PACIFIC GROVE MUSEUM of NATURAL HISTORY

Pollinator Math Activities

Museum Pollinator Workshop for Teachers

24 September 2022

Sorting

- Sort by color, size, characteristics (anatomy)
- Things to sort – pictures or models of insects, flowers, leaves

Complete the pattern

- Use objects from nature (loose parts) to make patterns and have students continue the patterns. They can make patterns for each other or for the teacher.

Symmetry

- Insects have bilateral (2-fold) symmetry. Flowers usually have radial symmetry.
- Make an insect – Fold paper in half (hot dog fold). Put blobs of paint on one half then fold over to print on the other side. Once the painting dries, draw/label the parts of an insect with crayon or marker and talk about symmetry.
- Flower prints – dip flowers into watery tempra paint then press them on a piece of paper to make a flower print. Try different flower. Talk about the radial symmetry of flowers.

Counting – numbers represent things in nature

- Make an insect like in the symmetry activity, or find pictures of insects. Learn about, label, and count the parts: Parts = 1 mouth (or proboscis), 2 compound eyes or 2 antenae, 3 body parts (head, thorax, abdomen), 4 wings (on a bee), 5 eyes total on a bee (2 compound eyes and 3 light sensitive eyes), 6 legs on an insect.

Measuring and graphing

- Put tape on the wall about kid shoulder height.
- Mark a center with 0 and mark every 10cm with a line. Have the students label the lines on either side by skip counting 10s.
- Draw a number line on the board from 0 to 100cm

- Measure each student's wing span and put an x above the measurement on the number line
- The x's stack up to make a graph.
- Discuss what the results look like. What is the wingspan of most of the birds in the class? Some are big, some are small, but most are in the middle. This number is sometimes called the average wingspan. Older students can calculate the average.

Monarch race

- Set up is like red light – green light. <45F frozen in one place. 46-55F can move very slowly. >55F can fly.
- Journey North Booklet
- Represent how a monarch moves on a number line and with math symbols

Non-standard units of measure and angles – Bee Dance

- Look up a video on the bee dance so kids can see bees actually doing the bee dance in the hive.
- The duration of the wiggle indicates the distance to the flowers.
- The angle of the line that bisects the circle to the sun, indicates the direction to the flowers.
- Have students create a bee dance on paper and then act it out to indicate to a group of classmates the direction and distance of a particular flower. Each wiggle could represent a stride (non-standard unit of measurement). The angle in the hive could represent the angle relative to the sun outside of the hive.

Estimating

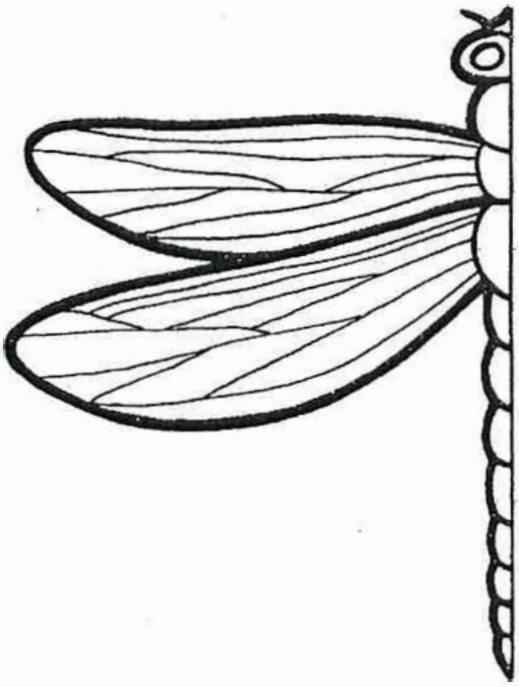
- Bees (students with medicine droppers) get nectar from a flower (jar of water on a flower) and put it into the hive (ice cube tray).
- Bees need to count the number of flower that they visit.
- Add up the number of flowers it took for all of the bees to fill 2 cells in the hive.
- Estimate how many flowers they would have to visit to fill up the whole hive.
- Conservation talk – Bees need flowers. If we pick all of the flowers, or pave over all of the natural areas, there will not be enough flowers. What if we put pesticides on the flowers? How can we protect bees and other pollinators?

