

Ecology Unit Study Guide

Vocabulary

Fill in each blank with a key term from the word bank below:

atmosphere	decomposers	food web	population
biodiversity	ecology	fossil fuels	precipitation
biology	ecosystem	habitat	primary consumers
births	emigration	immigration	primary succession
carbon	energy	logistic growth	producers
carrying capacity	energy pyramid	nitrogen	respiration
chemistry	evaporation	nutrient cycles	secondary consumers
community	exponential growth	photosynthesis	secondary succession
deaths	food chain	pollution	water

- All the plants and animals of the Elkhorn Slough wetlands form a community.
- The largest reservoir of nitrogen in the world is in the atmosphere.
- Northern elephant seals recovered from no individuals in California to over 30,000 individuals in California by 2010 (Figure 1). This type of growth is called exponential growth.

Figure 1 (left): Northern elephant seal (*Mirounga angustirostris*) births in California (1958-2005) (from <http://www.nmfs.noaa.gov/pr/pdfs/sars/po2007sene-ca.pdf>)

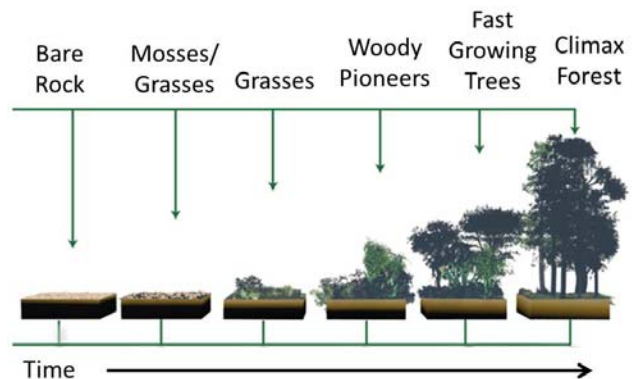
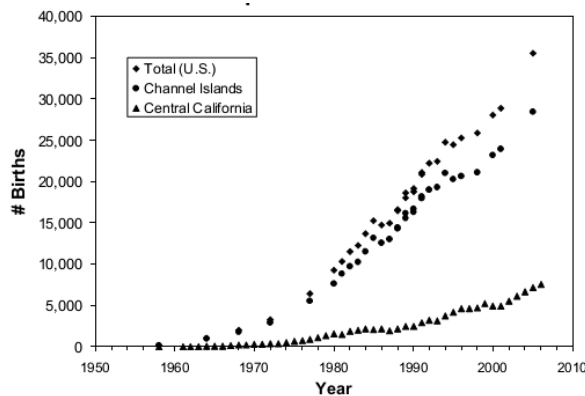
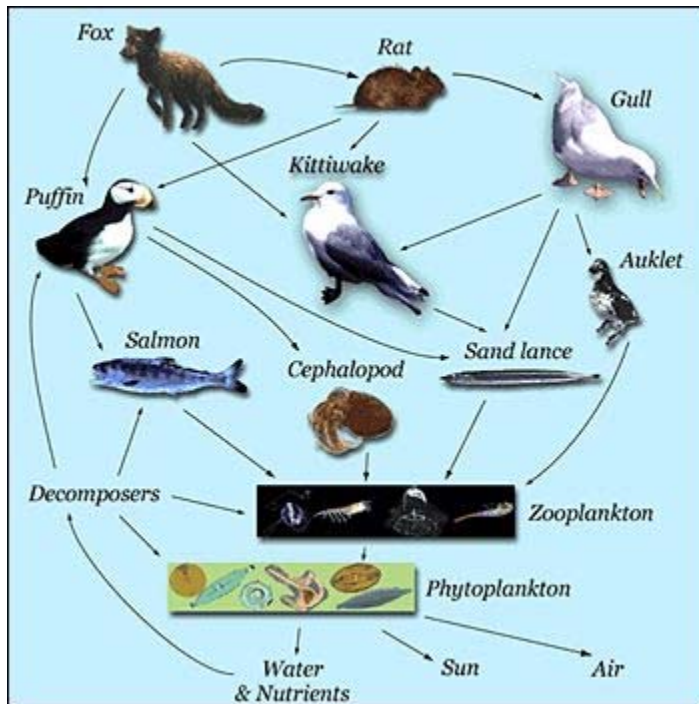


