

FIGURE SET 3

FIGURE SET HEADER for Set #3

Figure Set 3: Causes of intense elk browsing on cottonwoods and willows during the 20th century.

Purpose: To practice interpreting graphical data; to use the data to address the question of why browsing by elk in Yellowstone was so intense during the 20th century.

Teaching Approach: [“pairs share”](#)

Cognitive Skills: _____ knowledge, comprehension, interpretation

Student Assessment: [minute paper](#) or essay quiz

BACKGROUND for Set #3 ([back3.html](#))

Background

Why was elk browsing on cottonwoods and willows so intense during much of the 20th century?

Ripple and Beschta (2004a) used a combination of qualitative (historical documents, reports and records; historical photographs) and quantitative (population census) data to reconstruct wolf and elk population estimates during the 20th and early 21st centuries for the Greater Yellowstone Ecosystem. For example, National Park Service personnel kept records of the numbers of predators killed in Yellowstone each year after it was established in 1872, and these numbers give us an estimate of wolf population sizes in the Park until the last recorded wolves were eliminated in the mid-1920's. Elk census data were collected beginning in 1929 and continuing into the present, but prior to 1929 the population size was estimated based on partial censuses and visual estimates (thus the shaded portions of the graph). The diagrams in this figure set are a summary of that information, and show the relationship between wolf population sizes and elk population sizes before and after wolves were extirpated, and again after wolves were restored (Ripple and Beschta 2004a).

FIGURE for Set #3 ([figure3.html](#))

Figure

Figure 3 Numbers of wolves and elk

Legend

Figure 3. Twentieth century time series of (a) wolf populations and (b) elk population estimates and trend line for the Upper Gallatin Basin in the Yellowstone area. Shaded portions of a graph reflect uncertainty; elk census data are represented by closed diamonds. From Ripple and Beschta (2004a).

STUDENT INSTRUCTIONS for Set #3 ([students3.html](#))

Student Instructions

Now that you have seen the data in Figure sets 1 and 2, you are ready to address the following question: “Why was elk browsing on cottonwoods and willows so intense during much of the 20th century in Yellowstone National Park?” Using your hypothesis from the last exercise, can you make predictions about the population dynamics of the elk herds in and around Yellowstone during this time? Were they most likely growing, declining, or relatively constant, and why? Write down your predictions, and then with your partner examine the data presented in Figure 3. Were your predictions upheld, or not? Why?

Be prepared to discuss your impressions and conclusions with the rest of the class.

NOTES TO FACULTY for Set #3 (faculty3.html)

Faculty Notes

This figure set activity should be fairly brief. Usually students will predict that the elk population surged to much higher levels after wolves were extirpated from Yellowstone, and then dropped significantly when wolves were restored. (*Note: Make sure the students make their predictions before they see the figure!*) In some parts of the Greater Yellowstone Ecosystem there is evidence of major swings in the elk population, but this data set seems to show a steady and gradual decline in the elk population during the 20th century. This usually comes as a surprise to the students, because their expectation is of *direct* control by the predator on the prey population. This is a key time for some thought-provoking group discussion, in order to address the common misconception at the heart of this whole issue: that predator impacts are all direct, and never indirect. Some questions to help get a discussion started could include:

- If the wolves aren’t “controlling” elk density directly, then why is there a rebound in woody vegetation after the wolves return?
- It appears as if wolves are reducing elk browsing in riparian habitats, but not by directly reducing elk numbers. How else might wolves be reducing elk browsing?

Try to get the class to brainstorm ideas, while you write them on the board. Resist the urge to critique their ideas or to say which are correct at this point. If you can’t get students to speak up in the large group setting, have them “think-pair-share” with a partner, and then call on pairs to share their thoughts with the group. During this discussion, questions might also arise about the validity of the data, since some of the information is qualitative and not quantitative (students might think the numbers are “made up”). Ripple and Beschta (2004a) do a good job of showing that the evidence for the population trends shown in this figure is quite robust, even though not all of it is quantitative. For additional background on this topic, see the Methods section of their paper.

For assessment on this activity, have the students write a minute-paper addressing why their predictions about elk population dynamics were upheld or not. Alternatively, you could

combine assessment for Figure sets 3 and 4 into one essay quiz, incorporating the questions from both exercises.