Let Nature Take Its Course:

Helping the Environment Take Care of Itself

Meet Dr. Ray Brown:

I like being a scientist because it allows me to follow my passion of learning how nature works, and how we interact with nature. I became interested in natural resources in high school. I had a great biology and science teacher who helped me guide my interests toward where I am today. It always seemed that there was someone to encourage me when I needed it.

Dr. Ray Brown

Thinking About Science

Nature sometimes causes rapid changes, as in landslides, fires, and floods. At other times, nature's change is very slow. Change may take tens, hundreds, or thousands of years. Sometimes, natural resource scientists study natural processes that seem to take a long time, at least from a human perspective. In this study, the scientists wanted to discover how to help nature restore *native* plants to an *alpine* meadow area that had been damaged by human activities in the 1950's. When damage is done to an alpine area, it takes a long time for the land to repair itself. In the 1970's, the scientists began to help nature repair the damage. They recorded their activities and how much the land responded. Their research lasted almost 20 years! You can see that natural resource scientists sometimes need a lot of time and patience to carry out their research.

Thinking About the Environment

The natural environment can be disturbed by natural and human causes. Natural causes include things like wind, fire, and floods. Humans damage the environment by mining, building roads and buildings, and even from recreational activities. Often, the environment can repair itself over time. When the land is severely damaged by human activity, the environment might need help to become healthy again. When *natural resource managers* help the environment, they let nature do most of the work.

They prefer to let native plants restore the land to a healthy state. When native plants are in an area, the area has a better chance of restoring itself as the same kind of *ecosystem* that was damaged in the first place. When a natural ecosystem can become *reestablished*, the environment can resume its own processes and become healthy again.

Introduction

Until the early 1950's, people mined copper, gold, and silver in the Beartooth mountains in Montana (Figure 1). During mining operations, the soil near the surface was removed before the minerals were taken. All that was left was *mine spoil* (Figures 2 and 3). Mine spoil is highly *acidic*. The acidic spoil *erodes* into waterways and seeps through the land into groundwater, polluting the *watershed* below the mine. Plants cannot grow well on acidic mine spoil. Twenty years after the mining was abandoned, plants had not grown back on the mine spoil. This left an area that could not support any plants or animals, and encouraged *erosion* of the mine spoil into nearby streams.

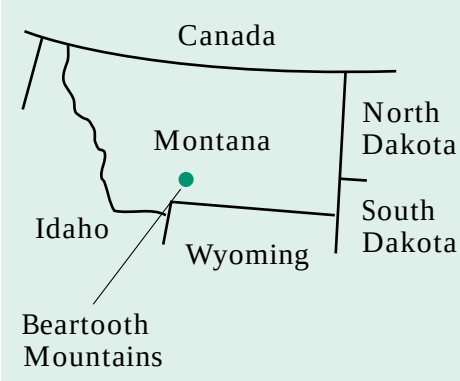

Figure 1. Location of the study area.

The scientists in this study wanted to find a way to help reestablish the alpine meadow ecosystem to its pre-mining condition. They hoped that by building the soil and planting a few native plants, normal environmental processes would take over and create a more *diverse* plant community.

