HIGH DESERT NATURE STUDY

A project submitted in partial satisfaction of
the requirements for the degree of Master
of Arts in

Secondary Education

by

Michael George Hanlon

August, 1980
The Project of Michael George Hanlon is approved:

James B. Cunningham

Charles H. Heimler

Barnabas B. Hughes, O. F. M.

California State University, Northridge
Acknowledgements

If there is any greater expression of joy than having successfully completed a project, it is knowing that the project is a usable entity and the participants have benefited from the experience. I feel fortunate that this project has been quite helpful to my students and the Antelope Valley in general.

I would like to thank my mother, Mrs. Helen Hanlon, who gave the inspiration to begin this undertaking and see it to completion.

I would like to thank Mr. Harold Bly for his critiques of the rough drafts and suggestions for improvement.

I wish to express my special thanks to my students who helped to field test the curriculum materials, made the presentations, produce the collections and made this project work. They were both the purpose behind this project and its harshest evaluators.

I am greatly indebted to my wife, Sandra Hanlon, who served as typist, sounding board, critic and friend. Without her tireless efforts this project would never reached completion.
## Table of Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>ii</td>
</tr>
<tr>
<td>Abstract</td>
<td>vi</td>
</tr>
<tr>
<td>Chapter I  Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Problem</td>
<td>1</td>
</tr>
<tr>
<td>Statement</td>
<td>2</td>
</tr>
<tr>
<td>Purpose</td>
<td>8</td>
</tr>
<tr>
<td>Background</td>
<td>16</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>19</td>
</tr>
<tr>
<td>Implementation</td>
<td>20</td>
</tr>
<tr>
<td>Chapter II  Review of Related Literature</td>
<td>23</td>
</tr>
<tr>
<td>Introduction</td>
<td>23</td>
</tr>
<tr>
<td>Outdoor Education</td>
<td>24</td>
</tr>
<tr>
<td>Nature Study</td>
<td>27</td>
</tr>
<tr>
<td>Environmental Education</td>
<td>32</td>
</tr>
<tr>
<td>Museums</td>
<td>36</td>
</tr>
<tr>
<td>Student Tutoring</td>
<td>50</td>
</tr>
<tr>
<td>Volunteer Training Programs</td>
<td>52</td>
</tr>
<tr>
<td>Chapter III  The Project</td>
<td>58</td>
</tr>
<tr>
<td>Development of the Project to Date</td>
<td>61</td>
</tr>
<tr>
<td>Curriculum Materials Developed</td>
<td>75</td>
</tr>
<tr>
<td>Mini-museum</td>
<td>78</td>
</tr>
<tr>
<td>Chapter IV  Evaluation of Project</td>
<td>83</td>
</tr>
<tr>
<td>Introduction</td>
<td>83</td>
</tr>
<tr>
<td>Student Presentation</td>
<td>83</td>
</tr>
<tr>
<td>Letter</td>
<td>Title</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>K</td>
<td>Mammal Monograph List</td>
</tr>
<tr>
<td>L</td>
<td>Black-Tailed Hare (jackrabbit) Monograph</td>
</tr>
<tr>
<td>M</td>
<td>Beechy Ground Squirrel Monograph</td>
</tr>
<tr>
<td>N</td>
<td>Bird Monograph List</td>
</tr>
<tr>
<td>O</td>
<td>Mountain Quail Monograph</td>
</tr>
<tr>
<td>P</td>
<td>Roadrunner Monograph</td>
</tr>
<tr>
<td>Q</td>
<td>Reptile and Amphibian Monograph List</td>
</tr>
<tr>
<td>R</td>
<td>Desert Horned Lizard Monograph</td>
</tr>
<tr>
<td>S</td>
<td>Mojave Rattlesnake Monograph</td>
</tr>
<tr>
<td>T</td>
<td>Insect Monograph List</td>
</tr>
<tr>
<td>U</td>
<td>Dragonfly Monograph</td>
</tr>
<tr>
<td>V</td>
<td>Giant Water Bug Monograph</td>
</tr>
<tr>
<td>W</td>
<td>Plant Monograph List</td>
</tr>
<tr>
<td>X</td>
<td>Desert Manzanita Monograph</td>
</tr>
<tr>
<td>Z</td>
<td>Photographs of Student Presentors and Museum Collections</td>
</tr>
</tbody>
</table>

Chapter IV

<table>
<thead>
<tr>
<th>Letter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Table 1 Presentation Figures</td>
<td>150</td>
</tr>
<tr>
<td>BB</td>
<td>Table 2 Summary of Evaluations of Presentations</td>
<td>151</td>
</tr>
<tr>
<td>CC</td>
<td>Summary of Thank-You Notes</td>
<td>153</td>
</tr>
<tr>
<td>DD</td>
<td>A Typical Thank-You Note</td>
<td>154</td>
</tr>
<tr>
<td>EE</td>
<td>An Elementary Teacher Letter of Appreciation</td>
<td>155</td>
</tr>
<tr>
<td>FF</td>
<td>An Elementary Principal's Letter of Appreciation to Palmdale High School's Principal - Mr. Robert Owens</td>
<td>156</td>
</tr>
</tbody>
</table>
ABSTRACT

HIGH DESERT NATURE STUDY PROJECT

by

Michael George Hanlon

Master of Arts in

Secondary Education

The Antelope Valley has long needed a nature study center to serve as a focal point for the development of curriculum in environmental education, conservation and outdoor education. This center serves to train high school students in the presentation of natural history topics to elementary grades and civic organizations. The center has also produced curriculum materials, houses permanent biological collections and serves as the organizational body for field trips, guest speakers and special programs.

Justification for this project comes from a variety of sources that include references from the Antelope Valley Conservation and Environmental Education Council, California State Education Code, Los Angeles County Course
of Study, Antelope Valley Union High School District Educational Master Plan and interviews with effected elementary and secondary teachers.

Background literature for this project considered the role and history of outdoor education, nature study, environmental education, conservation education and museums. Further analysis was made of the effectiveness of peer teaching, volunteer aides and docent programs as cited from current literature.

The project developed student museum-skills, field training program, student nature study presentations, museum collections, field trips, loan services, wildlife monographs, and a miniature museum.

An evaluation of the project's effectiveness as indicated by the development of nine topics, presented ninety-two times to a total audience of 4,090, was diagnosed favorably by the written critiques of the observing elementary teachers. Additionally, nineteen collections were prepared, loan specimen made available to schools, slide programs produced and the incorporation of various new museum preparation techniques included in the project.

The future of the project, although threatened by loss of revenue and administrative support, is expanding outside the realm of the high school district with the proposed inclusion in the development of a interpretative nature center for the City of Palmdale.
Chapter 1

High Desert Nature Study Project

Introduction

Problem

Antelope Valley has long needed a nature study center to serve as a basis for curriculum development in the area of outdoor and environmental education. At the present time, there is no collective or specific program of instruction in these content areas, whether organized at the school, district or area levels. In previous years, summer school provided the opportunity to offer special enrichment courses in these subjects but the passage of Proposition 13 has ended these programs for the foreseeable future.

For many years, native biological materials were collected. Monies were spent purchasing collecting apparatus and display facilities. Instructors began to properly use the teaching potential incorporated with these collections. The reduction in funds has meant that these collections, equipment, and the methodology developed are going unused. Additionally, there is no articulation in subject matter between high school and elementary districts. If instruction in the areas of environmental or outdoor education is ongoing in the schools there is no attempt to share the sources or materials. In summary, the schools of the Antelope
Valley exist in one of California's matchlessly diverse natural environments without an environmental or outdoor education program and as yet no attempt has been made to share what has been developed.

This project is a review of geographical, biological, social and economic factors pertinent to the development of a nature study center and its attendant services in the Antelope Valley. The project consisted of an analysis of these factors in relation to the establishment of the center and its services. The project proposes recommendations for the organization and operation of the center in cooperation with local schools and civic organizations. The project also includes an analysis of the first year experimental period with teacher and student input.

Statement

Demographic data. The Antelope Valley is an unique area that draws on desert, chaparral, foothill canyons and forested high country for its distinctive natural beauty. The North Los Angeles County General Plan (1975) describes the Antelope Valley as:

This Valley is a high desert basin (2,500 feet above sea level) embracing approximately 700 square miles of the extreme southwestern portion of the Mojave Desert. It is triangular in shape and is bounded on the north by the Soledad Mountains. (p. 1-1)
The Antelope Valley has been described as an Upper Sonoran life zone due to its dry climate. It has an annual rainfall 8.87 inches with a prevailing southwest wind having a mean hourly speed of 12-15 miles per hour (See Appendix A, Table 1 for precise climatic data). These winds tend to lessen summer heat but intensify cold temperature of the winter. Santa Ana climatic conditions are common in the Fall and Spring seasons. Snow usually falls once a year with abnormal temperatures occasionally reaching 10° F. All of these weather factors combine to make the Antelope Valley an area with varied recreational possibilities.

In terms of governmental organization, the Antelope Valley comprises approximately 1,947 square miles of northeastern Los Angeles County and the southwestern portion of Kern County. The major residential centers are Lancaster, Palmdale, Quartz Hill, Rosamond, Littlerock, Sun Village, and Pearblossom; all of these communities except Lancaster and Palmdale, are unincorporated. The 1970 census established the Antelope Valley population at 83,540 with the estimated 1980 population of 107,540. At present the two major population centers are Lancaster with 60,000 and Palmdale with 30,000 people, as determined by the Palmdale and Lancaster Chambers of Commerce (1979) (See Appendix B - Table 2 for current population figures and breakdowns). Aircraft manufacturing, real estate,
government services, agriculture and light commerce make up the employment resources that currently employ 40,141. (See Appendix C - Table 3 for employment figures by industry).

The ethnic breakdown of the Antelope Valley was described by Antelope Valley College (1976) in their Application for Reaffirmation of Accreditation, 1976. As:

The ethnic composition of Antelope Valley is predominately white. Based on 1970 census statistics, the white population constituted 96 per cent, including Spanish-Americans which was 8 per cent of that total. Blacks represented 3 per cent of the other 1 per cent. (p. 31)

Antelope Valley Schools. Antelope Valley is served by 19 elementary schools, 9 private elementary schools, 4 public high schools, 3 private high schools, and 1 community college. The forecasted enrollment for 1979 indicates that 19,834 students will attend public elementary schools in nine districts, 7,052 students will attend high school in the one high school district, 6300 college students will attend the community college and 1100 will participate in adult education programs. Private schools account for an enrollment of 2,102 students.

Public Involvement in Environmental Education. Several civic groups and governmental agencies have begun participation in environmental and outdoor education activities. They provide resource materials, speakers,
organizational talent and backing to school districts upon request. In addition, there are specific groups who are working to formulate workable units for dissemination to the schools.

The Antelope Valley Conservation and Environmental Education Council (AVCEEC) is a collection of several local, county, state and federal groups dedicated to the formulation of projects and literature for use throughout the Antelope Valley. The stated purposes of the AVCEEC (1977) are:

To support and conduct activities that relate to conservation and environmental education concerns of: OUR WATER--OUR WILDLIFE--OUR PEOPLE.

Developing an awareness for conservation and environmental education in the Antelope Valley area.

Acquiring and disseminating accurate information and materials on conservation and environmental education for use in the Antelope Valley Schools and other community organizations.

Encouraging, sponsoring, conducting and participating in workshops and other meetings concerned with conservation and environmental education in the Valley.

Support of federal, state and county agencies and school district programs in planning, developing and implementing conservation and environmental education activities.

Studying and promoting legislation related to conservation and environmental education.

The AVCEEC members represent: ten school districts, Los Angeles County Forester and Fire Warden, Los Angeles
County Parks and Recreation, Los Angeles County Office of the Superintendent of Schools, California Department of Parks and Recreation, the United States Forest Service, United States Department of Agriculture-Soil Conservation Service, Lancaster Women's Club, Quartz Hill Beautiful, Wildflower Preservation Committee and the Sierra Club.

Since the AVCEEC began in 1968, they have sponsored several conservation project competitions between elementary grades and directed wildflower interpretations walks.

The AVCEEC has distributed wildlife packets to Antelope Valley schools and has made three attempts at developing an environmental education master plan for the Valley through use of license plate funds from the State. Their application's purpose statement has directed this project's development. The AVCEEC (1978) states:

This project proposes to develop an articulated plan for the school districts and community groups in the area. This a unique undertaking as to date there is no program like it available for curriculum offering (within Los Angeles County). (p. 1)

Past projects have included the publication of the Antelope Valley Wildflower Guide and a collection of literature and materials called the North County Environmental Study Field Packet. Their present endeavors included revising the pamphlet Wildlife of the Antelope Valley to book form. They intend to develop a field trip guide of the Antelope Valley indicating the environmentally
important locations.

The United States Forest Service has served the Antelope Valley for the last decade as a major source of speakers, agricultural and youth forestry projects, and a provider of literature. In more recent years they have sponsored weekend workshops for educators entitled, "Investigating Your Environment." This program was developed around a series of field investigations which can be directly implemented into existing curriculum at any grade level. These investigations consist of written problems dealing with the forest, chaparral, desert, soils, water quality, animal habitats and map and compass. Details of these investigations will be discussed in another portion of this project.

The High Desert Chapter of the Sierra Club has provided many guided outdoor hikes, tours and outings for the populace of the Antelope Valley. They have also provided literature and support for the schools and are being actively sought for future programs and help.

Environmental and Outdoor Education in Antelope Valley Schools. The major focus of environmental education has been on the community college level. Course offerings provide more than eight classes relating to environmental education in four different departments. Enrollment, however, is confined to post-high school students. Three of the comprehensive high schools have
offered courses during summer sessions dealing with the field training and methodology of either the biological or physical sciences. These were terminated in the summer of 1978 due to a lack of funds. Elementary students generally are exposed to environmental education on the junior high level as the result of the two semester requirement of science.

Some individual instructors make a valiant effort to give their students outdoor environmental experiences but the numbers of these opportunities began dwindling in the school year 1978-79. Grades kindergarten through sixth were surveyed revealing that six out of the twelve schools felt they had little or no background to put together an environmental education program. The saddest indictment of the Antelope Valley schools is that little to no communication of ideas takes place among these schools. This is true both laterally among schools within the same district as well as vertically from elementary to secondary to community college. Personal discussions with elementary, secondary and college teachers about the proposed nature study curriculum met with their unanimous approval and encouragement.

Purpose

The initial goal of this project was to provide a nature study program for high school students,
emphasizing methods of collection, preparation and display. These students then, will serve as student interns in the junior and elementary classrooms making presentations on topics of their choosing. As this program progressed, the need for a permanent work area arose. This led to the establishment of a mini-museum on the Palmdale High School campus. Future plans developed from the museum and student intern program include a loan service of student produced collections and the dissemination of wildlife monographs for use in elementary classrooms. The mini-museum is scheduled to serve as a meeting room for clubs, and civic organizations. It will serve as the organizational body for field trips, seminars and special speakers. Therefore, the High Desert Nature Study Project will serve to provide environmentally-based nature study to both secondary and elementary students while accumulating permanent displays and collections for public view and use.

Importance of the project. The rationale for this project comes directly from a variety of sources including the California State Education Code, the AVCEEC guidelines, comments from selected teacher groups, and the Antelope Valley Union High School District Master Plan 1976-81.

The basic impetus for this project comes directly from the State Education Code. In Chapter Three, Article
I - General Provisions - Section 51202, (1978) the code states (sections of passages are underlined for emphasis.)

The adopted course of study shall provide instruction at the appropriate elementary and secondary grade levels and subject areas in personal and public safety and accident prevention; fire prevention; the protection and conservation of resources, including the necessity for the protection of our environment; and health, including the effects of alcohol, narcotics, drugs, and tobacco upon the human body. (p. 5)

This general indication is further elaborated upon in Article 2 - Course of Study for Grades 1-6 - Sections 51210 and 51211; the entire text may be found in Appendix D. In Article 3 - Courses of Study of Grades 7-12, the exact same language is used to reiterate the need for environmental education in the secondary curriculum. Section 51220 (b); is verbatim of Section 51210 (c); as is Section 51220 (d) of Section 51210 (e); and Section 51221 of Section 51211. Additional Education Code sections that relate to conservation education are found in the Appendix E. Incorporating this direction from the State Education Code, The Course of Study for Grades Kindergarten through Twelve - 1979 to 1981 was developed by California State Steering Committee for Curriculum and Instruction (1979). The document includes a specific section dealing with environmental education. Its five goals set the stage for curriculum development on the local level;
Goal 1.0: NATURAL BEAUTY - RESPECT FOR LIFE - to develop an appreciation of natural beauty and aesthetically pleasing surroundings and a reverence for all forms of life.

Goal 2.0: ECOLOGY - RESOURCE MANAGEMENT - to develop an understanding of basic ecology and the use of technology in activities for the management of renewable and nonrenewable resources (e.g., planning for the use of land, producing and conserving energy, controlling pollution, protecting wildlife.)

Goal 3.0: VALUES - SOCIAL MECHANISMS - to understand how values, ethics, and morality form the basis upon which environmental and resource use decisions are made and the role that social institutions play in providing the mechanisms through which these decisions are implemented.

Goal 4.0: PERSONAL LIFE - STYLE - to develop a personal life-style which supports the environmental rights of others and contributes to the maintenance of a healthy and productive physical environment.

Goal 5.0: ENVIRONMENTAL PROBLEM SOLVING - to develop the ability to create viable solutions to environmental problems and to work independently or cooperatively to implement them. (p. 54-58)

These two documents provide the overall administrative direction to organize an environmental education program, they may not be fully incorporated in many district curriculums. The educators of the State of California have recognized that this subject area has been neglected in the past and the subject area needs to be rectified. Therefore it is felt that the direction stated in these documents should serve as the guide for the development of this project.
The Antelope Valley Conservation and Environmental Education Council (1978) has discussed similar types of project for several years. As they stated in their Needs Statement for California License Plate Funds of their Environmental Education Grant Program 1978 - 79:

For some time the school districts and their attendant consultant services have had a need for a comprehensive environmental education plan for the Antelope Valley area. (p. 1)

Specifically referring to the education of student interns for use in the elementary and secondary programs the AVCEEC (1976) made the following comment:

One suggestion was that the council, in cooperation with other groups in the Valley could train specialists from colleges and high schools to serve schools in the area. (p. 2)

In the past four years the Council has worked with Los Angeles County Department of Parks and Recreation on the establishment of an interpretative nature center in the Antelope Valley known as Rawley Duntley Park. Recently the County has deeded the park to the City of Lancaster; which the Lancaster Planning Commission determined its use would be better utilized for soccer fields and picnic areas. The AVCEEC's support statement can be interpreted as support for this curriculum project. The AVCEEC (1975) state:

We encourage further development of a plan to provide cooperative human resource service at this Antelope Valley outdoor interpretive center for all school and community groups. (p. 2)
During the October, 1979 meeting of the AVCEEC, this project was presented, materials demonstrated and 1978-79 evaluation statistics discussed. The Council gave their support to the High Desert Nature Study Project and volunteered supplemental information and advisory help. The results of this aid may be found in the later part of this chapter in the background section.

