Promoting Pollination
Farming for Native Bees

Overview

Pollination, the transfer of pollen grains to fertilize the ovules of flowers to produce seeds and fruits, is essential to agriculture and natural ecosystems around the globe. Some plants have lightweight pollen that can be transferred by wind, but many crops have heavier pollen, which must be transferred by animals. Insects, birds and bats can move pollen between flowers, but it is the bees that are most important for achieving pollination and maximum yields of many crop plants.

Crops that are highly dependent on pollinators to achieve economical yields include almond, apple, cherry, pear, cranberry, blueberry, blackberry, melons and squash. For most of these crops, bees are the insects providing most of the pollination activity as they move from flower to flower to collect food. Without bees to move pollen, crops would be far less productive, and many fruits and vegetables would not ripen as evenly or as quickly. Estimates suggest that one-third of our food is from crops pollinated by bees, so it is important for farmers to consider strategies to effectively pollinate their crops.

Since their introduction from Europe in the 1600's, honeybees have become the most economically-important pollinator for fruit and vegetable production in the US. Each year, farmers rent millions of beehives to pollinate their crops and help ensure good yields. However, honeybees are becoming more difficult to manage because of problems such as parasites and diseases. These and other issues are resulting in higher rental costs for farmers who need pollination services from honeybees. These problems have led to increased interest in using native pollinators which can be conserved on farms to help ensure crop pollination.

The goals of this activity are to introduce students to the importance of native bees as agricultural pollinators and to teach them how farmers can increase the populations of crop-pollinating native bees through landscape management.

Resource References

Farming for Bees. Xerces Society for Invertebrate Conservation
http://www.pollinator.org/Resources/Farming_for_Bees_2nd_edition.pdf

Pollinator Habitat: Assessment Guide for Organic Farms. The Xerces Society for Invertibrate Conservation
http://www.xerces.org/wp-content/uploads/2009/11/OrganicPollinatorHabitatAssessment.pdf
California Pollinator Project: Citizen Science Pollinator Monitoring Guide. Xerces Society for Invertebrate Conservation.
http://www.xerces.org/wp-content/uploads/2010/06/CA_CSM_guide.pdf

California Pollinator Project: Citizen Scientist Monitoring Pocket Guide. Xerces Society for Invertebrate Conservation
http://www.xerces.org/wp-content/uploads/2010/06/CA_CSM_pocket_guide.pdf

Agroforestry: Sustaining Native Bee Habitat For Crop Pollination. USDA National Agroforestry Center
http://plants.usda.gov/pollinators/Agroforestry_Sustaining_Native_Bee_Habitat_for_Crop_Pollination.pdf

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Introduction

In North America there are over 4,000 species of native bees. If adequate natural habitat is nearby, they can provide a significant portion of a crop's pollination need.

There are simple practices growers can do to make their farm and surrounding landscape more suitable for bees. These insects need undisturbed nesting sites and access to nectar and pollen when crops are not in bloom. They also need water and some need materials for nest building such as mud or leaves. Many farms have some of these resources already, but increasing them will likely improve native bee abundance over time.

This activity is intended to show students how farmers can increase the populations of crop-pollinating native bees through landscape management practices. Students will identify a few common native bees and learn about their life cycle and habitat needs. By performing a pollinator habitat assessment, students will learn how to identify the farming and landscape management practices that encourage the increase of native pollinator populations.

To Lead This Activity You Need to Know

This activity requires an advanced vocabulary and understanding of agro-ecology concepts that may not be suitable for all students. A thorough review of some of the terms in the score sheet may be necessary.
Facilitators of this activity need to possess the following in order to effectively lead students through this activity:

- Understanding of the role bees have in pollination
- Ability to identify agricultural crops that are pollinated by bees
- Ability to identify a few common native pollinators present on a farm and knowledge of their life cycle and habitat requirements (e.g. are they ground or cavity nesting)
- Knowledge of the potential positive and negative impacts of various farming practices on native bee populations
- Knowledge of the landscape features in and around the farm where the activity will occur

Key Concepts

- Pollination
- Native bees life cycles
- Habitat management
- Farmscaping
- Farming practices: weed and pest management, tillage, cultivation

