2018 Project Abstract
For the Period Ending June 30, 2022

PROJECT TITLE: Pollinator Ambassadors Program for Gardens
PROJECT MANAGER: Elaine Evans
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 05f as extended by M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 18

APPROPRIATION AMOUNT: $250,000
AMOUNT SPENT: $249,302
AMOUNT REMAINING: $698

Sound bite of Project Outcomes and Results

The Pollinator Ambassadors for Gardens program broadened pollinator education access across Minnesota, particularly to traditionally underserved audiences, through training 43 youth Pollinator Ambassadors and distributing 250 Pollinator Education Toolkits. Broader adoption of pollinator conservation action-steps will help Minnesotans conserve pollinator diversity, which will support food production, water quality, and healthy ecosystems.

Overall Project Outcome and Results

Minnesotans are aware of the importance of pollinators to healthy food systems and ecosystem health but lack prepared educators and education materials to provide action steps for pollinator conservation. The Pollinator Ambassadors Program for Gardens aimed to 1) provide direct training to youth to engage their communities in pollinator education and 2) create a Pollinator Education Toolkit with expert-designed materials that educators state-wide can use to teach pollinator conservation action steps. We have successfully trained 43 Pollinator Ambassadors between the ages of 14 and 18 through in-person and virtual workshops. Pollinator Ambassadors have directly engaged approximately 3,000 Minnesotans. We distributed 250 Pollinator Education Toolkits across Minnesota to 53 nature centers, 91 classroom educators, 33 Master Gardeners and Master Naturalists, 42 non-profits, 14 federal, state, or municipal agencies, and 17 University of Minnesota Extension programs. These Pollinator Education Toolkit holders estimate reaching 100,000 people annually. Many organizations receiving Pollinator Education Toolkits prioritize service to or primarily serve low-income audiences (40%), recent immigrants (15%), Latinx communities (15%), African American communities (13%), Asian American communities (9%), and Native American communities (9%). Toolkits are also available publicly through Inter Library Loan and check out at four University of Minnesota Extension and Outreach Centers across Minnesota. Over 400 educators across the world have accessed the Digital Pollinator Education Toolkit with an estimated annual reach of 180,000. The Pollinator Ambassadors Program for Gardens has increased capacity to reach a broad geographic range of audiences in Minnesota, with youth trained in Big Stone, Hennepin, Ramsey, Wright, and Olmsted counties and toolkits with educators in 60 of Minnesota's 87 counties, as well as increasing reach to traditionally underserved audiences. Broader adoption of pollinator action steps by Minnesotans will help conserve pollinator diversity, which in turn will support food production, water quality, and healthy ecosystems.

Project Results Use and Dissemination

We have several resources that should be shared broadly. A summary of the impact of the Pollinator Ambassadors for Gardens program is available on the Bee Lab YouTube channel. The University of Minnesota Bee Lab website has a page dedicated to the Pollinators Ambassadors program. Pollinator Education Toolkits are available for checkout out through Interlibrary Loan and at the University West Central, North Central, Southwest and Rosemount Research & Outreach Centers. Digital Pollinator Education Toolkit resources are available to everyone who fills out our application form. We have created a "Learn to Use Pollinator Education Toolkits" video playlist to provide extra background, and a "Pollinator Ambassadors" video playlist to complement activities from the Toolkits. The Habitat Assessment Guide for Yards and Gardens is available as a pdf document.

Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2018 ENRTF Work Plan Final Report (Main Document)

Today's Date: August 15, 2022

Final Report

Date of Work Plan Approval: 06/05/2018

Project Completion Date: June 30, 2022

PROJECT TITLE: Pollinator Ambassadors Program for Gardens

Project Manager: Elaine Evans

Organization: Regents of the University of Minnesota

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Location: Statewide

Total Project Budget: $250,000

Amount Spent: $249,302

Balance: $698

Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 05f as extended by M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 18

Appropriation Language: $250,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to increase knowledge of pollinators in gardens and yards and improve pollinator habitat by expanding outreach, training, and tools for Minnesota communities as part of the Pollinator Ambassadors program. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 18. ENVIRONMENT AND NATURAL RESOURCES TRUST FUND; EXTENSIONS. [to June 30, 2022]

I. PROJECT STATEMENT: The Pollinator Ambassadors for Gardens project will enhance outreach capacity for pollinator education by **training educators and youth who will then be engaged in native pollinator education and monitoring**. In addition, the project will provide pollinator education and habitat improvement tools to greater Minnesota with creation of a **pollinator education toolkit** including a pollinator habitat assessment guide for yards and gardens.

Why? Native pollinators are important for crop production and ecosystem health. Declines have led to increased awareness with 87% of Minnesotans concerned about pollinator decline (MEP poll, 2017). **Public education is in higher demand than can be met by pollinator educators** like the UMN Bee Squad, Bee Atlas, and Monarch Lab, and Pollinate Minnesota with more than 500 requests each year. Many pollinator gardens have been created to support pollinator conservation but there is little documentation of pollinator use or support for endangered or rare pollinators.

Goals and actions

Enhance native pollinator outreach capacity by:

1) training pollinator educators in native pollinator biology and conservation
2) engaging youth as pollinator educators to reach new audiences in underserved communities
3) providing a pollinator outreach kit to greater Minnesota nature centers, 4-H groups, and others.

Increase knowledge of pollinators by:

1) monitoring pollinators in gardens through youth engagement in citizen science
2) assess value of gardens to rare and endangered by enhancements with plants on which they depend

II. OVERALL PROJECT STATUS UPDATES:

First Update March 31, 2019

The Pollinator Ambassador team has made plans for launching our education program in the summer of 2019. We have created programming by adapting existing curriculum to engage youth as pollinator educators and train them in presentation and leadership skills. We have identified youth groups serving underserved communities with which to work in the summer of 2019 and gardens and natural areas in which to conduct monitoring activities. Content and design work for the pollinator outreach kit has begun.

Second Update September 30, 2019

The Pollinator Ambassador program has successfully trained 32 youth Pollinator Ambassadors between the ages of 14 and 18. After a two day training with all students together, students met with instructors weekly from June 25 to August 13 to monitor monarchs and bees, build pollinator knowledge, and develop leadership and presentation skills. They have presented to the public at four events to date, reaching approximately 2,500 people. Content and design work for the pollinator ambassador outreach toolkits continues. The Urban Habitat Assessment Guide is in a final round of edits. Distribution of toolkits including the Habitat Assessment Guides will begin in mid-November.

Amendment Request as of September 30, 2019

We are requesting an extension of the project end date to June 30, 2021. This will allow for an additional year of programming for the Pollinator Ambassador team to work with an additional ~20 youth from the Mississippi River Green Team to train them to be youth Pollinator Ambassadors. We have funding available to cover this program primarily because we had budgeted to cover salaries for all youth participants, but the Mississippi River Green Team was able to cover salaries for their Green Team members (estimated cost savings of $44,000 from "Pollinator Ambassador" salary when 2020 is also included). In addition, the youth salaries that we covered for

other programs were set by their programs at a lower rate than what we had budgeted for, allowing a savings of an additional $6,720 from “Pollinator Ambassador” salary. We would like to continue with the program to train youth, providing an opportunity for returning youth to strengthen their skills and become mentors to first year Pollinator Ambassadors. We would work at a smaller scale and primarily with youth from the Mississippi River Green Team so we can best utilize our funding to support the program.

We would like to move $50,720 in from Pollinator Ambassador youth salary to salary to support Pollinator Ambassador staff to provide an additional year of programming to Pollinator Ambassador youth. We are requesting to shift $16,891 to Elaine Evans, Program Manager, to cover additional time to oversee and provide expert content advice to the UMN Pollinator Ambassadors Program as well as providing training to youth during the Pollinator Ambassadors program. There is an increased percentage of FTE to cover classroom time as a visiting expert during instruction. We are requesting to shift $6,701 to Bridget Mendel, Project Lead, to cover additional time to manage the Pollinator Ambassadors Program. We are requesting to shift $9,528 to Brooke Sommerfeldt, Program Coordinator, to cover additional time to coordinate the Pollinator Ambassadors Program as well as an increase in percent FTE from 20% to 25% to cover time as a visiting expert during instruction. We have added a new line for a Pollinator Ambassador Instructor, at 20% FTE for 1 year to provide instruction and training to Pollinator Ambassador youth during the summer of 2020. This would be covered by a shift of $17,600.

We would like to support Pollinator Experts to provide expert content to Pollinator Ambassadors youth during trainings by shifting $8,500 from the “Regional Coordinator” to contracted Pollinator experts. We were able to cover regional coordination with staff time from the Pollinator Ambassador Project Lead and the Program Coordinator.

In addition to training more youth and providing more in depth training for returning youth, we would like to enhance the Pollinator Ambassador Outreach Toolkit by providing more activities and increasing the durability of the materials. We would like to move $2,000 from “Travel expenses in MN”and $1,500 from “Regional Coordinator” to “Printing” to use for production costs for the Pollinator Ambassadors toolkits. We were able to arrange monitoring sites close to the areas we used for training and so did not need to use travel funds we had allocated for transporting Pollinator Ambassadors to monitoring sites. We also did not need many monitoring supplies. We would also like to move $1600 from “Classroom Assistants” and $1700 from “Materials for Citizen Science Monitoring” to Materials for Pollinator Outreach Toolkits (totaling $3,100). With this funding we will be able to include additional materials and activities, such as a Monarch Migration Game. We would like to use these funds to enhance the educational potential of the Pollinator Ambassador Toolkits by increasing funding for the 200 kits from ~$30 per kit to ~$50 per kit.

“Amendment Approved by LCCMR **10/31/2019**.”

Third Update March 31, 2020

We have made plans to train an additional 18 youth in the summer of 2020. Half of these would be returning from our 2019 cohort of Pollinator Ambassadors, providing the opportunity to engage the youth in more advanced training and work on leadership skills as they share their knowledge from 2019. Due to uncertainty around the covid-19 pandemic, these plans are currently on hold. The youth organization we are partnering with (the Mississippi River Green Team) does not have an option to continue programming on-line if in-person programming is not available. The program would start in mid-June so we are currently waiting until late May to determine if we can work directly with the youth this summer. We will work with program organizers to see if remote learning options can be made available if in-person in not an option.

The Habitat Assessment Guide for Yards, Gardens, and Parks is complete. This guide provides detailed information for people to assess their gardens and improve pollinator habitat. Most pieces of the Pollinator Ambassador Outreach toolkits have been designed and produced. A set of thirty-eight partial toolkits have been

distributed. The remaining pieces are in the final stages of design and production. We have begun to promote the kits and solicit applications. We have made plans to have a kit available at each of the ten UMN Extension Research and Outreach Centers throughout Minnesota as well as several kits available to the general public through the interlibrary loan system. The remaining one hundred and fifty kits will be distributed to selected educator applicants. Distribution is currently on hold until activities can resume at the UMN Bee Lab.

Fourth Update September 30, 2020

The time period from March to September of 2020 brought many challenges. Our plans for in-person trainings with youth and for distribution of toolkits to use for education events, camps, and in-person activities changed due to Covid19. We had to pivot to work on providing resources that educators could use to provide pollinator content using remote platforms. We were able to adapt pieces of the physical toolkits into digital materials that educators could use for remote teaching. In addition to producing pdfs of posters, we created interactive slide shows to create more opportunities for active engagement. To promote the use of these materials, we produced training videos focused on background information and presentation tips to enable educators to get the most out of the digital Pollinator Ambassadors Outreach Toolkits.
training.

AMENDMENT REQUEST March 23, 2021

We are requesting funds be shifted from the personnel wages line to professional contracts.

- Personnel wages would be reduced by $31,974 to a revised budget of $166,830
- Professional services would be increased by $31,974 to a revised budget of $59,394

These changes are being requested due to shifts in operations due to the COVID-19 pandemic and administrative changes. Due to hiring restrictions at the UMN, transferring funds to a professional contract would enable us to work with youth organizations to engage students as Pollinator Ambassadors. In addition, some administrative changes have occurred. One of our instructors left the U of MN but remained with the program as a contractor. In working with different youth organizations to hire pollinator ambassador youth, some organizations preferred contracting to direct hiring of youth.

We are also requesting funds be shifted from travel to printing, supplies, and other.

- Travel would be reduced by $4,191 to a revised budget of $2,722
- Printing would be increased by $2,691 to revised budget of $13,391
- Supplies would be increased by $500 to revised budget of $4,453
- Other would be increased by $1000 to revised budget of $3,210

Our original plan included production of 200 Pollinator Education Toolkits. We have received more than 200 requests for Pollinator Education Toolkits and would like to supply these Toolkits by reallocating some of our funds. We are not able to travel and request to move $4,191 from travel to provide postage ($1,000), supplies ($500), and printing ($2691) to produce an additional 50 Pollinator Education Toolkits to provide to educators across MN.

Fifth Update March 31, 2021

We completed design of Pollinator Education Toolkits as well as adaptation to digital formats to enable educators to use for remote teaching. In addition to producing pdfs of posters, we created interactive slide shows to create more opportunities for active engagement. To promote the use of the toolkits, we presented webinars on their use and presentation tips to the Minnesota Master Naturalists, the Minnesota Department of Education, and the Schoolyard Gardens Conference. Pending approval of a no-cost extension of our funding to June of 2022 and an amendment request, we have also created plans for engaging youth remotely in 2021, continuing our efforts to engage youth as pollinator educators.

Project extended to June 30, 2022 by LCCMR 7/1/21 as a result of M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 18, legislative extension criteria being met.

Sixth Update September 30, 2021:

In the summer of 2021, we engaged an additional 11 youth in our Pollinator Ambassador training, bringing our total youth engagement to 43 youth. We engaged youth from Ramsey, Olmstead, and Big Stone counties using a weekly virtual meeting format. These trained youth then engaged the public through presentations.

We distributed additional Pollinator Education toolkits to educators throughout MN and distributed toolkits to Extension Research and Outreach Centers and interlibrary loan that can be borrowed by anyone in Minnesota. In total, 200 kits have been distributed and an additional 50 kits are set to be distributed this fall. To date, presentations with the toolkits have reached approximately 1,600 people. We promoted the use of the kits through presentations, videos, and social media. The digital toolkit materials have been accessed by 289 organizations. Presentations with the digital toolkits have reached approximately 900 people. Several of the digital toolkit pieces are available in Spanish.

Seventh Update March 31, 2022:

Our direct work with Pollinator Ambassador youth for this grant has ended, but we continue to work with youth to train them as pollinator educators. We have adapted the model we developed in this program to use for future education programs in the UMN Bee Lab. We will continue to work to enhance pollinator outreach capacity by engaging people from various communities and providing training in pollinator conservation issues and action steps. We are enhancing the usability and reach of our Pollinator Education toolkits with the production of videos to accompany the lessons of toolkit items. Videos will provide instructions for the Monarch Mishaps and Pollinator Buffet games, an overview of pollinator status with the "How are pollinators doing?" video, and a video on how to become a Pollinator Ambassador that will highlight pollinator actions of people advocating for pollinator conservation in their communities. We continue to promote the toolkits to local, regional, and national audiences.

Final Update June 30, 2022

Minnesotans are aware of the importance of pollinators to healthy food systems and ecosystem health but lack prepared educators and education materials to provide action steps for pollinator conservation. The Pollinator Ambassadors Program for Gardens aimed to 1. provide direct training to youth to engage their communities in pollinator education and 2. create a Pollinator Education Toolkit with expert-designed materials that educators state-wide can use to teach pollinator conservation action steps. We have successfully trained 43 Pollinator Ambassadors between the ages of 14 and 18 through in-person and virtual workshops. Pollinator Ambassadors have directly engaged approximately 3,000 Minnesotans. We distributed 250 Pollinator Education Toolkits across Minnesota to 53 nature centers, 91 classroom educators, 33 Master Gardeners and Master Naturalists, 42 non-profits, 14 federal, state, or municipal agencies, and 17 University of Minnesota Extension programs. These Pollinator Education Toolkit holders estimate reaching 100,000 people annually. Many organizations receiving Pollinator Education Toolkits prioritize service to or primarily serve low-income audiences (40%), recent immigrants (15%), Latinx communities (15%), African American communities (13%), Asian American communities (9%), and Native American communities (9%). Toolkits are also available publicly through Inter Library Loan and check out at four University of Minnesota Extension and Outreach Centers across Minnesota. Over 400 educators across the world have accessed the Digital Pollinator Education Toolkit with an estimated annual reach of 180,000. The Pollinator Ambassadors Program for Gardens has increased capacity to reach a broad geographic range of audiences in Minnesota, with youth trained in Big Stone, Hennepin, Ramsey, Wright, and Olmsted counties and toolkits with educators in 60 of Minnesota's 87 counties, as well as increasing reach to traditionally underserved audiences. Broader adoption of pollinator action steps by Minnesotans will help conserve pollinator diversity, which in turn will support food production, water quality, and healthy ecosystems.

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Train Pollinator Ambassador Instructors and youth to engage in education and pollinator monitoring

ENRTF BUDGET: $221,128

Description: Instructors and other pollinator educators will be trained by experts in native pollinator biology. They will in turn train groups of youth (ages 15-17) in 3 urban centers in pollinator education using Driven to Discover Citizen Science curriculum (Pollinators and Monarchs). Groups will be based in Minneapolis, Saint Paul, and Rochester due to existing connections between youth groups and Extension Educators in these locations. This project expands on a program begun in 2016 by the UMN Bee Squad, training underserved youth in honey bee education. Pollinator Ambassador youth will fulfill requests for public presentations. We will track the number of people attending presentations by Pollinator Ambassador youth educators. Pollinator Ambassador youth will apply classroom instruction in pollinator biology in the field and gain experience in field biology techniques while gathering information on pollinator use of urban pollinator gardens and effects of resource enhancement for rare and endangered bees and butterflies. Data will be analyzed to determine support of pollinators by urban gardens and shared with ongoing databases of Minnesota pollinators.

Outcome	Completion Date
1. Experts in native pollinator biology and conservation will train Pollinator Ambassador instructors as well as other pollinator educators lacking native pollinator expertise, such as educators at the UMN Landscape Arboretum's Pollinator Discovery Center and the Bell Museum and Planetarium.	6/30/2019
2. Pollinator Ambassador instructors will train ~45 youth (~10 in each of 3 urban centers in 2019 and an additional 15-20 youth throughout MN in2021) to prepare them for public native pollinator education	1/01/2022
3. Pollinator Ambassador youth will fulfill requests for public presentations at schools, festivals, parks, and other public events reaching ~5,000 people.	6/30/2022
4. Pollinator Ambassador youth will survey gardens using standard bee survey protocols and protocols from the Monarch Larva Monitoring Project and monitor for rare and endangered bees and butterflies through additions of flowers on which specialists depend. Results will be summarized in a report on garden use by pollinators which will contribute to ongoing databases of pollinators.	6/30/2021

First Update March 31, 2019

Pollinator Ambassadors instructors have attended monthly meeting for organization of plans for the summer program as well as training in native pollinator biology. We have contacted youth groups in Minneapolis, St Paul, and Rochester to identify youth to engage in the program. Pollinator Ambassador Instructors will begin working with youth in June and a two day workshop, followed by weekly meetings.

Second Update September 30, 2019

The Pollinator Ambassador program has successfully trained 32 youth Pollinator Ambassadors between the ages of 14 and 18. Sixteen students were from the Mississippi River Green Team program in Minneapolis. Eleven students were from Rosa Parks Charter School in Rochester. Five students were from the Right Track program in St Paul. After a two day training with all students together, students met with instructors weekly from June 25 to August 13 to monitor monarchs and bees, build pollinator knowledge, and develop leadership and presentation skills. The Pollinator Ambassadors have presented to the public at four events to date: two

public festivals, a public talk on the UMN Dirt Stage at the MN State Fair, and an educational activity with a visiting 4H group. They have reached approximately 2,500 people.

