



The Balance of Nature in the Desert

Objective:

Students will demonstrate an understanding of the characteristics of specific living organisms in the environment and how their structure and function contribute to survival. Students will describe how specific desert creatures adapt to and impact the local ecosystem by using observation, prediction and application.

Performance Objectives:

Grade 6: SS Strand 2: Concept 2 PO3

Strand 4: Concept 1 PO6 & 7; Concept 3 PO2

Grade 7: SS Strand 4: Concept 3 PO1 - 6

Grade 8: SS Strand 2: Concept 2 PO1

Concept 4 PO1 – 6

NGSS MSL2; MSL3

CCSS 6-8; WHST.5; WHST.6; WHST.8; WHST.10

Background Information:

Life in the desert can be a challenge for people and other living creatures. So, what is a desert? A desert can be a hot, arid place with little water. It can be a dry region covered with sand dunes and cacti, and many hot deserts are in the subtropical zones. The desert of Arizona has those characteristics and even more. Scientists say a desert is a place where more water would be lost through evaporation than is gained from rain. This means that deserts are dry places, but they may not always be hot. The Arizona desert is cool in the winter months and can reach hot temperatures of over 110 degrees in the middle of the summer. Even with cool temperatures, the desert is always a dry place. Most deserts receive less than 10 inches of rain in an entire year. Arizona is one of those dry deserts with very little rain.

Grades: 6-8

Key Vocabulary:

- **Ecosystem**
- **Diversity**
- **Adaptation**

Related Literature:

Desert Ecology

John B. Sowell

Desert Habitat

Kelley Macaulay

Life in the Desert

Dorothy H. Patent

Mohave Desert

Robert Webb

For many forms of life, **adaptation** is the primary means by which survival can happen. Even desert plants have to adjust to the dry climate, and some plants even slow their growth to fit the environment. For example, large cacti store great amounts of water in their thick stems. The saguaro cactus is a good example of a desert plant that has adapted to life in the arid regions of Arizona. The saguaro soaks up water when it rains and stores it for nourishment. The rippled outer skin of the saguaro is designed to expand as water is collected and stored. Saguaros grow slowly and can live well over 100 years.

Creatures living in the desert have ways to conserve water in their bodies and to locate more as they need it. Desert animals have had to develop ways to cool themselves and find shelter from the hottest part of the day. There are many types of animals and insects that have found a way to live in the desert regions of the world. Arizona is the home for many plants and animals that flourish in the dry desert.

The Desert Ecosystem

The term **ecosystem** describes the interaction of both the living and non-living components in an area. To determine the relationships between the living organisms, we study the individual level, the population of living things and the ecosystem. Understanding the individuals in an ecosystem involves looking at the life cycle, behavior, anatomy and specific habitat. The research of populations means looking at group behaviors, interactions within the group and growth of the population. Expanding the analysis takes us to the community of various species interacting and competing for resources in a given area. When all of the factors are combined, we look at the operation and function of the living organisms as a whole.

The **diversity** of animal and plant life in an ecosystem is impacted by a number of variables such as: sunlight, temperature, water, precipitation and soil conditions. Harsh or unstable weather conditions may cause drought or flooding while strong winds may disrupt the stability of the soil and alter the food source for some creatures. Maintaining a suitable habitat depends on an organisms' ability to adapt to changes in the ecosystem.

The balance in the desert ecosystem involves survival of both plants and animals. Some desert creatures have to evade the heat during the hottest parts of the day. For example, rodents come out at night to search for food and stay in burrows during the day. Reptiles like rattlesnakes are mostly active at dawn or dusk when the desert temperatures are lower. There are even some desert plants that only grow under larger plants to gain shelter from the sun's hottest rays.

Another way some creatures survive in the desert is to regulate their body temperature to stay cool even on hot days. Some animals have fur that serves as an insulator to help keep the body temperature regulated. Absorbing water and storing it in the body is a way that some plants and animals have adapted to the desert heat. Plants like saguaro cactus have an intricate water system that keeps the plant alive by storing large quantities of water in the body of the tall plant. The ridges along the body of the saguaro look almost like water canals that service the plant with moisture. The roots of the saguaro are very shallow as they have no need to grow long or deep to find water. Another example is in birds of prey who replenish their body with liquid from the animals they eat.

Survival for many animals is a matter of keeping away from predators. Camouflage is one means that nature has provided. Often animals appear the same color as their surroundings. Most desert animals are tan, sandy colored or brown much like the ground color of the Arizona desert. Being difficult to detect is a benefit for species of animals, especially those that are slower to move or unable to escape the clutches of the predator.

