

USU Extension

PUPS

Program



Protectors of Urban Pollinators



UtahStateUniversity
SALT LAKE COUNTY EXTENSION

USU Extension Protectors of Urban Pollinators (PUPs) Curriculum

Developed by Katie Wagner

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What is USU Extension?

Utah State University Extension is part of the Cooperative Extension Service. Through 33 statewide county offices and facilities, USU Extension, the community out-reach branch of Utah State University, proudly serves residents in every county of Utah. The USU Extension Service disseminates research-based, non-biased information to local communities in the areas of agriculture, horticulture, 4-H and family and consumer sciences.

What is PUPs?

The USU Extension (Protectors of Urban Pollinators) PUPs program was developed by Katie Wagner, a USU Extension horticulturalist in Salt Lake County, Utah in 2013. Ms. Wagner created the PUPs curriculum to address growing interest in pollinator education throughout Salt Lake County. Salt Lake County, like many other counties throughout the country, is an urbanized area with over 1 million residents and growing. Residents are increasingly concerned about the impact of urbanization on natural ecosystems and what they can do to promote pollinator populations in their local communities. Although the PUPs curriculum was developed in Utah, it can be taught throughout the country in communities with various population densities. The USU Extension PUPs program was developed for youth education although older youth and adults can follow along with the POPs program, Promoters of Pollinators, (see below). PUPs trainees learn the 3 P's: Plant pollinator plants, protect pollinator habitat, and promote the importance of pollinators to others, through a series of activities and group discussions. The USU Extension Promoters of Pollinators (POPs) curriculum is the companion curriculum to the PUPs program and focuses on continuing the pollinator promotion conversation beyond the PUPs program. The POPs program is intended for older youth and adults. The POPs curriculum suggests activities and group discussions that can help POPs educators continue pollinator education with PUPs graduates or new audiences. POPs educators may be parents, teachers, youth mentors, or others. Examples of community groups that can benefit from the PUPs and POPs curriculum include school groups, scouts, camp leaders, church groups, Cooperative Extension educators, community garden educators, Master Gardeners, 4-H leaders, museum educators, and other community groups.

Who May Use This Curriculum?

The PUPs curriculum is free and available for use by educators. Educators must notify the developer of intent of use and materials cannot be altered from their original state without permission from the developer. Contact the developer at Katie.wagner@usu.edu. Educators can access materials and register intent to use online at <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>.

Helpful Curriculum Materials (most materials are optional):

- Pollen pictures (search online ‘pollen grain SEM’)
- Pollen balls or bee bread (health food stores or online)
- Sugar water
- Colored pencils, crayons, or markers (multiple colors)
- Colored tissue paper or construction paper (red, orange, yellow, white)
- Perfume (fruity scented) or scented oils
- Party ‘blowout’ and long straw (you can also construct hummingbird and butterfly tongues from rolled and hand-molded construction paper)
- Velcro pieces (sticky one side)
- Yellow pollen balls (for What is Pollination? group activity 3)
- 4 Small plastic baskets or funnels
- Plastic cones (for Pollen Basket Relay Race, group activity 3)
- 2+ Yellow balls (for Pollen Basket Relay Race, group activity 3)
- Googly eyes (sticky one side)
- 2 ‘Bee Eye Kaleidoscope Lenses’ available at: <http://thewoodenwagon.com/woodentoy/summer-toys/GM830.html> or insect eye glasses (several available for purchase online – also called fly eye glasses)
- 2 Apple blossom illustrations (download at <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>)
- Bee costume (wings, insect eye glasses, googly eyes, antennae)
- Antennae supplies: headband, springs, yellow and black pipe cleaners
- Hot glue gun (glue bees to antennae tips)
- USU Extension PUPs packets (available at <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>)
- USU Extension PUPs curriculum (available at <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>)
- Pollinator plants to start pollinator garden

PUPs Curriculum:

Group Discussion One: The USU Extension PUPs Program (page 2 of PUPs packet)

Page 2 of the PUPs packet introduces the USU Extension PUPs program and identifies the 3 P's:

- 1) Plant pollinator plants (provide a food and nectar source for pollinators);

