



NATURE'S GARDEN



An Introduction to the Ecology of the Boise Front

INSTRUCTIONAL OBJECTIVE: Students will study the ecology of the Boise Front and become naturalists, interpreting interrelationships found between living things and the environment.

INTRODUCTION

Dear Teachers / Group Leaders,

Students visiting the Idaho Botanical Garden will have several kinds of outdoor experiences. When they first arrive, they will be greeted by a staff Garden Teacher. The Garden Teacher will guide students along Nature's Garden Trail, helping them discover how they fit into the ecology of the Boise Front. Topics studied in the field will be ecology, plants, geology, and animals.

It is important that the students be introduced to some of the enclosed material before visiting the Idaho Botanical Garden. You may wish to adapt the activities to your grade level. Please read the Nature's Garden story, about the Boise Front, with your students to help them identify, understand, and make connections with the meaning of ecology. Review the key concepts about ecology, plants, geology, and animals. Study the key terms, and notice how they are used in the Nature's Garden story. Please also do the "Name Tag Activity: A Lesson In Predicting." Your Garden Teacher will want to know your students' names!

The other activities enclosed are suggested for use after your experience in Nature's Garden to help students come to conclusions and to reinforce what they have learned.



KEY CONCEPTS

ECOLOGY

Ecology is the study of the interrelationships between living things and the environment. The Boise Front provides us with a wonderful opportunity to study ecology in a familiar setting. We will study plants, geology, climate, animals, and how their interrelationships affect and are affected by man.

PLANTS

Plants make life on earth possible. Their ability to convert the radiant energy from the sun into chemical energy is the only significant way in which the energy from the sun is made available for life on this planet. Plants also make the oxygen we breathe, cleanse the air of dust and pollutants, hold surface soil in place, and provide us with food, fuel, medicines, clothing, and shelter. Plants create an aesthetic environment as they please us with their colors, shapes, and fragrances.

Nature's Garden, a small section of the Boise Front, provides us with the opportunity to study native and introduced plants, and compare them to cultivated plants in the irrigated part of the Idaho Botanical Garden. We will see how plants prevent erosion and provide food and shelter to animals. We will also see how some introduced plants have altered the ecology by creating fuels for the fires that threaten the front every summer.

GEOLOGY

by Dr. Monte Wilson

Nature's Garden has a very interesting geological history. This area has experienced lava flows, earthquakes, and being covered by a large lake. It also has the two valuable geological resources of building stone and geothermal waters.

Between about 10 and 14 million years ago, volcanic activity produced thick layers of rhyolite in this area. We cannot see this rhyolite rock in Nature's Garden because it is buried by hundreds of feet of other rock and sediment. However, Castle Rock, which is visible on the skyline to the northwest, is composed of this kind of rock.

Sometime around nine to ten million years ago, the type of volcanic activity changed and produced a basalt lava flow. This basalt flowed out on top of the older rhyolite.

Later, between two and six million years ago, this area was flooded by a large lake which covered much of the Snake River Plain from Oregon to the Twin Falls area. The area that we now know as Nature's Garden was below the water near the northern shore of that lake. Streams running off the mountains carried mud, sand, and gravel that were deposited as sediment in the lake. These sediments accumulated to several hundred feet in thickness and were modified into sedimentary rocks. Some of these sedimentary rocks such as

sandstone are quite hard; others form soft layers of clay or loose beds of gravel. Some animals were living in the lake at the time the sediments were deposited. Because of this, we find a few fossils, mostly snails and clams, in the sandstone and other sedimentary rocks. Sandstone has been quarried from Table Rock and from the ridge just above the Old Penitentiary for use in buildings. Most of the buildings and the wall at the penitentiary are made from this sandstone as are parts of the State Capitol and many other buildings in Boise.

The flat landscape to the south, known as the Snake River Plain, is separated from the mountainous area to the north by a large break in the rocks, known as the Boise Front Fault. Rocks to the south have been lowered along this fault in relation to the rocks to the north which have been raised. Movements along this fault must have produced many earthquakes during the long time that it was active. It appears that this fault has not moved to produce earthquakes for many thousands of years.