In the development and implementation of this project, teachers from three school districts were sampled concerning their needs in the area of environmental education. Most of the elementary instructors felt they did not have sufficient background to construct materials in this area. They welcomed any opportunity to add to their fund of science programs. The topics most sought after included teacher in-services, classroom materials, presentations, follow-up guides, slide programs and field experiments. Following these initial discussions, the student intern program was begun. Six schools actively participated in the project in 1978-79, with three other schools requesting presentations or materials for the school year 1979-80.

A final needs analysis was undertaken upon completion of the intern presentations. Additional needs included display materials, live animals, teaching collections, field activities with student interns, and curriculum guides to the Antelope Valley. The
overwhelming response of the schools who participated was to continue the student intern program, expand project capabilities, and better utilize developed materials throughout the year.

In 1976 an accreditation team recommended that laboratory experimentation be incorporated into freshmen level science classes at Palmdale High School. In addition, inadequate space had caused safety problems and improper display of much of the biological collections. As the student intern program began to take shape it became evident that a permanent facility was needed to work up display plants and animals. These conditions mentioned in the accreditation report, gave the project its rationale for requesting additional space from administration with the understanding that the area would be used as a museum work area. More detailed discussion will be covered under the heading of implementation.

In 1974, the Antelope Valley Union High School District made an assessed needs survey as part of the progression toward their Master Plan for 1976-1981. The sample audience of 800 parents discussed a series of topics; the results were: (1976)

The statement of need clustered around twelve major areas of concern and are listed with the total number of points received by each cluster: Subject Matter (737), Student Attitude (603), Educational Practices (401), School Operation (390), Guidance (195), Parent-Teacher Attitudes (178), Discipline
The District Master Plan contains direct suggestions made by parents, published in a summarized manner. Topics that deal directly or indirectly with this project can be found under the headings of Subject Matter, Student Attitudes, School Operation, and Articulation. The complete text of these comments are found in Appendix F. Finally, the Antelope Valley Union High School District selected the Rise Commission Report to mirror their own philosophy on education for the future of the Antelope Valley. They included a summary of the Commission's remarks to emphasize the direction the district (1976) wanted to take:

The Commission's recommendations aim at equipping each of these learners with the knowledge, skills, attitudes and values required for responsible and rewarding life in modern society.

The recommendations seek to free learning and teaching from the constraints of time, place and age. They attempt to breach the real and imaginary wall that tend to make intermediate and secondary schools isolated islands for adolescents. (p. 78)

In summation, the rationale for this project results from the directives of many different sources. The State Education Code states that environmental education should be taught in the schools and the Course of Study for Kindergarten through Twelve 1979-1981 as used by fifty
of fifty-two California counties, provides the basic framework for its implementation. The Antelope Valley Conservation and Environmental Education Council has given direct support for this project by specifically calling attention to similar ideas they have supported in the past. Administrators and teachers indicate their professional needs include environmental education programs and they willingly commit themselves to participate. Finally, the Antelope Valley Union High School District has indicated in their Educational Master Plan for 1976-1981 that the general needs of the District's students will be met by this type of project. They are willing to devote facilities and time so that the project has the opportunity to progress.

Background

The conceptual framework for this project comes from the work of Leon Hunter of the Barstow Unified School District. He is well-known throughout San Bernardino County for his excellent desert-oriented science program. In 1968 he obtained a grant from ESEA Title III and built a 1,000 foot Desert Research Station on 120 acres leased from the Bureau of Land Management. The facility is located north of Hinkley, California and provides instruction for students in grades five through twelve from twenty schools. The Desert Research
Station (1968) has been built around a major goal:

To provide an opportunity for students to discover and use the 'processes' of science through the selection of and environmental problem and the formation of an experimental design that will provide data which may be used to support or reject the student's hypotheses (p. 2)

The Desert Research Station has developed an indoor laboratory, a small observation pond, study sectors of 10 acres each and numerous research topics to pose problems to students exploring and working at the Station. It provides the maximum available exposure to all variables of the desert ecosystem with the only limits placed upon the student are his imagination and time. Special summer programs for interested high school students provide long term investigations. Many students have gone on to receive awards in regional, state and national science fair competition. This facility represents the ultimate in an outdoor environmental education program. The only limitation that applies to the Desert Research Station is that it tends to be limited only to science classes as determined by district philosophy and decisions. Funding poses a problem to districts wishing to adopt this program in an era of low budgets.

The National Audubon Society has suggested for the past three decades detailed plans for community nature centers. Three major centers exist in Los Angeles County; Placerita Canyon in the Saugus-Newhall area, Eaton Canyon
above Pasadena, and the Whittier Narrows site. All three have taken their direction from Audubon guidelines that combine research with nature study and outdoor experiences. They further provide community groups with access to special collections, meeting areas, and a volunteer Lecturer service. These Los Angeles County facilities are in keeping with the Audubon philosophy (1962) to which this project is also aimed:

Most important, an outdoor nature center provides an effective learning situation where experiences are direct and people can learn by doing and working. At a nature center, the out-of-doors is real. It is replete with excitement, exploration and adventure. It is filled with wonderful work opportunities for youngsters. Moreover, learning is rapid and easy because the learner is stimulated and has fun. (p. 13)

The student intern program began with requests in 1974 and 1975 for high school students to help with summer school elementary environmental education programs. Many of the materials developed in the Palmdale High School Field Biology course were used to provide for these requests. The presentations proven beneficial for the high school students, elementary classes and the instructors involved. In addition, the use of student aides for general and lower reading level science classes has shown that peer instruction is often better received than the traditional lecture, discussion and laboratory approach. These observations lead to the formulation
of student intern portion of the project.

Definitions of Terms

The following terms have special significance to this project:

1. Ecology--the scientific study of the interrelationships of plants and animals to their physical environment.

2. Ecosystem--all living things and their environment within a given area of any size; all are linked together by energy and nutrient flow.

3. Environmental Education--Hammerman (1973) is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality. (p. 3)

4. Habitat--the native environment of an animal or plant, or the kind of place that is natural for an animal or plant.

5. Nature Center--National Audubon Society (1965) is a natural outdoor area. Usually these include an educational or interpretive building with appropriate displays and teaching aids, nature and conservation education trails, managed pools, lakes or streams, plantations, demonstrations of soil and water conservation, wildlife food plantings, observation towers, habitat study areas and other educational features. (p. 4)

6. Outdoor Education--Lewis (1975) is a direct simple method of learning that extends the curriculum to the out-of-doors for the purpose of learning. It is based upon the discovery approach
to learning and it appeals to the use of the senses; audio, visual, taste, touch, and smell for observation and perception. (p. 6)

7. Student Intern—a student, usually in high school, who provides help, guidance and information in nature study to younger students and civic organizations.

Implementation

The High Desert Nature Study Project has two major goals; the immediate objective was the development of the mini-museum and the lecture-demonstrations the student interns used in elementary classrooms. The second objective is to develop the project's community service functions to provide for field experimentation, guided field trips and community nature study awareness activities. All future developments are contingent on further funding and commitments of time by volunteers and students. A description of future programs are detailed in Chapter Four.

In June 1979, approval was given by the administrative staff of Palmdale High School for the conversion of a former textbook depository into a miniature natural history museum. In this facility are to be housed the displayed and biological collections, apparatus, and preparation equipment. Curriculum materials, teaching collections and taxidermic displays will also be prepared at this location. At present the Palmdale High
School Science Club members are the only students actively engaged in completing the Center's setup. As mentioned previously, elementary districts provided the suggestions for materials to be developed at the Center. They will serve as the target audience for future programs. The AVCEEC has endorsed and indicated they would support, any proposal for funding, provide speakers or provide technical assistance.

In the spring semester of 1979, advanced students in the Invertebrate Zoology course at Palmdale High School volunteered to make presentations of their choice to the elementary grades. Thus the student intern program was begun. It will be broadened to include student-directed field study experiments and a wider variety of natural history programs to be presented throughout the year. This portion of the project is eagerly being awaited by local instructors and now only requires the training of a new staff of student interns. To date the major drawbacks have been in the areas of funds and transportation. Both of these challenges have been met by the cooperative efforts of the instructors involved in the project. Any further expansion of this portion of the project will require some form of outside sources of transportation and funding.

Future plans for the project call for completion of a loan service agreement between schools for teaching
collections, live specimens, slide programs and field trips. If enthusiasm can be generated on the total high school district level, the possibility of the three high schools serving all of the elementary and civic organizations in the Antelope Valley could become a reality.

At the present the project is limited to the elementary districts that directly contribute students to Palmdale High School. Future funds may be derived from California State License Plate funds or ESEA Title IV C. Whatever course this project takes will require the active involvement of community organizations if it is to succeed.

The Antelope Valley Conservation and Environmental Education Council has pledged their time and assistance to make the entire project a workable entity for all Valley youngsters. The past acceptance indicates that the project should have little difficulty expanding throughout the Antelope Valley.
This project has its roots in several national educational trends interwoven into the fabric of American history, i.e., outdoor education, nature study, environmental education and the museum movement. In a simplistic sense, all are involved with the interpretation of natural phenomena at different levels. Outdoor education has come to emphasize camping and its associated outdoor skills; nature study deals with the life cycles and surroundings of various species; environmental education focuses on the interrelationships between organisms and their environment, and museums collectively display specimen as habitat groups or collections. Preliminarily, it becomes necessary to investigate each area—its history and present state to effectively analyze its contribution to this project.

Introduction. Outdoor education, nature study and environmental education all have their beginnings in the pioneer tradition of the United States. Newcomers to America were required to carve out a livelihood from the land they found. This required a direct and clear understanding of natural phenomena, animal and plant life cycles and a reliance upon oneself, to survive. The frontier tradition of "roughing it" became a part
of our national philosophy. Even following the development of major cities and urbanization, one could look to the West to start anew with only one's wits between him and disaster. During these formative periods, Americans had a close relationship with nature without the need for a formalized curriculum to make it part of the course of study. In mid-nineteenth century, education was moving from the home to the one-room school house. The industrial revolution saw the development of massive schools of several rooms and with increasing subject matter. The industrialization also saw the exodus from an agricultural way of life to that of urban factory work. Parents began to realize their children were missing out on a part of their life that had been so important in the maturation of the adults and that was a working knowledge of nature and a oneness with it.

Outdoor Education

Outdoor education can trace its origins to Joseph Cogswell and the Round Hill School of Northampton, Massachusetts from 1823 to 1834. Here boys enjoyed hiking and camping activities while instruction in mineralogy and botany were also accomplished. Later school camps included the Gunnery camp established by Fredrick Gunn in 1849 in Washington, Connecticut, which continued well into the mid-twentieth century. It emphasized hiking,
camping and the study of nature. Dr. Joseph Rothrock is credited with establishing the first private camp, the North Mountain School of Physical Culture, which professed the curative properties of life in the cleanliness of the out-of-doors. The first church camp was begun by Rev. George Hinckley in 1880 on Garner's Island, Wakefield, Rhode Island. Organized camping took two general lines of development: the private camp and the organizational camps. Both capitalized on the images of folk heros such as Davy Crockett, Kit Carson, Daniel Boone and countless others. Private camps tended to sycophanize the rich and develop toward their fancies. Organizational camps tended to be aimed at the lower income groups. Organizations such as the Boy Scouts, Girl Scouts, YMCA and the YWCA sought to get as many youngsters into the out-of-doors as possible.

In education, the two major forces that gave impetus to outdoor education were the impact of industrialization and the changing views on the nature of learning. In 1917, the Educational Policies Commission expounded their famous seven cardinal objectives; of these, the mention of health and wise use of leisure time provided important beginnings for outdoor education. Statistics on the number of rejections for lack of fitness of entering males to the military during World War I raised the national concern over health and physical education.
The result was state-mandated programs for physical education.

The Progressive Era in Education stimulated by the "Eight Year Study" saw the increased role of schools in wider curriculum offerings emphasizing citizenship, community living and family living.

The greatest progress in outdoor education came after the first World War. Donald and William Hammerman (1973) cite the forces and eras of process that has shaped Outdoor Education:

During the developmental years of outdoor education three programs emerged as dominant influences. These were L. B. Sharp's National Camp and Life Camp operations; the Battle Creek program at Clear Lake, Michigan; and the Tyler Texas Outdoor Laboratory.

Three basic developmental periods characterized the growth of outdoor education in the United States. These were the Period of Inception (1930-1939), the Period of Experimentation (1940-1952), and the Period of Standardization (1953 - ). (p. 55)

The Period of Inception came about at a time when schools were attempting to educate the "whole child" and camping became the ideal method for expanding these functions of the schools. The Period of Experimentation saw educators using outdoor experiences to enrich the curriculum. The Period of Standardization saw the establishment of finite guidelines, and acceptance of camping as essential to the basic curriculum. During this last timeframe, school camping changed from mere outings to
resident outdoor activities with formalized facilities. Programs went from a summertime extra to an accepted part of the yearly instruction curriculum. It further encompassed many aspects of the classroom subject matter enhanced by pre-camp orientation and post-camp follow-up to unify the experience for the student. California, Minnesota, New Jersey, and New York have emerged as leaders in the outdoor education field with the establishment of their own state associations. Several organizations have influenced the direction of outdoor education. According to Hammerman (1973), the founding of these groups were by:

The late L. B. Sharp founded the Outdoor Education Association, Inc., in 1951. The American Association for Health, Physical Education, and Recreation established the Outdoor Education Project under the direction of Julian Smith in 1955. The Outdoor Education and Camping Council of AAHPER was formed in 1965. In the West, the Association for Environmental and Outdoor Education was incorporated in 1954. (p. 56-57)

Thus, outdoor education has become an integral part of today's general education programs, limited only by funding.

**Nature Study**

Nature study entered the curriculum when the philosophy of object teaching began during the mid-1800's. Object teaching was based on the concept that the nature of things could be taught by fully using the five senses
to interpret objects. Louis Agassiz further emphasized object teaching by requiring teacher trainees to study living specimen in the wild rather than from texts. Toward this end, he established the first biological field school on Penikese Island in Massachusetts. Wilbur Jackman, working at the Cook County Normal School, fostered the study of nature study through two books, *Nature Study* and *Nature Study for Grammar Grades*. Liberty Hyde Bailey at Cornell developed horticulture from a craft to an applied science. He emerged as a leader of the nature study program at Cornell along with Anna Comstock, when that institution was called upon to investigate the problems of the agricultural depression of 1891-93. Many rural residents were migrating to urban centers, partly as the result of problems in crop production. The Cornell Nature Study program was essentially an agricultural movement. It was based on the premise that influencing rural youth through an awareness of nature would be the first step in educating the public to curb New York's agricultural problems. The first experiments were conducted at schools in Westchester County under the direction of L. H. Bailey. The program was so successful that the State of New York appropriated funds to continue and expand methodology. The project consisted of establishing junior naturalists clubs, with 30,000 students involved during peak years. The major organ of
communication became the "Rural School Leaflet," a simple set of experiences with the objects of nature. Later the bulk of these leaflets were incorporated into the "Home Nature Study Course" actively used from 1903-1911.

The other project that gained wide acceptance was the junior gardeners program that involved over 25,000 students, planting crop materials throughout local communities. E. Lawrence Palmer reiterated the need to continue the principles of nature study long after it had been "discredited" by the elementary science education community.

Nature study was interpreted by many authors to represent a variety of aesthetic and cultural experiences as well as the study of nature. Vessel (1963) describes nature study as: "In general, the aim of nature study was to open the pupil's mind by direct observation to a knowledge of and love for the common things in his environment" (p. 8). The publishers of Comstock's book, Handbook of Nature Study described the governing themes of nature study as:

The kernel of that method of treatment (nature study) is the study of the organism in its environment, its relation to the world about it, and the feature which enables it to function in its surroundings. This study takes the individual organism, rather than an abstract phylum or genus, as the point of departure. (p. vii)

Many proponents espoused a thorough-going philosophy
of life premised on nature rather than considering nature study as mere scientific investigation. They often fanatically incorporated tenets that bordered on a form of religious doctrine.

Following World War I, education saw a trend toward instruction in practical concepts. Subject selection focused on the life of man and the making of a living. Many educators called for articulation in subject matter by prescribing curriculum to specific grade levels. Gerald Craig developed a newer approach to elementary science curriculum that excluded nature study. His study was based on children's reactions to basic science questions enabled him to devise specific science objectives to be included in each grade level. The National Society for the Study of Education, (1932) in their Thirty-First Yearbook, elaborated a number of objections to the use of nature study in the elementary grades. Typical comments described nature study as teaching only isolated facts rather than principles of science, teaching things of a biological nature for the sole purpose of bringing students closer to religion, and that nature study was mental discipline only. Further criticism centered on the dearth of physical science topics, in nature study philosophy, the unscientific treatment of natural phenomena, and the absence of pattern or sequence to topics presented from year to year. Although nature
study diminished in its importance and influence in elementary science after the 1920's, scholars like E. Lawrence Palmer attempted to keep it a part of the curriculum through his writings and influence upon teacher training institutions. He accomplished some integration of nature study into conservation education and the newer elementary science programs of study.

Advocates of nature study admitted it had not accomplished its mission due to a lack of teacher interest, they claimed. Anna Comstock (1961) discussed the shortcomings of programs as:

These difficulties are chiefly three-fold: The teacher does not know what there is to see in studying a planet or animal; she knows little of the literature that might help her; and because she knows so little of the subject, she has no interest in giving a lesson about it. (p. xi)

Critics had further emphasized that there was a lack of articulation and integration between elementary and secondary grades. Secondary science education had developed around a four-subject curriculum: general science, biology, chemistry and physics. Many biologists felt that nature study was an insufficient basis for the future study of biology, hence it should be eliminated in the grammar schools.

Nature study, broadly viewed, was the predecessor of ecology. It has many practical uses in the curriculum of the 1980's. At a time when Man is destroying environ-
ments with a variety of pollutants, nature study can describe the cumulative effects of solid, liquid and gaseous wastes on wildlife. Further it can demonstrate the interrelatedness of organisms by investigation of their life cycles. Since many elementary teachers still lack depth in their scientific background, nature study can provide basic instruction on local habitats without requiring further college training or in-service workshops. Nature study gives the student insight into his physical living environment. Proper instruction can illustrate why wise conservation of wildlife and restrictions on the public are necessary to ensure the survival of wildland and its inhabitants.

