Developing a guidebook for an outdoor classroom

David D. Martell

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California State University
San Bernardino
DEVELOPING
A GUIDEBOOK FOR AN OUTDOOR CLASSROOM

A Project Submitted to
The Faculty of the School of Education
In Partial Fulfillment of the Requirements of the
Degree of

Master of Arts
in
Education: Environmental Education Option

By

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San Bernardino, California
1992
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DEVELOPING
A GUIDEBOOK FOR AN OUTDOOR CLASSROOM

David D. Martell
California State University San Bernardino, 1992

Abstract

The attention given to environmental education in recent times has prompted the need to provide teachers with outdoor materials which they can use to educate students in the out-of-doors. The development of an outdoor-classroom field guide for teachers of all grades to enable them to develop and provide a field-type experience for their students in a local outdoor classroom.

The selected hands-on activities in the guide were chosen for their content relevancy to the outdoor classroom and the Science Framework for California Schools, 1990.

The guide was field-tested by local teachers.
DEDICATION

I would like to take the opportunity to sincerely thank all of the following organizations, businesses and individuals for their support of the Pinon Mesa Environmental Study Area. Without their assistance the study area would have never become a reality for our students, staff and community to share.

Crystal Island
Leoco Fence Co.
Lions Club
Desert Windscape Nursery
Marinelli Realty
Mega Electric
Phelan Nursery
San Gabriel Mt. Interpretive Society
United States Forest Service, Mendocino National Forest, Chico Tree Improvement Center, Chico, CA.
Wrightwood Womens Club
All of the students and staff who helped make the area what it is today.

A very special thanks to Dr. Darleen Stoner and Dr. Britt Leatham for their help with this project as part of my master's degree program.
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INTRODUCTION

Nearly all of the students in the desert areas of Southern California live within a designated Desert Conservation Area. As this designation implies, the desert is a fragile ecosystem, and conservation of this system is important. Individuals living within such an ecosystem bear some responsibility for its maintenance and protection.

This project was based on the belief that the educator of today has the challenge to provide exposure to environmental awareness and concepts as a part of the total curriculum to which students are exposed.

It is imperative that many of our young people become more aware of the fragility of the Mojave Desert and the importance of protecting the desert and its flora and fauna. Studies have indicated that it takes anywhere from 10 to 50 years for a plant species to return to an area devastated by human activity, if it is to return at all (Bureau of Land Management, 1990).

I developed a field and tour guidebook to the Pinon Mesa Desert Environmental Research Tract. This five acre parcel in the Mojave Desert was established by staff and students in order to study environmental
concepts within the high desert ecosystem.

As students progress through environmental activities in the outdoor classroom setting, they will probably realize that their generation will be the future guardians of our vast natural heritage. It is hoped that this environmental sensitivity will be carried with them as they become adults and move to a variety of different locations.

The various aspects of this project allow students to experience a "natural" desert environment. By visiting this site, students will become sensitive to the effects of ongoing abuse of this fragile environment. The teacher of today is responsible to structure and provide a learning situation that will encourage students to become responsible citizens of the world, integrating skills and information needed for the conservation of natural resources.

Science curriculum in the past at Pinon Mesa Middle School has been taught through lecture, and textbook, with little exposure to the outdoors. However, the availability of an outdoor classroom, a hands-on and active-learning approach toward environmental education can be utilized that will motivate students through activities in a novel setting: the outdoors.
LITERATURE REVIEW

Four major questions determined the need for the project. The first of these questions concerns the project content: Is there a need for outdoor education? The second question concerns student learning and environment: Would a novel-setting such as an outdoor classroom aid or hinder the educational process? The third question concerns integration of curriculum and its affect on student learning: Can the student understand concepts better in cross-curricular situations? The fourth question concerns teacher attitude: How does teacher attitude affect the student attitude?

Outdoor Education, Is It Really Needed?

Current outdoor education programs need to develop a vast view of the realities of living on a planet with very limited natural resources, animal life and plants inclusive. Our planet is characterized by dwindling and limited natural resources. Ross (1979) instituted a futures study of environmental awareness by the year 2000. He concluded that preservation of our environment, depends on an active environmental education program through all areas of the curriculum.

An investigation of fifty-three students indicated a significant improvement in their attitudes toward the
environment after periods of instruction in the out-of-doors (Jauss, 1982). He suggests that a positive attitude towards the environment is realized by exposure of students to outdoor educational programs.

Stoner, Clymire and Helgeson (1989) state that students are more cognizant to the environment after exposure to outdoor education programs. Students report increased understanding of environmental concepts after exposure to outdoor education, which improves their critical-thinking and problem-solving skills.