The Pollinator Ambassadors were also trained as citizen scientists collecting data for two ongoing projects, the Monarch Larva Monitoring Project (MLMP) and the Great Sunflower Project. All data collected have the Pollinator Ambassadors have been shared with these national projects, as well as with the local sites of collection. These data can be used to inform management decisions and guide decisions regarding pollinator conservation.

Two MLMP sites were monitored. One site was located at the City of Falcon Heights Community Park, a MLMP site for over 20 years. The second site was located at Quarry Hills Nature Center in Rochester MN. Youth collected data on immature monarch stages found on common milkweed plants. The data collected at both sites were very typical of monarch phenology, with peak egg laying in June, decreasing into July, and then increasing again mid-July into early August, and dropping down again. These peaks represent the 2-3 generations of monarchs we expect to see in Minnesota each summer. The stages of monarchs observed were also very typical, generally seeing more eggs and 1st instar stages than any of the others. We expect to see more eggs or early instars in one week than we do later instars the following week as most get preyed on.

Two sites were monitored for collection of data for The Great Sunflower Project: the pollinator gardens at the University of Minnesota Bee Lab in Saint Paul MN and Quarry Hills Nature Center in Rochester MN. At the U of MN Bee Lab gardens, Pollinator Ambassadors recorded 2,145 insect visitors to twenty-five different species of flowers. *Monarda fistulosa, Agastache foeniculum,* and *Eutrochium maculatum* had the most insect visitors. *Monarda fistulosa, Heliopsis helianthoides,* and *Coreopsis palmata* had the most different types of insect visitors. At Quarry Hills Nature Center, a total of 451 insect visitors were recorded on seventeen different species of flowers. *Heliopsis helianthoides, Agastache foeniculum,* and *Monarda fistulosa* had the most insect visitors. *Heliopsis helianthoides, Pycathemum virginianum,* and *Monarda fistulosa* had the most different types of insect visitors. Despite being within the range of recent sightings, the endangered rusty-patched bumble bee was not seen at either site. We also did not see any *Macropis* oil collecting bees despite observations at their host plant, *Lysimachia cilliata.* One rare bee sighting did occur. *Xylocopa virginica*, a bee rarely seen in Minnesota, was recorded during observations at the University of Minnesota Bee Lab gardens.

Third Update March 31, 2020

We have made plans to train an additional eighteen youth from the Mississippi River Green Team (Green Team) in the summer of 2020. Half of these youth would be returning from our 2019 cohort of Pollinator Ambassadors. One common comment from participants in 2019 was that they wanted to be exposed to more information. We have adapted our 2019 program to include opportunities for returning youth to have more direct contact with content experts to expand their knowledge. In collaboration with the Green Team program, we have made plans to connect with components of their other programming to work on leadership skills and community connections. Due to uncertainty around the covid-19 pandemic, these plans are currently on hold. The Green Team does not have an option to continue programming on-line if in-person programming is not available. The program would start in mid-June so we are currently waiting to determine if we can work directly with the youth this summer. The Green Team already has a Pollinator Outreach Toolkit so at a minimum we are hoping to find an opportunity to provide background and training so those kits can be used by the Green Team at outreach events.

Fourth Update September 30, 2020

Our goal to train an additional 18 youth for Outcome 2 of Activity 1 in the summer of 2020 was not met. In-person activities were not allowed and attempts to coordinate online learning opportunities with the youth in the Mississippi River Green Team program failed due to lack of access to technology for the youth. We have currently trained 32 youth in our Pollinator Ambassador Program, nearly reaching our goal of ~45 youth. Uncertainties about access of youth to technology continues, but we will continue to try to find a way to provide effective training remotely to reach our goal of training ~45 youth. Through connections with public and community schools, we plan to provide pollinator educator training to an additional 15 youth from across MN.

We were also unable to engage youth as pollinator educators at public outreach events this summer for Outcome 3 of Activity 1. By working with youth at schools this fall and winter, we hope to create opportunities for youth Pollinator Ambassadors to use their voices as pollinator educators and advocates. For Outcome 4 of Activity 1, we have created video training and online resources to encourage pollinator counts in the classroom. While we are not collecting those data, we are encouraging that those data be shared with the Great Sunflower Project, an on-going national pollinator monitoring effort.

Fifth Update March 31, 2021

While we were unable to work with youth in 2020, we did supply resources and training to four youth training as pollinator educators with a related 4H program. For 2021, we have reformed plans to engage youth as Pollinator Ambassadors remotely, pending approval of a budget request and a no-cost extension. We have spoken with several youth groups about the possibility of connecting. While there are limitations to remote engagement, we are excited to reach students across MN.

Sixth Update September 30, 2021:

The Pollinator Ambassador program has successfully trained 43 youth Pollinator Ambassadors between the ages of 14 and 18 meeting our goal of ~45 youth. In 2021 we worked with 11 students. Three students were from Rosa Parks Charter School in Rochester. Five students were from the Urban Roots program in St Paul. One student was from Como High School in St Paul. One student was from Big Stone 4-H. One student was from Monticello High School. Students met with instructors weekly from June 25 to August 13 to build pollinator knowledge and develop leadership and presentation skills. The Pollinator Ambassadors have presented to the public at two events to date, a public talk on the UMN Dirt Stage at the MN State Fair and Conservation Days at Bonanza State Park . They have reached approximately 280 people. Building on the 1,500 that were engaged in 2019, the total in-person audience reached by our Pollinator Ambassador youth is approximately 2,780. Our summer of 2021 youth Ambassadors are continuing their outreach efforts, but we expect that we will fall short of our goal for the youth Pollinator Ambassadors to reach 5,000 people, due to the continuing limitations on in-person activities.

Seventh Update as of March 31, 2022:

Pollinator Ambassador youth will be included in a Bee Lab video that will highlight the reach and impact of pollinator education. This video is currently in production. We expect to have this video available in June of 2022. This video will help our Pollinator Ambassadors to reach audiences despite continuing limitations on public events due to the Covid-19 pandemic.

Final Update June 30, 2022

Through in-person and virtual workshops, we trained 43 youth between the ages of 14 and 18 from Ramsey, Hennepin, Big Stone, Wright, and Olmsted counties in pollinator biology and education. These youth presented pollinator conservation action steps to approximately 3,000 Minnesotans through presentations at the Monarch Festival in Minneapolis, the Pollinator Festival in Saint Paul, the Pollinator Party in Minneapolis, the Ecology Fair at the University of Minnesota, the Dirt Stage at the Minnesota State Fair, Conservation Days at Bonanza State Park in Big Stone County., and to their classmates.

Pollinator Ambassadors monitored gardens for pollinators in 2019 and completed pollinator surveys and monarch larva monitoring at two sites. These data were shared with ongoing projects the Great Sunflower Project and the Monarch Larva Monitoring Project. We were unable to continue training and data gathering in subsequent years due to the lack of in-person training due to the COVID-19 pandemic. Pollinator Ambassadors were trained to use the biodiversity portal iNaturalist to share data on pollinators.

ACTIVITY 2: Provide tools for distance pollinator education

ENRTF BUDGET: $28,872

Description: A pollinator habitat assessment guide focused on home, school, and community gardens will be created and made available to the public, including schools, to enhance effectiveness of gardens as pollinator habitat. The habitat assessment guide and pollinator outreach toolkit will increase the ability of Minnesotans to provide high quality to pollinators by assessing their gardens and following suggestions for improvements. A pollinator outreach toolkit including table-top poster displays, an interactive quiz, and materials for citizen science projects will be developed for use by and distributed to organizations such as 4H groups, nature centers, and schools unable to bring in pollinator experts to present information. The pollinator outreach toolkit will enable organizations located a long distance from locations with pollinator experts to provide the public with high quality, engaging, pollinator education.

Outcome	Completion Date
1. Garden pollinator habitat assessment guide, based on the successful model developed by the Xerces Society for farms and natural areas, will be developed by the Xerces Society in cooperation with the UMN Bee Lab.	6/30/2019
2. Create and promote pollinator outreach kit, as described above. Distribute ~250 kits to groups in greater Minnesota reaching ~10,000 people.	6/30/2022

First Update March 31, 2019

The Xerces Society has been engaged to produce a pollinator habitat assessment guide for gardens. We estimate that content and design will be completed by early June 2019. Content for the pollinator outreach toolkit is being designed with expert input from Pollinator Ambassador team members and consultation with nature centers and others who will be using the toolkits for outreach and education. It is estimated that kits will produced by June 2019.

Second Update September 30, 2019

Design and content for the Urban Habitat Assessment Guide is nearly complete with a deadline of November 1. Content and design work for the pollinator ambassador outreach toolkits continues with most pieces also set for a November 1 deadline. Distribution of toolkits including the Habitat Assessment Guides will begin in mid-November.

Third Update March 31, 2020

The Habitat Assessment Guide for Yards, Gardens, and Parks is complete. The Xerces Society produced this document with input from Dr. Evans from the UMN Bee Lab. The guide is included in the Pollinator Ambassador toolkits. It is also available to the public at the Xerces society website. The Xerces Society will promote the guide during Earth Week as part of an effort to improve habitat in managed areas. The guide provides detailed information on how to improve pollinator habitat. The target audience is home owners, community gardeners, and park managers. Here is a link to the guide: https://www.xerces.org/publications/habitat-assessment-guides/habitat-assessment-guide-for-pollinators-in-yards-gardens

Most pieces of the Pollinator Ambassador Outreach toolkits are designed and produced. In November, the first set of these partial kits were distributed to thirty-eight organizations. We distributed most kits at the Minnesota Naturalists Association annual meeting in conjunction with a training session. Kit recipients include nature centers, city, county, and state parks, the Minnesota Zoo, and BWSR. The remaining pieces of the toolkit are in the final stages of design and production. We have begun to promote the kits and solicit applications. We are prioritizing distribution to organizations working with underserved communities as well as those working in underserved areas of the state. We have made plans to have a set of kits available for check out to Master Gardeners, Master Naturalists, 4-H groups, and others at the ten UMN Extension Research and Outreach Centers throughout Minnesota. In addition, we have designed the kits to be compatible with the interlibrary

loan system so they will be available for check out to the general public. While the kits can function as stand-alone education pieces without additional background, we want to provide opportunities for educators to add value to the kits by offering in person workshops as well as videos for people unable to attend workshops.

Fourth Update September 30, 2020

Currently, 38 organizations have received a partial set of the Pollinator Education Toolkit. We have an additional 175 applicants. The production and distribution of the physical pieces of Pollinator Outreach Education toolkits was delayed until early 2021 to provide more opportunity to adapt content to a digital format for use in the summer of 2020, when most educational activities were limited to remote learning formats. A minimum of 200 complete kits will be distributed in early 2021. Applicants will be prioritized to receive kits according to the geographic area they cover and the audiences they serve, with underserved audiences prioritized. Several kits will be held back from distribution to be made available through interlibrary loan services and to make them available at the UMN Research Outreach Centers located throughout MN. The digital toolkits have been downloaded by twenty users including several county Master Gardener groups, community schools, 4-H groups, and others. These groups serve Dakota, Blue Earth, Sibley, Brown, Faribault, Hennepin, and Le Sueur counties. While the physical kits are limited to educators working with audiences in Minnesota, the digital kits are available globally. Digital toolkits are being used in California, Michigan, West Virginia, Oregon, New Jersey, Kentucky, Wisconsin, and Mexico.

Fifth Update March 31, 2021

200 Pollinator Education Toolkits have been produced. Toolkits have been distributed to 187 organizations and individuals. Distribution of the remaining kits through interlibrary loan and UMN Research and Outreach Centers is currently being arranged. We were able to adapt pieces of the physical toolkits into digital materials that educators could use for remote teaching. In addition to producing pdfs of posters, we created interactive slideshows to create more opportunities for active engagement. To promote the use of these materials, we produced training videos focused on background information and presentation tips to enable educators to get the most out of the digital Pollinator Ambassadors Outreach Toolkits.

The digital toolkit has been accessed by 89 organizations and individuals including county Master Gardener groups, community schools, 4-H groups, high schools, elementary Schools, Botanic Gardens. These groups serve Carver, Chippewa, Cottonwood, Crow Wing, Dakota, Ramsey, Hennepin, Ottertail, Kanabec, Chisago, Marshall, Polk, Mahnomen, McLeod, Nicollet, Olmstead, Washington, St Louis, Steele, Winona, Wabasha, Houston, Blue Earth, Sibley, Brown, Faribault, and Le Sueur counties. While the physical kits are limited to educators working with audiences in Minnesota, the digital kits are available globally. Outside of Minnesota, digital toolkits are being used in Illinois, California, Michigan, West Virginia, Oregon, New Jersey, Kentucky, Wisconsin, Canada, Mexico, and Peru.

Sixth Update September 30, 2021

Figure 1 Locations of organizations that have received physical Pollinator Ambassador toolkits

We have distributed UMN Pollinator Ambassador Toolkits been to 226 educators and into publicly accessible portals (interlibrary loan and UMN Research and Outreach Centers) throughout Minnesota. The last 24 toolkits will be sent this fall. Current organizations that have received toolkits are located throughout Minnesota (Figure 1) and have reached approximately 1,600 people to date. The digital UMN Pollinator Toolkit materials have been accessed by 289 educators reaching approximately 900 people across most of North America and parts of South America (Figure 2).

We are currently surveying recipients to learn more about how the kits were used. Several organizations have planted pollinator gardens and had students engage more with pollinators in their outdoor

learning classrooms. Most organizations receiving the toolkits primarily serve, prioritize service to, or identify as low income, recent immigrant, Latinx, African American, Asian American, Native American, recent immigrant, and refugee communities. Several of the digital toolkit pieces are available in Spanish. We are currently gathering information from toolkit users on other languages that would benefit the communities they serve.

As a final step to reach more people and provide tools for educators to teach about pollinator conservation, we will make a series of videos to accompany the UMN Pollinator Education toolkits. These short videos can be used in classrooms or shared by organizations via social media. The videos will be available through the UMN Bee Lab Youtube channel.

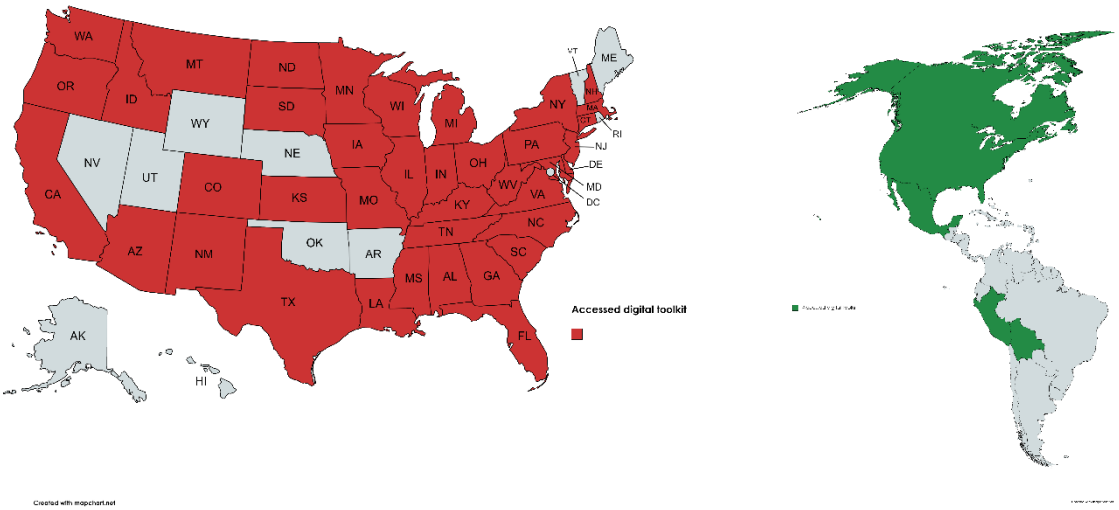


Figure 2 Distribution of digital toolkits across the US, and North and South America. Red indicates states with organizations that have accessed digital UMN Pollinator Education Toolkits. Green indicates countries that have accessed digital UMN Pollinator Education Toolkits,

Seventh Update as of March 31, 2022

We have increased the distribution of the digital toolkits with an additional 53 digital toolkits. We are increasing the impact of the toolkits by producing videos that can be shown in classrooms and distributed through social media to enhance pollinator awareness and action steps. We are preparing an evaluation for toolkit users to assess the use of the toolkits in educational events and the impact on action steps. We will report these data in our final report.

Final Update June 30, 2022

The Xerces Society for Invertebrate Conservation in consultation with Dr. Elaine Evans from the University of Minnesota Bee Lab produced a Habitat Assessment Guide for Yards, Gardens, and Parks, providing detailed information on how to improve pollinator habitat. The target audience is home owners, community gardeners, and park managers. Here is a link to the guide: https://www.xerces.org/publications/habitat-assessment-guides/habitat-assessment-guide-for-pollinators-in-yards-gardens

We distributed 250 Pollinator Education Toolkits across Minnesota to 53 nature centers, 91 classroom educators, 33 Master Gardeners and Master Naturalists, 42 non-profits, 14 federal, state, or municipal agencies, and 17 University of Minnesota Extension programs. These Pollinator Education Toolkit holders estimate reaching 100,000 people annually. Many organizations receiving Pollinator Education Toolkits prioritize service to or primarily serve low-income audiences (40%), recent immigrants (15%), Latinx communities (15%), African American communities (13%), Asian American communities (9%), and Native American communities (9%). Toolkits are also available publicly through Inter Library Loan and check out at four University of Minnesota Extension and Outreach Centers across Minnesota. Over 400 educators across the world have accessed the Digital Pollinator Education Toolkit with an estimated annual reach of 180,000. The Digital Pollinator Education Toolkit enables us to update and continue to add to this resource with suggestions from users from annual

surveys. We currently have several of the Toolkit resources available in Spanish and hope to add translations into Hmong and Somali.

IV. DISSEMINATION:

Description: After receiving pollinator education training, Pollinator Ambassador youth will present pollinator education activities to organizations such as schools, nature centers, 4-H groups, as well as large public outreach events such as the Pollinator Party and Monarch Festival. Data collected by Pollinator Ambassador youth on use of pollinator gardens by pollinators will be shared with the Minnesota Bee Atlas database as well as incorporated into presentations by Pollinator Ambassadors, and cooperating organizations such as the U of MN Bee Squad and Monarch Lab, and Pollinate Minnesota. In addition, Pollinator Ambassadors instructors will receive broad training in native pollinator biology and conservation which will be incorporated into the educational programing of their host organizations. Pollinator Outreach Kits will be distributed to educational organizations throughout Minnesota. Priority will be given to groups that do not otherwise have access to pollinator outreach resources. Information about the kits, and ordering instructions, will be available at the website for the U of MN Bee Squad, www.beelab.umn.edu/bee-squad

First Update March 31, 2019

We have created a calendar of events for Pollinator Ambassador youth to present pollinator education after their training, during the late summer and fall of 2019.

Second Update September 30, 2019

The Pollinator Ambassadors have presented to the public at four events to date: two public festivals, a public talk on the UMN Dirt Stage at the MN State Fair, and an educational activity with a visiting 4H group. They have reached approximately 2,500 people. Presentations at several workshops are planned for the fall and early winter of 2019-2020. Pollinator Ambassadors staff from the UMN Bee Squad, UMN Extension, Pollinate MN, and the Monarch Joint Venture have received broad training in pollinator education that they are incorporating into programming at with their host organizations. For example, Pollinate Minnesota, a non-profit pollinator education organization that has focused primarily on honey bees, now includes more information and tools for the public regarding native bee biology, identification, and conservation.

Third Update March 31, 2020

In November, Katie-Lyn Bunney from Monarch Joint Venture and Elaine Evans from the UMN Bee Lab taught a workshop to twenty-six attendees of the Minnesota Naturalists Association annual conference with detailed instructions and background to use the Pollinator Outreach Toolkits in their environmental education programs. The Pollinator Ambassadors youth presented three sessions on pollinators at the 2020 Ecology Fair on the St Paul Campus of the UMN, reaching fifty people. Unfortunately, plans to present another workshop on use of the Pollinator Outreach Toolkit at the 2020 Gathering Partners: A Conference for Friends of Minnesota's Natural Resources Conference were delayed until 2021 due to the covid-19 pandemic.