Many plant and animal species in the desert have physical features that allow them to survive and contribute to the ecosystem. An interesting example of adaptive physical traits is in the desert tortoise, aka *Gopherus Agassizii*. The desert tortoise's natural habitat is the Sonoran and Mojave deserts. These slow moving reptiles can appear rock-like in color and have managed to adapt to the extreme heat of the day by using their flattened forelegs to dig burrows for shade and shelter. The toenails and scales on the legs allow the tortoise to effectively dig deep burrows or shallow resting spots at the base of a desert bush. The desert tortoise is an herbivore who feasts on desert plants and grasses found low to the ground.



(Public domain photos)

Baby desert tortoises are very small, about the size of the palm of a child's hand. Adults can grow as heavy as eight pounds and live over 50 years.

Humans aside, there are many questions that can be asked in observing the desert ecosystem:

- What is the link between these living organisms?
- How do they interact with one another and survive?
- How does each of them fit into the “food chain”?
- How will their populations grow or decline if they are faced with climate changes?
- To what extent would conditions cause the end of a species?

Sources: National Parks Service; Mohave Desert Ecosystem Program; Wild Tracks; Arizona Sonora Desert Museum; Wikipedia; The Franklin Institute; University of Michigan.

Procedures and Pre-Activities:

1. State the learning objectives.
2. Read informational literature related to ecosystems.
3. Review vocabulary.
4. Present the background information and discuss.
5. Using the desert animal photos, have students discuss how the animals live (burrows, trees, etc.), where they fit in the food chain, etc.
6. Review the climate charts and discuss the effects climate has on the environment and the potential for climate changes.

Group Activity: Divide the class into four groups. Each group will work together to gather information and share ideas. First, have four pieces of paper and put an Arizona desert area name on each piece of paper. Fold and have one student from each group draw a desert area. Areas:

1. High Altitude (Flagstaff); 2. Low Desert – Sonoran (Tucson)
3. Urban Desert – Butterfly Wonderland area; 4. The Salt River – (as it flows near the Tempe area)

Students are to use the form “I think I know” and follow the directions. Groups write down their findings on the note sheet (I Think I Know) and discuss their desert area. Each group will document their findings in a one page paper. Directions for the assignment are on the form called **The Ecosystem and Environmental Stressor**.

The second part of the assignment is to introduce the environmental stressor. Again, write the stressors on pieces of paper and have a member of each group draw a paper and reveal the one environmental stressor for their group’s desert area. After discussion, each student writes a paragraph that predicts the impact of the environmental stressor. (Directions are on the form)

Reflection and Assessment:

After visiting Butterfly Wonderland, discuss the experience and the location of the building as it relates to the environment. Ask students to compare the environment in the butterfly atrium to that of the desert outside the building. Discuss the differences and how the ecosystems support survival of the creatures in them.

Research Project:

Students review the photos and list of Arizona animals. Each student selects one of the species to research. Using computers, students research the selected animal for the following:

Scientific classification; natural habitat and survival; adaptations (to the environment); placement in the food chain (prey or predator); social interaction; anatomy (form and function); impact and contribution to the ecosystem.

Students should have two sources and document per teacher instructions. The essay outline is attached and may be used for this project.

The Living Desert

An ecosystem consists of the living community in the same location. These are examples of living organisms in the desert environment which make up the unique ecosystem. All life interacts in some way and must adapt to the environmental changes that take place over time. Consider these elements of the ecosystem: sunlight, temperature, precipitation, water and soil.







(Public domain photos)

Arizona desert animals:

Antelope jackrabbit
American Golden Eagle
Bighorn sheep
Birds- over 30 species
Black widow spiders
Black-tailed jackrabbit
Bobcat
Desert Cottontail
Coyote
Grasshopper mice
Gray fox
Great Horned Owl
Harris' Antelope squirrel
kangaroo rats
Kit Fox
Lizards - Gila Monster
Mexican Gray Wolf
Mountain lion aka puma or cougar
Mule Deer
Pronghorn
Raccoon
Rock Squirrel
Round-tailed ground squirrel
Scorpions
Spiders - Black Widow
Snakes - Western Diamondback Rattlesnake
Striped skunk
Tortoises - Desert Tortoise
White tailed deer
White throated woodrat

The Living Desert

Type of Arizona desert: _____

Directions: Fold the paper in half. You now have two sides, one for what you think you know about the desert area you have selected and the other for what you learn through discussion and research.

