Climate Change in Iowa

Overview

This activity encourages communities in Iowa to learn about the processes and consequences of climate change. Participants will examine the ring width of tree cores that were collected by an Iowa State professor in the 1980's and use them to form hypotheses about the climate over time. By matching up tree cores from different sources of wood, both living and dead, participants learn how to reconstruct the climactic past of Iowa and develop a sense of how scientists can know about events that happened a long time ago.

Vocabulary

Dendrology is the study of characteristics of trees.

Learning Goals

1. Understand the concept of dendrology and how living (and dead) trees can capture the footprint of climatic variables from hundreds of years in the past.
2. Develop an accurate timeline by matching tree-core samples from four sources.
3. Be able to give an approximate date that each of the four samples came from by calibrating the timeline with the living tree.
4. Identify the signatures of climate change (drought, fire, flood) in the core samples and map them onto the timeline.

Materials

- 'Climate Change in Iowa' poster
- 4 tree cores sample
- 9 Climate variable tokens (Drought, Fire, Flood)
- Real-life tree sample or cross-section photograph

Set-up

1. Display the poster on a flat surface.
2. Place the tokens to the side of the poster.
3. Place each core-sample with its corresponding location at the bottom of the poster.

Procedure

Short Form

1. Briefly explain that the paper strips represent tree cores from different sources of wood. It will be the participants' job to determine how they fit together.
2. Allow the participants to determine the orientation of each sample using context from other samples by matching them and using information derived from each source of wood (i.e. older sources of wood are more likely going to represent samples that were alive before younger samples of wood).
3. Using the nine tokens help the participant to identify the occurrence of three types of climatic variables (drought, flood, fire) by placing the tokens next to the areas where they believe these events took place and in what years they took place in.

Definition of Success:

Participants can correctly orient the core samples and correctly associate climatic variables with the appropriate region of the timeline. They will understand that there are interesting ways to determine the climactic history of a region.

Long Form

1. Briefly explain that the paper strips represent tree cores from different sources of wood and it is their job to determine how they fit together.
2. Allow the participants to determine the orientation of each sample using both the context of other samples, and using information derived from the source of wood (i.e. older sources of wood are more likely going to represent samples that were alive before younger samples of wood).
3. Encourage the participant to make an estimate of the year that the oldest source of wood was obtained using the prompt that each tree ring represents one year of growth. For older or more advanced participants you could nudge them into the idea that there may be a range of "correct" answers due to the ambiguity of some of the core sample matches. This means that there are multiple ways for two of the cores to be lined up with each other.
4. Using the nine tokens help the participant to identify the occurrence of three types of climatic variables (drought, flood, fire) by placing the tokens next to the areas where they believe these events took place and in what years they took place in.
5. Have the participant look at the real-life tree sample. Ask them to make a hypothesis ring spacing/depth when using real wood. What are some potential limitations in using these methods for chronological dating? Under what scenarios might there be ambiguity for accurate dating? If using the University of Iowa tree stump photograph, ask them to identify how old the tree was before it was struck by lightning and removed in 2019.

6. Broaden the scope of the concepts in the activity: have a brief conversation about how scientists can use indirect data like those represented in tree ring samples to make inferences about the history of the natural world. You could even highlight how, in some ways, dendrology has some parallels with paleontology and how they both make estimates of the past and are powerful tools to understand the world.

Definition of Success:

Participants can correctly orientate the core samples and correctly associate climatic variables with the appropriate region of the timeline. They will understand that there are interesting ways to determine the climactic history of a region. They will gain an understanding of how scientists can use indirect data to make predictions on unobserved events.

Further Resources

- [Link to research article of data used](https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/WR017i004p01183):
  https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/WR017i004p01183
- [Data link](https://www.ncdc.noaa.gov/paleo-search/study/search.json?dataPublisher=NOAA&dataTypeId=18&investigators=Duvick%2C%20D.N.&headersOnly=true):
  https://www.ncdc.noaa.gov/paleo-search/study/search.json?dataPublisher=NOAA&dataTypeId=18&investigators=Duvick%2C%20D.N.&headersOnly=true

NGSS Standards

[K-ESS2-1 Earth's Systems](#)

Use and share observations of local weather conditions to describe patterns over time.

[3-ESS2-1 Earth's System](#)

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.