

Bee Campus USA - James Madison University

Report on 2020

Pollinator Habitat Creation & Enhancement

- Land Bridge Meadow – JMU's new land bridge facilitates pedestrian access on East Campus. The original 1.5 acres of forest/open space meadow in the project area was increased to 3.7 acres of forest/open space meadow and will help meet stormwater management runoff reduction requirements. The area features a meadow planted with native, pollinator-friendly plants and is intended to be used for pollinator education and outreach.
- East Campus Hillside Pollinator Garden Beds – Using a mini-grant from the ISNW, Dr. Amy Goodall, Dr. Wayne Teel, and students in courses constructed a number of raised beds in the area just below the perennial meadow on the East Campus Hillside. The beds feature plants presently missing or underrepresented to attract and provide food for pollinators. A variety of nectar and pollen producing plant species were planted with a wide range of colors, shapes and flowering times. The raised beds were constructed using micronized copper azole treated lumber that is designed to eliminate any toxic side effects common in other treated woods. Students and faculty constructed the beds and did the planting. Maintenance of the gardens is carried out by faculty and student volunteers. Their work was included in JMU news: <https://www.jmu.edu/news/2019/04/24-pollinator-gardens.shtml>
- Bioscience Building Pollinator Gardens – Using a mini-grant from the ISNW, in spring 2019, Dr. Mike Renfroe and students in courses installed full season pollinator beds outside the Bioscience building. The beds included plants species that flower in the spring, summer and fall. The plantings focused on native plants but ensured that a mixture of perennial species was used that will be largely self-maintaining.
- Orchard Mason Bee Homes – Using a mini-grant from the ISNW, Dr. Renfroe and students in courses created and installed four pollinator homes for solitary bees and ground nesting bees at the Bioscience Building Pollinator Garden to enhance the native pollinator population.



Students constructing pollinator garden beds on the East Campus Hillside. Photo by JMU Creative Media, Elise Trissel.



This newly established pollinator-friendly meadow is part of the JMU Land Bridge project. Photo by Dale Chestnut.



In Spring 2019, a bee home and pollinator garden were prepared by biology students near the Bioscience Building. Photo by Dr. Mike Renfroe



Education & Outreach

Twelve pollinator education and outreach events with over 350 participants total have been held. The Institute for Stewardship of the Natural World (ISNW) and EJC Arboretum coordinated the education and outreach programming for our Bee Campus USA program. Amanda Bodle, Program Manager with the ISNW, is also the co-chair for our Bee Campus Advisory Committee. To kick off our participation with the Bee Campus USA program in 2018-19 the ISNW organized the program described below. Two of the program's leaders were JMU Bee Campus Advisory Committee members. More information can be found here: <https://www.jmu.edu/stewardship/abookfortheburg.shtml> Inspired by a One Book, One Community model and infused with sustainability, A Book for the 'Burg is a community-wide reading program first launched in academic year 2013-14 to engage our community in conversations around a thought-provoking environmental stewardship/sustainability theme. Community members were encouraged to explore the local libraries' book selections and attend a number of related events and activities. The 2018-19 program was the second A Book for the 'Burg. The focus on pollinator education and conservation intentionally assisted in fulfilling JMU's Bee Campus USA application requirements. Additionally, A Book for the 'Burg was launched in partnership with JMU's 2018 International Week, "Our Changing Climates: Everybody's Business," as the implications of climate change for pollinators are global. For 2018, A Book for the 'Burg joined a national conversation already underway about the importance of pollinators and their declining populations. Our approach to the reading selections was a unique one; rather than a single book selection, our community libraries had an array of books related to pollinators available, and new to the program were K-12 selections. Community members could visit the Massanutten Regional Library, the James Madison University Libraries, or the Eastern Mennonite University library for an inspiring selection of books. Programming included workshops, guest lectures, a film screening, youth activities, and facilitated dialogues. Programs were free, open to the public, and did not require participants to have read the recommended books. Both the readings and events challenged us to think about how environmental stewardship is and can be integrated into our lives, and to recognize that our choices have significant ethical implications for our own lives, for the lives of those we know in our community, and for the lives of many others in this interconnected world. A Book for the 'Burg is the result of a partnership between James Madison University, Eastern Mennonite University, Massanutten Regional Library, and the City of Harrisonburg Parks and Recreation. The following events were hosted as part of this program: 9/20/18 - Crafty Kids @ Central Library, September Theme: Pollinators As part of an existing event series, Massanutten Regional Library hosted a pollinator-themed craft for K-5 kids at the Central Branch. For more information visit <https://mrlib.org/event/crafty-kids-central-library-5/2018-09-20/> . 9/24/18 - Importance of Pollinators and Participant Research to Help Them Presented by Dr. Amy Goodall and Dr. Wayne Teel, this workshop focused on why we should care about the Earth's pollinators, as well as how we can work together to help bees, moths, butterflies, and birds that serve as pollinators. Included was a discussion of the importance of pollination within ecosystems including those that contribute to human food sources, and the most significant causes for declines in pollinators across the globe. Hands-on activities were used to increase participant interests in observing and enjoying pollinators as well as exemplify how citizen-based research can contribute to scientific knowledge of pollinators and conservation of their habitats. 9/25/18 - BYOB (Bring Your Own Book) Club, September Theme: Pollinators Massanutten