Tip: Pollen grains provide food (protein) and nectar provides sugar (energy) for pollinators. Compare pollen and nectar to human sources of protein (meat, nuts) and sugar (honey, fruit). Do human bodies need protein and sugar too? Yes we do! Honey is regurgitated nectar that came from the flowers. Bees collect pollen and carry it back to their nest or hive to feed developing bees (baby bees). Pollen is highly nutritious and is the primary source of protein for the nest or hive. Consider showing participants magnified pictures of pollen grains. A great source for images can be found by searching 'pollen grain SEM' for scanning electron microscopy (SEM), online. 'Pollen balls' or 'bee bread', a mass of pollen grains mixed with nectar by bees, can be purchased at health food stores or online and can be shown to and tasted by participants (be cautious of pollen allergies)! Sugar water is a good representation of nectar. Some of the best pollinator plants include flowering herbs (like lavender, cilantro, and sage) and native plants. Although pretty, petunias do not provide a quality pollen and nectar source to pollinators. For a listing of good plants for pollinators in Utah and surrounding areas, reference 'Gardening for Native Bees in Utah and Beyond' (<http://extension.usu.edu/files/publications/factsheet/plants-pollinators09.pdf>). If you are using this curriculum in other areas around the country, contact your local Extension Service office for a listing of plants appropriate for your area or visit the Xerces Society regional plant lists (<http://www.xerces.org/plant-lists/>) online.

- 2) Protect pollinator habitat (preserve existing pollinator habitat (plants) and avoid use of broad spectrum insecticides that are toxic to pollinators);

Tip: The term 'pesticide' is an umbrella term that includes 'herbicide' (kills weeds), 'insecticide' (kills insects), 'miticide' (kills mites), 'fungicide' (kills fungus), 'bactericide' (kills bacteria), molluskicide (kills mollusks like snails) and so forth. Not all pesticides are toxic to pollinators however some (including some certified organic insecticides) are lethal (especially broad spectrum insecticides) and should be avoided if possible! Broad spectrum insecticides are developed to kill many types of insects. Fortunately, by planting good plants for pollinators (see above) you are also providing good habitat for beneficial insects (like lady bird beetles and lacewings) that prey on garden pests (like aphids and spider mites). By attracting beneficial insects to your garden, you reduce the need to spray broad spectrum insecticides to control

garden pests. For more information on beneficial insects, visit USU Utah Pests (<http://utahpests.usu.edu/htm/factsheets/by=category/category=198>).

- 3) Promote importance of pollinators to others (spread the word to family, friends, and neighbors in your community about the importance of pollinators).

Are pollinators important for production of many of our favorite foods? Do pollinators contribute to floral biodiversity (wildflowers)? Are pollinators an important food source for other animals like birds and some fish (like salmon and trout)? The answers are yes, yes, and yes! These are many reasons why promoting the value of pollinators to others is important – especially since many populations of pollinators (like honeybees, western bumblebees, and the monarch butterflies) are in decline! We can all play a role in the recovery of populations of these important animals by applying the 3 P's!

PUPs participants are asked to draw a picture of a pollinator visiting a flower in the empty box at the bottom of the page 2 of the PUPs packet. It is likely that PUPs participants will think of bees first although it is possible that some knowledgeable PUPs may already know that other insects and animals also pollinate flowers. Examples of other animals that pollinate flowers are shown on page 5 of the PUPs packet.

Group Activity One: Importance of Pollinators (page 3 of PUPs packet)

The first activity teaches PUPs participants about the importance of pollinators. Primary focus is placed on the importance of pollinators for food production. PUPs participants are asked to write down their favorite food on page three of their packets. Many PUPs participants will be surprised to learn that their favorite foods contain ingredients made from plants that depend on pollinators for reproduction (see Table 1). For example, pizza sauce contains tomatoes. Although tomatoes are wind pollinated, bumblebees increase pollination success of tomato blossoms through buzz pollination. Bumblebees grab onto flowers and vibrate their flight muscles, causing a windstorm of pollen grains inside the bloom. This yields more tomatoes per plant. Even if PUPs participants pick a food that is not directly derived from plants that require pollination, like ice cream, ask participants if they like to eat their favorite food with other foods (like strawberries, chocolate or peanuts). For example, hotdogs are often consumed with condiments and toppings like ketchup (tomato), mustard (mustard seed) and pickles (cucumber), all plants that benefit from pollinators. Pollinators are important for meat and dairy production as well. Many livestock are fed alfalfa which is pollinated by bees.

Table 1: Fruits and Vegetables, Primary Pollinator, and Common Food Items

<u>Fruits & Nuts</u>	<u>Primary Pollinator</u>	<u>Other Food Items</u>
Almond	Honeybee	Butter, sweets (paste)
Apple	Honeybee, native bees	Applesauce, juice
Apricot	Bees	Jams, jellies
Avocado	Bees, flies, wasps, birds	Guacamole
Banana	Pollination unnecessary	Banana bread, sweets
Blackberry	Honeybee, native bees	Jams, jellies, sweets
Blueberry	Native bees, honeybee	Sweets
Cashew	Flies, ants, wind	Mixed nuts, sweets
Chestnut	Wind, honeybee, native bees	Mixed nuts, sweets
Cherry	Honeybees	Sweets, juice
Coconut	Honeybee, other insects	Curries, sweets
Cranberry	Native bees, honeybee	Sauce, juice
Fig	Fig wasp (exclusively)	Sweets
Grape	Wind	Jelly, juice, wine
Grapefruit	Honeybee	Juice
Guava	Honeybee	Juice, sweets
Kiwi	Honeybee	Sweets
Lemon	Honeybee	Juice
Lime	Honeybee	Juice
Mango	Bees, flies, ants	Juice, sweets