Nature's Garden is just on the lower side of the Boise Front Fault and the hills rise up on the other side. This is why we can see rhyolite and sandstone on the ridges above the penitentiary that are the same as rocks buried beneath Nature's Garden.

The Boise Front Fault has broken the rocks to depths of a few thousand feet beneath the earth's surface. Water seeping into the fault system tends to go down through the broken rocks and it becomes warm. Hot water is pumped out of wells located along the fault system. Two of these wells are in the pump house just northwest of the penitentiary. These wells were drilled in 1890 to depths of about 400 feet. The water has a temperature of about 171°F and has been used for a century to heat buildings in Boise. There are several other hot water (or geothermal) wells in the city and in other parts of Idaho.

ANIMALS

Animals including people are a large part of the Boise Front ecosystem. We may not always see animals, but we know they are there by the traces they leave. Some animal's traces in Nature's Garden are nests, burrows, tracks, and scat.

People also leave traces. Like the first wagons on the Oregon Trail, mans' vehicles continue to scar the fragile desert soils. When off-road vehicles such as motorcycles and four wheel drive vehicles leave designated roads or trails, they can cause erosion on the steep slopes of the Front. Erosion causes serious soil loss, killing plants and altering habitats.

Can you think of other ways people change the Boise Front?

KEY TERMS

Review these terms and their meanings. Write a complete sentence for each key term. Include an example in your sentence. Share your examples with the other students in your class. The first one is done for you.

- *Adaptation*: How a living thing fits into its habitat. The wings of a bird are an adaptation that allows flight.
- *Botanical Garden*: A place where plants are collected and displayed for scientific, educational, and artistic purposes.
- *Community*: Different kinds of plants and animals living in the same habitat.
- *Decomposers*: Living things that get their food from the remains or wastes of plants and animals, example: bacteria.
- *Ecology*: The study of how living things interact with each other and with their nonliving environment.
- *Ecosystem*: A group of communities and their nonliving environment.
- *Environment*: The surroundings of a living thing, including the plants and animals with which it lives.
- *Erosion*: The moving of sediments to a new place.
- *Food Web*: A description of how all the living thing in an ecosystem feed on each other.
- *Habitat*: The place where a plant or animal lives. (example: a pond)
- *Herbivore*: An animal which eats only plants or plant parts.
- *Introduced Plant*: A plant not native to an area, but brought in by man's activities. (example: cheatgrass)
- *Native Plant*: Plants that are natural to a community. (example: sagebrush)
- *Omnivore*: An animal which eats plants and animals. (example: people)
- *Pollution*: The adding of any substance to the environment in harmful amounts.
- *Predator*: Animal that hunts and eats other animals
- *Producer*: A living thing such as a plant that makes its own food.
- *Recycle*: Turn waste or trash into usable products.
- *Scat*: An animal's solid waste.
- *Scavenger*: Animal that feeds on decomposing plants or animals.

NATURES GARDEN

Ask your students to close their eyes and imagine Nature's Garden and the Boise Front, as you read the following story to them. It would be good to show the class pictures, either before or after the story, of the Boise Front with rocks, plants, and animals that are found in the ecosystem.

One of my favorite past times is to go hiking in the Boise Front to take a look at the ecology of the Sagebrush steppe ecosystem. I find this plant and animal community, which at first glance is not as exciting as that of a tropical rainforest, to be quite fascinating. I start at the bottom of the hill and as I start walking up the trail, I notice the difference between the habitats of the green lawns and gardens in town and at initially what looks like a dry and lifeless landscape. However, as I walk, I start at the bottom of the hill and as I start walking up the trail, I notice the differences between the habitats. Below are green lawns and gardens in town, and up here it looks like a dry and lifeless landscape.

The first plants that stand out are the bunch grasses, which can be found in patches throughout the hills, and are a native plant, just like the abundant sagebrush. Another plant that is found throughout the front is cheatgrass, which is an introduced plant, and can cause the hills to catch fire easily in the dry and hot months. If I stop for a moment, I start to see the grasshoppers taking refuge in the shade that the low lying plants provide. By inspecting the sagebrush that line the trail, I see that the leaves are much smaller than plants that are found in a typical home garden. They are covered in tiny white hairs that give the leaf a silver color. The small, hairy leaves slow down water loss from the plants. The shrubs are providing food, shelter and help to protect the soil from erosion.