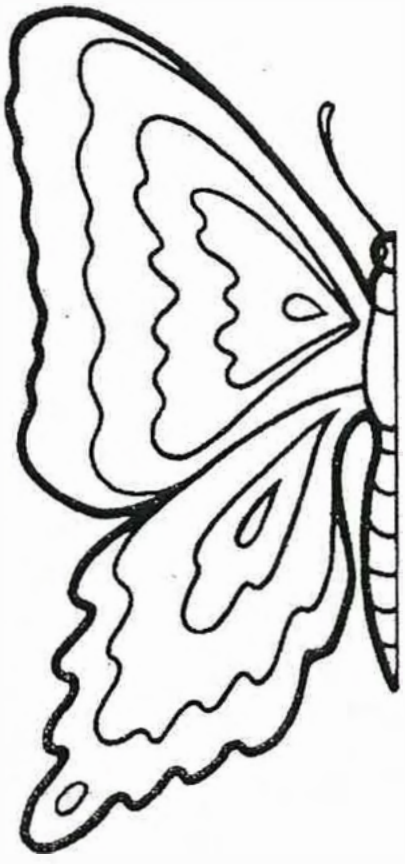
Monarch Glider (3-5 p.96), Species Area Curve (3-5 p.139)

CUT THESE OUT, PASTE THEM IN YOUR NOTEBOOK
DRAW THE OTHER HALF

Shape and Space

Each picture shows half a symmetric shape. Complete the other half. Name the insects you have completed.





JOURNEY NORTH

http://www.learner.org/jnorth/

JOURNEY NORTH
A Global Study of Wildlife Migration and Seasonal Change

Photo © Journey North

Too Cold to Fly?
The Effects of Temperature on Fall Migration

By Elizabeth Howard and Rita Welch

Photo © Journey North

A Race Against Time

Monarchs must hurry during fall migration. The butterflies must leave their northern habitat before they get trapped by the cold!

Photo © Journey North

Paralyzed

Cold temperatures paralyze monarchs. A monarch can't fly unless its flight muscles are warm enough. In temperatures below 50°F degrees, it took one hour for this butterfly to crawl a few feet.

Photo © Journey North

Flight Threshold

A monarch's flight muscles must be 55°F (13°C) before the butterfly can fly.

Photo © Journey North

Cold-blooded

Monarchs are **cold-blooded**. This fact affects *every moment* of their lives. Cold-blooded animals do not maintain a warm body temperature. Their temperature depends upon the surrounding environment.

Warming Up

Cold-blooded monarchs have special behavioral adaptations for warming up. Monarchs can bask in the sun and they can shiver. Both adaptations help a monarch raise muscle temperatures to flight threshold.

Basking
Monarchs can bask to warm their muscles.

Photos © Journey North

Shivering
Monarchs can shiver to warm their muscles.

October 3 - 7

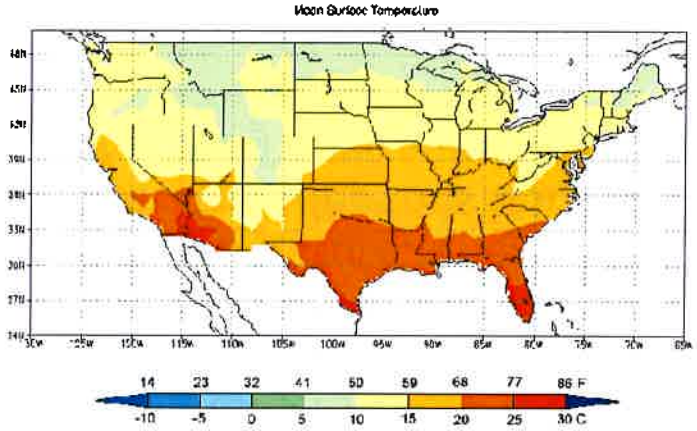


Photo © Journey North

Falling Temperatures

These maps show how quickly air temperatures drop as the fall season progresses. Watch what happens between August and December. As temperatures fall, monarchs have a smaller and smaller window of time in which they can fly.

