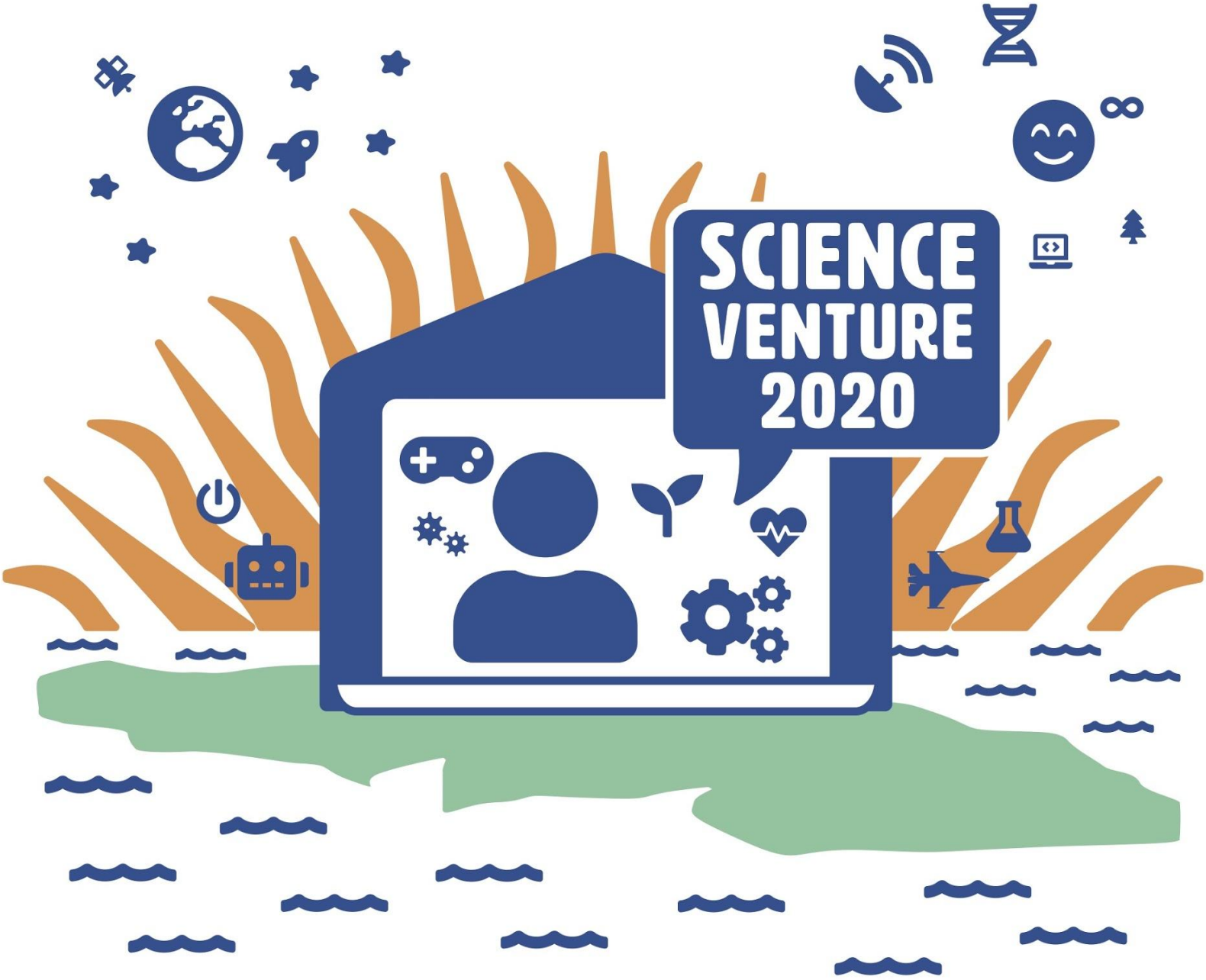


Science Literacy Week

Forest Fire Biodiversity

Science Literacy Week - Forest Fire Biodiversity

This lesson will give youth insight into how natural forest fires can increase biodiversity. Youth will learn that forest fires are natural and forests are well adapted in a variety of ways to deal with fires. Some species are even dependent on fires for their survival. That being said, not all fires are good including the fires used to deforest the Amazon. In the activities, youth will learn to design a healthy and diverse ecosystem. Youth will also analyse cones and seeds to discover what makes them well adapted for fires.

