
Chapter 2. The Parking Lot

Topic Sections in the Chapter	Lines of Inquiry in the Section
Introduction	None
Habitat Features and Natural History	General Surface Features Energy Absorption Water Relations Plant Succession Animal Life

Introduction

The parking lot is a wonderful place to begin your explorations of the school grounds precisely because it would seem to be the last place one would go to study natural history. Admittedly, a parking lot is not teeming with life, and much of what one sees is not “natural” at all. But these attributes make the parking lot a great place to start observing and thinking about the properties common to all habitats. For example, dark asphalt causes temperature differences that can easily be measured; the movement of rain water falling on pavement is clearly visible; and the few plants or animals that can live on the parking lot draw attention

to the habitat conditions needed for their survival. The altered, more extreme, and less diverse nature of the parking lot highlights such features, which may be less noticeable (at first) in a more natural setting.

The parking lot of your school can be an excellent environment to begin your study of local natural history. This is a very common habitat across this country, and paved areas collectively have a significant impact on our environment. An examination of this habitat can “pave the way” to better understanding and appreciation of other local habitats.

Habitat Features and Natural History

General Surface Features

The areas of interest in the parking lot are the paved (or gravel) parking area, the curbs, and surrounding sidewalks. In general, unless the school was built on a very flat location (unusual in southwestern Virginia), we can assume that heavy machinery has altered the parking area to its current grade. You may be able to find evidence of the original grade or surface features by looking at the surroundings. Sometimes the parking area has been cut into a hillside, or the top of a hill has been cut off. Other lots have been made by filling in a shallow dip or by pushing soil removed elsewhere to form a raised flat area.

If you have an asphalt parking lot on your school grounds, it is made up of at least two materials, tar and stone. Tar is a product of oil refining. Oil originated from the fossilized remains of plants and animals that were buried long ago. The ultimate source of energy for these **organisms**—as for all organisms today—was the sun, as plants captured this energy and used it to build new tissues (some of which animals ate) many millions of years ago. Theoretically, then, when you stand on an asphalt lot, you are standing on stored energy that reached the earth millions of years ago.

The stone that is added to the tar gives the surface durability to withstand the friction of car and truck tires. Without the addition of stone, the tar it would be a gooey mess in the heat of summer. While the tar is brought in from faraway refineries, the stone is normally of local origin. In southwestern Virginia, paving stone is likely to be limestone or **dolomite** dug from a nearby quarry. Dolomite is preferred because it is more resistant to weathering, due to a higher content of magnesium.

Like tar, dolomite and limestone represent the remains of organisms that lived long ago. The area that is now central and western Virginia was covered by shallow seas from about 545 million years ago until about 360 million years ago. During this time, some organisms living in the seas removed calcium from the water and deposited it in their shells or outer skeletons. When these organisms died, their remains fell to the ocean floor, collecting over thousands of years in large deposits many hundreds of feet thick. These deposits resulted in the limestone and dolomite rocks that underlie our area today.

Concrete sidewalks, as well, have their own tale to tell. You can observe that the texture and color is very different from the asphalt pavement.

The surface is rough and has a sandpaper-like texture. The concrete sidewalk is made from a mix of cement and sand along with gravel. When cement is mixed with sand, gravel, and water, a chemical change occurs that leads to crystallization of the cement particles, bonding these substances together and producing a sort of “instant rock,” the concrete. The gravel in the concrete sidewalk is not visible unless it is broken apart because, when the concrete was poured, the surface was smoothed with a trowel and the rocks settled into the mixture. The cement, which acts as a “glue” to fuse the other particles together, is made primarily from finely powdered limestone that has been “cooked” at high temperatures. The sand may be from river deposits or from ground sandstone. Sandstone is another kind of rock which can be found underlying southwestern Virginia and is also an important quarry stone. Sandstone represents the beaches of seas that existed millions of years ago.

Energy Absorption

The black surface of the asphalt absorbs energy from the sun, and even on a winter day you will notice that the asphalt is distinctly warmer than its surroundings. On a summer day, of course, it is sometimes unbearable to step onto the pavement in bare feet. A concrete sidewalk will also get hot but not as hot as the asphalt. In either case, if you jump into the grass nearby, you will feel relief. So in the parking lot we can contrast the energy absorption of at least three different surfaces—grass, asphalt, and concrete—and apply the concept that different colors and materials absorb different amounts of light and generate different amounts of heat. The heat-related properties of these surfaces can be readily investigated easily by students armed with thermometers.

