An environmental education field guide for Mystic Lake wetland habitats

Linda Jean Ellingston
AN ENVIRONMENTAL EDUCATION FIELD GUIDE FOR

MYSTIC LAKE WETLAND HABITATS

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Environmental Education

by
Linda Jean Ellingston
June 2001
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ABSTRACT

This curriculum guide, An Environmental Education Field Guide for Mystic Lake Wetland Habitats, is for grades four through six. It examines how wetlands, wildlife, and people interact and depend upon each other. The San Jacinto Valley wetland area is used as an example of wetland habitat destruction from population pressures that have changed the natural landscape. It is also used as an example of what habitat reconstruction can do to restore vital habitats. Through student contact with the wetlands increased awareness of the fragile interrelationships between the physical and biological components of a wetland habitat is gained. Students can use ecological themes to help them assimilate collected and given data into logical cohesive ideas, laying the ground work for developing an environmental action project.
ACKNOWLEDGMENTS

I would like to acknowledge Dr. Darleen Stoner, Environmental Educator at California State University, San Bernardino, for her help, contributions, and guidance toward the completion of this project. Special thanks goes to my daughter, Laurel Meskimen, for graciously taking time to edit this project. I would also like to extend my appreciation to my daughter, Jeanelle Meskimen, and to my dear friend, Kris Miller, for their emotional and financial support. And finally, I wish to acknowledge my dear grandchildren, Mackenzie, Bela, and Ayla, without whom I would have not had the heartfelt motivation to complete this project.
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CHAPTER ONE
INTRODUCTION

This curriculum guide was developed to support an environmental education field trip, for fourth through sixth grade students, to the San Jacinto Wildlife Area and Mystic Lake wetlands in the San Jacinto Valley of southern California. The purpose of this curriculum guide is to stimulate student interest in the continued preservation and expansion of the San Jacinto Wildlife Area and Mystic Lake wetlands habitats.

The focus of the curriculum guide is on wetland habitat survival requirements related to water, food, shelter, and space to live and reproduce. Students will identify the components of habitats, recognize how humans and other animals depend upon habitats, and interpret the significance of loss or change in habitats with regard to wildlife and people.

Students will compare and contrast various wetland habitats, both at school and on the field trip. As they visit the Mystic Lake wetland area they will discover that wetlands are more than just one habitat and more than just
habitats for animals. They will see first-hand what habitats have common: they provide water, food, shelter, and space to live and breed; they are interconnected with each other and the whole environment; and removal of even one component of a habitat will have an impact on the ecological balance of the whole ecosystem. Students will generalize that habitat components are survival requirements for all animals, including people. This learning is supported by the California Department of Education, "Classrooms must emphasize basic principles that govern the planet's resources for no species can exceed the limits of life-support systems that sustain it" (1997, p. 1).

This environmental education curriculum guide is designed for a field trip to the San Jacinto Wildlife Area and Mystic Lake wetlands. It includes a supporting literature review; the natural and human history of the San Jacinto Valley; and pre-site, on-site, and post-site lessons. It is designed to guide students through environmental awareness, problem-solving processes, and hands-on activities.
CHAPTER TWO

LITERATURE REVIEW

"The core goal of environmental education is to foster in students a sense of accountability toward themselves, others, and their environment as a whole" (Disinger, 1997, p. 24). Environmental Education helps students become aware of their actions, environmentally and socially, and assists in the development of environmentally responsible citizenship behavior skills. The following literature review is provided as a foundation upon which a bridge may be built between students' interpretation of wildlife survival needs and survival requirements for all life, including human.

A Brief History of Environmental Education

"Learning about the environment has, in one form or another, had a place in schools since there have been schools," wrote John F. Disinger (1997, p. 25). Environmental education for the American school system existed only partially in earlier environmental movements such as nature study, conservation education, and outdoor
education. All of these educational approaches focused on learning in and about the environment.

Nature study was first defined for the American school system in the late 1800s by Henry Barnard, U.S. Commissioner of Education (Ornstein & Levine, 1997). Barnard introduced and integrated the ideas of the famous Swiss educator, Johann Heinrich Pestalozzi (1746-1827), who based his ideas on learning through direct observation. Emphasis was placed on the environment and reliance on sensory experience. Like Jean Jacques Rousseau, Pestalozzi advocated lessons based on sense experiences that originated in the learner's home and family life. For both Rousseau and Pestalozzi, nature was the source of knowledge for the learner.

American conservation education was first stimulated by the dust-bowl droughts of 1934 and 1936, which caused extensive soil erosion by wind and water in the American mid west. As the population of the United States grew, the need for people to know about environmental problems and resource conservation and management could not be ignored since lack of natural resources could seriously affect the
entire American economy (Hammerman, Hammerman, & Hammerman, 1983). Conservation education's main objective was to inform the American public about environmental problems and the importance of conserving natural resources.

Outdoor education was the result of the pressing need for conservation education. "The child-centered school and the community school of the 1930s both assumed the task of involving the learner in outdoor experiences" (Hammerman et al., 1983, p. 9). Book learning was supplemented by direct investigations outdoors as well as in the local community. "Since the beginning, outdoor educators have attempted to bring about changes in learning activities, teaching strategies, grouping arrangements, materials, and the use of instructional space" (Knapp, 1992, p. 2).

The importance of environmental education has been confirmed by the United States government since the 1930s (Disinger & Roth, 1992). In 1990 The National Environmental Education Act (Public Law 101-619) gave the United States Environmental Protection Agency authority to administer an Office of Environmental Education. This act was not the first of its kind to be signed into law, but it did
reaffirm the federal government's stance toward environmental education (Disinger, 1997).

Rachel Carson, in her book 1962 book Silent Spring, warned that the probable consequence of the use of DDT and other pesticides could cause a time when spring would come but no bird songs would be heard. The birds would have died from trace remnants of the persistent poisons found in the insects they had eaten or the grains they ingested (Robbins, 1986). Carson's book helped stimulate the need for information and education about the environment and is "generally identified as the catalyst for the American environmental movement of the 1960s and 1970s" (Disinger, 1997, p. 26).

In 1969, Professor Bill Stapp of the University of Michigan first developed a working definition of the term environmental education when he wrote,

> Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution (Stapp et al., 1969, p. 30-31)

This definition is still commonly used as the standard definition of environmental education (Disinger, 1997).
Beginning in the 1960s and continuing to the present, the United States federal and state governments have enacted laws and implemented policies toward the goals of environmental education (Marcinkowski, 1990, p. 7). These agencies' interest in environmental education has been geared toward sustainable resource management and environmental protection. Other environmental agencies, organizations, groups, businesses, and industries have also attempted to influence public school curricula, many successfully (Disinger, 1997). According to Disinger (1997), "Today's environmental education has grown from this broad base toward a synthesis that redirects the goals of its predecessors by putting attention on the interconnections with humans and their environment" (p. 27).

Environmental Education Goals

Disinger and Roth wrote, "The promotion of citizenship education, often for adults as well as children, is typically identified as the primary task of schooling" (1992, p. 1). Producing environmentally responsible citizens and fostering positive student behaviors is the goal for environmental education. Approaches to
accomplishing this goal vary depending upon the educator's background, purpose, and/or mission (Knapp, 1992, 1996; Lisowski & Disinger, 1991; Munson, 1994; Wade, 1996).

Environmental education curricula are designed to be infused into existing curricula studies due to the lack of existing school organizational patterns (Disinger, 1997). "Infusion of environmental concerns in various curricula areas, particularly the sciences, is the characteristic mode of including environmental education in U.S. school curricula" (Disinger, 1997, p. 38). However because of its interdisciplinary nature, "environmental education lends itself well to an infusion approach" (Volk, 1997, p. 58). Language arts, science, history, social studies, music, math, art, and so on, are ideal vehicles for infusing environmental content into existing curricula (Volk, 1997, p. 59).

In 1997 the California Department of Education published a curriculum guide called A Child's Place in the Environment, for the purpose of providing elementary school teachers an example of an interdisciplinary, thematic
environmental education program. The most serious message this curriculum guide offers is this:

Students (should) participate in experiential learning activities that are true to ecologic principles and the themes of the core curriculum. Experiential learning through field studies at all grade levels contributes to the understanding of diverse ecosystems and values structures. (California Department of Education, 1997, p. 4)

A key factor in the California Department of Education's curriculum guide is the mention of a thematic approach. Thematic learning -- an approach for teaching science as themes rather than isolated facts--help students connect concepts and organize scattered pieces of disconnected information (Stoner, 1996). Broad themes connect ecological concepts and weave together ideas into coherent connections among different disciplines instead of focusing on bits and pieces of remembered facts.

Lisowski and Disinger (1991) and Munson (1994) agreed that teaching ecological principles form the foundation for environmental education goals. They believed that field-based science programs help students' understanding and retention of ecological concepts, and that field-based programs also build a strong foundation upon which to
attain the goal of life-long responsible environmental behavior.

Another point of view toward accomplishing environmentally responsible actions is from the perspective of outdoor education. In 1996 Knapp wrote that outdoor education:

...involves a particular method of teaching. This method is best described as experiential learning (or experience-based learning), and it consists of four distinct segments: (a) active student involvement in a meaningful and challenging experience, (b) reflection upon the experience individually and in a group, (c) the development of new knowledge about the world, and (d) application of this knowledge to a new situation (where the cycle begins again). (1992, p. 2)

Teaching about the environment as well as teaching in the Environment follows a process of discovery designed for the student to achieve, through meaningful and memorable experiences, motivation for further study. The environment's educative power was a theme used by the American educator John Dewey (Ornstein & Levine, 1997). For Dewey, cause and effect relationships could be perceived only through direct experience (Knapp, 1992).
Constructivist Teaching and Learning Method

Environmental education is about the environment and constructivism is a method of constructing a bridge between the students' understanding of the environment and a broader spectrum of knowledge and experience about the interactions of all life. "Constructivism, also known as constructivist learning, is the learning philosophy that has been guiding the revision of today's education" (Stoner, 1996, p. 10). "Constructivists favor an activity-centered curriculum in which students actively (mentally and physically) interact with knowledge to construct meaning for themselves" (Ornstein & Levine, 1997, p. 451).

Constructivism emphasizes the importance of understanding the learner's prior knowledge before beginning instruction on a new concept or topic. A bridge of understanding is constructed from the students' experiences and current conceptual understanding to the teacher's wealth of knowledge (Knapp 1992; Lisowski & Disinger 1991; Munson, 1994). Orr (1994) illuminated the reason for the design of the constructivist philosophy when he stated:
In the curriculum we have fragmented the world into bits and pieces and called it disciplines and sub-disciplines. As a result, most students graduate without any broad integrated sense of the unity of things. (p. 10)

Constructivism begins with seeing connections rather than separations, and provides students with the necessary tools and motivation to assess and compare their own connections to the natural world. The main thrust of the constructivist theory is that "people learn by actively constructing knowledge, explore new information against their previous understanding, reflect, share hypotheses with others, and revise their thinking" (Ornstein & Levine, 1997, p. 403). Knapp wrote that according to constructivists, "there is still a place for memorizing basic facts, practicing discrete skills out of context, or listening to lectures, but these ways of learning should be minimized" (1996, p. 57).

Environmental education action projects that stimulate investigative and problem solving skills at school or in the community, can use the constructivist method of connecting relevant learning into meaningful patterns that prepare students for a life-long commitment to sustaining a
healthy environment (Hammerman et al., 1983). Projects that are focused locally are successful and motivating when the focus is directly on the students' familiar surroundings (Hammerman et al., 1983).
CHAPTER THREE
BACKGROUND FOR TEACHERS

Natural History

Water

Climate for the San Jacinto Valley is in a transitional area between sea and desert. Two seasons dominate this area, the cool and clear, rainy winters and the hot, dry summers. This climatic type is referred to as Mediterranean, dry-subtropical (Crother, 1994).