Photo © Journey North

Warm Enough to Fly?

Air temperatures help us predict whether a monarch could warm its muscles to flight threshold. As a general rule, monarchs need air temperatures of at least 50°F on a sunny day (or 60°F on a cloudy day).

Photo © Journey North

Temperature and Migration

Temperatures influence when, where, how fast, and how high monarchs can fly. As you follow fall migration, predict when and where a monarch could fly based on daily temperatures.

Using pollinator gardens to help teach math

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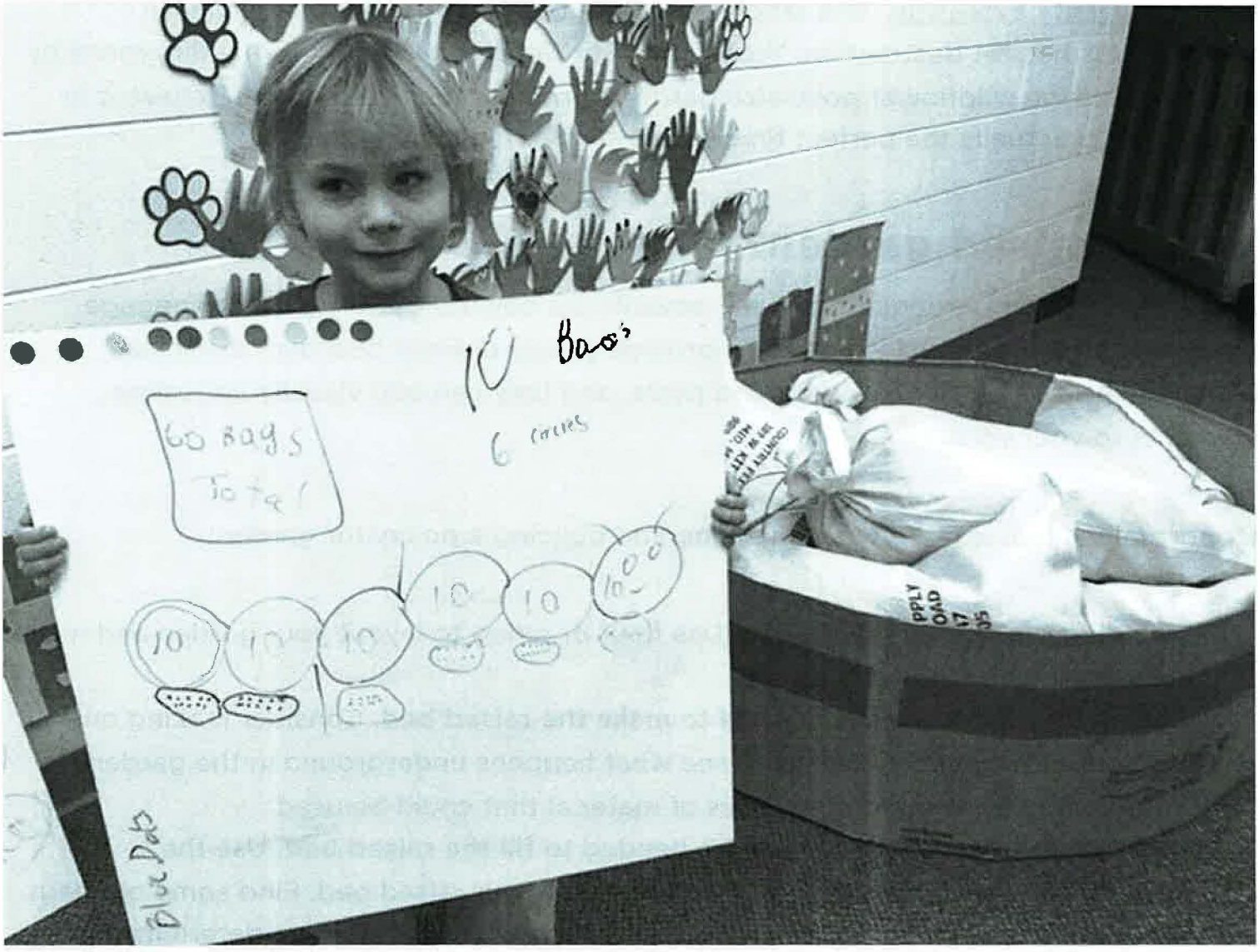
anuary

Engaging youth in planning and designing a pollinator garden can help them gain comfort with math.



