# UNDERCOVER ASSIGNMENT

Grade 6–8

## Lesson at a Glance

Students explore relationships between different types of ground cover, living organisms, and water in an ecosystem.

## Key Concept

Differences in ground cover and terrain create a number of microclimates with a variety of temperature, moisture, light and soil conditions in ecosystems.

## Hawai‘i Content Performance Standard III, Science, Grade 6

| Strand | | The Scientific Process | |
|---|---|---|---|
| Standard 2: The Scientific Process: NATURE OF SCIENCE—Understand that science, technology, and society are interrelated. | | | |
| Topic | | Science, Technology, and Society | |
| Benchmark SC.6.2.1 | | Explain how technology has an impact on society and science. | |
| Sample Performance Assessment (SPA) | | The student: Explains ways in which technology has changed our society and science. | |
| Rubric | | | |
| Advanced | Proficient | Partially Proficient | Novice |
| Explain and provide examples of how technology has an impact on society and science | Explain how technology has an impact on society and science | Give a partial explanation of how technology has an impact on society and science | Recognize that technology has an impact on society and science |

## Hawai‘i Content Performance Standard III, Science, Grade 7

| Strand | | The Scientific Process | |
|---|---|---|---|
| Standard 2: The Scientific Process: NATURE OF SCIENCE—Understand that science, technology, and society are interrelated. | | | |
| Topic | | Science, Technology, and Society | |
| Benchmark SC.7.2.1 | | Explain the use of reliable print and electronic sources to provide scientific information and evidence. | |
| Sample Performance Assessment (SPA) | | The student: Explains how the evidence found in a wide variety of print and electronic sources (e.g., database programs, internet) can be used to develop conclusions | |
| Rubric | | | |
| Advanced | Proficient | Partially Proficient | Novice |
| Explain how print and electronic sources can be used to provide scientific information and evaluate the sources used for validity and reliability. | Explain the use of reliable print and electronic sources to provide scientific information and evidence. | Explain that print and electronic sources can be used to provide scientific information and evidence. | Recognize that print and electronic sources can be used to provide scientific information and evidence. |

**Hawai‘i Content Performance Standard III, Science, Grade 8**

| | | | |
|---|---|---|---|
| Strand | | The Scientific Process | |
| Standard 2: The Scientific Process: NATURE OF SCIENCE—Understand that science, technology, and society are interrelated. | | | |
| Topic | | Science, Technology, and Society | |
| Benchmark SC.8.2.1 | | Describe significant relationships among society, science, and technology and how one impacts the other. | |
| Sample Performance Assessment (SPA) | | The student: Provides earth and space examples of how science, technology, and society have impacted each other. | |
| Rubric | | | |
| Advanced | Proficient | Partially Proficient | Novice |
| Evaluate and describe the relationships among society, science, and technology and how one impacts the other. | Describe significant relationships among society, science, and technology and how one impacts the other. | List a few relationships between society, science, or technology. | Recognize relationships among society, science, and technology. |

**Objectives**
Students will be able to:
1) distinguish among various types of ground cover in the schoolyard; and
2) describe how ground cover affects temperature, the water cycle, and living things.

**Time**
three class periods

**Subject Areas**
Science, Social Studies, Language Arts

**Materials**
student reading sheet (provided)
student data sheets (provided)
one for each group of students:
- thermometer
- cup of water
- watch with a second hand

**Teacher Background**
An **ecosystem** is a community of living things, people, their environment and the way they interact with one another. In Hawai‘i, we can classify some ecosystems as “native” or “nonnative.” We can also classify ecosystems as “marine” (relating to the sea) or “terrestrial” (relating to the earth). Our various terrestrial ecosystems are comprised of different **natural communities** at distinct elevation zones: coastal strand, wet and dry forests, subalpine forest, alpine shrubland, and alpine desert.