Forest Fires

As forest fires currently burn across the west of Canada and the United States, it's easy to feel despair from its destruction. But that wouldn't be telling the whole truth. Forest fires are completely natural and ecologically beneficial for a forest ecosystem. It is important to mention that this does not include fires from deforestation such as in the amazon or the increase of fires from climate change.

Forests are a place of huge diversity. Between the trees, insects, shrubs, wild flowers, birds and mushrooms, a forest is a network of species that work together contributing different things for the benefit of the forest as a whole. Biodiversity therefore boosts forest productivity, as well as the forest's resilience and ability to adapt to change, such as climate change.

As forests age, tall trees like evergreens can take over and prevent the forest floor from obtaining enough sunlight. This lowers the forest's biodiversity as well as it's risk of fires. When the forest regrows after a fire, it regrows differently and the slags of burnt trees become homes for insects, moss, birds and squirrels. The gaps in the forest canopy now allow for life to flourish on the forest floor. As the forest regrows the biodiversity increases and as a whole the forest benefits.

Science Literacy Week - Bug Hotel

Materials

- Paper
- Pencil
- Coloring tools
- Dice
- Tools for dissecting cone

Safety Considerations

- Finding a cone outside should be done with parent supervision.
- Be careful handling cones, they can be sharp or pokey.
- When dissecting, only use tools such as scissors or knives if you have parent supervision. Otherwise try to just use your hands. Wear gardening gloves for more difficult cones.

Keywords

Biodiversity - the variety of life and species that occupy an ecosystem.

Forest Canopy - The upper layer of a habitat zone, often the leaves and branches formed at the uppermost part of the forest.

Resin - Organic and viscous compound secreted by plants for protective benefits.

Germinate - For a seed to begin to grow into a plant.

Cone - The dry fruit of a conifer tree, formed from a tight array of scales which protect and release the seeds.

Seed - The unit of reproduction for flowering plants.

Moratorium - A temporary prohibition of an activity.

Science Literacy Week - Forest Fire Biodiversity

Background Information - Forest Adaptations to Fire

Serotinous Cones

Some pine species have adapted and developed very thick, hard cones that are glued shut with **resin**. (Resin is a solid / highly viscous substance that plants secrete in response to injury). These cones hang on pine trees for years after the seed has matured. When in contact with a fire, the resin melts and the cone opens up, releasing its seeds into the forest. After a forest fire, these pine trees are among the first species to regrow.

Figure 1. Image source https://www.thoughtco.com/serotiny-and-the-serotinous-cone-1342894

Fire-induced sprouts

This adaptation allows for the above ground part of a tree or plant to be completely destroyed by a fire. After the fire, the tree can re-sprout from its undamaged, underground root system. Nutrients stored in the root system allow for this phenomenon to occur.

Figure 2. Image source https://en.wikipedia.org/wiki/Rhamnaceaev

Thick Bark

Finally, trees in fire-prone areas such as BC develop thick bark which makes catching fires much more difficult. The thick bark also protects the inside of the tree which is crucial for transporting nutrients. Next time you are on a hike, keep an eye out for trees that have blackened bark, this may indicate that this tree survived through a forest fire because of its thick and fire resistant bark.

Fire-activated seeds

Much like the serotinous cones, fire activated seeds lay dormant for years until they are activated by a fire. They are either activated by the heat, smoke or other chemicals. These seeds have a tough coating. The major difference between fire-activated seeds and serotinous cones is that these seeds need fire in order to germinate. This means that in some cases, controlled fires are used to protect these species.

Science Literacy Week - Forest Fire Biodiversity

Background Information - Deforestation in the Amazon

Forest fires are used in the Amazon for deforestation. Huge areas of the forest are cleared for use by cattle ranches and soy plantations. Since 1978, these industries have been driving a booming economy in Brazil and the rate of deforestation steadily increased until the early 2000s when the rate dropped substantially, see figure 3. That's when the government in Brazil started protecting more of the rainforest and cracking down on illegal deforestation. Private companies started putting in place Soy and Beef moratoriums meaning they would only purchase goods from existing farms and plantations, rather than newly deforested regions. These policies are being reversed and the current government in Brazil is heavily influenced by the agriculture industry, resulting in an increase in deforestation since 2012.