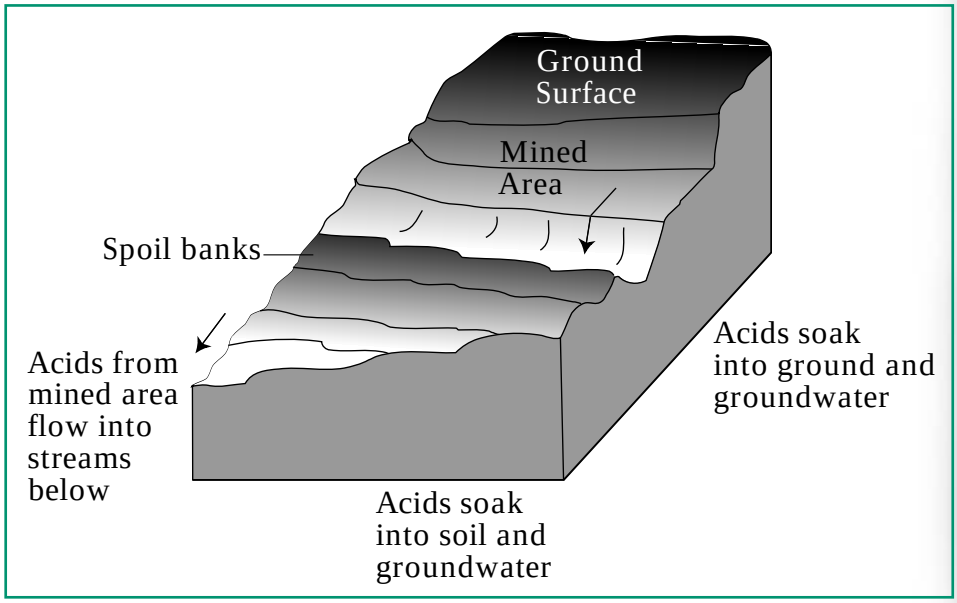

Figure 2. Illustration of mine spoil.

Glossary:

native (**na** tiv): Naturally occurring in an area.

alpine (**al** pin): High mountain area.

natural resource manager (**nach** ur ul **re** sôrs **ma** ni jür): Skilled person who takes care of natural resources.

ecosystem (**e** ko sis tem): Community of plant and animal species interacting with one another and with the nonliving environment.

reestablish (re uh **stab** lish): to bring about or establish again.

mine spoil (**min** spoy ul): The waste material left over from mining.

acidic (uh **si** dik): Acid forming (Acid is a substance with a pH less than 7).

erode (e **rod**): To wear away by water or wind.

watershed (**wä** tür shed): Land area that delivers water and sediment to a major river via small streams.

erosion (e **ro** zhun): The process of eroding or wearing away slowly.

diverse (di **vürs**): Differing from one another.

manure (meh noor): Animal waste products.

organic (ôr **geh** nik): Related to or coming from living organisms.

fragile (**fra** jul): Easily destroyed.

Pronunciation Guide

a	as in ape	ô	as in for
ä	as in car	u	as in use
e	as in me	ü	as in fur
i	as in ice	oo	as in tool
o	as in go	*ng*	as in sing

Figure 3. The McLaren mine site in the early 1970's, before Dr. Brown began his research.

Reflection Section

- Why is it important to restore abandoned mining areas to their pre-mining environmental condition?

- If the soil cannot support plant life, what is the first thing that the scientists should do to help the land become healthy again?

Methods

The scientists identified a study area of 1.6 acres (How many hectares is this? Multiple 1.6 by .405.) The scientists bulldozed the 1.6 acres of mine spoil so that it would be close to the original lay of the land (Figure 4). Then, they added lime and steer *manure* to the mine spoil area. They added the lime, which is basic (the opposite of acidic), to raise the pH level to match the pH of other, nondisturbed land in the area (Figure 5). The disadvantage of lime, however, is that it causes *organic* matter to decompose quickly. The scientists used the manure to add extra organic matter to the soil. Then the scientists added fertilizer to the soil.

While they were preparing the soil, the scientists collected seeds from five native grasses and one sedge (a plant similar to a grass). They selected grasses that would have naturally grown in the area before the mining operation. They put the seeds into bags and shook them up, so the different kinds of seeds were mixed together. They planted the seeds in the newly prepared soil (Figure 6). For the next 3 years, they spread more fertilizer over the entire area. In the fourth year, they divided the 1.6 acres into four equal parts.

Figure 4. Bulldozing the mine spoil site.

Figure 6. Planting seeds in the prepared soil.

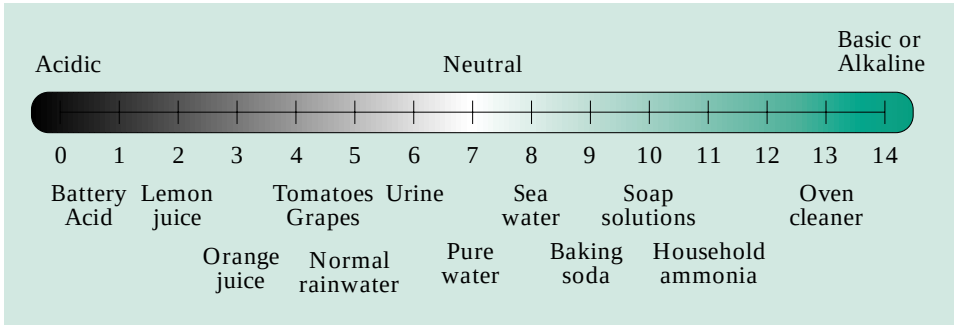

Figure 5. The pH scale.