The capacity of asphalt and concrete to absorb energy during the day can have significant local impact. The energy absorbed by these surfaces will radiate back into the air as heat. This helps explain why snakes are often run over at night by cars: In the cool of the night, some unfortunate reptiles come out on the warm pavement to maintain their body temperature (reptiles’ body temperature varies with the surrounding temperature). Cities with large expanses of paved surfaces as well as concrete buildings absorb a great deal of solar energy during the day, energy that is released as heat. If you have been in a large city on a summer night, you may have noticed that the air does not

cool down as quickly as it does in suburban or rural areas. You can verify this observation by examining local weather reports that frequently show city high temperatures higher than surrounding rural and suburban areas (the nights' lows are also often higher). The effect on the local ecology can be observed, too. Some plants in cities may begin to bloom in the spring long before the same plants would bloom in surrounding areas, and plants that would normally not be found so far north can be found thriving in some vacant lots or parks.

Water Relations

Another important physical property of asphalt pavement is that it is generally impervious to water. When comparing a paved surface to its original, unpaved state, we see a dramatic difference in what happens to rainfall in that area. Most of the water that falls on a parking area simply runs off the surface, while rainwater that falls on lawns, meadows, and forests has a chance to soak into the ground.

This difference can have a substantial effect on local streams. The rainwater that falls on building roofs, streets, and parking lots moves quickly into drains that often run directly into streams, bypassing the natural "filtration" that occurs as water percolates through soil. Following a substantial rainfall, the volume of flow in streams near paved areas can increase rapidly, partly as a result of the storm runoff from the paved surfaces. Higher and more rapid flows increase erosion in and around the stream. Streams subjected to high rates of erosion typically have sharply cut, steep banks, often with exposed tree roots. Increased erosion due to runoff has an impact on things living in a stream. The soil sediments carried by the water are not necessarily toxic, but the build-up of sediments can degrade or even destroy the habitat of many gill-breathing organisms. Runoff can also have toxic properties when it carries with it road salt from winter treatments for ice, heavy metals from vehicular exhaust, or oil, gasoline, antifreeze, and brake and transmission fluids that can leak from cars. (You can see the evidence of leaking fluids in the middle of most parking spaces.)

Plant Succession

(Note: If you are unfamiliar with the term "succession," please see the Glossary for a definition.)

Things in nature are constantly changing. The parking lot provides an ideal environment to study an important process of change, primary

succession, the process by which plants colonize new rocky (or rock-like) areas.

Parking lots, like other human-made structures, do not last forever. As soon as the parking lot is paved, the erosion process begins. The tar begins to "dry out" as certain chemical compounds evaporate. Vehicular and pedestrian traffic, sun, wind, rain, ice, snow, and chemicals begin to break it down. Close examination of the surface using a magnifying glass or by running your fingers across it will reveal tiny particles of eroded pavement as well as material from the surroundings. These particles can act as agents to further contribute to erosion. Cracks may form under stress because of the expansion and contraction of the asphalt during temperature changes. During the winter, cycles of freezing and thawing can wreak havoc on asphalt and concrete surfaces. Each time water freezes in a crack it expands with enormous force. When it thaws and melts it can move deeper into the cracks. The potholes in our roadways form in this manner, and bridges must be engineered to account for expansion and contraction.

As a result of erosion—by the same processes that cause erosion in more "natural" habitats, such as a rocky mountain top—we can witness the beginning of soil formation in the parking lot. Sediments eroded from the surface as well as from the surroundings collect in the cracks, along curbs, or in depressions in the pavement where water puddles form when it rains. Some organic material (from plant or animal origin) is also deposited in these spots.

Tiny plant seeds are deposited by wind or water into the sediments collecting in parking lot cracks. The seeds that are most tolerant to extreme environments sprout when conditions are favorable, and the most hearty sprouts survive and begin to grow. As their roots penetrate into the sediments and their leaves spread upward and outward, these plants help retain even more soil particles. As some plants die and decompose, they enrich the developing soil. The plants that survive, however, begin to change the physical features of the environment in the crack, especially by providing shade to bring the temperature down and increase available moisture. In these ways, these first plants (called "pioneers") make the environment more hospitable for other plants that might not ordinarily have been able to grow there.

Succession refers to this process, where new plants (and associated animals) take advantage of improved conditions and are able to replace previous plants. Depending on how well-maintained your school grounds are, you will be able to see various stages of the succession process.

Eventually, over a long period of time even a parking lot would revert to a more natural setting as it follows recognizable patterns of succession.

