Overview

Henry David Thoreau was not only a writer and philosopher, he was also a naturalist and what we would call today a "citizen scientist." In this game-based learning experience, students take on the role of Thoreau the naturalist as they investigate the biodiversity of Walden Pond, collecting information and specimens of the many species of plants and animals to be found there, while being mindful of protecting the environment. Supporting the 15-30 minute gameplay experience, are five pre- and post-play activities that will extend and deepen students' understanding of Thoreau's work as both a naturalist and an author and witness to the beauty of nature.

Essential Question

- How can we be both curious and mindful about our natural environment?

Enduring Understanding

- Understanding and protecting our natural environment is a critical part of being a citizen of our world.

"Leave No Trace" principles addressed by this lesson

Leave What You Find

Preserve the past: examine, photograph, but do not touch cultural or historic structures and artifacts.

Leave rocks, plants and other natural objects as you find them.

Avoid introducing or transporting non-native species.

Do not build structures, furniture, or dig trenches.

Respect Wildlife

Observe wildlife from a distance. Do not follow or approach them.

Never feed animals. Feeding wildlife damages their health, alters natural behaviors, [habituates them to humans], and exposes them to predators and other dangers.

Protect wildlife and your food by storing rations and trash securely.

Control pets at all times, or leave them at home.

Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.

Subjects

Environmental Science

Gameplay Time

15-30 minutes with five options for related activities

Activity Time

Five activities ranging from 20 minutes to several 60 minute sessions over seasonal gaps

Cost: *Free*

Age Range: *14-18*

Languages

English. The game is also available with Spanish and French subtitles.

Materials

- Web-based game module https://www.waldengame.com/play-the-natural-world
- Curriculum materials included in this PDF
- Related materials mentioned **in bold** are in the appendix at the end of this document

Objectives

Students will be able to:

- Reflect on Henry David Thoreau's work as a naturalist and citizen scientist.
- Articulate the basic concepts of phenology, the study of cyclical or seasonal biological events, and why it is important to understanding climate change.
- Gather phenological data about flora and fauna in their local environment.
- Apply an understanding of phenology to their own experiments around climate change.
- Demonstrate a respectful relationship to the natural environment.

Warm-Up Activity (REMOTE-FRIENDLY)

What's growing in your neighborhood?

Objectives

Students will be able to identify plants they find in their local neighborhood.

Activity Time

20-60 minutes

Materials

- Smartphone with camera.
- A free plant identification app or site like Pl@ntNet (https://plantnet.org/en/), iNaturalist (https://www.inaturalist.org/) or Budburst (https://budburst.org/)

Main Activity

Lesson Hook

You are going to do some citizen science in your own neighborhood. With your smartphone and plant identification app, take a walk and identify as many unique plants as you can. Notice what state of growth they are in – are they small, new growths, or established plants? Are they flowering? Are the leaves green or are they old and dropping to the ground?

Make a group collage of all the plants that the class has found, photographed, and identified.

Lesson Prompts

"What is a course of history or philosophy, or poetry, no matter how well selected, or the best society, or the most admirable routine of life, compared with the discipline of looking always at what is to be seen?"

- Henry David Thoreau, Walden

The science of phenology literally means "the science of appearance" and comes from the Greek words "phaino" (to show or appear) and "logos" (to study). It is the study of cyclic and seasonal natural phenomena and you can find out more about it here: https://budburst.org/phenology

Henry David Thoreau, who practiced his own version of the "citizen science" of phenology, had a habit of walking the woods every day and taking notes on everything he found: the days that each plant bloomed, the level of the water in the pond, and every detail he noticed about the natural environment. As a warm up to this lesson, students will do a short exercise in the footsteps of Thoreau, walking their own local environments and taking photos and notes about the plants they find.

- Set a timeframe for students to do their collection of images – it could be as short as an hour, a day, or even a week.
- Once students have collected images, set up a working time to identify them using the plant identification resources. This could be a good group activity, especially if a number of students have found similar plants.
- If you have time, have students create a poster (or virtual poster using a free online collaboration tool like Mural.co or Miro.com) of all of the images and identifications.

