campus Fund and the Apis Fund.
* Compiling a species list and cross-referencing with experts like Jane Sorenson and Annie White.
* Sun mapping, soil assessment, and site measurements of the Bittersweet Garden area for finalizing the garden layout.
* Organizing volunteers and other project collaborators, such as getting a videographer to document our progress, working through the Audoubon to purchase plant species, as well as other garden elements.
* Ordering garden and planting features such as mulch for walkways, straw mulch, compost, landscape cloth, and a sod cutter.
* Transforming the garden space by removing existing garden elements like sod, garden beds, bushes, etc. and adding new features like bee houses, mulch paths, and native flora.
* Making a plan for continual upkeep for watering the garden while the garden is establishing itself.

 Our 200 hours were met throughout several semesters, starting from the end of the summer of 2019, to the summer of 2021. We began by infrequently meeting an hour every two weeks to discuss the progress of the garden, and delegating tasks to divide and conquer at the beginning stages of the project. We meet with various actors from the University of Vermont and the Audubon Society to discuss garden essentials, trials, and issues that arose throughout the planning of the garden. The beginning of the project consisted of grant writing to secure more funds for the garden, presenting our ideas and vision to those grant boards, and making a case as to why transforming spaces like this is essential to the Landscape Committees. From there, meeting with our Audubon partners every other Tuesday to discuss project goals, share insights, and problem-solve any issues that presented themselves during the planning phase of this project. Reaching out to various UVM and Burlington outlets to spread the word about the garden and rally volunteers, from presenting in UVM classes, reaching out to UVM social media pages, and the greater Burlington community. We searched for and found a videographer to document our progress, and scheduled with them to ensure a smooth process amongst all of our external and internal collaborators. During the planting and implementation phase of this project, we continued to rally volunteers and dug our hands deep into the Earth to transform the space from a largely inhabitable lawn space to a pollinator centered haven of native flora.

**Results**

 The product of the Bittersweet Garden was better than I imagined, we were able to accomplish the implementation of the garden easily and efficiently, even if we had obstacles that required flexibility and patience, we were able to overcome them. The moment the bug hotels went up and were filled with sticks and reeds to accommodate their new community, hoverflies and small beetles moved in, securing their spot in what will be prime pollinator real estate as the plants continue to grow and flourish. The roots that will soon reach deep into the Earth at the Bittersweet will spread throughout Burlington and UVM through the spirit and nature of the space, educating and showing that natural, perennial gardens are beautiful spaces that support biodiversity. Biodiversity that is declining, and could be stabilized through the efforts of individuals, and we sought to give inspiration and information on the benefits and the expectations of gardening for pollinators and birds.

**Personal Reflection**

 I sought to understand what planting for pollinators really meant for people and the environment at the start of this project, what green spaces in public areas could mean from both an aesthetic and educational point of view, and what are the consequences of spaces like the Bittersweet. While not all of these questions can be answered in definite terms, the experience I had along the project facilitated an outlook on what I hope to see as a trend for individual gardeners and landowners. Furthermore, the garden is meant to be a testament to taking the health and well-being of our important pollinators into our own hands by restoring habitat, educating individuals, and adding to the experience for students at the University of Vermont and in the Environmental Program. I had not expected to essentially take on the position of a project manager, but through this experience, I learned the importance of time organization and management of not just myself, but others, as well as the essentialness of open and clear communication with multiple stakeholders and contributors.

 The Bittersweet Garden encompassed the essence of my time at the University of Vermont, the inspiration for the garden started during a travel study course to Copenhagen, where we studied through the Danish perspective on urban and sustainable transitions in the wake of human-made climate change. Through this lens, we came to understand the importance of green spaces that sustain not just ourselves, but our entire community from the buzzing bees to the worms deep in the earth. This was further solidified when visiting the Den Gronne Friskole, where in the middle of this bustling city stood a very tranquil place of learning of sustainability for children and adolescents, nurturing a bond to one another and to their environment. Pollinators and birds alike played quintessential roles in the sustainable process, not just from an urban development lens, but have a position from the energy sector to the political realm and international relations. After the trip to Copenhagen in Summer 2019, I saw the breadth of potential that pollinators can and do play across many fields, from rewilding solar fields increases the efficiency of the solar panels by creating a microclimate to bringing together different nations on climate change goals.

 Planting for pollinators will be essential to the survival of our pollinators in the very near future, habitat restoration is crucial if we want to stop mass decline in population and biodiversity dead zones. In my environmental political science courses such as International Environmental Governance we learned the concept of thinking globally, acting locally, and this project highlights this concept by positioning the garden in a location to eventually be just a link in a chain of pollinator gardens throughout Burlington, helping to close the gap in the habitat fragmentation through the city of Burlington and UVM more specifically. Pollinator gardens are a perfect example of the individual action we can take to show our policymakers and leaders that habitat restoration and pollinator conservation are important culturally and socially.