The San Jacinto Valley watercourse has one main river: the San Jacinto River. Dry for the majority of the year, the often flash-flooded San Jacinto River is fed during the wet, winter months by the runoff from the western slopes of the San Jacinto Mountains. The river enters the valley in the southwest at Bautista Canyon, near Hemet at 1600 feet above sea level (asl), and then travels northwest along the base of the foothills until about halfway down the valley where the river bed turns again to the southwest and follows the center of the valley. It slows and settles in the southern end of the Mystic Lake wetlands, at about 1300
to 1430 feet asl. When the water level is high enough, water leaves the lake at the San Jacinto Wildlife Area through the San Jacinto River channel. On the western edge of the wildlife refuge the river makes a sharp left turn southwest once more and goes through a large gap called the Bernasconi Gap or the San Jacinto y Nuevo Potero, between the Lakeview Mountains and the Bernasconi Hills. The San Jacinto River continues out of the valley toward the Perris Plain and on toward Lake Elsinore (Sharp, 1994).

The headwaters of the San Jacinto River begin in the San Jacinto Mountains. Water is tunneled into channels, above and below ground, to the valleys below. At about 4000 feet above sea level, in the San Jacinto Mountains, is Garner Valley, a high lying, wetland basin in which sits Lake Hemet. Lake Hemet Dam and Reservoir originally were developed in the 1895 for valley irrigation purposes (Whittington, 1951).

Standing water is a common sight throughout the flat valley floor during the wet winter months. Most of the valley displays a temporary wetland environment for weeks after a heavy rainstorm. The San Jacinto Valley is the
first in a chain of southern and western elongated valleys
that receive water from the San Jacinto Mountains via
springs, artesian wells, high ground water table, and river
channels. Elevations for the San Jacinto watershed,
starting in the highlands and moving downhill, are as
follows:

Mount San Jacinto Wildlife Area = 1430 feet
Garner Valley, Lake Hemet Dam = 4334 feet
Hemet/Val Vista (SE valley) = 1600 feet
San Jacinto City = 1567 feet
Mystic Lake, = 1300 feet
San Jacinto Wildlife Area - 1430 feet
Lake Elsinore = 1240 feet
Temecula = 1006 feet
Oceanside = approximately sea level (Automobile
Club of Southern California, 1991).

Some water caught by the highlands seeps into the
ground and is channeled down hill through aquifers
(underground river channels) where it resurfaces as springs
or artesian wells in the western valleys below. Underground
and surface water that is not evaporated, used, or stored
finds its return trip to the ocean through Temecula Canyon where it follows the Santa Margarita River to Oceanside and the Pacific Ocean. The high relief and steep slopes of the San Jacinto Mountains; the sand and gravel valley floors; and the solid basement rock of granite, provides excellent conditions for aquifers, springs, and artesian wells in the Peninsular Ranges (Sharp, 1994; Whittington, 1951). The eastern slopes of the San Jacinto Mountains drain toward the Coachella Valley.

Water from the western slopes of the San Jacinto Mountains settles in the Mystic Lake low-lying wetlands. It is a 3,000-acre shallow body of alkaline-rich water that often completely dries during the hot summer months. However, there have been many consecutive years that the lake has remained wet. It is a flood control basin for the rushing waters from winter storms. "In 1993 Mystic Lake was filled with water to a depth so that only the Ramona Expressway (the east-west valley highway) and Gilman Springs Road (the northern highway of the valley) were passable" (San Bernardino County Museum Association, 1993, p. 27).
Mid-century practices destroyed the original diverse wetland habitat of the Mystic Lake bed. The lake bed was drained and tilled during the mid 1900s for agricultural practices of dairy, cattle grazing, and crop farming (Crother, 1996) but destruction of this natural wetland habitat was due, in actuality, to a combination of factors: multiple water use, diversion of the San Jacinto River, ground water appropriation from wells and springs, plowing and planting of the wetland soils, and cattle grazing on delicate wetland vegetation (Whittington, 1951).

Adjacent to and including Mystic Lake is the San Jacinto Wildlife area, the field site area for this curriculum guide. Managed by California's Department of Fish and Game, and it are one of the state's prime examples of successful rebuilt wetlands. It is one of the few areas of wetland habitat left in California for birds that make such sites their home for a part of the year.

Landforms

The San Jacinto Valley, surrounding mountains, multiple remnant hills that dot the valley floors, and the Mystic lake wetlands are in a geologic province called the
Peninsular Ranges (Sharp, 1994). This province, located in the southwestern corner of southern California, trend north northwesterly. High mountains and long valleys characterize the area. Composed mainly of granites and lavas, the Peninsular Ranges extend along the entire 800 miles of peninsular Baja California. The United States has about 130 miles of the northern part of this province.

The highest point of the Peninsular Ranges is Mount San Jacinto. At 10,804 feet asl, Mount San Jacinto towers more than nine thousand feet above the San Jacinto Valley (Sharp, 1994). This great range can be seen from the Mystic Lake wetlands, even though the wetlands are twenty-five miles away. The sight is spectacular, especially during cold, clear, winter days when the mountains are snow-capped, the valley is kelly green with grasses, and the wetlands are rich with wildlife, flowers, and reeds.

The San Jacinto Valley is circled on the east by the San Jacinto Mountains, on the north by the well-worn "badlands" of the San Timoteo Hills, on the west by the old remnant Bernasconi Hills, and on the south by the Lakeview Mountains. The valley is about fifteen miles long and eight
to twelve miles wide. The valley's 35,000 acres are relatively flat, alluvium filled (debris from the remnant mountains deposited from the action of water), and the valley's floor is granite-based (Sharp, 1994).

Despite what stereotypes lend themselves to believing that Los Angeles or San Francisco are earthquake cities, the reality is that the San Jacinto Fault is considered by geologists to be the most active fault among California's tectonic plate corridor (Sharp, 1994). The San Jacinto Fault and its spurs run along the north and south sides of the San Jacinto Valley (San Bernardino County Museum Association, 1993). The cities of San Jacinto, Hemet, Riverside, and San Bernardino have experienced much tectonic activity in recent years.

The valley has been sinking about 1/64th of an inch per year for over 500,000 years, but in the last 40 or so years the subsidence has increased to several inches per year (Sharp, 1994). This increase is unquestionably due to ground water removal, which was rerouted for irrigation purposes (Crother, 1996).
Rocks and Soils

The hills in the San Jacinto Valley and interconnecting valley floors are submerged mountains that eroded to fill the valleys with alluvial sand and gravel (Sharp, 1994; Whittington, 1951). Soil variation in the valley is minimal except for the alkaline residues in Mystic Lake left from the continuous deposition and evaporation of water.

Relatively coarse-grained, homogeneous, igneous rocks (once molten and able to intrude other rocks) are dominant in the valley. The 100 million year old rocks are from the Southern California Batholith that composes the Peninsular Ranges (Sharp, 1994). The main rock types from the batholith are granites and lavas. Although formed at great depth, they have subsequently been exposed at the surface by deep erosion. "The younger, terrestrial deposits were deposited into the San Jacinto Valley basin about 80 million to 1.8 million years ago or less" (Sharp, 1994, p.28).

The San Jacinto Mountains and the residual valley hills are composed of mainly igneous and metamorphic rocks
while the valley soils are sedimentary alluvium which is derived from the recently transported soils of the residual hills (Sharp, 1994). At the San Jacinto River and adjacent 8-mile wide flood plain, the deeper sediments are of coarse gravels that become gradually sandy to a fine-sandy loam at and near the surface. The depth of the alluvium is about 6 feet at the riverbed and 50 feet at the southwestern Lakeview Mountains edges (Whittington, 1951).

Mystic Lake and the San Jacinto Wildlife Area soils are typically alkaline due to the long periods of soil and water deposition during the wet winter months and the slow summer drying (Sharp, 1994). The floor of the wetlands is generally covered with a light brown, medium-grained sandy flood-plain soil and generally lacks organic matter except where wetlands have been reestablished (Crother, 1996). Since 1986 the reconstructed ponds and marshes of the San Jacinto Wildlife Area have developed deposits of organic material, which is darker in color due to the decomposition of organic material and oxygenation from the plants (Crother, 1996).
South of Mystic Lake and the wildlife area, the valley ascends toward the Lake View Mountains where fifty feet of alluvial soils are well-drained, sandy loams. North of the lake and wetlands, the valley rises toward the San Timoteo (Badlands) Formation. This dissected hilly formation, drains its sandstone, siltstone, and occasional conglomerate beds into Mystic Lake. The soils of the San Timoteo are about two to three million years old. Sharp (1994) wrote,

There are rich fossil contents that lay there, like bones of extinct animals such as camels, ground sloth's, deer, giant land tortoises, mastodons, dogs, cats, bears, pigs, antelope, raccoons, wolverines, horses, and rhinoceros that have been found right off Highway 60 next to Gillman Hot Springs Road. (p. 229)

The remnant hills almost surround the wildlife area. They are covered by large granitic boulders that resemble sacks of wool. These boulders are typical of subsurface weathering and erosion patterns of homogeneous granitic rock, hence their geologic description "wool-sack boulders" (Sharp, 1994, p. 230-231).
Plants of the Mystic Lake Wetlands

Chaparral and riparian (riverside) wetland vegetation habitats, reflect the temperature, rainfall, slope, elevation, evaporation, and soil conditions for this area. Distributions of plants vary with the season and type of growth. In the wetland meadows, during the wet season, low sparse shrubs, a variety of grasses, and herbs begin the season. By spring clusters of grasses and wild flowers cover the flat, valley floor with an abundance of color. In the dry, summer season most of the valley's plants die or turn brown.

Coastal sage scrub habitat covers the remnant hills surrounding the wetland area. "This vegetation habitat is considered among the most endangered in the nation due to human development" (California Department of Education, 1993, p. 111). This type of vegetation is open, with low, sparse shrubs that have large root systems, which survive the summer droughts.

In the mid 1800s the abundant natural diversity of the valley's plant life was diminished (Whittington, 1951). The blends of tall, wetland grasses, riverside woodlands,
valley grasses, and herbs, were sacrificed for cattle production, dairies, agricultural irrigation, and flood control. "By the mid 1900s the trampling of grasses by grazing and the removal of native grasses had occurred" (Whittington, 1951, p. 131). Today the land use pattern, established by the Spanish-Mexican settlements, has changed little except for the regenerated wetlands at the San Jacinto Wildlife Area.

At the San Jacinto Wildlife Area, reclaimed water from the local Eastern Municipal Water District and private well water from several hunting clubs is used in constructed ponds, marshes, and a water storage area. Waterfowl food plants such as Cattails (Typha latifolia), long-leafed grasses of Alkali Bulrushes (Scripus robustus), California Bulrush (Scripus californicus), and Creeping Spikerush (Eleocharis papaustris) have been planted (Crother, 1996; Eastern Municipal Water District, 1994). The high nutrient content of the reclaimed water has made an ideal environment for restoring riparian-wetland vegetation. Cottonwood and willow trees have been planted along the wildlife's Old San Jacinto River course.
Some of the invasive or exotic plants (not originally found in the area) are the giant grass reed called Arundo (Arundo donax), the Salt Cedar (Tamarisk chinensis), and Tree of Heaven (Ailanthus altissima). When non-native invasive plants move in, native plants and animals are displaced which may severely alter the equilibrium of the area and result in the loss of habitat for many animals.

Animals of the Mystic Lake Wetlands

The variety of habitats, found on the San Jacinto Wildlife Area, include riparian wetlands, grasslands, and rocky hills. These habitats support many animals: 240 species of birds including 22 species of birds of prey, 38 species of mammals, 32 species of reptiles, and 7 species of amphibians.

When a plant of animal species is facing conditions, which could cause it to become extinct, it needs to be protected from further decline. An official listing "threatened" or "endangered" provides protection. A species is endangered when it is in serious danger of becoming extinct throughout all or a significant portion of its range unless special protective measures are taken. The
predominant cause of threatened, endangered, or extinct species is loss of habitat. A threatened species is not presently threatened with extinction but is likely to become an endangered species in the near future if protective measures are not taken (Steinhart, 1990).

Species of special concern at the wildlife area are; the Bald and Golden Eagles, Peregrin and Prairie Falcons, Swainson's Hawk, American White Pelican, Double-crested Cormorant, White-faced Ibis, Northern Harrier, Burrowing Owl, Bank Swallow, and Stephen's Kangaroo Rat (California Department of Fish and Game, 2000; EMWD, 1994). The Stephen's Kangaroo Rat lives in the sandy loam soils above the edge of the flood plain throughout the area. This nocturnal animal's range is limited to small portions of western Riverside County and northern San Diego County (EMWD, 1994).