Regional Library hosted a BYOB (Bring Your Own Book) Club at Restless Moons Brewing (120 W. Wolfe Street) on the last Tuesday of the month at 7 pm. The September meeting focused on pollinators as part of A Book for the 'Burg. Find out more at <https://mrlib.org/event/byob-bring-your-own-book-club-restless-moons-brewing/all/10/2/18> - Building Homes for Native Pollinators Dr. Michael Renfroe and members of his biology classes demonstrated how to build nesting sites for orchard mason bees and solitary ground nesting bees that are native to Virginia. Orchard mason bees are important pollinators for many of our early spring-flowering orchard tree species that provide humans with fruit such as apples, peaches, pears, and plums. It is easy to provide habitat to these lesser known, but important native pollinators, thus enhancing the biodiversity of our pollinator community, and making sure they continue to provide valuable ecosystem services. 10/10/18 - Bats, Moths, and Bugs: The Irreplaceable Role of Nocturnal Pollinators The plight of daytime pollinators such as bees has been in the news over the past few years. But what about the pollinators who make their home in the darkness of night? Diverse, beautiful, and vitally important to life on earth, nocturnal pollinators face as many problems as their daytime friends, plus they have the added challenge of dealing with ecological light pollution. Dr. Paul Bogard, JMU English professor and author of *The End of Night: Searching for Natural Darkness in an Age of Artificial Light*, discussed the value and beauty of nocturnal pollinators, the challenges to their existence, and what any of us can do to help. 11/1/18 - All ages documentary with an up-close look at butterflies, hummingbirds, bees, bats & flowers The Massanutten Regional Library offered a free screening of *Wings of Life* presented by Disney Nature. 11/8/18 - Painting Bees & Molding Wax: The Role of Pollinators in the Artist's Studio Local artist Paul Cook led a discussion on pollinators as subjects and as producers of vital mediums for the artist's studio. Participants examined pollinators through the works of Maria Merian, Beatrix Potter, and Sir Joseph Noel Patton. In terms of vital mediums, participants looked at the use of beeswax in various processes such as wax glues, lost wax casting, and the works of Aganetha Dyck. Additionally, the EJC Arboretum Director sits on The Bee Campus Advisory Committee, and the EJC Arboretum hosted the following events in 2019: 2/24/19 - Pollinators in your Backyard Bee City Committee tabling event, 50 children & 30 adults. This city-wide event was a huge success. This collaborative event was organized in the effort for Harrisonburg to become a 'Bee City'. Nichole & Lisa represented the Arboretum - informational board display, seeds give-away, and DIY seedball and face painting activities. 5/2/19 - Bee and Pollinator Hotel Making, 31 kids & 9 adults. Children explored the life of a honeybee, its value to an ecosystem, and learned how to make their very own bee hotel to take home. The workshop included a special guest beekeeper who shared what beekeeping is. 5/17/19 - Butterfly Release, 25 children & 10 adults. Gail Napora led a lesson on monarchs followed by a butterfly release. Participants learned about monarch life cycle, their migration, and why they need to be protected. 9/29/19 - Monarch Tagging Workshop (paid event), 10 children & 9 adults. Gail Napora led a hands-on lesson on monarch butterflies, their life cycle, migration, and why they are so important. This lesson was followed by a monarch tagging activity and monarch release. Each participant got to take home their own butterfly identifier code so that they can track the progress of their butterfly's journey. Additionally, students voluntarily organized events in 2019. The JMU "Bee-Friendly" Beekeepers, a student organization, hosted the following activities: April 19, 2019: Building Hives Workshop April 26-27, 2019: Painting Hives Workshop May 9, 2019: Installation of Package Bees on the East Campus Hillside Unfortunately, due to the pandemic, many events that were planned for 2020 were cancelled or postponed.