Education is also needed to change people's action and attitude toward wildlife. Kellert (1983) in a study conducted in association with the U. S. Fish and Wildlife Service, examined students' knowledge, behaviors and attitudes toward animal life. The research indicates that, contrary to many popular beliefs, students in early grades exhibit exploitive, cruel and unfeeling attitudes toward wild animals (Kellert, 1983).

Kellert's study also indicates that students between the second and fifth grade are fond of "huggable" types of wildlife. This would seem indicate that these students would be good targets for developing relationships between students and animals. In middle grades, students
have a marked interest in and knowledge of animals which suggests that this is the time to teach the "factoids" and concepts about animals, as well as to develop cognitive processes in environmental education.

The outdoor classroom should improve the student's attitudes toward the environment.

The Teacher and The Novel Setting

A novel-setting may pose problems for the teacher and the student. Preparation and care must be taken into account if students complete tasks in novel settings such as an outdoor classroom. Falk, Martin and Balling (1978) state that novel-settings will interfere with student-learning, indicating a need for specific preparation of students prior to participating in a specific task in a novel-setting.

In preparing the student for an outdoor lesson, the use of David Ausubel's concept of the "advance organizers" (cited in Joyce and Weil, 1972) can be utilized to prepare preliminary hands-on classroom activities thus improving concept attainment of the student in the outdoor classroom.

Integration of the Curriculum

Another problem has been integration of subject
matter. This is also considered a novel-setting for student and teacher. Environmental education activity is most often integrated into math and science. Teaching an integrated and active, discovery program produces positive results for student understanding (McBride and Silverman, 1991).

Kar (1981) placed an emphasis on active learning and the integration of the total curriculum for the prevention of and solving environmental problems.

In another study, emphasis on the integration of curriculum suggests increased critical thinking skills in students (Shymansky, 1979).

**Teacher Attitude and Training**

Teacher attitude and knowledge appear to be related to the resultant attitude of their students. In a study conducted in 1974, Shrigley concluded teacher's attitude can affect students' attitudes. In this study of teacher attitudes and knowledge about ecology, teachers' attitude towards and knowledge of ecology was very low, which correlates with student attitude.

Teacher training has direct impact on the instructional quality. Hooper (1981) concludes that if teachers are given specific training in environmental education, they will teach environmental concepts more effectively.
Hooper (1981) found less than fifty per cent of teachers teach environmental education, but most desire additional training.
PROJECT GOAL

The goal of this project was to provide teachers with an appropriate field guidebook for use with students in an outdoor classroom in the Mojave Desert ecosystem.
Project Design

A needs assessment was conducted during fall 1991 at five schools: three elementary, one middle school and at one high school. All of the schools were within the Snowline Joint Unified School District and are located close enough that the teachers and students have the potential to utilize the outdoor site. This assessment (see Appendix) was directed at teachers of varying experience and background.

Fifty-two teachers responded out of sixty surveyed.

Table 1: Survey Response of Teachers

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<th>Question</th>
<th>Per Cent Respondents</th>
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<td>Felt uncomfortable about using the desert resource?</td>
<td>Ninety per cent</td>
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<tr>
<td>Lack general knowledge about the desert?</td>
<td>Sixty Percent</td>
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Forty-six teachers (ninety per cent) responded that they felt very uncomfortable about using the desert classroom their students. Thirty-one (sixty per cent) of the teachers who responded had materials for hands-on activities but lacked the general background knowledge of the desert ecosystem.

The assessment revealed that a general guidebook or
trail guide to the outdoor classroom would be of great benefit to teachers.

The guide was developed after the outdoor classroom was constructed in November 1991. The classroom was developed in sections representing ecosystems within the Mojave Desert. It was felt that the guide should be developed in a manner to take the teacher around the outdoor classroom by trail winding through the varied ecosystems of the high desert.

The activities were selected for their ease of adaptation to the desert ecosystem and to provide a variety of activities.

Field testing began on January 10, 1991 at an afterschool inservice for teachers kindergarten-grade ten at Pinon Mesa Middle School. During the next week, six teachers reviewed the guide, walked through the outdoor classroom, and conducted some of the many correlated activities with their classes. Feedback from teachers attending an inservice indicated that all initially felt very comfortable using the outdoor classroom for environmental studies.
An Outdoor Classroom Guidebook For Teachers

Prepared by: Dave Martell
Pinon Mesa Middle School
First Things First

This guide to the Pinon Mesa Desert Environmental Research Tract, DERT, is the culmination of a year's field work and master's project at California State University San Bernardino. You, the teachers in the desert, asked for this guidebook.

Many hours were spent in the field in order to prepare this guide. Other teachers and students spent many more hours assisting me in the construction of this environmental education area. Local clubs and organizations provided financial support, materials, and labor.