Melon	Bees	Cantaloupe, honeydew
Nectarine	Bees, wind	Juice
Orange	Honeybee	Juice, sweets
Papaya	Not known, honeybee	Juice, sweets
Peach	Bees, wind	Jams, jellies, sweets
Peanut	Bees	Butter, mixed nuts
Pear	Honeybee	Sweets
Pecan	Wind	Mixed nuts, sweets
Pineapple	Pollination restricted	Juice, sweets
Pistachio	Wind	
Plum	Honeybee	Preserves, sweets
Raspberry	Honeybee	Jams, jellies, sweets
Rhubarb	None, Consume Stalks	Rhubarb Sauce, Pie
Strawberry	Native bees, honeybee	Jams, jellies, sweets
Watermelon	Honeybees, native bees	
Walnut	Wind	Mixed nuts, sweets

Information Sources:

<http://afrsweb.usda.gov/SP2UserFiles/Place/53420300/OnlinePollinationHandbook.pdf>

<http://www.caes.uga.edu/commodities/fruits/pecanbreeding/papers/documents/PecanPollination.pdf>

<http://fruitandnuteducation.ucdavis.edu/generaltopics/AnatomyPollination/Pollination1/>

<http://aggie-horticulture.tamu.edu/archives/parsons/fruit/banana.html>

<http://www.hort.purdue.edu/newcrop/morton/pineapple.html#Propagation>

<u>Vegetables & Herbs</u>	<u>Primary Pollinator</u>	<u>Other Food Items</u>
Artichoke	Harvest premature flower*	Artichoke hearts
Asparagus	Harvest spears*	
Bean	Pollinators unnecessary	Dried, green beans
Beet	Consume root**	
Broccoli	Harvest premature flower*	
Brussels Sprouts	Harvest leaves*	
Cabbage	Harvest leaves*	Sauerkraut, kimchee
Carrot	Consume root*	Broth (soups)
Cauliflower	Harvest premature flower*	
Celery	Harvest stalks*	Broth (soups)
Chive	Harvest leaves*	
Cilantro/Coriander	Coriander seed from honeybee	Asian, Mexican foods
Cucumber	Honeybee, other insects	Pickles
Dill	Leaves and seed	Garnish
Eggplant	Bumblebee	Baba Ganoush
Garlic	Harvest heads (cloves)	Common flavoring
Kale	Harvest leaves*	
Kohlrabi	Consume root*	
Leeks	Harvests*	Soups
Lettuce	Harvest leaves	Salads, topping
Mustard	Honeybees (seeds)	Mustard

Okra	Honeybee, native bees	Gumbo, Indian foods
Onion	Consume bulb*	Cooked, raw, topping
Parsley	Consume leaves	Garnish
Parsnip	Consume root*	
Pea	Pollinators unnecessary	
Pepper	Honeybee, native bees	Salsa
Potato	Consume tuber	
Pumpkin	Honeybee, native bees	Pie, soup
Radish	Consume root*	
Rutabaga	Consume root*	
Spinach	Consume leaves	
Squash	Honeybee, native bees	
Sweet Corn	Wind	Corn syrup
Sweet Potato	Self-pollinating	
Swiss Chard	Consume leaves	
Tomato	Wind and native bees	Sauce, salsa, ketchup
Turnip	Consume root*	

*Primarily pollinated by insects for seed production

**Primarily pollinated by wind for seed production

Information Sources:

<http://afrsweb.usda.gov/SP2UserFiles/Place/53420300/OnlinePollinationHandbook.pdf>

http://bioweb.uwlax.edu/bio203/2011/keesler_cole/reproduction.htm

<http://www.faculty.ucr.edu/~legneref/pollination/pollinat3.htm>

<u>Other Plants of Interest</u>	<u>Primary Pollinator</u>	<u>Food Items</u>
Alfalfa	Honeybee, native bees	Livestock feed
Cacao	Insect pollinated	Chocolate
Coffee	Self-fertile, bees	
Corn	Wind, bees shake anthers (pollen)	Syrup, livestock feed
Cotton	Bees (Bumblebees)	Fabric
Peppercorn	Not clearly defined	Seasoning
Rice	Wind	
Soybean	Self-fertile	Tofu, processed foods
Tea	Insect pollinated	Leaves
Vanilla	Hand pollinated	Flavor, ice cream
Wheat	Self-pollinated, wind	Flour