Participants engage in an exercise as part of A Book for the 'Burg workshop in September 2018, titled "The Importance of Pollinators and Participant Research to Help Them," led by Dr. Amy Goodall. Photo by JMU Creative Services.



Participants release butterflies as part of an EJC Arboretum program in May 2019. Photo by EJC Arboretum.



Members of the JMU Bee-Friendly club are shown participating in the Painting Hives Workshop in April 2019.

Courses & Continuing Education

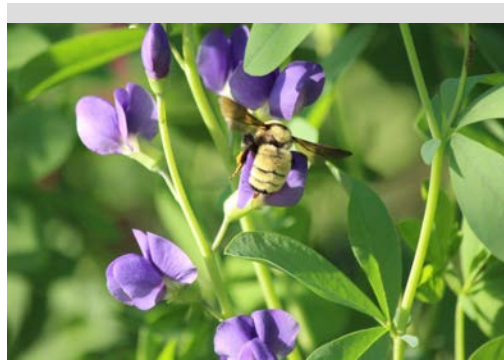
For-credit, JMU undergraduate courses *Course content may be different by instructor, so courses information is organized below by instructor. The information below includes the course name, number of students enrolled in the latest course offering, and pollinator topics covered in the course. This information was reported by faculty for 2020. Dr. Amy Goodall GEOG 210 Spring 2020 Physical Geography 24 Hillside plant identification, pollination presentation, and lab activity GEOG 340 Spring 2020 Biogeography 24 Bumble Bee life history and identification, Bumble Bee game, semester-long bird and bee surveys GEOG 210 Fall 2020 Physical Geography 22 Hillside plant identification, pollination as species interaction GEOG 210 Fall 2020 Physical Geography 24 Hillside plant identification, pollination as species interaction GEOG 440 Fall 2020 Global Biodiversity 11 semester- long project assessing butterflies on and off campus, bee identification and survey during class Dr. Wayne Teel ISAT/GS 429 Sustainability: An ? Class spends two meeting periods studying pollinators Ecological Perspective Dr. Mike Renfroe BIO 360 Environmental Ecology 16 Ecology and importance of pollinators, how to and Evolution construct bee houses for mason orchard bees. BIO 366 Plant Biology 36 Ecology and importance of pollinators, how to construct bee houses for mason orchard bees Dr. Heather Griscom BIO 402 Forest Ecology 21 Inventorying and categorizing urban trees in the city as a resource for pollinators (or not) Dr. Cindy Klevickis ISCI 173 Life and Environmental 24 Science for Teachers IDLS 395 Issues of the Chesapeake Bay 24 Approximately 48 students from the Roop Learning Community section of ISCI 173: Life and Environmental Science for Teachers and IDLS 395: Issues of the Chesapeake Bay, spent time working on the Monarch Waystation at the JMU Arboretum which was created more than 10 years ago by the Roop Learning Community, a group of students who live and take courses together. The classes also create checkout back-pack learning kits for families to use while they are at the EJC Arboretum. Several of the activities in the kits feature pollinators. Research and Scholarship Student work with pollinators has been included in multiple research events hosted by JMU: • The Graduate showcase 2020 included a poster by Biology Graduate Student, Sarah Brown. See <https://www.jmu.edu/grad/GraduateShowcase/2020/poster-presentations/sarah-brown.shtml> • At the 2019 Biosymposium, Zoe Bergman, Chris Coggin, and Katelyn Harless (advisor: Dr. Heather Griscom) presented,



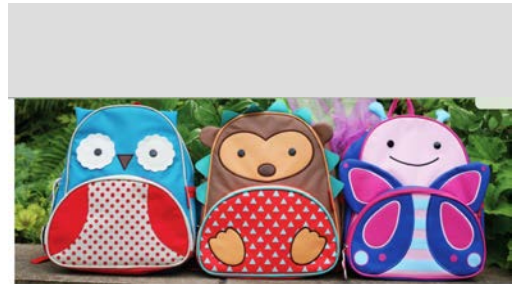
“Phenology, pollination, and seed dispersal syndromes in reforested dry tropical ecosystems.” And, Daniel Bradford, Densel Dagdagan, Keegan Lowman, Lexa Treml, Jennifer To, and Arcangelo Arecchi (advisor: Dr. Patrice Ludwig) presented, “Usage of drones for counting flowers necessary for pollination.” See pages 4 and 61 respectively at https://www.google.com/url?client=internal-element-cse&cx=016476667732860519677:h7le3e3by1g&q=https://www.jmu.edu/biology/_files/docs/Biosymposium_Program_040819.docx&sa=U&ved=2ahUKEwic7sLtiLDuAhXoGVkFHUXoCF84KBAWMAAd6BAgCEAI&usg=AOvVaw2Y39GeXfk7HqPzdE2-Tikd Continuing Education • Through the summers of 2018 and 2019 the Professional & Continuing Education’s Youth Programs hosted four Arboretum Explorer Camps for 64 participants from the ages of 5-10. The camps include various activities that involve pollinators, for example, a butterfly release. Two summer camps in summer 2020 were cancelled due to the pandemic. • Additionally, Professional & Continuing Education’s Youth Programs organized five Science Explorer camps for 150 participants in 1st-11th grades that involve pollinator activities including scavenger hunts.



