Planning Workshop

In this workshop, we introduce the concept of monoculture and discuss why this conventional farming practice brings with it numerous risks. We begin a discussion about the importance of biodiversity in the garden as an ecological solution to these risks. Students then play a strategic game by choosing plants they would like to include in the garden and playing out the interactions with "good bugs" and "bad bugs" in order to come up with the most resilient combination of plants to include in the school garden.

Grade Levels

Grade 6-7

Curriculum Objectives

Grade 6

Science and Technology: Understanding Life Systems

Overall Expectations

- 3 – Demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans

Specific Expectations

- 3.2 – Demonstrate an understanding of biodiversity as the variety of life on earth, including variety within each species of plant and animal, among species of plants and animals in communities, and among communities and the physical landscapes that support them
- 3.4 –Describe ways in which biodiversity within and among communities is important for maintaining the resilience of these communities
- 3.5 – Describe interrelationships within species, between species and between species and their environment, and explain how these interrelationships sustain biodiversity

Grade 7

Science and Technology: Understanding Life Systems

Specific Expectations

- 1 – Assess the impacts of human activities and technologies on the environment, and evaluate ways of controlling these impacts
- 2 – Investigate interactions within the environment, and identify factors that affect the balance between different components of an ecosystem
- 3. – Demonstrate an understanding of interactions between and among biotic and abiotic elements in the environment

Specific Expectations

- 3.2 – Identify biotic and abiotic elements in an ecosystem, and describe the interactions between them
- 3.8 – Describe ways in which human activities and technologies alter balances and interactions in the environment
- Demonstrate an understanding of habitats and communities and the relationships among the plants and animals that live in them

Materials:

- Slide deck: “Good Bug/Bad Bug” (available on the GUO website)
- Garden Ecosystem game cards (available on the GUO website)

Activity

Part 1: Surviving Monoculture

Explain to students that they will be playing three games over the course of the workshop with the goal of choosing the vegetables they will be planting in the school garden. Ensure students are familiar with the terms “pest” and “predator.”

With the aid of the Good Bug, Bad Bug slide deck, explain that each student will receive a card:

- If they are a pest, they seek vegetables, and when they find them, record the names of those vegetables; if an *activated* predator finds them, the pest dies and must return to their desk.
- If they are a predator, they must first find the plant that activates their powers – these plants represent what attracted them to the farm in the first place. Once “activated” predators seek out the insects they eat (sending them to their desks).
- If they are a plant, they go to sit at their desk once a pest eats them.
- All students are required to tell other students what they are when asked and no running away is allowed!

Remind students to carefully read their role card to determine if they are a pest or predator, and which plants or insects they must seek out or avoid, in order to survive. At the end of the game, surviving vegetables are worth 10 points.

Distribute the following Ecosystem cards:

- 3-4 Flea beetles
- 2 Braconide wasps
- Lettuce cards to the remaining students

Begin the game: Students wander around and ask each other who is what. As flea beetles find lettuces, they "eat them" and the lettuces die and must go sit down. With this scenario, all the lettuces (or almost) die within a couple minutes (The braconide wasps are unable to become activated and can therefore not kill any of the flea beetles).

Have the students return to their desks, and discuss what happened.

Explain that we call this system a monoculture: “mono” means one, and “culture” refers to the crop or plants cultivated. We use the word **monoculture** to refer to farms that cultivate one crop over a large area – most farms in Canada are monocultures.

- Why is this kind of system risky? What happened when we only had one type of crop in our game?
  Monocultures become magnets for insects that like to eat that crop and can therefore be devastated by pests (this is what happened in the game).
- How do you think these farmers deal with these problems?
  Through the use of chemical pesticides and fertilizers
- Why is this a problem?

So, in fact, when we set up a monoculture, we are creating a system that is inherently reliant on large quantities of pesticides and fertilisers.

- Why is this problematic?
  Encourage the following responses (use photos to guide the discussion):
  1. Chemicals pollute our waterways and soils;
  2. Chemicals affect the health of farm workers and their families; and,
  3. Pesticides also kill beneficial insects such as bees and other pollinators.

We've created a system that is wreaking havoc on the natural environments that surround our farms! Humans have been farming for 10,000 years, but it's only in the last 60 or so years that we've started farming like this. In the grand scheme of things it is a very, very recent transformation in the way we produce food.

- So what were we doing before? What would the alternative be?
  Remind students of the root of the problem: monoculture!

Part 2: Good Bug, Bad Bug

Introduce the concept of **poly-culture.** "Poly" means *many.* By including many different crops on a farm, or in a garden, we can solve many of the problems created by monoculture by creating and allowing for complex relationships to develop between the organisms it harbours, be they plants, animals, insects or tiny micro-bacteria in the soil. The inter-connectedness creates strength and resiliency.

For example: a conventional response to the pest problem we had in our game is to use chemicals. Instead, an ecological approach looks to interactions among species to create solutions: an organic farmer creates habitats for a pest's predators – beneficial insects that can help keep harmful insects under control.

Optional in-depth discussion: "Multi-functionality"

In a typical garden, or conventional farm, each organism has a single function: Corn is grown to sell; trees are planted to provide shade. When we garden organically and ecologically, we take into account the multiple roles that each component plays. For example, what other role or function could a tree play? (Shelter and nesting sites and materials for birds and squirrels, pollen for bees, nuts or food for humans, leaves help build the soil when they fall); come up with some other examples of the multiple roles played by various garden organisms.

Multi-functionality also implies that not only does each organism play multiple roles, but each role is supported by multiple organisms. Instead of relying on a single pesticide to eradicate all pests, we rely on a wide variety of predators. That way if one predator leaves, there are many others to take its place and the web still holds.

If we can make it so that all the "jobs" in the garden are covered by various plants, animals and insects, there is no need for external (and harmful) inputs, such as pesticides and synthetic fertilizers.

Of course, the garden we'll be creating is a human intervention, we are creating an ecosystem that benefits us, but that also relies on us to function. We only have to look outside to realize that if we planted some tomatoes in the front of the school, we couldn't just let nature be and

expect an abundant harvest; instead, we have to create the conditions for this web of biodiversity to exist. So that's what we'll be doing today.

In order to create a system like this – where we attract good bugs to the garden to keep bad bugs under control – we first need to know who the good bugs and bad bugs are. Using the "Good Bug, Bad Bug" slide deck, review some common garden bugs and their role in ecological food production. (This can be done as a team-based quiz).

Part 3: Creating a Bio-diverse Garden

Now that we know who we want to keep out of the garden and who we want to attract to the garden, we're ready to play our game again and choose a more ecologically minded design for our garden. Let the students know that the vegetables they choose in this game will be those that they plant in the school garden. Give students a choice between all different kinds of vegetables and "Good Bugs," and ensure that you have at least 4 "Bad Bugs." Review the initial rules and play the game again with the goal of having the most vegetables surviving at the end.

Monitor the interactions in order to determine when to end the game; each game typically last between *3 and 4 minutes*. Repeat the game2-3 times, discussing after each scenario what worked and what did not. On the blackboard, note which vegetables survived. After three tries, students should have increased the number of surviving vegetables.

Take the combination of vegetables from the best result and record those vegetables as the ones that will be planted in the garden in the next workshop.