Information Sources:

<http://afrsweb.usda.gov/SP2UserFiles/Place/53420300/OnlinePollinationHandbook.pdf>

http://www.aragriculture.org/insects/bees/pollinators_importance.htm

POPs (Promoters of Pollinators) Program: Activity extension (page 4 of POPs packet):

Take time during a meal to discuss food items used to prepare the meal, or look at a menu and discuss food items listed on the menu. Ask students to identify which foods were pollinated by pollinators. Discuss how important pollinators are for your diet and how eating habits would change if pollinators did not exist. Would you be forced to give-up your favorite foods?

Individual Activity 1: Matching fruit and plant type (page 3 of PUPs packet)

Sometimes PUPs participants do not understand that different types of foods are produced by different types of plants. Where do apples come from (tree)? What type of plant produces almonds and oranges (tree)? What type of a plant produces tomatoes (plants)? How about blueberries and raspberries (bush)? What type of a plant produces grapes (vines)? For plants that depend on insect pollination, pollinators must move pollen between male and female flower parts of the same plant. Therefore, to pollinate apple blossoms, pollinators must move pollen from male apple blossom flower parts (stamen = anther + filament) to the female apple blossom flower parts (pistil = stigma + style + ovary) – see Figure 1 on page 15. PUPs participants can complete this activity by matching (draw a line) between the fruit on the plate and its correct plant type: apple with tree, raspberry with bush, tomato with plant, and grape with vine. Encourage PUPs participants to color in the fruits with an appropriate color choice (apple: red, yellow, green), tomato (red, orange, yellow, purple, pink), grape (yellow, green, purple, red) and raspberry (red, purple, yellow, orange).

Group Discussion 2: Types of Pollinators (page 5 of PUPs packet)

When PUPs participants hear the term ‘pollinator’, they sometimes exclusively think of the European honeybee. Bees are the most important pollinator of fruits and vegetables and honeybees are the primary pollinator of commercial agriculture crops. Sometimes PUPs participants are surprised to learn that many other types of animals pollinate fruits, vegetables, herbs, and wildflowers. Did you know that the European honeybee (*Apis mellifera*), the bee beekeepers tend in beehives, is not native to North America? Did you know that Native America is home to over 4,000 species of native bees (bumblebees, sweat bees, leafcutter bees and so forth) and Utah alone hosts over 900 native species of bees? The second discussion introduces PUPs participants to types of pollinators including bees (honey and native), moths, butterflies, beetles, bats, flies, wasps, ants and hummingbirds. All of these animals help move pollen from male flower parts to female flower parts. The plant produces fruit and seeds upon successful transfer of pollen from male to female flower parts. More information on native bees and other pollinators is available at www.bees.usu.edu or www.xerces.org online. Ask PUPs participants to circle types of pollinators; participants will be surprised to learn that they correctly complete the exercise when they circle ALL the choices!

The second part of group discussion 2 educates PUPs participants on the connection between pollinator type and preferred flower shape and color. Different types of pollinators have different tongue lengths and shapes for sipping nectar from flowers. Some pollinators, like butterflies and hummingbirds, have long mouth parts that can access nectar buried deep within

tubular-shaped flowers. Other pollinators like ants and flies, visit pollinator plants with shallow-shaped flowers and easy access to pollen and nectar. Furthermore, different types of pollinators are attracted to different flower colors. In this way, plants and pollinators have co-evolved to develop specialized relationships. In fact, some plants (like certain types of figs) are exclusively pollinated by one type of pollinator (fig wasp). By planting a diversity of pollinator plants with various flower shapes and colors, gardeners attract a wide variety of pollinators to the garden. This activity educates PUPs participants on pollinator preferences for different flower shapes and colors. See Table 2 for pollinator preferences of flower shapes and colors. PUPs participants correctly complete the exercise by matching butterfly with honeysuckle, bee with sunflower, bat with cactus, and hummingbird with penstemon.

Tip: Note to PUPs participants that bats and most moths are nocturnal (fly at night) so plants that depend on pollination by bats and moths must open their flowers at night!