I recommend that you visit the area prior to a field trip. In this way you will be able to adequately orient yourself. Even if your speciality is not ecology, this guide should give you enough information to use specific activities in the environmental guides Project WILD, Project WILD Aquatic, Project Learning Tree, The California State Environmental Education Guide, Project AIMS and others.

Some materials in the guide such as the plant and cloud identification keys can be adapted or copied for your use with students.
For a class trip, call the Pinon Mesa office (868-3126) at least two weeks in advance to arrange a date. If time permits, a Forestry Club member or Student Mentor may be available to assist your class. These students have expressed a desire to work in the outdoor classroom and have assisted the science department in construction and maintenance of the area.

April through June is the best time for plant activities. September through November and March and June are best for animal, weather and pond studies.

Our rules are simple in order to protect the area:

1. Stay on the trails
2. Flowers and leaves belong on plants within the fenced area.
3. Reptiles and other wildlife belong on the sand, not in the hand.
4. Trash stays in the hand.

ENJOY YOURSELF!
WELCOME

Welcome to the Pinon Mesa Desert Environmental Research Tract.

You are invited to take a leisurely stroll and relax to enjoy the desert. The trail will lead you over desert terrain that has existed for eons of time. Explore this small portion of the Mojave Desert. Here you may find answers to questions you have about desert ecology, local plants, soils, and animals of the area. It is hoped that you will develop an appreciation of the flora and fauna that exist in the wild and will become aware of the damages done to the natural desert environment by human action.

DESERT ECOLOGY

Deserts of the southwest share common features: meager rainfall (usually less than ten inches per year), generally hot with long intervals of drought, and low humidity.

The Mojave Desert in some ways is distinctly different from its neighboring deserts: the Great Basin Desert, the Colorado Desert, and the Sonoran Desert. Local temperatures can get as high as 105 degrees Fahrenheit; the humidity in the teens and about nine inches of rain fall annually.
These climatic variables of the Mojave are moderated by its higher elevation as compared to bordering deserts. Many of the plants and animals you encounter along the Pinon Mesa trail are not found in any other desert region of our world. Cactus is limited to the western hemisphere, for instance.

From a distance, a desert can look as lifeless as the moon, but in reality it teems with hundreds of varieties of plant, flora and animal life, fauna.

Ecology is the relationship between living organisms and their environment. Everything that lives in the desert has developed special ways to survive in this harsh environment and this is what makes them so unique and special.

Plants have been naturally selected for adaptations to this harsh environment.

Wind is a common in the desert. Consequently, many desert plants often grow in low clumps for support and protection. Some of these plants even trap blowing sand to start dunes or to keep soils from degrading.

Other species of plants secrete poisons through their root systems to keep other plants from growing near them. This keeps water competition at a minimum.
Animals have mobility and can escape the temperatures and predators. Many animals dig burrows or have colors that match the soil. In this way they stay cool and moisture is conserved. Mammals tend to be active at night, evading the hot day temperatures. The reptiles are active during the early and late parts of the day. During the heat of the day almost all animals are under the protection of shade.
A COMMUNITY
A COMMUNITY

At times the Mojave Desert can seem harsh and unforgiving. The extreme summer temperatures can take their toll on both wildlife and plants. Every living thing in the desert has three basic problems to solve in order to survive: scarcity of precious water, high temperatures, and availability of food. Adaptation of many species to extreme variables is the key to survival in this environment. A balanced relationship between living things and their environment is essential for the ecological well being of our beautiful desert ecosystems. This balance is called a community.

Humans are now major part of the equation. Their action toward the ecosystem have increased the number of at-risk species, such as the Desert Tortoise and Fringe-Toed Lizard. Population growth has taxed the water supplies as well as damaged the fragile soils of the desert.

PLANT COMMUNITIES

As you walk along the trails, take time to observe the plants as a whole community and not just individual plants. Plants, like people, have definite preferences as to where they live. We call these areas "plant communities." The plant community along the trail is
the Joshua Tree Community, found from 3,500 feet to 5,000 feet. At this elevation the rainfall is more plentiful than lower deserts and summer temperatures are not as extreme. Near the end of the nature trail, the desert's aquatic Spring Community is represented by the pond area which includes rushes, Arrow Weed, Willows and other riparian vegetation.

Across from the entrance, the Mojave Desert Wash Community is represented. Washes are subject to extreme flash floods and are preferred by most of the colorful flowering annuals. Here you will find the seasonally blooming Butter Cups, Storksbill, Rattlesnake Weed and California Poppy.

Not included in our area is the Cliff Community which the solitary Fir and Barrel Cactus exist.