Figure 2 (right): Change in species over time in the forest after a volcano in Washington state (Lucas Martin Frey, Wikimedia)

- After a volcano erupts in Washington state, mosses and grasses break down bare rock and eventually trees are able to live at the site after about 150 years (Figure 2). This process is called primary succession.
- Mass extinctions, such as the Cretaceous-Tertiary (K-T) extinction event when dinosaurs became extinct, greatly reduced the biodiversity of the Earth, which is often measured as the number of species.

- Two ways that the population size of Monterey Bay sea lions can increase are births and immigration.
- The three nutrients that cycle through the living and nonliving parts of ecosystems are water, carbon, and nitrogen.
- Evaporation contributes to the return of water vapor to the atmosphere



- This diagram in Figure 3 for Alaska's marine community, is called a food web.
- Figure 3 includes several food chains, such as phytoplankton → shad → gamefish.
- The trophic level of auklets, according to Figure 3, is secondary consumer.
- The trophic level of phytoplankton, according to Figure 3, is producer.
- The trophic level of zooplankton, according to Figure 3 is primary consumer.
- The trophic level of foxes, according to Figure 3, is tertiary consumer.

Figure 3: Diagram of trophic relationships for Alaska's marine community (U.S. Geological Survey)

- Some questions from the science of ecology that are being studied by the SCWIBLES fellows include how mountain lions can keep living in the Santa Cruz Mountains as the number of people increases, what limits the growth of plants in Elkhorn Slough, and how to restore an oyster species in Hawaii.
- In the diagram of an ecosystem called a(n) energy pyramid, the amount of energy stored at each level determines the width of each block.
- After farmers abandon a field in North Carolina, it is first colonized by weedy grasses and shrubs that use the soil and nutrients that remains. Through the process of secondary succession, a mature pine forest can develop in about 30 years.
- The kelp forest ecosystem of Monterey Bay includes all the organisms, nutrients, energy, waves, rocks, and more.
- Photosynthesis incorporates carbon dioxide into living organisms.

19. The three fossil fuels (oil, coal, and natural gas) are formed from decayed plants and release carbon dioxide when they are burned.

20. All the mountain lions in the Santa Cruz Mountains form a population.

Calculations

Use the following information to answer the questions below.

On March 24, 1989, the supertanker 'Exxon Valdez' ran aground on Bligh Reef in northeastern Prince William Sound, Alaska, spilling 42 million liters of crude oil, the largest oil spill in USA history until the 2010 Gulf of Mexico oil spill and one of the world's most devastating human-caused environmental disasters.

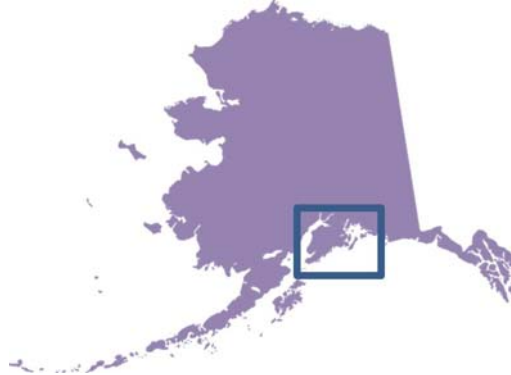


Figure 4: The 'Exxon Valdez' 3 days after grounding (a) and the location of the oil spill in Prince William Sound, southeast Alaska (b). Exxon Valdez photo courtesy of NOAA Office of Response and Restoration.