Environmental Education

Environmental education is the newest of the contributing fields to the project developed and implemented by this author. It has its roots in the conservation movement in the United States dating back to 1832. Some factors that led to an increase in public concern over the state of the environment were the increasing population, urbanization and industrialization. Men such as Gifford Pinchot, Jay N. Darling, Robert Johnson and John Muir led the fight to better supervise our wildlands and better regulate resources. Their efforts saw the development of the White House Conference on Conservation,
the National Conservation Commission, and the North American Conservation Conference. This conservation movement carried through the Progressive era making the public aware of the plight of the natural wildernesses which were yet virtually unspoiled.

The 1930's and 1940's saw the establishment of the United States Soil Conservation Service, the Tennessee Valley Authority, and the Civilian Conservation Corps. These agencies were necessitated by problems stemming from man's lack of appreciation and knowledge of nature. Authors such as Aldo Leopold, Hugh Bennett, and Robert Marshall helped to keep alive the conservation movement and integrate conservation education into the curriculum.

Environmental education became an outgrowth of the biological science field of ecology. The goal was investigating the interrelationships between plants and animals and their physical environment. The student protest movement of the 1960's sought to challenge the established mores and norms. Environmental problems such as air and water pollution, pesticides and overpopulation became major focal points illustrated graphically by authors such as Rachel Carson, Stewart Udall, Paul Ehrlick and Fairfield Osborn. Ecology took on new meanings as it began to serve as a movement to investigate and expose any and all threats to the environment. Some advocates seemed to use rather extremists means in their solution
to problems. The end result was the incorporation of environment, the creation of the Environmental Protection Agency and the beginning of a national awareness of the fragile nature of the environment. In California in 1968, the Miller Bill was passed which first required the instruction of environmental education in the schools. In 1970, the passage of the Environmental Education Act provided federal funds to support elementary and secondary courses in environmental education. It also resulted in the establishment of the Office of Environmental Education within the U. S. Office of Education. The Alliance for Environmental Education was founded in 1972 under the leadership of the Conservation Education Association. Among the 28 member organization of the Alliance, there are such diverse groups as the National Wildlife Federation, League of Women Voters, American Forest Institute, National Education Association, National Science Teachers Association, American Federation of Teachers and the National Association of Conservation. Out of the alliance for Environmental Education proceedings, many national and regional organizations developed to direct and evaluate the progress of environmental education in the nation's school. The first evaluative conference was held in Snowmass, Colorado, in July, 1975 to discuss the level of
development that environmental education had reached and pinpoint areas in need of change. The result was a document, *Environmental Education: Perspectives and Prospectives-Key Findings and Major Recommendations*, which covered a wide spectrum of government, labor, industry, education and business. It pointed to problems with definitive solutions and made recommendations for the future. One outcome of this conference and other organizational deliberations are described by the State Steering Committee on Curriculum and Instruction (1979). They define environmental education as:

> An environmental education program is concerned with aesthetics, values, and morality in relation to helping students understand and respect their interdependence with a finite and limited ecosystem. (p. 52)

The State Steering Committee further define what types of objectives should be accomplished as a result of participation in environmental education:

> An environmental education program is future oriented. It is designed to give students firsthand, practical learning experiences in making observations, gathering data, and solving problems in relation to environmental-resource management. (p. 52)

Finally, environmental education draws from many subject areas and should unify them in a common bond. The State Steering Committee for Curriculum and Instruction (1979) states: "An environmental education program is infused into a number of curriculum areas including science,
social sciences, and the practical arts" (p. 52).

Julian Smith (1972) discussed the relationship that exists between outdoor education, nature study and environmental education. He states:

Terms such as outdoor education, recreation, environmental education, and conservation education have common characteristics and are interrelated. None of them can be regarded as disciplines, and the identity of the terms is dependent upon the setting of the activities involved, the grouping of the experiences, and their applications. (p. 27)

Julian Smith (Hammerman 1973) went on to state that these curriculum areas were important because they satisfied the general goals of education such as:

Self-realization, human relationships, and civic responsibility are readily discernible in outdoor education, with specific implications for a command of the fundamental processes - health, citizenship, worthy use of leisure time, vocation and ethical character. (p. 37)

Finally, Julian Smith (Hammerman 1973) indicated that subject matter was best taught in the field, but that no one concept area had exclusive control over effective use of the wilderness. He states: "No single department, subject matter, field of individual interest has a corner on the outdoors" (p. 37).

Museums

In developing a nature center of any size one needs to look at the role of museums, their development, their changes in philosophy and their impact on education.
Even the smallest facility will use current museum methodology and classification techniques in the display of materials. The *Encyclopedia Britannica* (1966) defines a museum as: "places in which collections of objects are exhibited for their particular interest (p. 1037)".

The term museum comes from the Greek word "museion" - meaning a place for learning, imagination and inspiration. The Greeks, in Athens, placed at least one collection of pictures that could be actively viewed by the public.

In the evolution of the museum the emphasis shifted from public viewed arrays to private collections of "things" - art objects, rocks, plants, stuffed animals, souvenirs of European explorers' travels and religious icons. From the classical Greeks to the Renaissance, collections remained out of public view in private homes or church storage areas. Italian families of the Renaissance often displayed their collections to friends and acquaintances as a source of prestige and inspiration. During the French Revolution the idea that the public should be allowed to view these collection became prevalent. This idea set in motion an attempt to organize and categorize materials that had been so long stored away from public observation.

In the United States, Williams (1973) indicates that the first attempt at collecting materials was sanctioned by the Charleston Library Society in 1773. In
1785, Charles Willson Peals used part of his home to display materials but later moved the collection to Philosophical Hall. Avid groups began to form to develop public access to the vast materials coming from exploration in the West. These included the Academy of Natural Science in Philadelphia, Maryland Academy of Sciences and the State Cabinet of Natural History in Albany, New York. The California Academy of Sciences began in San Francisco in 1853, amidst the wild nature of the West and in 1891 a building to house the Academy was dedicated. Several individuals were instrumental in developing America's museum system and present technology. Dr. Louis Agassiz established the Gray Museum of Comparative Anatomy at Harvard and stimulated an era of enthusiasm in the study of natural history. Albert Brickmore established the American Museum of Natural History in New York in 1869, now the world's largest museum. James Smithson donated monies to the U. S. Government according to Williams (1973), to organize "an establishment that would help spread knowledge among men" (p. 13). Congress finally formed the Smithsonian Institution in 1846 which now contains eight different subdivisions. Carl Akeley, while working for the Field Museum of Natural History in Chicago, was the first to create habitat groups. He further perfected mounting techniques for large mammals, and a wax leaf method of making scientifically-accurate
leaves.

During the 1930's the main emphasis of museums shifted from merely collecting specimen from around the world to one of research with the materials that were at hand. Since the 1950's, museums have begun to devote more attention to the need of the general community rather than to the scientific community. In the 1973 edition of the *Official Museum Directory* over 6,000 museums are listed in the U. S. and Canada with an estimated increase of 330 museums per year for the past five years. Modern museums might be best classified in the following categories: Art galleries, historical, cultural, natural history and science and industry museums. Since natural history is the theme of the author's project, investigation of this type of museum yields the most pertinent data. The philosophy of the modern museum attempts to explain nature as it is. Natural history museums concentrate on geology, botany, anthropology and zoology as their primary responsibilities. The administration of most natural history museums have come to place education of the public as their primary purpose. There has been a shift from concentration on nature study to visualizing man's problems and technology. The public is interested in complex problems and their possible solutions. Typical specialized subdivisions of natural history museums are universities museums, trailside
displays and children's museums. Typical examples of modern programs include professionally guided tours, museum stores, classroom programs, cafeteria facilities, mobile programs, branch museums, taped and video programs and scientific staffs to help in identification of materials. Most funding for museums comes from private sources such as trust funds, gifts, endowements, real estate, stock and bonds and other fund-raising activities. Public funding accounts for only about a third of the funding for all museums, usually in the form of grants for research or education.

Two major educational aims of museums can be used as measuring devices of their effectiveness. The first states that each museum must develop an appropriate program to serve the particular community it supports. Second, its educational efforts must be directed toward students and adults. The following narrative paragraphs provides specific examples of natural history museums and discussions of their effectiveness based upon these two criteria.

The San Bernardino County Museum, founded in 1952 in Bloomington, California; is now housed in a new facility just outside Redlands, Ca., along Interstate Highway 10. Within its facilities are collections of mammals, birds, reptiles, minerals, fossils, Native American artifacts and items of ethnology. The museum had branches
in Barstow, Needles, Lucrene Valley, and the mountain community of Rock Camp. The major emphasis has been on historical materials dealing with San Bernardino, the archeology of early man and Indian cultures and some wildlife of the County. A major priority has been placed upon the two archeological digs at Calico (outside Barstow) and Rock Camp (near Lake Arrowhead). The museum professed purpose is maintainence of the history of San Bernardino County and the displays foster this purpose. There is no educational program other than guided tours for school children with printed materials available to indicate the important locations to be observed. In personal discussions with museum volunteers it was established that there are no mobile programs and given the remote nature of the museum to area schools, the museum is less than effective as an educational device for the instruction of students. Discussions further revealed that funding by Sna Bernardino County does not place educational services as a high priority.

The Living Desert State Park in Carlsbad, New Mexico, is a noble attempt to combine three components of a zoo, botanical garden and propagation house in the display of native Chihuahuan desert. Open in June, 1971, through state and federal funding of nearly two million dollars, it is now owned by the State of New Mexico and operated by the City of Carlsbad. The zoo consists of an aviary,
underground burrows exhibit, bear and prairie dog exhibits, reptile house, duck pond, hooved animal exhibit with a combined total of over 50 native animals from either the Chihuahuan desert or North America proper. The botanical garden emphasizes native desert plants but also displays desert plants of Arizona, California, Colorado and Utah. The propagation house serve as a market for saleable flora as well as housing unique specimen from the U. S., Mexico, Bolivia, Madagascar, and South Africa. The stated purpose of the Living Desert State Park (1979) is to "preserve a representation of the Chihuahuan desert and to provide an entertaining and educational experience for visitors of all ages" (p. 3). The museum's philosophy demonstrates an ecological direction concerning the park, that are no animals caught to be exhibited there; animals are admitted to the Park as the result of injury or illness and, if they recuperate sufficiently, are released in a wild area. The only animals that are retained are those that cannot survive in their natural habitat. Living Desert State Park is truly a museum in that it bolsters its outdoor wildlife interpretation with extensive indoor displays. It's educational efforts are restricted to on-site tours, published guide materials and plant propagation literature. Interviews by the author with museum personnel indicate that educational programs for
local school districts are hampered by the seasonal deliberations of the State of New Mexico legislature and or the Carlsbad City Council. The Living Desert State Park does make an effective effort, though, at educating with the on-site materials available and are quite effective as an information source to visiting tourists.

The Nature Centers of Los Angeles County are located at Placerita Canyon near Saugus, Eaton Canyon Park near Pasadena, and the Whittier Narrows near South El Monte. Each facility consists of a museum and wildlife park with materials and guided walks unique to that particular area. As an example, the Placerita Canyon facility exemplifies activities at these centers. Guided and self-guided nature trails include Walker Ranch, Hillside trail to Rocky Point Overlook, the Heritage trail, the Ecology Trail, and the Juniors trail (for children 3-6). All materials are organized with an intense ecological background and the field trip is the main educational experience. As Los Angeles County Parks and Recreation (1979) states in their Field Trip Information Brouchure:

The field trip you are requesting is an ecologically oriented lecture and walk through a museum and wildlife park. It will be lead by experienced field biologists of the Los Angeles County Nature Centers. The major purpose of the field trip, aside from the aesthetic appreciation, is to develop a simple understanding of some of the inter-relationships of plants and animals and their environment using the ecosystem concept. (p. 2)
Toward this end the Nature Centers make pre-visit and follow-up materials a requirement for utilization of the area. The length of the trip is from 1-1½ hours with the program primarily aimed at 4th, 5th and 6th grades. Personal observation of this program indicates that these Nature Centers do an effective job of communicating their objective and offer a wide range of experiences to other levels of the educational community than those mentioned. Unfortunately, the center's programs are limited to ecological materials. Further, due to reduced funding, there are no community programs or school visitations. The Los Angeles County Nature Centers provide a basic nature study area for the general public.

Additionally, the Los Angeles County Museum of Natural History at Exposition Park provides a wide variety of programs and visual materials throughout the spectrum of Natural History. The museum provides loan collections, gifted student training sessions, weekend presentations and special science group meeting facilities. Tour registration requirements parallel that of the Nature Centers. The Museum provides materials to the schools and supplemental information for teachers. Again, the Museum is limited by County funding and the requirement of on-site use of facilities.

The Living Desert Reserve (LDR) in Palm Desert, California, interprets the Colorado Desert on its 900
acre site. Begun in 1953, it now includes two major exhibit buildings, six miles of nature trails, a walk-through avairy, botanical gardens, a developmental center, a gift shop, Indian artifacts and a model of an Indian Camp. It also includes an animal first-aid center and a large wash with a flood plain study area. The Reserve began with the long-term lease of flood control acreage from the Coachella Valley Water District, the Bureau of Land Management and City of Indian Wells having added acreage through the years. The Living Desert Reserve is a privately endowed organization that relies on fees from members, contributions, and fund-raising activities to keep the museum functioning. The botanical gardens, like the Living Desert State Park, are structured to exemplify the major desert habitats of North America. The floodplain and adjacent Palm Canyon are utilized for research and field trips to study indigenous wildlife. Two miles further into the foothills is Deep Canyon, site of the University of California's Phillip L. Boyd Deep Canyon Research Center where major topics include study of the desert big horn sheep and behavior and physiology of typical desert animals. The Reserve (1979) is dedicated to:

The preservation and interpretation of the native plants and animals of the Colorado Desert, with emphasis on education for the general public, particularly school children. (p. 13)
Thousands of children are admitted yearly. Tours are self-guided, with some under the direction of the Curator of Education. Classes and field trips entice the public to become members and supporters. Research programs provide a scientific aspect to round out its usefulness to the community. Inspection of the grounds indicates that private funds accomplish as much or more for a museum facility as can taxpayer's monies. Education is a firm commitment of the Reserve and a number of field guides, brochures and interpretive manuals are available. There is no program during the summer months permitting new exhibit preparation. In the Living Desert Reserve's "Project Outreach" volunteers take specialized programs into the surrounding school classrooms to describe the nature of the Colorado desert environments. The Living Desert Reserve is an effective organ of expression of the complexities of the desert and completion is not likely to be completed for decades to come.

The most provocative and modern facility to interpret desert wildlife is the Arizona-Sonora Desert Museum (ASDM) in Tucson, Arizona. It is a blend of natural history museum, zoo, aquarium, botanical garden and earth science display center. Its new approach to museum layout, has been chronicled in Sports Illustrated, American Education, and Exxon USA. The vast museum includes an orientation room, small animal room, Water Street USA, small cat
canyons, lizard enclosures, walk-in aviary, aquariums, earth science center, demonstration desert garden, large animal exhibits, interpretative ramada, miscellaneous exhibits and administrative offices and services. The museum according to Sports Illustrated (1975) ranks in the top ten in the U. S. and one of seven museums worldwide that the British Broadcasting Company filmed for English viewing. The exhibits are well-displayed with sufficient information and technical assistance to make the tour interesting.

The Arizona-Sonora Desert Museum is financed by private membership fees, gate receipts and endowment funds. Initially funded by Arthur Pack, cofounder and first president, the Museum remains free of financial restrictions and fluctuations of state or federal funding. Discussions with administrative staff indicate a sense of freedom of expression and program development. Educational pursuits are the main priority, albeit, with no formal connection of any school district, university or educational organization. Merit not mandate dictates acceptance and inclusion of new museum sections.

William H. Carr, the other cofounder of the Museum drafted the guiding theme of the Arizona-Sonora Desert Museum. Carr's philosophy is included in Stocker's (1977) article where Carr states:

We are using outdoor conservation education
as a means for helping man to recognize and assume his responsibilities toward nature in order to gain some hope of assuring his future. The time to do this is right now--before man succeeds in totally defiling his habitat and making it unlivable. (p. 7)

Stocker (1977) further provides the stated purpose of the museum as:

Learn the larger story of the Sonoran Desert and come to respect the environment and to see that aridity does not mean that desert life is lacking in richness. (p. 7)

The greatest contribution that these extensive facilities provide is the free educational opportunity available to the public. As former director Holt Bodinson in Stocker's (1977) article put it: "First and foremost the museum is an educational institution" (p. 7).

In an effort to educate the school-age public, over 30,000 students come to the Museum annually without charge. Two well equipped vans containing animals, slides, video equipment, assorted animal skulls and two lectures take the museums programs to the area's schools. The ASDM have initiated an exchange program with Hermosillo and Guaymas, Mexico, hoping to someday set up a sister museum there. Other museum educational programs include an extensive teacher training program, two week summer school programs for high school students that include excursion throughout the state of Arizona and a special evening lecture series. There is an overt
attempt to educate the public on the roles nature's creatures perform, and to make the public ecologically aware in an effort to dispel ignorance about the desert. The major premise is acceptance of the desert and its life as it is. This museum lives up to the two goals mentioned earlier in this section better than any other establishment visited by the author. Carla McClain, the communications officer of the ASDM summed up the benefit to society and the community, in Stocker (1977) when she declared the end result of the museum's effect should be:

> We want to help along a generation of environmentally aware children. We particularly hope they'll know and revere their land and identify with it. (p. 11)

The previous section illustrates the variety of presentations and materials available throughout the Southwest and in Los Angeles County. It is apparent upon comparison that private institutions may solicit monies more freely than public facilities. The underlying fear of the appearance of commercialism may restrict the state or federally funded operation from completely developing the facility. Although the Arizona-Sonora Desert Museum stands out as the ultimate in providing well-rounded educational services, those museums with less developed programs are making effective use of their facilities and can document effective gains in the
education of the public. It is a sad commentary that the Mojave Desert seems to be the only American desert that lacks some form of interpretive institution to educate the public to the interrelationships of its flora and fauna.

**Student Tutoring**

On Investigating the role of student interns as a part of American education, one finds support in the peer teaching/tutoring concept utilized in various curriculum fields. Additionally, more field-oriented programs are utilizing nonprofessionals to guide students and provide interpretative opportunities otherwise not available due to costs. The programs for docents of several museums and aforementioned institutions indicate the high level of instruction and quality of presentation available by volunteers.

In tutoring, cross-age tutor - tutee programs provide an effective teaching tool while providing direct benefits to the student, tutor and teacher. Nancy Mavrogenes and Nancy Galen (1979) extoll the advantages of tutoring:

Those tutored are provided with immediate feedback in a one-to-one relation; thus, they learn more and also realize a sense of worth from identifying with older model figures. The tutors themselves form a common bond of cooperation with the teachers; they learn while preparing lessons and so acquire a sense of responsibility, concern for others
and improved self-image, and a more positive attitude toward school.