The influence of both the desert and coastal environments makes for diverse and rich habitats for many species. During the spring and early summer, the newly created Cattail marshes have a large nesting colony of
Tri-colored Blackbirds and a small colony of Yellow-headed Blackbirds. Other species that have nested around the ponds and marshes include; Pied-billed Grebe, Redhead, Mallards, Cinnamon Teal, Common Moorhen, Virginia Rail, numerous Black-necked Stilts, and American Avocets. Migrant shore birds are most numerous from March through Mid-April and Mid-August through September (California Department of Fish and Game, 2000). On the coastal sage scrub hillsides, Sage and Rufous-Crowned Sparrows as well as Granite Spiny Lizards can be seen. Between late November and Mid-March is a good time to watch for Mountain Plovers, Long-billed Curlews, Burrowing Owls, Short-Eared Owls, and Mountain Bluebirds.

Millions of migratory birds funnel through the Pacific Flyway each winter on their annual flight from Alaska and Canada to Latin America (Crother, 1994). California, a critical 700-mile link on this corridor, has drained, diked, or filled for urban or agricultural use, over 90% of its natural wetlands since the 1700s, resulting in the loss of habitat for resting, feeding, breeding, and rearing of young. The San Jacinto Wildlife Area has provided a vital
habitat for this corridor. Rebuilt ponds and marshes serve as refueling stops for migrating birds and is a home for resident waterfowl and shorebirds.

Since the mid 1800s more than 55 species, that once occupied the Mystic Lake wetlands, have become extinct (California Department of Fish and Game, 2000). Many reasons exist for the increased extinction of plants and animals in California but habitat destruction is considered number one. Habitat loss is usually due to the increased human population, which tends to contaminate, spread, and consume natural habitats (California Department of Education, 1993). "Other contributing factors to habitat destruction are; the introduction of non-native or exotic species into native habitats, commercial exploitation, predator control, global environmental problems, and pesticide usage" (p. 5).

The reconstructed wetland habitat at the San Jacinto Wildlife Area is a prototype for regenerating and protecting natural habitats. The regeneration of a portion of the Mystic Lake wetlands habitat, is the approach to species survival the California Department of Fish and Game
has accomplished. Citizenship involvement is a first step in the reestablishment of natural habitats for wildlife. Strong public support may motivate politicians to legislate protection and regeneration of California's delicate and diverse array of habitats.

Human History

Native Americans

Evidence of Native American habitats, in regions of southern California, has been traced backwards in time 20,000 years (Modesto, 1980, p. 2). For over 7,000 years Native Americans in the San Jacinto Valley intimately interfaced with the natural environment. In the last 200 years, with the immigration of the Spanish, Mexican, and Americans changed the natural environment to reflect their cultural heritage. Most natural habitats of the San Jacinto Valley have been altered or destroyed.

"Beginnings of Native American settlement are marked by the present day Soboba Indian Reservation (or Sovovo/Savabo, a western group of the Shoshone Nation originally called the Payomkawic)" (Whittington, 1951, p. 133). The ancestors of the Soboba of today were mountain
people, kin of the Mountain Chauilla (Whittington, 1951). They hunted and gathered food over the entire valley. There were six separate villages located in the lower canyons and slopes of the San Jacinto Mountains near the town of San Jacinto. Each village had their own private hunting area and river, spring, or small lake. Water was the stabilizing factor of their subsistence in all the villages. This area was the cultural center for other tribes and clans from the desert to the mountains. Their population, prior to the arrival of the Spanish in 1769, was about 30,000 (1951).

The Soboba Indians lived in single-family grass and tule reed huts, called a "kish" (Modesto & Mount, 1980, p. 23). The Palo Verde was used for building such huts (Whittington, 1951). They were round and about ten feet in diameter. There was only one opening in the hut, a door that always faced to the east (Modesto & Mount, 1980).

Just prior to the arrival of the Spanish, drought and famine drove Native Americans from the Temecula area into the hunting lands of the Sobobans. "This intrusion precipitated war which reduced the Soboba to a single village, called Ivah" (Whittington, 1951, p. 137). The Ivah
hid among caves and only gradually re-took foothill hunting grounds around the present Soboba Indian Reservation lands. The Soboba never regained their former strength. "Then in 1862 a smallpox infection, brought by a sailor from the San Diego area, killed most of the remaining Native Americans in the valley" (Modesto, 1980, p. 20). The pre-Spanish population of over 30,000 was reduced to the 1948 population of an estimated 100 families (Whittington, 1951), and "by 1974 the aboriginal population was about 900 racially mixed descendent" (Modesto & Mount, 1980, p. 20). It could be said that the Native Americans became an endangered species due to the destruction of their natural habitat requirements.

The Soboba Indians followed seasonal harvests for their valley food. "Native distribution of food sources varied with each season and type of growth" (Modesto & Mount, 1980, p. 18-19). They gathered, hunted, fished, and grew their food.

Plants that were gathered had many uses. Fiber plants like Agave buds were used for food and the agave leaves for weaving and sewing fiber. The grey green Ocotillo supplied
fuel and the Acacia (of the Mimosaceae family) supplied gum and yellow dye. The Mesquite beans and the Chia or Button Sage were the principal sources of sugar and oil (Whittington, 1951, p. 138). Seeds from Amaranth, Mesquite, Screwbean, Paloverde, Acorns and Pinon nuts were collected in early winter from the San Jacinto Mountains and supplied the communities with a storehouse of available food throughout the entire year (Modesto & Mount, 1980).

Archeologists unearthed human coprolites (pieces of human waste; scat) taken from various prehistoric Cahuilla villages and determined they had an animal diet including Deer, Mountain Sheep, Antelope, Rabbits, Raccoon, Badgers, small rodents, Snakes, Lizards, Tortoises, Ducks, Grebes, Mudhens, Swans, Doves, Quail, and waterfowl eggs. Food obtained by fishing, included Suckers, Trout, and Clams (Modesto & Mount, 1980, p. 18).

Cultivated Native American gardens of Corn, Squash, Beans, Pumpkins, Melons, Tobacco, and medicinal herbs were grown near village water sources (Modesto & Mount, 1980). Irrigation ditches that provided water for the gardens were dug with hard mesquite digging sticks. The Soboba Indians
had no metal tools until the arrival of the Spanish (Whittington, 1951).

The immigration of the Spanish, Mexican, and Americans brought gradual and continuous displacement, impoverishment, and death by disease to the San Jacinto Native American population. The original Native American habitat of was destroyed. American settlers continued claiming their land even after the Soboba Reservation was established and protected by the U. S. Government, on June 18, 1883 (Whittington, 1951).

**Spanish**

Regional exploration by the Spanish began after 1769. The Cahuilla Indians were the mountain guides for Spanish explorers including Galvez (1771) and Juan Bautista d'Anza (1774-76) (Whittington, 1951). Native guides led the Spanish and later Mexican military parties through the San Jacinto Mountains, enabling the ultimate establishment of routes for trade and colonization. "The Spanish explorers realized the higher valley routes were preferred because they offered a much better watered route than the desert routes" (Whittington, 1951, p. 147).
Whittington (1951) quoted Father Font, historian of the 1774-76 Juan Bautista d'Anza expedition, about the San Jacinto Valley,

I was very well pleased by the crystalline And beautiful water of this Arroyo de San Joseph (San Jacinto River), which runs from the Sierra Nevada San Jacinto Mountains) and comes through a valley so leafy that because of its beauty and attractiveness we called it Paradise Valley. (p.148)

Whittington (1951) went on to cite Juan Bautista d'Anza as he was viewing the San Jacinto River and its bordering plain,

Good opportunities for large grain fields, and for the raising of horses cattle, sheep and goats, which would be very advantageous in this place because it is in the midst of such desert country. (p. 148)

Juan Bautista d'Anza foresaw Spanish and later Mexican activities, which would eventually dominate the valley lands. The deserts, vegetation, and weather conditions of this new land were similar to their native lands.

The procedure by which Spanish conquest became settlement was characterized by building mission stations where Native Americans had "rancherias" or clan villages (Modesto & Mount, 1980, p. 15). The rancheria was a village
near springs or flowing water, situated from harsh weather, and protected from enemies in canyons. This assured converts and an available labor force for the Spanish conquest.

In 1821 the Spanish built seven extensions to the mission of San Luis Rey, then located by the present-day Oceanside. The northern most mission station, called Casa Loma, was in the area of the original Soboba villages, in the San Jacinto Valley. The San Jacinto Valley Spanish extension was called an "asistencia" or "rancho" (Whittington, 1951, p. 151-2). The Spanish asistencia included houses for supervisors of the Native American workers, a chapel, and a stopping place for visiting missionary priests. The farm or "rancho" was, by 1835, 24 leagues (35,508 acres), the approximate size of the present San Jacinto Valley (Whittington, 1951).

Extensive pastures were available around the mission for the raising of livestock. A grainary in the asistencia stored harvests from native grasses and a small vegetable garden was located near the main buildings for residents (Whittington, 1951). The frontier mission organization
depended heavily upon the cattle economy, where by more and more land was necessary.

Mexican

By 1823 the San Jacinto Rancho was under Mexican rule. Mexican-enforced law required the inexpensive land of the area to be sold. Native Americans began secluding themselves in the San Jacinto Mountains from the reach of religious or military authority, thus went the cheap labor and land supplies (Whittington, 1951).

The Spanish "asistencia/rancho" was a livestock center; its Mexican counterpart was the "hacienda" which was an agricultural plantation. Irrigation ditches were dug to provide water to the large crops. Between 1835 and 1846 civil forces within Mexico weakened Mexico's hold on New California. Distance, instability, and the interests of other nations also threatened Mexico's hold on this province (Whittington, 1951). The Spanish land-use pattern of livestock and range and the Mexican land-use pattern of agriculture merged.
American

In the late 1800s, English immigrants were attracted to the San Jacinto Valley by the abundance of hides and tallow from the San Jacinto Rancho, while Italians and French were attracted to the large and inexpensive tracts of land (Whittington, 1951). Early American settlers were scarcely noticed in the Spanish-dominated San Jacinto Valley.

Extensive Spanish holdings were divided mainly among the intermarried members of four families. By 1842 the generous Mexican land grants, recognizing the Jose Estudillo claim to 35,503 acres of the San Jacinto Valley (including the San Jacinto Rancho) and the Miguel Pedrorena claim to the San Jacinto Nuevo y Potrero with 48,861.10 acres (which includes the Mystic Lake wetlands) were accepted by the U. S. Land Commission (Whittington, 1951).

Even with the mid 1800s southern California land boom, these two ranchos continued to keep the cattle and sheep ranges open and free of fences. The majority of the valley's occupants were the Spanish and Mexican shepherds,
herders, and Native Americans until about 1886. The San Jacinto cattle and sheep herds still roved over fenceless range. "Early American farmers had to schedule regular watches in their recently acquired San Jacinto farmlands to prevent herds from trampling their new crops" (Whittington, 1951, p. 163).

By 1890 the shift of interest from cattle range to commercial agriculture had been completed. That year the San Jacinto Land, Flume, and Irrigation Company became Hemet/San Jacinto area's irrigation and water distributor (Whittington, 1951). With available water utilities came an influx of American settlers.

"The town of San Jacinto was founded during a Catholic mass commemorating the feast of Saint Hyacinth in 1872 and the town of Hemet (a Cahuilla Indian word "Hemica" meaning box or enclosed by trees) got its start around 1892-95" (Whittington, 1951, p. 174). After the 1890s land use continued to reflect the national distribution of the early settlers. The English, who settled around Hemet and the town of San Jacinto, liked small plots of ground in town lot arrangements, olive culture, and utilities development.
The French and Italians followed the extensive Spanish-style of potato and vine holdings, but the French also had smaller sites for rabbits and poultry culture. The Dutch started and have maintained a dairy industry in the alkaline soils of the western edge valley since the 1930s (Whittington, 1951). Land use patterns, established by the chain of human occupants, can still be seen throughout the San Jacinto Valley. Around the towns of Hemet and San Jacinto small agricultural plots dominate, while the central, northern, and western parts of the valley have kept the Spanish and Mexican livestock and crop productions.