21. Before the Exxon Valdez oil spill, the AB fish-eating 'resident' pod of orcas (killer whales) in Prince William Sound, Alaska, had 36 members. During the year after the oil spill, the pod experienced no births, 8 deaths, and no immigration or migration. Seven of these disappearances occurred within 6 days of the oil spill. 8 deaths was much more than the average 1.6 deaths per year experienced from 1984 to 2005. Scientists think these deaths may be due to inhalation of oil when the whales came to surface and eating contaminated fish. What was the population size of pod AB in March 1990? Show your work below using the population growth equation. 28

$$N(1990) = N(1989) + B - D + I - E$$

$$N(1990) = 36 + 0 - 8 + 0 - 0 = 28$$

22. From March 1988 to March 1989, the year before the Exxon Valdez oil spill, the population experienced 5 births and one death. What was the population size in March 1988? Show your work below using the population growth equation. 40

$$N(1989) = N(1988) + B - D + I - E$$

$$N(1988) = N(1989) - B + D - I + E$$

$$N(1988) = 36 + 5 - 1 = 40$$

23. In 2010, the AB pod included 25 individuals. Has this population recovered to its pre-spill population size? no

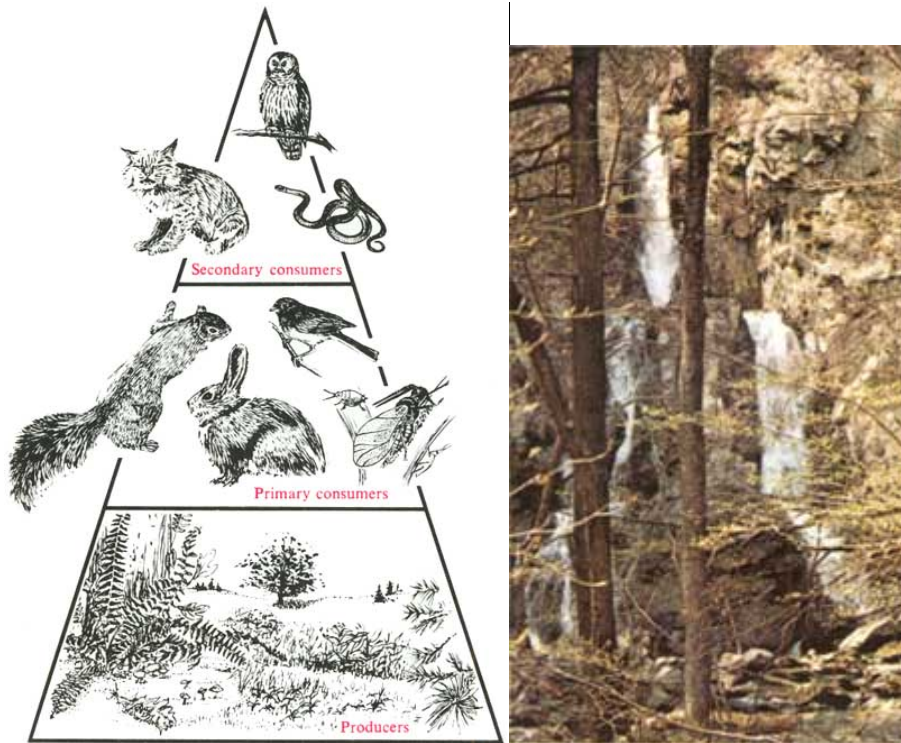


Figure 5: Diagram of trophic levels of Shenandoah National Park's deciduous forest (from http://www.cr.nps.gov/history/online_books/natural/9/nh9i.htm) and photo (by Hugh Crandall)

24. In Figure 5 above, plants of the deciduous forest (deciduous = trees that lose their leaves in winter) produce about 6,000 kilocalories (=6 million calories) of energy per year per square meter for animals like squirrels, rabbits, and songbirds to eat. Approximately how many kilocalories are available to their predators, including snakes and owls? Show your work in the space below. 600 kcal

$$6,000 \text{ kcal} \times 10\% = 600 \text{ kcal}$$

25. In Figure 5 above, approximately how many kilocalories are available in the bodies of snakes and owls to the top predators (not pictured), including bears and mountain lions? Show your work in the space below. 60 kcal

$$6,000 \text{ kcal} \times 10\% \times 10\% = 60 \text{ kcal}$$