Objectives

- Identify a few common native bees
- Learn life cycle of these bees
- Identify habitat needs of these bees
- Learn how to perform a pollinator habitat assessment
- Learn how farming practices affect pollinator habitat
- Recommend ways to increase native pollinator habitat at specific farm

Materials

- A farm or garden with a diversity of plants
- Clipboards and pencils for every student
- Pollinator Habitat Assessment Sheet (one for every student)

A day or so beforehand, the facilitator should identify crops that have a significant amount of native pollinator activity. Using the California Pollinator Project monitoring guide listed in the resource section, identify and record 3-4 of the observed pollinators, prioritizing native bees. Research these pollinators and make sure you can answer the following questions:

- What is the name of the pollinator?
- What are its basic characteristics (size, color, pattern, antenna size, etc.)?
- What is the life cycle of each pollinator?
- Is each pollinator ground nesting or cavity nesting?

Activity (45-50 minutes)

Native bee identification and habitat exploration (15-20 minutes)

1. After welcoming the students to the farm or garden and describing it briefly, tell them that the focus of today's visit is going to be learning about some of the native pollinators that live on the farm.
   - Ask them to define what pollination is.
   - Ask them to describe the different ways plants are pollinated (i.e. wind, self, animal).
   - Ask them to identify the most important animal pollinators (bees).
   - Tell them that 25% of what we eat is dependent on honey bee pollination. Explain to them that honey bee populations are declining due to factors such as increases in parasites and diseases and that native pollinators have the potential to help fulfill a lot of our crops' pollination needs.
   - Explain to them that farmers can increase the number of native pollinators by increasing their habitat and by using less destructive chemicals.
2. Break the group up into smaller groups (ideally 4-6 students). Give each student a clipboard, pencil, and copy of the Worksheet.
3. Tour the groups around the farm pointing out crops that require insects for pollination (e.g., tomatoes, zucchini, watermelon). Point out crops that don't require insects for pollination (e.g., corn, peppers). Lead each group to the sites you scouted the previous day. Have the students observe the plants and pollinators. Reassure them that the

insects will not hurt them. Honey bees and other insect are not aggressive when they are foraging for nectar and pollen. See if the students can describe some physical characteristics of each pollinator (size, color, striped, antenna length, etc.). Point out one or two of the pollinators you observed and researched the previous day. Inform the students of the life cycles of these pollinators (do they build their nest in the ground or in cavities, how long they live, what they need to survive, are they solitary or do they live in community, ect.) See if the group can find a nesting site.

Pollinator Habitat Assessment (30 minutes)

1. Explain to the students that there are many things a farmer can do to increase the populations of native pollinators of his or her farm. Doing a pollinator habitat assessment is one way farmers can use in assessing the impacts of their farming and landscape management practices on native pollinators.
2. Walk the students through the "Pollinator Habitat Assessment."
    - Have student fill in their name, date, and location description.
    - Have students draw a rough sketch of the farm and surrounding area. Make sure students include hedgerows, wooded areas, surface water, and farm borders.
    - Have students determine scores for the subsections and sections (1 – 5) of the habitat assessment.
    - After completing each subsection, ask students to recommend possible ways to increase the score. Have them record recommendations in boxes titled "Recommendations to Increase Score."
    - Transfer the section total scores into the summary table to generate the overall total score for the assessment
    - Ideally, score should be greater than 100. Scores less than 100 indicate poor habitat for native pollinators
    - Have students reflect on the farm map they drew. Have them indicate on the map the recommendations they recorded in the "Recommendation to Increase Score" box of each subsection.

Discussion and Reflection (10-15 minutes)

Discussion: Once they are finished, ask the group what they learned. Why should farmers work toward increasing the populations of native pollinators? What habitat requirements do native pollinators need? What are the names of a few native pollinators they observed today? What do they need to survive? What are some ways farmers can increase native pollinator habitat? What recommendations do you have for increasing the native pollinator habitat on our farm?

Pollinator Habitat Assessment

Name:_____

Site Summary

Date:
Location Description:
Sketch of Site:

Determining Scores for Habitat Assessment

Summary Table. (The figures entered into this summary table will be calculated during completion of the assessment.)