Fourth Update September 30, 2020

While in-person events were not an option, we did share information about Pollinator Ambassador toolkits via digital presentations. For national pollinator week, on June 22, we presented information on how to become a pollinator ambassador to forty youth participating in the MN 4-H Pollinator Training program. On September 17, we presented information on how to use the toolkits, both physical and digital, to over 60 attendees at the Pollinator Summit hosted by the UMN Landscape Arboretum.

Fifth Update March 31, 2021

Pollinator Ambassador youth presented in Ramsey and Big Stone counties to 500 students and 40 adults.

Katie-Lyn Bunney from Monarch Joint Venture and Elaine Evans from the UMN Bee Lab taught two workshops about the toolkits and how to use them to over 90 attendees at presentations for the Minnesota Department of Education and the Minnesota Schoolyard Garden Conference. Brooke Sommerfeldt created a short video slideshow explaining the program which is being advertised on the UMN College Readiness Consortium website used by parents and youth leaders to find youth programming. The toolkits have also been promoted at general pollinator talks presented by the UMN Bee Lab to over 600 attendees

Sixth Update September 30, 2021:

Elaine Evans presented information on the toolkits at the GreenSteps Cities Workshop to 22 attendees that are planning pollinator education in their organizations across Minnesota. Elaine Evans has also presented to MN 4-H on using the toolkits, as well as promoting the toolkits during other general pollinator talks to over 200 attendees. The Pollinator Education Toolkit playlist on the UMN Bee Lab youtube channel has had several hundred views.

Seventh Update as of March 31, 2022:

Our 2022 Pollinator Ambassador youth gave presentations about pollinators in their communities at 5 events that reached 50 adults and 230 youth in Big Stone and Ramsey counties.

Final Update June 30, 2022

The University of Minnesota Bee Lab website has a page dedicated to the Pollinators Ambassadors program. We have created a "Learn to Use Pollinator Education Toolkits" video playlist to provide extra background, and a "Pollinator Ambassadors" video playlist to complement activities from the Toolkits. The Habitat Assessment Guide for Yards and Gardens is available as a pdf document. . We have promoted the Toolkits and the Ambassadors program in talks with gardening groups, educators, naturalists, Master Naturalists, and Master Gardeners reaching approximately 3,000 people. The UMN Bee Lab will continue to provide training and add to video resources to enhance the Pollinator Education Toolkits. Pollinator Ambassador youth have provided pollinator education to ~3,000 people. The Pollinator Education Toolkits have been used by educators to reach an estimated 100,000 people.

V. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview: See attached budget sheet

Explanation of Capital Expenditures Greater Than $5,000:

Explanation of Use of Classified Staff:

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours: 6673	Divide by 2,080 = TOTAL FTE: -3.2

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours: 2375	Divide by 2,080 = TOTAL FTE: -1.1

B. Other Funds:

SOURCE OF AND USE OF OTHER FUNDS	Amount Proposed	Amount Spent	Status and Timeframe
Other Non-State $ To Be Applied To Project During Project Period: None			
	$	$	
Other State $ To Be Applied To Project During Project Period: none			
In-kind Services To Be Applied During Project Period: Project coordination and education program development to be provided by UMN Extension employees Rebecca Masterman, Patrick Jirick, and Andrea Lorek Strauss	$ 6,000	$ 6,000	
Estimated salaries and transportation costs for Pollinator Ambassador Youth and Coordinators provided by the Mississippi River Green Team for 2019 and 2020	$44,000	$22,000	We were only able to work with the Mississippi River Green Team in 2019.
Past and Current ENRTF Appropriation:			
Minnesota	$	$	
Other Funding History:			

VI. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Elaine Evans	Associate Extension Professor	U of MN Bee Lab	Project Manager
Bridget Mendel	Project Coordinator	U of MN Bee Squad	Project Lead
Ana Heck	Project Coordinator	U of MN Bee Squad	Project Lead
Brooke Nikkila	Bee Research Technician	U of MN Bee Squad	Program Coordinator
Lisa Curtis	Program Coordinator for Citizen Science & Schoolyard Gardens	U of MN	Instructor
Katie-Lyn Bunney	Program Coordinator for Monarchs in the Classroom	U of MN	Instructor
Erin Rupp	Director	Pollinate Minnesota	Instructor
Anne Turnham	Communications	U of MN Bee Squad	Communications
Sarah Foltz Jordan	Pollinator Conservation Specialist	The Xerces Society	Create Habitat Guide
Audrey Favorito	Videographer	Wild Carrot Productions	Videographer

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role

Rebecca Masterman	Assistant Extension Professor and Bee Squad Program Director	U of MN Bee Lab	Assistance with project management
Patrick Jirick	Youth Development Extension Educator	U of MN	Assistance with program coodination in Rochester
Andrea Lorek Straus	Extension Educator	U of MN	Assistance with educational programming

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

There is a higher demand for pollinator education than can be met by current pollinator educators. The Pollinator Ambassadors program will increase pollinator education capacity in Minnesota by training youth Pollinator Educators as pollinator outreach experts and creating Pollinator Education Toolkits that will be made available to organizations throughout Minnesota, providing interactive pollinator education from experts. The Pollinator Education Toolkits include a habitat assessment guide for gardens, enabling assessment and improvement of gardens as pollinator habitat. As part of their training, Pollinator Ambassador youth will monitor pollinators in gardens and assess supplementation of gardens with plants preferred by rare and endangered pollinators. Results from monitoring will be summarized and shared with pollinator databases housed at the U of MN and included in education materials. Improving the capacity for pollinator education focused on native pollinators and increasing our understanding of pollinator usage of garden habitats will benefit Minnesotans by improving conditions for pollinators. The University of Minnesota Bee Lab will continue to update and add elements to the digital Pollinator Education Toolkits and provide trainings on their use to insure continued usage by recipients.

VIII. REPORTING REQUIREMENTS:

- **The project is for 4 years, will begin on 07/01/2018, and end on 06/30/2022.**
- **Periodic project status update reports will be submitted March/31 and September/30 of each year.**
- **A final report and associated products will be submitted between June 30 and August 15, 2022.**

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

A. Budget Spreadsheet
B. Visual Component or Map
C. Parcel List Spreadsheet
D. Acquisition, Easements, and Restoration Requirements
E. Research Addendum

Attachment A:
Environment and Natural Resources Trust Fund
M.L. 2018 Project Budget-Final

Project Title: Pollinator Ambassadors Program for Gardens
Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 05f
Project Manager: Elaine Evans
Organization: U of MN
College/Department/Division: CFANS/Entomology/Extension
M.L. 2018 ENRTF Appropriation: $250,000
Project Length and Completion Date: 4 years, June 30, 2022
Date of Report: 03/31/2022

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Revised Budget 3/25/2021	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits) - Overall	**$166,830**	**$166,830**	**$0**
Elaine Evans, Pollinator Ambassador Project Manager: $37,500 (80% salary, 20% benefits); 12.5% for 2 years, 20% FTE for 1 year			
Bridget Mendel Pollinator Ambassador Project Lead: $24,000 (80% salary, 20% benefits) for 15% FTE for 3 years			
Brooke Sommerfeldt, Pollinator Ambassador Program Coordinator: $22,000 (75% salary, 25% benefits) , 20% FTE for 2 years, 25% FTE for 1 year			
Sarah Weaver, Pollinator Ambassador Instructor: $28,182, (75% salary, 25% benefits) 25% FTE for 2 years			
Katie-Lyn Bunney, Pollinator Ambassador Instructor: ~~$25,272~~ (75% salary, 25% benefits), - $7,442			
Anne Turnham, Communication Specialist: $21,289 (80% salary, 20% benefits) 15% FTE for 2.25 years			
11 Pollinator Ambassadors: $8,808 (93% salary, 7% benefits) 10% FTE for 1 years			
Pollinator Ambassador Instructor: $17,600 (75% salary, 25% benefits) 20% FTE for 1 year			
Professional/Technical/Service Contracts - overall	**$59,394**	**$59,394**	**$0**
Erin Rupp, Pollinate Minnesota, Pollinator Ambassador Instructor, (12 days x 8 hrs x $120/hr) + (5 days x 8 hrs x $60/hr) (Total estimated amount - $13,920)			
Pollinator Ambassador youth salary with Right Track,- $6031			
15 Pollinator Ambassador youth stipends, ($400 for 26 hours of service) - $5,850			
Xerces Society - produce a habitat assessment guide for 1 year (Total estimated amount - $5,000)			
Katie-Lyn Bunney, Monarch Joint Venture, Pollinator Ambassador Instructor: $20,093			
Pollinator experts to provide expert content during Pollinator Ambassador Training (Total estimated amount - $8,500)			
Equipment/Tools/Supplies - overall	**$4,453**	**$3,762**	**$691**
Craft and office materials (including posterboards, markers, etc.) for Pollinator Ambassadors to design and create outreach displays (Total estimated amount - $553)			

Materials for citizen science monitoring: sweep nets, misc. insect curation supplies, pins and labels, insect drawers and trays, native plant materials for resource specialists, Monarch Larva Monitoring Protocol kits (Total estimated amount - $300)			
Materials for Pollinator Outreach Toolkits (Total estimate- $3600)			
Printing			
Printing costs for habitat assessment guides, Pollinator Ambassador outreach materials, and Pollinator Outreach Toolkits (Total estimated amount $13,391)	**$13,391**	**$13,391**	**$0**
Travel expenses in Minnesota - overall	**$2,722**	**$2,722**	**$0**
Initial training seminar: lodging $1,400, meals $1,800 (Total estimated amount - $2403)			
Travel for Instructors (Total estimated amount - $319)			
Other - overall	**$3,210**	**$3,203**	**$8**
Postage costs for Pollinator Ambassador outreach kits (Total estimated amount - $3000)			
Background checks- 6 people x $35 (Total estimated amount - $210)			
COLUMN TOTAL	$250,000	$249,302	$698

University of Minnesota Extension

POLLINATOR AMBASSADORS PROGRAM

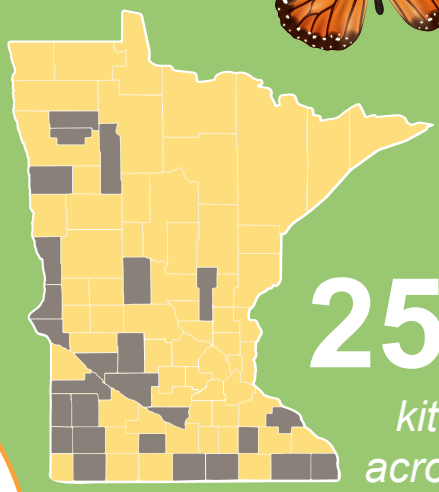
by the numbers

43 POLLINATOR AMBASSADOR YOUTH

directly engaged

3,000 MINNESOTANS

Increased pollinator conservation action will enhance food production and water quality, preserve endangered pollinator species, and conserve healthy ecosystems accross Minnesota



250 *kits across*

60 COUNTIES

Reaching an estimated

100,000 MINNESOTANS PER YEAR

Asian American

African American

Low-income

Recent Immigrants

Latinx

Native American

REACHING UNDERSERVED AUDIENCES

Over

400 EDUCATORS ACROSS THE WOLD

accessed the

DIGITAL POLLINATOR TOOL KIT

reaching an esitmated

180,000 PEOPLE PER YEAR

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Funding provided by the Minnesota Environment and Natural Resources Trust Fund.

Bee Lab

University of Minnesota
Department of Entomology, Bee Lab
z.umn.edu/pollinatorambassador

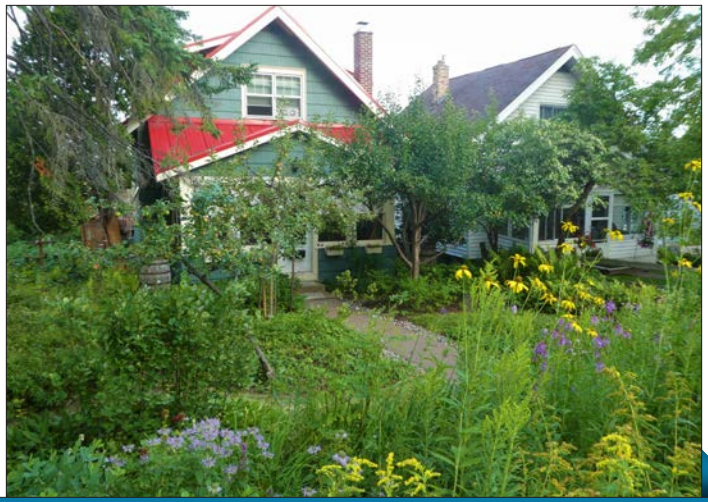
Habitat Assessment Guide for Pollinators in *Yards, Gardens, and Parks*

Above: a diversity of native wildflowers make it possible for this small urban pollinator garden to support a variety of bees, butterflies, and other insects all season long. Below: native wildflowers and fruit trees provide high quality resources for pollinators, wildlife, and people in a small space.

Purpose

Landscaping for pollinators is one of the easiest ways for urban, suburban, and rural residents to directly benefit local wildlife. Schoolyards, community gardens, back yards, corporate campuses, rain gardens, and neighborhood parks all have the potential to meet the most basic needs of pollinators, including protection from pesticides, and resources for foraging, nesting, and overwintering.

The goal of this tool is to evaluate pollinator habitat at a given site, and identify areas for improvement. This process will also help you prioritize the most essential next steps to take for pollinators at the site.



November 2019

The Xerces Society for Invertebrate Conservation

www.xerces.org

XERCES SOCIETY for Invertebrate Conservation

University of Minnesota

Acknowledgments

Authors

Sarah Foltz Jordan, Jennifer Hopwood, Elaine Evans, Kelly Gill, Aimee Code, Stephanie Frischie, and Phyllis Stiles. Portions of this guide were adopted from a Natural Areas Pollinator Habitat Assessment tool developed by Sarah Foltz Jordan, Mace Vaughan, Eric Lee-Mäder, Jennifer Hopwood, Jessa Kay Cruz, Brianna Borders, Jolie Goldenetz-Dollar, Kelly Gill, Nancy Adamson, and Anne Stine.

Editing and layout

Sara Morris. Template by Jessa Kay Cruz, Matthew Shepherd, Ashley Minnerath, and Hailey Walls.

Acknowledgments

Funding for the development of this guide was provided by the Minnesota Environment and Natural Resources Trust Fund (ENRTF) as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR). Additional funding for the Xerces Society's pollinator conservation program has been provided by the USDA Natural Resources Conservation Service, Audrey and J.J. Martindale Foundation, Cascadian Farm, Ceres Trust, Cinco, Clif Bar Family Foundation, Columbia Foundation, CS Fund, Disney Worldwide Conservation Fund, The Elizabeth Ordway Dunn Foundation, Endangered Species Chocolate, LLC, Gaia Fund, General Mills, Irwin Andrew Porter Foundation, McCune Charitable Foundation, The Metabolic Studio, Organic Farm Research Foundation, Organic Valley Farmers Advocating for Organics Fund, Panta Rhea Foundation, Swimmer Family Foundation, Sarah K. de Coizart Article TENTH Perpetual Charitable Trust, SeaWorld & Busch Gardens Conservation Fund, Turner Foundation, Inc., Whole Foods Market and their vendors, Whole Systems Foundation, and Xerces Society members.

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Thanks to Eric Lee-Mäder, Mace Vaughan, Jessa Kay Cruz, Nancy Adamson, Karin Jokela, Ray Moranz, Eric Venturini, Kitty Bolte, Ian Lane, and Julia Brokaw for their valuable feedback on this document.

Photographs

We are grateful to the photographers for allowing us to use their wonderful photographs.

- **Ali Boese:** Figure 2 (<10% flowering vegetation, *p. 5*).
- **Dustin Demmer / Blazing Star Gardens, LLC:** Figure 1 (6. flowering median, *p. 3*).
- **Kiley Friedrich:** Figure 6 (cellophane bee nests on campus, *p. 8*).
- **Pascal Gaudette** [flickr.com/doundounba]: Figure 7 (green sweat bee nesting in log, *p. 9*).
- **John Kehoe** [flickr.com/johnjkehoe_photography]: Figure 7 (leafcutter bee nesting in wall, *p. 9*).
- **Kent McFarland** [flickr.com/vtebird]: Figure 7 (bumble bee queen nesting in bunchgrasses, *p. 9*).
- **Stephen Thomforde:** Figure 1 (7. flowering native bee lawn, *p. 3*).
- **The Xerces Society / Nancy Lee Adamson:** Figures 1 (3. vegetable gardens, *p. 3*), 9 (numerous pollinators on wingstem, *p. 10*).
- **The Xerces Society / Jessa Kay Cruz:** Figure 5 (before and after, *p. 7*).
- **The Xerces Society / Candace Fallon:** Figure 6 (mining bee nest, *p. 8*).
- **The Xerces Society / Sarah Foltz Jordan:** Cover (small garden); Figures 1 (1. fruit trees, 3. flowering shrubs, 4. shade flowers, 5. prairie pocket, 9. flowering curb, *p. 3*); 4 (native prairie, *p. 6*); 7 (nests in dead tree, *p. 9*).
- **The Xerces Society / Kelly Gill:** Figure 4 (wooded area, *p. 6*).
- **The Xerces Society / Jennifer Hopwood:** Figures 2 (~40% flowering vegetation, *p. 5*); 6 (small sweat bee nest, *p. 8*); 8 (community science project, *p. 10*).
- **The Xerces Society / Emily May:** Figure 3 (~80% native flowers, *p. 6*).
- **The Xerces Society / Sara Morris:** Figures 1 (cavity-nesting bee, *p. 3*); 3 (<10% native flowers, *p. 6*); 4 (edible landscaping, *p. 6*); 6 (green sweat bee nest, *p. 8*); 7 (small carpenter bee nest in raspberry & resin bee nest in fence post, *p. 9*).
- **The Xerces Society / Matthew Shepherd:** Cover (urban pollinator garden); Figures 1 (ground-nesting bee, 8. rain garden, *p. 3*); 3 (~50% native flowers, *p. 6*); 4 (flowering bee lawn, *p. 6*); 7 (bee nests in prairie plant, *p. 9*); 8 (pollinator habitat sign & yard/garden tour, *p. 10*).
- **The Xerces Society / Mace Vaughan:** Figure 8 (community garden, *p. 10*).
- **The Xerces Society / Justin Wheeler:** Figure 2 (~80% flowering vegetation, *p. 5*).

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XERCES SOCIETY for Invertebrate Conservation

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Regional offices from coast to coast.

The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection, harnessing the knowledge of scientists and enthusiasm of citizens to implement conservation programs worldwide. The Society uses advocacy, education, and applied research to promote invertebrate conservation.

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Assess How Your Landscape Is Supporting Pollinators

Instructions

- This habitat assessment guide is designed for urban, suburban, and rural developed landscapes. If you are working on a farm, natural area, or rangeland, please see xerces.org/habitat-assessment-guides for a more appropriate guide.
- Prior to conducting an assessment, you may wish to print aerial photos to help with site and landscape questions.
- The assessment should ideally be done twice, once during the habitat evaluation process (before taking recommended actions) and once after any changes have been implemented.
- Use the **Checklist of Actions to Promote Pollinators (page 4)** to help you select next steps for your site.

Total Score for Habitat Assessment

1. Each item in the assessment should be given the appropriate value from the "Score" column, or a score of 0 if not present.
2. Add up the scores to calculate a subtotal for each subsection (e.g., 1c. Foraging features present on site.).
3. Next, add up subsection subtotals to get a total for each section. Transfer these figures into the summary table on page 5 to generate the overall score for each assessment.
4. The scores in each section should be used to identify resource concerns and prioritize next steps. For example, if the nesting resource score is low, actions that boost that score should be prioritized. Ideally, managers at each site should strive to achieve an overall score of at least 180 points, with ongoing improvements to the site (and score) each year.

