Intro to Bio-Indicators

Purpose:
This discussion-based activity will serve as an introduction to a couple of the most common air quality bio-indicators in preparation for the hands-on experience of the bio-indicator walk. Students will learn about historic and present air quality bio-indicators, how they can be used to help predict local air quality, and some shortcomings of using only bio-indicators to make conclusions about the environment.

Discussion:
This activity can complement other activities involving scientific monitoring and how our noses are a built-in monitor for humans (as well as a first line of protection). Bio-indicators mean using the natural environment as an indicator of air quality. You may want to ask:

- Why might living things in nature be good predictors of air quality?
- What types of living things might be used as indicators?

Tell students that when living things in nature are used to predict the quality of the environment, they are called bio-indicators.

Review the resource "Can you spot the lichen?" to learn about one of the most common and easy to spot bio-indicator. Practice identifying each of the three categories of lichen. If you have time, review the resources related to ozone sensitive plants (plant slides/cards and video) to learn about another example of air quality bio-indicators.

It's important to make sure students understand the "drawbacks of indicators" so they have a good idea of the usefulness and limitations of using only bio-indicators to predict the quality of an environment.

Try to answer some of the following questions:

- What limitations do bio-indicators have when it comes to predicting air quality?
- How could we be more certain that our conclusions are correct?
- Do you think there are bio-indicators for other aspects of the environment, like soil or water quality?

Categories of Lichen – Three Growth Patterns

Crustose

Foliose

Fruticose

Take A Walk!

Purpose:

This walk will put the bio-indicator information from the intro activity into a real-world context. Students will look for indicator species and form conclusions about local air quality based on what they find.

Directions:

Choose an area to take the walk. Landscapes with trees and wild plants work the best. You can take as much or as little time as you want. You may also want students to bring something to write on so that they can take notes or draw sketches of their observations.

Take a walk! If possible, bring print-outs of the categories of lichen and ozone sensitive plants. If you have magnifying glasses, they're a fun addition! *(GASP has a lichen shadow box, plant list booklets, and magnifying glasses in the office - feel free to borrow them if you're nearby. Email info@gasp-pgh.org.)*

Try to identify which of the three categories of lichen you are finding. Remember: Crustose will be found in any air, foliose is found in moderately clean air, and fruticose are found only in clean air. Multiple growth forms might be found in one spot. Also remember: Lichen doesn't change overnight - it's an indicator of long-term air quality.

The plants found in the ozone-sensitive plant booklets are all fairly common in southwestern PA. By walking in a wilder landscape, you should be able to find several species. Remind the students that they should look at a few different types of plants before making conclusions of the area's ozone levels.

Have students take note of anything in the area that might affect the air quality.

Discuss your findings! For example:
- What categories of lichen did you find? Did you find any ozone damage on ozone sensitive plants? What does that indicate?
- Since bio-indicators like lichen give clues to long-term air quality, do you know if anything that's not a current issue but a past one might have impacted air quality (such as a now-closed factory or main roadway)?
- If you wanted to confirm what your findings suggest, how might you do that?
  - *Idea: Check if there are any EPA, county, or Purple Air monitors in your area.*
- What factors might be affecting the air quality of the area in which you walked?