Stops in this guide are keyed to numbered markers along the trail. These markers identify selected plants.

Enjoy the trail—go very slowly—be watchful, look, smell and listen. You will be treated to a few minutes in a rapidly vanishing ecosystem.
Figure 1
Trail Map

Animal Track Area

Tortoise Station

Gate

Weather

Aviary

Pond

SCALE:
100 Feet
NATURE TRAIL

PLANT SPECIES
NATURE TRAIL PLANT SPECIES

The nature trail was designed for the classification of perennial desert plants. Perennials are plants that are present at all seasons of the year.

Use of the plant identification key will allow students to use classification skills and to name the most common plants of the desert environment, as well as to observe plant growth habits.

The common name is given first, followed by the scientific name, brief description, economic uses (if any), and habitat.

1. Mormon Tea, Ephedra spp. Green shrub with jointed twigs, looks leafless. Mormons and Indians used it as a tea.
   Habitat: Mesas, plains, flats up to 6,000'.

2. Desert Buckwheat, Eriogonum fasciculatum. Shrub, low growth, small green leaves, stems red brown, in spring white to pink flowers bloom, brown in other seasons. Used as a food by the Indians.
   Habitat: Fine soil areas up to 4,000'.

3. Yucca, Yucca whipplei. Low or clumped mass of blue green spikes, sharply pointed, smooth edges. Used in shampoos.
Habitat: Any area with fine soils.

4. **Bladder Sage, *Salazaria mexicana***. Small green shrub, stick-like, similar to Mormon Tea but has very minute leaves. In the spring, flowers shaped like goblets or bladders appear; color is a deep purple.
Habitat: Sandy washes.

5. **Juniper, *Juniperus californica***. Low to large growing shrub, deep green color; light green berries contain seeds through summer.
Habitat: Rocky areas, dry, well drained soils.

6. **Little Leaf Horsebrush, *Tetradymia glabrata***. Small medium sized plant, gray to silver bark, light green leaves, many long spines mixed with yellow flowers. Toxic to sheep.
Habitat: Salt flats to rocky slopes.

7. **Bluebunch Wheatgrass, *Agropyron spicatum***. Bunched up patches of brown to tan clumps of wheat looking grasses. Spring growth is blue-green in color. Prized food for buffalo and elk in the Great Basin. Also used by Indians as a food.
Habitat: Open spaces in well drained soils.
8. Cholla, *Opuntia bigelovii*. Small branched tree-looking cactus; green branches covered with many sharp golden colored spines. Flowers green to purple in May. Often called Teddy Bear or Jumping Cholla, it will not jump and is not cuddly.

Habitat: Fine or rocky soil areas to 5,000 feet.

9. Joshua Tree, *Yucca brevifolia*. A lilly, this small to large arthritic looking tree grows everywhere in the high desert and in Israel. Development is reducing the species as people clear lots for housing.

Habitat: Any soils near the 4,000 foot level.

10. Big Sagebrush, *Artemisia tridentata*. A many branched shrub with a trunk. Strong bark with grey-green leaves, aromatic when crushed. Flowers yellow to green in May. Leaves have blunt teeth at the tips.

Habitat: Great Basin to Mojave Desert to 10,000'.

11. Flannel Bush, *California fremontia*. A large dark green bush, up to 20' high. Leaves green on top grey on bottom.

Habitat: In washes on loamy soils.
HOW CAN THE PLANTS TAKE IT?

How do desert plants survive the harsh environment?

Our desert plants use specific biologic adaptations in order to survive wind, lack of precipitation, reduced nutrients, and increased salts and alkalis of the California desert soils.

Wind causes certain species of plants to grow close together for protection and support.

The lack of abundant water forces other plants to secrete poisons to keep other vegetation from growing near them and competing for the meager available water.

ANNUALS "Drought Escapers"

Annuals, which add so much color to the spring desert, germinate, grow, mature, flower rapidly and produce seed during the few weeks when moisture from the late winter and early spring rain is relatively abundant. Their seeds lie dormant on and below the soil until enough water washes the resin or waxy substance from the seeds or sand abrades the seed coat enough for water to stimulate the seeds germination.

Since annuals are so short-lived and do not have a drastic effect on the soil moisture, they grow close together. During the spring many areas of the
desert are carpeted by annuals.

**PERENNIALS "Drought Evaders"**

Perennials keep their leaves or green stem year round. These plants flower in the spring along with the annuals. When the hot summer temperatures arrive, perennials may shed their leaves and enter a state of dormancy until suitable growing conditions are once more prevalent. Some perennials have extremely small leaves to reduce the amount of water they may loose to transpiration and evaporation.

