Habitat Degradation

Background

Regardless of where you live, you are probably accustomed to seeing land being cleared for development. Trees are cut down and hauled away, grasslands are cut or burned, and earth is leveled. Have you ever wondered what became of all the animals that formerly lived in those areas and depended upon them for their survival? What effect did this disruption have on amphibians, birds, fish, mammals, reptiles, and invertebrates that formerly inhabited the area? An organism's habitat encompasses the living and nonliving environment in which it typically lives. When a habitat is degraded or destroyed, some animals may be able to move to a healthier part of the habitat or emigrate to another suitable habitat. However, unless the habitat is repaired, restored, or replaced, individuals in the surviving populations often face increased competition for limited resources. Consider, too, the fate of many smaller animals, plants, and microorganisms. What becomes of them when their habitat is destroyed?

Habitat destruction is the leading cause of species extinction. As the human population grows and the amount of resources that we consume increases, mature forests, coastlands, and grasslands are cleared to build farms, houses and hotels, and industrial sites and complexes; many of the latter are devoted to meeting our energy demands. As this occurs, the organisms surviving in these disrupted habitats must seek shelter in the remaining natural areas, seek new habitats, or adapt to live in closer proximity to humans. For some species, the challenges may be impossible to overcome.

Currently, deforestation endangers the most species. Rapidly, vast areas are becoming biological wastelands as forests are cleared for raw materials or to make way for development. Deforestation affects aquatic as well as arboreal and terrestrial species, as previously shaded waterways are suddenly exposed to sunlight and sediment. People commonly think of forests when they consider habitat loss, but the reality is that species in every biome are pressured by human development.

Many conservation efforts focus on the preservation of an entire habitat as the most effective means of conserving species. However, even if they have not been destroyed altogether, many of the world's habitats have become fragmented. Habitat fragmentation can result in the separation of populations into isolated patches of habitat, effectively decreasing the gene pool of a species and potentially leading to inbreeding and loss of genetic diversity. These conditions can reduce a species' fitness to survive environmental pressures such as disease and climate change. As these habitat patches shrink, the likelihood of local population extinction increases. If the size of a habitat patch becomes smaller than what a particular species requires, the local population of that species will become extinct. As habitats become fragmented, competition increases between remaining individuals, also resulting in a decrease in population. For example, pandas feed on bamboo shoots. But, as bamboo forests in China are destroyed, there is less food to support panda bear populations. Due to habitat loss, pandas are an endangered species.

Terrestrial isopods are land-dwelling crustaceans commonly known as sow bugs (*Porcellio laevis*) and pill bugs (*Armadillidium vulgare*). They have many other common names, including roly-polies, potatobugs, and wood lice (no relation to body lice). Like their relatives, lobsters, crabs, and shrimp, even these terrestrial isopods breathe with gills that must remain moist. Although similar in size, color, and life cycle, pill bugs and sow bugs are distinguishable. When threatened, sow bugs either flee or remain perfectly still, appearing to be dead. Pill bugs curl up into a tight ball for protection (a defensive posture of armadillos, hence, "Armadillidium").

Objective(s)

- ✓ to test the habitat preferences of pill bugs
- ✓ to observe how pill bugs behave when the availability of the desired habitat is decreased
- ✓ to analyze and graph data collected involving the destruction of the pill bug's habitat
- ✓ to apply conclusions to real-world habitat degradation scenarios

Materials

- pill bugs (x10)
- petri dish bottom
- choice chamber w/lids
- 150 mL beaker
- 50 mL moist terrarium soil
- plastic spoon
- timer
- paintbrush

Pre-Lab Questions

Answer the following questions on your lab paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences and show your work for math problems.

1. Describe the predicted habitat preferences of pill bugs.
2. Describe three human land use practices that have a detrimental effect on other species of plant or animal.
3. What is a choice chamber?

✓ Use a ruler to recreate the Data Table below neatly on your lab paper, and be sure it is drawn approximately the same size

Safety

Procedure

In this experiment, you will use a choice chamber to test and observe how pill bugs react to habitat loss and fragmentation. You will fill one side of the choice chamber with moist terrarium soil, the ideal habitat of pill bugs, and then remove spoonfuls of soil over time. All the while, you will observe the pill bugs' behavior.