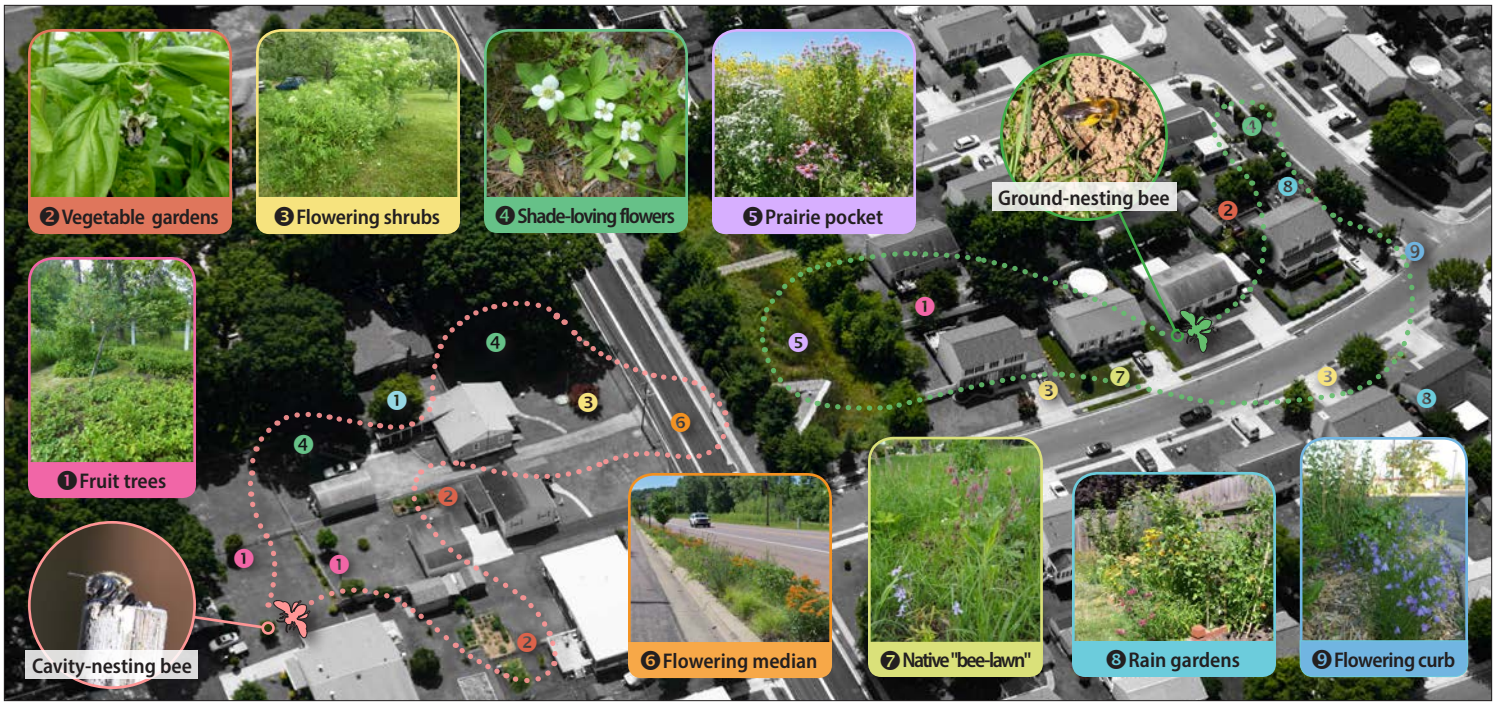
Quick Guides for Improving Habitat

If you are not interested in scoring your site, but still want to improve your habitat for pollinators, use the **Checklist of Actions to Promote Pollinators** (page 4) along with the **Xerces Society Recommended High Value Plants for Pollinators** (page 12) for priority steps you can take to improve habitat for pollinators. These two resources can also be downloaded as a single sheet at xerces.org/habitat-assessment-guides, making it easy to share or bring on trips to your local garden center!

Why Plant Native?

Native plants have a very long history of naturally occurring in the wild ecosystems of a given area (pre-European settlement of the Americas). **Non-native plants** naturally occur in other parts of the world or the country, but may grow well in your area as ornamental or garden plants. Some non-native plants have the tendency to escape into the wild and become **invasive**, replacing natives plants and causing serious ecological and economic problems. Although pollinators may find some nutritional value from non-native plants, **native plants do the best job of supporting the widest array of native pollinators**, given their long co-evolutionary history. In fact, roughly ⅓ of bee species will only collect pollen from particular native plants, and most butterfly and moth caterpillars can only feed on particular native plant leaves. See **Reference Materials & Resources** on page 11 for further information.

Figure 1: Abundant natural areas and wildflower landscaping in your neighborhood can help facilitate the movement of pollinators from one patch of habitat to another, and increase the likelihood that they will have enough food and nesting sites to build healthy populations.



CHECKLIST OF ACTIONS
To Promote Pollinators In Yards, Gardens & Parks

XERCES SOCIETY for Invertebrate Conservation

KEY:

- Promotes foraging resources
- Helps protect pollinators from pesticide exposure
- Promotes nesting and overwintering habitat
- Contributes to pollinator conservation in your community

LANDSCAPING

- ☐ Plant a **native** wildflower garden that includes species that bloom in succession all season long and are high-value to pollinators (species with ★ on **Table 1**, page 12).
- ☐ Plant **native** bunchgrasses; these plants are food for rare butterflies and also help provide nesting sites for bees.
- ☐ Reduce lawn footprint by converting as much as possible to *flowering* habitat.
- ☐ Plant ***spring***-blooming **native** wildflowers, such as woodland ephemerals in shady areas.
- ☐ Plant ***spring***-blooming **native** shrubs and trees, such as willows (*Salix*), maples (*Acer*), and native fruit trees and shrubs.
- ☐ Plant ***summer***-blooming **native** wildflowers, such as blazing star (*Liatris*), bee balm (*Monarda*), and numerous others.
- ☐ Plant ***summer***- *or* ***fall***-blooming **native** shrubs, such as wild roses (*Rosa*) or meadowsweet (*Spirea*).
- ☐ Plant ***fall***-blooming **native** wildflowers, such as asters (*Symphyotrichum*), native sunflowers (*Helianthus*), and goldenrods (*Solidago*).
- ☐ Plant **native** trees that serve as important host plants for a wide variety of butterflies and moths (species with on **Table 1**, page 12).
- ☐ Plant **native** milkweed (*Asclepias*), violets (*Viola*), pawpaws (*Asimina*), or other regionally appropriate plants that provide critical food for specialist butterflies and moths.
- ☐ Plant species known to provide food for specialist bees in your region (species with on **Table 1**, page 12).
- ☐ Gradually replace perennial and annual landscaping that provides little value to wildlife (e.g., daylilies, hostas, pansies) with more diverse **native** wildflower plantings.
- ☐ If non-native plants are included in landscaping, choose varieties that are known to have value to pollinators (e.g., flowers with ample pollen or nectar) **AND** that are not invasive or aggressive.
- ☐ Remove invasive species from your landscape, as well as any non-native species that appear to be spreading into wild areas (e.g., butterfly-bush).
- ☐ Ensure that new landscaping plants were not treated with neonicotinoids or other related insecticides.

LAWN & YARD CARE

- ☐ Avoid pesticides (including herbicides, insecticides, and fungicides) on lawns and other landscaping; choose less harmful alternatives such as non-chemical controls.
- ☐ For mowed areas, reduce mowing frequency and increase mowing height, allowing flowering weeds to flourish.
- ☐ Leave dead wood on site, including dead logs, snags, and brush; consider planting flowers around these features, to add intention and aesthetic value.
- ☐ Leave leaf litter on-site—keep a thin layer of leaves on lawn; use the rest to mulch trees/ shrubs/ garden and/or rake to woodland edges if available.
- ☐ Leave bare spots or areas with patchy vegetation in lawn; avoid thick turf and sod.
- ☐ Avoid plastic mulch/ weed barrier, heavy wood chips, and treated wood chips.
- ☐ Leave dead wildflower stems standing over the ***winter***; prune them back in ***early spring*** to 8–12" to create nesting sites for stem-nesting bees.
- ☐ Prune shrubs with pithy stems, to create nesting sites for stem-nesting bees.
- ☐ Leave some areas of lawn unmown to create tall grass habitat.
- ☐ Install a water feature (e.g., bird bath with stones to prevent insects from drowning) for pollinators that need water for nest building or other uses.
- ☐ Seed a "bee lawn" (incorporate clovers & other flowers into new or existing lawn).

FRUIT & VEGETABLE GARDENS

- ☐ Plant fruit trees and fruit-bearing shrubs, including **native** species when possible (e.g., blueberries [*Vaccinium*], currants and gooseberries [*Ribes*], elderberries [*Sambucus*], chokeberries [*Aronia*]—species with on **Table 2**, page 12).
- ☐ Plant **native** raspberries/ blackberries (*Rubus*); prune in ***early spring*** to create nest sites for stem-nesting bees.
- ☐ For more continuous fruit and flowers, plant ever-bearing varieties of strawberries (*Fragaria*), raspberries, and other fruits.
- ☐ Plant a tea or herb garden and allow plants like basil (*Ocimum*), mint (*Mentha*), and lavender (*Lavendula*) to flower; most herbs do very well in containers if space is limited (see **Table 2**, page 12).
- ☐ Plant bee-pollinated vegetables like squash (*Cucurbita*) and tomatoes (*Solanum*) **and** allow pollinator-attractive culinary garden plants—such as lettuce (*Lactuca*) and mustard (*Brassica*)—to bolt in order to provide additional floral resources (see **Table 2**, page 12).
- ☐ Avoid pesticide use on fruit and vegetable crops; manage pests by using prevention strategies (e.g., crop rotation or selection of resistant varieties) and non-chemical pest control methods (e.g., hand-picking or insectary plantings to promote beneficial insects for natural pest control).

COMMUNITY ACTION

- ☐ Organize a neighborhood **native** plant or seed exchange (**never** share non-native plants that are aggressive / potentially invasive).
- ☐ Create habitat in community hubs (e.g., libraries, post-offices, schools, or senior centers) or in unused spaces like sidewalk medians.
- ☐ Volunteer with a local park to improve habitat (e.g., removing invasive species or collecting wildflower seeds).
- ☐ Provide signage to explain your pollinator conservation actions to your neighbors.
- ☐ Host a tour of your pollinator friendly yard or garden.
- ☐ Talk about pollinators and their habitat needs to your neighbors, friends, family, local businesses, schools, library, church, etc.
- ☐ Talk to your city officials or local colleges about signing a bee friendly resolution and/or getting certified as a Bee City USA or Bee Campus USA.
- ☐ Participate in a community science project, such as bumble bee or monarch monitoring (see *Resources*, page 11).

Print additional copies of this and other habitat assessment tools at: xerces.org/habitat-assessment-guides.

SCORING YOUR SITE

Site Summary

Site name:	
Owner(s)/manager(s):	
Address:	
Define and describe the project area:	

Attach map or sketch below, if available:

Site Assessment

Assessment Dates		
	BEFORE	
	AFTER	

Optional: Checklist of Actions to Promote Pollinators

Score Your Site ➡	MAX	BEFORE	AFTER
Section 1: Foraging Habitat	100		
Section 2: Nesting Habitat	50		
Section 3: Pesticide Practices	35		
Section 4: Community Action	40		
OVERALL SCORE	225		

Section 1: Foraging Habitat

Pollinators need a diversity of abundant flowers that bloom throughout the growing season. Native plants do the best job supporting a wide diversity of pollinators, and are essential for many species.

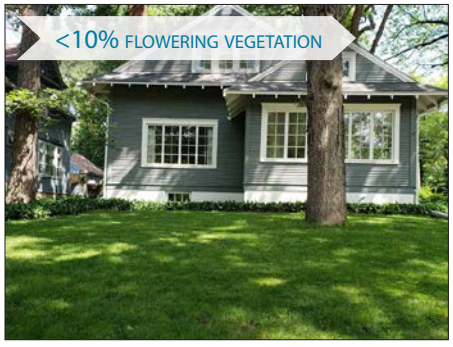
1a. Percent of site (excluding paved areas and buildings) composed of flowering vegetation (Figure 2). This includes native wildflowers, ornamental flowers, flowering shrubs, or decidous trees. *Does not include lawn areas, or invasive or noxious species (See* https://plants.usda.gov/java/noxiousDriver *for additional examples).*

Max score of 10.

SCORE ALL OPTIONS THAT APPLY (points per option)	Score	Before	After	Treatment to increase score (see items with ❁ on page 4)
Percent cover of flowering vegetation: *Score 1 point for every 10% of vegetation that flowers, up to 10 points.*	0–10			
Subtotal (1a)				(1a)

Section 1: Foraging Habitat

Figure 2: Examples of percent cover of flowering vegetation (note: count all plants that provide flowers, whether or not they are currently in bloom):



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1b. Percent of flowering vegetation on site that is native (Figure 3).

Max score of 10.

SCORE ALL OPTIONS THAT APPLY (POINTS PER OPTION)	Score	Before	After	Treatment to increase score (see items with ❀ on page 4)
Percent of flowering cover that is native: *Score 1 point for every 10% of native flowering vegetation, up to 10 points.*	0–10			
Subtotal (1b)				(1b) →

Figure 3: All three of these yards have high percentages of vegetative cover that flowers. However, they differ in how much of that flowering cover is **native**:

1c. Foraging features present on site (Figure 4).

Max score of 37.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with ❀ on page 4)
Diverse native prairie patches, rain gardens, or other native wildflower plantings. *Score 10 if any of these features are present. If these features take up the entire yard/site, score 37 and move on to next section.*	10			
"Bee lawn" with flowers that bloom when mown at standard heights (e.g. clover, creeping thyme, self-heal). Mowing is less frequent than traditional turf.	4			
Wooded or shrubby areas with a variety of native flowering species (e.g., maples, basswood, willows, wild plum, or other fruit-bearing shrubs)	10			
Native plants (e.g., woodland ephemerals in shady areas) are used for ground cover, rather than wood chips, turf, or non-natives like daylilies or hostas.	5			
Edible landscaping/vegetable garden with bee-pollinated plants (e.g., squash, apple) and/or plants that are allowed to bolt (e.g., lettuce, basil).	4			
Ornamental flower gardens with pollinator-friendly annuals or perennials, such as lavender, cosmos, hollyhocks or zinnias.	4			
Subtotal (1c)				(1c) →

(1a + 1b) ↓

Figure 4: Examples of foraging features include:


Diverse native prairie patch *or* rain garden


Flowering "bee lawn" (shown: white clover)


Native flowering wooded area with shrubs, trees, *and* ground plants


Edible landscaping (foot path bordered by berries and herbs)

Go to top of next page

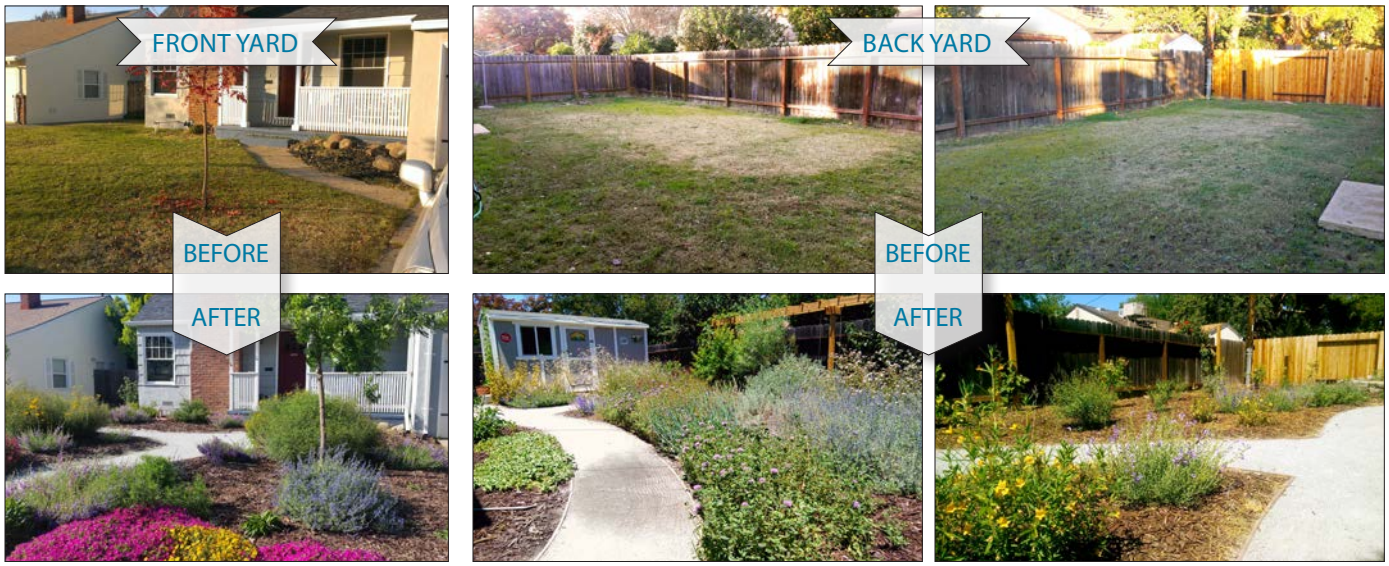
1d. Pollinator-friendly forage diversity by season. **See Tables 1–2 on back cover for a list of some of these plants.*

Max score of 30.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with ❀ on page 4)
SPRING-blooming species. Flowering plants, shrubs, or trees on site that bloom in SPRING (Feb–May) and support bees*. *This includes fruit trees and some flowering weeds (e.g., dandelions), but does not include low-value plants (e.g., Eurasian lilacs), invasive, or noxious species (see Resources).* *Score 1 point for each species, up to 10 points.*	0–10			
SUMMER-blooming species. Flowering plants, shrubs, or trees on site that bloom in SUMMER (Jun–Aug) and support bees*. *This includes some flowering non-native plants (e.g., hollyhocks), but does not include low-value plants (e.g., hybrid peonies), invasive, or noxious species (see Resources).* *Score 1 point for each species, up to 10 points.*	0–10			
FALL-blooming species. Flowering plants, shrubs, or trees on site that bloom in FALL (Sep–Nov) and support bees*. *This includes some flowering non-native plants, (e.g., lavender), but does not include low value plants (e.g., mums), invasive, or noxious species (see Resources).* *Score 1 point for each species, up to 10 points.*	0–10			
Subtotal (1d)				**(1d)**

(1a + 1b + 1c)

Figure 5: This California yard was transformed into a pollinator paradise by planting diverse drought- and fire-resistant native species with overlapping bloom periods.



1e. Pollinator "superfoods", specialist bee plants, and host plants for butterflies and moths. *See Tables 1–2 on back cover for a list of some of these plants. Note that some of these plants may not be appropriate for every region/site.*

Max score of 13.

SCORE ALL OPTIONS THAT APPLY	SCORE	BEFORE	AFTER	Treatment to increase score (see Tables 1–2 on page 12)
Pollinator "superfoods" (★). Certain native plants are known to provide exceptional forage for a wide variety of bees and other pollinators. *Using Tables 1–2, score 0.5 point for each plant spp. present, up to 5 points.*	0–5			
Food for specialist bees (🐝). These plants provide pollen for "specialist" bees that only collect pollen from a narrow range of plants. *Using Tables 1–2, score 0.5 point for each plant spp. present, up to 3 points.*	0–3			
Host plants for butterfly and moth caterpillars (🐛). In the same way monarchs depend on milkweed for caterpillar food, many other butterflies and moths depend on specific host plants for their young to eat. *Using Tables 1–2, score 0.5 point for each plant spp. present, up to 5 points.*	0–5			
Subtotal (1e)				**(1e)**
Foraging Habitat Total				**(1a + 1b +1c + 1d + 1e)**

Section 1: Foraging Habitat

Section 2: Nesting & Overwintering Habitat

Native bees nest & overwinter in a variety of places. Roughly 70% nest in the ground, and about 30% nest in cavities in dead wood, branches, and plant stems. Bumble bee nests are often found under woody plants, tall grasses, or hidden among vegetation. Many insects, including some butterflies, moths, beetles, hoverflies, and queen bumble bees, overwinter underneath leaf litter, in the duff layer of forests, or under loose soils. Diverse habitat features on your site will increase the likelihood of nesting and overwintering success.