The sun is really beating down and making me quite hot, so I keep moving slowly up the trail, to some shade provided by the wild roses and trees that are growing on the side of the trail. The green is quite a contrast from the all the brown that can be seen on the hills. I'm starting to understand that gardens in the city below and the Boise Front ecosystems are very different. In gardens, the producers, plants, need a lot of water, while up here in the hills the producers get by with very little. There must be more water under the ground for the wild rose and trees to grow in the area though. I can see the line of green that makes its way down a ravine. I suspect that once upon a time water flowed down the slope from a spring but the water is underground now. This is probably a favorite vegetation grazing spot for herbivores, like mule deer and cotton tail rabbits, and a great place for quail to hide from predators that might want to eat them, such as the redtail hawks that soar in the sky. Looking down, I see some coyote scat on the ground. It has seeds, grasshopper legs and fur in it, which is consistent with a diet of an omnivore. When I look up at the hills, I spot the gopher mounds again, which is one species of prey that the coyotes hunt. The mounds that the gophers make pile the soil on the hillside. I know that the soil has decomposers that are breaking down any of the dead plants, and upon further inspection, the soil around here is a light color, especially compared to the soil I use to plant the garden in my backyard. This gets me to thinking again about how much water is up in the hills of the Boise Front. Except in this little ravine area with its green trees and shrubs, there's not much water around here. The plants and animals must have adaptations, like the sagebrush's leaf size and hair, to survive in this environment. Looking down the hill at the Idaho Botanical Garden, I know that I have seen little tree frogs near the water features and heard the chickadee sing it's song, "chickadee-dee-dee-dee," but in the foothills, it is too dry and open with hardly any trees and low lying shrubs for those animals. The only creatures that I've seen are grasshoppers, a bull snake that has crossed my path, and beetles, a food for the magpies that are flying overhead, that stick their bottoms up as I walk by. I see now that the Boise Front isn't dead, but is full of life and everything is connected together in a food web.

- After going over the ecology, plants, animals, and geology of the ecosystem, have your students close their eyes and imagine a time before cars, roads, house, and even before people were here.
- Do they think the ecosystem was the same or different?
- How do they think that all the parts of the ecosystem work together?
- Think of the key terms and how they fit into the Boise Front.
- After writing sentences with the key terms above, have the class write a story about the Boise Front with the terms from above.
- Think about whether you want to make the story in present time or maybe 200 years ago. Who was around 200 years ago? Anyone? What do you think the area looked like? Make a class illustration for the story.
- Ask the class to find and study the ecology key terms in the story.

NAME TAG ACTIVITY: A LESSON IN PREDICTING

OBJECTIVE:

You will be able to predict one thing you observe in Nature's Garden.

PROCEDURE:

The process of predicting involves using details and information available, using information from prior experiences, and using common sense.

- **Details and Information Available:** (Including vocabulary, story, and key concepts from the Nature's Garden instructional material.) Discuss the environment in which we live, high desert. Make a list of plants, animals, and geological features found in the Boise Front.
- **Information from prior experiences:** What plants, animals, and geological features have you seen while on walks around Boise in the past? What have you seen while walking in a similar area? Might you expect to find the same things in Nature's Garden?
- **Common Sense:** Discuss how common sense helps you in predicting. Why wouldn't you predict that you would find a giraffe walking around the Boise Front? Why might you see sagebrush?
- **Create a Name Tag:** Draw a plant, animal or other project you predict you will see on your visit to Nature's Garden. Print your name largely and clearly near your drawing. Wear your name tag the day of the tour. Your garden teacher will want to know who you are! While you are at the Idaho Botanical Garden, watch for signs of the thing you predicted you would see.
- **Evaluation:** When you return to class, discuss how accurate your prediction was. If you didn't see your predicted object, or signs of your object, discuss why you didn't.



HOW DO PLANTS HOLD SOIL TOGETHER?

PURPOSE:

To look at the way roots hold soil together.

MATERIALS:

Clear container (baby food jar), six radish seeds, one small paper cup, one cup potting soil, water and paper plate.