**Ground cover**, **microclimates**, and living things all influence one another to create a specific environment within an ecosystem. A microclimate is the relatively uniform climate of a small site or **habitat**. The mountainous topography of the islands, trade winds, the variability of rainfall and other conditions create many different microclimates. Ground cover affects how, why, and where natural communities form. Ground cover also affects the **water cycle**. For

example, parts of the Kaʻū district on Hawaiʻi Island receive a great deal of rain, yet seem very dry since rain quickly percolates through the lava rock ground cover and moves beyond the reach of plant roots. In rainforests, water is absorbed by the lush, thick ground cover. In contrast, on Kahoʻolawe the land is barren and eroded and as a result, there is very little groundwater. At one time, rain fell on Kahoʻolawe from a column of clouds that extended from Maui to Kahoʻolawe and during winter storms from the south. Rainfall on Haleakalā diminished markedly in the nineteenth century as Haleakalā's forests were destroyed by nonnative grazing mammals. This in turn had an adverse effect on Kahoʻolawe's rainfall.

Air temperature is also affected by ground cover. Dark surfaces tend to absorb the sun's heat during the day and radiate that warmth throughout the day and into the evening. In rural areas, cattle are often attracted to this warmth and can be seen resting on paved roads, rather than on the nearby grass. In moist areas, such as wetlands or rainforests, water is continually evaporated. This process of evaporation helps cool the ground and the air above it.

Ground cover is an important factor in determining environmental conditions and an ecosystem's health. These conditions, in turn, affect the way natural communities form. People often alter ground cover to suit their own needs (paving streets, growing or cutting trees, removing weeds, diverting streams) without considering the impact of these actions on the environment. By altering ground cover, we affect the natural communities and the ecosystems of which they are a part. Learning to observe and understand the interdependence of physical factors and living things is an important step toward understanding the complexities of our environment.

For a global comparison, see the Undercover Assignment Student Reading.

**Teaching Suggestions**

1) Have the class read the student reading and discuss the ways ground cover affects temperature, living things, and the water cycle.

2) Divide the class into small groups and take students outside to complete the student data sheet. Have the groups choose different areas with different ground cover around the schoolyard to represent different types of ecosystems.

3) Distribute cups and thermometers, cautioning students to lay thermometers on the ground surface and not to insert them in the soil since they might break. Alternatively, use a 16 penny nail to make a hole in the soil, and put the thermometer in the hole.

4) When students have completed their investigation, visit the different ecosystems and review students' answers.

5) Analyze the information as a class and summarize the different ways that ground cover can affect temperature, the water cycle, and living things.

Discussion Questions:

- Have students describe their ecosystems. Is there anything unique about the ecosystem?
- How is it maintained?
- How often is the landscape in the schoolyard maintained?
- Do any of the ecosystems receive enough water?
- Is the schoolyard effectively maintained? (Cost, amount of water used, suitable plants for landscaping) If not, how can it be effectively maintained?

**Extended Activities**

- Repeat and extend the investigation to a different type of ecosystem, such as an overgrown lot, a coastline, or a wetland.

- Have students write short stories around the theme of ground cover. Possible topics: If you were an alien from outer space, or a dinosaur, or a termite, what kind of ground cover would you prefer and why? If your whole schoolyard was paved over with concrete, or turned into a forest, how would that affect the water cycle, the temperature, or living things?

- Follow up with a discussion on forest ground cover and the water cycle, and the role of forests as watersheds. See "Watershed Wisdom," Humans and the Environment, Grade 6.

- Take a field trip to a recent lava flow. Compare different types of flows: a) flows of various ages but at the same elevation, or b) *ʻaʻā* and *pāhoehoe*. How do the flows vary in terms of plant growth and microclimate? How is the same flow different at various elevations?

## What is ground cover?

Ground cover refers to the "clothes" the Earth wears on its surface. Ground cover can include grass, trees, pavement, houses, or just bare soil. Can you think of ways that ground cover affects the water cycle, the air temperature, and soil conditions? All are affected by ground cover.