2a. Habitat for ground-nesting bees and other insects that seek shelter under ground (Figure 6).

Max score of 25.

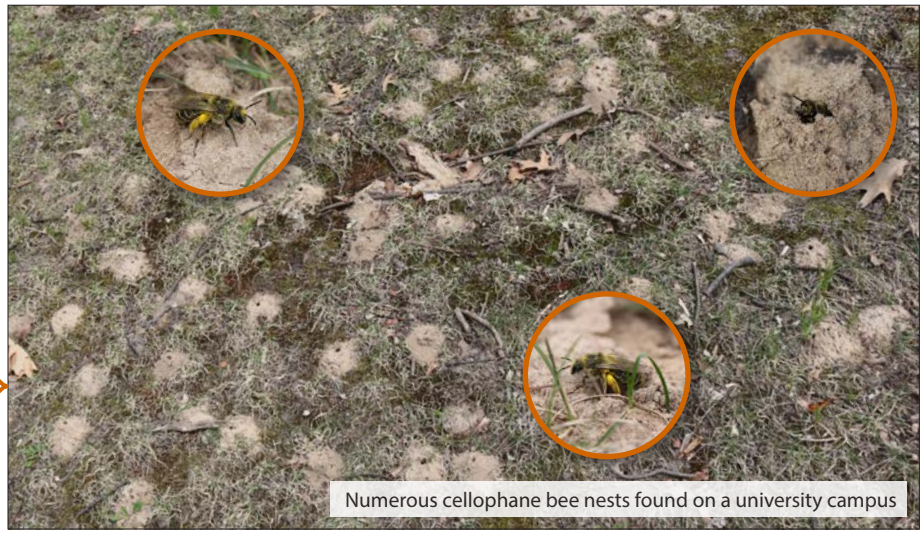
SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with ↓ on page 4)
1 point for every 10% of vegetated area that is unmown (including gardens, wooded areas, wild spaces)	0–10			
Areas on site with patchy vegetation or bare ground (do not count compacted, pesticide-treated, or highly disturbed ground): **Absent** *(0)* | **Present** *(5)*	0–5			
Clump-forming native bunch grasses in gardens or unmown areas: **Absent** *(0)* | **Sparse** *(2)* | **Abundant** *(5)*	0–5			
Leaf litter left on site in the fall and through the spring (or longer): **Absent** *(0)* | **Sparse** *(2)* | **Abundant** *(5)*	0–5			
Subtotal (2a)				**(2a)**

Figure 6: Although traditionally viewed as "unsightly", lawns with patchy vegetation and bare spots offer critical nesting habitat for ground nesting bees. Unlike ground nesting wasps, these bees are active for a very short period, have very small nests, and are extremely unlikely to sting. In fact, without carefully watching at the right time, you probably won't even notice them sharing your space!

Small sweat bee nesting in gravelly soil

Mining bee nest entrance hidden by leaf litter

Green sweat bee nesting in a bare spot in lawn



Numerous cellophane bee nests found on a university campus

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Section 2: Nesting & Overwintering Habitat *continued*

Section 2: Nesting & Overwintering Habitat

2b. Habitat for cavity-nesting bees and other insects that seek shelter in wood, stems, and other cavities (Figure 7).

Max score of 25.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with ✓ on page 4)
Dead wildflower stems retained & pruned to promote stem-nesting insects: Absent *(0)* | Sparse *(2)* | Abundant *(5)*	0–5			
Native and non-native shrubs pruned to promote stem-nesting insects: Absent *(0)* | Sparse *(2)* | Abundant *(5)*	0–5			
Dead logs and standing dead trees on site: Absent *(0)* | Sparse *(2)* | Abundant *(5)*	0–5			
Brush piles or other woody debris on site: Absent *(0)* | Sparse *(2)* | Abundant *(5)*	0–5			
Rock piles, rock walls, or rock garden edging on site: Absent *(0)* | Sparse *(2)* | Abundant *(5)*	0–5			
Subtotal (2b)				

(2b) (2a)

Figure 7: The majority of wood- or cavity-nesting bees nest in pre-existing tunnels or cavities in dead trees (A), logs (B), and brush, or the centers of pithy-stemmed shrubs (e.g., elderberry, sumac, raspberry [C]) and large-statured prairie plants (D, *shown: Baptisia*). Bumble bees also nest under clump-forming bunchgrasses or other tall grasses (E). Loosely constructed rock walls (F), untreated fence posts (G), and other structures may attract additional bees.


Dead tree with nests


Sweat bee found nesting inside an old log


Small carpenter bee nesting in a raspberry cane


Cut stems on this pithy prairie plant provide excellent nesting sites


Bumble bee nest (and queen) in an area with tall grasses


Leafcutter bee nesting in a wall


Resin bee nesting in a fence post

Nesting & Overwintering Habitat Total (2a + 2b)

Creating Natural Nesting and Overwintering Habitat *for Pollinators and Other Beneficial Insects*

The availability of nesting and overwintering habitat is **one of the most important factors** influencing populations of native bees and other beneficial insects. Yet, traditional landscaping practices rarely leave enough natural resources to support these animals. This Xerces Society document focuses on a variety of natural nesting habitat features and practices, such as our LEAVE THE LEAVES campaign, that can be readily incorporated into most landscapes. For more information, please visit xerces.org/pollinator-conservation/nesting.

Section 3: Pesticide Practices

Pesticide use in lawns, gardens, and landscaping can have negative impacts on pollinator populations.

3. Pesticide use on site.

Max score of 35.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with on page 4)
New landscaping or garden plants are organic, or purchased from nurseries that DON'T use neonicotinoids or other related insecticides in their supply chain.	5			
Use of herbicides, fungicides, insecticides, or other pesticides on site: **Not used** *(30) … proceed to Section 4* | **Used** *(0) … continue to next question*	30			
If pesticides are used on site, they are part of an IPM program that specifically addresses pollinator protection, and focuses on pest prevention strategies and nonchemical pest management methods, before resorting to pesticides. **No** *(0)* | **Yes** *(5) … continue to next question*	5			
If pesticides are used on site, their use is ONLY for managing invasive species that threaten ecosystem health (e.g., spot-treating invasive thistle or buckthorn). **No** *(0)* | **Yes** *(10) … continue to Section 4*	10			

Pesticide Practices Total

Section 4: Community Action

Educating family, friends, and neighbors about pollinator conservation can lead to community-wide changes. Engaging in community science efforts, such as bumble bee monitoring, can lead to advances in our understanding of pollinators and their conservation needs.

4. Community action (Figure 8).

Max score of 40.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score (see items with on page 4)
Install a pollinator habitat sign (homemade or otherwise) to explain your pollinator conservation actions to your neighbors	5			
Help create a garden in your neighborhood or share native pollinator plants or seeds with neighbors	10			
Help to organize or host a tour of a pollinator-friendly yard or site	5			
Talk to city officials & local colleges about signing a bee friendly resolution and/or getting certified as a Bee City USA or Bee Campus USA.	5			
Talk about pollinators & their habitat needs to your neighbors, friends, family, local businesses, schools, library, church, etc.	5			
Participate in community science or habitat efforts, such as bumble bee monitoring or invasive species removal (see Resources on next page)	10			

Figure 8: *Examples of community actions:*


Install a pollinator habitat sign


Help create a garden in your neighborhood


Host a tour of pollinator habitat


Participate in a community science project

Community Action Total

Reference Materials & Resources

Pollinator Conservation

100 Plants to Feed the Bees

This book highlights 100 of the most valuable plant genera for pollinators across North America, including both native and select non-native flowers. xerces.org/publications/books/100-plants-feed-bees

Attracting Native Pollinators

A complete guide to the fascinating lives of these vital creatures. The book includes detailed profiles of commonly encountered bee genera and illustrated plant lists to help you to choose the best plants for your region. xerces.org/publications/books/attracting-native-pollinators

Habitat Installation Guides

These regional guidelines provide in-depth practical guidance on how to install and maintain foraging and nesting habitat for pollinators by planting wildflowers or native flowering shrubs. Region-specific plant recommendations are included in the appendices of each guide. xerces.org/pollinator-conservation/habitat-installation-guides

Pesticides in Yards and Gardens

Find the latest guidance on protecting pollinators by minimizing pesticide use and exposure in a residential or urban setting. xerces.org/pesticides/pesticides-your-garden

Nesting & Overwintering Habitat Resources

Find detailed information the nesting requirements of pollinators and beneficial insects and how to provide natural and artificial nesting habitat for pollinators and other beneficial insects in your yard or garden. xerces.org/pollinator-conservation/nesting

Lady Bird Johnson and Xerces Society Plant Database for Pollinators

The Xerces Society partnered with the Lady Bird Johnson Wildflower Center to generate a list of plants that are of special value to pollinators and beneficial insects. www.wildflower.org/project/pollinator-conservation

Flowering Bee Lawns Toolkit

From the University of Minnesota, this page offers guidance on enhancing mown turf with native and non-native flowers for bees. https://z.umn.edu/floweringbeelawn

Native Plant Resources:

Regional Native Pollinator-Friendly Plant Lists:

Recommended native plants that are highly attractive to pollinators and are well-suited for small-scale plantings in gardens, campuses, and in urban greenspaces.

- ***Pollinators:*** xerces.org/pollinator-conservation/plant-lists
- ***Monarchs:*** xerces.org/monarchs/monarch-nectar-plant-guides

***Bringing Nature Home* by Doug Tallamy.**

This eye-opening book compares the value of native and non-native plants to wildlife, and inspires ecologically smarter landscaping with native plants.

North America Native Plant Societies:

Find a group near you to learn more about native plants, invasive species issues, and more. nanps.org/native-plant-societies

Biota of North America Program (BONAP):

Use this comprehensive plant database to determine if a given plant is native to your location. www.bonap.org

USDA–Natural Resources Conservation Service

- ***PLANTS Database:*** Standardized information about the vascular plants of the U.S. and its territories. plants.usda.gov
- ***Introduced, Invasive, and Noxious Plants:*** Federal and state noxious weed, invasive, and introduced plant lists, with links to more information. plants.usda.gov/java/noxiousDriver

Community Action

Bring Back The Pollinators Campaign

Join thousands of others who have pledged to provide habitat and protect pollinators from pesticides. www.bringbackthepollinators.org

Bee City USA / Bee Campus USA

An initiative of the Xerces Society, this program endorses a set of commitments, defined in a resolution, for creating sustainable habitats for pollinators in cities and campuses nationwide. **www.beecityusa.org**

Bumble Bee Watch

Contribute your bumble bee sightings to this app or website to help scientists better understand bumble bee distribution and conservation need. www.bumblebeewatch.org

Native Bee Monitoring Guides & Tools

Developed by the Xerces Society, these guides provides instructions for assessing pollinator habitat quality and diversity by monitoring native bees. xerces.org/xerces-bee-monitoring-tools

Xerces Community Science Opportunities

Find a variety of community science projects related to bumble bees, milkweed, monarchs, and more. xerces.org/community-science/

Citsci.org

Search this list of community science projects for keywords you are interested in, such as your state and "pollinators" or "bees".

iNaturalist.org

A website and app to help you document the diversity around you, and arrive at correct identifications of the wildlife you are seeing.

Figure 9: Due to their long co-evolutionary history in wild ecosystems, native plants like wingstem (*Verbesina alternifolia*) are frequently better floral resources for native pollinators (e.g., bumble bees and sweat bees) than non-native ornamental plants.

Xerces Society Recommended High Value Plants for Pollinators

★ **POLLINATOR "SUPERFOODS"**—Certain native plants are known to provide exceptional forage for a wide variety of bees and other pollinators, including monarchs. See table below for a list of some of these plants.

FOOD FOR SPECIALIST BEES—Many native bees are "specialists," only collecting pollen and other resorces from specific plants. See table below for a list of plants known to provide food for a number of specialist bees.

LEPIDOPTERA HOST PLANTS—The caterpillars of many butterflies and moths can only feed on specific plants. For example, great spangled fritillary larvae only feed on violet leaves. Some plants support an amazing diversity of lepidoptera; e.g., oaks support hundreds of butterflies and moths species. Since most native plants support at least one butterfly or moth, we use for a genus supports over five species ***OR*** one species that doesn't eat anything else.

NOTE: *These lists are not exhaustive—see Resource section to identify additional native plants for your site. Some of these plants may not be appropriate for every region/site.*

TABLE 1: SUPERFOODS & HOST PLANTS

HIGH VALUE PLANTS Appropriate for *Most* Regions

Native Wildflowers

- ***Agastache*** [giant hyssop]—★
- ***Asclepias*** [milkweed]—★
- ***Cirsium*** [thistle (native)]—★
- ***Echinacea*** [purple coneflower]—
- ***Euthamia*** [goldentop]—★
- ***Helianthus*** [sunflower]—★
- ***Lupinus*** [lupine]—
- ***Monarda/Monardella*** [beebalm]—★
- ***Penstemon*** [beardtongue]—
- ***Ratibida*** [coneflower]—
- ***Salvia*** [sage]—
- ***Solidago*** [goldenrod]—★
- ***Symphyotrichum*** [aster]—★
- ***Verbena*** [vervain]—
- ***Viola*** [violets]—

Native Shrubs & Trees

- ***Acer*** [maple]—★
- ***Amelanchier*** [serviceberry]—★
- ***Amorpha*** [leadplant/false indigo]—★
- ***Ceanothus*** [wild lilac]—★
- ***Cercis*** [redbud]—
- ***Cornus*** [dogwood]—
- ***Pinus*** [pine]—
- ***Prunus*** [wild plum]—★
- ***Quercus*** [oak]—
- ***Rhus*** [sumac]—
- ***Ribes*** [currant]—★
- ***Rosa*** [wild rose]—★
- ***Rubus*** [raspberry/blackberry]—★
- ***Salix*** [willow]—★
- ***Sambucus*** [elderberry]—
- ***Spiraea*** [spirea/meadowsweet]—★
- ***Vaccinium*** [blueberry/cranberry]—★
- ***Viburnum*** [arrowwood/viburnum]—★

Native Grasses

- ***Andropogon*** [bluestem]—
- ***Bouteloua*** [grama]—
- ***Carex*** [sedges]—
- ***Elymus*** [wheatgrass, wildrye]—
- ***Hierochloe*** [sweetgrass]
- ***Koeleria*** [Junegrass]—
- ***Muhlenbergia*** [muhly]—
- ***Schizachyrium*** [little bluestem]—
- ***Sporobolus*** [dropseed]—

HIGH VALUE PLANTS for *Specific* Regions

Pacific Northwest

- ***Baccharis*** [coyotebrush]—★
- ***Berberis*** [barberry]—★
- ***Clarkia*** [clarkia]—★
- ***Cleome*** [bee plant]—★
- ***Fragaria*** [strawberry]—
- ***Grindelia*** [gumweed]—★
- ***Helenium*** [sneezeweed]—★
- ***Phacelia*** [phacelia]—★
- ***Rhamnus*** [buckthorn]—
- ***Sidalcea*** [checkerbloom]—★

Great Plains & Intermountain West

- ***Callirhoe*** [poppymallow]—
- ***Dalea*** [prairie clover]—★
- ***Ericameria*** [goldenbush, rabbitbrush]—★
- ***Eriogonum*** [wild buckwheat]—
- ***Geranium*** [wild geranium]—
- ***Heterotheca*** [false goldenaster]—★
- ***Machaeranthera*** [tansyaster]—★
- ***Oenothera*** [evening primrose]—
- ***Sphaeralcea*** [globemallow]—★
- ***Vernonia*** [ironweed] —★

Great Lakes & Northeast

- ***Cephalanthus*** [buttonbush]—★
- ***Dalea*** [prairie clover]—★
- ***Eutrochium*** [joe pye weed]—★
- ***Ilex*** [holly]—★
- ***Liatris*** [blazing star]—★
- ***Packera*** [ragwort]—
- ***Pycnanthemum*** [mountain mint]—★
- ***Silphium*** [cup plant]—★
- ***Zizia*** [Alexanders, zizia]—★
- ***Carya*** [hickory]—

Southwest & California

- ***Arctostaphylos*** [manzanita]—★
- ***Baccharis*** [coyotebrush]—★
- ***Berberis*** [barberry]—★
- ***Bidens*** [beggarticks]—★
- ***Eriogonum*** [wild buckwheat]—
- ***Grindelia*** [gumweed]—★
- ***Larrea*** [creosote bush]—★
- ***Monardella*** [monardella]—★
- ***Phacelia*** [phacelia]—★
- ***Salvia*** [sage]—

Midwest & South Central

- ***Boltonia*** [doll's daisy/false aster]—★
- ***Chamaecrista*** [partridge pea]—
- ***Eutrochium*** [joe pye weed]—★
- ***Helenium*** [sneezeweed]—★
- ***Liatris*** [blazing star]—★
- ***Pycnanthemum*** [mountain mint]—★
- ***Silphium*** [cup plant]—★
- ***Tillia*** [basswood]—
- ***Verbesina*** [wingstem]—★
- ***Zizia*** [Alexanders, zizia]—★

Southeast & Mid-Atlantic

- ***Baptisia*** [wild indigo]—
- ***Coreopsis*** [tickseed]—
- ***Desmodium*** [tick-trefoil]—
- ***Eutrochium*** [joe pye weed]—★
- ***Gaillardia*** [blanketflower]—
- ***Helenium*** [sneezeweed]—★
- ***Hibiscus*** [rosemallow]—
- ***Ilex*** [holly]—★
- ***Liatris*** [blazing star]—★
- ***Vernonia*** [ironweed]—★

GROWTH FORMS: Wildflower/Forb () Shrub/Tree () Grass/Sedge ()

TABLE 2: EDIBLE LANDSCAPING PLANTS WITH VALUE TO POLLINATORS

- ***Abelmoschus esculentus*** [okra]
- ***Allium****† [chives, garlic, leek, onions, shallot]
- ***Amelanchier***† [juneberry, serviceberry]
- ***Asimina***† [pawpaws]
- ***Anethum graveolens**** [dill]
- ***Brassica**** [broccoli, cabbage, cauliflower, kale]
- ***Calendula*** [calendula]
- ***Capsicum***† [peppers (bell/chili, habanero)]
- ***Castanea***† [chestnut, chinquapin]
- ***Citrullus*** [pine melon, watermelon]
- ***Citrus*** [lemon, lime, tangerine]
- ***Coriandrum sativum**** [coriander/cilantro]
- ***Corylus***† [hazelnut]
- ***Cucumis*** [cucumber, melon]
- ***Cucurbita***† [pumpkin, squash]
- ***Diospyros virginiana***† [common persimmon]
- ***Fagopyrum esculentum**** [buckwheat]
- ***Foeniculum vulgare**** [fennel]
- ***Fragaria***† [strawberry]
- ***Helianthus annuus***† [sunflower]
- ***Lavandula*** [lavender]
- ***Malus***† [apple, crab apple]
- ***Matricaria**** [chamomile]
- ***Mentha****† [mint]
- ***Ocimum**** [basil]
- ***Opuntia***† [prickly pear]
- ***Origanum vulgare**** [oregano]
- ***Passiflora***† [passionfruit]
- ***Persea americana*** [avocado]
- ***Phaseolus***† [bean (common, scarlet runner, wild)]
- ***Prunus***† [almond, apricot, cherry, peach, plum]
- ***Pyrus*** [pear]
- ***Ribes***† [currant (black, golden, red)]
- ***Rosa***† [rose (dogrose, hybrid tea, wild)]
- ***Rubus***† [blackberry, raspberry]
- ***Sambucus***† [elderberry (black, blue, red)]
- ***Solanum***† [eggplant, potato, tomato]
- ***Vaccinium***† [blueberry, cranberry]
- ***Vicia***† [fava bean, vetch]

NOTES: *Must be allowed to bolt/flower †Some or all members of the genus are NATIVE to North America

XERCES SOCIETY
for Invertebrate Conservation

CHECKLIST OF ACTIONS
To Promote Pollinators In Yards, Gardens & Parks

KEY:

- Promotes foraging resources
- Helps protect pollinators from pesticide exposure
- Promotes nesting and overwintering habitat
- Contributes to pollinator conservation in your community

LANDSCAPING

- ☐ Plant a **native** wildflower garden that includes species that bloom in succession all season long and are high-value to pollinators (species with ★ on **Table 1**, page 12).
- ☐ Plant **native** bunchgrasses; these plants are food for rare butterflies and also help provide nesting sites for bees.
- ☐ Reduce lawn footprint by converting as much as possible to *flowering* habitat.
- ☐ Plant ***spring***-blooming **native** wildflowers, such as woodland ephemerals in shady areas.
- ☐ Plant ***spring***-blooming **native** shrubs and trees, such as willows (*Salix*), maples (*Acer*), and native fruit trees and shrubs.
- ☐ Plant ***summer***-blooming **native** wildflowers, such as blazing star (*Liatris*), bee balm (*Monarda*), and numerous others.
- ☐ Plant ***summer***- *or* ***fall***-blooming **native** shrubs, such as wild roses (*Rosa*) or meadowsweet (*Spirea*).
- ☐ Plant ***fall***-blooming **native** wildflowers, such as asters (*Symphyotrichum*), native sunflowers (*Helianthus*), and goldenrods (*Solidago*).
- ☐ Plant **native** trees that serve as important host plants for a wide variety of butterflies and moths (species with 🐛 on **Table 1**, page 12).
- ☐ Plant **native** milkweed (*Asclepias*), violets (*Viola*), pawpaws (*Asimina*), or other regionally appropriate plants that provide critical food for specialist butterflies and moths.
- ☐ Plant species known to provide food for specialist bees in your region (species with 🐝 on **Table 1**, page 12).
- ☐ Gradually replace perennial and annual landscaping that provides little value to wildlife (e.g., daylilies, hostas, pansies) with more diverse **native** wildflower plantings.
- ☐ If non-native plants are included in landscaping, choose varieties that are known to have value to pollinators (e.g., flowers with ample pollen or nectar) **AND** that are not invasive or aggressive.
- ☐ Remove invasive species from your landscape, as well as any non-native species that appear to be spreading into wild areas (e.g., butterfly-bush).
- ☐ Ensure that new landscaping plants were not treated with neonicotinoids or other related insecticides.