Table 2: Preference of Flower Shape and Color by Pollinator Type

Flower	Bats	Bees	Beetles	Birds	Butterflies	Flies
Color	Dull white, green, purple	Bright white, yellow, blue	Dull white, green	Orange, red, white	Orange, red, purple	Pale and dull to dark brown or purple, often veined
Odor	Strong, fruity	Fresh, mild, pleasant	Fruity, spicy	None	Spicy, none	Putrid
Shape	Regular, Bowl-shaped, closed during day	Shallow, landing platform, tubular	Large, bowl-like	Large, funnel-like, no landing platform but strong perch support	Narrow tube, wide landing pad	Shallow, funnel-like or trap-like
Bloom Time	Night	Day	Day	Day	Day	Day and night
Nectar	Abundant, somewhat hidden	Usually present	Sometimes present, not hidden	Ample, deeply hidden	Ample, deeply hidden	Usually absent

Table sourced from: 'Basic pollination syndrome character table' available at:
http://www.personal.psu.edu/mnm14/blogs/biology_12_lab_flowering_plant_reproduction/lessons/03--.html

Group Activity 2: Creating Flowers for Different Types of Pollinators (page 5 of PUPs packet):

Table 2 should be referenced to guide PUPs participants on how to construct flowers that attract different types of pollinators using arts and craft materials. Consider purchasing a perfume or scented oil to adorn flowers that attract pollinators by scent. Talk to about flower color, shape, and odor with PUPs participants. Consider using a 'party blowout' to demonstrate the curled tongue of a butterfly and a long straw to demonstrate the long mouthparts of a hummingbird. Pollinator mouthparts can also be constructed out of construction paper or other materials. Encourage PUPs participants to use the correct color choice to color flowers in their packet (the cactus bloom does not need a color since it is white).

POPs (Promoters of Pollinators) Program: Activity extension (page 5 of POPs packet):

Specialized pollinator and plant relationships are critical to support the immense biodiversity of flora (plants) and fauna (animals). Table 3 lists examples of specialized or interesting pollinator and plant relationships. Walk around a garden in bloom and observe differences in types of pollinators and other insects that visit blooms of varying shapes, aromas, and colors. Ask participants to take notes of their observations and discuss their notes with the group. Encourage participants to research one or more of the relationships listed in Table 3.

Table 3: Examples of Specialized or Interesting Pollinator and Plant Relationships

<u>Pollinator</u>	<u>Pollinator Plant</u>	<u>Specialized Relationship</u>
Monarch Butterfly	Milkweed species	Host plant for caterpillars
Honeybee	Almond	Vital for almond industry
Bumblebee	Tomato	Pollinate greenhouse tomatoes
Squash Bee	Squash and pumpkin	Primary pollinator of squashes

Fig Wasp	Fig	Exclusive pollinator of fig
Leafcutter bees	Cactus	Exclusively pollinate cactus
Yucca moth	Yucca	Exclusive pollinator of yucca
Hawk moth	Hawk moth orchid	Exclusive pollinator of (HM) orchid
Melipone bee	Vanilla bean	Commercial vanilla hand pollinated
Long-nosed bats	Agave	Primary pollinator
Bats	Saguaro Cactus	Major pollinator

<http://www.esa.org/ecoservices/poll/body.poll.scie.ispo.html>

Individual Activity 2: Bee Maze (page 6 of PUPs packet)

PUPs participants must help the honeybee fly away from difficult weather conditions toward its hive located in the sun. Honeybees use the sun to orient themselves so they do not typically fly in overcast conditions (bees do fly in partly cloudy conditions) and rainy weather or at nighttime. Honeybees are tropical animals and do not usually leave the hive if air temperatures drop below 50°F so the colony stays inside the hive during winter months in many locations throughout the United States. Mention to participants that they can become a hazard too by trying to swat or step on bees and other insects, be respectful!