Until 1888 the San Jacinto Valley remained a difficult area to reach because of the topography caused by the San Jacinto Mountains. Stage lines and wagon companies, who followed the old Native American trails made only irregular stops in the valley. But in April 1888 the Santa Fe Railroad extended its Perris line into the city of San Jacinto and commercial agriculture developed (Whittington, 1951).
The turn of the century saw dirt and gravel roads extended along the railways into the area. "By the 1930s extensions of paved highways with trucks took products from the valley to the Los Angeles markets" (Whittington, 1951, p. 226). However, major highways by-passed the valley.

In the 1990s the western edges of the Los Angeles basin's population began to expand into the rural Perris Valley Plain. Small communities grew and converged. The Hemet-San Jacinto areas have also expanded and merged but the northwestern wetland area has generally maintained its early 1900s character.
CHAPTER FOUR
SAN JACINTO WILDLIFE AREA

History

Millions of migratory birds funnel through the Pacific Flyway each winter on a transcontinental flight from Alaska and Canada to Latin America. Rivers, marshes, and ponds serve as refueling stops, offering birds rest and food along the way. California, a critical 700 mile link in this migratory corridor, has lost 91% of its wetlands in the past century (Crother, 1996). The San Jacinto Wildlife area, with its 8,550 acres, is one of the few areas of wetland habitat left in California. Located along the Pacific Flyway, the wildlife area provides vital habitat for migratory and resident waterfowl and shorebirds (Crother, 1996).

In 1982 the Wildlife Conservation Board began buying land in the valley as a partial compensation for the loss of wildlife habitat due to the construction of the State Water Project (California Department of Fish and Game, 2000). Today the wildlife area is rapidly recovering the once abundant wintering and resident water bird species.
The San Jacinto River no longer feeds the seasonal wetlands in the Mystic Lake area. However, the California Department of Fish and Game, the Eastern Municipal Water District, and well-water from several local duck clubs, donate adequate quantities of secondarily treated reclaimed water to the wildlife area (Crother, 1996).

Wetlands can improve the quality of the water while providing for habitat creation, environmental enhancement, and public education and recreation. In addition to providing green space and wildlife habitat, wetlands help treat water as it filters back down to replenish groundwater reserves. The reclaimed water is then used once again for agriculture, irrigation, and other special uses from the recharged groundwater (Crother, 1996).

The wildlife area is approximately 8,000 acres. The California Department of Fish and Game has rebuilt and maintained its wetland habitats by putting in ponds, marshes, and vegetation. They have replanted part of the San Jacinto River as well as a large area used for water storage with Native Cottonwood trees, Black willow, and Arroyo Willow trees.
The San Jacinto Wildlife Area's headquarters are located at 17050 Davis Road, Lakeview, California. Access to the wildlife area from the south is from the Ramona Expressway; assess from the north is off Highway 60 at Theodore Street, south, until it curves and becomes Davis Road. Continue traveling on Davis road for 3.5 miles to the entrance of the wildlife area.

Wetlands

Wetlands may be referred to as a swamp, marsh, fen, lowlands, flood control basin, bog, or temporary puddles. But whatever they are called, they all share some characteristics that are different from other types of habitats. Wetlands are areas that, at least periodically, have waterlogged soils or are covered with a shallow layer of water (National Wildlife Federation, 1989).

When dry, dormant, low areas receive water, they erupt with plant and animal life. Some wetlands, like the Mystic Lake riparian wetlands, usually appear during the wet season, then dry up later in the year. Some areas around Mystic Lake have vernal pools that appear in the spring. They may last one day to several months and are dry by
summer. A whole host of life appears in such a wetland. There is a race against time for each inhabitant to secure a mate and raise offspring (The Watercourse & Western Regional Environmental Education Council, 1992, p. 79).

Soil type, elevation, and water sources (ground, surface, and precipitation) contribute to the formation of wetlands. Water that flows into the low-lying wetland areas is captured and stored until it is slowly released down stream or into the soil (The Watercourse & Western Regional Environmental Education Council, 1992, p. 133). The Mystic Lake riparian wetlands are fed from the San Jacinto River and from a high groundwater table from the San Jacinto Mountains' underground waterways (aquifers). The ability of wetlands to hold water is one reason they are valuable for watershed management. Thick grassy roots act like a sponge that holds water and prevents evaporation. Sandy soils, of the Mystic Lake area, seep water faster than if they were clay soils (Western Regional Environmental Education Council, 1992, p. 54). The wet winters raise the valley's groundwater levels, which also help to keep the lake basin filled.
Value of Wetlands

Wetlands are important to plants, animals, humans, and the total environment. Because of the abundance of food, vegetative cover (shelter), and water, most wetlands are rich with diverse wildlife. They serve as spawning grounds for microbes, water creatures, waterfowl, and land wildlife. The area provides green space and habitats that promote species maintenance and diversity, especially for nesting and migratory birds (Crother, 1996).

Flood Control

Natural wetlands act like a large shallow bowl with a sponge on the bottom. They collect flowing water that decreases its velocity by spreading out among the spongy grass roots. "The vegetation helps to slow down the water and binds soil to help prevent it from eroding" (Western Regional Environmental Education Council, 1992, p. 54-57).

Silt Trappers and Water Purifiers

When floodwaters are slowed by wetlands, the silt and other sediments settle out among the roots and stems of wetland plants. This helps to protect streams, lakes, and
other bodies of water downstream from a build up of sediment (Western Regional Environmental Education Council, 1992).

Wetland plants can take up and use nutrients and chemicals that flood-deposited silt may contain. These impurities might eventually contaminate rivers, lakes, groundwater, and other water supplies. Wetlands promote decomposition of many toxic substances. Plants filter out bacteria and solids while absorbing rich nutrients while adding oxygen to the system through photosynthesis. Wetlands can render small quantities of sewage harmless, but they are no match for large urban quantities (Crother, 1996).

Wildlife Nurseries

There is more life in a healthy wetland than in almost any other kind of habitat (National Wildlife Federation, 1989). These productive places can support huge numbers of insects, fish, birds, and other animals. The thick vegetation of a wetland is a good place to hide, and the rich food supply gives growing animals a healthy start in life.
Resting Place for Migratory Birds

Wetlands, in the fall or spring, usually have many kinds of resting and nesting birds visit. Over 90% of all wetlands in California have been destroyed by people and their actions (Crother, 1996). This makes any wetlands left, along the California migration corridor from Canada and Alaska to Mexico and South America, called the Pacific Flyway, extremely important for the continuation of resting and nesting bird populations.

Wetland Problems

Tropical forests, grasslands, deserts, wetlands, temperate forests, coral reefs, estuaries, and most other types of habitats are disappearing at tremendous rates (Crother, 1996). Habitat loss is a major obstacle to the recovery of many endangered species.

People cause most habitat loss. Urban sprawl, agricultural development, dams, introduction of exotic species, overgrazing, soil erosion, toxic runoff, harvesting and mining natural areas, and human recreation, are other human actions that have caused the destruction of habitats (National Wildlife Federation, 1998).
Animals and plants with specific habitat needs are extremely susceptible to extinction when changes occur in their habitat. For example, many birds migrate between different habitat areas at different times of the year. When people destroy a significant part of either habitat, or destroy the animals' resting stops along the way, many of them are not be able to reproduce or even survive (National Wildlife Federation, 1989).

The introduction of exotic species, unregulated hunting, over collecting, and toxic pollution are some of the other serious consequences that people can cause to themselves, to wildlife, and to the habitats they share.

Wetland Habitats

The Mystic Lake wetland habitats have enough food, water, shelter, and space to provide a rich and diverse wildlife population. The Mystic Lake area ecosystem, an area consisting of all living things and their interaction with one another and with the physical environment, has many different types of habitats that interact with each other. There is a riparian habitat, coastal sage habitat, cattail marshes habitat, pond habitat, mudflats habitat,
and shallow wetlands habitats. Each habitat is suitable only to those life forms, which have adapted to its ecological conditions. Species with very specific habitat requirements tend to be less able to adjust to environmental change (Department of Fish and Game, 2000).
APPENDIX:

FIELD GUIDE LESSONS
CURRICULUM GUIDE FOR THE SAN JACINTO WILDLIFE AREA
AND MYSTIC LAKE WETLANDS

The following lessons are designed to stimulate student awareness and interest in the environmental risks, problems, and issues of habitat loss, sustainability, and regeneration. There are three lessons in this environmental education curriculum guide for the San Jacinto Wildlife Area: pre-site preparation, on-site outdoor experience, and post-site evaluation lessons.

The pre-site lesson begins at school where students investigate a temporary wetland puddle habitat. After they have learned about their schoolyard wetlands, they are ready to begin the on-site field trip to the San Jacinto Wildlife Area wetlands. Here they will spend four hours hunting for and recording information about wildlife. There are six different wetland habitats where students will stop and record information for later use back in the classroom. The post-site lesson is held in the classroom. This lesson helps students categorize and organize their gathered data so they can assess the various aspects of wildlife's
habitat in a wetland environment and determine if they want to start an environmental action plan, or not.
PRE-SITE LESSON

PUDDLE PAD, A BIG CONCEPT IN A LITTLE POND

SITE: A school yard, dirt puddle, preferably after a rainstorm, or create a puddle with a hose or bucket.

The lesson is specifically designed for the San Jacinto Valley and interconnecting valleys within the San Jacinto watershed (a 200,000 acre area that ranges from the peaks of the San Jacinto Mountains, down hill through the Perris Plain to the coast ranges, Lake Elsinore, and the Temecula area. Schoolyards located on these valley floors, will tend to mirror many of the same physical and biological characteristics found at the San Jacinto Wildlife Area and Mystic Lake wetlands.

LESSON SUMMARY: As students prepare for the Mystic Lake riparian (San Jacinto River-side) wetlands field trip, they will begin at school, investigating the living and non-living components of a temporary wetland puddle habitat, at school. In Part I of this lesson they will observe and record evidence of animals that might use the puddle; measure the diameter and depth of the puddle; and infer how the basic survival requirements of each animal is met. In Part II students will investigate the same puddle three days later. They will observe and record information about the non-living habitat components, measure again the diameter and depth, and compare and contrast the changes from the first visit to the last.

The main object of this lesson is to show students that an ordinary puddle at school can reflect some of the same physical and biological conditions as the wetlands field trip area. Similar conditions between the puddle and the larger wetlands might include climate, sandy soils, high groundwater levels, insects, rodents, burrowers, birds, etc. Differences might be found in the varieties and numbers of plants and animals, microclimates, land shapes, waterways, etc.
GRADE LEVEL: 4th to 6th

DURATION: Part I - 1 1/2 hours
             Part II - 50 minutes

LEARNING OBJECTIVES: Upon completion of this lesson, students will be able to:

1. Recognize temporary wetland areas on their schoolyard.

2. Understand that temporary wetlands are part of a larger water system.

3. Explain how a temporary wetland is formed after a Rainstorm.

4. Recognize that groundwater, runoff, precipitation, and human influence can contribute to wetlands.

5. Be able to discuss the value of data collection.

6. Define environments, wetlands, and habitats.

7. Use their sense awareness of sight, sound, and smell to record observations.

8. Infer how the basic survival needs of plants and animals are met.

9. Distinguish habitat requirements into living and non-living components.

10. List the positive and negative consequences of various human influences on a school yard puddle environment.

11. Distinguish between human-built and nature-made habitats.

12. Be able to determine north without a compass.
13. Be able to generalize about the climatic conditions of the puddle.

PROCESS SKILLS USED:

1. Observe a puddle on the schoolyard.
2. Use senses to gather and record data.
3. Communicate orally and in writing.
4. Predict consequences of destroying life forms in an ecosystem.
5. Generalize about characteristic life forms associated with temporary wetland habitats.
6. Analyze the needs of plants and animals and recognize how these needs are met.