Why Plant Native?

Native plants have a very long history of naturally occurring in the wild ecosystems of a given area (pre-European settlement of the Americas). Non-native plants naturally occur in other parts of the world or the country, but may be grow well in your area as ornamental or garden plants. Some non-native plants have the tendency to escape into the wild and become invasive, replacing natives plants and causing serious ecological and economic problems. Although pollinators may find some nutritional value from non-native plants, native plants do the best job of supporting the widest array of native pollinators, given their long co-evolutionary history. In fact, roughly ⅓ of bee species will only collect pollen from particular native plants, and most butterfly and moth caterpillars can only feed on particular native plant leaves.

LAWN & YARD CARE

- ☐ Avoid pesticides (including herbicides, insecticides, and fungicides) on lawns and other landscaping; choose less harmful alternatives such as non-chemical controls.
- ☐ For mowed areas, reduce mowing frequency and increase mowing height, allowing flowering weeds to flourish.
- ☐ Leave dead wood on site, including dead logs, snags, and brush; consider planting flowers around these features, to add intention and aesthetic value.
- ☐ Leave leaf litter on-site—keep a thin layer of leaves on lawn; use the rest to mulch trees/ shrubs/ garden and/or rake to woodland edges if available.
- ☐ Leave bare spots or areas with patchy vegetation in lawn; avoid thick turf and sod.
- ☐ Avoid plastic mulch/ weed barrier, heavy wood chips, and treated wood chips.
- ☐ Leave dead wildflower stems standing over the ***winter***; prune them back in ***early spring*** to 8–12" to create nesting sites for stem-nesting bees.
- ☐ Prune shrubs with pithy stems, to create nesting sites for stem-nesting bees.
- ☐ Leave some areas of lawn unmown to create tall grass habitat.
- ☐ Install a water feature (e.g., bird bath with stones to prevent insects from drowning) for pollinators that need water for nest building or other uses.
- ☐ Seed a "bee lawn" (incorporate clovers & other flowers into new or existing lawn).

FRUIT & VEGETABLE GARDENS

- ☐ Plant fruit trees and fruit-bearing shrubs, including **native** species when possible (e.g., blueberries [*Vaccinium*], currants and gooseberries [*Ribes*], elderberries [*Sambucus*], chokeberries [*Aronia*]—species with 🌳 on **Table 2**, page 12).
- ☐ Plant **native** raspberries/ blackberries (*Rubus*); prune in ***early spring*** to create nest sites for stem-nesting bees.
- ☐ For more continuous fruit and flowers, plant ever-bearing varieties of strawberries (*Fragaria*), raspberries, and other fruits.
- ☐ Plant a tea or herb garden and allow plants like basil (*Ocimum*), mint (*Mentha*), and lavender (*Lavendula*) to flower; most herbs do very well in containers if space is limited (see **Table 2**, page 12).
- ☐ Plant bee-pollinated vegetables like squash (*Cucurbita*) and tomatoes (*Solanum*) **and** allow pollinator-attractive culinary garden plants—such as lettuce (*Lactuca*) and mustard (*Brassica*)—to bolt in order to provide additional floral resources (see **Table 2**, page 12).
- ☐ Avoid pesticide use on fruit and vegetable crops; manage pests by using prevention strategies (e.g., crop rotation or selection of resistant varieties) and non-chemical pest control methods (e.g., hand-picking or insectary plantings to promote beneficial insects for natural pest control).

COMMUNITY ACTION

- ☐ Organize a neighborhood **native** plant or seed exchange (**never** share non-native plants that are aggressive / potentially invasive).
- ☐ Create habitat in community hubs (e.g., libraries, post-offices, schools, or senior centers) or in unused spaces like sidewalk medians.
- ☐ Volunteer with a local park to improve habitat (e.g., removing invasive species or collecting wildflower seeds).
- ☐ Provide signage to explain your pollinator conservation actions to your neighbors.
- ☐ Host a tour of your pollinator friendly yard or garden.
- ☐ Talk about pollinators and their habitat needs to your neighbors, friends, family, local businesses, schools, library, church, etc.
- ☐ Talk to your city officials or local colleges about signing a bee friendly resolution and/or getting certified as a Bee City USA or Bee Campus USA.
- ☐ Participate in a community science project, such as bumble bee or monarch monitoring (see *Resources*, page 11).

Print additional copies of this and other habitat assessment tools at: xerces.org/habitat-assessment-guides.

Xerces Society Recommended High Value Plants for Pollinators

★ **POLLINATOR "SUPERFOODS"**—Certain native plants are known to provide exceptional forage for a wide variety of bees and other pollinators, including monarchs. See table below for a list of some of these plants.

FOOD FOR SPECIALIST BEES—Many native bees are "specialists," only collecting pollen and other resorces from specific plants. See table below for a list of plants known to provide food for a number of specialist bees.

LEPIDOPTERA HOST PLANTS—The caterpillars of many butterflies and moths can only feed on specific plants. For example, great spangled fritillary larvae only feed on violet leaves. Some plants support an amazing diversity of lepidoptera; e.g., oaks support hundreds of butterflies and moths species. Since most native plants support at least one butterfly or moth, we use for a genus supports over five species ***OR*** one species that doesn't eat anything else.

NOTE: *These lists are not exhaustive—see Resource section to identify additional native plants for your site. Some of these plants may not be appropriate for every region/site.*

TABLE 1: SUPERFOODS & HOST PLANTS

HIGH VALUE PLANTS Appropriate for *Most* Regions

Native Wildflowers

- ***Agastache*** [giant hyssop]—★
- ***Asclepias*** [milkweed]—★
- ***Cirsium*** [thistle (native)]—★
- ***Echinacea*** [purple coneflower]—
- ***Euthamia*** [goldentop]—★
- ***Helianthus*** [sunflower]—★
- ***Lupinus*** [lupine]—
- ***Monarda/Monardella*** [beebalm]—★
- ***Penstemon*** [beardtongue]—
- ***Ratibida*** [coneflower]—
- ***Salvia*** [sage]—
- ***Solidago*** [goldenrod]—★
- ***Symphyotrichum*** [aster]—★
- ***Verbena*** [vervain]—
- ***Viola*** [violets]—

Native Shrubs & Trees

- ***Acer*** [maple]—★
- ***Amelanchier*** [serviceberry]—★
- ***Amorpha*** [leadplant/false indigo]—★
- ***Ceanothus*** [wild lilac]—★
- ***Cercis*** [redbud]—
- ***Cornus*** [dogwood]—
- ***Pinus*** [pine]—
- ***Prunus*** [wild plum]—★
- ***Quercus*** [oak]—
- ***Rhus*** [sumac]—
- ***Ribes*** [currant]—★
- ***Rosa*** [wild rose]—★
- ***Rubus*** [raspberry/blackberry]—★
- ***Salix*** [willow]—★
- ***Sambucus*** [elderberry]—
- ***Spiraea*** [spirea/meadowsweet]—★
- ***Vaccinium*** [blueberry/cranberry]—★
- ***Viburnum*** [arrowwood/viburnum]—★

Native Grasses

- ***Andropogon*** [bluestem]—
- ***Bouteloua*** [grama]—
- ***Carex*** [sedges]—
- ***Elymus*** [wheatgrass, wildrye]—
- ***Hierochloe*** [sweetgrass]
- ***Koeleria*** [Junegrass]—
- ***Muhlenbergia*** [muhly]—
- ***Schizachyrium*** [little bluestem]—
- ***Sporobolus*** [dropseed]—

HIGH VALUE PLANTS for *Specific* Regions

Pacific Northwest

- ***Baccharis*** [coyotebrush]—★
- ***Berberis*** [barberry]—★
- ***Clarkia*** [clarkia]—★
- ***Cleome*** [bee plant]—★
- ***Fragaria*** [strawberry]—
- ***Grindelia*** [gumweed]—★
- ***Helenium*** [sneezeweed]—★
- ***Phacelia*** [phacelia]—★
- ***Rhamnus*** [buckthorn]—
- ***Sidalcea*** [checkerbloom]—★

Great Plains & Intermountain West

- ***Callirhoe*** [poppymallow]—
- ***Dalea*** [prairie clover]—★
- ***Ericameria*** [goldenbush, rabbitbrush]—★
- ***Eriogonum*** [wild buckwheat]—
- ***Geranium*** [wild geranium]—
- ***Heterotheca*** [false goldenaster]—★
- ***Machaeranthera*** [tansyaster]—★
- ***Oenothera*** [evening primrose]—
- ***Sphaeralcea*** [globemallow]—★
- ***Vernonia*** [ironweed] —★

Great Lakes & Northeast

- ***Cephalanthus*** [buttonbush]—★
- ***Dalea*** [prairie clover]—★
- ***Eutrochium*** [joe pye weed]—★
- ***Ilex*** [holly]—★
- ***Liatris*** [blazing star]—★
- ***Packera*** [ragwort]—
- ***Pycnanthemum*** [mountain mint]—★
- ***Silphium*** [cup plant]—★
- ***Zizia*** [Alexanders, zizia]—★
- ***Carya*** [hickory]—

Southwest & California

- ***Arctostaphylos*** [manzanita]—★
- ***Baccharis*** [coyotebrush]—★
- ***Berberis*** [barberry]—★
- ***Bidens*** [beggarticks]—★
- ***Eriogonum*** [wild buckwheat]—
- ***Grindelia*** [gumweed]—★
- ***Larrea*** [creosote bush]—★
- ***Monardella*** [monardella]—★
- ***Phacelia*** [phacelia]—★
- ***Salvia*** [sage]—

Midwest & South Central

- ***Boltonia*** [doll's daisy/false aster]—★
- ***Chamaecrista*** [partridge pea]—
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- ***Tillia*** [basswood]—
- ***Verbesina*** [wingstem]—★
- ***Zizia*** [Alexanders, zizia]—★

Southeast & Mid-Atlantic

- ***Baptisia*** [wild indigo]—
- ***Coreopsis*** [tickseed]—
- ***Desmodium*** [tick-trefoil]—
- ***Eutrochium*** [joe pye weed]—★
- ***Gaillardia*** [blanketflower]—
- ***Helenium*** [sneezeweed]—★
- ***Hibiscus*** [rosemallow]—
- ***Ilex*** [holly]—★
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GROWTH FORMS: Wildflower/Forb ( ) Shrub/Tree ( ) Grass/Sedge ( )

TABLE 2: EDIBLE LANDSCAPING PLANTS WITH VALUE TO POLLINATORS

- ***Abelmoschus esculentus*** [okra]
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- ***Asimina***† [pawpaws]
- ***Anethum graveolens**** [dill]
- ***Brassica**** [broccoli, cabbage, cauliflower, kale]
- ***Calendula*** [calendula]
- ***Capsicum***† [peppers (bell/chili, habanero)]
- ***Castanea***† [chestnut, chinquapin]
- ***Citrullus*** [pine melon, watermelon]
- ***Citrus*** [lemon, lime, tangerine]
- ***Coriandrum sativum**** [coriander/cilantro]
- ***Corylus***† [hazelnut]
- ***Cucumis*** [cucumber, melon]
- ***Cucurbita***† [pumpkin, squash]
- ***Diospyros virginiana***† [common persimmon]
- ***Fagopyrum esculentum**** [buckwheat]
- ***Foeniculum vulgare**** [fennel]
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- ***Pyrus*** [pear]
- ***Ribes***† [currant (black, golden, red)]
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- ***Vicia***† [fava bean, vetch]

NOTES: *Must be allowed to bolt/flower †Some or all members of the genus are NATIVE to North America

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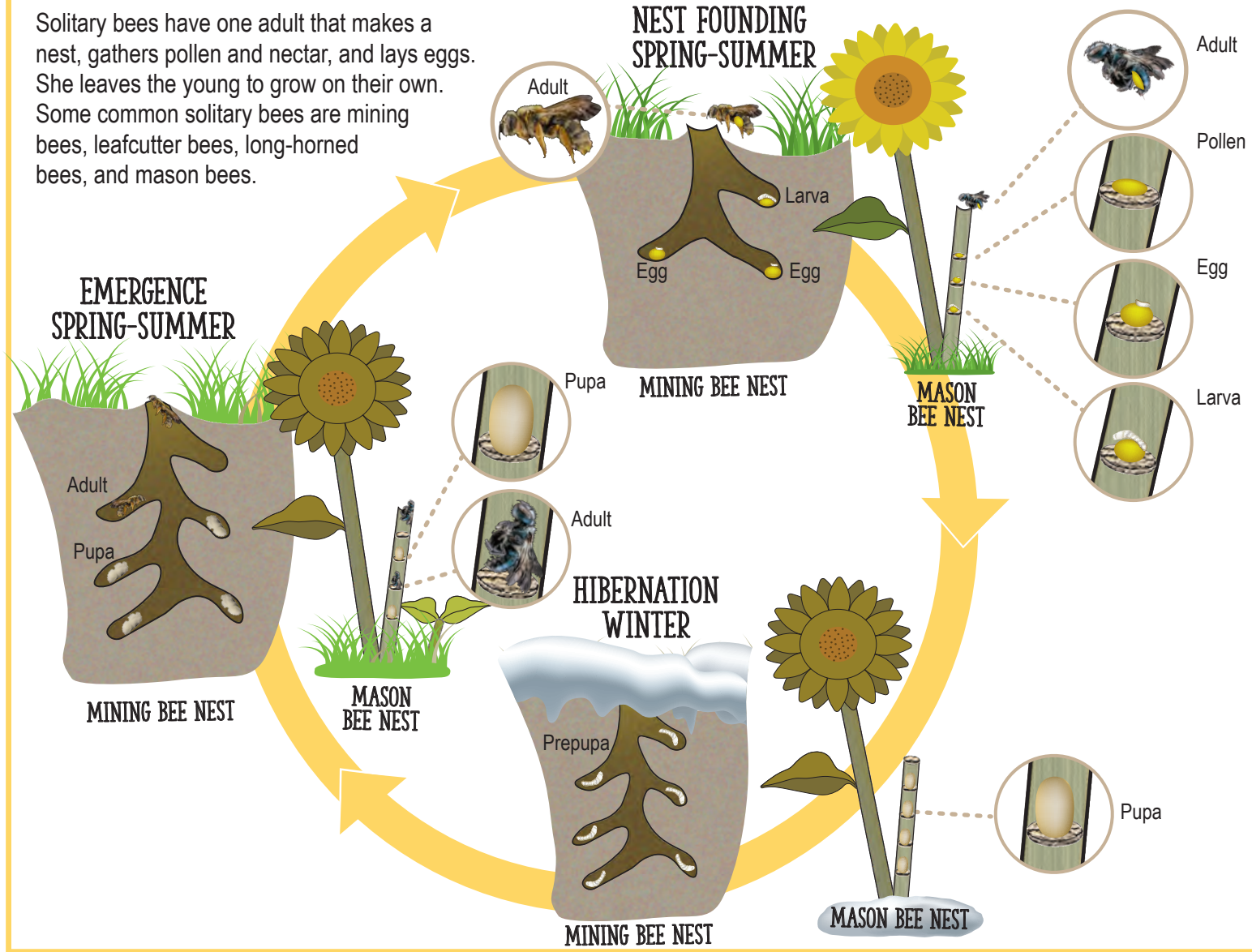
A BEE NEST ROUND THE YEAR

ANNUAL CYCLE OF SOLITARY BEES

Solitary bees have one adult that makes a nest, gathers pollen and nectar, and lays eggs. She leaves the young to grow on their own. Some common solitary bees are mining bees, leafcutter bees, long-horned bees, and mason bees.



NEST FOUNDING SPRING-SUMMER

Mother bees collect and mix pollen and nectar, and lay eggs on pollen balls in a series of separate chambers. The mother bee leaves her young on their own and will die soon after nest construction is done. Eggs hatch into larvae and eat the pollen ball.