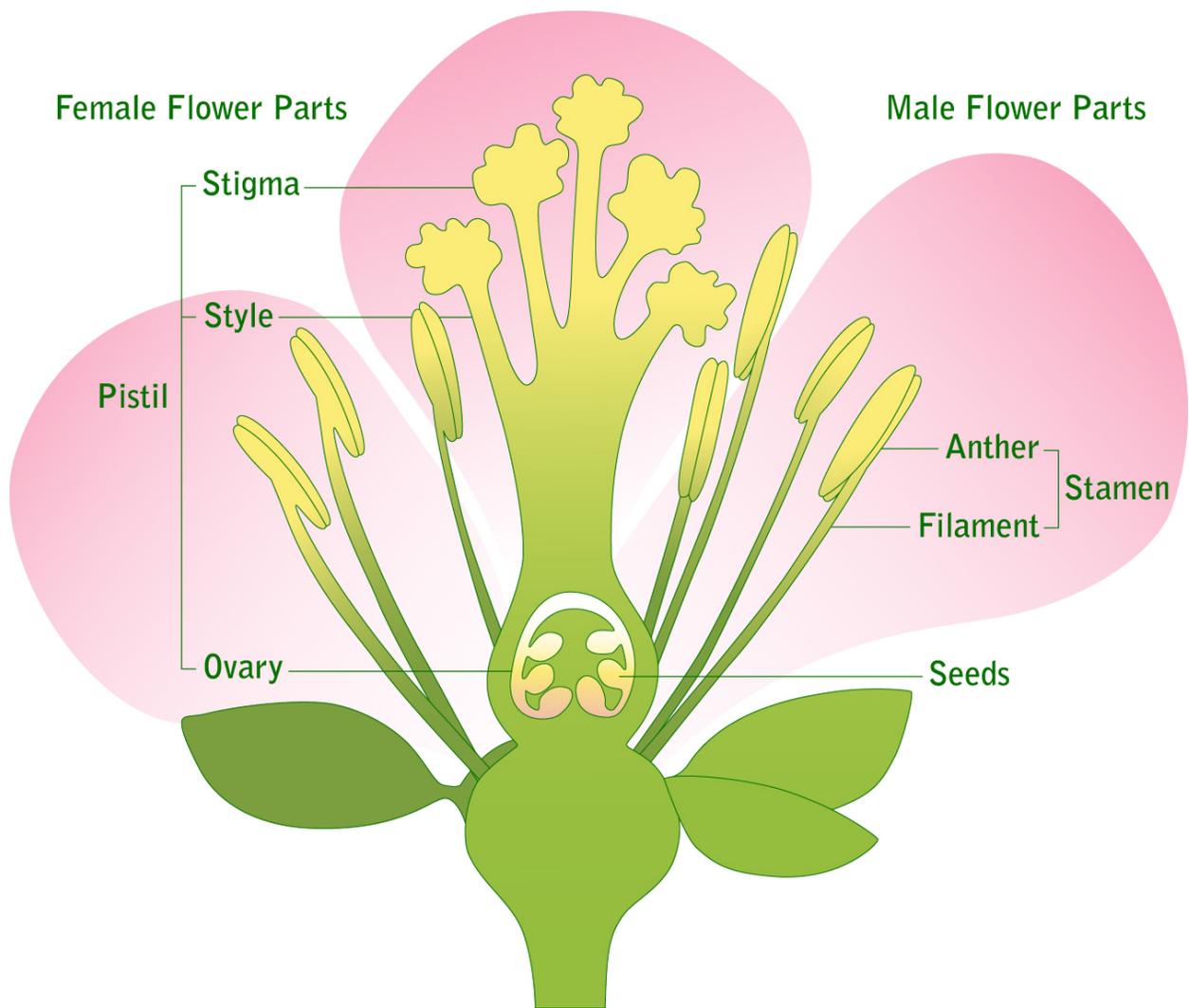
Tip: Many species of native bees are more active during cloudy, rainy, and cool temperatures than European honeybees. Some greenhouse production facilities use bumblebees to pollinate greenhouse grown crops (like tomatoes) since bumblebees are better able to navigate inside the greenhouse than European honeybees.

Group Discussion 3: Bees (page 7 of PUPs packet)

Although all pollinators are important, bees are the most important pollinators for fruit and vegetable production. Group discussion 3 teaches PUPs participants that bees fly from flower to flower and transport pollen. Bees move pollen from male flower parts to female flower parts of the same plant. For example, honeybees transport pollen between male flower parts (stamen = anther + filament) of apple blossoms to female flower parts (pistil = stigma, style,

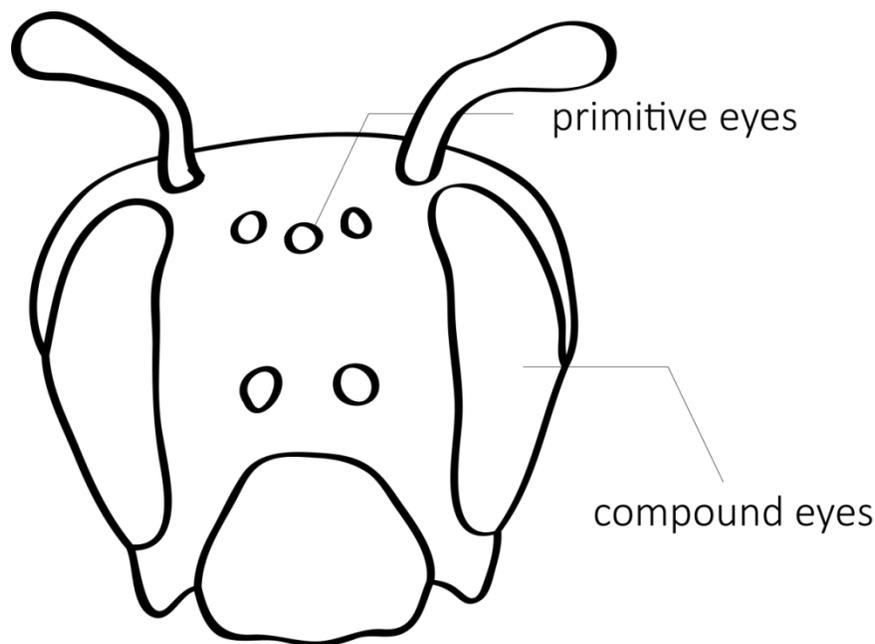
ovary) of apple blossoms (see Figure 1). Pollen from an apple blossom cannot fertilize a squash flower but pollen from a male squash flower can fertilize a female squash flower. Ask the PUPs participants if they understand the difference. PUPs participants are asked how bees are able to orient themselves as they fly from flower to flower; the answer is they use the sun!

