Forests & Climate Change: Forest Systems

ACTIVITY SUMMARY
This activity provides a framework to invite your group into the topic of forests and climate through *systems thinking*. Systems thinking is about bringing to light complex relationships (like ecosystems and climate change) to draw connections that may not be obvious at first. his activity can be used as a lead-in to the other climate-public lands curriculum or adapted as an intro to a citizen's science project.

As you gauge your group's prior familiarity with these topics, you can scale the discussion appropriately. For groups that are less familiar with climate impacts or may not have a strong background in ecology, this activity offers a framework to work from. For groups that are more knowledgeable, use both your own and your group's knowledge (as well as the **Forests & Climate Talking Points**!) to use this exercise as a jumping off point to dive deeper into climate impacts.

OBJECTIVES
We Broads are lucky to count ecologists, biologists, and many self-taught nature enthusiasts among our ranks. We can open up this knowledge and way of observing the world for others! Open-ended questioning and discussion tools allow us to guide our group's thinking while building their curiosity and interest in the topic.

By the end of this activity, your group will be able to:

- Understand the importance of both looking closely at one organism and seeing the overarching, complex systems that are connected to its survival
- Recognize that there are connections and complex relationships in nature
- Question how parts of a system (e.g. tree, soil, atmosphere, energy, humans) interact with each other, and impact the health and stability of the system

METHODS
Inquiry, Communication, Visualization, Discussion

MATERIALS
Optional: Flip chart paper and easel or a white board and markers

AUDIENCE
Small to medium sized groups

TIME CONSIDERATIONS
15 to 20 minutes, depending on the extent of group discussion

BRIEF BACKGROUND READING
Systems Thinking Can Support Public Understanding of Climate Change: https://bit.ly/2XXOdYA

FACILITATING THE ACTIVITY

1. To set up, draw a line down the center of the flipchart or whi eboard. If possible, position your group in a circle near a tree for this activity. (See ***Modifications*** section below for a discussion-based approach.)

2. Pose a question to your group: "If you were a researcher, what would you want to learn about a tree?" Have them call out anything that someone tasked with studying the tree could learn, perhaps questions that they have wondered to themselves before. If needed, you can start them off with a few concrete characteristics (e.g., height, weight, diameter).

3. Record the group's answers as they call them out. Put the answers that relate to *concrete aspects about the tree itself* on the left column of the flip chart. On the right column, ecord the answers that refer to *processes that connect the tree to the world around* it **but do not label these two categories**.

    - ***Facilitation Tip:*** *If your group is having a hard time coming up with questions, remind them that we don't have to be scientific professionals to ask questions and be curious. Offer "How, What, When, Where, Why" prompts if needed.*

The Tree	Interconnections
• Height/Weight/Diameter • Seasonal changes in appearance and behavior • Size/shape of leaves • Texture and function of bark • Age of the tree, how the tree changes with age	• Nutrients absorbed by the tree from the soil • Amount of water absorbed by the tree from the air and the earth • The tree's ability to withstand drought or fi e • Species that depend on the tree for food or shelter • People who depend on the tree for food or industrial purposes • How much carbon the tree absorbs from the atmosphere

4. Once you have gathered a well-rounded list, ask the group if they have figu ed out what criteria you are using to divide their responses into two groups. How would they label each side of the board? After a few guesses, label the left column "Tree Features" or "The Individual Tree" and the right column "Systems Level" or "Connections and Processes." Invite your group to discuss the importance or value of both columns. Consider exploring why one column has more ideas than the other. Invite a few people to share their thoughts. Did you learn anything about your group's interests or ways of thinking in the process?

5. Restate that the left side contains aspects about the tree 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; i.e. 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). It might seem easier to isolate things when we want to learn about them, but the relationships among things are also important. Without its ecosystem (water, atmosphere, soil, animals to disperse its seeds, fungi, etc.), a tree cannot survive.

6. Transition the conversation into the topic of forest-climate connections. Climate change is a great example of systems-level change impacting ecosystems at many levels. Explain that both categories of questions are important to seeing and understanding climate impacts and adaptations.

    - For instance, a question about the tree's bark is very important to understanding the tree's resistance to fi e, which may help us understand if this species of tree will survive more frequent wildfi es in the future.