HIBERNATION WINTER

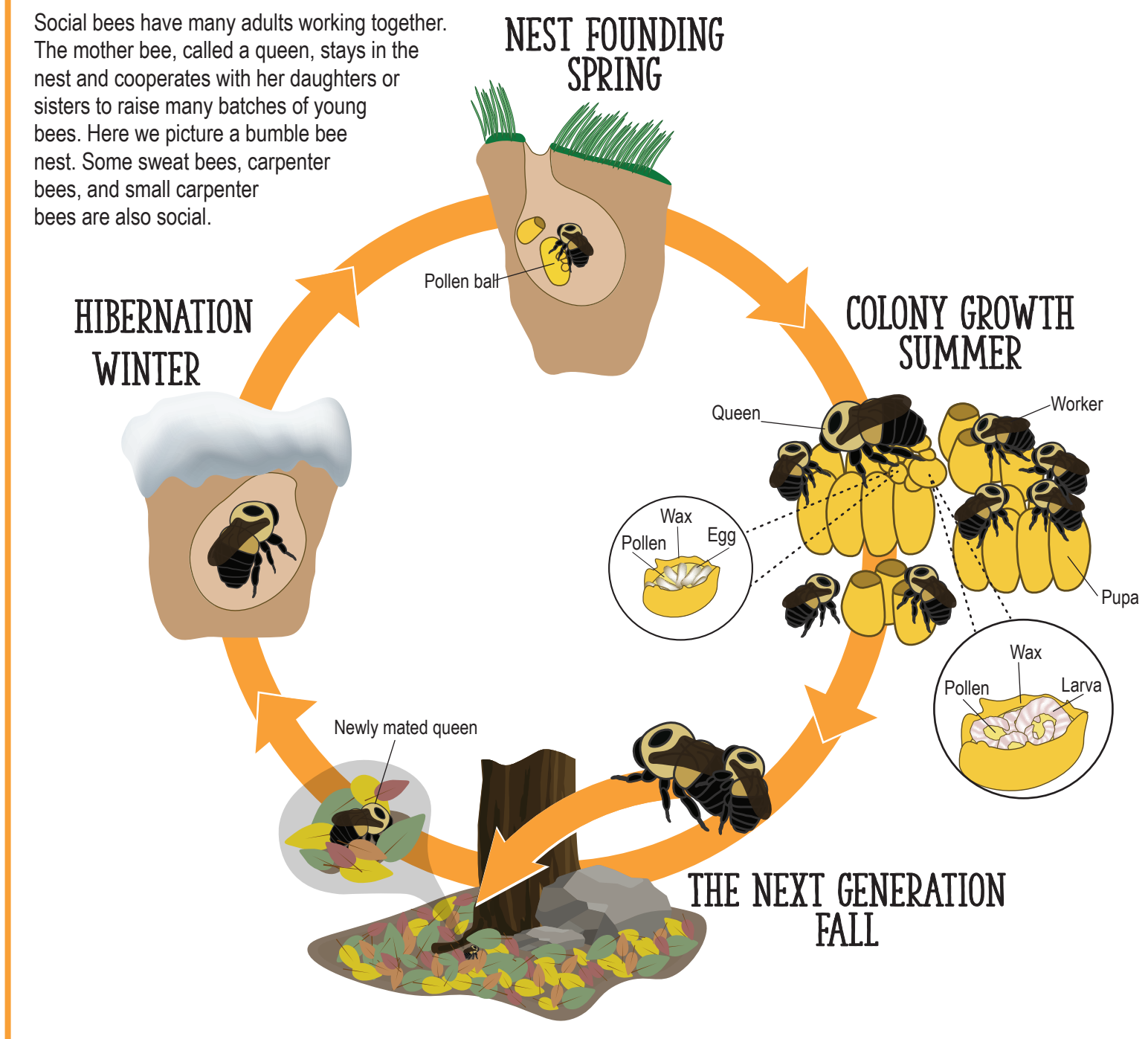
The larvae have eaten all their pollen and spend the winter at rest in the nest as prepupae, pupae (sometimes in cocoons), or adults.

EMERGENCE SPRING-SUMMER

Adult bees leave the nest, find mates, and the females build new nests. Different species of bees emerge at different times.

ANNUAL CYCLE OF SOCIAL BEES

Social bees have many adults working together. The mother bee, called a queen, stays in the nest and cooperates with her daughters or sisters to raise many batches of young bees. Here we picture a bumble bee nest. Some sweat bees, carpenter bees, and small carpenter bees are also social.



NEST FOUNDING SPRING

Queen bees mix pollen and nectar to form a pollen ball and lay eggs on it. Bumble bee queens lay multiple eggs on a pollen ball while most other social bees lay one egg on each pollen ball.

COLONY GROWTH SUMMER

Nests grow through the summer. Adult social bees stay in the nest after they emerge. Bumble bee nests have a queen and her daughters working together. In some social bees, it is sister bees who work together.

THE NEXT GENERATION FALL

Social bees produce the next generation in the fall. New queens and males leave the nest to find mates from other nests. Newly mated queens search for a place to spend the winter, usually digging themselves into the ground.

HIBERNATION WINTER

For most social bees, only new queens survive the winter. In honey bee colonies, the queen and workers survive the winter together in the nest.

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Funding provided by the Minnesota Environment and Natural Resources Trust Fund.

University of Minnesota Extension
Department of Entomology, Bee Lab
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Illustration Credit:
Elaine Evans (top)
Jeremy Hemberger (bottom)

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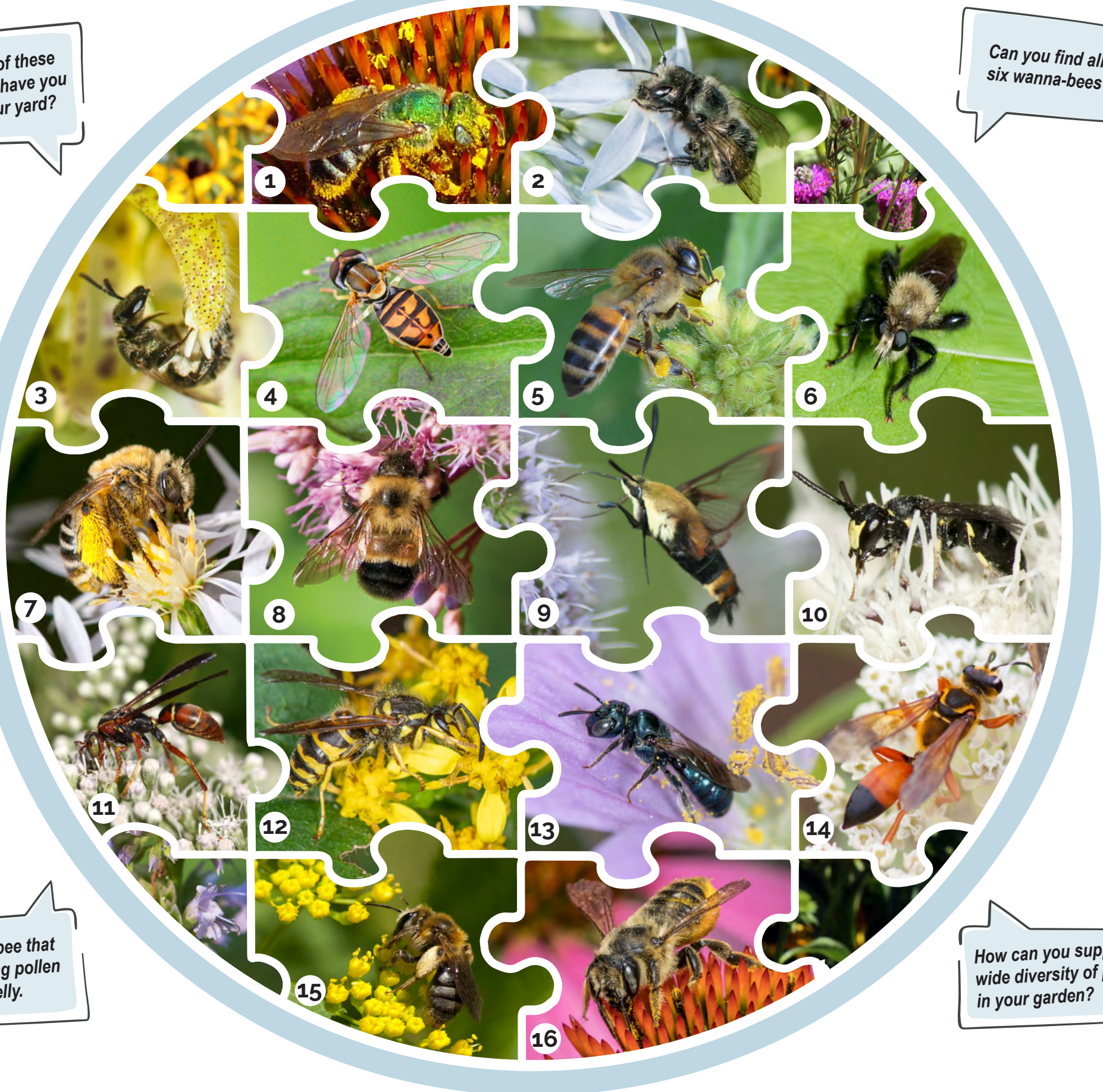
BEES OR WANNA-BEES?

How many of these pollinators have you seen in your yard?

Can you find all six wanna-bees?



Find the bee that is carrying pollen on her belly.

How can you support a wide diversity of pollinators in your garden?

WHAT IS A BEE?

Bees are insects that get all of their food from flowers. They are usually fuzzy, to gather pollen that sticks to their hairs.

Although most people picture bees being yellow and black, they come in all colors of the rainbow.

Pollinators come in many different sizes and shapes to match with different flowers.

WHAT IS A WANNA-BEE?

Some flies, wasps, and moths look a lot like bees. These insects mostly visit flowers for nectar, and do not move as much pollen as bees, but can still be important pollinators.

KEY

1. GREEN METALLIC SWEAT BEE (May-September)
2. MASON BEE (April-June)
3. METALLIC SWEAT BEE (April-September)
4. FLOWER FLY* (April-September)
5. HONEY BEE (April-September)
6. ROBBER FLY* (June-September)
7. LONG-HORNED BEE (July-September)
8. BUMBLE BEE (April-September)
9. HUMMINGBIRD MOTH* (May-August)
10. MASKED BEE (June-September)
11. PAPER WASP* (April-Sept)
12. YELLOWJACKET* (April-September)
13. SMALL CARPENTER BEE (May-September)
14. SPHECID WASP* (June-September)
15. MINING BEE (April-September)
16. LEAFCUTTER BEE (June-September)

*WANNA-BEE

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Photos by:
Heather Holm
iNaturalist_dleaon1
Elaine Evans

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FOUR ACTIONS TO HELP POLLINATORS

1. PLANT FLOWERS

Observe flowers to see which ones attract diverse pollinators. Prioritize planting flowers that bloom in early spring or fall. Keep plants free of pesticides, including fungicides and insecticides.

2. PROVIDE HOMES

GROUND NEST

Varied: bare soil, covered with leaves, disturbed, undisturbed.

CAVITY NEST

Logs, plant stems cut to 8-inches.

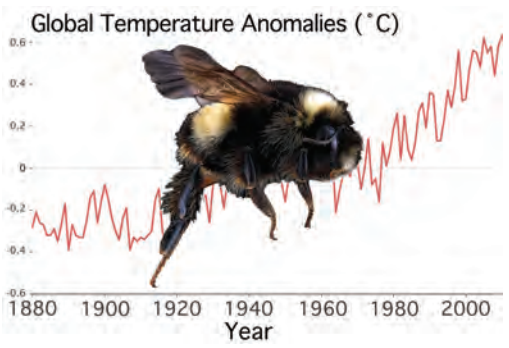
BUMBLE BEE NEST

Piles of dried grass and sticks in undisturbed areas.

CATERPILLARS

Diverse native plants.

3. TAKE CLIMATE ACTION



Pollinators are suffering due to climate change. Reduce the release of greenhouse gasses by using clean energy and supporting environmental regulations. Plant trees, grasslands, and sustainable crops. Add more plant-based foods to your diet.

4. COLLECT DATA

Collect and share pollinator observations with scientists. Help scientists answer important questions and conserve pollinators.

MONARCH LARVA MONITORING PROJECT

monarchjointventure.org/mlmp

BUMBLE BEE WATCH

bumblebeewatch.org

iNATURALIST

iNaturalist.org

Learn more at BeeLab.umn.edu

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2. Julia Brokaw, Elaine Evans, Wendy Caldwell
3. Design by Elaine Evans
4. Wendy Caldwell

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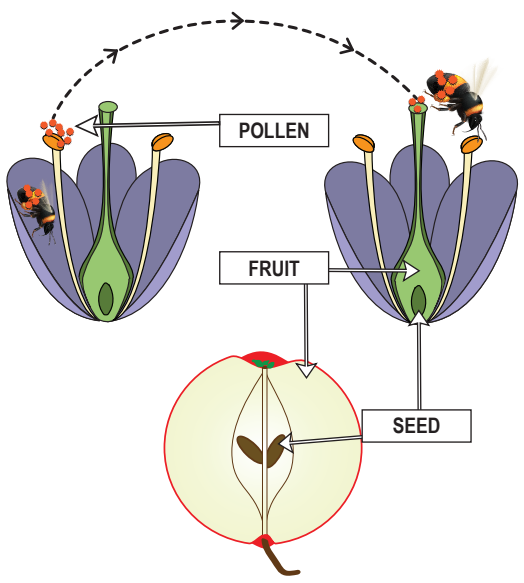
HOW ARE THE POLLINATORS DOING?

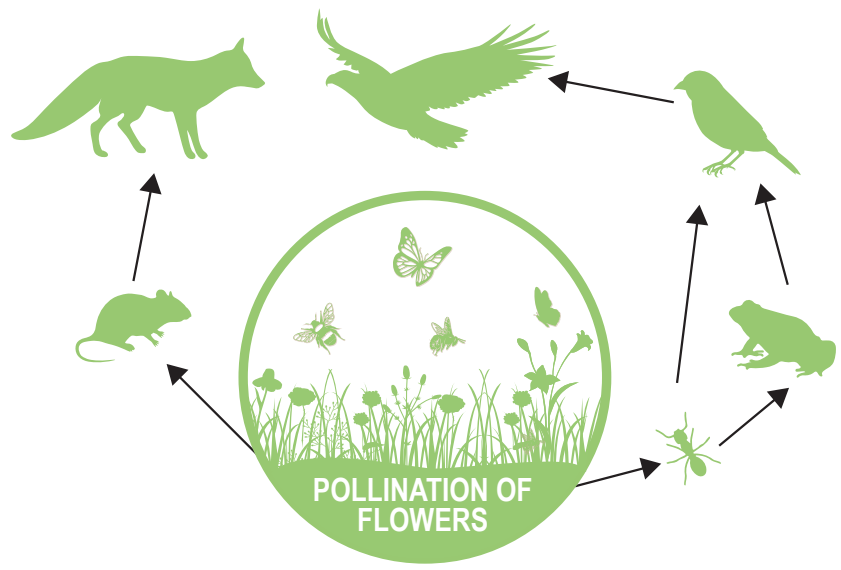
WHY ARE POLLINATORS IMPORTANT?

POLLINATION



By moving pollen between flowers, pollinators help plants produce fruits, seeds, and nuts.

80%
OF PLANTS RELY ON ANIMALS FOR POLLINATION



Pollination also creates the next generation of plants to feed and house countless creatures, build soil, and filter water. Our ecosystem depends on healthy and diverse pollinator populations.

IN DECLINE, OR FINE?

Some pollinators are in decline. Some appear stable. For most, we don't know how they are doing.

BUMBLE BEES

Some species are **near extinction**.

ONE out of THREE

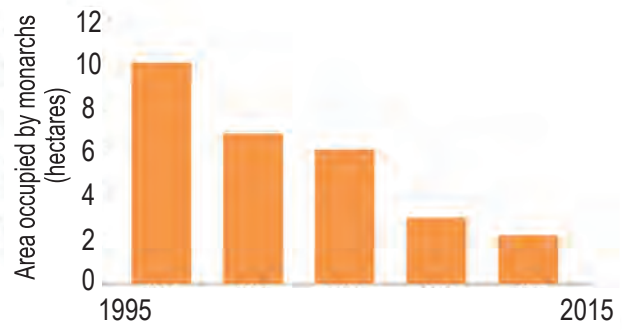
BUMBLE BEE SPECIES ARE IN DECLINE

HONEY BEES

Honey bees are **NOT in decline**, but have health problems resulting in many colony deaths. However, beekeepers can raise more bees.

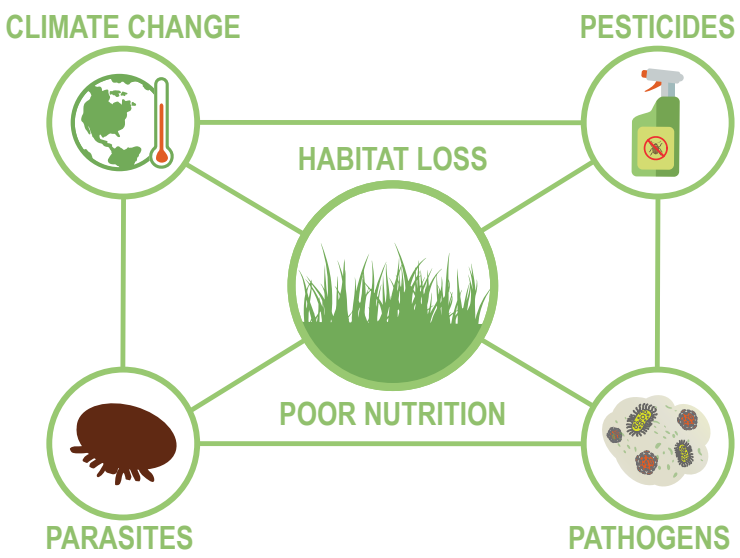
MONARCH BUTTERFLIES

Monarch butterfly populations are **in decline**.



Monarch Colonies At Overwintering Sites in Mexico*

WHAT IS CAUSING DECLINES?



Fewer flowers and nesting sites, more pesticides, increases in parasites and diseases, and global climate change are all major problems for pollinators.

ACTIONS TO HELP POLLINATORS

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

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Photo Credit:
Heather Holm
iNaturalist,
Wendy Caldwell

*Monarch colonies at overwintering sites in Mexico:

Years	Data collected by
1994-2003	Monarch Butterfly Biosphere Reserve (MBBR)
2004-2020	WWF-Telcel Alliance, in coordination with the MBBR
2000-2001	As reported by Garcia-Serrano et. al (The Monarch Butterfly: Biology and Conservation, 2004)

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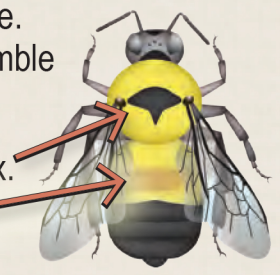
RARE MINNESOTA BEES

RUSTY PATCHED BUMBLE BEE

Once common, the rusty patched bumble bee is now rare. To distinguish rusty patched bumble bees from other bumble bees look for these features:

1. T-shape of black hairs on an otherwise yellow thorax.
2. Rusty patch on second abdominal segment.



COMMONLY MISTAKEN FOR RUSTY PATCHED BUMBLE BEES:

TRICOLORED BUMBLE BEES (*Bombus ternarius*) have bright orange hairs on abdominal segments 2 and 3.

BROWNBELTED BUMBLE BEES (*Bombus griseocollis*) have a rusty brown patch on the second abdominal segment, bordered at the back by black hairs.

HALF-BLACK BUMBLE BEES (*Bombus vagans*) have all yellow hairs on abdominal segments 2 and 3.

REDBELTED BUMBLE BEES (*Bombus rufocinctus*) have many different color patterns. Some have orange hairs on the 2nd abdominal segment, but not in the same pattern as the rusty patched bumble bee.

YELLOWBANDED BUMBLE BEE

Though once common, the yellowbanded bumble bee (*Bombus terricola*) is now only found in scattered locations, mostly in northern Minnesota.

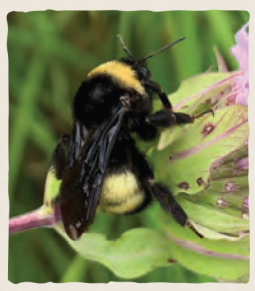
To distinguish yellowbanded bumble bees from other bumble bees, look for these features:

1. Black hair on the back half of the thorax.
2. A fringe of yellow hairs appearing with black hairs at the end of the abdomen.

COMMONLY MISTAKEN FOR YELLOW BANDED BUMBLE BEES:

Black and gold bumble bees (*Bombus auricomus*) and American bumble bees (*Bombus pensylvanicus*) are much larger and have no yellow fringe at the end of the abdomen.

Bombus auricomus



Bombus pensylvanicus

ASHTON'S CUCKOO BEE

Possibly Minnesota's rarest bee, Ashton's cuckoo bumble bee (*Bombus ashtoni*) takes over other bumble bee nests, relying on rusty patched and yellow-banded bumble bees (both in decline), instead of making their own. Look for bumble bees with sparse hair on the abdomen. There are usually light hairs near the tip of the abdomen.