Students prepared a pollinator garden near an entrance to the Bioscience Building. Photo by Dr. Mike Renfroe.



Representative of the purple and gold JMU colors, students and faculty have observed yellow bumblebees on blue wild indigo plants in the EJC Arboretum and in the City of Harrisonburg. Photo by Amy Goodall.



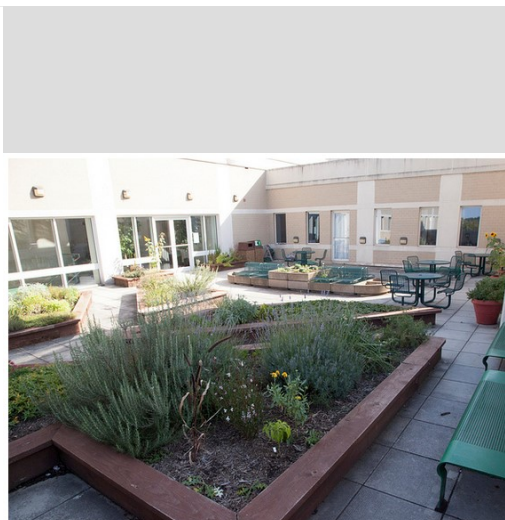
Pre-service teachers in Dr. Klevickis’ Life and Environmental Science Course prepared back-pack learning kits for families to use while they are at the EJC Arboretum. Several of the activities included feature pollinators. Photo provided by Dr. Klevickis

Service-Learning

- 23 students have worked at the rooftop garden between Spring 2018 and Fall 2019.
- One student is completing a capstone project mapping butterfly habitat for course credit, advised by Dr. Amy Goodall.
- Led by faculty member Dr. Amy Goodall with assistance from multiple students from a course, gardens have been created at local elementary and middle schools and pollinator lessons are a component of the effort.
- The three habitat creation projects previously discussed were completed by students as service-learning projects in courses, and thus the students working on these projects were already “counted” under the Curriculum & Continuing Education section of this report.
- Under the direction of Dr. Carole Nash, students weed, plant, and water the ISAT/CS Rooftop Garden. The student volunteers are recruited from a number of courses.
- One student is completing a capstone project mapping butterfly habitat on East Campus for course credit under advisor Dr. Amy Goodall.
- Since Fall 2013, JMU Geographic Students have surveyed and reported observations of



butterfly species at multiple habitat patches in Harrisonburg, VA including habitat patches in the E. J. Carrier Arboretum, JMU East Campus Hillside sites. • Dr. Goodall and her course students (including those doing capstone projects) have been building gardens at elementary and middle schools for the past several years. Among the lessons taught are plant life cycles and the benefits of pollinators like bees and butterflies. One of the capstone projects was, “Bee Friendly: Methods for Increasing Pollinator Awareness and Conservation” presented by Anna E. Hellwege-Bales, Molly Rooney, Francesca Marie Ross, Olivia Faye Massie, Christopher R. Quin, David A. Fish, Tristan Mariner, and Willem G. Lensi (advisor: Dr. Amy Goodall) at the School of Integrated Sciences Symposium 2019. See p. 71 at https://www.jmu.edu/sis/_files/sis-symposium-book-2019.pdf. The school garden work was also in the JMU news: <https://www.jmu.edu/news/2020/06/30-educational-gardening.shtml>. • Three service-learning, habitat development projects were part of courses previously listed. These efforts included creation of the East Campus Hillside Pollinator Garden Beds, Bioscience Pollinator Garden, and Orchard Mason Bee Homes. The ISAT/CS rooftop garden is maintained by students and faculty and led by Dr. Carole Nash.