**CACTI "Drought Resisters"**

**Western Hemisphere**

Cacti are succulent plants that have lost their leaves: green waxy pods, paddles, and stems perform the necessary functions of photosynthesis that in other plants are carried on by the leaves. The waxy coating assists in conserving water in built-in water storage areas (cell reservoirs). Some species of cacti have been known to survive without water for 20 years.
PINON MESA PLANT
IDENTIFICATION KEY
PINON MESA PLANT IDENTIFICATION KEY

Read each question to your class. Discuss the outcomes and decide on an appropriate answer. Follow the directions after each answer. When you cannot go any further you have identified the plant.

#1. A. Does the plant have leaves? YES, Go to #3
B. Does the plant lack leaves? YES, Go to #2

#2. A. Does the plant have short spines? YES, Cholla
B. Is the plant stick-like? YES, Mormon Tea

#3. A. Are the leaves flat? YES, Go to #6
B. If not flat.

#4. A. Are leaves scale-like? YES, Juniper
B. They are not scale-like?
C. Are the leaves spear-like?

#5. A. Is the plant low and grey-green? YES, Yucca
B. Is the plant tree-like? YES, Joshua

#6. A. Do the leaves have smooth edges? YES, Go to #8
B. Are the leaves lobed with veins? YES, Go to #7
#7. A. Are the leaves small, white-green and is the plant a shrub?  
B. Are the leaves dark green on top, yellowish and hairy underneath?  

YES, Big Sagebrush

#8. A. Do the leaves have smooth edges?  
B. Do leaf edges look like a saw?  

YES, Go to #9

YES, Yerba Santa

#9. A. Are the leaves oval in shape?  
B. Do the leaves smell badly?  

YES, go to # 10

YES, Rabbit Brush

#10. A. Are the leaves small and the plant is 2 feet tall with white flowers?  
B. Are the leaves large, waxy and smooth and have red bark?  

YES, Buckwheat

YES, Manzanita
SPECIES TEST PLOT
SPECIES DESCRIPTIONS, SPECIES TEST PLOT

The following is a general description of the trees currently being studied in the species test plot. This area is used for measuring and studying the adaptability and growth rates of different trees introduced to the desert landscape in recent years.

1. Afganistan Pine, Pinus eldarica.
   Native to southern Russia, Afganistan and Pakistan. One of the best desert pines.
   Grows fast and needs little water.
   Needles in pairs, 10-13 cm long, dark green
   Donated by: U.S. Forest Service

2. Calabrian Pine, Pinus halepensis brutia.
   Native to the eastern Mediterranean, southern Russia and Italy. Rapid grower in heat, the tree can withstand long periods of drought once established. Needles are in pairs 10-13 cm long, lt. green, silvery bark.
   Donated by: Phelan Nursery

3. Incense Cedar, Calocedrus decurrens. A native of the San Bernadino Mountains, western Nevada and Oregon. A very adaptable tree, slow growth, red bark,
leaves flat fan shaped, small duckbill-shaped cones.

Donated by: Phelan Nursery


Donated by: Desert Windscape Nursery
CLIMATE

Why is this region of California so dry and hot? Understanding how the Mojave Desert formed will provide the answer.

Deserts have three main processes that determine their development, which are listed below.

RAIN SHADOW

Mountains located near areas of deserts cause the air to rise. As the air rises it loses its moisture on the far side. Then, as the air moves over the mountains and down the slopes, it warms and robs the land of moisture, actually "sucking" the available water from the surface. Mountains south of the Mojave Desert, the San Gabriels and San Bernardinios, act as barriers to moisture, thus creating a rain shadow which has evolved over the years.

HIGH PRESSURE

As high pressure builds in the atmosphere, air is warmed and the air absorbs much of the available moisture in the form of water vapor. If an area experiences consistent high pressure, deserts can
develop. The central and eastern Mojave as well as the Sahara and the Sonoran deserts are partially caused by constant high air pressure.

**INLAND**

Inland deserts are formed because they are far from any moisture source such as an ocean. The Australian, Gobi and Turkestan deserts are examples of these types of deserts.

**CLOUDS IN THE DESERT**

Storms move very fast across desert regions. Over the high desert, with its close proximity to the mountains, many cloud formations develop on a daily basis. Clouds are indicative of approaching weather systems or the degree of instability of the present air mass.