I Think I Know

I Learned

The Ecosystem

Assignment: After gathering all of the information about your desert area, discuss the characteristics of the area. Write a (1 page) description of the ecosystem that includes the following:

- Name of the desert area
- Amount of sunlight
- Average temperature (day and night)
- Altitude (location on map of Arizona)
- Physical features of the area
- Native plant and animal life
- Food chain

Environmental Stressor

Each group will select an environmental stressor to impart on their ecosystem.

Assignment: Each group reevaluates the ecosystem based on the environmental stressor that takes place. In a well-developed paragraph, each student will predict the impact that the stressor would have on the specific ecosystem previously selected.

Stressors:

Tornado and driving rain

Severe drought

100-year flood

Earthquake (Level 7)

Toxic waste spill

Essay Outline Template

- I. INTRODUCTION
 - A. Background Information
 - 1. General background information that grabs attention (reference)
 - 2. More specific background information to lead into the thesis (reference)
 - B. Thesis statement
 - 1. Topic
 - 2. Outline your key points
- II. BODY
 - A. Support Paragraph 1
 - 1. Thesis statement
 - 2. Supporting Ideas
 - a. Reason/Detail/Fact and transition (reference)
 - b. More information and transition (reference)
 - c. Maybe even more information (reference)
 - 3. Summarizing/Concluding/Transition sentence
 - B. Support Paragraph 2
 - 1. Thesis statement
 - 2. Supporting Ideas
 - a. Reason/Detail/Fact and transition (reference)
 - b. More information and transition (reference)
 - c. Maybe even more information (reference)
 - 3. Summarizing/Concluding/Transition sentence
 - C. Possible Support Paragraph 3
 - 1. Thesis statement
 - 2. Supporting Ideas
 - a. Reason/Detail/Fact and transition (reference)
 - b. More information and transition (reference)
 - c. Maybe even more information (reference)
 - 3. Summarizing/Concluding/Transition sentence
 - D. Maybe even another Support Paragraph 4 (or more)
 - 1. Thesis statement
 - 2. Supporting Ideas
 - a. Reason/Detail/Fact and transition (reference)
 - b. More information and transition (reference)
 - c. Maybe even more information (reference)
 - 3. Summarizing/Concluding/Transition sentence
- III. CONCLUSION
 - A. Summarize/Review key points
 - B. Concluding thought
- IV. REFERENCES (MLA format)

Tips for writing essays:

Thesis – The theme of your essay put into one sentence.

Consider a point of view (your argument)

Your thesis should do the following:

- respond directly to the prompt
 - contain a definite statement
 - is your thesis an arguable claim
 - show you have knowledge of the topic
 - illustrate a passionate perspective
 - not too specific or too broad
 - list key points to be discussed in the essay
 - can you provide evidence to back up the thesis
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- Typically, the thesis is located at the end of the opening paragraph. Make it clear, strong, and easy to find.

Example:

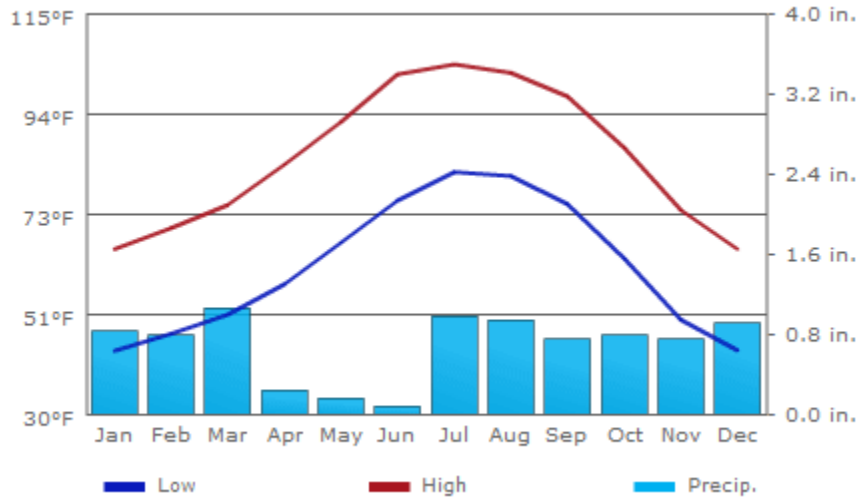
The life of a typical middle student is characterized by time spent studying, attending class, and socializing with friends.

Practice: Write a thesis statement about the following topics.

1. My favorite car

2. Attendance in school

Arizona Climate Chart



Totals and averages

Annual average high temperature	84.5 °F
Annual average low temperature	61.1 °F
Average temperature	72.8 °F
Average annual precipitation	8.3 in.
Days per year with precipitation	36 d.
Average annual hours of sunshine	3832 h.