An Alcona County first grader shows the math they did to calculate the soil they would need to plant a raised pollinator garden. All photos by Brandon Schroeder, MSU Extension.

Why math?

Math is the language of science and an essential part of STEM (science, technology, engineering, and mathematics). However, it can often be confusing and frustrating for youth. Engaging youth in planning and designing a raised pollinator garden can be one way to help youth gain comfort with math.

Why a pollinator garden?

Ask youth to try to imagine a world without bees. Make a list of everything the youth ate in their last meal and identify those items that depended on pollination. Then, read together the first paragraph in "Factors that threaten pollinator health" from Michigan State University Extension. This article tells us that one reason for the decline in pollinators is habitat destruction. Youth and their families can help make a difference by planting a native wildflower pollinator garden right near their own home. Believe it or not, winter is actually the perfect time to get started planning a garden.

Why a raised garden?

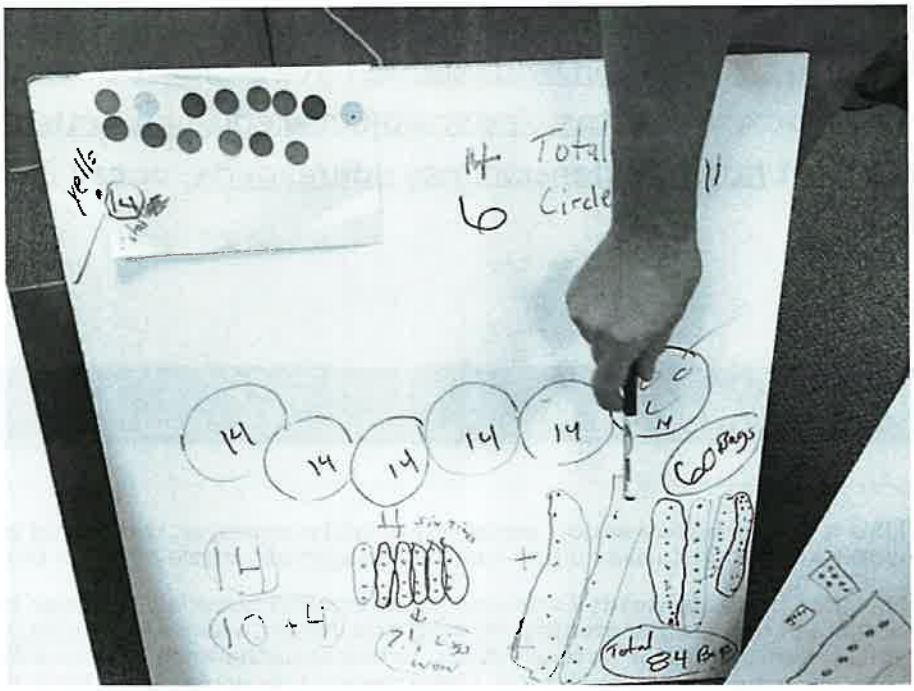
A raised pollinator garden offers many advantages beyond opportunities to engage youth in mathematics. Raised gardens provide clearly defined boarders that make planning easier, a barrier to weeds and pests, and they can add visually appealing elements to your yard.

Opportunities to use math when planning and building a pollinator garden:

- **Deciding the size of the garden.** Use flour or string to layout your garden and make sure youth can reach all parts.
- **Calculating the materials needed to make the raised bed.** Consider making one side out of Plexiglas to let youth see what happens underground in the garden. Youth can even research the types of material that could be used.
- **Determining how much soil will be needed to fill the raised bed.** Use the cardboard from old boxes to make a model of your raised bed. Find some old bags like feed sacks, fill them with leaves to model the bags of soil and determine how much soil you will need. Alcona County first graders had a great time applying math to calculate the soil they would need for the bookworm pollinator garden at

the Alcona Library (see photos).