PROCEDURE:

- Put several (6-10) radish seeds in a clear container.
- Pour water in the container to cover the seeds.
- Leave the seeds covered with water for 2-3 days. Let them have time to sprout.
- Plant 5-6 of your seedlings in a paper cup. Keep the soil damp, but not soggy, for two weeks.
- After two weeks; tear or cut the paper cup from the soil over a paper plate.
- Do you see any roots?
- Count the roots you see.
- Describe how the roots and soil look.

HOW ARE PLANTS USEFUL?

This is an extended assignment. During the next week, make a list of plant uses. Read your list to the rest of your class. Discuss and decide by voting on the five most important plant uses listed.

To the teacher: possible answers at the end of the packet.

NATURE'S GARDEN FOOD WEB

This activity shows connecting food chains in the community of Nature's Garden. Look at the living things listed below and draw lines between all of the things that interact with each other. When you finish you will have drawn a food web. You could use these plants and animals in the story you write.



- Which living things in this food web make their own food?
- Imagine that bunchgrass is taken out of the food web. Count how many other organisms would be affected. Do this by counting the lines you have drawn from the bunchgrass. (It is to be expected that answers will vary.)
- Now imagine the frog is removed from the food web. Count how many other organisms would be affected.
- What are some reasons the answers to questions two and three are different?
- Draw a food web or a food chain in which you are a part.

To the teacher: See possible answers at the end of the packet.

REFLECTION AND EVALUATION

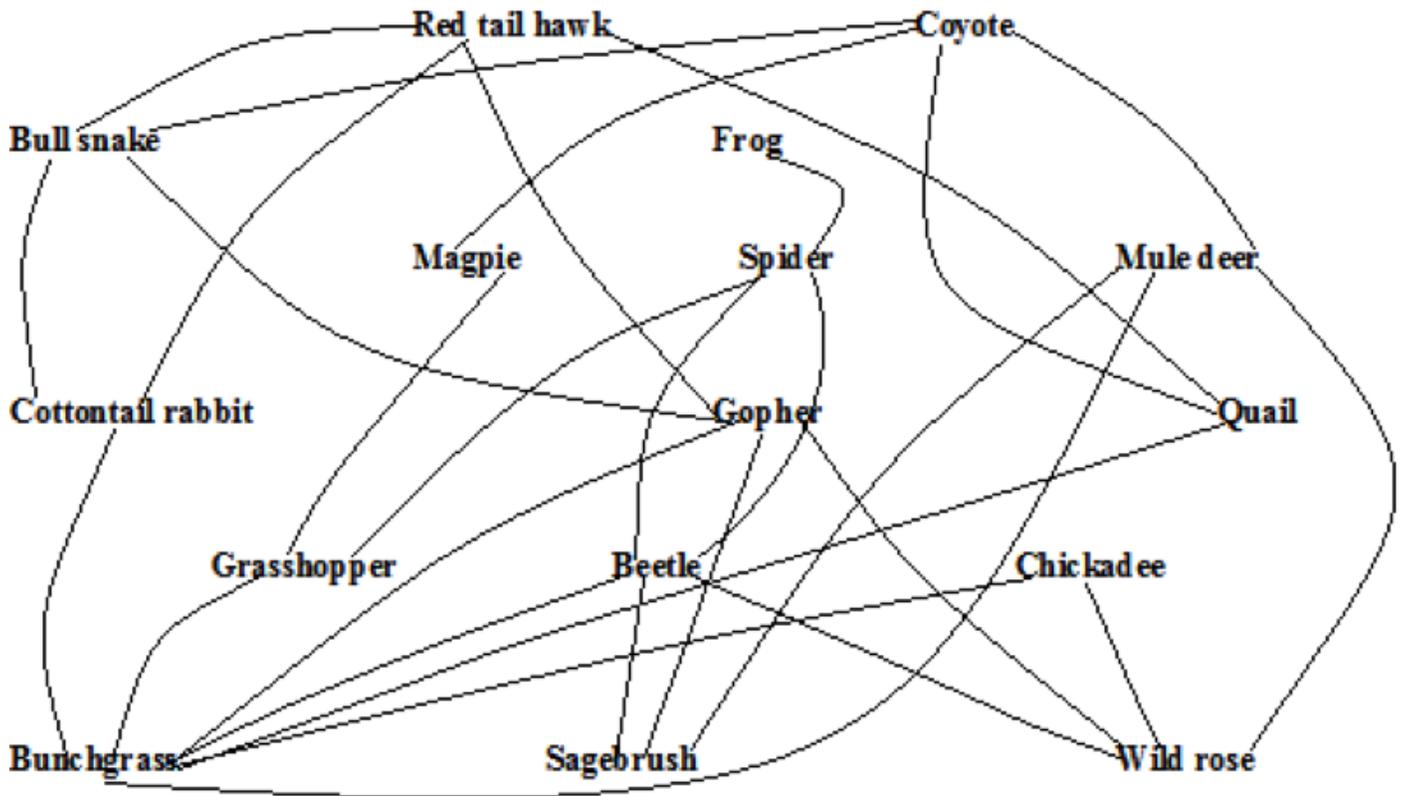
- Name three plants that provided you with some food today.
 - Name three plants living in your environment.
 - Name a large plant population in your school yard.
 - Besides their food making, why do you think plants are so important?
 - Why do we find certain plants in one type of environment, but not in another?
 - Explain differences between plants and animals considering such things as growth, food source, habitat, and adaptations.
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- Pretend you have time-traveled 100 years into the future. Write down what you discover has happened in the Boise Front, Nature's Garden.
 - How could you help solve the problems facing the Boise Front today?

