

Lesson	Aquaponics - Water Garden Lesson 1
Topic (title of lesson)	Intro to Aquaponic Ecosystems
SCO/Learning goals/Essential question/ECG(s)	SCO: Explain how different parts of an ecosystem interact and affect each other. Learning Goal: Students will be able to define an aquaponics system and understand the benefits fish and plants provide to each other. Essential Question: How do we keep an aquaponics system stable? ECG: Creativity & Innovation
Prior knowledge and/or misconceptions	Students should have a good understanding of ecosystems, and some climate change impacts on water, that lead to the need for more sustainable practices. It's recommended this lesson be followed by the Human Impacts: Ecosystem lesson plan. Misconceptions may include not understanding what a healthy aquarium looks like for a fish, such as poor water quality.
Accommodations	This lesson includes watching a video and writing. Closed captioning can be used to support hearing impaired students. The use of technology or assistive devices can be used for the writing portion and the option to print or use google docs is available.
Materials/Grouping	This lesson uses a Back to the Roots Water Garden Kit , as well as purchasing a fish and fish tank accessories pH strips are required for testing Optional: nitrate, nitrite, ammonia testing strips
Safety	When setting up the tank, avoid water getting near electrical outlets or the end of the plug

Engagement: This lesson will begin by learning about what aquaponics is. Your classrooms Back the Root's Water Garden should already be set up, or should be done in a separate class after this lesson. For set up instructions, use this [checklist](#), along with the manual provided in the kit.

Begin the lesson by watching this video: <https://www.youtube.com/watch?v=bypO24HAPCg>
This video explains the basic concept of aquaponics and some examples of sustainable benefits.

Let the students know that although you set up or will be setting up the aquaponics kit with the provided plants and recommended fish, they have the opportunity to add more species, change the plants, and alter the water chemistry.

Exploration: Use pH strips to test the acidity in the water. If the tank is not yet set up, test tap water for now and re-test when the tank is filled. Water is typically around a pH of 7, and the recommended pH for both fish and plants is around 6-6.5. (In this water garden, the fish prefers 6-7 and plants prefer 5.5-6.5). You can also measure the water temperature using a thermometer. If your tank is set up, determine if the water temperature is suitable for the chosen species (should be 24-28 °C for bettas). More info [here](#).

Additionally, if you have a testing kit you can test the nitrate, nitrite, ammonia and carbonate levels in the tank. These tests will be more relevant once the aquarium has been in use for a little while and during the second lesson.

Explanation: Discuss with students why the pH might be higher or lower than 7 and reasons it can change. You can share a short video on ocean acidification:

<https://www.youtube.com/watch?v=qAkhuETYn5U>

Although this water garden project supports freshwater fish, changes in CO₂ and pH can still have harmful effects. Excess CO₂ won't be an issue in the classroom aquarium, but pH is still an important measurement and can be affected by other add-ons that will be looked at in the next lesson.

Elaboration: Now that students have a basic understanding of the importance of measuring and having equilibrium in their aquarium, the topic will become how to introduce new species into the ecosystem. As a class or individually, read this article:

<https://thecadrepei.com/2021/09/29/a-goldfish-out-in-the-wild-how-a-harmless-looking-fish-can-pose-a-significant-ecological-danger-in-pei/>

Discuss how goldfish are not native to ponds or rivers in PEI and the goldfish found were assumed to have escaped or been dumped from someone's own pond. The focus of this article is to touch on invasive species and how one species can affect biotic and abiotic factors of an ecosystem and cause major issues.

Evaluation (Assessment):

See below

Name: _____

Date: _____

Use the information from the video and the Back to the Root's [FAQ page](#) to answer the following questions:

1. A typical fish tank has to be cleaned about once a week. This water garden only needs to be cleaned every 5-6 weeks. Why is that?

2. How does the practice of aquaponics contribute to saving water?

3. Potential Hydrogen, commonly referred to as pH, measures how acidic water is. An example of something that is acidic is lemon juice which has a pH of about 2. What is the ideal pH range that is suitable for both plants and fish to live in the Back the Roots aquaponics tank?

4. Why do the plants in aquaponics not require any soil or fertilizer to grow?

5. Thinking about how goldfish can disrupt ecosystems they aren't native to, name two reasons why it is important to research a new species before adding it to the aquaponics tank.