- **Deciding how many plants you will need.** Tape newspaper together to make the shape of the top of the garden and have youth use this to measure and draw the placement of the plants based on recommended planting distances. If you are planning on growing plants that are a variety of heights, draw rings (like a topographical map) on the paper.



For more ideas about exploring pollinators with youth, read "Students find winter is a perfect time to prepare for spring pollinator garden projects" and its linked articles.

Michigan State University Extension and the Michigan 4-H Youth Development program help to create a community excited about STEM (Science, Technology, Engineering, and Mathematics). 4-H STEM programming seeks to increase science literacy, introducing youth to the experiential learning process that helps them to build problem-solving, critical-thinking and decision-making skills. Youth who participate in 4-H STEM are better equipped with critical life skills necessary for future success.

To learn more about the positive impact of Michigan 4-H youth in STEM literacy programs, read our 2017 Impact Report: "Equipping Young People for Success Through Science Literacy."

To learn more about MSU Extension, visit the MSU Extension website. To learn more about 4-H and Extension opportunities in Alcona County, stop by our Harrisville office at 320 S. State St. Harrisville, MI 48740, or visit us online at our Alcona County MSU Extension Facebook page or Alcona County Extension office page.

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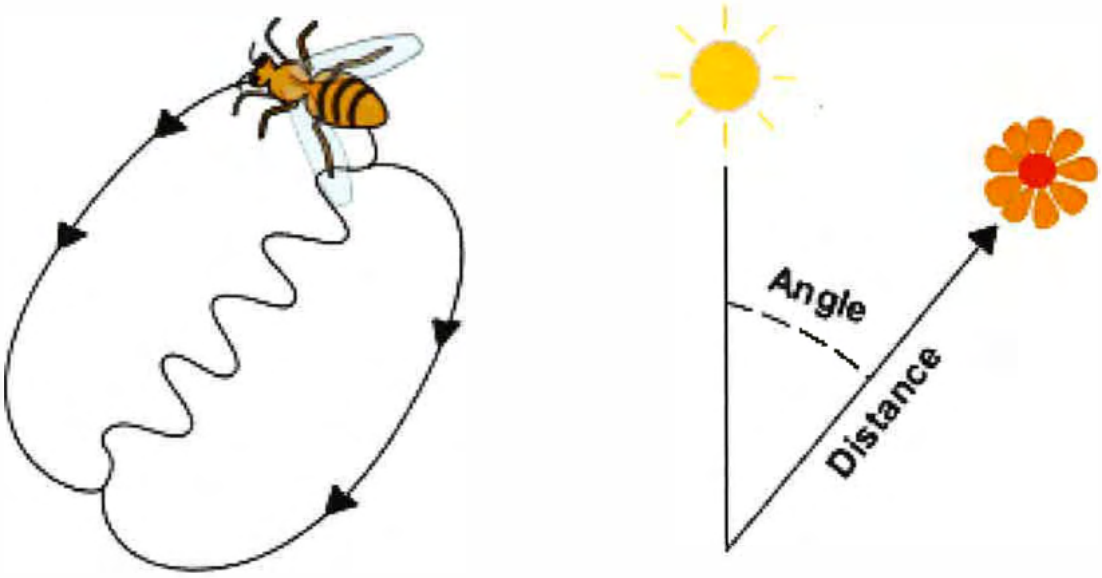
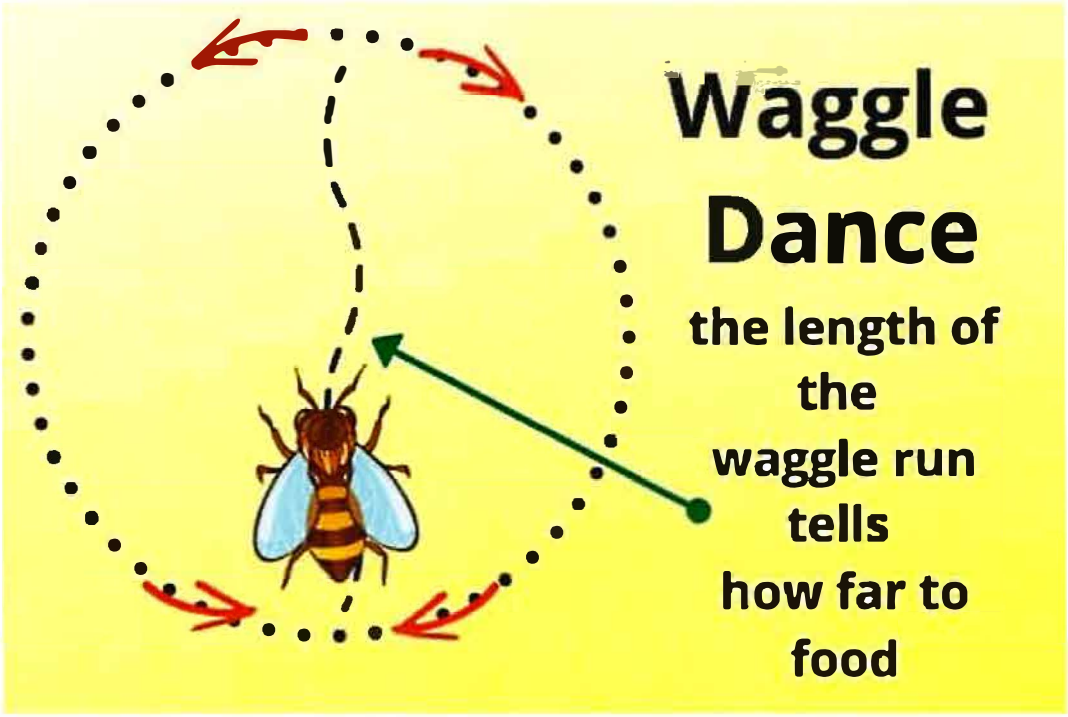
Bee Dance



