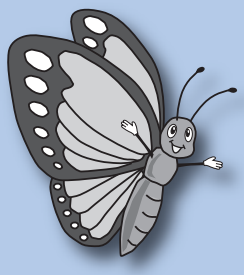
Milkweed Magic

ACTIVITY 7



Learning Objectives:

- Introduce the concept of biomonitoring.
- Identify ozone injury to common milkweed leaves
- Demonstrate how human actions can impact the natural world.

Subject

- Science

Materials

- Milkweed Magic student worksheet

Teacher's Background Information

NOTE: If students have not learned about ozone, use the Introduction section to review what ozone is, how it's formed, and how it can impact human health prior to completing this activity.

Did you know that plants and animals can give us clues about pollution in our air, land, and water before humans even notice that something is wrong? These sensitive species are called bioindicators. One way your students can learn more about air pollution is to study the plant common milkweed. Common milkweed is very sensitive to air pollution, in particular, ground level ozone. In Wisconsin, common milkweed is a good plant to study because it grows all over the state.

In this activity, your students will become biomonitoring scientists while conducting a simple ozone injury check-up on milkweed. Ozone injury can be seen on the leaves of milkweed plants. The "injury" is unique and is pretty easy to identify – a little black polka-dot called a stipple. Stipples form when ground level ozone attacks the photosynthesizing (or food producing) cells of the plant and actually causes the cell to break open and die. Once dead the cell turns black, looking like a little black polka-dot on the leaf surface. If enough cells on the leaf die, the plant may pull out its nutrients from that leaf and just let the leaf die and drop. If enough leaves are dropped from the plant, the plant may not be able to make enough food to survive.

Here is the checklist of what ozone injury looks like on milkweed plants:

- ☐ **Stipples (black dots) are found only between the veins, not on them.**

  This is because ground level ozone only affects the photosynthesizing cells and the veins are not photosynthesizing cells, they are vascular cells which transport food and water to and from cells.

- ☐ **Stipples are found only on the upper leaf surface.**

  Again, the bottom of the leave is filled with stomata – the air vents on the plant, not used for photosynthesis.

- ☐ **Stipples have distinct, sharp edges.**

  This is because each stipple is one cell that has died and cells have walls (sharp edges).

- ☐ **No haloes or discoloration around the stipple.**

  Again, each cell has walls so when one cell dies it does not harm the cells around it.

- ☐ **Stipples are black or very dark in color.**

  The cell is broken open and no longer contains fluid.

- ☐ **Stipples are scattered over the leaf surface, not clustered in groups or in obvious shapes such as circles.**

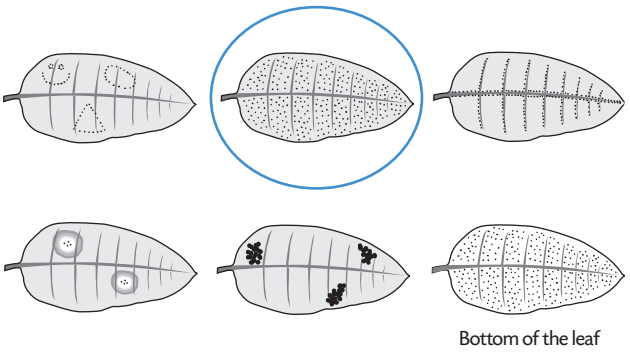
  Ground level ozone affects cells randomly, not in clusters or shapes.

Student Worksheet Answers

What do you need to live?
(in no particular order)

1. Food
2. Shelter
3. Water
4. Air

Circle any leaves with ozone damage.



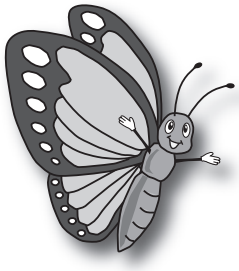
For more examples of milkweed leaves and damage to the leaves, please visit EEK! the DNR's website for kids and teachers at dnr.wi.gov/eek. Type "milkweed slide show" into the search bar. If you are interested in expanding your milkweed study, check out the DNR's Milkweed Monitoring Network. It is a program to get kids outside to study real milkweed plants for ozone damage.

Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity *(see the glossary on page 65 for definitions).*

Name _____ Date _____

Milkweed Magic



Now that you know what **ozone** is and how it impacts human health, you are probably wondering if ozone can be harmful to plants and animals. The answer is YES, and the close relationship between a plant called **milkweed** and the monarch butterfly will show us how.

Necessities of Life

What do you need to live?

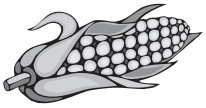
1. _____
2. _____
3. _____
4. _____

I bet food was at the top of your list. What type of food do you like? Circle the pictures of foods you like.


ice cream


water


pizza


corn


green beans


apple


cake


carrots

Monarch butterflies need the same types of things you do. What do you think their diet includes? Circle the pictures of the food you think monarch butterflies like.


dandelions


soda


flies

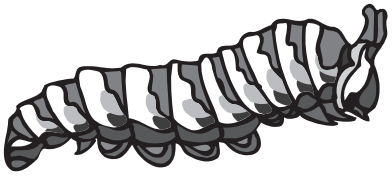

water


lilacs


hamburger


milkweed


cupcake



Unlike us, the caterpillars of a monarch have a very specific diet. They exclusively eat milkweed leaves, which are actually poisonous to most other creatures.