MATERIALS:

1. Students, (each group):
   a. "Puddle Pad Worksheet, Part I and Part II"
   b. Writing surface for worksheets
   c. Pencils
   d. Ruler
   e. A long piece of string and scissors

2. Teacher:
   a. Extra worksheets and pencils
   b. A ball of string

MANAGEMENT SUGGESTIONS:

1. When outdoors, set up boundaries and a time limit for students.
2. Ask students to follow good outdoor manners such as cooperation, respect, safety, and attention.
ACTIVITY BACKGROUND:

Ecology is the study of the interrelationships of the living and non-living factors in the environment. Non-living components are things like soil, climate, landforms, and air quality; the living components of the environment are plants and animals including humans. Developing the concept of the interrelatedness of all things is necessary in order to understand our own position in the interrelationships. Habitat is a concept, an idea. It is another word for home or eco (Oikos - Greek for House). Home is where we live and sustain ourselves. It must supply our basic survival needs of water, food, shelter, and space in order for us to live and grow, and this is true for all life forms.

When water flows downhill, a puddle, pond, lake, or inland sea is formed where it stops. Puddles form in low spots or depressions in the land's surface. If the puddle lasts for several days, animals may visit or reside there. Residents that might have made it their habitat include toads, flying insects, freshwater shrimp (fairy), tadpoles, worms, and one-cell animals, to name but a few. Visitors that include the puddle as a part of their habitat might include insects, butterflies, birds, rodents, cats, dogs, and people.

There is a race for animals to obtain these survival needs (water, food, shelter, and space) to live and breed in such short-lived habitats. Some animals deposit eggs before the water dries and their offspring are born in the next season; some bury themselves and go dormant for up to 20 years; and some migrate and relocate when the water leaves.

Depending on the elevation and the amount of precipitation (rain and snow), wetlands may only be a few yards square or they may cover the entire school grounds and beyond. The water that collects either evaporates, seeps into the ground, or flows downstream. Consequently, these temporary wetlands rarely last through a dry season. Wetlands located on sandy soil, like the Mystic Lake and
surrounding interconnecting valley floors, seep water at a rapid pace, so unless the ground water level is above the surface, most of the water will filter underground.

PROCEDURE:

Give yourself ample time before this activity to review the section on the natural history of the San Jacinto Valley wetlands. This activity does not have set outcomes. Possible outcomes can be anticipated if you are familiar with the background information.

PART I: LIVING COMPONENTS OF A PUDDLE PAD

The object of this outdoor activity is to show how schoolyard puddles can be habitats or parts of habitats for a variety of animals. Students will find and describe evidence of animals that they think live in or near puddles and determine if they are a visitor or a resident animal.

Pre-Site Steps:

Prior to the activity, ask students to note when and where (dirt) puddles begin to form around the school yard. Have them look for the lowest areas on the school yard first.

The San Jacinto Mountains and the remnant hills that dot the floors of the valleys have deposited alluvial soils (sediments that are deposited from the action of water) formed from the same parent rocks. The valleys are flat, have sandy soils, and have a high ground water level that holds standing water for much of the wet winter season.

1. Before class and after a rainstorm, locate a schoolyard dirt puddle, as far away from human traffic as possible. If the field trip has already been scheduled and there has been no rain, then find a low spot on the schoolyard and fill it with a bucket or a hose for at least 3 days before students explore the area. The night before the activity,
baking flour can be sprinkled around the puddle to show animal tracks.

2. Share with students the background information.

3. Divide 30 students into five groups of six. Each group needs to choose:

   a. A "spokesperson" reports the findings to the rest of the class and measures the diameter and depth of the puddle with string and a ruler;

   b. A "recorder" that records the information that everybody agrees to and keeps all the groups records;

   c. Four "scouts." Two of them look for evidence of wildlife first in the puddle's outer area (five feet from and to the puddle's edge); they are called #1 scouts. Two scouts look for evidence of wildlife at the waters edge and in the water; they are called #2 scouts. (If there are more students, add scouts).

4. Give each group a Puddle Pad, Part I worksheet; found at the back of the lesson.

   a. Tell students they will be gathering data about animals that visit or live in the puddle habitat. They will be looking for and recording evidence of wildlife, first at a distance of five feet and then in the water. Then after all group members are satisfied that they have gleaned as much evidence as needed, they will gather into groups to fill in the worksheet.

   b. Students will be looking for: insects, insect eggs, spider webs, feathers, nests, prints, scat, mosquito, salamanders, frogs, toads, water wigglers, burrows, holes,...

   c. Tell them they will be gathering information and
deciding as a group what animal evidence found was from a puddle visitor or an inhabitant.

5. Puddle Pad, Part I, worksheet: Explain the following things to look for while they are filling out their worksheet.

a. Water Source - Potential water sources may be from a sprinkler, a rain storm, high groundwater level, or a hose.

b. Food Source - Potential food sources may be from plants or animals that live in or visit the puddle.

c. Shelter Source - Potential sources of shelter may be found in the water, mud, dirt, or plants of the puddle. Visiting animals' shelters might be difficult to determine, so guess. Each animal or animal evidence found can be researched to confirm or deny students' guesses.

d. Space to Live and Breed - Some animals need the water for only a short time and then they leave, as do mosquitoes. Other animals, like microorganisms and fairy shrimp, spend their entire life-cycle in the short-lived puddle habitat. Visiting animals may use the puddle to obtain part of their habitat needs, but may not use it to nest and raise their young.

e. Measure the diameter of the puddle with string, then, measure the string with the ruler. The ruler can be gently dipped into the puddle, like an oil dipstick in a car, to see where soil sticks to the ruler to determine depth.

f. Visitor or Resident - Visitors may use the puddle for part of their habitat needs while residents are able to find their habitat needs.
On-Site Steps:

1. Before you take the class outside to the chosen puddle, make sure the recorders bring the work sheet, a writing surface, and a few extra pencils. The spokespeople need to bring, string, and a ruler. Describe the boundaries by telling everyone to stop 10 feet from the puddle, form a circle around it, and wait until further directions.

2. Outside, let the first set of scouts encircle the puddle from five feet away. Have them slowly move in toward the outer edge of the puddle while searching for animal evidence. When they are done have the second set of scouts search the edge and contents of the puddle for signs of animal life.

3. Have all spokespeople measure the diameter and depth of the puddle with string and a ruler, after all scouting has been completed.

Post-Site: Evaluation Questions

1. How many animals, if any, were evidenced in the water or around the puddle? (Temporary wetlands residents may be home to organisms such as mosquitoes, salamanders, frogs, toads, fairy shrimp, worms, and microorganisms that must secure food, shelter, and space to reproduce).

2. Was there any algae in the water? (Lasting schoolyard puddles may have a concentration of food sources like algae, and other plant species. This rich food supply makes these puddles an attractive home and a nursery for many animals.)

3. Was there any evidence of people in or around the puddle?

4. How have people influenced this puddle?

5. How many animals were considered visitors and how many residents? (At the Mystic Lake wetlands many animals inhabit the area full-time, while many others only visit
during the wet winter months and leave when the climate gets hotter and dryer.)

6. If the puddle lasted for several days, do you think there would be any changes in the puddle habitat? What? Why or why not?

7. Tell students that in three days they will go out and gather new information about the non-living elements of the puddle habitat. They will again measure the size of the puddle, and infer reasons for changes or no changes.

PART II: NON-LIVING COMPONENTS OF A PUDDLE PAD

The object of Part II is to increase student's appreciation of an ordinary mud puddle by observing the delicate interplay of natural systems needed to form and maintain the puddle for the life forms that depend upon it.

Pre-Site Steps:

1. Three days after the first visit to the puddle visit the puddle again to observe and record the non-living components of the puddle habitat.

2. Share the background information with students.

3. Pass out the "Puddle Pad Worksheet, Part II."

4. Go over the worksheet. (Many things contribute to the formation of wetlands, including soil type, elevation, and water source. The main variable is water.) Variables to observe and record will be:

   a. Air Temperature - Changes in temperature affect animal activity and the amount of oxygen in the water; cooler water can hold more oxygen.

   b. Wind - Wind accelerates the evaporation of water and keeps it cooler.
c. Locating North Without a Compass - There are several ways to find north outside but if all else fails use a compass. One way to find north is to put a stick in the ground at high noon. The shadow that is cast, in the northern hemisphere, will point to the north. Another way is to look for moss on tree trunks and on old buildings. The moss is usually found on the north facing sides.

d. Soil - Sand silt and clay are common minerals in soil. If a wetland forms on clay or other semi-impervious soil, a small amount of water infiltrates the ground. Most of the water will evaporate into the air. At the other extreme is sandy wetland soils. Water moves into the soil quickly, and unless the ground water level is above the surface, most of the water will filter underground.

d. Size and depth of the puddle - Large, deep wetlands have more room for diverse organisms. Wide, shallow wetlands will evaporate more quickly.

e. Have students look for signs of wildlife and record what plants grow in and around the puddle.

f. Tell students their group will be looking for changes in the puddle's environment since the last visit.

On-Site Steps:

1. Make sure each recorder has a copy of the worksheet, a pencil, and the spokesperson has a ruler.

2. Take the students outside to the original puddle. Make sure students do not damage any animal evidences around the puddle before exploration has been completed.
3. Scouts investigate first, as they did before, the recorder records the information relayed to them, and the spokesperson measures the puddle.

4. Have them complete the worksheet as a group.

5. The post-site evaluation can be done outside or inside the classroom.

Post-Site Evaluation:

1. What are the major functions of a plant or animals' habitat? (provides the basic survival needs of water, food, shelter, and space to live and breed).

2. Is the puddle nature-made or human-made?

3. What changes were found in the size and shape of the puddle from the first visit to the second? What caused these changes?

4. Were there any evidences of animals? What? Where were they found?

5. What human influences might affect this puddle, both in a positive and negative manner?

6. What is the water source for the temporary wetlands? (precipitation, groundwater, hose, bucket, sprinklers...).

7. What would you say about the climatic conditions for the continuation of the puddle's life cycle?

8. What could be the consequences to the wildlife that uses this puddle if it were destroyed?

9. What might be the consequences to wildlife and people if the Mystic Lake Wetlands were destroyed? Let the students infer, then tell them they will have the opportunity to learn what the consequences have been in the on-site field trip to the San Jacinto Wildlife Area and Mystic Lake wetlands.
a. Loss of a wildlife stopover and nesting site along the Pacific Flyway for thousands of migratory birds. Over 90% of the wetlands in California have been destroyed by human activities. The consequences of this loss of habitat has been devastating to wildlife. Wetlands serve as spawning grounds for microbes, water creatures, waterfowl, and land wildlife.

b. Loss of flood and erosion control.

c. Loss of a natural water detoxification and purification.

d. Loss of open and green space.

e. Loss of habitat protection and species diversity.

f. Loss of recreational areas for people.

g. Loss of water storage areas.

h. Loss of educational opportunities.
Worksheet: PUDDLE PAD: PART I

Directions: Look for animals and evidences of animals that may use the puddle habitat. Decide, as a group, what the animal is and describe how they might use/not use each habitat resource.

Group:___________ Date:___________ Time:___________

| OUTER AREA OF THE PUDDLE                                                                 |
| Location of Puddle:                                                                    |
| Animal Evidence:                                                                       |
| Where found:                                                                           |
| Animal Name:                                                                           |
| Water Sources:                                                                         |
| Food Sources:                                                                          |
| Shelter Sources:                                                                       |
| Space to Breed:                                                                        |
| Visitor or Resident:                                                                   |
| Diameter:                                                                                |
| Center Depth:                                                                          |
| Notes:                                                                                 |

| INNER AREA OF THE PUDDLE                                                             |
| Animal Evidence:                                                                      |
| Animal Name:                                                                          |
| Water Sources:                                                                        |
| Food Sources:                                                                         |
| Shelter Sources:                                                                      |
| Space to Breed:                                                                       |
| Visitor or Resident:                                                                  |
| Notes:                                                                               |
Worksheet: PUDDLE PAD, PART II

Directions: Fill in the worksheet by describing the Non-living elements of the puddle. Do this as a group.