https://amazingworldofanimals.wordpress.com/2015/05/13/honey-bee-dances/



https://carolinahoneybees.com/the-honeybee-dances-bust-a-move/

LONGWOOD GARDENS

Pollinator Math at Home

At a Glance:

tude ts wil disco e differe t types of pol ina ors while usin math s ills to calculate and p o lem sol e.

Materials:

- olored pe cils
- encil

Objectives:

- tude ts will o ser e arious olli a ors i action.
- tuden s will re ord da a a d draw conclusions
- tudents w use math s ills to sol e wo d pro lems.

Resources:

www.ar orday or cele rate
www fs.fed.us wildflowe s pollinato s inde .shtml

Directions:

earch fo pollinators in wo differen parts of your ac yard.
pend 10 minutes i each area ecord your findin s o each aph y shadin in the o es.

Name of Area 1_____

	Number Observed													
Pollinator	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ee	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ut e fly	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ird	1	2	3	4	5	6	7	8	9	10	11	12	13	14
eetle	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ly	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Name of Area 2_____

	Number Observed													
Pollinator	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ee	1	2	3	4	5	6	7	8	9	10	11	12	13	14
u er ly	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ird	1	2	3	4	5	6	7	8	9	10	11	12	13	14
eetle	1	2	3	4	5	6	7	8	9	10	11	12	13	14
F y	1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 hich pollinator was o ser ed the most i each area?

Area _____

Area 2 _____

2. Now loo at you esults for Area 1.
How many ees did you o se e in 10 minutes?

_____

3. How many ees do you thin you would see in 0 minu es?
how yo r wo

_____

4. How many flies did you observe in Area 2?

_____

5. If a fly visits 15 flowers in 10 minutes, how many flowers will it visit in one hour?

_____

6. If a honeybee flaps its wings 60 times per minute, how many times will it flap it's wings in 10 minutes?

_____

In one hour? (Fact: Honeybees flap their wings 11,400 times per MINUTE!)

_____

7. If a butterfly lands on a flower and has enough pollen to pollinate three flowers, how many flowers would get pollinated if:

The butterfly collects pollen from five flowers?_____

The butterfly collects pollen from 10 flowers?_____

8. A bee can travel around 15 miles per hour and visit 75 flowers. How many miles could it travel in 12 hours?

_____

How many flowers would get pollinated in 12 hours?

_____

9. How many miles would a bee travel in a day?

_____

A week?

_____