Each year, they stopped fertilizing one of the four areas. That way, a portion was fertilized every year for 3 years, a portion for 4 years, a portion for 5 years, and one for 6 years (Figure 7). Every year, the scientists identified the species (the type of plant) and the number of individual plants per area growing on the site.

Reflection Section

- What did the scientists want to find out when they divided the area into four portions?

- Why did the scientists select seeds that would have naturally grown in the area?

Results

The scientists found that it did not help to fertilize the soil beyond the first 3 years. They knew this by measuring the growth of the plants and identifying new plants every year. In other words, there was no difference in plant growth between the four portions for the first 6 years (look again at Figure 7). The scientists found that new plant species grew in the area over time (Figures 8 and 9). This was considered a success, since a healthy alpine meadow has a diversity of plant species. The seeds from these new species had come from nearby areas that had native plants growing on them. The seeds were brought into the area by wind, water, and animals. Look closely at Figure 8. The first 6 years did not have much plant diversity. The scientists think that by fertilizing the soil, they were encouraging the growth of the grasses that they planted. The grasses grew thick, and did not allow other species to become established. It was only after fertilization was stopped that other plant species were able to grow. Look at Figure 10 and compare it with Figure 3. These photographs were taken from the same place before the research (Figure 3) and during the research, after plants had begun to grow (Figure 10).

Reflection Section

- Why were other species able to grow after the fertilization treatments were stopped?

- What is the advantage of having a wide diversity of plant species? Think about insects and other animals. Why would a diversity of plant species encourage insects and animals to move into the area?

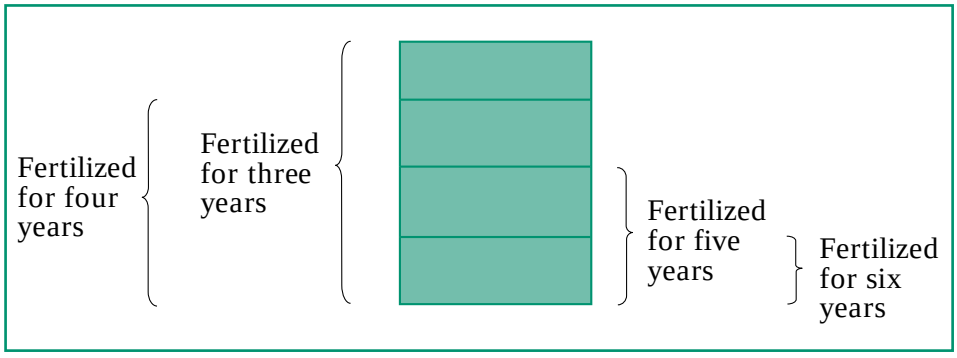

Figure 7. Dividing the land into four areas to test for the effects of fertilizing the soil.

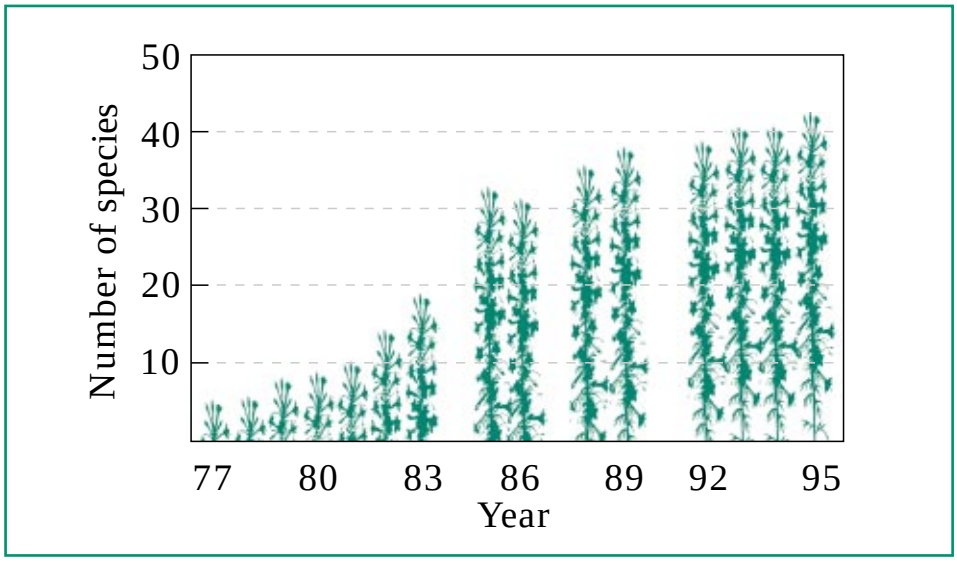

Figure 8. Total number of plant species identified per year.

