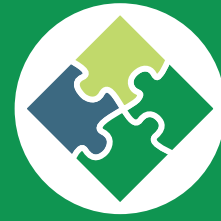


## SYSTEMS ENRICHMENT EXERCISE

# Learning about a Tree

Students are introduced to an important skill for understanding complex systems—recognizing interconnections.



### Objectives

- After completing this exercise, students will be able to
- list characteristics that are important to consider when using systems thinking to understand something new, and
  - define systems thinking as a method of study that focuses on how parts of systems (e.g., trees, soil, atmosphere) interact with each other.

### Materials

- Flip chart paper and easel (for outside) or white board (for inside) and markers

### Introduction

This exercise is the first of several systems thinking exercises that instructors can use to supplement the module activities and further develop systems thinking skills among their students. This exercise should be used with the discussion that is described in step 1 of Part A in Activity 1.

### Doing the Exercise

1. To set up, draw a line down the center of the flip chart or white board. Once students are situated near a tree and **before** asking

students what they think about the words “climate change,” ask them to brainstorm what could be learned about a tree. Have them call out anything that someone tasked with studying the tree could learn. You can start them off with a few concrete characteristics (e.g., height, weight, diameter, chemical composition). This step can also be done before you go outside to make it easier to note their comments on the board.

2. Record the students’ answers as they call them out. Put the student answers that relate to concrete aspects about the tree on

the left side of the flip chart. On the right side, record the student answers that refer to *processes* that connect the tree to the world around it. Below is an example.

3. Once students have run out of answers, ask them what criteria you are using to form these two groups. How would they label each side of the board? After a few guesses, label the left column “Things” or “Tree Features” and the right column “Interconnections” or “Connections and Processes.” Explain to students that the left side contains aspects about the tree

Note: You may have to prompt students for items to list on the right side of the board. It is fine if they come up with only one or two items for the right side at this point. You can give them a chance to add more later.

#### THINGS

- Height
- Weight
- Diameter
- Chemical composition
- Size of leaves
- Shape of leaves
- Texture of bark
- Shape of tree
- Cellular structure

#### INTERCONNECTIONS

- Rate of photosynthesis
- Rate of respiration
- Nutrients absorbed by the tree
- Amount of water absorbed by the tree
- Animals that depend on the tree for food
- Animals that depend on the tree for shelter
- People who use the tree as a meeting place

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In this activity, students are encouraged to consider the interconnections that trees have with the surrounding environment.

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that can be learned in isolation, without reference to the rest of the world. The right side contains answers that refer to the tree's connections to the rest of the world. Each of these answers implies some sort of process or interaction that the tree has with the world around it.

In general, we tend to focus on the left side of the board when we consider what can be learned about any subject (like a tree). If the left side has several more items than the right, you can point this out to students to illustrate this tendency. It is easier to isolate things when we study them, but the connections among things are also important and are also part of how that thing functions and responds.

This would be a good time to brainstorm more items for the right side. If students have more than four items in the right

column, congratulate them on including interconnections in their thinking about the tree and explain that they are already on their way to becoming systems thinkers.

Even when we do think about processes, we tend to teach about them in isolation. For example, we may teach students about photosynthesis which connects the tree to the atmosphere, but we do not typically explain how the process of photosynthesis impacts the carbon cycle. Students may not understand that photosynthesis affects processes beyond plant survival and growth. In this module, we are working to make these connections more obvious and explicit.

After this systems thinking exercise, return to step 1 of Activity 1, Part A to generate ideas about the words climate change.



### Background for More Discussion

You may continue by explaining to students that they are embarking on a unit about climate change and forests that will also enable them to improve their systems thinking skills. In general, systems thinking refers to habits of thinking that pay particular attention to connections within a system (the items on the right side of the chart) in order to understand how the parts of a system fit together and interact with each other. In systems thinking, we do not disregard the answers on the “Things” side. Those are important if we want to understand the tree. However, systems thinkers enhance their understanding of those things by learning about how they are relevant to the answers on the “Interconnections” side when studying a tree, or a forest, or many forests—or any dynamic system.

To emphasize the importance of considering interconnections, have students visualize a similar exercise with themselves as the subject rather than the tree. Imagine, for instance, that a class of aliens has encircled a student and they are discussing what could be learned about the human. On the left side of the chart, the aliens could put descriptors such as height and weight. They could discuss characteristics of the human digestive tract, respiratory system, or brain. But would that really tell the aliens much about us?

Think about how much more the aliens could learn from the items that would be on the right side of the chart. They might learn about how humans need clean air to breathe and water to drink. They might also learn how we affect the environmental systems

that provide those things. They might learn about our relationships with other people—how we act with our friends and our families. They could even learn that young humans go to school, have teachers, and talk about trees.

If they are particularly observant, the aliens might realize how the context of a situation significantly affects our behavior. They might observe that we interact differently with each other on a playing field versus in a classroom. They might see that we interact differently with teachers than with friends, or with strangers than with family members. The list could go on and on.

The point is, in order to truly understand our behavior, these aliens would need *to understand our interconnections with the world around us and how those interconnections can change over time.*

As the title of this module suggests, the activities focus on the interconnections between forests and climate change. Humans play a large role in affecting forests and climate, and in turn, they affect humans as well. So, these activities really focus on the interconnections between humans and forests and climate change. The systems thinking connections and exercises are available so you can help your students understand these interconnections and how they change over time.

You can transition to step 2 by asking students how long they think scientists have been talking about climate change and carbon emissions and continue with the timeline in Activity 1.