Animal Life

Many different kinds of animals may occupy the parking lot habitat at different times during the day and year. Tiny mites are often seen crawling on the surfaces of dry sidewalks, while during a heavy rain numerous worms may be found attempting to escape their flooded burrows. The weeds growing out of a crack, like an oasis in the desert, can

harbor a variety of insects and spiders. As the plants in the crack become better established, more kinds of organisms may find a home there.

The parking lot also has many transient guests. Birds may land to pick at crumbs of breakfast dropped by teachers and students hurrying to class or bits of afternoon snacks that fall to the ground. At night, mice and rats may venture into the parking area seeking similar treats, while bats are frequently seen feeding on insects attracted by lights in the parking area. Trash cans in or around parking lots may also attract skunks, raccoons, or squirrels in search of food. Occasionally, an eager skunk may be found temporarily trapped in the bottom of a trash can.

Parking Lot Inquiries

Useful materials: thermometers (regular and maximum/minimum), buckets of water, kickballs, trowel, pots and potting soil.

General Surface Features

Take your students out to the school parking lot.

How has this area been changed over the past 200 years?

Reach down and run your fingers over this surface. Describe how it feels.

Look at the surface. How many different kinds of materials make up this surface?

What evidence can you point out to support your previous answer? What are the original sources of the raw materials that went into making this surface?

Why are stones mixed with the tar?

How is the asphalt surface similar to the sidewalk? How is it different?

Energy Absorption

Provide students with thermometers and a data sheet for recording temperatures on different surfaces.

Place your hand on the asphalt, a car, the sidewalk, and in the grass. How do the temperatures of these surfaces compare?

Predict the temperature of these surfaces at different times of the day.

How could we test these predictions using thermometers?

Make a graph or chart to show the differences among the surfaces and how the temperatures change during the day.

How can you explain the differences in temperature that you observed?

Predict how the temperatures will change at night.

Does the pavement appear to be hotter or colder than the air temperature?

What effect does paving have on air temperature around your school during the day? At night?

If you have access to maximum/minimum thermometers, these could be used to compare the effect of buildings and pavement on temperature. The thermometers can be used to compare high and low temperatures in town vs. in the country over several days.

What factors affect the temperature in your community as a whole?

Is the existence of buildings or pavement a significant factor?

How could you test this using our maximum minimum thermometers?

Water Relations

Buckets of water can be used to observe how water travels over the parking lot. If you prefer, kickballs could be released at different locations to give an idea of the routes runoff water takes.

Where does water go when it falls on the parking lot?

Does all the water run off? What else can happen to it?

Where does the water that runs off ultimately go?

How is this different from the water that falls on the lawn?

How will the runoff affect a stream?

Imagine what this area looked like 200 hundred years ago. Imagine a sudden thunderstorm today and one 200 years ago. In which situation would you expect the stream to have the greatest flow?

Have the students examine the parking lot surface where cars have been repeatedly parked.

What can you see that would be carried by runoff water to a stream? How would this affect the stream?

Plant Succession

Are there any cracks in the parking lot pavement?

Can you find any soil in cracks in the parking lot?

Where did the particles that make up this soil come from?

Can you find evidence of plant life in the parking lot?

How did the plants get here?

What conditions must plants be able to tolerate to live here? Can all plants tolerate these conditions?

Are the plants that are growing here the same ones that you find in the lawn?

Do these plants grow as fast as plants in the lawn? How could you test your answer to the preceding question?

Can you find some cracks with plants growing in them that appear to be older than the one you are looking at? How are these cracks similar? How are they different?

Predict what the parking lot might look like next year, five years, or ten years from now if it is not maintained.

With a trowel, try scraping the soil and debris from cracks in the sidewalk. Place this material in pots with vermiculite or sterile potting soil and keep moist for one to two weeks. Grow the plants that sprout.

How many different plants can you recognize?

Where did these seeds come from?

How did they get there?

Can you find plants growing nearby that look just like the ones you grew?

Do cracks in different parts of your school grounds have the same seeds in them? Design an experiment to answer this question.

Animal Life

What animals can you find living in the parking lot?

What makes the parking lot a suitable habitat for these animals? Does time of day affect their activity? How could you test this? What organisms might come to this area at night?

How might humans influence the number and kinds of organisms that might visit the parking lot? How could you test this?

Focus on the Features of Habitats

The following four chapters of this book concentrate on organisms found in various schoolyard habitats. The ideas about habitat features presented in this chapter on parking lots can help you understand the interactions that go on between any organism and its habitat. In any habitat, such interactions exert a large influence on where organisms live, what their features are, and how they survive.