So why is the Amazon so important to protect? For starters, the region contains over 400 billion trees that absorb CO2. This means the Amazon is the world's largest carbon sink accounting for 86 billion tonnes of CO2. If the Amazon is converted into farms and ranches, the effects on climate change would immediately worsen. Not only that, the Amazon is the most biodiverse place on the planet. Around 30% of the world's species and 10% of the world's biodiversity call the Amazon home. Biodiversity ensures healthy ecosystems that contribute to climate stability, protection of water resources and nutrient cycling. Not to mention a wealth of genetic information that could one day be crucial for developing a cure to a disease. In the Amazon, water cycles through rain, into trees and back into the atmosphere where it rains again. A single molecule of water travelling through the Amazon can fall as rain and be recycled up to 6 times before it reaches the ocean! However, if too much of the Amazon is deforested it will reach a tipping point where the water cycle is disturbed in a way where the Amazon will no longer be able to support this recycling. At that point the forest may shift into more of a Savannah and much of the biodiversity will be lost.

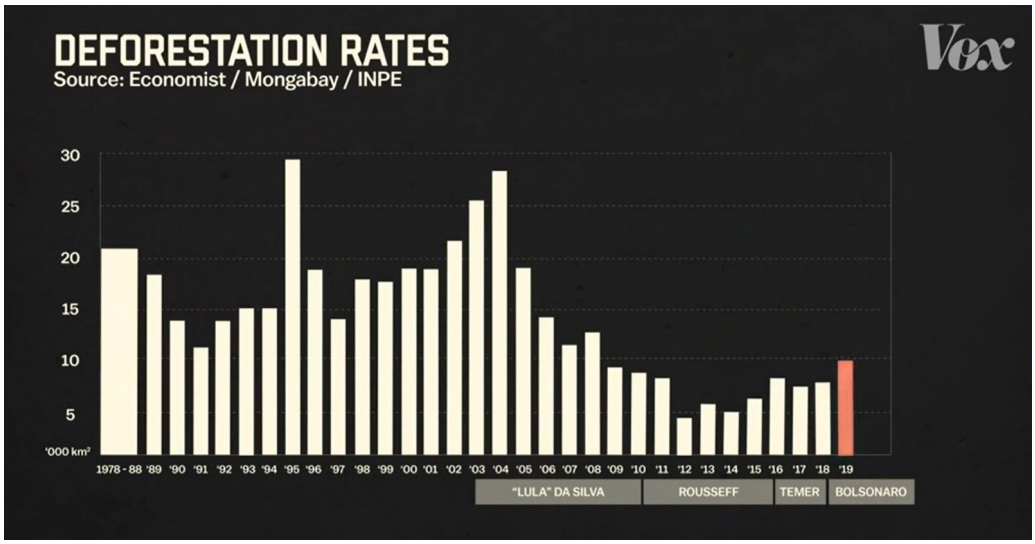


Figure 3. Image source: https://enterprise.press/stories/2019/11/26/deforestation-in-the-amazon-underwent-a-massive-reduction-in-the-early-2000s-but-can-it-happen-again-7055/

Science Literacy Week - Forest Fire Biodiversity

Designing an Ecosystem

In this activity, youth will draw a healthy and diverse ecosystem in response to an environment or challenge that an ecosystem faces. Each youth will receive a different environment and challenge combination and will have to present and explain why their ecosystem is healthy and how the species that live in the ecosystem interact with each other. If the youth can explain why a diverse ecosystem is beneficial that is a bonus. Youth should be sure to include 1) **Producers**, 2) **Consumers** and 3) **Decomposers** in their ecosystem. Some of the environment/challenges that can be given include;

	Environment	Challenge
1	Desert	Drought
2	Tundra	Fires
3	Boreal Forest	Heavy Rains
4	Temperate Forest	Cold
5	Grassland	Hot
6	Mountain	Storms

Steps

1) Roll the die to determine your environment.
2) Roll the die a second time to determine which challenge your environment faces.
3) On a sheet of paper or equivalent online setup, start drawing all of the species that will inhabit your ecosystem.
4) You can either label the species in your drawing or keep track on the side of all of the species in your ecosystem. Keep in mind that you will need producers, consumers and decomposers! And don't forget about the really tiny organisms.
5) Look at and answer the guiding questions.
6) Present and share your unique and interesting ecosystem!