Exit Ticket

Have students determine several of the most predominant species in your local environment based on how many students discovered these species. Have them list their scientific names. Ask students to choose their favorite plants from all of the species discovered by the class.

Assessments

Student photos, correct identifications, whole class discussion of the importance of phenology, individual exit ticket responses.

Pre-Game Discussion (REMOTE-FRIENDLY)

How has Thoreau's work as a citizen scientist helped us to understand climate change?

Objectives

Students will connect the citizen science done by Thoreau at Walden Pond in the 1850s to our modern understanding of climate change and how it affects our local environment.

Lesson and Activity Time

20 minutes

Materials

- Video by Professor Richard Primack, a biologist who has used the data collected by Thoreau and other citizen scientists to study the effects of climate change on the flora and fauna at Walden Pond: https://www.youtube.com/watch?v=3x_cK1rpG64

Main Activity

Lesson Hook

The teacher will play professor Primack's video (3 minutes) where he discusses how global and urban climate change have caused Concord, where Walden Pond is located, to increase in temperature about 5 degrees Fahrenheit over the last 150 years. Because of this, plants are now flowering about 10 days earlier than in the time of Thoreau.

Class Discussion

Why is it so important that Thoreau's data about blooming times of plants at Walden, which were collected so long ago, are available for today's scientists to use as a comparison? If we did not have Thoreau's data from 150 years ago, how would we be able to study the changes to the environment at Walden? Can citizen scientists of today make a difference for the scientists of tomorrow?

Naturalist gaming

As game theorist Alenda Y. Chang notes in her book *Playing Nature: Ecology in Video Games*, most people reflexively think of nature and videogames as mutually exclusive.

However, there are a number of games, like *Walden, a game*, that challenge that assumption. *Walden*, and other games like *Firewatch*, *Everything*, and even *Pokémon Go* can connect us to ideas about nature and its critical role in our lives. They are small, safe spaces where we can explore nature and learn more about nature without risk or fear. They are what literary scholar Lawrence Buell calls "Enviromental Texts."

Buell, in his book *The Environmental Imagination*, suggests four criteria for these "environmentally oriented works" — a work that helps us to understand nature and humanity's relation to it. These criteria are:

1. "The nonhuman environment is present not merely as a framing device but as a presence that begins to suggest that human history is implicated in natural history."

2. "The human interest is not understood to be the only legitimate interest."

3. "Human accountability to the environment is part of the text's ethical orientation."

4. "Some sense of the environment as a process rather than as a constant or a given is at least implicit in this text."

Naturalist Gaming, a YouTube channel, has done several wonderful playthroughs of environmental games like *Walden* discussing these criteria and other aspects of the games that you may find useful to share with your students. In this Walden play through, the host identifies all of the species of plants and animals he encounters!

Playing the Game (REMOTE-FRIENDLY)

Can you be a citizen scientist and also be mindful of the environment?

Objectives

Students will take on the role of Thoreau working as a citizen scientist while living at Walden Pond.

Students will be able to identify fifteen or more species of plants and animals by their common and scientific names. They will assist with scientific tasks while remaining mindful about how their actions may impact the environment.

Lesson and Activity Time

30 minutes

Materials

- *Walden, a game* The Natural World module https://www.waldengame.com/play-the-natural-world
- *Walden, a game* **species checklist** found in the appendix of this document.

Main Activity

Lesson Hook

The game itself is an immersive environment that provides a hook to draw students into playing the role of Thoreau.

Lesson Prompt

- Students will play The Natural World module (30 minutes).
  - ▹ If they are playing in pairs or groups, the teacher can encourage them to discuss their choices and thoughts about the game out loud with each other while the teacher circulates and checks in with each group.
- In the game, students will:
  - ▹ Discover fifteen or more species of plants and animals
  - ▹ Complete a scientific survey of the shore of the pond to assess spring water levels
  - ▹ Assist a scientist in studying examples of local species
  - ▹ Remain mindful of protecting the environment
  - ▹ Discover passages from Thoreau's writings by gathering arrowheads
- At the end of the module, students will be shown a recap screen reviewing how they did in accomplishing their tasks. The screen will allow them to save and print their in-game journal. The journal will include the passages students found (all of them are excerpts from Walden about nature and the environment). It also includes records of their interactions with objects, and quotes about the tasks they completed.
  - ▹ If desired, the teacher can also ask students to use the checklist included in the appendix to take notes on which plant and animal species they found in the game.