OIL BEES

Find yellow loosestrife flowers (*Lysimachia*) near wetlands, then look for medium-sized, shiny black bees with long hair on their back legs below the knee. Oil bees (*Macropis*) only visit yellow loosestrife.

Yellow loosestrife

Help us find these rare bee pollinators. Have your camera ready to take and share photos on **iNaturalist.org**

You can help document bumble bee locations and trends by taking photos for the bumble bee watch program. **bumblebeewatch.org**

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Photo Credit:
Susan Blayney, Heather Holm, Joel Gardner, USGS

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MYTHS AND REALITIES FOR POLLINATORS

MYTH

Managing honey bee colonies as a beekeeper will save the bees.

REALITY

There is a honey bee health crisis, but honey bees are not at risk of extinction as professional beekeepers can replace dead colonies. Keeping honey bees in areas without enough flowers or proper management can harm all bees, some at risk of extinction.

MYTH

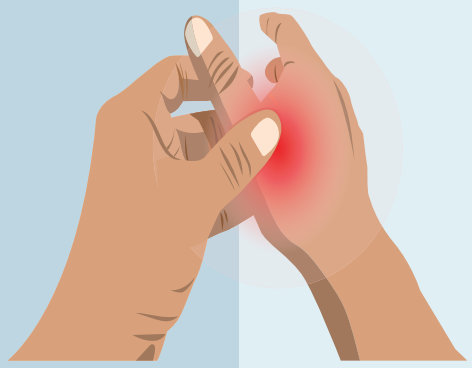
If you plant flowers for pollinators in your yard, you will get stung.

REALITY

When visiting flowers, bees are not defensive. When bees are visiting flowers they are focused on collecting nectar and pollen and usually ignore people. Most bees are extremely gentle even at their nests.

MYTH

Swelling from an insect sting indicates an allergic reaction.



REALITY

Swelling is a normal reaction to a bee sting. While allergic reactions are serious, only 3% of people are truly allergic to stinging insects. We suggest visiting a health professional to diagnose any venom allergies.

MYTH

All wasps are mean.

REALITY

Most wasps are harmless and beneficial. Wasps are an incredibly diverse group of insects and are closely related to bees. A few species can be bothersome, but many wasps control populations of insect pests and can be important pollinators. #wasplove

MYTH

Agriculture is bad for bees.

REALITY

Farmers can have positive impacts on pollinators with pollinator-friendly agriculture. Pesticide exposure and lack of flowers and wild areas on farms harm pollinators, but with our support, farmers can create large areas of pesticide-free pollinator habitat.

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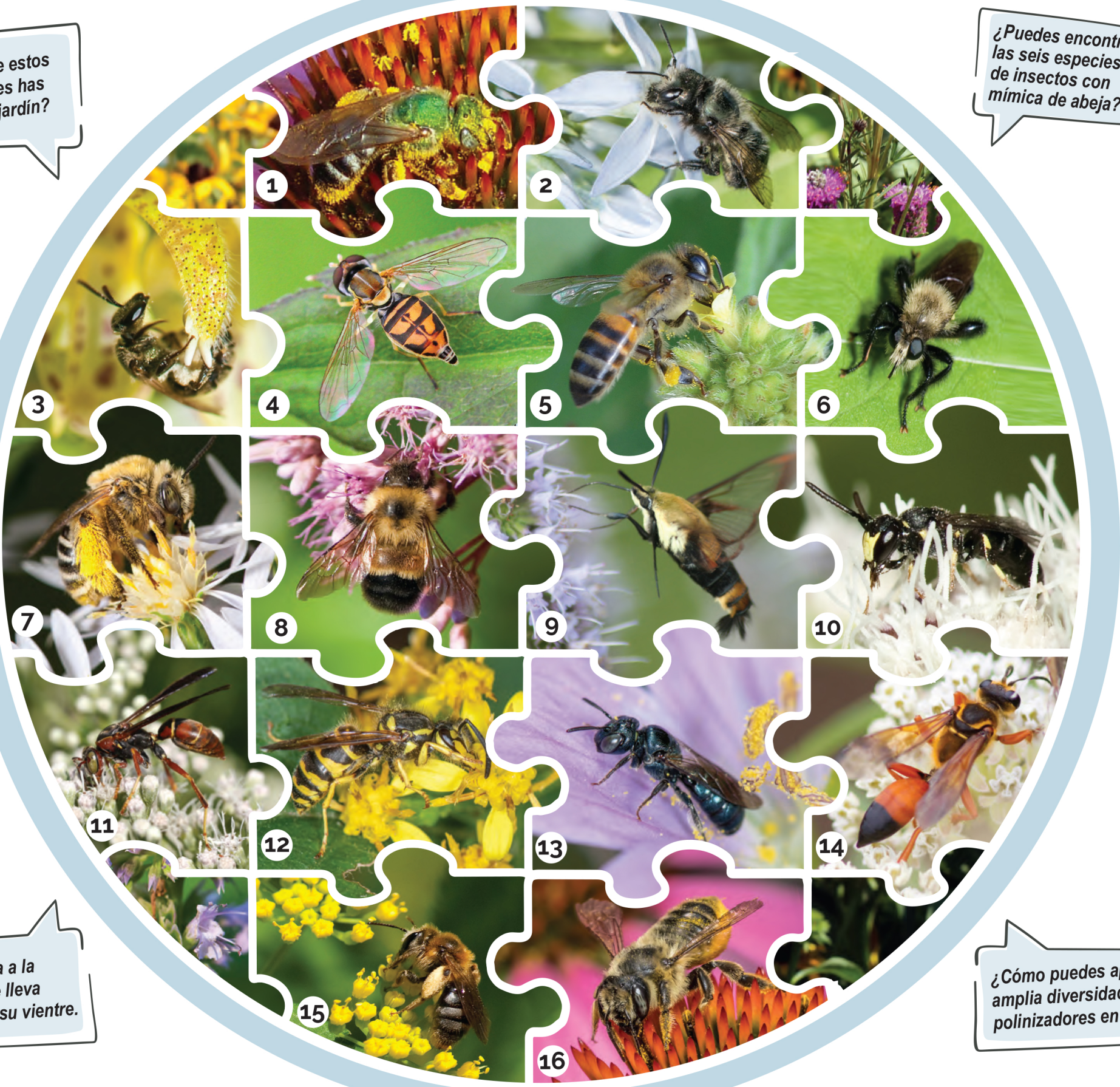
ABEJAS O MÍMICAS

¿Cuántos de estos polinizadores has visto en tu jardín?

¿Puedes encontrar las seis especies de insectos con mímica de abeja?



Encuentra a la abeja que lleva polen en su vientre.

¿Cómo puedes apoyar una amplia diversidad de polinizadores en tu jardín?

¿QUÉ ES UNA ABEJA?

Las abejas son insectos que obtienen todo su alimento de las flores. Suelen estar peluditas para poder recoger el polen que se adhiere a su pelo. Aunque la mayoría de la gente imagina que las abejas son solamente de color amarillo y negro, ellas vienen en todos los colores del arcoíris.

Los polinizadores vienen en diferentes tamaños y formas para combinar con diferentes flores.

¿QUÉ ES UN INSECTO CON MÍMICA DE ABEJA?

Algunas moscas, avispas y polillas se parecen mucho a las abejas. Estos insectos visitan principalmente las flores por néctar, y no mueven tanto polen como las abejas, pero aún pueden ser importantes polinizadores.

CLAVE

1. Abeja Verde Metálico *Agapostemon*
2. Abeja Albañil *Osmia*
3. Abeja del Sudor *Lasioglossum*
4. Mosca de las Flores* *Syrphidae*
5. Abeja Doméstica de la Miel *Apis mellifera*
6. Mosca Ladrona* *Asilidae*
7. Abeja de Cuernos Largos de Cardo *Melissodes*
8. Abejorro *Bombus*
9. Mariposa Picaflor* *Hemaris*
10. Abeja Enmascarada *Hylaeus*
11. Avispa de Papel* *Polistes*
12. Avispón Amarillo* *Vespa*
13. Abeja Carpintera *Ceratina*
14. Avispón de Cintura de Hilo* *Sphecidae*
15. Abeja Minera *Andrena*
16. Abeja Cortadora de Hojas *Megachile*

*MÍMICAS

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Crédito de fotografía:
Heather Holm
iNaturalist_dleaon1
Elaine Evans

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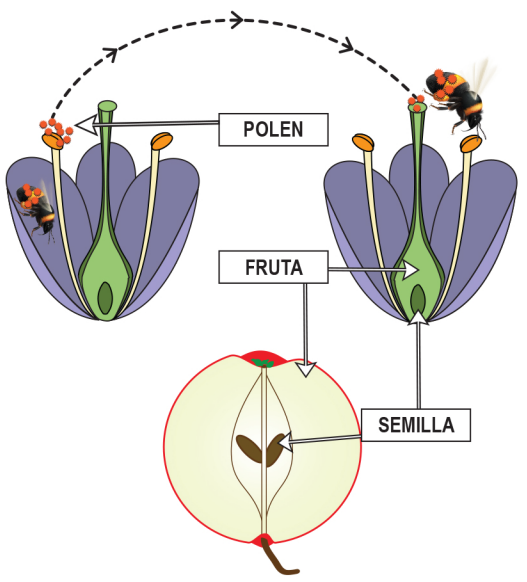
CÓMO LES ESTÁ YENDO A LOS POLINIZADORES

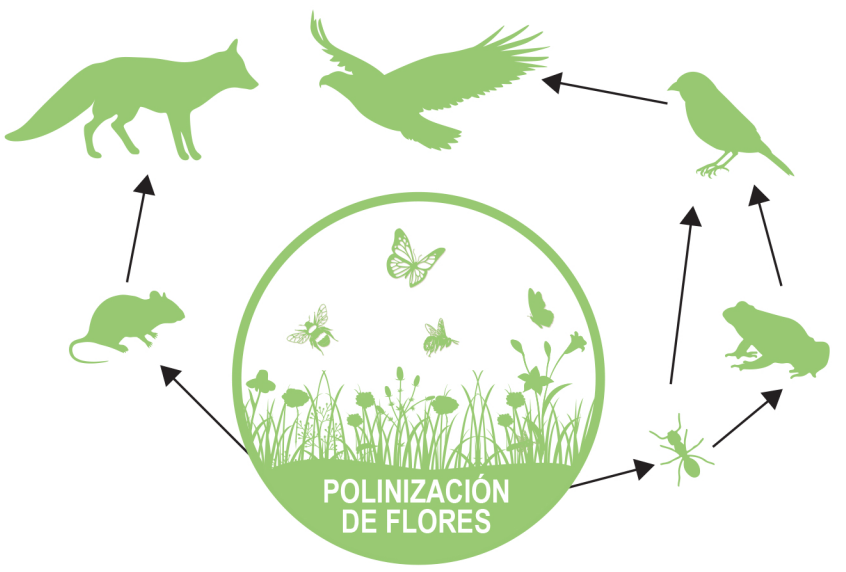
¿POR QUÉ SON IMPORTANTES LOS POLINIZADORES?

POLINIZACIÓN



Al mover el polen entre las flores, los polinizadores ayudan a las plantas a producir frutos, semillas y nueces.

EL **80%** DE LAS PLANTAS DEPENDEN DE LOS ANIMALES PARA LA POLINIZACIÓN.



La polinización también crea la próxima generación de plantas para alimentar y albergar a innumerables criaturas, construir suelo y filtrar el agua. Nuestro ecosistema depende de poblaciones de polinizadores saludables y diversas.

¿EN DECLIVE O BIEN?

Algunos polinizadores están en declive. Algunos parecen estables. Para la mayoría, no sabemos cómo les está yendo.

ABEJORROS

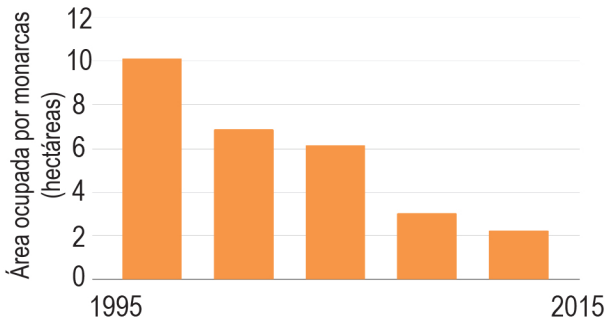
Algunas especies están **al borde de la extinción**.

ABEJAS MELÍFERAS

Las abejas melíferas **NO están en declive**, pero tienen problemas de salud que provocan la muerte de muchas colonias. Sin embargo, los apicultores pueden criar más abejas.

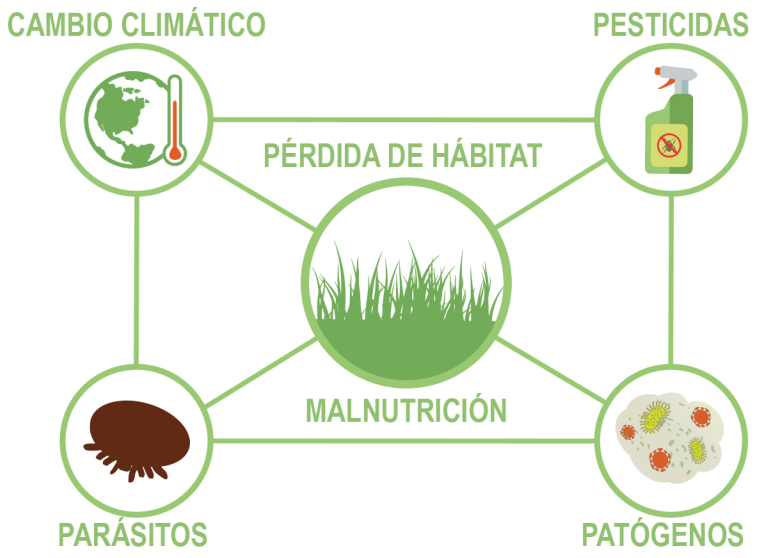
MARIPOSAS MONARCA

Las poblaciones de mariposas monarca **están en declive**.



Colonias de monarcas en sitios de hibernación en México *

¿QUÉ ESTÁ PROVOCANDO LOS DECLIVES?



Menos flores y sitios de anidación, más pesticidas, aumento de parásitos y enfermedades, y el cambio climático global son problemas importantes para los polinizadores.

ACCIONES PARA AYUDAR A LOS POLINIZADORES

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iNaturalist,
Wendy Caldwell

* Colonias de monarcas en sitios de hibernación en México:

Años	Datos recopilados por
1994-2003	Reserva de la Biosfera Mariposa Monarca (MBBR)
2004-2020	WWF-Telcel Alliance, en coordinación con MBBR
2000-2001	Según lo informado por García-Serrano et. Alabama (The Monarch Butterfly: Biology and Conservation, 2004)

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CUATRO ACCIONES PARA AYUDAR A LOS POLINIZADORES

1. PLANTAR FLORES

Observe las flores para ver cuáles atraen a diversos polinizadores. Dele prioridad a la plantación de flores que florecen a principios de primavera y otoño. Mantenga las plantas libres de pesticidas, incluidos fungicidas e insecticidas.

2. PROPORCIONAR VIVIENDAS

NIDO EN EL SUELO

Variados: suelo desnudo, cubierto con troncos, tallos de plantas cortados a 8 pulgadas, hojas, perturbado, sin perturbación.

NIDO DE CAVIDAD

Troncos, tallos de plantas cortados a 8 pulgadas.

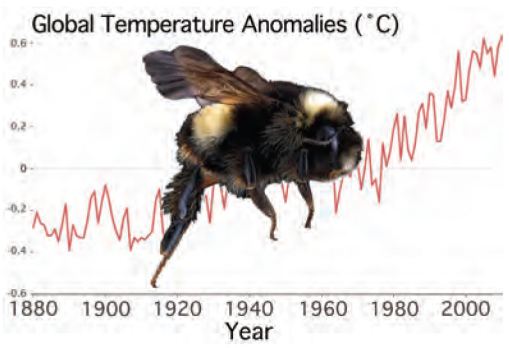
ABEJORRO

Deje montones de hierba seca y palos en áreas tranquilas.

ORUGAS

Diversas plantas autóctonas.

3. TOMAR ACCIÓN CLIMÁTICA



Los polinizadores están sufriendo debido al cambio climático. Reduzca la emisión de gases de efecto invernadero mediante el uso de energía limpia y respaldando las regulaciones ambientales. Plante árboles, pastizales y cultivos sostenibles. Agregue más alimentos de origen vegetal a su dieta.

4. RECOPILACIÓN DE DATOS

Recopile y comparta las observaciones de los polinizadores con los científicos. Ayude a los científicos a responder preguntas importantes y conservar a los polinizadores. Proyectos en los cuales puede participar:

MONARCH LARVA MONITORING PROJECT

monarchjointventure.org/mlmp

namonarchs.org/es/proyectos-piloto/monarch-larva-monitoring-project-2/

BUMBLE BEE WATCH

bumblebeewatch.org

iNATURALIST

iNaturalist.org

colombia.inaturalist.org

Obtenga más información en BeeLab.umn.edu

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1. Heather Holm, Courtney Celley/USFWS
2. Julia Brokaw, Elaine Evans, Wendy Caldwell
3. Design by Elaine Evans
4. Wendy Caldwell

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MITOS Y REALIDADES SOBRE LOS POLINIZADORES

MITO

Cuidando y manteniendo colonias de abejas melíferas, los apicultores salvarán a las abejas.

REALIDAD

Hay una crisis de salud de las abejas melíferas, pero las abejas melíferas no corren riesgo de extinción ya que los apicultores profesionales pueden reemplazar las colonias muertas. Mantener a las abejas melíferas en áreas sin suficientes flores o sin un manejo adecuado puede dañar a todas las abejas, algunas en riesgo de extinción.

MITO

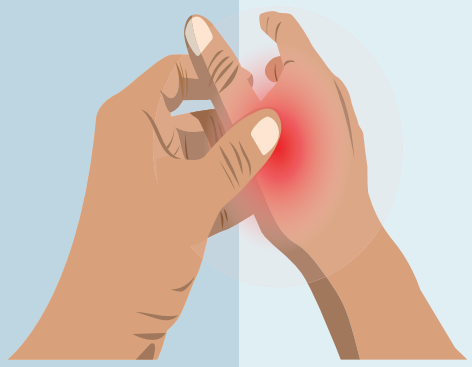
Si plantas flores para polinizadores en tu jardín, te picarán.

REALIDAD

Al visitar las flores, las abejas no se ponen a la defensiva. Cuando las abejas visitan las flores, se concentran en recolectar néctar y polen y generalmente ignoran a las personas. La mayoría de las abejas son extremadamente inofensivas incluso en sus nidos.

MITO

La hinchazón por la picadura de un insecto indica una reacción alérgica.



REALIDAD

La hinchazón es una reacción normal a la picadura de una abeja. Si bien las reacciones alérgicas son graves, solo el 3% de las personas son realmente alérgicas a los insectos que pican. Sugerimos visitar a un profesional de la salud para diagnosticar cualquier alergia al veneno.

MITO

Todas las avisp as son malas.

REALIDAD

La mayoría de las avispas son inofensivas y beneficiosas. Las avispas son un grupo de insectos increíblemente diversos y están estrechamente relacionados con las abejas. Algunas especies pueden ser molestas, pero muchas avispas controlan poblaciones de plagas de insectos y pueden ser importantes polinizadores. #wasplove (#amoravispa)

MITO

La agricultura es mala para las abejas.

REALIDAD

Los agricultores pueden tener impactos positivos en los polinizadores con una agricultura amigable con los polinizadores. La exposición a pesticidas y la falta de flores y áreas silvestres en las granjas dañan a los polinizadores, pero con nuestro apoyo, los agricultores pueden crear grandes áreas de hábitat de polinizadores libres de pesticidas.

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