Figure 9. Plants beginning to grow in the area.

Figure 10. The McLaren mine site after plants began to grow.

Implications

The scientists believe that planting and fertilizing native grasses for the first 3 to 5 years is an important first step to restoring native alpine meadow ecosystems. The grasses help enrich the soil and reduce erosion. After a few years, nature can be left to take its course, and allow a diversity of plants to grow. The scientists recommended that natural resource managers collect native seeds so that they can be used to help repair severely damaged areas. It is important to protect naturally occurring plants near areas that have been disrupted. Some areas, such as old mining sites, need help from managers to become reestablished. However, managers should always use native vegetation, and should let nature do most of the work.

Reflection Section

- Describe another situation where people can help nature take its own course. (Hint: Does your school have an area that was planted for wildlife?)

- Why is the restored natural area preferred over mine spoil? What are the benefits of restoring the natural area? What are the disadvantages of the mine spoil?

FACTivity

In this FACTivity, you will compare two different kinds of soil. You will need to get two shallow cardboard boxes that are about 16 inches long on each side. Your teacher may need to cut the boxes so that they are about 10” deep and open on the top. Dig up two different kinds of soil, along with the plants growing in the soil. Dig up squares about 15 inches on a side so they will fit into the boxes. Try to dig into the soil at least 3 inches. One kind of soil should be from your school yard or an area where grass is growing. The other should be from a wooded area that has some plants growing in the soil, but this area should not have grass.

First, dig a piece out of each soil block, enough to fill half of a 16-ounce mayonaise jar

Oh Say Can You Seed?

Many of the natural areas used for the 2002 Games are *fragile.* This is especially true in the high mountain areas. This means that any damage done to them will take a long time to repair. The 2002 Games planners wanted to protect these areas as much as possible. They also wanted to repair them quickly after the athletic events were over. They asked Dr. Brown, the scientist in this article, to help them. Dr. Brown suggested that they save the topsoil that was removed and collect native seeds for planting when the 2002 Games were over. Dr. Brown showed the 2002 Games planners how to work with the natural environment. By doing so, the natural areas are protected for future generations.

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(with lid). Do not include the green plants. Put one type of soil in each jar. Fill the jars with water. Close the lids and shake the jars. Label the jars "Soil from wooded area" and "Soil from grassy area." Set the jars aside.

Now, observe the soil and plants in each box. Count the number of different kinds of plants in each box. Can you find any insects? Count the number of insects you find in each box. What other observations can you make about each sample of soil? Make a chart for each box (see an example below). After 30 minutes, examine the jars. Organic material will be a very dark layer floating on or near the top of the water. Without disturbing the jars, measure the amount of organic matter in each jar using a ruler.

	Soil from Grassy Area	Soil from Wooded Area
Number of different plants		
Number of insects		
Other observations (different colors)		
Other observations (other objects found)		
Other observations		
Amount of organic matter (in inches)		

Sample Chart for Soil Observation

Which box of soil is more diverse? Which soil has more organic matter? Why? You have learned in this article that soil with more organic material will be more diverse than soil with less organic matter. Is that true of the soil samples you have observed?

Alternative activities—Select two or more areas of soil to study outdoors. You may also bring in soil samples from home; the amount of organic matter can be measured in soil from many different areas.

FACTivity adapted from: Hogan, K. (1994). *Eco-Inquiry: A guide to ecological learning experiences for the upper/elementary/middle grades.* Dubuque, Iowa: Kendall/Hunt. 1-800-228-0810. Reprinted with permission.

From Brown, Ray W.; Amacher, Michael C.; Williams, Bryan D.; Mueggler, Walter F.; and Kotuby-Amacher, Janice. Ecological restoration of acidic mine spoils at high elevations: Long-term significance of revegetation and natural succession. In: W. R. Keammerer (Ed.). Proceedings: *High Altitude Revegetation Workshop No. 12,* June 1996. *Colorado Water Resources Research Institute, Information Series (No. 83).* Colorado State University.

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