Group: __________ Date: _______ Time: ______

Circle Your choices: Cold  Moderate  Hot  Wet  Dry

Wind Direction From: North  South  East  West

Sky: Sunny / Cloudy / Clear / Other

Soil Type: Edges; One foot away;

Diameter: Center Depth:

Plants in and by the puddle:

Animals:

Compare and Contrast your two visits to the puddle.

Changes:

No Changes:
ON-SITE LESSON

SENSE OF SITE

SITE: The San Jacinto Wildlife Area and Mystic Lake wetlands.

The San Jacinto Wildlife Area entrance is located at 17050 Davis Road, Lakeview, California. Access to the wildlife area, from the south, is from the Ramona Expressway. Access from the north is off Highway 60 in Moreno Valley at Theodore Street. Travel south along Theodore Street until it curves and becomes Davis Road. Continue south for 3.5 miles of dirt road to the wildlife entrance.

SUMMARY: Students will become acquainted with the Mystic Lake riparian (riverside) wetlands area while on a four-hour field trip to the San Jacinto Wildlife Area. Their field walk will be an easy 2.2 miles of dirt road, sided by a blend of wetlands and hillsides. There are a total of six stations that students will investigate. At Station #6 the school bus will pick up the students. Each station represents a different type of wetland habitat. They will see a mixture of man-made pond and marsh habitats interspersed in a natural riparian wetlands ecosystem.

The on-site activity will be to hunt for animals and evidences of animals. They will also be discussing changes in habitat arrangements of water, food, shelter, and space between the stations.

GRADE LEVEL: 4th through 6th grade. A class size of 30 students is used for this lesson but can be adapted for smaller or larger classes.

DURATION: Four hours on-site, 9:00 am to 1:00 pm, which includes a lunch break and bus pick-up at the last station. The field guide is divided as follows: There is an hour allowed for arrival particulars and a walk to Station #1 and #2; 30 minutes is allotted for Station #2; one hour is given for Stations #3 and #4; a 15 minute walk to Stations
LEARNING OBJECTIVES: Upon completion of this lesson, participants will be able to:

1. Collect animal data using their senses at a local reestablished wetlands area.

2. Develop an understanding that all living and non-living elements of habitats are interdependent.

3. Form a foundation of relevant ecological concepts that supports an understanding of human dependence on habitats.

4. Understand what natural resources are, how they affect people, and how people affect natural resources.

5. Understand that natural wetland habitats are rapidly disappearing due to human actions.

6. Be able to describe the different arrangements of habitat components at each of the field stations.

7. Be able to distinguish between human-built and nature-made habitats.

8. Understand the value of reestablished wetlands.

PROCESS SKILLS USED IN THIS LESSON:

1. Use senses to gather and record data.

2. Communicate orally, pictorially, and in writing.

3. Infer habitat requirements for specific animals and plants.

4. Analyze the needs of plants and animals and recognize how these needs are met.
5. Describe factors that threaten and enhance animal habitats.

6. Compare the differences and the sameness of wetland habitats at the site.

7. Estimate the populations of some wetland animals.

PREPARATION FOR FIELD STUDY:

1. Materials for students:
   a. Backpack.
   b. Location map of the area (Appendix B).
   c. Animal data collection worksheets and clipboard or cardboard held with a rubber band.
   d. Extra pencils.
   e. Appropriate clothing for walking (no open-toe shoes, shorts, or skirts; wear long-sleeved tops and long pants).
   f. Lots of drinking water (none at the site).
   g. Snack and lunch.

2. Materials for Teacher:
   a. Location map of the area (Appendix B), field guide notes, and field guides located on-site.
   b. Extra pencils and worksheets.
   c. Extra water.
   d. Lunch.
   e. Toilet paper.
   f. Plant and animal field guides, maps, and "Self-Guided Auto Tour Guide" located at the wildlife office.

MANAGEMENT SUGGESTIONS:

1. Safety:
   a. Students stay behind the leader on the trail and an aid should be at the end, for safety and stragglers.
b. Keep students in a close group. Do not have them go off the road alone, stay in pairs, and always have everyone in sight at all times.
c. Do not drink or touch pond water.
d. Count students upon arrival to the wildlife area and after each activity.
e. No running or climbing.
f. Do not eat or touch any plants or pick up sticks or rocks on the trail.

2. Hints:
   
a. At each station, walk until about half the members have gone by the station, then step back to the middle so that you can discuss the area where both ends of the group can see and hear you.
b. Be firm about the rules and relax them as time goes on.
c. Keen observation is a skill that can be developed through practice. Look, listen, and learn.
d. Be flexible - if something interesting shows up that is not in your plans, go with the flow and enjoy it.
e. The only restroom at the wildlife area is at the headquarters area. An outhouse is at the last station.

3. Environmental Ethics:
   
a. Stay on the road or trails so the fragile environment is not damaged. (To preserve animal tracks in the dirt, have the students walk in the tire tracks and look to the road sides for prints, scat, burrows, holes, cracks, nests...)
b. Pick up any litter and throw it away later.
c. Stay as quiet and disguised as possible it is a good way to see wildlife and their behavior.
d. Leave the area the same as, or better than found.
BACKGROUND FOR TEACHERS: See the natural history section of the curriculum guide in Chapter III.

BACKGROUND FOR STUDENTS: Have students read the following natural history of the San Jacinto Valley.

NATURAL HISTORY

Water

There are two main seasons in the San Jacinto Valley, cool, rainy winters and hot, dry summers. This climatic type is called Mediterranean, dry-subtropical. About 10-26 inches of rain fall on the valley each year.

The San Jacinto River is the main river that flows through the valley. Dry for most of the year, the river is often flash-flooded during the wet, winter months. The river begins in the southwestern part of the valley and exits the valley in the northwestern wetlands through the Bernasconi Gap, between the Lakeview Mountains and the Bernasconi Hills, onto the Perris Plain.

Some of the water, caught by the westward facing side of the San Jacinto Mountains, seeps into the ground and travels down hill through aquifers (underground river channels). The water resurfaces as springs and artesian wells in the valleys below.

Mystic Lake, a 3,000 acre shallow body of water, is the lowest spot on the San Jacinto Valley floor. It collects and holds the runoff waters from the San Jacinto River and slowly evaporates or seeps it into the ground so that by summer most, if not all, of the water has left the lake.

The original Mystic Lake wetlands was drained and tilled in the 1850s which destroyed the fragile environment. This destruction was due to the agricultural practices of cattle grazing, dairy farms, and crop farming.
Land

High mountains and long valleys are found in and around the San Jacinto Valley. The highest point of the San Jacinto Mountains is Mount San Jacinto at 10,804 feet above sea level (asl). Mount San Jacinto towers more than nine thousand feet above the Mystic Lake wetlands (lowlands), at 1300 feet asl, and is only about twenty-five miles away.

The San Jacinto Valley is circled on the east by the San Jacinto Mountains, on the north by the well-worn San Timoteo Hills, on the west by the Bernasconi Hills where Lake Perris sits, and on the south by the Lakeview Mountains. The valley is about fifteen miles long and eight to ten miles wide. The valley's 35,000 acres are flat, filled with up to fifty feet of soil debris from the surrounding mountains and hills, and the rock under the sandy soil is a hard granite.

The San Jacinto fault, the most active fault in California, runs along both the north and south sides of the valley. The action of the fault has caused sinking of the land for the last 500,000 years. In the last forty or so years the valley began sinking much faster due to removal of groundwater for irrigation purposes. This has caused the land to collapse into some of the underground aquifers which has stopped the flow of some springs and artesian wells.

The many boulder-strewn hills in the valley are part of a sunken mountain range that has eroded (soil that has worn away) to fill the valley with sand and gravel. Most of the valley soil is the same; granites and lava. They were deposited into the valley about eighty to two million years ago or less. The depth of the soil debris is about six feet at the San Jacinto River bed and about fifty feet at the foot of the Lakeview Mountains.

The soil of the Mystic Lake lowlands is alkaline due to the long periods of soil and water deposition during the wet winter months and the slow summer drying which leaves
the salts in the water sitting on the top of the lake bed. At the San Jacinto Wildlife, next to Mystic Lake on the south, the rebuilt and replanted ponds and marshes have developed organic matter from the plants making the soil a darker color because of the decomposition of the plants.

**Life**

There are two main types of plant habitats at the San Jacinto Wildlife Area and Mystic Lake wetlands. The hills in and around the wildlife area are covered with coastal sage scrub and the flat lands are riparian (riverside) wetland vegetation. The plants vary with the changing seasons. During the wet season the wetland meadows have low sparse shrubs, grasses, and herbs that cover the land. In the dry summer most of the plants die or turn brown. The coastal sage scrub, which contains an abundance of different plants and animals, has low, sparse shrubs that have large root systems, which survive the summer droughts. It is considered the most endangered in the nation due to human development. See the "Species of Special Concern at the San Jacinto Wildlife Area and Mystic Lake Wetlands" handout, found at the back of this lesson, for definitions and specie lists of plants and animals.

The Mystic Lake wetlands have at least 240 kinds or species of birds, 38 types of mammals, 32 types of reptiles, and 7 species of amphibians, which have been sited. Millions of migratory birds come to this area on their annual flight from Alaska and Canada to Latin America. Over 90% of the wetlands in California have been drained or built upon which has left few places for these birds to rest, nest, feed, or breed. The wildlife area ponds and marshes are an important habitat for these birds and for other resident and migratory animals.

Since the 1850s, more than fifty-five species of plants and animals that once occupied the wetlands, have become extinct (gone forever). Habitat loss is considered the main factor in this destruction. Habitat loss is usually due to: increased human population and urban development; introduction of exotic species (plants or
animals that came from another area and are not natural to the new area may tend to crowd out the original life forms); commercial exploitation; predator control: global environmental problems; pesticide usage; and pollution.

The San Jacinto Wildlife Area

Wetlands is a collective term that refers to marshes, swamps, bogs, and similar areas, all of which filter and cleanse water, help contain floodwaters, and provide natural habitats for many species of fish, birds and other wildlife. The San Jacinto Wildlife Area has about 8,550 acres of wetlands in the northwestern San Jacinto Valley.

In 1982 the California Department of Fish and Game began buying land in the valley as a partial compensation for the loss of wildlife habitat due to the construction of the State Water Project. From 1986 to the present the California Department of Fish and Game bought, reconstructed, and has maintained the area. They have put in and/or planted ponds, marshes, and part of the San Jacinto River.

Today the wildlife area is quickly recovering the once abundant wintering and resident water bird species. Although the San Jacinto River no longer feeds the wetlands, water donations from the Eastern Municipal Water District and several duck clubs provide adequate amounts of reclaimed water (partially treated waste water) to the area.

The regeneration and protection of natural habitats at the wildlife area came from citizen involvement and public support. This is a necessary first step to motivate politicians to legislate more land in order to reestablish more of California wild and wetlands.

ACTIVITY:

March through May are ideal months to visit the area. Hopefully, a sufficient amount of rain fell on the San Jacinto watershed, bringing an abundant show of wildlife.
In a wet season, wild and showy, spring flowers follow the runoff patterns down the hillsides puddling on the flat wetlands, looking like shimmering pools of captured sunshine.

Before taking your class on a field trip to the wildlife area, visit the wetlands yourself. Become familiar with the field activity Stations #1 through #6. Look at the different habitats, their features and associated wildlife. Go to the office and obtain some maps and field guides for the trip. The "Auto Tour Guide" is not to be taken home. It follows the lesson field guide stations from #1 - #6 and gives a brief statement about each station, it's habitat, and associated wildlife.

Pre-Site Steps:

1. Several days prior to the trip, give students a list of things to bring and wear on the trip and a copy of the "Student Background" to read in groups or with the whole class.

2. Give student's a brief outline of their field trip (see the On-Site Steps of this lesson).

3. Remind students that wetlands are rare and need to be protected. Over 90% of California's wetlands have been destroyed. Their benefits and values are numerous, they are: migration vacations; natural nurseries; havens for rare plants and animals; water purifiers; flood control areas where water is captured, held, and slowly released; and a place to enjoy and see a diversity of wildlife.