Teachers, likewise profit. They are provided with more time for developing the curriculum, they can cover more material, and they can devote their efforts to the most troublesome areas that need their extended attention. (pp. 17)

Cross-age tutoring has been used by exceptional students in upper grades to help the younger students scholastically. Jimmy Lindsey and Elaine Watts (1979) discuss the values of tutoring to both the tutor and tutee. Their major rationale indicated several reasons for placing exceptional students in tutor roles. First, a mastery of cognitive, affective and psychomotor skills should have occurred and further reinforcement can be gained when the learner is required to teach what he has learned. Children with learning difficulties tend to have behavioral problems to mask their feelings of inadequacy. When these children are serving as tutors they are required to be responsible for their peer's learning and must interact to accomplish the learning activity. In so doing the tutor tends to develop feelings of belonging, self-worth, accomplishment and emotional maturity. Younger students experiencing difficulties with the subject matter need individualized instruction and tend to learn more from older students they admire. The exceptional students need the admiration they receive; it tends to sharpen their skills and abilities. Tutoring
further tends to strengthen the bonds between teachers and tutors and promotes a spirit of cooperation and friendship within the school setting. Although the aforementioned behavior changes have been ascribed to exceptional students one can assume the same benefits are also true for other students who become involved in tutoring. Arlene Silberman (1979) states the major block to wide use of peer teaching or tutoring is the teacher. Silberman perceives that teachers are threatened by students who know as much about the subject as they; often teachers see themselves as the sole source of all knowledge to be gained by their students. She determined that these feelings keep teachers from using peer teaching in the classroom.

Volunteer Training Programs

In many communities, volunteers, parents and interested college students fill the need for a trained individual to guide young people through an outdoor education setting or series of experiments. Two categories of volunteers arise based upon the type of organization and training these aides receive. Field aides and volunteers tend to have a short introductory training period and usually instruct single-concept lessons or are utilized in small settings. Some volunteers are part of an experimental situation. Docents in comparison,
are volunteers that complete an intensive training program, take an exam and make a commitment of time to the institution.

Marian Kurner (1979) describes a program in which parents and horticulture students serve as guides for a nature trail system in Murietta, Ohio. It was the parents that organized the program initially, sold it to the superintendent, prepared lesson plans and information sheets and worked with teachers to make the nature center workable. By utilizing volunteers, the parents keep the program on a shoestring budget with the major cost being that of transportation. The four year old program has seen over 4,800 students, parents and teachers participate.

In Frances Kelsey's (1974) ecology program, the volunteers, mostly mothers, senior citizens and college students are trained as field aides. Formal training comes from Dartmouth Faculty, volunteers with specialized knowledge, and group in-service training sessions. The field sides commit time and are utilized in a variety of outdoor education projects in the elementary schools. High School classes spend time in the field with emphasis on ecological relationships. Teachers team-train with the field aides to plan and evaluate the program, coordinate efforts, and settle differences. The Hanover Conservation Council supervises the training and
coordination. The program has been quite successful.

The use of high school students as biology resource people for lower grade levels is described by Ken Highfill (1975). An area adjacent to the Lawrence High School campus, Kansas has been set aside as a study area for all grade levels. It was fenced and surrounded with a plant buffer zone prior to the release of native mammals. Biology students who made themselves knowledgeable about the animals, their behavior, and the area, serve as field instructors for pre-visit orientations, during the encounter and in follow-up exercises. The program has been so successful that all grades have participated, as well as Educationally Mentally Retarded and Emotionally Handicapped classes.

In comparison to volunteer field aides and students, the training and utilization of docents tends to be a more formalized undertaking. As the Living Desert Reserve Docent Council Information Sheet (1979) describes, a docent refers to many things:

The word "docent" comes from the latin "docere", meaning to teach, instruct, conduct. The word is widely used in museums, zoos, nature centers and historical buildings all over the world to mean trained volunteer guide. (p. 1)

The docent program at any institution offers a pledge to the general public of keeping the institutions' commitment to ongoing educational services. Trained
docents can be effective bridges between the public and the institution providing direct and indirect forms of feedback and evaluation of services and programs. In surveying four programs there were several common characteristics. In all cases the educational program that the prospective docents receive tends to be comprehensive and requires more than a casual devotion of time and energy. Most curricula are taught by institution staff with a specific lecture topic schedule, final examination, required reading and a requirement to attend further training sessions as they are available. To serve as tour guides and school aides, docent trainees must lead at least two walks critiqued by a supervisor. Upon completion of the training course docents are required to keep current membership in the institution's docent council or auxiliary and serve a designated amount of time per week or month. Duties include serving as trail guides, support staff, classroom lecturers or exhibit resource personnel. In addition to the educational potential docents provide the public, volunteers continually point out the institution's reasons for existence. Docent services enable a natural history facility to provide educational services of quality and consistency. These services would be unavailable if they had to be provided by a paid staff.

In observing the docent programs of the Arizona-
Sonora Desert Museum, the Living Desert Reserve, Placerita Canyon Nature Center and the Los Angeles Zoo very few differences were noted. Subject matter and length of training of docents are major areas of concern: ASDM requires 21 weeks, LDR-15 weeks, Placerita Canyon-10 weeks, and Los Angeles Zoo-22 weeks. ASDM providing more extensive presentations concerning fish, amphibians and invertebrates. Placerita Canyon concentrates on local flora and fauna and ecological relationships easily visible at the facility. Los Angeles Zoo draws on the large variety of exotic animals and, most noteworthy, presents important discussions on endangered species and the problems man creates in the world for animals. All institutions mentioned emphasize how to work with and instruct small children. All but the Los Angeles Zoo have monthly newsletters to keep docents aware of events and important activities of their respective institutions. ASDM and Placerita require the docent to maintain an active notebook on training topics and special programs. Placerita further requires the purchase of basic natural science texts for individual reading. ASDM requires the docent to take a midterm examination and design his/her own tour of the museum. LDR allows its docents use of all facilities, and encourages work with staff and guest lecturers in the development of new materials and specimen presentations.
The use of docents is a highly effective and cost-efficient educational program that tends to maximize the potential of any institution for use by the general public. Docent training requires, however, an expert staff with advanced training abilities and facilities for long-term training and follow-up. Where a docent program is unavailable, students and lay volunteers can be utilized to provide effective guidance to the younger school children. The best compromise between these two types of programs appears to be the combination of training and professionalism of the docent programs with the youthful enthusiasm of peer teaching when initially instituting a project.
Chapter 3
The Project

Philosophy

The Antelope Valley has numerous possibilities as an environmental study area. Students of various grade levels are eager to become involved in outdoor environmental education programs that enliven their outlook on the area they call home. This project combines parts of environmental education and nature study with as many outdoor education experiences as can effectively fit the curriculum. The major rationale is that as these students experience more contact with their desert environment and its wildlife they will begin to develop an appreciation for its fragile nature. This appreciation will enable them to make wise and thoughtful decisions on how the Antelope Valley shall progress as a natural area into the twentieth century.

Dimensions of this Project

This project combines the major areas of study of the biological sciences, geology, meteorology and climatology with museum preparation and teaching skills. The outcome is focused on the development of a permanent miniature museum facility and a student intern system that supplies wildlife presentations to elementary grades. Participation is restricted to students in 10th, 11th, and 12th grades.
who present materials to elementary and junior high school audiences. Museum preparation is confined to the Palmdale High School campus where collections are maintained and catalogued; slide programs assembled, displays completed, and loan materials disseminated. The training of student interns includes laboratory procedures, display practices, specific field experiments and certain aspects of field collecting and preparation. Evaluation is made by both the instructor and the class as a whole prior to any presentation outside of class. Presentations and subject matter are determined by individual choice and is supervised by the instructor. The critique process is a check on the accuracy of background materials and presentation skills done in a friendly and helpful manner. Topics, experiments and experiences are evaluated and revised to reflect student interest and enjoyment.

General Project Goals and Specific Objectives

A. To develop an appreciation for the wildlife of the Antelope Valley and communicate that appreciation of others.

1. The student will demonstrate an active concern for wildlife by learning and properly participating in collection, housing and care of live native animals and plants.

2. The student will be able to present a lecture discussion on his field of research using good delivery techniques, proper handling of specimen and correct audience appeal techniques.
3. The student will illustrate in written form his understanding of ecological principles by successfully completing laboratory experimental questions from field exercises that investigate many of the Valley's varied environments.

4. The student will create pre-visit and post-visit materials to enable the site instructor to properly prepare students for their presentation.

B. To develop an appreciation for the uniqueness of the Antelope Valley and Mojave Desert by maintaining collections, displays and panoramas for public view.

1. The student will demonstrate proper resource management by collecting only abundant organisms and presenting them for viewing in a manner that maximizes their display potential.

2. The student will illustrate a working knowledge of environmental awareness by utilizing pictures, paintings and other media to represent endangered and threatened species.

3. The student will properly assemble materials to demonstrate proper museum techniques, security, and maintainence of previously collected materials.

4. The student will graphically display his/her appreciation for the natural habitats of native organisms by creating artistic habitat groupings and displays.

5. The student will develop study guide materials on the various ecosystems found within the Antelope Valley and their inhabitants.

C. To develop a respect for the parameters of nature by fostering activities that stimulate students to actively pursue investigations of various environments, scientific endeavors of man and cooperative ventures with other institutions such as universities, museums, botanical gardens and wild animal enclosures.
1. The student will demonstrate his enthusiasm for scientific observation by actively participating in extracurricular excursions to study various phenomena.

2. The student will actively contribute to the success of special programs and presentations by his attendance and participation.

3. The student will describe the components of an environment by the correct completion of field experiment designed to uncover the contributing elements of that environment.

4. The student will illustrate his enthusiasm in the pursuit of possible career options by accompanying the class on investigations of institutions of higher learning and vocational preparation.

5. The student will demonstrate his understanding and training in ecology and the biological sciences by leading guided field trips for younger educational levels and civic groups.

D. To foster a cooperative atmosphere between school districts by exchanging materials and talents for the education of students.

1. The student will demonstrate his willingness to promote learning by assembling projects within his area of research for use in the lower grades.

2. The student will discuss with elementary instructors and classes the particular important biological and ecological data of the loan collection to ensure its proper usage.

3. The student will illustrate his cooperative attitude by active delivery, setup and retrieval of the loaned materials.

Development of the Project to Date

Elementary and Community Imput: The inception of the
specifics for this project came from three principal sources: 1) participants at "Investigating Your Environment" workshops, 2) elementary teachers, and 3) discussions with students involved in a invertebrate zoology class. Upon tabulation and evaluation of these comments the current program was begun.

"Investigating Your Environment" is a weekend workshop for teachers and the resource personnel of various county, state and federal wildlife and conservation agencies. The program includes field investigations of water, soil, and animal habitats. Participants become involved in a process approach to studying ecology that culminates with interpreting various environments and man's effects upon them. The materials distributed to the participant can be directly utilized in the classroom or with the general public. The program is sponsored by the United States Forest Service and this author has been a facilitator (instructor) at several workshops over the past three years. A section of the schedule groups participants by common locale. In this session the participants plan local ecological strategies called "Back-home Action Plans". At the workshop held on April 1-2, 1979 at Camp Cisquito, Green Valley, California, ten educators from community college, high school and elementary districts all sought a better program for the Antelope Valley. Their recommendations can be broken down into four topic areas:
Community College services, Desert Environmental Education, General Ecology and Specialized Program classes. Under the title of General Ecology it was suggested that high school students could present topics dealing with desert awareness to groups of younger students. Specifics include slide presentations on desert wildflowers, "Snakes Alive", desert animal displays, and field trips to Palmdale High School for special wildlife presentations. Upon the completion of this workshop, the Antelope Valley Conservation Environmental Education Council was contracted, input solicited and a support statement issued to help in coordination of the program.

In an attempt to survey the needs and interests of local school districts a cover letter was sent to 24 elementary and junior high principals, with eight responding favorable. A copy of the letter is found in Appendix H. Phone calls with interested teacher indicated the kinds and types of programs requested. Common requests included the topics: mammals of the Antelope Valley, reptiles, birds, insects of the Antelope Valley, plants and ecology of the Antelope Valley.

Upon collecting the aforementioned data, it was presented directly to the students in the author's high school invertebrate zoology class and the students' response was favorable. It was generally agreed that
those who desired to put together presentations would be able to prepare elementary and junior high classroom discussions while the remainder of the students could work in an area of their choosing, leading to the development of permanent collections and displays. Students were to get credit in the class for either activity as a regular part of the course of study. Thus, the development of both pursuits began in mid-April, 1979, under the direction of the author who was the instructor. Appropriate administrative and legal questions were resolved to enable the project to move toward completion.

Student Presentations: It was felt that the first step in effective preparation of topics was the proper training of students in field collecting and a survey of the various environments that directly relate to the Antelope Valley as an ecological study area. Instruction consisted of classroom lectures and preparation of materials, and field experimentation concerning proper collection techniques. Since these topics were of value to the entire class, times for field trips were established so as to benefit the majority of students and all were encouraged to attend the training sessions regardless of chosen topic areas. Collecting techniques included: proper preparation, storage and display of botanical and herbarium specimen, insect collection, pinning and labeling, mammal live trapping, measurement and housing
and release, reptile recovery, handling and housing, bird identification and general ecological considerations. Field experimentation took the form of working through the prepared lesson plans from "Investigating Your Environment"; prior approval for use of these materials was secured from Mr. Don Bielefield of the California Regional Office, United States Forestry Service, San Francisco, California. The study areas included the titles: "Investigating the Chaparral Environment", "Investigating Animals and Their Environment", "Investigating a Desert Environment", and "Some Forest Investigations". These areas were developed over several weekends and provided an effective survey of the surrounding environments. A copy of the student training curriculum is found in Appendix I.

Students began presentation development by researching their topics through the campus and local library and classroom references. After the students had determined their schemes for delivery, it was decided that a team program would reduce anxiety and produce mutual effectiveness by combining resources and talents. A consensus of the class indicated a pre-performance critique of each presentation by the other members of the class would be helpful. It was designed to alleviate delivery problems, buttress weak areas in research and provide a review of all materials to be utilized. Each school that received a group presentation would further evaluate the program
and return a report to the instructor. The critique was
given in written form to the team prior to their first
performance in the elementary schools. It was agreed that
comments would be limited to constructive comments
intended to foster a better delivery. The final topics
that were presented were "Mammals of the Antelope Valley",
"Reptiles", "Comparative Anatomy", "Cells", "Systems of
the Body", "Ecology of the Antelope Valley", "Birds",
"Insects" and "Plants of the Antelope Valley". The three
topics, "Comparative Anatomy", "Cells", and "Systems of
the Body" were specifically requested by the junior high
schools.

Scheduling of topics proved to be the second greatest
difficulty. Many of the eight schools requested the same
program within short periods of time of their presentation
at other schools. To keep presentors from missing too
many of their regular high school classes, the instructor
arranged alternate dates or provided excused time from his
class to make up lost time in other missed classes. The
greatest problem centered on transporting presenting teams,
equipment and specimen to schools in time for proper setup
while observing the mandates of the California State
Education Code concerning transportation of students and
instructors meeting regular class schedules. Often lunch
hours, conference periods, before and after school periods
and parental assistance made the presentations possible.
The elementary school teachers often transported students back to the high school. The final problem dealt with proper feeding and care of live animals. Many of the presentations would go out to schools within a short time of each other. This required large areas to be available for storage or handling of live animals, projectors, posters and the like until the presentations were completed. Administrators' observation of this problem led them to consider establishing a permanent facility for housing, display and development of materials.

As previously mentioned, the final evaluation process was the compilation of performance forms given to each teacher who viewed a presentation. They were instructed to mail the forms back to the high school. A copy of the evaluation form is included in Appendix J. Additionally, an inquiry on future programs and needs was attached to the evaluation form to enable the author to assess the effectiveness of the project and develop new materials. The results of all evaluations and needs analysis are found in Chapter Four of this project. In summary, the comments were extremely favorable, with most evaluations containing handwritten Thank You notes and questions from the students who observed the presentations.

Museum Developments. The Palmdale High School Field Biology classes had been establishing permanent collections such as mammals, birds, insects and plants for over
a decade. With the passage of Proposition 13 there were no opportunities to update or catalogue these valuable collections. Additionally, a museum-style set of four cabinets was donated in the Spring of 1978 to the high school from the estate of Luther Little. It contained mammals and birds of the Antelope Valley dating to World War I. The school's collections consisted of an herbarium, insects, mammal study skins, bird study skins, marine organisms, amphibians and reptiles, all housed in various locations on the campus. There was a great need for a permanent display facility where materials could be catalogued and displayed for public viewing. The problem of providing this storage area and workroom has been resolved only recently, the museum taking shape only within the 1979-80 school year. Previously, materials were displayed for public viewing at Back-to-School Night and Open House and then returned to their cubbyholes. Students not involved in giving presentations completed a very active and timely specimen list that has enabled the loan service to go forward. Additionally, students are now preparing monographs of native plants and animals to correspond to preserved and live specimen. Students giving presentations found it necessary to organize many of the collection materials in order to evaluate their effectiveness prior to their presenting. The end result was an orderly set of materials available for loan to
other departments and schools as well as for content areas of biology and physiology.

Organization of the collections was the result of the field training associated with the background work for the student intern presentations. Additional field problems aided in preparation included "Investigating Water Environment", "Measuring the Environment" and "Soils Investigations" all of which are included in the "Investigating Your Environment" materials. Classes on the preparation of skeletons, proper mounting of herbarium specimen, plaster casts of animal tracks and latex molds of reptiles helped to round out the technical background needed by these presenters.

The Antelope Valley Conservation and Environmental Education Council at its October, 1979, meeting made several recommendations to better utilize the Mini-museum and its collections by the general public. Suggestions included making displays for local branches of the Los Angeles County Library, collection viewing at the Spring, 1980, Wildflower Building of the Antelope Valley Fair, and making wildlife presentations to local civic and service clubs. These local civic and service groups often provide funds for expansion and student projects. Further discussion included the possible integration of the student training program into elementary in-service workshops and the establishment of a student recognition program such as
the State of California Ecology Merit Award Program. Plans are being made to include some of these ideas in the 1979-80 school year program of events within the curriculum for student interns.

The Palmdale High School Mini-museum as a permanent display facility is still in the planning and development stages due to lack of funds and student help, however the collections and materials now available enjoy a wide use among several instructional areas. It is hoped that, as more interested civic and professional groups become involved, volunteer help will fill the gap and the museum will move beyond being merely a development and storage facility.