In forested areas, rain can soak into the spongy ground and be used by plants, or drain beyond their roots to become groundwater. Where cement covers the ground, most rain will wash into a storm drain or stream, and flow out to sea. Some of it will evaporate along the way, but very little will seep down to become groundwater. Ground cover has a major effect on the water cycle and on all other living things there. On the barren island of Kahoʻolawe, there is much runoff when it rains, extensive erosion, and as a result, there is very little groundwater. Kahoʻolawe's top soil has been blown away and the trampling of animal hooves has made the ground extremely hard. Plants do not grow easily on Kahoʻolawe. The island has few tall trees to capture rain clouds to replenish groundwater supplies. Groundcover has a major effect on the water cycle and all other living things within an ecosystem.

The color of ground cover and the moisture it holds affect air and soil temperatures. Dark green grass absorbs the sun's energy and heats up. But moisture in the soil may evaporate and slightly cool the air around the grass. If you walk across this grass in bare feet it will feel cooler than a dark road surface near it. The dark road surface absorbs energy from the sun. If the road has no water to allow evaporation to occur, it will feel very hot on your bare feet. A white concrete surface will reflect some of the sun's energy back up. The concrete won't feel as hot to walk on, but the air above it will be warmer!

## How are living things affected by ground cover?

Most plants and animals are adapted to certain types of ground cover and other growing conditions. For example, some insects are found only in decaying matter in soil; others live on barren lava flows or on certain types of plants. The physical conditions—temperature, rainfall, and sunlight—are different in each example. These mini-climates are referred to as **microclimates**. The mountainous **topography** and the differences in rainfall in the Hawaiian Islands create many different **natural communities** such as rainforests, deserts, and beaches. Within each natural community, there are a number of microclimates having a wide assortment of ground covers. An **ecosystem** is formed when living things, people, natural communities, and the environment interact with one another.

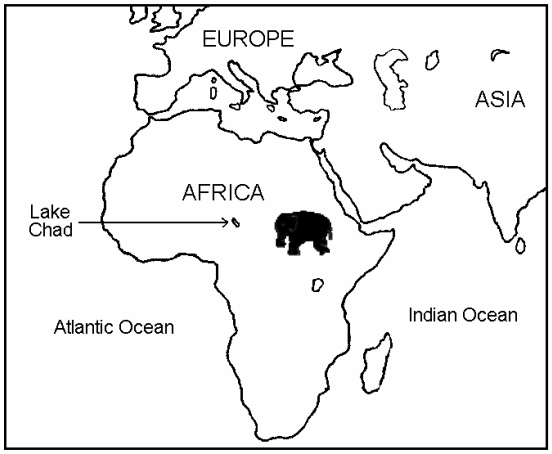
Ground cover tends to change over time. Wind, rain, and roots break up bare lava rock and start to turn it into soil. Seeds then sprout in the soil. As plants grow, they shade the ground, and their roots and leaves absorb moisture, creating different growing conditions. Such conditions may allow additional plants and animals to survive, creating a new ground cover. Ground cover is always changing naturally.

## How can living things affect ground cover?

People often speed up or even reverse natural processes by cutting down forests to make pastureland, or paving natural areas to build shopping centers. All of these changes have a big effect on temperature, the water cycle, and living things. Overall, we can determine the health of an ecosystem by looking at the negative and/or positive impacts we impose on them. An example of a negative impact on a watershed ecosystem in Hawai‘i occurred when cattle and other large hoofed mammals were introduced after the arrival of Captain Cook in 1778. These animals destroyed much of the forest ground cover, caused erosion to increase, and prevented water from soaking into the ground. Eventually groundwater levels dropped. In the 1930s, lands were reforested and water levels rose throughout the islands.