	Score
Section 1: Landscape Features (max score 20)	
Section 2: Farmscape Features (max score 30)	
Section 3: Foraging Habitat (max score 20)	
Section 4: Nesting Habitat (max score 28)	
Section 5: Farm Practices (max score 70)	
Overall score	

1a. What kind of vegetation is within ½ mile of the farm?		
Select only one	Score	Recommendation to increase score
Includes natural or semi-natural vegetation – ex: woods, creeks, brush, grasslands that aren't lawns.	10	
Agricultural crops- complex mix (15 or more different types of crops)	5	
Agricultural crops- simple mix (less than 15 different types of crops)	0	
Subtotal (1a)		

1b. Dominant vegetation in non-cropped area within ½ mile of farm		
Select only one	Score	Recommendation to increase score
All native plants	10	
Mix of native and non-native plants	7	
Non- Native flowering plants	5	
Weeds	0	
Sod-forming grasses (for lawns)	0	
Subtotal (1b)		
Landscape features total (1a+1b)		

2. Does the farm have		
Select all that apply	Score	Recommendation to increase score
Hedgerows	5	
Undisturbed bare ground	5	
Tree and shrub wind breaks	5	
Irrigation Ditches	5	
Meadows with wildflowers	5	
Bolted crops (vegetables that are flowering)	5	
Subtotal (2a)		

3a. Percentage of area at farm that is covered in flowering vegetation that is not crops.		
Select only one	Score	Recommendation to increase score
>85% cover	10	
45%-85% cover	7	
30%-45% cover	5	
20% - 30% cover	3	
<20%	1	
Subtotal (3a)		

3b. Number of species of non-grass flowering plants and flowering shrubs on farm that are currently blooming and support bees (this includes some crops and cover crop)		
Select only one	Score	Recommendation to increase score
5+ species	10	
3-4 species	5	
1 – 2 species	3	
0 species	0	
Subtotal (3b)		

4a. Potential sites for ground-nesting bees *Ground nests are often marked by a small mound of excavated soil, but may also be nothing more than a small hole in the ground. Nests may be dug in bare soil, area of patchy vegetation, or hidden among plants, including at the base of crop plants such as squash. They are usually in marginal areas such as ditch banks, and frequently can be found close to buildings or other structures.*		
Select all options that apply A= abundant, M= moderate, S = scarce	Score	Recommendation to increase score
Areas of well-drained bare ground, or with sparse vegetation	A = 5 M = 3 S = 1	
Areas with sandy loam soil	A = 5 M = 3 S = 1	
Areas with bare but compacted soil, or excavated soil (absent = 0, present = 3)	0-3	
Subtotal (4a)		
4b. Potential sites for wood and cavity nesting bees *The great majority of wood or cavity nesting bees do not excavate their own nest; they occupy pre-existing tunnels or cavities in snags, the center of pithy stemmed shrubs, and in brush piles. Bumble bees frequently nest in abandoned burrows or under clump-forming bunch grasses.*		
Select all options that apply A = abundant, M = moderate, S = scarce	Score	Recommendation to increase score
Dead wood, brush piles, or snags present	A = 5 M = 3 A = 1	
Twigs present	A = 5 M = 3 A = 1	
Areas of undisturbed native bunch grasses (clump-forming)	A = 5 M = 3 A = 1	
Subtotal (4b)		
Native bee nesting habitat total (4a+4b)		

5a. Use of pesticides		
Select all that apply	Score	Recommendation to increase score
No use of insecticides	40	
IPM program in place	10	
Insecticides sprayed at night	5	
Insecticide sprayed only outside of crop bloom period	5	
Buffer of at least 30' between any insecticide application and habitat areas	5	
Subtotal (5a)		

5b. Land Management techniques on the farm		
Select all that apply	Score	Recommendation to increase score
Burning, mowing, or haying is done to <1/3 of area each year	10	
Grazing plan that encourages wildflower diversity/abundance	10	
No disturbance or cultivation of field borders	10	
Subtotal (5b)		
Farm Practices Total (5a+5b)		