The ISAT/CS rooftop garden is maintained by students and faculty and led by Dr. Carole Nash.



The Red-banded Hairstreak (*Calycopis cecropis*), photographed by JMU GEOG 440 student Danielle Petry on the East Campus Hillside, is a unique sighting. Butterfly surveying efforts began on the JMU campus in 2010 under the direction of Dr. Goodall.

BEE FRIENDLY: METHODS FOR INCREASING POLLINATOR AWARENESS AND CONSERVATION

Presenters
Anna E. Hellwege-Bales, Molly Rooney, Francesca Marie Ross, Olivia Faye Massie, Christopher R. Quin, David A. Fish, Tristan Mariner, Willem G. Lensi

Advisor
Amy Goodall

Sponsor
Harrisonburg City Public Schools

The team identifying plants and analyzing soil for a proposed habitat plan.

Pollinators are significantly tied to ecosystem function and resilience and are critically important for human food supply. Pollinators have been in steep decline globally and are in need of conservation. The goal of this project is to devise methods to increase public interests in observing, monitoring, and conserving pollinators. Our work includes planning and managing public school vegetable gardens and native flower habitats, creating learning tools about garden species, and interacting with campus and city entities for public outreach which includes our development of a web-based interactive map that depicts pollinator habitats. We also propose a citizen science that is designed to monitor pollinator species over time and will engage public school students in learning about pollinator diversity and data collection methods. Our presentation includes interactive hands-on activities.

71

Geographic Science

Dr. Amy Goodall and Geographic Science capstone students at JMU have supported pollinator awareness and conservation with the local public schools.

Educational Signage

A sign was installed at each of six entrances to campus to highlight JMU’s participation with the Bee Campus USA



program. An additional four signs were installed adjacent to pollinator areas on campus to highlight their importance. The signs were funded with a gift to the ISNW for environmental stewardship from Scott Electric.



Example of signage installed at the six primary entrances to campus denoting JMU's participation in the Bee Campus USA Program. Photo by Abe Kaufman.



A sign designates our pollinator conservation and education area at the perennial meadow on the East Campus Hillside. Photo by Abe Kaufman.

Policies & Practices

To make pest management practices more pollinator friendly, JMU has implemented an Integrated Pest Management (IPM) Plan that serves as a guideline for the following: (1) Outline the goals of pest management at JMU (2) Identify the responsible parties for pest management (3) Outline performance measurement, quality assurance and control strategies (4) Outline steps to identify pests at JMU (5) Outline the practices and strategies used to enforce pest control at JMU (6) Outline how pesticides are stored and applied on campus grounds (7) Outline preventive strategies for pest infestation. The JMU IPM plan applies to all 770 acres of the university campus grounds. This includes JMU designated habitat areas. The University aims to protect habitat areas on campus by using pesticide conservatively across campus and to minimize site management practices on habitat areas. The IPM promotes the use of a range of preventative and non-chemical approaches to control pest populations and stave off infestation. If an infestation with unacceptable impacts occurs, thereby warranting additional treatment, IPM favors the use of least-toxic pesticides. Chemicals and pesticides are used only in targeted locations and for targeted species. The targeted application of a toxic pesticide is allowed only after all other reasonable non-toxic options are exhausted. The type and quantity of all pesticides used on campus are tracked and the location of each use is also documented. To reduce pesticide use, mechanical practices are also employed. These include baiting, trapping, using pest monitors, and rodent stations. Another strategy to reduce pesticide use and protect habitat areas is through preventing pest infestation. Strategies include: cleaning trash regularly, clearing debris, and



provide adequate drainage. In addition, new plantings are selected in habitat areas based on appropriate climatology. The IPM policies are executed by trained technicians who receive certification every two years with a four-hour training.

Integrated Pest Management Plan: [ipm.pdf](#)

https://www.jmu.edu/facmgt/sustainability/Bee_Campus/jmu-pollination.shtml

Recommended Native Plant List: [habitat.pdf](#)

<https://svswcd.org/wp-content/uploads/2016/08/Native-Plants.pdf>

Recommended Native Plant Supplier List: [habitat.pdf](#)

https://www.jmu.edu/facmgt/sustainability/Bee_Campus/jmu-pollination.shtml



A riparian buffer along a restored stream channel where the use of pesticides are avoided. Photo by Dale Chestnut.

Learn More

<https://www.jmu.edu/beecampus>

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Abe Kaufman (shown far left, digging), chair of the JMU Bee Campus Advisory Committee works with students, faculty, and staff on the East Campus Hillside meadow.