1. Place moistened terrarium soil into one side of the choice chamber. Loosely pack the soil – do not compact it – and break up any clumps that exist.
2. Collect 10 pill bugs from the classroom pill bug container. Use the petri dish bottom to transport them.
3. Use the paint brush to gently transfer five pill bugs to each side of the chamber. Put on the lids.
4. Count and record the number of pill bugs on the soil and not on the soil, recording your data every 30 seconds for 3 minutes. Continue to record your counts even if the pill bugs all move to one side or stop moving at all. Stop timing when 3 minutes have elapsed.
5. After the first 3 minutes have elapsed:
    a. Use the plastic spoon to quickly but carefully remove two scoops of soil from the choice chamber. Return the soil to the beaker. Make sure that there are not any pill bugs in the soil you remove.
    b. Repeat the counting and timing procedure. This time, record the data in the table in the "Amount of Soil" row for "2 scoops removed."
6. After the second 3 minutes have elapsed:
    a. Use the plastic spoon to quickly but carefully remove two scoops of soil from the choice chamber. Return the soil to the beaker. Make sure that there are not any pill bugs in the soil you remove.
    b. Repeat the counting and timing procedure. This time, record the data in the table in the "Amount of Soil" row for "4 scoops removed."
7. After the third 3 minutes have elapsed:
    a. Use the plastic spoon to quickly but carefully remove two scoops of soil from the choice chamber. Return the soil to the beaker. Make sure that there are not any pill bugs in the soil you remove.
    b. Repeat the counting and timing procedure. This time, record the data in the table in the "Amount of Soil" row for "6 scoops removed."

8. After the fourth 3 minutes have elapsed:
    a. If there is any soil remaining in the choice chamber, use the spoon to quickly but carefully remove two scoops of soil (or as much as you can without harming the pill bugs). Make sure there are not any pill bugs in the soil you remove.
    b. Repeat the counting and timing procedure. This time, record the data in the table in the "Amount of Soil" row for "8 scoops removed."
9. Use the paint brush to gently return all the pill bugs to the classroom pill bug container.

Data Table

Amount of Soil	Time (m:ss)	Number of Pill Bugs		Behavior Notes
		On Soil	Not on Soil	
0 scoops removed	0:00			
	0:30			
	1:00			
	1:30			
	2:00			
	2:30			
	3:00			
2 scoops removed	0:00			
	0:30			
	1:00			
	1:30			
	2:00			
	2:30			
	3:00			
4 scoops removed	0:00			
	0:30			
	1:00			
	1:30			
	2:00			
	2:30			
	3:00			
6 scoops removed	0:00			
	0:30			
	1:00			
	1:30			
	2:00			
	2:30			
	3:00			
8 scoops removed	0:00			
	0:30			
	1:00			
	1:30			
	2:00			
	2:30			
	3:00			

Clean Up

- ✓ rinse (no need to dry): petri dish bottom, choice chamber w/lids, beaker, plastic spoon
- ✓ trash: used soil
- ✓ everything else returned to its original location

Results & Analysis

Answer the following questions on your lab paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences and show your work for math problems.

1. Create an appropriate graph to plot the number of pill bugs found on the soil over time as the number of scoops of soil removed. Explain the relationship between the independent and dependent variables.
2. From the results of the exercise, what conclusions can you draw about pill bug habitat preference?
3. Compare the behavior of pill bugs on moist soil to the behavior of those not on moist soil.
4. As you reduced the amount of soil available to the pill bug population over time, did the behavior of the pill bugs change? Describe any changes in behavior you observed, and propose an explanation for them.
5. At the beginning of this experiment, an equal number of pill bugs were placed on each side of the choice chamber. Why is this important?
6. Did you observe anything about pill bug behavior that might help explain how natural habitat loss can contribute to the extinction of a species?
7. As cities expand, nearby natural areas are often negatively impacted by agricultural, residential, commercial, and industrial land use and its effects on the environment. Name an organism whose habitat might be degraded or diminished due to human activity (other than ones already mentioned in this document), and describe some possible impacts of human land use practices on that organism's habitat.
8. Beyond the conservation of other species, what do humans have to gain by preventing the degradation and destruction of natural habitats?