**Museum Activities and Extracurricular Activities:** Field trips are among the most sought after activities that interest students. The annual exodus to view the migration of the California Gray Whale attracts faculty, students and parents. Field trips further elucidate the discussions of endangered species when one watches these giant mammals breach in open water. That the ocean has a special lure for residents of the desert is evident by the fact the three most requested trips other than to view whales migrate are to observe the tidepools, participate on the Los Angeles County Marine Sciences Floating Laboratory or cruise to Anacapa Island. In contrast, the San Gabriel Mountains provide interesting investigations
into forest and mountaintop ecology. Most of the aformentioned field trips are well-attended, the major obstacle being the transportation. The Antelope Valley Union High School District has no funds for field trips and volunteer parents must submit their driving records to the District's insurance carrier for approval. Several alternatives are being investigated, but the present solution is to use the author's spacious camper to transport a few students to study areas, or sell candy to pay for the use of buses.

Field experiments, other than those previously mentioned, include investigating the geology of the Antelope Valley. Since the San Andreas Fault runs through the area it provides a dramatic picture of the effects of folding, shifts and cracks in strata. Antelope Valley College instructors were called upon to help demonstrate these and other important features to students. Night astronomical investigations in Palmdale yield a wealth of information because observation is not hampered by foul air and, with the physics instructor's hobby being the building of telescopes, he can easily be called upon to demonstrate the locations of constellations and galaxies. The San Gabriel foothills are active sites for map, compass and topographic experiences. Many students have derived a better understanding of map-making through successful navigation of their favorite trail. The agriculture department provides activities concerning forestry projects,
erosion control and student participation projects involving the Los Angeles County Office of Forestry and Fire Warden.

Special excursions include a trip to Moorpark College's Department of Exotic Animal Training facility, complete with lecture and tour. A former student is now enrolled in Moorpark's Exotic Animal Training Program. We have asked Marineland to provide a behind-the-scenes program concerning marine mammal training activities. Little Africa, located in Acton, California provides an easily accessible location to observe the training and handling of animals used in movies. Several Palmdale High School graduates are now employed with this firm. Invitations have been forthcoming from the Biology Department, California State University, Northridge to join their high school biology club. Special trips and tours of their facilities have been promised but as yet convient dates or coordination with participants has meet with disappointment. The field biology class taught by the author allowed for the exposure of students to research institutions such as the Salk Institute, University of California at San Diego and the Rancho Santa Ana Botanical Gardens. Most trips are now restricted to a radius of 100 miles from the Palmdale High School which greatly limits the exposure and locations available.

Guided field trips are limited by transportation
problems encountered, for both elementary and secondary schools. Presenters have directed tours of elementary students through the agricultural areas and science facilities with enthusiastic praise from adult leaders and parents. Junior high school youth are given an introduction to the science program's potential every Spring in hopes of stirring an interest for future coursework. Weekend excursions and interpretive walks are in the planning stage but are wanting for lack of qualified students to lead them. The usual problem is that students who complete training often graduate before they have an opportunity to present programs. Several graduates have been hired for summer jobs with Los Angeles County Department of Parks and Recreation on the basis of their training with the collections and/or presentations. One graduate recently was hired by the National Park Service.

Although the field training activities do not approach the intensity of those offered by the Living Desert Reserve or the Arizona-Sonora Desert Museum, they do provide the interested student with many opportunities to become involved with his community and the environments that surround it. If a nature study interpretive center is ever instituted in the Antelope Valley, it is hoped that programs similar to the field training described here can be implemented in order to serve a larger student population. The interpretive center could then maximize the
environmental potential of its instruction to Valley students that are now unavailable but to a select few.

**Loan Services:** At present the most-sought-after materials for are live, handleable animals that can be displayed for an extended period of time. Next are live potted native plants accompanied by data on the Native American uses of these. Snakes and mammals are the easiest to house and display with the only restrictions being a limited amount of cages and terrariums to hold them. Mormon Tea, creosote bush, common sage and yucca are common examples that can be used by teachers as these have rather colorful backgrounds in the history of the West and especially the Antelope Valley.

Slide programs on wildflowers, desert animals, plants and the various ecological aspects of the Valley's environs are popular with elementary teachers. These programs enable instructors to develop their own environmental education units and place emphasis where they feel it is necessary. Attention was recently drawn by a local Valley environmental group to a proposed electric generation plant in Mojave. Classes discussed the pros and cons of this project by viewing examples of Valley air pollution, wind patterns and weather. They then decided to back the opposition which eventually defeated the proposal.

Collections such as live mammals and reptiles are made available to elementary school on demand and specific
instructions are given as to their care and handling. Usually the elementary teacher has specific needs that dictate what specimen are delivered. Curriculum materials or references are suggested to help the teacher make full use of the collection.

In reflection the loan service is not used as much as was thought it would be. Whether teachers are not instructing in environmental education, local flora or fauna or just do not know of the service has not yet been ascertained. Future discussions with elementary teachers will be needed to evaluate their in-class needs for specimen from the loan service.

**Curriculum Materials Developed**

**Plant and Animal Monographs:** With the multitude of material that is available in the different environments of the Antelope Valley, this initial project cannot encompass all. Therefore, lists of popular and frequently observed specimen were developed to aid younger students in independent study of Valley wildlife. Each monograph sought to give personal life histories with an emphasis on ecological relationships. In the case of plants an emphasis on the early uses of specimen by the Arapaho, Mojave, Cachuma Indians and early settlers was a prime factor in selecting plant monographs.

The current list of mammals consists of thirty-one
animals, some of which are distinctly rare and only occasionally observed throughout the Antelope Valley. Many students want to know about the animals described in forest service campfire stories and reported sightings. Specifically, the black bear and the mountain lion conjure up stories and frantic camp tales but such animals are rarely seen in the Antelope Valley due to man's encroachment upon their habitats. A recent study by Peter Gilford, State Biologist working for the State Water Resources Board (1975-77) found evidence of fifty-two mammals throughout the Antelope Valley. The monograph list and examples of the Black-tailed Hare (jackrabbit) and the Beechy Ground Squirrel are included in Appendices K, L, and M.

Birds are abundant in the Antelope Valley during most of the year. The Valley lies on the Pacific flyway and numerous ponds, lakes and streams provide areas of refuge during fall migrations. Our current list of birds consists of thirty-one monographs describing the colorations, unusual habits and feeding patterns. Twenty-one other bird monographs are presently being developed as these birds are frequently sighted in the Antelope Valley. Gilford's study revealed 148 different birds -- many of these birds are migrants. A list of the current produced bird monographs, and a copy of the mountain quail monograph and roadrunner monograph are included in Appendices N, O, and P.
Reptiles are the most common animal thought of when discussing desert inhabitants. A discussion of reptiles usually evokes a flood of questions from students about which animals are poisonous and where to look and how to handle these animals. The current list of Antelope Valley reptiles and amphibians totals thirty-one. This contrasts to Gilford's more exhaustive counts of fifty different species many only occasionally found in the Valley. Our list and the monographs on the Desert Horned Lizard and the Mojave Rattlesnake are found in Appendices Q, R and S.

Insects are the type of organism that are countless in number and found in every habitat. Twenty-five monographs have been developed, most dealing with the characteristics of insect orders and those members found in the Antelope Valley. Work is in progress on arachnids and their relatives as many young students were interested in tarantulas, black widows, scorpions, and vinegarroons. As an indication of the difficult nature of recording the kinds and types of insects in such a large area as the Antelope Valley, Gilford gives no data to be considered. Lists of the insect orders monographs and the examples of the dragonfly, Order Odonata, and the giant water bug, Order Hemiptera, are found in Appendices T, U, and V.

Native Antelope Valley plants are the second most diverse group, compared to insects, investigated. Each spring hundreds of people migrate from the Los Angeles
Basin to view the spectacular display of wildflowers along foothill slopes and wilderness plains. Many of these shrubs, trees and bushes in this collection of monographs were used for food, fiber or shelter by generations of Mojave Indians and by the German settlers that first inhabited Palmdale. Students find it a source of excitement to identify a plant while on an outing with parents. Therefore, the monographed literature deals with common names and exemplifies the identifiable characteristics useful in the wild. The current list includes 20 families of plants and individual members of these families. A current publication of the Antelope Valley Conservation and Environmental Education Council, *Wildflowers of the Antelope Valley*, lists ten times the number of plants now monographed and does not consider the non-flowering shrubs and trees of the area. The list and descriptions of Desert Manzanita and Mormon tea are found in Appendices W, X, and Y.

**Mini-Museum**

*Maintained Collections:* Mammals in the form of museum study skins are arranged according to their order. Common names are used most often so as to be familiar to younger students and the general public. The major categories are Marsupials, Bats, Rabbits and Hares, Rodents, Carnivores, Herbivores, and Insectivores. The
mammal collection now totals over 350 specimen, but no new collecting is taking place to prepare study skins. Museum emphasis has shifted to housing live mammal representatives of the Antelope Valley. Scientific measurements, data, photographs and animal behavior are collected by students and then the animals are released back in their native habitats. This ensures that the ecological lesson of preservation of wildlife is not ignored for the sake of another pelt.

The bird collection resulted from donations of dead birds from people in the Palmdale area. The remainder had been collected by Palmdale High School instructors who obtained federal and state collection permits with the stipulation that the birds be used for scientific study. These permits expired in 1968 and no new birds have been prepared except those already dead. Present count is 125 specimen from the following general categories; grebes, waterfowl, vultures, hawks and falcons, gallinaceous birds, cranes and allies, pigeons and doves, shorebirds, gulls and alcids, cuckoos, anis, and roadrunners, owls, swifts and hummingbirds, kingfishers, woodpeckers and perching birds. Bird watching and reporting has replaced any collecting and occasional treks to the foothill are very enlightening for students.

Reptiles and amphibians are the smallest collections thus far. Emphasis is on the live display of these
animals and since the local foothills and canyons abound in reptiles, students are encouraged to collect and display local representatives and then later release them back in their natural habitat unharmed. The current collection numbers 45 specimen.

Insects and Arachnids are arranged in their scientific order emphasizing typical and unusual individuals of the Antelope Valley. Current count of both collections combined totals over 500. The arthropods are a source of interest to younger students especially the tarantula, whip scorpion and numerous spiders because they have heard of them through stories from friends, teachers or local folklore.

The herbarium consists of over 200 different pressed specimen of common flowering plants and deciduous plant species. Students are cautioned to collect only plentiful plant materials reducing the chance of eradicating an especially delicate specimen or ones with low population numbers.

Mollusk shells form a large collection, often used in the loan program. The collection is the result of many excursions to various oceans and beaches during which more than 400 specimen were collected. Arranged by common name and sometimes by location, the shells are displayed in trays with appropriate background information and labeling.
Echinoderms and crustaceans were collected on numerous tidepool trips by Palmdale High School biology classes. The present collection numbers over 150 specimen and make excellent representatives of the ocean for the loan program.

The author's numerous field biology classes at Palmdale High School have developed a large slide collection of plants, mammals, reptiles and habitats which are used with units on desert environments, plants or animals. These visual descriptions of the Antelope Valley are being catalogued and duplicated for use in the loan service, especially loans to civic and service clubs. The Wildflower Preservation Committee has made several donations of wildflower photos which help to supplement the herbarium specimen. Cooperative programs between project students and the photography classes is yielding photos of plants and animals of the Valley to document as many species as possible. See Appendix Z for photos of collections and presenter team programs.

Student Training Outline: In order to prepare students to make presentations or properly work with the various museum collections, a defined schedule of curriculum topics and techniques was required. Each student had a series of written instructions, precautions and list of materials for each topic. All techniques were demonstrated prior to the initial start of the activity. Additionally,
field investigations were completed to engender an ecological aspect into all of the materials studied or encountered.

Previous sections have described the course content and discussed the components of the loan service program, field trips, extracurricular activities and career education aspects of this project. The scheduling of these activities is based upon available good weather, student participation and appropriate study site accessibility. The Antelope Valley is subject to snow and torrential rains that can cancel any field program. Often several techniques and experiments are accomplished in a single day. This project has thus been a stimulating experience for both the author and students. The pace tends to be rapid, the acquisition of knowledge lasting and the comradeship between students and instructor intense. To date, no major roadblock has kept the class from maximizing its potential to the community and the students themselves. The accent has always been on practical and worthwhile knowledge. Reports from graduates attending institutions of higher learning indicate they feel better prepared by having participated in the class and training.
Chapter 4
Evaluation of the Project

Introduction

In the spring semester, 1979 plans for the High Desert Nature Study Project were implemented. The principal areas that were instituted and evaluated consisted of the presentations by the student interns, the development of the museum collections, and the developed curriculum materials. Further, the instructional basis for the project was critiqued for effectiveness, student reaction and practicality. The following narrative paragraphs describe the makeup of the presentations, evaluations by the host instructors, and teacher recommendations for expansion. The final topic deals with the author's evaluation of the project in light of more recent events, future proposals and input, and the restrictions on the project's capabilities.

Student Presentations

As previously mentioned, the students who participated in the project were from the author's invertebrate zoology class at Palmdale High School. Each student had the opportunity to select his/her own method of presentation or type of collection to be completed and catalogued. The opportunity to use high school student presentations were
solicited through direct letters from the author to 24 elementary and junior high school principals in the Antelope Valley. (See Appendix H for a copy of the letter of introduction.)

Eight schools responded positively indicating specific contact persons who would arrange topic scheduling with the author. One additional school deferred participation until the 1979-80 school year. Schools participating in the project were one junior high school in Littlerock, California; one junior high school in Palmdale; one elementary school in Lancaster, California; and five elementary schools in the Palmdale area. The actual schedule of topics, dates of presentations and the mode of presentation were left to the school administrator. Variations include school assemblies, rotating class programs and one-hour talks.

Some teams spent an entire day on a campus while others completed their presentations in less than two hours. Nine topics were developed by the high school students: "Mammals", "Birds", "Reptiles", "Plants", "Insects", "Ecology", "Systems of the Body", "Cells", and "Comparative Anatomy". The first five topics utilized native wildlife examples and emphasized their ecological roles in the Antelope Valley. The last four topics were specifically requested by the two junior high schools for their advanced classes. Each school chose the topics they
wished to view; not all participating schools saw every topic. Records were kept by the presenting team on the number of students, the number of individual presentations and the number of different schools at which they delivered their programs. (See appendix AA for a summary of these figures.)

The high school students made a total of 92 individual presentations, averaging 10 presentations per topic. The total estimated attendance at the presentations was 4,090, averaging 45 elementary or junior high students per presentation. Separate topics were presented at the different schools on 21 different times, averaging 4.3 schools per topic area. Each presentation concluded with a question-and-answer period to further help the elementary or junior high student understand the topic presented.

Following each presentation, an informal discussion was held between the author and the presenting team to help evaluate their performance. All presenters said they enjoyed the experience, would gladly do it again, and had a better appreciation for the role of an instructor. Many expressed feelings of nervousness, or situations where their talks had been weak, but all seemed to enjoy giving the presentation. Most felt that the team concept of presentation helped to alleviate tension. When elementary student thank-you cards began arriving at the high school, the enthusiasm for the program became even
greater. Most would admit to feelings of accomplishment and the improvement of their self-worth as a result of having given the presentations.

An in-class evaluation process was begun at the high school to provide positive reinforcement and a beneficial critique prior to the actual presentation before a school audience. Each team presented its topic as if their audience was a typical elementary school class. At the conclusion, fellow classmates made suggestions and comments intended to eliminate weaknesses in delivery. The author cautioned against ridicule and students were encouraged to make written comments to presenters if they noted mannerisms or problems that might be embarrassing. The author began monitoring these written remarks after one student used it as a vehicle for a personal vendetta. Common discussion items included the use of jargon or slang, difficulty in vocabulary, the depth and breadth of background information and disruptive mannerisms. Attention was called to the team's ability to shift discussion levels to accommodate various grade levels, the continuity of the presentation, integration of team members and the overall timing. Materials were critiqued for proper usage, display, and suggestions were made for more effectiveness. Each group decided upon what materials to utilize from the collections and what duplicated materials to hand out. The logistics of pick-up and
delivery became a cooperative effort between the author and the elementary host teacher.

**Evaluation of Presentations**

Each contact person or school administrator was given an evaluation form for each individual presentation complete with envelope for private comments and scrutiny. Evaluation procedures were left up to the administration of the school with the request that the forms be returned by the end of the Spring Semester, 1979. Attached to the evaluation form was a questionnaire dealing with the proposed future needs of the host school. (See appendix J for a sample form.) Thirty-four evaluation forms were returned with a variety of comments. Following is a summary of the host schools' comments, given at liberty. (For a numerical summary of these evaluations see Appendix BB, Table 2.) Under the heading of Quality of Presentation, there were 17 comments for excellent, 11 for superior, 5 for good and 1 for fair. General comments indicated the presentations were well-received by both the students and their instructors. For the item dealing with the Speaker's Preparation of the Topic, 20 respondents indicated the team students were prepared, with only one indicating the team was only fair. One evaluator indicated a team had not properly stapled or run off their handouts prior to arrival and, hence, held up their initial
presentation. Concerning the question dealing with problems in delivery, 16 evaluators felt there was no problem, while five indicated the student team was nervous. Individual comments indicated that most teams recovered their composure. One student was difficult to understand due to soft vocalization. Under the heading of Distracting Mannerisms, 17 critiques indicated no problems here. Four additional comments indicated that gumchewing, the use of the term "OK", speaking clearly and the monopolization of the topic by one student were the chief derogatory items of the presentations. Data pertaining to Student Interest showed there were 23 who felt their students were interested while two indicated they were very excited with the talk. There were no comments of a negative nature dealing with the ability to hold student interest. This author feels that the comments of evaluators indicates a high degree of success for the program. The negative comments were not ones of great consequence to the overall presentation. Student interest in the topics would seem to be the major factor for evaluating the success of the presentations.

The item dealing with Likes and Dislikes of the Student Population generated a variety of comments. Five responses indicated that the use of live or stuffed animals created a favorable atmosphere for the students. Three enjoyed the displays and models while three others relished
the slide programs or sample materials. Teacher comments of a positive nature dealt with the delivery; i.e., the explanation of difficult ideas and illustrations of balances within the insect world. Three negative comments concentrated also on delivery mechanisms; i.e., too much lecturing, some pictures difficult to see, and the need for more visual aids. More attention will be paid in the future to eliminate these problems. The presentations, in general, were well received by both students and instructors.

The ninth item, requests for additions to the presented program generated a diversity of comments. Three responses indicated satisfaction with the topics as presented. Eight respondents felt slides would be a more effective tool than the posters used. Three evaluations recommended practice for presenters, indicating need to become more polished for future talks. One instructor wanted a quiz developed for the conclusion of the talk. One instructor wanted a nature walk to accompany the program. Another instructor desired a discussion and display of bird nests to accompany the talk on Birds. One teacher complained that the insect collections were difficult to see from the back of the room. These general comments give the author direction for correction in program mechanics. The size of the insects is unresolvable due to their inherent size while other comments have open
avenues to students interested in creative photography.