## How is an ecosystem affected by change in ground cover?

Lake Chad, once one of Africa's largest freshwater lakes (more than twice the size of the island of Hawai‘i), has fluctuated in size from time to time but overall is shrinking. With its wetlands and waterbirds, it lies in four countries: Chad, Niger, Nigeria, and Cameroon. An expanding human population, increased irrigation, and low rainfall have contributed to its shrinking. Lake Chad is in an African savanna known as Sahel (Sähĕl′). Sahel is the transitional zone from the Sahara desert to the north and the savannas to the south. Its ground cover is mostly grass. Its climate is characterized by long dry seasons followed by short wet seasons. Further south of Sahel and the savannas are rainforests.

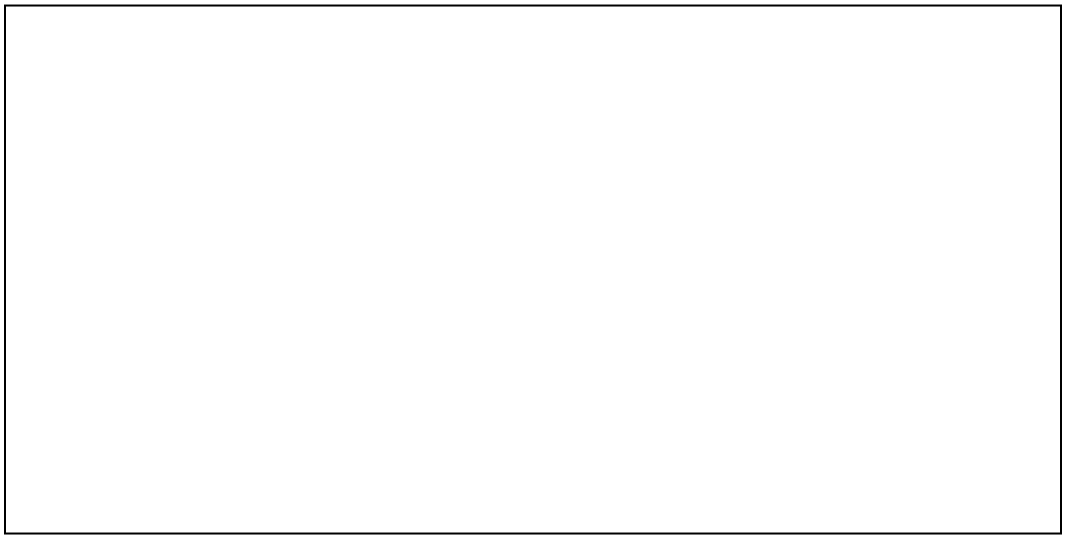



Normally Lake Chad has received most of its rainfall during its rainy season. In the late 1960s, the area experienced a series of droughts. As the rains failed to come, the savanna of Sahel began to change into a desert through a climatic and human-induced process called desertification. This can be caused when ground cover is cleared for agriculture and livestock, resulting in a drier climate. In deserts, rainfall is so slight it is less than 25 cm (10 in) a year. In Sahel, many farmers harvest their fields and let them remain fallow until the next planting season. During this time, the ground is bare. Winds often blow the nutrient-rich top soil away. Animals graze on the fragile vegetation. Trees are cut for fuel. Without vegetation, this complex ecosystem is unable to recycle moisture back into the atmosphere, which would result in the return of the rains. Since rainfall is so scarce, the people of these countries have become increasingly dependent on Lake Chad for their water. The drier the climate becomes, the more people will rely on the lake for their needs and the shrinkage of the lake will continue.

## What is ground cover's importance?

Natural ground cover is vital to ecosystems in Hawai‘i and around the world. It is important to the water cycle, temperature and soil. The long-term health of every ecosystem is dependent on the quality of its ground cover.

Draw a picture of the ground cover.



Where is your ecosystem in your school? _____

Is the groundcover in your ecosystem natural or created by human?_____

_____

List all the living things you can find on the ground cover. _____

_____

What is the ground cover's temperature? _____

How does the ground cover affect the temperature? _____

_____

_____

How does the ground cover affect the water cycle? Pour a cup of water on the ground cover and record how long it takes to soak in (or run off). _____

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