Name_____ Date_____

Impact of Ozone on Milkweed

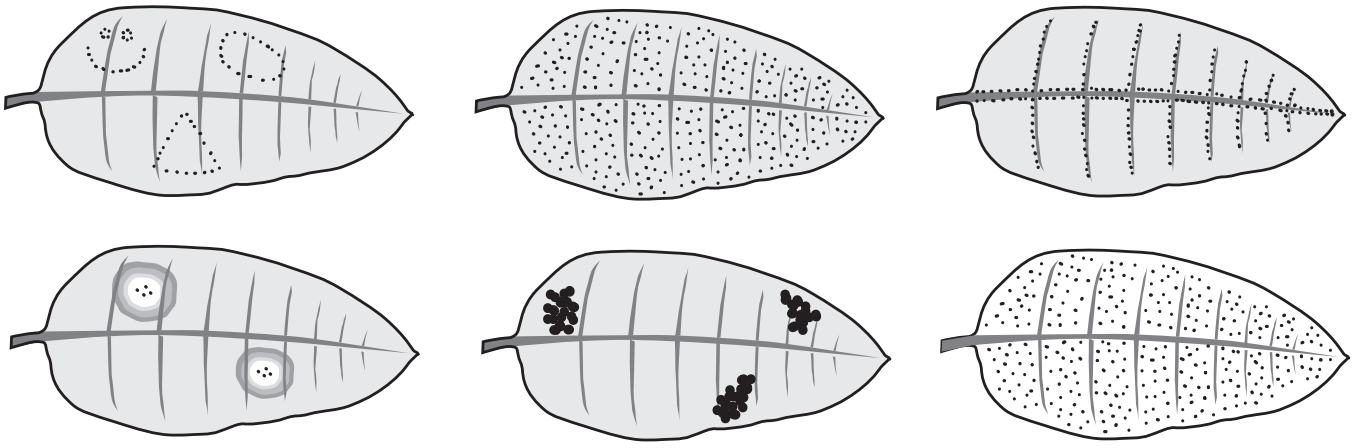
Did you know that plants and animals can give us clues about **pollution** in our air, land, and water, before humans even notice that something is wrong? **Biomonitoring** is the term scientists use to describe the use of plants, animals, or entire ecosystems to learn if our environment is polluted. In Wisconsin, common **milkweed** is a good plant to study because it is affected by **ozone** and it grows all over the state!

The presence of ozone in the air surrounding milkweed plants causes small stipples, or dark polka dots, to appear on the milkweed leaves. This damages the leaves and can harm the whole milkweed plant, or even cause the plant to die if it gets too damaged.

Signs of ozone damage:

- stipples (black dots), found only between the veins, not on them
- stipples are found only on the upper leaf surface
- stipples have distinct, sharp edges
- no haloes or discoloration around the stipple
- stipples are black or very dark in color
- stipples are scattered over the leaf surface, not clustered in groups or in obvious shapes, such as circles

Circle any leaves with ozone damage.



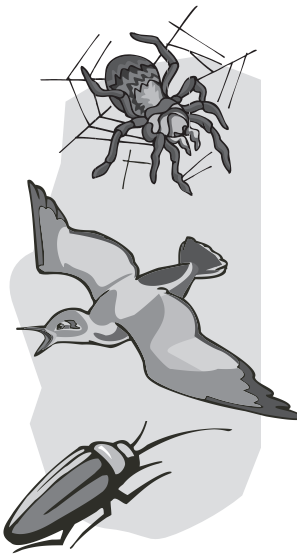
Bottom of the leaf

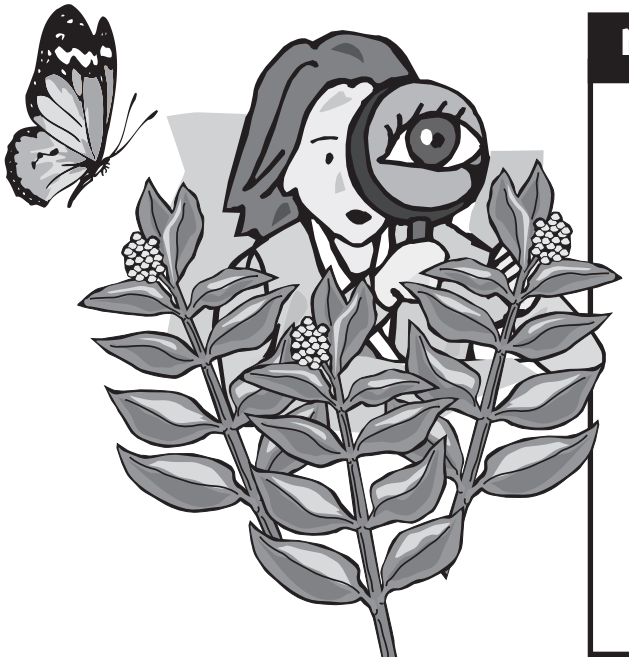
Name_____ Date_____

The monarch relies exclusively on milkweed to lay its eggs and as a food source for the caterpillar.

1. If milkweed is damaged by ozone how might this impact the monarch population?

2. What about other critters that feed on monarchs, like insects, spiders, and some birds, how might their populations be impacted?





Nature Detective

Explore the area around your school or house for milkweed and look for signs of ozone damage. If you cannot find any milkweed plants, plant your own. Not only will you be able to search the leaves for signs of ozone damage, but you'll also create habitat for the butterflies!

Hint: Late summer and early fall are good times to look for signs of ozone damage on milkweed.