The tenth item dealt with the need for pre-visit materials to introduce the topic. Seventeen evaluators felt they could have better prepared their classes had materials been available, while three instructors were satisfied in the program as presented. Item eleven was similar to item ten in that it solicited reactions to the need for post-presentation materials to summarize the presentation. The same 17 evaluators responded positively with only two evaluators declining any additional materials. Common requests included unit programmed suggestions, printed references and dittoed fact sheets for each topic. Prior to the actual presentations, no printed matter had been produced for dissemination. Students had developed monographs for their own use during the talks. It was agreed that these monographs should be directly available to the elementary instructors, coupled with summary questions and outlines for further classroom investigation of the topic. These monographs are currently under development.

Item twelve dealt with the length of delivery. Only six comments were given. Two evaluators felt it too long, two felt the program was all right as presented while two felt the program was too short in duration. Item thirteen asked the instructor, "Did the students feel talked down to?" Negative responses totaled twenty, while no
evaluators felt this item was true of the presentation teams. Item fourteen asked if the presentation was over the ability of the student audience and, if so, was it due to vocabulary, attitude or other. Seventeen evaluators felt the presentations were delivered at the students' level of comprehension; two felt the presentations were indeed over their students' ability to understand and four indicated the vocabulary was new but challenging to their students and therefore an effective part of the talk. General comments indicated that the presenters seemed adept in tailoring the presentation to the grade level of the student audiences. Presenters further proved their ability to adapt to their changing assemblies by deleting advanced topics if the atmosphere dictated it.

The author feels that these previous comments indicate high school students' ability to do creditable presentations and are a tribute to their perception and adaptability.

The section on comments drew a variety of comments. Adverse comments included five responses pertaining to pictures being too small to be effective in presentations. The evaluator felt that not all members of a team participated and another felt that one team needed additional background to more correctly answer student questions. One evaluator would like to see large models in presentations while another mentioned that the transition between
presentations of individual team members was difficult at times. The most damaging comments actually came after a presentation when one high school student presenter began criticizing the enthusiasm and intelligence of student and the general atmosphere at one junior high school. His comments found their way back to that junior high's host science instructor. The incident required an immediate conference with the student in question, where other items were revealed. Complaints included the use of bad and unnecessary jokes, taking over discussion from other team members and talking down to students. Discussions with the individual and the other team members remedied the problem for future presentations. This situation further required a personal conference with the host science teacher and the author. The problem was alleviated through the establishment of guidelines for future talks and discussions and the need for professional attitude when commenting on audiences and their enthusiasm.

The positive comments provided some gauge of the success of the program. These tended to outweigh the negative remarks as they were more extensive and informative in both numbers and illustrations. Eight evaluators felt that the presentors were very well prepared. Six felt that the topics were very good, while four stated that their students had been very interested in the programs. Four instructors recognized the teams' ability to adjust
to the varied grade levels during their presentations and three appreciated the fact they were on time for the presentation. Two evaluators indicated that presenters handled questions well and another felt the presenters ably handled large amounts of material and delivered it well. The most gratifying comment indicated that a teacher's elementary students were in awe of the high school teams. She felt that the team members had inspired her students in their studies of science and commented that she expected many would be successful high school science students as a result of these presentations. In the final analysis the positive comments, students' enthusiasm and large number of presentations indicate that the project was successful. The negative comments were such as to pose no problem for the 1979-80 school year. Corrections and changes in philosophy are underway to insure continued future success of the program. Success of the program was further substantiated from responses of the elementary audiences themselves.

The only request that was made of the elementary host school was the completion and return of the evaluation forms. Four schools decided to have their students thank the high school students, Palmdale Hith School and even the author through written thank-you notes. Although one can assume the elementary instructors stimulated the letter writing campaign, it is interesting to note the varied
styles and comments of the students utilized. Four hundred and four pieces of mail were received, and 107 had accompanying illustrations of the presentation. Fifty-six were addressed to the author, 9 to the Palmdale High School Science Department, and three to just "friends". The rest were addressed to the student team members who delivered the topics. Each topic received varying numbers of Thank-You notes: Ecology tallied 180, Birds - 85, Systems of the Body - 85, Mammals - 78, Reptiles - 34 and Comparative Anatomy - 18. The responses varied but most indicated enjoyment of the program, thanked the students for their work, acknowledged the program liked best and asked the teams to return next year. Additional comments were usually in the form of questions. Typical questions asked how the brain works, for more information on the desert tortoise, and where to get pictures of the bald and golden eagles. Many questions centered on where the birds came from, who stuffed them, and could we share our shell collection. Other students wanted programs developed about cats or about rock collection. The thank-you notes were a greater morale booster than the actual presentations. The high school students often spent time answering questions, or compared notes about interested children they had encountered. (See Appendix CC for numbers and distribution by school and topic) These notes illustrate that the student audiences were positively affected by the
presentations. Often the elementary students identified the part of a presentation that was most important to them. These thank-you notes provided positive reinforcement for the project and an impetus to continue in the next school year. (See Appendix DD for a typical thank-you note.)

In the final days of the Spring Semester, 1979 the author received a number of personal letters of graditude from the elementary teachers who participated in the program. Ten cards came from classroom instructors, while three elementary principals expressed their appreciation. (See Appendix EE) One administrator directed a favorable letter to the high school district superintendent. (See Appendix FF). Most teachers expressed their appreciation for the program, discussed the student interest in the topics and asked that the program be continued next year. Three teachers volunteered to help set up this program in their school for next year. Two teachers indicated that their students had been stimulated to continue their studies of the presented topics.

Upon reviewing the comments of the evaluators, the high school students' discussions, and the thank-you notes from both students, teachers, and administrators, the author concludes that this portion of the project has been successful. The student interns provided the participating schools with an effective environmental education program that stimulated and informed the student audiences.
of the varying aspects of wildlife in the Antelope Valley.

Nature Center

During the Spring Semester, not all students of the invertebrate zoology class chose to participate in the presentation of topics in the various schools. Many elected to renovate the Palmdale High School collections or create museum displays. As the demands for materials for the presentations became paramount in importance, collections such as mammals, birds and insects were the first to be organized. At the close of the 1978-79 school year, 19 different collections were cleaned, reconstructed and put into usable form for the next year. Details of the numbers and composition were discussed in the third chapter. Specific accomplishments included the cataloging of research specimen of Antelope Valley native mammals, birds, reptiles and amphibians, including measurements, habitats and numbers. Mammal track casts and bird watching information were also accumulated. Live caged mammals and reptiles were temporarily housed for public viewing and study. Insects and arachnids were arranged by the scientific orders. Crustaceans, echinoderms and mollusks were cleaned and mounted for the loan collections with proper labels attached for easy identification. The herbarium specimen were updated and categorized by scientific family. Specimen of local
interest were arranged for use in the loan service. Slide programs were begun to emphasize the variety of natural habitats within the Antelope Valley and their attendant flora and fauna. The loan service of collections was made available to local school districts but drew little response. This kind of response was due to the lateness in the school year of the completion of the collections and insufficient notice of this service to the elementary schools.

One unresolved problem was the exact location of a permanent facility for display and development of these materials. This problem was not solved until the 1979-80 school year, at which time a former storage facility was obtained and renovated as the mini-museum. At the close of the 1979-80 school year the efforts of the participating students had successfully made the nature center or mini-museum a functional reality at Palmdale High School.

Although the present year has seen reduction in time and capabilities of the High Desert Nature Study Project, significant accomplishments have been made within the mini-museum. (Specific details on current restrictions are discussed in the Summary section of this chapter.) Current progress includes the establishment of a permanent facility with display cabinets and work tables. There has been a shift in emphasis from presentations to the development of monographs for use in the elementary classrooms. Live
specimen of animals and plants are being collected for the loan service, which can be maintained on a permanent basis. The previously catalogued collections are being displayed and stored for easy retrieval and research. Skulls, skeletons, latex models and bioplastic mounts have been added to extend the capabilities for high school and elementary instruction. Although student participation has decreased, due to the cancellation of the invertebrate zoology class, enthusiasm is still prevalent. Slide programs continue to increase as winter and spring rains have produced a profusion of wildflowers for photographing. Success for 1979-80 has centered around the development of the mini-museum.

Recommendations for Expansion

As a part of the evaluation process, host teachers were encouraged to express their needs for Environment Education Programs. Although the response was less than expected (13 responses to this item out of 34 evaluation returned) it does give some indication what directions should be pursued. The thirteen responders felt more high school presentations should be made. One suggested the need for a field trip to the Devil's Punchbowl above Llano, California. Ten instructors needed slide programs and an additional ten responses indicated they desired field trips with high school students as naturalist/guide.
Eight instructors felt that field or classroom experiences would be helpful while an additional eight instructors wanted dittoed materials and curriculum guides. Seven teachers determined that live animals would be beneficial to them and another seven instructors indicated that schoolyard experiences would be helpful. Five inquired about teaching collections for use in the classroom, namely insects and live plants. Three instructors requested monographs of mammals, reptiles and birds, while only one individual was interested in reference information. One contact person surveyed her colleagues and directed one extensive report for evaluation. The school requested presentation topics to include the areas of weather, earth science, forest products, astromony, aviation, automotives, energy, oceanography, more information on specific organs of the body and general monographs. She also indicated a desire for a changing loan collection every month of the school year, 1979-80.

Many of the aforementioned requests, as previously discussed, are presently under development, notably curriculum guides, loan slide programs, live animals, loan collections and an extended set of wildlife monographs and references. Some requests will require advanced planning and training of the student interns. Others can be developed through teacher in-service or workshops, by the completion of the 1979-80 school year curriculum
materials emphasizing Antelope Valley natives and their contributions will be completed in the areas of Mammals, Birds, Reptiles, Ecology, Plants, and Insects. These will include pre-visit and summary information, an outline and supportive monographs.

Student input for expansion included more out-of-the-area field trips. Most felt they had experienced a more-than-adequate field training program and that if transportation funds were available, guiding elementary students on nature walks would prove beneficial for all involved.

**Future Possibilities**

Major projections for the future offer expanded possibilities for the mini-museum and the student intern program. Some projects will be out of the jurisdiction of the school district while others will draw on current programs. Recently several public agencies hinted that a permanent facility would be built in the Antelope Valley as part of the Wildflower Preservation Facility. The question of including a laboratory or mini-museum was raised and will be considered when construction funds are firmly committed. Inquiries into federal funding prospects have produced the "Zoo-Mobile Program", funded by ESEA Title IV-C. Changing financial budgets for the Antelope Valley Union High School District put the "Zoo-Mobile
Program" in doubt as the district would be required to finance the program after initial funds ran out. The recent layoffs of 71 teachers casts grave questions of even attempting the proposal phase of the "Zoo-Mobile Program". California State Environmental Funds from monogramed license plate fees offers another alternative but, as the competition is extensive, this avenue seems remote. The most promising project centers on the objectives and experiences already defined in this project. The City of Palmdale has leased an 85 acre parcel from the Bureau of Land Management but must develop a community enrichment project to retain jurisdiction over the land. Inquiries by the author to two city councilmen has produced a favorable climate for the development of a regional nature study site on the acreage. Initial discussions of this project have generated the development of a formal proposal to be submitted mid-summer, 1980. As the City of Palmdale is an energetic community, eager to promote both the economic and educational growth of the area, this project may prove an effective addition to the High Desert Nature Study Project, as well as serve as an environmental education source for the local schools and general public.

**Summary**

In further evaluating the effectiveness of this pro-
ject, an investigation of its utility for the future must be determined. In making that determination, an analysis of the positive and negative outside influences shed some light on the role the project will play in the coming school years.

The problems encountered in the past two years have served as warnings that the project's effectiveness can be eroded by the capricious whims of the voting public or an uninterested administration. The funding restrictions of Proposition 13 have only recently been felt in the Antelope Valley. The result has been reduced course offerings, cancellation of field trips of any kind (unless funded privately), and the elimination of staff positions. This had cancelled the invertebrate zoology class, put the author in three different rooms during the day and added new preparations to his existing workload. District administration tends to both dictate course content and insulate itself from criticism or imput about programs. Site administration is supportive of the project as long as it does not require any change in the normal routine, violate contract agreements or require any additional funds. Elementary administration also has not been supportive of the program this school year (1979-80) as they are undergoing similar problems and upheaval. Acquiring adult volunteers, parent chaperons and new student interns has been a problem. The reduced time
available for recruiting and the training of new students has necessitated the reduction of presentations to the elementary schools in 1979-80. One team is all that remains and they are in constant demand. Present effort has thus shifted to introducing the nature study programs into the biology classes with the hope of increasing the number of presentor teams for 1980-81. At present, the author is not sure if he will even be teaching in the biological sciences or at Palmdale High School in 1980-81, so nebulous is the decision-making process at the district level.

In spite of all of the negativism and loss of some of the original aspects of this project, there are viable alternatives for the coming years. If the Antelope Valley Union High School District becomes so restrictive that the basic training program and presentation schedules cannot be accomplished, community agencies may provide the means. The Boy Scouts of America, in their Explorer program could provide much of the training, field work and presentations with little or no restrictions. Civic groups could by contacted through the representatives of the AVCEEC to provide funds or the organization to keep the program alive outside of the school. The Palmdale YMCA has donated $250.00 this year to the science program for needed projects and materials. Within the school context, parental volunteers or booster clubs could be sought to
help fund, provide transportation and supervise the activities of this project. Utilization of biology students to prepare materials, give presentations and monitor the collections could be included as part of the regular course requirements. Finally, the City of Palmdale's nature study site proposal could provide similar types of experiences off campus, also including students from the other three high schools in the Antelope Valley. The potential for keeping alive the project is assured; the only drawbacks are the changes in the author's philosophy of utilizing only local schools and the commitment of additional time.

The final evaluation of this project can be found in the students who have participated in its success. The favorable response on the part of those students involved in both the presentations and the preparation of the collections and mini-museum illustrate its positive potential. As has been previously discussed, the feelings of pride and self-worth for the successful completion of their undertakings could be easily observed through direct discussion. The thank-you notes and positive reinforcement the presentors received heighten their commitment to the program. The museum workers were able to experience similar feelings when they delivered guided tours to parents on Back-to-School and Open House nights. They also participated in orienting the new freshmen class to
the opportunities in the science department. In both cases, the students received gratification for their work and in turn provided some measure of meaning for the effort they exhibited. Their contributions are a reality, the mini-museum exists because of their work and the presentations will be used in some form in the classes of the future. If the materials are only casually utilized in the future, they have still provided a basic environmental education program for the students of the Antelope Valley.

The effectiveness of this project lies in two aspects of its framework. The training sessions provide the high school students with experiences in the field that tie together their previous science education and the ecological principles they have studied in the classroom. They can easily visualize both the complexity of the Antelope Valley as a large ecosystem and the effects of man's destruction of the different life zones and their inhabitants as they investigate different habitats. They actively gather data from biological investigations while in the natural environment of both entities. They come to realize that in their presentations or museum work they are perpetuating an ethic of caring about the world in which they live. Students begin to realize this concept when they display their developed materials for others to see, recognizing that others do not have to go
out to nature and remove another similar specimen. Students extol the beauty of nature by presenting facts and examples of local creatures to children at ages when these children are formulating environment ethics within their lives. The student further guides this ethic formation toward an environmental morale decision deeply instilled. Students are then involved in effective environmental work that produces positive results.

The second aspect which accounts for the effectiveness of the project is the enthusiasm it generates in both the instructor and the student. Student feelings of accomplishment have been previously discussed. These same feelings are also true of the author. The sense of successful teaching can be immediately derived from watching a class eagerly involved in its work. Classroom presentation or field training helped to bridge the gap between instructor and student. The casual learning atmosphere enable both parties to interact, exchange information and discuss common attitudes on a personal basis. In this manner, the project provided the author with the opportunity to get in touch with his students as a human being and impart attitudes that both understood and appreciated. The project can be deemed successful because it stripped away the usual time restraints and classroom format and allowed the student and instructor to interact as respected associates.
We, who are committed to the education of environmentally-aware students, know that some means of instruction must be sought out, no matter what administrative directives are imposed.
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Appendix A - Table 1

Climatic Data of the Antelope Valley

<table>
<thead>
<tr>
<th>Period</th>
<th>Average Temperature</th>
<th>Precipitation</th>
<th>Humidity Noon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Mean</td>
<td>Max</td>
</tr>
<tr>
<td>January</td>
<td>31</td>
<td>44</td>
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<tr>
<td>April</td>
<td>44</td>
<td>59</td>
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<tr>
<td>July</td>
<td>65</td>
<td>81</td>
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</tr>
<tr>
<td>October</td>
<td>47</td>
<td>64</td>
<td>80</td>
</tr>
<tr>
<td>Year</td>
<td>46</td>
<td>62</td>
<td>77</td>
</tr>
</tbody>
</table>

Elevation: 2,549 Feet
Prevailing winds: S/W
Mean hourly speed: 12-15 mph
Climatic Conditions:
287 clear days
44 partly cloudy days
34 cloudy days

SOURCE: U. S. WEATHER BUREAU

Note. From Community Economic Profile for Palmdale, Los Angeles County, California by the Palmdale Chamber of Commerce and the City of Palmdale, September, 1977 p. 1.
## Appendix B - Table 2

Employment By Industry in the Antelope Valley* as of December 31, 1978

<table>
<thead>
<tr>
<th>Industry</th>
<th>Employment</th>
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<tbody>
<tr>
<td>Agriculture</td>
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<tr>
<td>Mining</td>
<td>125</td>
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<tr>
<td>Construction</td>
<td>1380</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>10829</td>
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<tr>
<td>Transportation, Utilities, and Communications</td>
<td>1084</td>
</tr>
<tr>
<td>Trade</td>
<td>5431</td>
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<tr>
<td>Finance, Banking, Real Estate, Insurance</td>
<td>3500</td>
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<td>Services</td>
<td>7788</td>
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<tr>
<td>Government</td>
<td>8804</td>
</tr>
</tbody>
</table>

Total Employment--40,141

*Includes North Los Angeles County-Acton/Kern County Line, Southeastern Kern County-Boron, California City, Mojave, and Rosamond.