Guiding Questions

- How do the species in the environment interact with each other?
- Why is a diverse ecosystem better suited to deal with challenges?
- Which environment would be the most diverse?
- Which environment - challenge combination do you think is the least likely to occur in nature?
- Which environment - challenge combination do you think you live in? Be specific and you can list off multiple challenges.

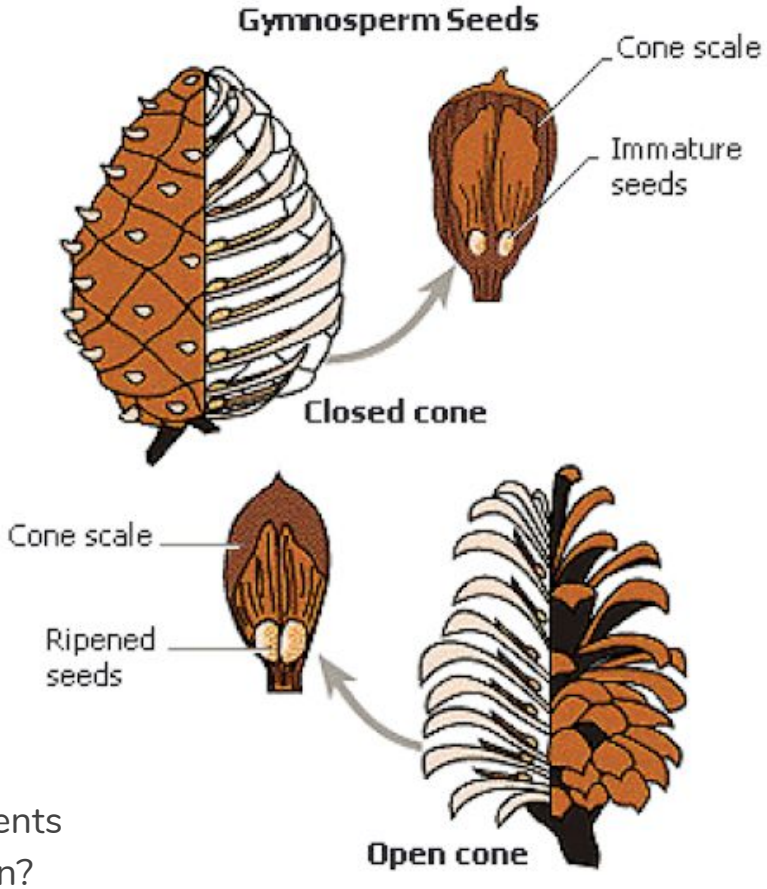
Science Literacy Week - Forest Fire Biodiversity

Cone Dissection

Youth are assigned with exploring their local area and finding some cones or seeds. They are then encouraged, with adult supervision, to dissect the cone. Youth can find the immature or ripened seeds under the layers of scales. After the dissection youth can try to think of and design their own fire resistant seed/cone!

Steps

1) With adult supervision, explore your local area looking for cones or seeds. Try to pick up a range of different cones!
2) Back at home, carefully take apart your cone/seed and determine the different parts of the cone/seed. Be careful handling the cone as well as using any tools to help with the dissection.
3) Take a look and answer the guiding questions.



Guiding Questions

- What do you notice about the structure of the cone/seed?
- How is the structure adapted to deal with fire?
- Are there other factors that would allow for the cone to open and release its seeds?
- What time of year is it? Does the time of year impact the cones?
- What area did you find it in? What is the environment like? What other environments do you think you could find these seeds in?
- How would you design a fire proof capsule to protect something important?

Science Literacy Week - Forest Fire Biodiversity

Cone Dissection

#SVatHome
#SciLitWeek

Want to share your project or results with us?

Email or tag us @ScienceVenture

Have a question?

Reach us at svworkshops@engr.uvic.ca