Exit Ticket

The journal has blank space for students to take notes on each passage by adding their own thoughts or data. For example they can add notes about the species that a quote refers to, such as where they found it, whether it was flowering or not, and whether or not it is a species they have seen in their own local environment.

Assessments

The teacher can collect and assess the species checklist and/or the journal entries from each student.

Phenology Project (REMOTE-FRIENDLY)

Are you ready to do your own citizen science and submit your data to an ongoing phenological research project?

Objectives

Students will synthesize what they learned during this lesson to participate in a citizen science project by collecting and submitting phenological data about local plant species over the course of several months or seasons.

Lesson and Activity Time

Several 30 minute sessions over 3+ months

Materials

- Phenology data sheets from budburst.org or the Budburst app: https://budburst.org/phenology-and-climate.

Main Activity

Lesson Hook

People all over the world are sending in citizen science observations to answer the question "How is climate change affecting plant phenology?" You can participate in this project by collecting data in your local environment over several seasons and submitting that information to the Budburst.org research project.

Lesson Prompt

Students will fill out phenology data sheets (found at the link above) for the plant species they identified in the warm-up exercise. Then, over the course of several months or a season, they should do additional observations of the same plants. By observing when these plants change over the course of several seasons and completing several observation reports on the same plant, they will be providing valuable information to an ongoing research project.

Exit Ticket

Create a spreadsheet of all the student observations noting how each plant changes over the course of this extended exercise.

Assessments

Individual observations completed by each student.

Summative Reflection (REMOTE-FRIENDLY)

What have you learned about cyclical seasonal changes in nature? What about longer term changes in nature? How can we contribute as citizens to a greater understanding of our living, changing natural environment?

Objectives

Students will be able to connect Thoreau's writings on nature, observation, and seasonal change to their own experiences doing citizen science and phenology. They will be able to reflect on how seasonal changes differ from the long term effects of global and urban warming on our environment.

Students will compose short, reflective essays about what they have learned.

Lesson and Activity Time

Take home assignment or 45-60 minutes in-class

Materials

- Poster or collage of local species identified by the class in the warm-up lesson.
- Spreadsheet of observations done in the Phenology project.
- 15 short primary source selections from the Walden book related to themes of looking at natural phenomena: https://www.waldengame.com/s/Walden_Edu_The-Natural-World_Excerpts.pdf.

Main Activity

Lesson Hook

Our environment is a living, changing ecosystem, not a static thing. Noticing the changes in our environment, day to day, month to month, year to year, even decade to decade and beyond, can teach us more than we might think about the wider world. Not just as citizen scientists, but as citizens of our neighborhoods and local communities, and of the world.

Henry David Thoreau rarely left his hometown of Concord, and yet his writings about the natural environment there have affected the lives of millions of people who have read his writings about nature and have, as we have seen, used his notes about the local species to learn more about how our global climate is changing over time.

Lesson Prompt

"The earth is not a mere fragment of dead history, stratum upon stratum like the leaves of a book, to be studied by geologists and antiquaries chiefly, but living poetry like the leaves of a tree, which precede flowers and fruit—not a fossil earth, but a living earth."

- Henry David Thoreau, Walden

Read the provided excerpts from Walden about nature, wildness, and the changing of the seasons, and use them as a jumping off point for a short 1-2 page reflective essay about the changes you have observed in nature and how you see the relationship between these seasonal changes and longer term climate shifts like those discussed by Professor Primack in the pre-game discussion.

Exit Ticket

Individual student essays

Assessments

The teacher can assess the student's engagement with the themes of the lesson through their final written essay.

Appendix: Related Materials

Walden Species Checklist **The Natural World Lesson**

Name _____ **Date** _____

Check off each species you found in the game and add any notes about its flowering state, leaves, or other things you notice. (Some species can only be heard but not seen in the game.)