**SOURCE:** Employment Development Department, Lancaster, California. July 1979.

**Note:** From personal communication with Edna B. Jensen, Employment Development Department, 44902 N. 10th St. West, Lancaster, CA, July 1979.
Appendix C - Table 3

Population Update--Antelope Valley

<table>
<thead>
<tr>
<th>Community</th>
<th>Population</th>
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<tr>
<td>*Northern Los Angeles Co.</td>
<td>91,010</td>
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<tr>
<td>excludes Saugus-Newhall</td>
<td></td>
</tr>
<tr>
<td>**Southern Kern County community</td>
<td>20,455</td>
</tr>
</tbody>
</table>

Antelope Valley Total: 111,465


**Source: Kern County Board of Trade-July 1, 1978 estimates.

Kern County by community:

<table>
<thead>
<tr>
<th>Community</th>
<th>Population</th>
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</thead>
<tbody>
<tr>
<td>Mojave</td>
<td>2570</td>
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<tr>
<td>California City</td>
<td>2555</td>
</tr>
<tr>
<td>Boron</td>
<td>2550</td>
</tr>
<tr>
<td>Edwards AFB</td>
<td>10300 (residents)</td>
</tr>
<tr>
<td>Rosamond</td>
<td>2480</td>
</tr>
</tbody>
</table>

Total: 20455

Appendix D

Text of the California Education Code
Relating to Environmental Education in Grades 1 - 6

(c) Social studies, drawing upon the disciplines of anthropology, economics, geography, history, political science, psychology and sociology designed to fit the maturity of the pupils. Instruction shall provide a foundation for understanding the history, resources, development, and government of California and the United States of America; the development of the American economic system including the role of the entrepreneur and labor; man's relationship to his human and natural environment; eastern and western cultures and civilizations; and contemporary issues.

(d) Science, including the biological and physical aspects with emphasis on the processes of experimental inquiry and on man's place in ecological systems.

51211 - Instruction required by subdivision (c) of Section 51210 in the area of social sciences shall also provide a foundation for understanding the wise use of natural resources.

Appendix E

Sections of the California Education Code that apply to Conservation Education

<table>
<thead>
<tr>
<th>Code Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8705 - 8707</td>
<td>Established legislative policy for environmental education.</td>
</tr>
<tr>
<td>8720 - 8723</td>
<td>Provides for a Conservation Education Service in the Department of Education.</td>
</tr>
<tr>
<td>8730 -</td>
<td>Establishes a Conservation Education Library.</td>
</tr>
<tr>
<td>8734 -</td>
<td>Provides for Conservation Education Grants.</td>
</tr>
<tr>
<td>52410 - 52414</td>
<td>Establishes an environmental internship program.</td>
</tr>
<tr>
<td>60041a -</td>
<td>Requires that state-adopted textbooks emphasize environmental protection.</td>
</tr>
<tr>
<td>8762 - 8733</td>
<td>Relates to county operation of conservation education schools.</td>
</tr>
</tbody>
</table>

Appendix F

Excerpts from Assessed Needs - Kelley (1976) by Topic Heading

I. Subject Matter

There is a need to develop within students an ability to reason and arrive at logical conclusions (p. 67)

II. Student Attitudes

There is a need for students to develop enthusiasm for life and learning. (p. 67)

There is a need to develop responsible citizenship to insure respect for self, country and property. (p. 67)

There is a need to develop better human relationships, individually and/or in groups by: (a) expanding cultural horizons (field trips outside the community); (b) utilizing professional consultants (i.e., psychiatry, social, etc.); (c) reinforcing self-confidence and self-respect. (p. 68)

There is a need to involve students in school activities by providing a wider variety of activities. (p. 68)

III. School Operations

There is a need to increase the number of facilities and improve those facilities now in use, i.e., lab stations, home economics, shop equipment, library, air conditioning, auditorium, classrooms, swimming pool, photo lab and more buses. (p. 69)

IV. Articulation

There is a need to improve articulation and cooperation among the elementary and secondary schools. (p. 71)

## Appendix G

### MUSEUM AIDE/DOCENT PROGRAM

#### COURSE OUTLINE

<table>
<thead>
<tr>
<th>SESSION NUMBER</th>
<th>THURSDAY</th>
<th>THURSDAY</th>
<th>SATURDAY</th>
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<tr>
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<tr>
<td>Introduction</td>
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<tr>
<td>History and Philosophy of the Museum—Bill Woodin, Former Director</td>
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<tr>
<td>Future Plans and Goals—Dan Davis, Director</td>
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<tr>
<td>Staffing and Structure—Lily Moore, Visitor Services Coordinator</td>
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<td>Responsibilities of a volunteer—Lily Moore</td>
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<tr>
<td>2</td>
<td>9/13</td>
<td>9/13</td>
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<tr>
<td>Deserts—Speaker to be announced</td>
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<tr>
<td>What is a desert?</td>
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<td>Causes of deserts?</td>
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<td>3</td>
<td>9/20</td>
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<tr>
<td>Interpretation with Adults—Speaker to be announced</td>
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<td>4</td>
<td>9/27</td>
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<tr>
<td>Interpretation with Children—Jody Simmons, Director of Camp Cooper</td>
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<td>5</td>
<td>10/4</td>
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<tr>
<td>Earth Science Lecture—William Panczner, Curator of Earth Sciences</td>
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<tr>
<td>6</td>
<td>10/11</td>
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<td>Earth Science Tour—Pete Kresan and Anna Pollard, Earth Sciences Interpreters</td>
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<tr>
<td>Botany Lecture—Dr. Mark Dimmitt, Curator of Plants</td>
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<td>11/3</td>
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<td>Ethnobotany—Dr. Richard Felger, Director of Research</td>
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<td>10</td>
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<tr>
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<td>11/15</td>
<td>11/17</td>
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<tr>
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<td>THANKSGIVING</td>
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<td>11/29</td>
<td>11/29</td>
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<tr>
<td>Small Animal Lecture (reptiles &amp; amphibians)—Merritt Keasey, Curator of Small Animals</td>
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<tr>
<td>13</td>
<td>12/6</td>
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<th>SATURDAY A.M.</th>
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<tr>
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<td>1/3</td>
<td>1/5</td>
<td>Large Animal Lecture (birds &amp; mammals) Dr. Inge Poglayen, Curator of Birds and Mammals</td>
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<td>1/10</td>
<td>1/12</td>
<td>Large Animal Tour (birds)</td>
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<td>Environmental Education in the Community's Schools--Janice Hunter, Environmental Educator</td>
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<tr>
<td>21</td>
<td>2/7</td>
<td>2/7</td>
<td></td>
<td>Final question and answer session Final evaluation</td>
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</tbody>
</table>
Dear Principal:

I am attempting to formulate an environmental education program for both Palmdale High School and the Antelope Valley schools. We have been training budding naturalists for many years, until Proposition 13 erased our funds. I now have a very enthusiastic group of superior science students without an opportunity to share their experience and training. We would like, therefore, to offer your school the services of these students as guest lecturers in the fields of Nature Study and of Life Science. The topic areas we have prepared include:

1. Mammals of the Antelope Valley
2. Reptiles of the Antelope Valley
3. Birds of the Antelope Valley
4. Plants of the Antelope Valley
5. Insects of the Antelope Valley
6. Division of Labor in Animals
7. Ecology of the Valley

This is the beginning of what we hope will become the High Desert Nature Center - a cooperative venture that will provide your school with nature study materials and our students with an opportunity to train as future naturalists.

We have only two requests of you. First, if you are interested please contact me and allow three (3) weeks ahead for scheduling. Second, we need you to complete the evaluation forms the students will bring with them. This will give us an opportunity to evaluate our training techniques and to plan for the future.

Thank you for your time and consideration in this matter.

Yours truly,

Mike Hanlon
Biology Teacher/
Science Department Chairman
Appendix I
Student Training Curriculum

1. Preparation and Collecting Techniques
   a. Mammal Study Skins - Demonstration Only
   b. Round Mounts of Birds - Demonstration Only
   c. Preparation of herbarium specimen - collection and mounting
   d. Herpetological mounts - Demonstration only
   e. Insect pinning techniques; Arachnid preservation
   f. Plaster tracks
   g. Live trapping techniques for mammals and reptiles
   h. Preparation of skeletons
   i. Latex molds of reptiles'
   j. Wildlife Photography
   k. Bioplastic mounts
   l. Bird watching and recording

2. Field Investigations and Methods
   a. Investigating the Chaparral Environment
      1. Plant list
      2. Transect sampling
      3. Soil data inventory
   b. Investigating Animals and their Environment
      1. Habitat analysis
      2. Tracks and interpretation
      3. Skulls and food habits
      4. Energy and matter cycles
      5. Analysis of Man's effect on habitats and food webs
   c. Investigating a Desert Environment
      1. Effects of weather
      2. Soil Characteristics - drainage and composition
      3. Plant and Animal habitat analysis
   d. Some Forest Investigations
      1. Tree crosssection analysis
      2. Tree boring exercise
      3. Analysis of ecological phenomena in a rotting log
      4. Types and uses of trees
   e. Measuring the Environment
      1. Pacing and measurement
      2. Use of the compass
      3. Combining pacing and compass
4. Maps and compass
5. Finding one's way in the woods

f. Investigating the Water Environment
   1. Analysis of stream ecosystem
   2. Collection and analysis of water animals
   3. Determination of stream flow
   4. Analysis of water samples for dissolved elements

g. Soil Investigations
   1. Analysis of soil types
   2. Composition of soil
   3. Soil profiles and characteristics
   4. Soil chemistry and plant life
   5. Measuring slope and gradient
   6. Possible useage for soils
Appendix J

Evaluation Form
Palmdale High School

Student Nature Study Presentation

Introduction: This form is to help us at Palmdale High School better train our student naturalists as well as grade their efforts to date. We are constantly trying to better our program as well as provide good nature study programs. Your candid comments will help us accomplish this goal.

1. Title of Presentation ____________________________

2. Name (s) of speakers ____________________________

3. Please rate the overall quality of the presentation (Circle one)
   Excellent   Good   Fair   Poor   Superior

4. Did the speakers appear to be prepared? _________

5. Did the speakers have any distracting mannerism that can be corrected? What?

6. Did the speakers have any noticeable problems with their presentation? ____________________________

7. Were your students interested in the presentation?

8. Were there any particular things that the students liked? What?

9. Is there an area of the presentation you would like to see added? What?

10. Could you have used prepared materials to introduce the speakers' topic before they presented it?

11. Could you use post-presentation materials to help summarize the Nature Study Topic for the class?

12. Was the presentation too long? Too short?

13. Did the students feel talked down to?
14. Was the presentation over students heads? If so, Why?

15. Please use this space for any pertinent comments you wish to express:

Part II: As a part of our program we are trying to increase the environmental education services and participation of schools in the Antelope Valley. We are developing materials and curriculum for use by various grade levels while trying to enhance the interest and participation of our high school students. We need your input to formulate our plans. Here are some of our suggestions. Please describe your needs.

A. Nature study printouts. Specifically:

B. Teaching collections for use in classroom_______
   ___________I would like the following
   if it were available _______________________

C. Slide programs

D. Live animals

E. More high school student presentations

F. Field trips with student naturalist guides

G. Experiments

H. School yard experiences

I. Book and reference information

J. Dittoed materials and curriculum guides

Please make any further comments about your needs or feeling toward the Nature Study Program Environmental Education.

Thank you for your time

Mike Hanlon
Biology Teacher/Science Department Chairman
Appendix K
High Desert Nature Study Project
List of Mammal Monographs

Insectivores
Desert Shrew - Notiosorex crawfordi
California Mole - Scapanus Latimanus

Bats
Pallid Bat - Antrozous pallidus
Long-Eared Bat - Corynorhinus rafinesquei
Western Mastiff Bat - Eumops perotis

Rabbits and Hares
Black-Tailed Hare - Lepus californicus
Audubon Cottontail - Sylvilagus auduboni

Rodents
Antelope Ground Squirrel - Ammospermophilus leucurns
Beechey Ground Squirrel - Citellus beecheyi
Mojave Ground Squirrel - Citellus mohavensis
Nimble Kangaroo Rat - Dipodomys agilis
Western Harvest Mouse - Reithrodontomys megalotis
Deer Mouse - Peromyscus maniculatus

California Pocket Mouse - Perognathus californicus
White-Eared Pocket Mouse - Perognathus alticolus
Desert Wood Rat - Neotoma fuscipes
Dusky-Footed Wood Rat - Neotoma fuscipes
Botta Pocket Gopher - Thomomys bottae
Western Gray Squirrel - Sciurus griseus
Golden Beaver - Castor canadensis

Carnivores
Raccoon - Procyon lotor
Ring-Tailed Cat - Bassariscus astutus
Striped Skunk - Mephitis mephitis
Spotted Skunk - Spilogale gracilis
Gray Fox - Urocyon cinereoargenteus

Desert Kit Fox - Vulpes macrotis
Coyote - Canis latrans
Bobcat - Lynx rufus
Black Bear - *Euarctos americanus*
Mountain Lion - *Felis concolor var californica*

Herbivores

California Mule Deer - *Odocoileus hemionus*
Appendix L  
High Desert Nature Study-Mammal Monograph  

Black-Tailed Hare (Jack Rabbit) - *Lepus californicus*  

**Identification:** The Jack rabbit is easy to tell from ordinary rabbits because of the size of the ears. They are twice the size of the head. Its legs are long and seem to have a spring in its heels. Its coloration tends to be tan, grizzled or gray. The ears are tipped with black on the upper surface. The Jack rabbit tends to be from 18-23 inches in length and weighs as much as a heavy house cat.

**Habitat:** This is the most familiar animal seen in the California deserts. It lives in open fields, deserts, and areas with plentiful amounts of shrubs.

**Offspring:** Several litters are born each year, the size varies from 3 to 7. They are born in a protected place under brush. Their eyes are open and they are well-furred at birth with a white spot on their heads. They are able to run within a few hours of birth.

**Food:** The Black-Tailed Hare eats grasses, herbs, stems and leaves of shrubs.

**Range:** The Jack rabbit is found in just about every open or terrestrial habitat ranging from below sea level (Death Valley) to 12,000 ft. They favor open areas in foothills, grassland, and chaparral. They are found in some flat, open areas in forest.

**Predators:** Birds of prey, bobcats, coyotes, dogs and man.

**Comments:** The Black-Tailed Hare depends on his good legs to out run his enemies. If cornered, the hare will leap into the air and can travel at 40 miles per hour.

**Traces:**

*Front*

*Hind*

Prepared by Jennifer Dargo
Appendix M

High Desert Nature Study-Mammal Monograph

Beechey Ground Squirrel - *Citellus beecheyi*

Identification: The Beechey Ground Squirrel has flicked or mottled fur with a gray mantle over its shoulders. It has a big, bushy tail. An adult weighs between 1.1 and 1.7 pounds.

Food: The Beechey Ground Squirrel's diet consists of a wide variety of green vegetation, nuts, seeds and fruit. They have been reported to be attracted to meat baits and observed to steal small birds to feed upon.

Habitat: The Beechey Ground Squirrel is so well adapted as to be the most numerous mammal in the State of California. This squirrel is usually found in semi-open areas, often in underbrush or underground dens.

Range: The Beechey Ground Squirrel is found from the hot, dry desert to the higher mountain elevations.

Young: The gestation period is approximately one month. The litters are born in an underground nest. There are 3-15 young born each spring. The young are out of the nest 8 weeks later. They frequently play outside the den. Some Beechey Ground Squirrels have been known to live as long as six years.

Comments: Several years ago, it was discovered that the fleas carried by the squirrels contain Bubonic Plague. Several people have died as a result and massive overpopulation of squirrels pose a serious health problem. They further do damage to agricultural crops and create drainage problems. Efforts have been repeatedly made to eliminate the animal but the squirrels are so common that they return within a few months. Farmers are encouraged to tolerate their predators such as coyotes, hawks and foxes as they tend to control the population size.

Predators: Birds of prey, larger mammals of the dog and cat families, snakes and badgers.

Tracks:

Prepared by Jennifer Dargo
Appendix N

High Desert Nature Study Project

List of Bird Monographs

Turkey Vulture - Cathartes aura
Golden Eagle - Aquila chrysaetos
Red-Tailed Hawk - Buteo jamaicensis
Cooper's Hawk - Accipiter cooperii
Mountain Quail - Oreortyx pictus

Band-tailed Pigeon - Columba fasciata
Mourning Dove - Zenaidura macroura
Barn Owl - Tyto alba
Burrowing Owl - Speotyto cunicularia
Road Runner - Geococcyx californianus

Black-Chinned Hummingbird - Archilochus alexandri
Anna's Hummingbird - Calypte anna
Common Raven - Corvus corax
Common Crow - Corvus brachyrhynchos
Brewer's Blackbird - Euphagus cyanocephalus

Western Bluebird - Sialis mexicana
Killdeer - Charadrius vociferus
Western Meadowlark - Sturnella neglecta
Robin - Turdus migratorius
Rufous - Sided Towhee - Pipilo erythrophthalmus

White-Crowned Sparrow - Zonotrichia leucophrys
Song Sparrow - Melospiza melodia
Fox Sparrow - Passerella iliaca
Western Tanager - Piranga ludoviciana
Orange-Crowned Warbler - Vermivora celata

Townsend's Warbler - Dendroica townsendi
Wilson's Warbler - Wilsonia pusilla
Cedar Waxwing - Bombycilla cedrorum
Acorn Woodpecker - Melanerpes formicivorus
House Wren - Troglodytes aedon
Cactus Wren - Campylorhynchus brunneicarpillus
Appendix O

Bird

Name: Mountain Quail (Oreortyx picta)

Phys. Chartrs.: Perhaps the largest of the New World quail, weighing as much as ½ kilogram (about 1 pound). Unlike the other quail species the sexes look alike. The plume consists of two feathers and is long and black. The throat is chestnut in color and rimmed with white, the head, breast and upper back are bluish gray the flanks are chestnut color with white stripes.

Distribution: Widely distributed over approximately 45 percent of the states mountainous areas from the Mexican to the Oregon border.

Nesting: Occurs in the coniferous forest areas of the state. The nest is a shallow depression on the ground, lined with leaves, pine needles, and grass found under the protection of a bush, log, rock, clump of grass or other suitable site.

Offspring: Average clutch size is 9 to 11 plain reddish-buff eggs. Incubation is 24 days. Offspring require a high protein diet for the first few weeks—consisting of ants and other insects.

Food: Consists of some small animals but primarily vegetation. Wheat, corn, barley, and oats, seeds, weeds and fruit.

Call: A loud crowing note or a soft whook.

Prepared by Lisa Kjesbu
Appendix P

Bird

Name: Road-runner (Geococcyx californianus)

Phys. Chartrs.: Approximately 56 centimetres (22 inches) in length. Hooked bill; shaggy crest; streaked back and breast; white belly; dark green wings, striped with white; stout bluish legs; and graduated tail held at an upward angle. Prefers to run along roads because clumsy in flight.

Distribution: Inhabits the deserts of Mexico and the southwestern U. S.; open country, desert, open pinon-juniper.

Nesting: The nest is built with twigs, usually in a cholla or paloverde. Made of cacti, mesquite, sage bush, or thorny bushes; a large course structure of sticks, lined with grass, feathers, strips of bark, snake skin, or rootlets, with slight depression.