 Community collaboration and involvement were an important aspect of this project, we wanted to encourage people to build a connection and memories with the pollinators in the space and the idea of pollinators in general. We also wanted as many perspectives having eyes on the project to ensure the best outcome for the space, we wanted various expertise and knowledge, an aspect of environmental studies as a field that by principle often promotes collaboration between community partners and other entities. Furthermore, we wanted students to be involved with planting not just to save ourselves some physical labor as several days we had one or no volunteers, but to really give the space and the project that spirit of togetherness and cooperation towards a larger goal then ourselves: helping pollinators. This will hopefully be carried on through labs and workshops in the space, as well as being that space for community to gather amongst nature.

 Lastly, through the creation of visual media through video, it shows our product essentially and the idea that we’re trying to sell, it gives an engaging material in addition to the space to provide more inspiration and leadership through communities and other universities. Communication is a large part of the challenges and solutions that face the field, visual media and creative communication engages people with the material to show what went into transforming the space, but the necessity as to why changing lawns into habitat is important. Projects like the Bittersweet promote this kind of intersectionality in that the presentation of the space has multiple different formats now and can reach a wider audience in the future. It further adds to the evidence of the amazing things accomplished every semester and even everyday in the environmental program.

 Overall, the goals set out at the beginning of this project like community building, effective habitat restoration that promotes biodiversity of both flora and fauna and serving as a showcase for what individuals can do in their own space were the main overarching goals for myself for this project. I believe that all of those goals have been reached, and continues in the array of ways that the project can be promoted, but the garden went in smoothly and the connections made along the way shows the invaluableness of this project to my own growth and to rounding out my time here at the University of Vermont as an undergraduate. I started off as a wildlife biology major when I first transferred to UVM, but I switched throughout my sophomore year because of obstacles I faced in that major, and I had somewhat resigned myself to believing that the conservation work I originally wanted to come here to do was not going to happen. Fortunately, my time here has ended doing the thing I thought I was going to be able to do when I entered the Rubenstein school, and that was the best way to close this chapter in my education.

**Contribution to Organization**

 Apart from providing the original idea and vision for the project, I was responsible for writing, securing, and prepping for grants, spreading awareness of the project throughout UVM, maintain relationships with and meet with weekly or bi-weekly with our partners, and implementing the actual garden. Furthermore, organizing volunteers, the videographer, ordering supplies, and continuing to engage UVM students through building a website and educational sign with the Summer 2021 NR 206 class. In addition, I was an effective team member who knew when to take the lead and when to step back and allow space for other ideas and concerns, I maintained open and efficient communication with our partners throughout the project thus facilitating a smooth communication line with little miscommunication hiccups.

 Our partners such as the Environmental Program not only allowed us the space to carry out this project, but fully supported and guided us with resources and reinforcement, and with equipment. In return, we supplied the Environmental Program a restored ecosystem that not only showcases what the Environmental Program is about but has further supplied the University of Vermont with a new location to send tours on, host workshops and events, and add more aesthetic value to the campus. We reflected the importance of individual action on wildlife conservation, the self determination to take the health and well being of our community and our Earth in our hands, a value that I have learned from my time learning in the Environmental Program. We have contributed a small contribution, but in the spirit of the Environmental Program, we hope that this contribution will serve as inspiration for others for many more semesters to come.

 The Audubon supplied us with money for plants and compost, as well as lend their invaluable knowledge in planting for birds and pollinators. Furthermore, the Audubon will be adding our garden site to their GIS map of bird-friendly gardens that shows their interest in investing in bird and pollinator centered gardening. I also applied for the Apis Fund from the Gund Institute to set up a maintenance fund for the garden for future needs and additions, as well as to facilitate a connection between UVM’s other partnerships and the project. Thus, we interlinked various UVM facilities and outside partnerships that have not only benefited the project but helped to strengthen the Environmental Program and UVM’s outside partnerships.

 Working with the videographer, our grant partners, committees, and clubs at UVM, the Audubon, and implementing the garden were all a part of the labor of love that is the Bittersweet Garden. Organizing volunteers and presentations, ordering some of the necessary materials to create the garden, and collaborating with NR 206 this July to set up an educational website and signage are just all mechanisms that went into making this project run smoothly towards the goals we had set out for it. Supplying the original vision and spearheading the project and finding a partner for ensuring the best outcome for the space was the start of my contribution, from emailing professors in a train car through Copenhagen after visiting Den Gronne Friskole from planting the last Blazing Star plug in the completed space. Meeting every Tuesday every week for the past four months to discuss and breakdown work for the project, imagine the space, and form connections between our experiences at UVM and connections with amazing contacts that made this project possible.