Figure 1: Apple Blossom Showing Male (Stamen) & Female (Pistil) Flower Parts



In the second part of group discussion 3, PUPs participants learn about bumblebee eyes. Bumblebees have two large compound eyes and three small primitive eyes. Teach PUPs participants that bumblebees have poor vision and see the world out of focus. The three primary colors bumblebees see is ultraviolet, blue and green. They do not see red like we do. Instruct PUPs participants on how to draw compound and primitive eyes on the bumblebee face in their packet (Figure 1). Consider bringing along stick-on googly eyes and 'bee vision' eyes (Bee Eye Kaleidoscope Lens - <http://thewoodenwagon.com/woodentoy/summer-toys/GM830.html>) or insect vision glasses to mimic the bumblebee eye pattern on their own faces. Ask the PUPs participants, if you had bee eyes and saw the world out of focus, would you be better able to see one tiny flower or a large mass of flowers? It is best to plant pollinator plants in groups or masses; large groups of plants act like billboards in the landscape and are more likely to attract bumblebees to your pollinator garden.

Figure 1: Bumblebee Face



POPs (Promoters of Pollinators) Program: Activity extension 3 (page 5 of POPs packet):

Practice your bee vision by visiting a garden in bloom and look at the difference between color masses and single plants. Look at the two areas with normal vision and then through insect vision glasses. If you do not have insect vision glasses, try briefly crossing your eyes causing your vision to be temporarily blurred. Be careful not to cross your eyes too long! Which

flowers do you notice better with insect vision, single flowers or flower masses? Ask students whether it is better to plant masses of pollinator plants or single plants when trying to attract bumblebees to a pollinator garden. Bumblebees look for 'billboards of color' when they are flying over the landscape so color masses of at least 3 feet long and wide are ideal for attracting bumblebees. Ask students to observe a group of pollinator plants of their choice for 5-10 minutes (the plants should be in bloom). Instruct students to take notes on the number and types of animals (bees, other insects, birds) that visit the flower group during the observation period? What kind of behaviors does each type of animal exhibit while visiting the flowers? Discuss individual observations as a group.

Individual Activity 3: Pollinator Word Search (page 8 of PUPs packet)

PUPs participants must locate types of pollinators in the word find. Words to search for include: honeybee, native bee, beetle, bat, hummingbird, butterfly, moth, fly, wasp and ant.

Group Activity 3: What is Pollination? (page 9 of PUPs packet)

Activity 3 demonstrates the process of pollination to PUPs participants. In group activity 3, PUPs trainees are reminded that plants that depend on animals for pollination must have pollen moved from one blossom to another blossom of the same plant (apple to apple, almond to almond, squash to squash and so forth). Download apple blossom illustrations at <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>. You will need two flowers. Hang the apple blossom illustrations some distance away from one another and use Velcro strips to attach 'pollen balls' to the anthers of the blossoms. Also attach Velcro strips to the stigma on the blossom illustrations. Invite participants to 'pollinate' the blossoms by moving the pollen balls from the anthers to the stigma. Encourage participants to move pollen from the anthers of one flower over to the stigma of the other flower (some plants like apples must be pollinated by pollen from another variety of apple, usually located on a nearby tree). Put participant's pollination skills to the test by asking them to wear insect vision glasses while attempting to move pollen between flowers. Older participants may find additional challenge by being spun around a few times before 'flying' to find pollen. Participants might enjoy bee-having like a bee during this activity by wearing wings, antennae, and googly eyes.

Group Activity 3: Pollen Basket Relay Race (page 9 of PUPs packet)

Some pollinators, like honeybees and bumblebees, transport pollen in baskets located on the backs of their legs. Create 'human pollen baskets' by using Velcro to attach plastic baskets or funnels to the backs of PUPs participant's legs. Use yellow balls to mimic pollen. Use cones to

mark your racecourse. Ask participants to race to collect pollen balls, place the pollen balls in their baskets, and then race to deposit them back at the hive or nest.