Clouds are a very interesting subject to use in a classification project for a class as well as in developing an appreciation of the outdoors. In the following section is a cloud key to assist students in classifying cloud types. This will help them develop observation skills and an appreciation for learning in the outdoor setting. Read questions to the students and brainstorm an answer. Have fun!
CLOUD

IDENTIFICATION KEY
Mr. Martell's Cloud Identification Key

1. Do the clouds look like white cotton puffs?
   YES, go to #4
   NO, go to #2

2. Do the clouds look like layers of cake?
   YES, go to #8
   NO, go to #3

3. Do the clouds look like high thin feathers?
   YES, go to #10
   NO, go to #5

4. Are the clouds on the ground in patches?
   YES, FOG
   NO, go to #5

5. Are the clouds small cotton like puffs low to the ground?
   YES, FAIR WEATHER CUMULUS
   NO, go to #6

6. Are the clouds cauliflower like, dark bottoms?
   YES, CUMULUS CONGESTUS
   NO, go to #7

7. Are the clouds anvil topped, huge, dark bottom?
   YES, CUMULONIMBUS
   NO, go to #9

8. Are the clouds layered thinly?
   YES, STRATUS
   NO, go to #9

9. Do the clouds look like a flying saucer?
   YES, LENTICULARIS
   NO, go to #10
10. Do they look like blurry streaks up high?
   YES, CIRRUS
   NO, go to #11

11. Do they look like fish scales or small dots?
   YES, CIRROCUMULUS,
   NO, to #8
DESERT SOILS
DEsert SOILs

The nature of the desert soils have a direct role in the ecology of the desert. Soil composition determines how much of the rainfall is available to plants. Soil that is composed of very fine particles such as clay does not allow much water to penetrate into the rootzone; thus runoff is increased. Soils that are coarse in nature, such as sand, pebbles and rocks, allow water to flow rapidly downward. An ideal desert soil is a mix of particle sizes to allow for the water to infiltrate into the soil and to absorb it. A very delicate balance of the soils is necessary for plant development, water table recharging and preventing severe runoff.

Erosion in the desert region is called geologic erosion. This type of erosion is a combination of the forces of water and wind on soils and can be seen as you enter the site.

Erosion by Wind

Erosion by the wind can occur in three ways. Suspension is the process in which very small soil particles are lifted from the surface, carried high in the air and travel long distances. Major dust
storms are evidence of this type of wind erosion.

A second type of wind erosion is saltation. Saltation is a process by which sand sized particles move in a wave or bounding motion.

Surface creep is the third type of wind erosion. In surface creep the soil moves like a ripple across the surface of the ground.

Erosion by Water

There are four types of water erosion that affect the soils of the desert. Sheet erosion is caused by rain falling faster than the soils can absorb them and water travels over the soil in sheets. The area east of the gate, across the gully shows the effects of sheet erosion.

Rill erosion occurs in paths after sheet erosion is concentrated in low spots. This erosion can be seen just below the rill area. Look for the small dry cuts in the soil.

Gully erosion is rill erosion taken to the fullest. This happens where water has followed rills over the years and excavated deep gullies. Notice the steep sided gulley to the east of the gate. This gully is twenty feet wide and ten feet deep.

Slumping, which can be seen in the upper reaches of the gully, is a result of saturation of the slopes of a
gully. In this case the soil absorbs so much water, it becomes almost liquid and gravity causes it to move down into the gully.

As you walk through the soils' area, be sure to compare the area with vegetation removed and the area with natural vegetation north of the gate. Removal of vegetation in any environment can cause serious conservation problems.
TORTOISE

EXHIBITION STATION
TORTOISE EXHIBITION STATION

A living fossil, the desert tortoise (Gopherus agassizii) is the official reptile of California, yet it is currently under siege. They are the oldest type of living reptile, evolving about 200 million years ago (Forgy, 1986). Around the Americas the term tortoise is restricted to the family of land tortoises, Testudinidae.

A tortoise is a land turtle with a high domed shell or carapace and thick columnar, elephantine hind legs.

Tortoises eat shrubs common to this study area. They drink water and soak as water is available. Most of their water is obtained from the vegetation on which they dine.

Tortoises spend much of their time in underground burrows or dens. These burrows provide protection from predators, extremes in temperatures and lack of moisture in the air. They also use the burrows for winter hibernation. Due to their digging habit the tortoise has been able to survive for many years allowing them to reach a maximum size of around 16 inches long and weight of 33 pounds (Berry, 1984).
The current populations of desert tortoise are under extreme impacts from human presence. In a recent study conducted in the Mojave Desert by the Bureau of Land Management, 20 per cent of the tortoises were shot (Berry, 1984). In contrast, the eastern Mojave desert, only one to five per cent showed evidence of being shot. Habitat destruction, disease and attacks by ravens are the main causes of the reduction of the species.