ANSWERS

Possible answers to “How Are Plants Useful?” activity:

Plants capture energy from the sun, make oxygen, hold soil in place, provide medicine, food, fuel, clothing, shelter, perfume, paper, decorations, cosmetics, art, and much, much more!

Possible answers to “Nature’s Garden Food Web” activity:



- Bunchgrass, Sagebrush, and Wild rose
- Answers will vary.
- Answers will vary.
- Food webs may not all be constructed in the same manner.
- Grass-----Cow-----Me (food chain).

Possible answers to the “Reflection and Evaluation” questions:

- Bread (wheat), orange, potato chip.
- Grass, Maple tree, Pine tree.
- The population of clover growing in the field.
- See “How Are Plants Useful?”
- Answers will vary. Here are some examples: Both plants and animals grow and reproduce. Plants make their own food through the process of photosynthesis. Animals rely on plants for their food. When considering plant and animal adaptations think about adaptations, to the cold, heat, lack of moisture, abundance of moisture, and varying amounts of light. Plants and animals can live in the same habitats and are found in many different types of habitats.
- Answers will vary. Here are some examples: Don’t litter, be kind to the animals and plants, become and stay informed and don’t destroy habitat.

IDAHO COMMON CORE STANDARDS

4TH GRADE:

LS: Life Sciences

LS1-4-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. Assessment is limited to macroscopic structures within plant and animal systems.

LS2.A: Interdependent Relationships in Ecosystems

The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back into the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (LS2-4-1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (LS2-4-1)

ESS: Earth and Space Sciences

ESS1.C: The History of Planet Earth

Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (ESS1-4-1)

There are three classifications of rocks produced within the rock cycle: sedimentary, metamorphic, and igneous. (ESS1-4-1).

ESS2.A. Earth Materials and Systems

Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (ESS2-4-1)

ESS2.E: Biogeology

Living things affect the physical characteristics of their regions. (ESS2-4-1)

5 TH Grade :

LS: Life Sciences

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (LS2-5-4)

LS4.C: Adaptation

For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (LS2-5-3)

LS4.D: Biodiversity and Humans

Populations of animals are classified by their characteristics. (LS2-5-2)

Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (LS2-5-4)

ESS: Earth and Space Sciences

ESS2.A: Earth Materials and Systems

Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (ESS2-5-1)

6 TH Grade:

LS: Life Sciences

LS2.A: Interdependent Relationships in Ecosystems

Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (LS2-MS-1)

In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (LS2-MS-1)

Growth of organisms and population increases are limited by access to resources. (LS2-MS-1)

Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (LS2-MS-2)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (LS2-MS-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (LS2-MS-5)

Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (LS2 MS-6)