4. Go over safety rules and environmental ethics with the class. They need to be respectful visitors.

5. Hand out an example of the worksheet, found in the back of this lesson, "Animals at The San Jacinto Wildlife Area" to go over in class. Tell them they will remain in the groups they were in when they did the pre-site lesson titled, "Puddle Pad" A Big Concept in a Small Pond.
a. All students will be collecting animal data from Stations #3, #4, #5, and #6. They will need at least three animal data sheets.

b. Explain to them that they will be listing and describing as many animals as they see or evidence; they will describe what the animal is or was doing (preening, grooming, eating, flying, walking, and so on); they will attempt to determine what the population of each animal is at the station; and they will list the dominant plants at the station.

6. Hand out an example of the worksheet "Non-Living Habitat Components," found at the back of this lesson, to go over in class.

   a. This worksheet will be filled in by the recorder and determined by group agreement. Students will have about 10 minutes to do this worksheet.

   b. The spokesperson will represent their group at the class discussion that follows completion of the worksheet.

7. Have them be sure to take notice of the changes in the arrangement of habitat requirements of water, food, shelter, and space to rear young. They will be comparing and contrasting the differences and the similarities of wetland habitats.
On-site Steps:

FIELD GUIDE TO THE SAN JACINTO WILDLIFE AREA

DURATION: Four hours on-site, 9:00 am to 1:00 pm, which includes a lunch break and bus pick-up at the last station. The field guide includes: one hour for arrival, walk to Station #1 and Station #2; 30 minutes for Station #2; one hour for Stations #3 and #4; a 15 minute walk to Stations #5 and #6; 30 minutes for lunch; and the remaining time for Station #6.

ENTRANCE:

1. Check gear and water; use restrooms. (There is an outhouse at the last station).
2. Pair students off for safety purposes.
3. Remind them to be quiet and respectful.
4. Stay behind the leader on the road or trail.
5. Keep away from soft dirt to see animal evidences.

STATION #1: OLD SAN JACINTO RIVER AND BUILT POND HABITATS:

This walk goes south along a built pond habitat with the Old San Jacinto River habitat at its southern end. The road curves around and returns to join the main road. This takes about 30 minutes to walk. Have students notice new sounds, smells, and sights. This is a good place for them to notice the interrelationships of the built and natural environments and how they interact with each other. It will be their introduction to collecting animal data. Have them look for tracks, spider webs, cocoons, chewed leaves, scat, nests, burrows, feathers, water wigglers (do not touch the water), listen for bird calls and insect noises, and so on but not fill in their animal data sheets yet.

The Department of Fish and Game planted about 100 native Cottonwoods, Black Willows, and Arroyo Willows in the year 2000 along the historic channel of the San Jacinto River to restore riparian wildlife habitat. Reclaimed water is used to provide the summer water necessary to keep these trees and shrubs alive. This valuable habitat provides the
all-important food, water, shelter, and space for the majority of species using the wildlife area. Most of the time the river has little water, but the reclaimed water allows these trees and shrubs to grow and provide nesting habitat for many birds.

**STATION #2: NATURAL RIPARIAN WETLANDS HABITAT:**

1. At Station #2, by the 1430 feet elevation sign, have students gather together in their groups to fill in the data collection sheet "Non-living Habitat Components." The recorder will write and the group as a whole will decide what the non-living components of the area are and what changes they find in the arrangements of water, food, shelter, and available space to raise a family, between the entrance and Station #2. The spokesperson will relay the groups' findings to the class after about 10 minutes.

2. After filling in the worksheet, have the class form a large semi-circle along the upper base of the hill and face east toward Mount San Jacinto. This location offers an excellent view of three natural habitats that intertwine (riparian, flat wetlands, and coastal sage with "wool sack boulders" on the hillsides).

3. The San Jacinto Valley runs in a southeast-northwest direction and is the result of parallel earthquake faults, which over time caused the depression of the valley. Tell the students that the San Jacinto fault can be seen on both sides of the flat, visible valley, both to the north and the south. It is block of earth that has been sinking for the last 500,000 years and is filled in with alluvial soils.

4. Mount San Jacinto, to the east, is in the background. The San Jacinto River runs from Bautista Canyon by Hemet, through the San Jacinto Valley to the transient Mystic Lake, seen to the north, then travels southwest through the wildlife area and out the Bernasconi Gap to the Perris Plain, it eventually reaches Lake Elsinore to the southwest. The San Timoteo Hills or "Badlands" (bad because they are so weathered and dissected they have little life
that grows on them) are to the north and, on a clear day, Mount San Gorgonio can be seen behind them towering at 11,499 feet asl. The western Bernasconi Hills are home to the Lake Perris Recreation Area.

5. Ask students, what are the three different "natural" wetland habitats that join together on this spot?

The Old San Jacinto River Habitat: Native Cottonwood trees that have heart-shaped leaves and Black and Arroyo Willow trees that have long slender leaves, follow the course of the river. Natural valley grasses and patches of bullrushes grow at the base of these tree-bushes.

Wetland Puddles and Mudflats: In the spring the flat lands are covered with a variety of ground cover, bushes, and bursts of flowers.

Coastal Sage Habitat: Sage brush, flowers, and "wool-sack" boulders dot the hillsides. This is the rare coastal sage habitat.

6. Ask, what changes they saw in habitats from the entrance to this station? (water, food, shelter, and space arrangements).

7. Ask, what is the range of elevation of the 25 mile watercourse between the top of the San Jacinto Mountains, 10,804 ft. above sea level (asl), and where they sit or stand, at 1430 ft. asl? (10,804 - 1340 = a 9,464 foot drop to the valley (Mystic Lake is at 1,300 ft. asl).

8. Where does the water go after collecting in Mystic Lake? (Some seeps into the ground, some evaporates, and some runs into the Old San Jacinto River channel which flows through the wildlife area through the Bernasconi Gap, between the Bernasconi Hills to the west and the Lakeview Mountains to the south (All these features can be seen by the students except the gap area).
9. What did you notice that was a human-built environment? (Created ponds, marshes, and the replanted Old San Jacinto River).

10. Did you see any tracks or evidences of animals? What? Where?

STATIONS #3 AND #4: BUILT MARSH/POND/MARSH HABITATS:

Each student begins their search for as many animals as they can find around the ponds and marshes and then fills in the data collection worksheets "Animals at The San Jacinto Wildlife Area." See how many of the birds illustrated on the "Auto Tour Guide" can be identified. Look especially for Black Phoebes, Avocets, and black-necked Stilts.

STATION #5: MUD FLATS AND SHALLOW WETLANDS HABITAT

There is a half-mile walk between Station #4 and Stations #5 to #6. Along this walk there are an abundance of wetland grasses and birds. Have them notice hawks or eagles searching high above looking for prey, red-winged black birds flying back and forth between grasses, or shorebirds may be feeding or nesting on their way to winter or northern nesting grounds. The smallest birds are Least or Western Sandpipers; middle-sized are Dowitchers and Yellowlegs; and the largest are Curlew, Stilts, and Avocets.

STATION #6: WATER STORAGE AND WILDLIFE VIEWING PLATFORM:

1. Students will have lunch, a discussion circle, and continue their animal hunt.

2. Have students sit for a while on the overlook and enjoy the variety of ducks, grebes, herons, shorebirds, and marsh birds active on the water and around the edge of this constructed wetland. The walk out on the trail to the northwest between the two large ponds could be the highlight of the trip.
3. Form a discussion circle and ask students:

a. What are the dominant plants at each station? Are they the same as the ones found at this station.

Station #1 - Planted built-pond grasses; flat land ground cover; riparian Cottonwood (planted), Willow trees (planted), and large Elderberry bushes.

Station #2 - Natural flat land ground cover; coastal sage hillside; reestablished riparian vegetation.

Stations #3 and #4 - Created pond and marsh Cattail and Bullrush grasses.

Station #5 - Marsh grasses.

Station #6 - Constructed wetlands. Everything seen at all the other habitats, except for the hillside, coastal sage habitat, is also found here, but in greater abundance and in a different arrangement.

b. Are there any plants, animals, or anything else you recognize that is also found at school? What is different? What is the same? Why? (trees; bushes; birds; insects; ground cover; flowers; puddles; water source...).

c. Are there any unusual smells or sounds you noticed walking through the wetlands ecosystem?

d. Do you think any animals noticed our presence? Why or why not?

e. Are there any human actions that are beneficial to this station? Are there any that are harmful? (Beneficial: Created ponds and marshes for habitat regeneration; reclaimed water allows the plants and animals to flourish by providing...
plants needed for nesting habitats for many birds). (Harmful: Polluted storm water runoff that settles in this area; continued land use for cattle, dairy, and crop farming which erodes the top soil and pollutes ground water reserves).

f. Are there any problems or needs you see that could increase the quality of the habitats in the reconstructed wetlands?

g. What is the value of observing nature in person rather than in a book? (Using our senses to learn ecological concepts increases our memory about and interest in natural areas).

h. What would happen to the soil, plants, and animals if this area was cultivated for agriculture? (Habitat loss).
Worksheet:

NON-LIVING HABITAT COMPONENTS

Directions: Do this worksheet as a group. The spokesperson will report findings at the class discussion. The recorder will write in the agreed upon information below.

Group: ___________ Date: ___________ Time: ______

<table>
<thead>
<tr>
<th>Circle Choices:</th>
<th>Cold</th>
<th>Moderate</th>
<th>Hot</th>
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<tbody>
<tr>
<td>Wet</td>
<td></td>
<td>Moist</td>
<td>Dry</td>
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Wind Direction From: N S E W

Evidence:

Sky Conditions: Sunny Cloudy Clear Other

Soil at; River: Flats: Hill:

Plants at; River: Flats: Hill:

HABITAT CHANGES: FROM ENTRANCE TO THIS STATION:

Water:

Food:

Shelter:

Space:

NO HABITAT CHANGES:

Water:

Food:

Shelter:

Space:

Notes:
Worksheet:

ANIMALS AT THE SAN JACINTO WILDLIFE AREA

Directions: List all animals seen, heard, or evidenced. Describe where they were found, what they are or were doing, and what their populations are. Describe or draw on the reverse side of this paper, the dominant plant at each station.

Station: _______________ Group: _____ Date: ____

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<tr>
<th>Animal:</th>
<th>Evidence:</th>
<th>Doing:</th>
<th>Population:</th>
<th>Dominant Plant(s):</th>
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POST-SITE LESSON

ANIMALS OF SPECIAL CONCERN AT THE SAN JACINTO WILDLIFE AREA

Site: Classroom, after a field trip to the wildlife area.

Lesson Summary: Students organize and classify the animal habitat data they collected on the San Jacinto Wildlife Area field trip. They then research an animal species of special concern at the wildlife area to determine why the species is in trouble and what has been done, or needs to be done to help the species recover. The last action project can be chosen from a list that is provided or they can decide on their own course of action.

Grade Level: 4th to 6th grades.

Duration: Three 50 minute classes (1st is evaluation of field trip; 2nd is an animal research project; 3rd is student's choice of action projects.

Learning Objectives: Upon completion of this lesson, students will be able to:

1. Give an example of an animal of special concern at the San Jacinto Wildlife Area.

2. Give examples of how changes in an ecosystem directly or indirectly affect wildlife and plants living there.

3. Understand the relationship of people's actions to threatened and endangered animals.

4. Students will understand what natural resources are, how they affect people, and how people affect natural resources.

5. Develop an understanding that sustaining and rebuilding natural environments is dependent upon responsible human behavior.
6. Apply skills and knowledge to help preserve, protect, sustain, and restore natural environments.

Process Skills:

1. Organize, sequence, and classify collected animal habitat data from the San Jacinto Wildlife Area.

2. Compare different wetland habitats and associated animals.

3. Research an animal of special concern at the San Jacinto Wildlife Area.

4. Analyze the needs of the animal and recognize how these needs are met.

5. Communicate orally, in writing, and pictorially.


7. Apply new knowledge to solve problems.

Materials:

1. For Students:
   a. Index cards
   b. White paper and colored pencils
   c. Construction paper

2. For Teacher: Paper sack

Activity Background:

Every year 27,000 species of plant or animal become extinct. There are between 30,000,000 to 100,000,000 species on Earth (about ten million have been discovered and named). Since 1985, when the extinction rate was 1,000 species per year, the rate of extinction has increased by 2,000 species each year, a rate far exceeding any in the
last 65 million years when the dinosaurs and many of their contemporaries were casualties of a mass meteorite extinction. The enormity of this destruction is staggering. This accelerated rate of extinction is directly linked to the human population explosion. Coral reefs, deserts, estuaries, grasslands, temperate forests, wetlands, and most other types of habitats are disappearing at tremendous rates. Habitat degradation and loss is the primary reason plants and animal species are becoming threatened, endangered, and extinct. The greatest obstacle to helping many endangered species recover is habitat destruction.