**Conflicts and Challenges**

 Kickstarting the project was a bigger obstacle than I had first imagined, I had reached out to several professors across soil sciences to the humanities department asking for advice. I had originally conceived the garden as being part community garden, part pollinator garden, but upon receiving guidance from Professor Teresa Mares that including edible foods would present more challenges, the idea manifested as a purely native, perennial pollinator garden that would be low maintenance. I had also originally conceived this project to be solo, but upon reflecting on the sheer size of the project and the actual available time I had overall to dedicate towards it, I realized working with another individual would help make the implementation of this garden easier, and more realistic. From the beginning of this project, I had to maintain a very flexible idea of what this project would look like. For me personally, someone who is naturally stubborn on most fronts, this was not always the easiest thing for me to swallow, and I had to take an uncomfortable position of being a co-contributor rather than being the sole creator. This project tested my patience over the two years it took to finalize and then implement, it forced me to test my flexibility and adaptability, and my passion for the field in general.

 One challenge during the project would be communication, especially since there were so many different outlets of information and people to keep in touch with, people we tried to connect with, and connections that were tested a few times throughout the project. There were multiple times that we had where we would split from a meeting with several people to email and connect with, and there were many instances within those times where the individuals we would reach out to would either not respond, or the number of emails that I would need to send felt almost overwhelming. Drafting emails to then email to listservs across different UVM schools like Rubenstein and classes like Professor Annie White’s permaculture class or doing presentations or advertising where and when I could about the garden to rally support and volunteers. Honestly, I felt I had more communication misses then hits at times, especially in regard to getting people to participate in the sign contest, advertising for these things was a lot harder than I had anticipated in getting people engaged and excited about the project. Further, we had some almost alarming moments, such as almost having none of our plants ordered shortly before planting was to begin. Through these miscommunication flubs, I learned that having a sense of humor about yourself and life in general is necessary, maintaining a positive outlook on a long project was one of the only things that kept me sane throughout the implementation of the garden.

 Another challenge was the nature of working with a partner on a traditionally singular experience in the environmental program. Overall, our partnership worked very well, we communicated on a personal level efficiently and did not let any tension or disagreements come between the larger goal of the project, and the instances of tension or disagreement happening was exceptionally low. We also checked in with one another pretty frequently about being overwhelmed and dividing the work evenly, and expressing gratitude to one another, which I learned is a very important part of any team dynamic is to reinforce with appreciation. Some of our external partnerships had more confusion around them, like trying to keep track of all of our partnerships and contacts while also not being involved with every email chain was difficult, especially when contacts wouldn’t respond to emails no matter if one or both of us reached out, but this wasn’t too common of a trend for us.

 Lastly, there were several components of the project that did not see fruition, at the end of everything else we had to do just to get the garden implemented and ready for planting, the other goals we had set out for ourselves, like designing a website and a sign, had to be dropped. Fortunately, we were turned on to an opportunity with NR 206 to complete the sign and website for us come July 2021. It felt disappointing that those two things were not accomplished, although on the flip side, we are able to continue to engage the UVM community through this capstone even after it’s implementation, highlighting the accomplishment of our long-term goal for the space, being an educational and natural place for students to gather.

 Overall, despite the test of endurance, the obstacles we faced felt minimal in the context of how well we worked together and with our partners, how easily we were able to share and delegate tasks, and how open we kept communication and genuine expression of care and appreciation. We started off as complete strangers at the beginning of this project, but despite this, we were united under a singular belief that pollinators are important, to us and to the world. This understanding of the importance of green spaces like the Bittersweet Garden in urban spaces like Burlington, Vermont was at the center of our dynamic, and that guiding hand made for a fruitful partnership with little strife and misunderstanding. Our partners likewise held this view and educated us on the best ways to achieve our vision with patience and understanding, making our partnerships a relationship of a group of passionate individuals who all want the best for our pollinators.

**Conclusion**

 The Bittersweet Garden was a labor of love for our pollinators, our environment, and our own well-being. At the beginning, we knew implementing this garden wasn’t going to be an easy or fast process, but throughout the project we learned the art and importance of being patient, adaptable and compromising. After a long year of social hibernation, the fruition of this garden symbolizes a new future and hope not just for us, but for the Environmental Program and UVM at large. Our garden will hopefully be just a link in a vast chain of pollinator gardens throughout UVM campus and the greater Burlington area, our goal and hope is that Burlington will truly become a bee-friendly city and safe space for pollinators of all varieties. The lessons we’ve learned throughout this project have been priceless, and have made us more able to tackle the obstacles ahead for ourselves and pollinators.

 Community support and participation is essential for projects like this, not only due to the tremendous physical effort required to transform green spaces, but because it fosters that sense of belonging to each other and to the world around us. From this project we have learned how to turn a functionally biodiverse dead zone into a flourishing habitat, how a space that some may deem insignificant can hold the weight of our entire future within its fragile roots. Like the American Robins who accompanied us throughout our transformation process, we learned how to find opportunities in unlikely places. Together, our green spaces could look like the Bittersweet Garden, where pollinators and people live harmoniously and benefit from one another. We hope this contribution to our shared future spreads its roots throughout Burlington, and eventually, the World.

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