    - Meanwhile, studying the animals that depend on a particular tree species would help us to understand the importance of that kind of tree to the larger ecosystem and how those relationships change as the tree's livable environment shifts further north or upslope as temperatures increase, impacting the species that depend upon it.

7. Return to the list of "systems-level" questions your group has generated. Ask each member of the group to share a *new or adapted* systems-level question that they would want to ask that's specifically linked t forests and climate change. What changes would they want to monitor?

    Discussion Extensions:
    - Consider introducing your group to the importance of timelines when talking about climate change impacts. Climate, unlike daily weather, is all about long-term trends and averages. If we were to design a study that dove into one of the group's systems-level questions, we would want to carefully collect data that covers many years in order to see long-term trends rather than year-to-year variability.

    - Consider transitioning to a conversation about which of the group's questions we do and don't currently have answers to. If you are familiar with a study that has answered any of these questions, now (or during the group hike that follows) is a great time to share your insights!

- If your group posed questions like "how much carbon does this forest absorb?" use your **Forests & Climate Talking Points** to explore regional trends and explain the important differences between old and young forests.

- Trees as living data stores: Someone in your group may have posed a question that would require drilling tree cores to reveal the tree's history. Trees are like living history books, recording every year of events in the forest. Both living and dead trees have shared thousands of years of information with scientists. For example, tree rings usually grow wider in warm, wet years and they are thinner in years when it is cold and dry. If the tree has experienced stressful conditions, such as a drought, the tree might hardly grow at all in those years. very old trees can offer clues about what the climate was like long before measurements were recorded. In this sense, the forests *themselves* have told us their stories of a changing climate if we listen close enough!

8. If you are using this activity to kick off a **Hike with a Purpose**, offer an invitation to your group to look closely, be curious about their surroundings, while also keeping these connections and big-picture interactions in mind. Perhaps offer to record your group's climate connections and questions throughout the day so that you can reach out to an expert and share what you've found with your group through a climate newsletter in the future.

MODIFICATIONS

If you would prefer to make this activity discussion-based, try the "pair-share" method. Ask your group to pair up and share the ways they could think to study a tree. Send each pair off to find a t ee that they can examine as they share questions. Go around in a circle and have each group share a favorite question until you have heard a good variety. Discuss what themes the group noticed and ask the group to categorize the types of questions that they heard. Introduce two categories—"tree features" and "interconnections"—and ask which category the group thinks fit with the majority of the questions listed. Int oduce the idea of systems thinking and the critical importance of asking questions about system-level connections in order to reveal the forest-climate connections that surround us.

BACKGROUND

Forests are fundamentally linked to Earth's climate. On a local scale, trees can create their own micro-climate by creating shady areas and altering air moisture levels. For instance, old-growth Douglas fir fo ests in Portland, Oregon's watershed capture water particles from the air, causing what is known as "fog drip." Through fog drip, these old forests *cause* 30 percent more precipitation to enter the watershed than neighboring clear cuts. Removing these trees would fundamentally alter the watershed's micro-climate, reduce summer streamflo , and harm river ecosystems and downstream communities.

Trees are also linked to climate on much larger scales as they remove massive amounts of carbon dioxide from the atmosphere. Because of the large amounts of carbon stored in forests, trees play a key role in stabilizing the global climate. Yet, as climate change drives long-term shifts in temperature and precipitation, some forests are becoming stressed while others may fare better. Climate change has many complex impacts on forest ecosystems.

Curriculum Source Credit: *This activity is sourced from Project Learning Tree's Climate Change and Forests Curriculum, original activity titled "Learning about a Tree" with adaptations and additions for the Great Old Broads audience.*

ADDITIONAL RESOURCES:

- ***Fourth National Climate Assessment Chapter 6: Forests*** https://bit.ly/2zidvq4
- ***Background info on tree rings:*** https://go.nasa.gov/34WKlbJ
- ***Tree Story: The History of the World Written in Rings,*** by Valerie Trouet. *"Children around the world know that to tell how old a tree is, you count its rings. Few people, however, know that research into tree rings has also made amazing contributions to our understanding of Earth's climate history and its influences on human civilization over the past 2,000 years. In her captivating new book, Tree Story, Valerie Trouet reveals how the seemingly simple and relatively familiar concept of counting tree rings has inspired far-reaching scientific breakthroughs that illuminate the complex interactions between nature and people."*
- ***Water Resources Bulletin, Water Drip:*** *https://bit.ly/3byKtkc*