Plants:

Bird's Foot Violet (Viola pedata)

Black Birch (Betula lenta)

Blackberry (Rubus allegheniensi)

Blue Flag (Iris versicolor)

Bluets (Houstonia caerulea)

Bracken Fern (Pteridium aquilinum)

Cattail (Typha latifolia)

Cinnamon Fern (Osmundastrum cinnamomeum)

Creeping Juniper (Juniperus horizontalis)

Dogwood (Cornus florida)

Early Goldenrod (Solidago juncea)

Eastern Hemlock (Tsuga canadensis)

Eastern Red Spruce (Picea rubens)

Ground Ivy (Glechoma hederacea)

Groundnut (Apios tuberosa)

Hay-Scented Fern (Dicksonia punctilobula)

Highbush Blueberry (Vaccinium corymbosum)

Indian Grass (Sorghastrum nutans)

Life Everlasting (Hylotelephium telephium)

Marginal Woodfern (Dryopteris marginalis)

Oxeye Daisy (Chrysanthemum leucanthemum)

Pasture Rose (Rosa carolina)

Pennsylvania Sedge (Carex pensylvanica)

Piper Grass (Agropyron repens)

Walden Species Checklist page 2

Pitch Pine (Pinus rigida)

Purslane (Portulaca oleracea)

Red Huckleberry (Vaccinium parvifolium)

Red Maple (Acer rubrum)

Roman Wormwood (Ambrosia artemisiifolia)

Royal Fern (Osmunda regalis)

Rye (Secale cereale)

Sandbar Willow (Salix exigua)

Smooth Sumac (Rhus glabra)

Smooth Yellow Violet (Viola pensylvanica)

St. Johnswort (Hypericum perforatum)

Sweet Pignut Hickory (Carya ovali)

Tall Anemone (Anemone virginiana)

Tall Cinquefoil (Potentilla arguta)

White Birch (Betula papyrifera)

White Oak (Quercus alba)

White Pine (Pinus strobus)

Wild Apple Tree (Malus domestica)

Wild Strawberry (Fragaria virginian)

Yellow Clintonia (Clintonia borealis)

Birds :

American Crow (Corvus brachyrhynchos)*

American Robin (Turdus migratorius)*

Barred Owl (Strix nebulosa)

Black-Capped Chickadee (Parus atricapillus)

Blue Jay (Cyanocitta cristata)

Canada Goose (Branta canadensis)*

Common Loon (Gavia immer)

Gray Catbird (Dumetella carolinensis)*

Hairy Woodpecker (Leuconotopicus villosus)*

*Audio calls only

Walden Species Checklist page 3

Mallard (Anas platyrhynchos)

Mourning Dove (Zenaida macroura)*

Nighthawk (Chordeiles minor)

Northern Cardinal (Cardinalis cardinalis)*

Partridge (Bonasa umbellus)

Ruby-Throated Hummingbird (Archilocus colubris)

Screech Owl (Megascops asio)

Song Sparrow (Melospiza melodia)

Tufted Titmouse (Baeolophus bicolor)*

Wood Thrush (Hylocichla mustelina)

Mammals:

Horse (Equus caballus)

Hare (Lepus americanus)

Hound (Canis lupus familiaris)

Human (Homo sapiens)

Mink (Neovison vison)

Red Fox (Vulpes vulpes)

Red Squirrel (Sciurus hudsonius)

White-Footed Mouse (Peromyscus leucopus)

Fish:

Common Shiner (Luxilus cornutus)

Yellow Perch (Perca flavescens)

Walleye (Sander vitreus)

Insects:

Water Bug (Family: Gerridae)

Ant (Family: Formicidae)

Fly (Order: Diptera)*

Mosquito (Family: Culicidae)*

*Audio calls only

Walden Species Checklist page 4

Amphibians:

Bullfrog (Rana catesbeiana)

Spring Peeper (Pseudacris crucifer)*

Reptiles :

Eastern Mud Turtle (Kinosternon subrubrum)

Fungi :

Old Man Mushroom (Strobilomyces floccopus)

*Audio calls only