Tip: Pollen placed in pollen baskets is tightly packed and is usually taken back to the nest or hive and therefore does not pollinate flowers. However, some pollen grains loosely stick to the hairy bodies of bees. This is the pollen that usually comes in contact with female flower parts. Pollen placed in pollen baskets is carried back to the hive or nest and used to nourish developing bees.

Group Activity 4: Three P's Mad Libs (page 10 of PUPs packet)

If you did not play Mad Libs growing-up, you missed out! Ask PUPs participants to provide verbs (like run, cut, play), plural nouns (like cars, dishes, fans), and nouns (like cat, dog, girl) without reading the story. Fill in the blanks with the provided words and read the goofy story aloud to the group. Without goofy words, the story reads:

Now that I am a USU Extension PUP, I know why it is important to plant pollinator plants, protect pollinator habitat, and promote the importance of pollinators to others. Pollinators move pollen from flower to flower which produces many foods we eat. Types of pollinators include bee, butterfly, moth, beetle, wasp, ant, bat, and hummingbird. I am going to tell my family about the PUPs program so they can promote pollinators too!

POPs (Promoters of Pollinators) Program: Activity extension 4 (page 5 of POPs packet):

Use your new knowledge of pollinators to create your own Mad Libs story. Bee creative!

Group Discussion 4: Help the Bee Find Its Way (page 11 of PUPs packet):

Now that PUPs participants are pollinator experts, put their memory to the test. Ask them to complete the 3 P's:

1. Plant Pollinator Plants
2. Protect Pollinator Habitat
3. Promote the Importance of Pollinators to Others

Group Activity 5: Time to Bee-come a Certified PUP! (page 11 of PUPs packet)

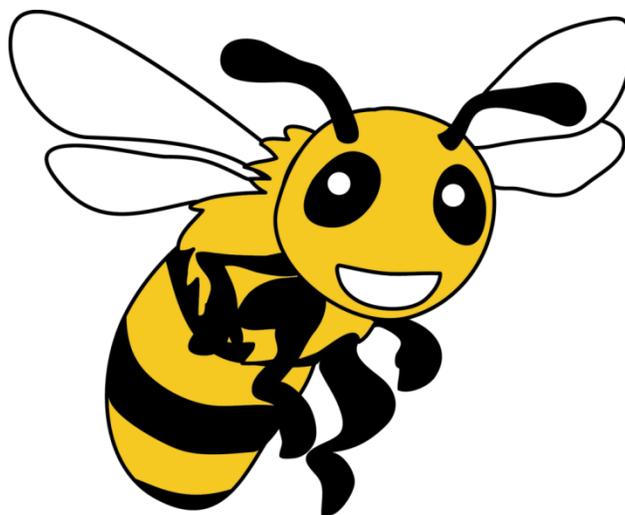
Now that participants have completed the PUPs curriculum, it is time to graduate them to a 'Certified PUP'! Instead of a traditional graduation cap, PUPs wear bee antennae. A following link is to a video that shows educators how to create bee antennae

<http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>. PUPs graduates are also awarded a 'USU Extension Certified PUP' button to wear and show-off to others. Buttons are available by contacting the developer (Katie.wagner@usu.edu). Consider completing the curriculum by planting a pollinator garden and registering it with USU Extension. Encourage PUPs to observe visiting pollinators as they tend the plants throughout the growing season!

POPs (Promoters of Pollinators) Program: Activity extension 4 (page 5 of POPs packet):

Help promote pollinators by planting a pollinator garden. Don't forget to register your garden with USU Extension at: <http://extension.usu.edu/saltlake/htm/yardgarden/pups-program>.

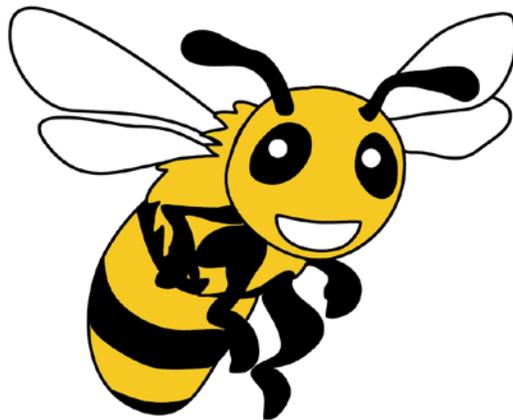
Remember to take a picture of your garden and upload it on the garden registration page or send pictures and the garden location to Katie.wagner@usu.edu. Don't forget to spread your knowledge and teach the curriculum to other educators – bee creative!



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Protectors of Urban Pollinators



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