

Liz Hadly Tracks the Impact of Climate Change in Yellowstone

Name: _____

Date: _____ Pd: _____

This worksheet complements the short video "Liz Hadly Tracks the Impact of Climate Change in Yellowstone" from the Scientists at Work series (<http://www.hhmi.org/biointeractive/liz-hadly-tracks-impact-climate-change-yellowstone>).

After viewing the short video answer the following questions:

1. Yellowstone National Park is a carefully managed ecosystem that protects some of the great animals and plants of our planet. Though highly managed, this ecosystem is not immune to what destructive force?

Climate change is an example of an outside, global force, that is happening so quickly that its impact is being felt by both the plants and animals of the Yellowstone ecosystems.

2. Researchers often study ecosystems for a long period of time. Dr. Hadly has studied Yellowstone's ecology for 30 years and the amphibians for 20 years. What is the value of long-term studies to advancing scientific understanding?

Scientists and researchers strive to find patterns between items of study (i.e. whitebark pine trees and bears). Long-term studies, like the ones completed by Liz Hadly, help to bring to light the intricacies of complex ecosystems.

3. Complete the following on a separate piece of paper:
 - a. Food webs are models that biologists use to illustrate the interconnected feeding relationships among organisms in a community. Use the descriptions in the table below to sketch a food web representing the relationships between the following organisms within the Yellowstone ecosystem. Use arrows → to show the energy transfer from the organism being consumed to the consumer. Also be sure to label all organisms and interactions.

Whitebark pine	<i>These trees produce high nutrient pine seeds within pinecones that reside high atop the tree far from the reach of bears.</i>
Mountain pine beetle	<i>Consumes Bores into the tr Normally, these insects play an important role in the life of a forest, attacking old or weakened trees, and speeding development of a younger forest.</i>
Bears	<i>Bears pillage the ground burrows (middens) of the Red squirrels in order to obtain the high nutrient seeds. These seeds are critical to the overwinter survival of the bears.</i>
Elk	<i>Feed on grasses and sedges.</i>
Grasses	<i>Grasses are consumed by elk and bears.</i>
Sedges <small>(an aquatic plant that resembles a grass)</small>	<i>This aquatic plant is consumed by both elk and aquatic insects.</i>
Clark's nut crackers	<i>The Clark's nutcrackers diet consists primarily of pine seeds. After eating a few seeds, the nutcrackers will stash 30 to 150 seeds in a pouch under their tongues before flying off to cache the seeds, within a ground trench, for the winter and following spring.</i>
Red squirrels	<i>Red squirrels easily get up to the whitebark pine cones to eat the seeds. They hide these seeded within ground burrows (middens) for future consumption.</i>

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4. Working with the data:

- a. Based on Dr. Hadly's research, of 46 active ponds surveyed in 1992-1993, 43 supported amphibian life. What percentage of the surveyed ponds had amphibians?

$$43 \text{ supported life} / 46 \text{ active ponds} = .93$$

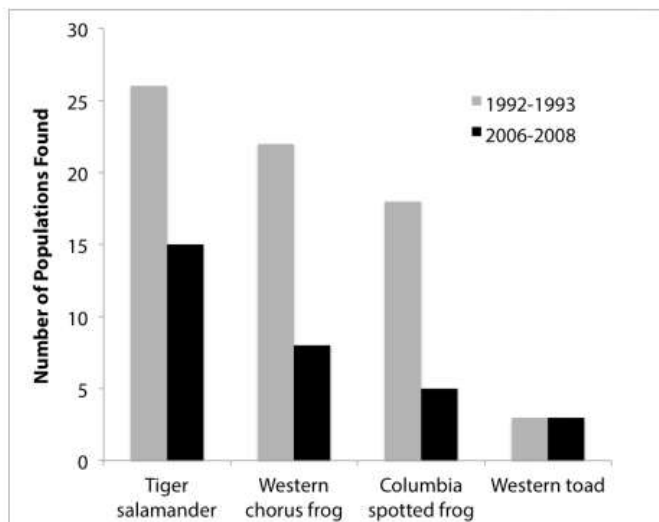
$$.93 \times 100 = 93 \% \text{ of the surveyed ponds had amphibians}$$

- b. From 2006 to 2008, only 38 of the 46 ponds contained water and only 21 of 31 ponds the researchers had access to contained amphibians. What percentage of the surveyed ponds had amphibians during that time range?

$$21 \text{ supported life} / 31 \text{ ponds} = .68$$

$$.68 \times 100 = 68 \% \text{ of the surveyed ponds had amphibians}$$

- c. Using the graph below, answer the following questions:



Data from: McMenamin, S. K., Hadly, E. A., & Wright, C. K. (2008). Climatic change and wetland desiccation: amphibian decline in Yellowstone National Park. *Proceedings of the National Academy of Sciences*, 105(4)

- i. Explain, in your own words, what the graph represents.

The graph shows the numbers of populations of four different types of amphibians at different time spans.

- ii. What is the overall trend in the data from 1992-1993 to 2006-2008?

The number of amphibian populations decreased

5. Justify how climate change has impacted the frog and salamander habitats and thus the populations of these organisms.

Climate change has caused ponds to disappear. This has led to the reduction of habitats and lower populations.

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6. If you were doing the research in the film, what is another scientific question you would like to try to answer?

"The whitebark pine is both a foundation and a keystone species," said Jesse Logan, a retired U.S. Forest Service entomologist. "The health of the whitebark pine is very closely related to the health of the entire ecosystem."

Without the seeds, biologists fear what's called a "trophic cascade," where the entire food chain shifts as a primary producer drops out. By Douglas Fischer, The Daily Climate on October 8, 2014

Yellowstone's Iconic High Mountain Pines Dying by Beetle's Mouth

7. Food webs illustrate the flow of energy in an ecosystem. Using the food web you have sketched, describe in detail the impact of climate change on the flow of energy in the Yellowstone ecosystem.