The desert tortoise you see here is a male, 8 inches long. The sticker on the tortoise is a permit from the state allowing the school to have it. Be sure to watch his movements if he is out.
ANIMAL TRACK
AREA AND POND
ANIMAL TRACK AREA

The animal track identification area is located between trail sign post number 8 and the erosion study area. The site can be used during all months, except January due to snow.

Steps for using the area are very simple. Excellent results are possible. Follow the outline below for excellent tracks:

1. Rake the plot with the special tool until the sand is very smooth.
2. Place a little feed, seeds or raw meat in the middle of the plot and return the next day.

To identify tracks, use A Field Guide to Animal Tracks by Olaus J. Murie, in our library.

POND ENVIRONMENT

The Desert Spring Community is represented at the pond area. Natural springs and ponds are located where ground water is near the surface of the ground or where faulting has developed a way for the water to reach the surface. Since standing water is rare in the desert, a very special community develops near them. Usually, the temperature is lower near a community such as this, and vegetation such as Arrow
Weed, rushes and the Desert Willow abound. Animals are also more abundant here due to the water and the protection provided by the vegetation. Activities for studying this area can be found in the following section.
CORRELATION OF
PUBLISHED
ENVIRONMENTAL
ACTIVITIES TO THIS
SITE
CORRELATION OF PUBLISHED ENVIRONMENTAL EDUCATION ACTIVITIES TO THIS SITE

The following references of related activities are for you, the teacher, to utilize at the Desert Environmental Research Tract. Of the resources, Project WILD, Project WILD Aquatic, and Project Learning Tree have an inservice requirement. These are given in the spring through the Snowline Unified School District Mentor Program and through the Environmental Education Resource Center at California State University, San Bernardino.

Some of the activities may need to be adapted to the high desert ecosystem. Activities are listed by source, grade level, then environmental concept. These environmental education materials present an extensive selection of activities for use in areas of the outdoor classroom.

These activities are correlated to the areas of the Desert Environmental Research Tract. The following key indicates the areas of the site where these activities can be used:

A- Aviary
AT- Animal Track Area
E- Erosion Area, Geology
N- Nature Trail

G- Garden Area
P- Pond Area
S- Species Test Area
W- Weather Area
### Project WILD - Elementary Guide

**Grade Level:** Elementary

**Environmental Skill:** Awareness

<table>
<thead>
<tr>
<th>Activity Title</th>
<th>Area</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ants On A Twig</td>
<td>N</td>
<td>9</td>
</tr>
<tr>
<td>Interview A Spider</td>
<td>N</td>
<td>9</td>
</tr>
<tr>
<td>Grasshopper Gravity</td>
<td>N</td>
<td>15</td>
</tr>
<tr>
<td>Wildlife Is Everywhere</td>
<td>N, S, T</td>
<td>19</td>
</tr>
<tr>
<td>Microtrek Scavenger Hunt</td>
<td>N, S, P</td>
<td>21</td>
</tr>
<tr>
<td>Everybody Needs A Home</td>
<td>P, A, S, N</td>
<td>31</td>
</tr>
<tr>
<td>Habittracks</td>
<td>N, A, T</td>
<td>35</td>
</tr>
<tr>
<td>Litter We Know</td>
<td>N</td>
<td>51</td>
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<tr>
<td>Tracks</td>
<td>N, A</td>
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**Environmental Skill:** Values

<table>
<thead>
<tr>
<th>Activity Title</th>
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<tbody>
<tr>
<td>Environmental Barometer</td>
<td>N</td>
<td>73</td>
</tr>
<tr>
<td>Urban Nature Search</td>
<td>N, P</td>
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</table>

**Environmental Skill:** Issues

<table>
<thead>
<tr>
<th>Activity Title</th>
<th>Area</th>
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<tbody>
<tr>
<td>Learning To Look, Looking</td>
<td>N</td>
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</table>

### Project WILD - Secondary Guide

**Environmental Skill:** Awareness, Knowledge

<table>
<thead>
<tr>
<th>Activity Title</th>
<th>Area</th>
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<tbody>
<tr>
<td>Interview A Spider</td>
<td>N, S</td>
<td>7</td>
</tr>
<tr>
<td>Ants On A Twig</td>
<td>N</td>
<td>49</td>
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</tbody>
</table>
Environmental Skill: Values

Activity Title: Urban Nature Search
Area: N
Page: 79

Environmental Skill: Issues

Activity Title: Learning To Look,
Looking To See
Area: N, P, A
Page: 31

Project WILD Aquatic

Grade Level: Elementary

Environmental Skill: Awareness

Activity Title: Water Plant Art
Area: p
Page: 11
Activity Title: Puddle Wonders
Area: p
Page: 21

Environmental Skill: Values, Knowledge

Activity Title: Water Canaries
Area: P
Page: 35
Activity Title: Micro Odyssey
Area: P
Page: 57