All plants and animals depend on their habitats for the basic necessities of water, food, shelter, and living space. The plants and animals in a habitat also depend upon each other and interact in many ways to form a balanced ecosystem. When people clear a forest, fill in a wetland, or construct a house, they not only destroy plant and animal homes, they also upset a system that has taken millennia to build. An ecosystem ("eco" means house in Greek) is the foundation for all life on Earth, including human. All animals need clean and available water, a sustainable and healthy food supply, shelter from the weather and predators, and enough space to live and raise a family.

Most people have a general idea of what endangered, threatened, or extinct species are, but biologists have certain definitions for each. In general, an "endangered" species is one that is in immediate danger of becoming extinct. Its numbers are usually low, and it needs protection to survive. "Threatened" species are those species whose populations are not yet low enough to be in immediate danger of extinction. They face serious problems, though, and are likely to become endangered if the problems affecting them do not stop. "Extinct" species are no longer living.

The vitality of Earth is reflected in the variety (diversity) of its inhabitants. So many species being in trouble is a sign that the planet is not as healthy as it needs to be. The more successful people are at maintaining
or improving the living conditions of as many lifeforms as possible, the better people's chances will be of maintaining or improving the quality of all species, including people.

People cause most habitat loss. Much of wildlife's habitats turn into buildings, farms, roads, lakes, and other types of human development. But this type of development is not the only cause of habitat loss. Grazing animals like cattle, sheep and goats, create another habitat problem -- overgrazing. Overgrazing can quickly turn healthy habitats into wastelands. A lot of land is destroyed or altered in the process of harvesting or mining firewood, lumber, gold, coal, oil, and so on. Illegal trapping, hunting, or poaching of some species of ducks, geese, rabbits, pheasants, deer, and other animals, which are abundant in many parts of the year, may also endanger wildlife populations, especially if a species is already rare.

Most plants and animals are in trouble because of a combination of factors. Introducing non-native, or exotic, species to an area can present a lot of problems for the plants and animals already living there. That is because all newcomers compete with the native plants and animals for water, food, shelter, and space. Most introduced species are not problems in their native lands. It is only when they are introduced into areas where they have no natural enemies that they start to cause trouble. When people use herbicides and pesticides to get rid of pest species, the poisons often harm other species, including certain mammals, insects, fish, and birds. These toxic chemicals, as well as sewage and urban runoff, are continually dumped into many lakes, rivers, and streams, poisoning birds, fish, plants, and other forms of life.

Despite the complex problems that face many vanishing species, there have been many success stories. But efforts to boost a species numbers will not mean much in the future if the habitat of an animal or plant does not exist or if the area is too degraded to support the species. Habitat protection is ultimately the key to saving rare,
threatened, or endangered species. And as habitats shrink more and more species will need all the help they can get. Protecting species through habitat preservation is difficult when original habitats have been severely altered. But habitat restoration may help to reverse the damage that has been done. Habitat restoration projects are rare, difficult, and expensive. Since 1986, the San Jacinto Wildlife Area has planted, built, and managed some of the San Jacinto Valleys' wetlands with the expressed purpose of reestablishing wildlife habitats. Over 5,000 acres of wetlands has been partially recreated. This project was one of the first of its kind for California wetlands.

Once a plant or animal is listed as endangered or threatened, scientists work together to come up with a recovery plan. Because different types of plants and animals have different problems, each species has a unique recovery plan. Once the requirements of certain species is determined recommendations on how to recover them is made. Most recovery plans stress the importance of habitat protection, public education, and strict enforcement of laws.

Procedure:

Pre-Activity: Evaluating Student Understanding of Ecological Concepts

1. Have groups order and categorize the data they took on the field trip. For example:

   a. List how many wings, crawlers, and four-legged Animals were found at each station?

   b. Which type of animal had the largest population? Which station had the largest number of these animals?

   c. What was the dominant plant and animal at each station?

   d. Which stations included a reconstructed wetlands
and which were natural environments?

e. How were the habitat requirements the same for all animals recorded? What were the differences?

2. Compare your school ground environment to that of the wildlife area (climate; soils; hills; grasses; flowers; bushes; trees; animals; and so on). Is your school-yard similar to or different than the reserve? How?

Activity:

1. After discussing the background information, copy each threatened or endangered animal of special concern at the San Jacinto Wildlife Area from the handout "Animals of Special Concern at the San Jacinto Wildlife Area," found at the end of this lesson, on a slip of paper and put the slips into a sack. Have the "spokesperson," of the original groups in the pre-site lesson titled "Puddle Pad: A Big Concept in a Little Pond," pick a threatened or endangered animal out of the sack for their group to research.

2. Explain that each group must try to find out why their animal species is in trouble and what has been done or needs to be done to help the species recover.

3. Each group should determine each job necessary to do the research project. For example, each group should have readers, artists, a spokesperson, writers, and so on. The encyclopedia is a good place to start researching a particular animal and its habitat. Other places to find information might be to call the California Department of Fish and Game, California Endangered species Coordinator, Natural Heritage Division; U.S. Department of fish and Game, Conservation Education Office, in Sacramento; California State Superintendent of Public Instruction about their Endangered Species Project; or the University of California, Riverside.

4. Research Format:

   a. Animal's common and scientific name.
b. Areas it is found in the world.

c. Habitat needs.

d. Why is this animal of special concern at the San Jacinto Wildlife Area?

f. Do a drawing of the threatened or endangered animal. For example, if the animal is a bird, what colors is it, draw its crown, beak, throat, back, body, wings, tail, legs, feet. Label any necessary information, like its size, shape, and so on.

f. Other things students might include in their research: Where it lives / how it moves / reproduction / how it gets food / people's use of it / how it protects itself / migration trails / what preys on it and what it preys on / who it lives with.

g. Have students answer the following questions in a class discussion:

1) What are the consequences of the disappearance of this species?

2) What are the trade offs involved if this animal becomes extinct?


4) What are the principal reasons for endangerment of this animal?

5) What is being done at the San Jacinto Wildlife Area for the endangered animal? At the Community or County, State, National, International, or world wide levels?
6) What can we as individuals do to help the endangered animal and its habitat?

Post Activity:

1. When the groups have finished their research activity, have them take out their drawing of their animal and frame it with a piece of construction paper.

2. Then have them, on three separate index cards, a) write the common and scientific name of their "animal of special concern" in large letters; b) list three reasons their animal is in trouble; c) and list three things that have been done to help their animal recover. Different group members need to write the lists so there is a variety of handwriting on the index cards. Have them keep a copy of their lists.

3. Hang the pictures up on the wall and put the index cards in a sack. Have three people from each group choose a card without looking at it. When all groups have three cards, place the card under the animal picture where they think it belongs. Do this until all cards have a place under one of the animal pictures.

4. Have students gather into their groups to decide whether or not the cards match the appropriate picture. If they do not match, what is out of place? Have each group rearrange their animal cards to fit under their animal picture. When they are done have all groups copy the correct information.

5. Ask students: (Have them keep a copy of the answers)

   a. What are the most common steps people have taken to help undo the damage done to wetland wildlife and their habitats in California? (Habitat restoration)

   b. What steps can we take to help restore wildlife habitats? Have them brainstorm what they can do to help the recovery of the threatened or endangered animals they researched. Then have
the class choose the best course of action. For example:

1) They could have a re-cycling campaign to fund the an enhancement project at school or in the community like: planting a natural habitat; building a small wetland pond, growing an Indian garden of corn, beans, and squash; getting and caring for plants that grow butterfly's or other beneficial insects.

2) They could participate in a community service project by calling the San Jacinto wildlife Area and volunteering to plant trees when needed, or have a campaign to enlarge the San Jacinto Wildlife Area by alerting their community to the importance of wetlands for people, wildlife, and the future.

3) The class could vote to choose one of the animals of special concern for continued research. Or they could adopt the whole wetlands and research any problems and issues, and then decide upon solutions they could effectuate. Several visits back to the wildlife area might motivate students.

\[\text{c. What are the historical, recreational, or commercial values of this area?}\]

\[\text{d. what positive or negative consequences of each cultures actions on their habitat resources were there? Write their answers and discuss.}\]

\[\text{e. What is the value of observing nature in person versus reading a book to learn? (Using our senses to learn ecological concepts increases our memory and interest in natural areas).}\]

\[\text{g. What would happen to the soil, plants, and animals if this area was cultivated for agriculture? (Habitat loss).}\]
Teacher Worksheet:

**HUMAN HABITATS IN THE SAN JACINTO VALLEY**

Directions: Read the background on the human history of the San Jacinto Valley. Then fill in this chart with a brief word that describes how each culture used the areas' natural resources for their habitat needs. On the back of this paper, list the positive and negative consequences of each cultures influence on the environment.

<table>
<thead>
<tr>
<th>Name: Native American (20,000 B.C. - today)</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Water Sources: Springs and creeks</td>
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<td>Food Sources: Hunting and gathering; gardens</td>
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<td>Shelter Types: Tule huts</td>
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<td>Space Used: San Jacinto Valley and Mts. And S. J. town</td>
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<tr>
<th>Name: Spanish (1769 to today)</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Water Sources: Springs; creek and river irrigation</td>
<td></td>
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<tr>
<td>Food Sources: Livestock; small gardens</td>
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<tr>
<td>Shelter Types: Mission stations</td>
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<td>Space Used: San Jacinto Valley around San Jacinto town</td>
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<tr>
<th>Name: Mexican (1823 to today)</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Water Sources: Springs, creek and river irrigation</td>
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<tr>
<td>Food Sources: Livestock and large crops; imports</td>
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<td>Shelter Types: Hacienda</td>
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<td>Space Used: Flat land of the San Jacinto Valley</td>
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<th>Name: American (1886 to today)</th>
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<tbody>
<tr>
<td>Water Sources: Springs; wells; irrigation</td>
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<tr>
<td>Food Sources: Crops; livestock; poultry; imports</td>
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<td>Shelter Types: Town houses; farms; ranch house</td>
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<td>Space Used: South-eastern valley near Hemet</td>
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SPECIES OF SPECIAL CONCERN AT THE
MYSTIC LAKE WETLANDS

When a plant or animal species is facing conditions that could cause it to become extinct, it needs to be protected from further decline. An official listing of "threatened" or "endangered" provides some protection from governmental agencies. It also provides protection for their habitats and projects to increase their territory.

THREATENED - A species is "threatened" when it is rare and is likely to become an endangered species in the foreseeable future if special protection and management efforts are not taken.

ENDANGERED - A species is "endangered" when it faces possible extinction throughout all, or a large part of its' territory. The main causes of endangerment are habitat loss, encroachment from exotic species (natural to a different location), pesticide poisoning, and pollution. Other threats include change of habitat, exploitation, predation, competition, or disease.

EXTINCT - Extinct means to no longer exist.

PLANTS:
THREATENED: Spreading Navarritia.
ENDANGERED: San Jacinto Valley Crown Scale Salt Bush (Atriplex coronata, var. notatior); Threadleaf Brodiaea (Brodia filifolia); Mountain Clover (Chara druis montanus).

ANIMALS:
THREATENED or ENDANGERED: Brown Pelican; Swainson's Hawk; Sandhill Crane; Northern Flicker; Least Bell's Vireo; Willow Flycatcher.
ENDANGERED: Bald Eagle (Haliaeetus leucocephalus); American Peregrine Falcon (Falco Peregrinus); Stephen's Kangaroo Rat (Dipodomys stephensi).
REFERENCES


Steinhart, P. (1990). California's wild heritage: Threatened and endangered animals in the golden state. California Department of Fish and Game, California Academy of Sciences, and Sierra Club
Books.