Offspring: A Clutch consists of 3 to 9 white eggs. They hatch at intervals. Very rare do all of the clutch live to maturity. Two or three will become dominant and push the weaker ones out.

Food: Although accused of killing other birds, primarily young Quail, the roadrunner's diet almost entirely consists of lizards. The youngsters also partake of this diet.

Song: Dove-like, each note lower pitched.

Prepared by Lisa Kjesbu
Appendix Q

High Desert Nature Study Project

List of Reptile and Amphibian Monographs

Reptiles

Lizards

Banded Gecko - Coleonyx variegatus
Sagebrush Lizard - Sceloporus gracilis
Granite Spiny Lizard - Sceloporus orcutti
Western Fence Lizard - Sceloporus occidentalis
Side-Blotched Lizard - Uta stansburiana

Coast Horned Lizard - Phrynosoma coronatum
Desert Horned Lizard - Phrynosoma platyrhinos
Western Skink - Eumeces skiltonianus
Collared Lizard - Crotaphytus collaris
Yucca Night Lizard - Xantusia vigilis

Western Wiptail - Cnemidophorus tigris
Southern Alligator Lizard - Gerrhonotus multicarinatus
California Legless Lizard - Anniella pulchra
Leopard Lizard - Crotaphytus wislizenii

Snakes

Western Patch-Nosed Snake - Salvadora hexalepis
Striped Racer - Masticophis flagellum
Garter Snake - Thamnophis spp.
Gopher Snake - Pituophis caterifer
Glossy Snake - Arizona elegans

Mountain King Snake - Lampropeltis zonata
Common King Snake - Lampropeltis getulus
Long-Nose Snake - Rhinocrypta lecontei
Sidewinder - Crotalus cerastes
Mojave Rattlesnake - Crotalus scutulatus
Western Rattlesnake - Crotalus viridis

Tortoise

Desert Tortoise - Gopherus agassizii

Amphibians

Salamanders
California Newt - *Taricha torosa*

Frogs

Pacific Tree Frog *Hyla regilla*
Canyon Tree Frog - *Hyla californiae*
Bullfrog - *Rana catesbeiana*

Toads

Western Toad - *Bufo boreas*
Appendix R

High Desert Nature Study - Reptile Monograph

Desert Horned Lizard - (Phrynosoma platyrhinos)

Description: Small throat scales with one row of enlarged scales on either side of the throat. Body is flattened, covered with small spines and a row of large spikes around the head. Body shape gives the reptile the common name - "Horned Toad". Colors vary to match the soil background it is found in. Colors vary from tan, brown, reddish to yellow. Underbelly tends to be pale yellowish-gray. This animal is capable of color changes within a few minutes. It generally measures from snout to vent between 4 to 5 inches in length.

Habitats: A common member of the Joshua Tree Woodland and desert flats with sandy or gravelly soils. Commonly found with ocotillo, saltbush, cactus, sagebrush and creosote bush. Widely distributed from southeast Oregon into Baja California; from the central plateau to Utah to the eastern slopes of the Sierra Nevada.

Food: Eats chiefly insects such as ants, bees, sowbugs, spiders, ticks, and butterfly and sphynx moth larvae.

Reproduction: Mating takes place in late April and peaks in June. Egg-laying starts in late July and finishes in early August. 10-30 eggs are produced and the young are called hatchlings. The new lizards require no parental help, they begin hunting and burrowing immediately.

Unusual Characteristics: Burrow just under the sand at night to take advantage of the absorbed heat of the desert. It uses its scales and horns as a defense mechanism, and since most predators get them caught in their throats, it seems to be an effective device. Most horned lizards grow the most in late summer or early spring when food is plentiful. Full growth is accomplished in three years. When excited some horned lizards may harmlessly squirt blood from a broken vessel in the eye.

Prepared by Terry Cook
Appendix S
High Desert Nature Study - Reptile Monograph

Mojave Rattlesnake - (Crotalus scutulatus scutulatus)

Description: A rather large rattlesnake, from 2 to 4 feet in length, large body blotches of dark brown color. Usually 27 to 44 diamond-like markings of brownish to yellowish color with alternating dark and light rings on the tail. A white strip is found behind the eye. The basic color is greenish-gray to greenish-brown giving it the common name of "Mojave Green" Rattlesnake.

Habitat: A common member of barren deserts, grasslands, and brushlands. The Joshua Tree Woodland and lower mountain slopes are favorite areas. It is common in scattered scrubby growth such as creosote bush and mesquite but not common in broken rocky terrain or where vegetation is dense.

Food: Various small rodents, especially Kangaroo Rats, lizards and other snakes.

Reproduction: Breeding takes place in March and April. Gestation is from 160 to 175 days with the young born alive. Most offspring are born in September or October and number from 5 to 13.

Unusual Characteristics: The Mojave Rattlesnake is considered the most dangerous of the western varieties as its venom is both a nerve agent (neurotoxin) and a blood agent (hemotoxin). Rattlesnake venom dries rapidly outside the venom glands and soon loses its potency when exposed to air. Rattlesnakes do not always rattle a warning before striking. They can swim and bite under water. Rattlesnakes will not bite to kill themselves or to avoid capture. They are resistant to their own venom and any bite made to themselves would probably be accidental.

Prepared by Steve Louie
Appendix T
High Desert Nature Study Project
List of Insect Monographs

Order Odonata

Dragonflies
Damselflies

Order Orthoptera

Grasshoppers
Crickets
Praying Mantids
Cockroaches

Order Isoptera

Termites

Order Plecoptera

Stoneflies

Order Hemiptera

Water Boatmen
Backswimmers
Giant Water Bugs
Water Striders

Order Homoptera

Cicadas

Order Coleoptera

Ladybird Beetle
Scarab Beetles
Long-Horned Beetles

Order Lepidoptera

Monarch Butterfly
White-Lined Sphinx Moth
Cabbage Butterfly

Order Diptera

Horse Fly

Order Siphonoptera
Fleas

Order Hymenoptera

Velvet Ant
Tarantula Hawk
Honey Bees
Appendix U

High Desert Nature Study - Insect Monograph

Dragonfly - Order Odonada - Suborder (Anisoptera)

Description: Two large pairs of elongate, membranous, many-veined wings that are held outstretched and never retracted. The abdomen is long and slender with some segmentation. Its compound eyes are large and occupy most of the head. The antennae are very short and bristle-like. As adults they are extremely good flyers, spending most of their daylight time on the wing. They usually remain near water but may range over many miles. They usually fly in tandem.

Habitat: Common member of freshwater such as streams, rivers, ponds and lakes.

Food: Nymphs feed on other aquatic insects; adults catch flying insects on the wing. Common hunters of streams, their keen eyesight enables them to capture while in flight.

Reproduction: Females lay eggs in quiet water or may be laid on water plants or on the surface of the water. Eggs hatch within 4-6 weeks or remain dormant through winter and hatch in the spring. Larvae are called naiads or nymphs and undergo incomplete metamorphosis. Dragonfly nymphs are one of the fiercest of any water animal - they will attack anything moving in the water. They are dull-colored and difficult to see. They capture their prey with a pair of large jaws called labium.

Importance: At all stages of their life, dragonflies are predaceous and keep misquitos, midges and other small insects under control.

Prepared by Leo Nichols
Appendix V
High Desert Nature Study-Insect Monograph

**Giant Water Bug - Order Hemiptera - Family (Belostomatidae)**

| **Description:** | Brownish, oval and flattened, from 1-2 inches long. Front legs fitted for capturing; it is the largest of the true bugs. |
| **Habitat:** | Common member of any slow-moving stream or river, ponds and lakes. |
| **Food:** | Very predacious - eats young tadpoles and fish as well as other aquatic insects. It secretes a poison when it bites its prey to finish killing the animal. |
| **Reproduction:** | Females of the genus Belostoma lay eggs on the back of the male which he carries until they hatch. Larger species lay eggs on various forms of aquatic vegetation. |
| **Unusual Characteristics:** | Some large varieties have been known to leave the water and fly about, often attracted to strong light. |

Prepared by John Large
## Appendix W

### High Desert Nature Study Project

**List of Plant Monographs**

**Flowering Plants**

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
</tr>
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<tbody>
<tr>
<td>Buckwheat Family</td>
<td>Lily Family</td>
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<tr>
<td>Mojave Buckweat</td>
<td>Joshua Tree</td>
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<tr>
<td>Flannel Bush</td>
<td>Venus Mariposa Lily</td>
</tr>
<tr>
<td>Cactus Family</td>
<td>Alkali Mariposa Lily</td>
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<tr>
<td>Silver Cholla</td>
<td>Yucca</td>
</tr>
<tr>
<td>Caltrop Family</td>
<td>Agave</td>
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<td>Creosote Bush</td>
<td>Mint Family</td>
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<tr>
<td>Evening Primrose Family</td>
<td>Woolly Blue-Curls</td>
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<tr>
<td>Dune Primrose</td>
<td>Bladder Sage</td>
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<tr>
<td>Figwort Family</td>
<td>Mistletoe Family</td>
</tr>
<tr>
<td>Yellow Paintbrush</td>
<td>Prince's Plume</td>
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<tr>
<td>Scarlet Beard's Tongue</td>
<td>Western Wallflower</td>
</tr>
<tr>
<td>Scarlet Bugler</td>
<td>Pea Family</td>
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<td>Indigo Bush</td>
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<td>Red-Stemmed Mimulus</td>
<td>White Lupine</td>
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<tr>
<td>Violet Penstemon</td>
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<td>Common Manroot</td>
<td>Pigweed Family</td>
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<td>Heath Family</td>
<td>Russian Thistle</td>
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<td>Desert Manzanita</td>
<td>Poppy Family</td>
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<tr>
<td>Honeysuckle Family</td>
<td>Bush Poppy</td>
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<tr>
<td>Blue Elderberry</td>
<td>Desert California Poppy</td>
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<tr>
<td>Joint Fir Family</td>
<td>Prickly Poppy</td>
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<tr>
<td>Mormon, Mexican, Squaw Tea</td>
<td>Potato Family</td>
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<tr>
<td></td>
<td>Indian Tobacco</td>
</tr>
<tr>
<td></td>
<td>Western Jamson</td>
</tr>
<tr>
<td></td>
<td>Peach Thorn</td>
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</table>
Sunflower Family
Rabbit Bush
Cotton Thorn
Golden Yarrow

Non-Flowering Plants
Shrubs
Antelope Brush
Flannel Bush
Mountain Mahogany
Salt Bush
Trees
Black Oak
Pinyon Pine
Juniper
Yellow Pine
Appendix X
High Desert Nature Study - Plant Monograph

Bigberry Manzanita - (Arctostaphylos glauca aromicola) -
Heath Family - Ericaceae

Common Names: Desert Manzanita, Bigberry Manzanita

Characteristics: These plants range from trailing shrubs to
plants more than 10 feet tall. The crooked
branches have a smooth, dark-red colored bark
and flat, wholly evergreen leaves, two inches
or less in length, which are inclined to be
vertical in position. The flowers tend to be
urn-shaped, small, and pink or white in color.
They form clusters, blossom in the spring and
are followed by the production of a reddish or
brown berry-like fruit that resembles a tiny
apple.

Habitats: Along dry slopes of the western and eastern
portions of the Sierra Nevada from Amador County
to Riverside County, below 4500 ft. A typical
member of chaparral and Joshua Tree Woodland
communities. It's flowers can be seen from
February to April.

Plant Used By: Indian Tribes and early Spanish settlers.

Common Uses: The berries were eaten fresh, dried and stored
for winter. Jelly was often made by the Spanish
and a soft drink was brewed from the dried pulp.
Many Indian tribes celebrated the ripening of the
Manzanita berries by holding a large feast. The
seeds were beaten into a fine flour and made into
a mush or baked as thin cakes. The widest usage
came from the leaves. The white settlers
introduced the mixing of the leaves with smoking
tobacco which was readily accepted by local
Indians. The Indians further ground the leaves
and mixed them with water to use as a wash or
lotion for the inflammation of Poison Oak. The
ground powder was boiled down into a yellowish-
brown extract, then used as a body wash for
severe colds. Applied to the head where it was
reported to stop certain types of headaches. The
Concow Indians chewed the leaves into a thick pad
and applied this pad as a poultice for sores.
Many Indian tribes used the wood for huts and
firewood. The Karok Indians made spoons, reels
for string, scrapers and tobacco pipes from the
manzanita.

Prepared by Traci Wright
Appendix Y

High Desert Nature Study - Plant Monograph

Mormon Tea - *Ephedra californica*; Joint Fir Family - *Ephedraceae*

Common Names: Squaw Tea, Mexican Tea, Desert Tea and Mormon tea

Characteristics: 0.5-1.5 meters tall with jointed photosynthetic stems, bright green to yellowish-green in color. Stems arise from thick underground root stocks; two slender, scalelike leaves, less than 5 mm. long arise from each stem node.

Sex Characteristics: Female - Leaf nodes scaly with seed bearing cones; each cone with two seeds. Distant relative of the pines.

Male - pollen bearing cones arise from leaf nodes.

Habitats: Eastern slopes of the Sierra Nevada usually dry slopes and fans largely below 3,000 ft. A typical member of the Creosote Bush Scrub, Colorado and Mojave Deserts, and Chaparral communities.

Plant Used by: Indian tribes, Mexicans and early Spanish settlers. Later reported to be used by Mormon settlers in Southern Calif.

Common Uses: The most widely used drink in California, it was steeped in boiling water. Often served as a tonic for kidney ailments, a remedy for blood disorders. A cure for colds and to soothe stomach disorders and ulcers. The stems were often ground into a powder and used on open sores or mixed with the resin of the Pinyon Pine and used as a salve. In the treatment of burns, the powder was slightly moistened and applied as a poultice. The Panamint Indians were reported to have ground the stems to make a bitter bread.

Prepared by Kim Leblo
Appendix Z
### Appendix AA

**Presentation Figures**

<table>
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<th>Topic</th>
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<th>(N_p)</th>
<th>(N_a)</th>
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<th>Average II</th>
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<td><strong>4090</strong></td>
<td><strong>4.3</strong></td>
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\(N_s\) - The total number of schools that a topic was presented

\(N_p\) - The number of presentations per topic

\(N_a\) - The estimated total attendance per topic

Average I - The average number of presentations per topic per school

Average II - The average audience per presentation
Appendix BB

Summary of Presentation Evaluations

Question and Responses

3. Rate the overall quality of the presentation.

   Excellent -17; Superior -11; Good - 5; 
   Fair - 1; Poor - 0

4. Did the speakers appear to be prepared?

   Yes - 20; No - 0; Fair -1; Comments -1

5. Did the speakers have any noticeable problems with their presentations?

   Yes - 0; No - 17; Comments - 4

6. Did the speakers have any distracting mannerisms that can be corrected?

   Yes - 0; No - 17; Comments - 4

7. Were your students interested in the presentation?

   Yes - 23; No - 0; Very - 2

8. Were there any particular things that your students liked? What? Disliked? What?

   Liked - 9; Comments - 9; Disliked - 3; Comments - 3

9. Is there an area of the presentation you would like to see added? What?

   Yes - 17; No - 3; Comments - Positive 5 Improvement 12

10. Could you have used materials to introduce the speakers' topic before they presented it?

    Yes - 17; No - 2; Comments - 2

11. Could you use post-presentation materials to help summarize the nature study topic for the class?

    Yes - 17; No - 2; Comments - 4
12. Was the presentation too long? Too Short?
   Too long - 2; No - 2; Too Short - 0; No - 2

13. Did your students feel talked down to?
   Yes - 0; No - 20

14. Was the presentation over students' heads? If so, why
   Yes - 2; No - 17; Comments - 4; Vocabulary - 4

15. Use this space for any pertinent comments you wish to express:
   Positive Comments; 30
   Negative Comments; 10
Appendix CC

Summary of Thank-You Notes

<table>
<thead>
<tr>
<th>School</th>
<th>M</th>
<th>B</th>
<th>E</th>
<th>BS</th>
<th>R</th>
<th>CA</th>
<th>L</th>
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<tr>
<td><strong>TOTALS</strong></td>
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<td>85</td>
<td>34</td>
<td>18</td>
<td>406</td>
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M - Mammals  R - Reptiles
B - Birds     CA - Comparative Anatomy
E - Ecology   L - Written Letters sent
BS - Body Systems P - Drawn Pictures sent

Letters Addressed to

<table>
<thead>
<tr>
<th>School</th>
<th>Student Teams</th>
<th>The Author</th>
<th>Science Dept.</th>
<th>Other</th>
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<td>Sierra</td>
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</tr>
<tr>
<td>Almondale</td>
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<tr>
<td><strong>TOTALS</strong></td>
<td>353</td>
<td>56</td>
<td>9</td>
<td>23</td>
</tr>
</tbody>
</table>
Appendix DD

I'm glad you're my friend. I hope you'll learn more about your friend.

Please thank everyone who helped me learn and grow.

Of course, much credit must go to

Sam Fried.

Jane E. Fried

June 13, 1979

Professor, Caltech

Spring 1979
Dear Mr. Hanlon,

I want to thank you and all of the students who participated in the science presentations at Tamarisk School. The students and the faculty were very impressed with the quality of the presentations.

If it is all possible we would like very much for this program to continue. We feel it is of great benefit to the children of our school.

Our thanks again for a very worthwhile, informative, and well presented program.

Sincerely,

Darlene Zans
Reading Specialist
Tamarisk School

June 12, 1979
Appendix FF

Tamarisk School PALMDALE SCHOOL DISTRICT
1543 EAST AVENUE Q-5 — PALMDALE, CALIFORNIA 93550

Mailing Address: Post Office Box 218
Phone: 947-7114

June 12, 1979

Palmdale High School
Mr. Bob Owens, Principal
2137 E. Ave. R
Palmdale, CA 93550

Dear Bob,

Please accept our thanks and gratitude for the fine performances of your students that visited and held the sessions on Birds, Ecology, Systems of the Body, and Mammals. They were all outstanding and presented an excellent program. The students and faculty at Tamarisk really enjoyed each presentation. I would encourage your school to continue these programs in the years to come. We would be very happy to have more of these programs next year.

Once again, the following students made presentations at Tamarisk School and were excellent P.R. agents for Palmdale High:

- Birds — Kurt Neil and Rene Clives
- Ecology — Antira Kinze11 and Denise Mulford
- Systems of the Body — John Rilling, Dave Fermer, and Martin Scott
- Mammals — Ann Massarella and Kandy Mansfield

Please extend my thanks and gratitude for a job well done to each of these students.

Sincerely,

George W. Peguesse
Principal, Tamarisk School

GWPmm
cc: Norton Nichols, Superintendent of AVUHSD
    Mike Henlon, Instructor PHS
    Carl Krueger, Superintendent of PCHS