Grade Level: Secondary

Environmental Skill: Awareness, Issues

Activity Title: Deadly Skies
Area: W
Page: 133

Project Learning Tree

Grade Level: Elementary
<table>
<thead>
<tr>
<th>Activity Title</th>
<th>Area</th>
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<tbody>
<tr>
<td>Adopt A Tree</td>
<td>N, S</td>
<td>4</td>
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<tr>
<td>The Closer You Look</td>
<td>N, P</td>
<td>5</td>
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<td>Expanding Sensory Perception</td>
<td>N, S, P</td>
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<td>Patterns In Nature</td>
<td>ALL</td>
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<td><strong>Environmental Skill:</strong> Knowledge</td>
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<td></td>
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<tr>
<td>Growth Graph</td>
<td>S, A</td>
<td>84</td>
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<tr>
<td>Schoolyard Safari</td>
<td>N, S</td>
<td>85</td>
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<td>Seed Dispersal</td>
<td>N, S</td>
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<td><strong>Environmental Skill:</strong> Awareness</td>
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<td></td>
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<tr>
<td>Tree Verse</td>
<td>S, N</td>
<td>6</td>
</tr>
<tr>
<td>Natural Materials Art</td>
<td>S, N</td>
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</table>

The California State Environmental Education Guide

<table>
<thead>
<tr>
<th>Activity Title</th>
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</thead>
<tbody>
<tr>
<td>Water On the Move</td>
<td>E</td>
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</tr>
<tr>
<td>Bird Bills</td>
<td>A, N</td>
<td>201</td>
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<tr>
<td>Camouflage Hunt</td>
<td>N</td>
<td>197</td>
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</tbody>
</table>

**Grade Level:** Elementary

**Environmental Skill:** Awareness
### Observing Microhabitats

<table>
<thead>
<tr>
<th>Activity Title</th>
<th>Area</th>
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</thead>
<tbody>
<tr>
<td>White Rain</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>Water Still on The Hill</td>
<td>N</td>
<td>2</td>
</tr>
<tr>
<td>On Living Pond</td>
<td>P</td>
<td>8</td>
</tr>
<tr>
<td>Lawn Jumpers</td>
<td>N</td>
<td>32</td>
</tr>
</tbody>
</table>

**Project Aims - Our Wonderful World, Book Seven**

**Grade Level:** Elementary

**Environmental Skill:** Awareness

**Activity Title** | **Area** | **Page**
---|---|---
White Rain | W | 5
Water Still on The Hill | N | 2
On Living Pond | P | 8
Lawn Jumpers | N | 32

**Grade Level:** Secondary

**Environmental Skill:** Awareness

**Activity Title** | **Area** | **Page**
---|---|---
Bottled Pollution | W | 3
Go With The Flow | N | 10
Habitat Comparisons | N | 18
Trees As A Crop | N | 23

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**TEACHING SOIL AND WATER CONSERVATION**

**Source:** United States Department of Agriculture, Soil Conservation Service.
<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>How Fast Do Soils Take In Water</td>
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<tr>
<td>How Does Organic Matter Help Soils?</td>
<td>7</td>
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<tr>
<td>How Much Sediment Does a Stream Carry</td>
<td>8</td>
</tr>
<tr>
<td>Splash Erosion</td>
<td>16</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY
Bibliography


Project AIMS. Book Seven.


Western Regional Environmental Education Council. (1983). *Project WILD.*

APPENDIX
THE DESERT ECOSYSTEM NEEDS ASSESSMENT

My name is Dave Martell and I am in the process of developing a field guide as part of my Master of Arts project at California State University at San Bernardino. I believe that the project will consist of much background information and a few activities to assist the teacher in feeling comfortable with teaching environmental science, specifically the desert ecosystem.

Please take a few minutes to answer the questions and return the form to Pinon Mesa by district mail.

FOR EACH QUESTION PLEASE CIRCLE THE APPROPRIATE SCORE
1 = OUTSTANDING  2 = GOOD   3 = FAIR   4 = POOR

1. How do you feel about teaching science at your site?
   1  2  3  4

2. Are you activity oriented?
   1  2  3  4

3. Rate your capacity to teach environmental concepts?
   1  2  3  4

4. Rate your ability to present desert environmental concerns to your students?
   1  2  3  4

5. Rate your knowledge of the desert ecosystem?
   1  2  3  4

6. If given the opportunity, would you feel a desert guide for the Pinon Mesa Area would be of benefit to you and your students?
   1  2  3  4

7. Would you be willing to field test a rough draft of the guidebook?
   YES   NO   NAME:

   Use the space below to make any additional comments.