Teaching and Research in the California Desert

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by

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INTRODUCTION

The California Desert[1] comprises a large portion of the remaining unbroken wild lands in continental United States, except for Alaska. It occupies about one quarter of the State (Fig. 1). Nearly half its 25 million acres are public lands administered by the Bureau of Land Management (BLM), U. S. Department of the Interior. These public lands belong to all the people of the United States and their descendants.

Wild lands areas, whose value for intellectual, recreational, economic and esthetic uses is irreplaceable, are among the earth's most rapidly disappearing resources. Recent establishment by Congress of the "California Desert Conservation Area" indicates governmental concern for the protection of natural values in this unique and important region. Situated close to large population centers, the Desert is threatened by careless and uncontrolled use.

The Bureau of Land Management in California is currently developing management plans for the California Desert. Emphasis has been on recreational activities because of the rapid increase in the use of off-road vehicles (ORVs) on desert lands. Indiscriminate use of ORVs--motorcycles, dune buggies, four-wheel drive vehicles--is causing damage to fragile Desert environments. Other BLM concerns include the regulation of grazing, mining, and other land uses as increasing numbers of people strain the capacity of the Desert to withstand human use.

BLM has been surveying the physical and biological characteristics of the Desert; the kinds, places, and duration of human activities there; numbers of persons involved; conflicts in use; and the nature of impacts on the natural environment. Although the BLM planning process has been underway since the late 1960's, until now there has been little information on use of the Desert in teaching and research. This report attempts to help fill this

need. We have found that teaching and research in the environmental sciences have been major activities in the Desert for many years. We have obtained information on such use by mail questionnaires and telephone interviews.

BACKGROUND AND METHODS OF STUDY

Our survey began with a series of telephone calls conducted by the senior author from December, 1974 to April, 1975. He questioned professors and graduate students at a number of colleges and universities in California to determine the extent of their use of the Desert in teaching and research. A report (Appendix I) titled "Teaching and Research in the California Desert Conducted by Institutions of Higher Education in California", was published in mimeographed form in June, 1975, and copies were sent to the Bureau of Land Management (BLM) in California. BLM then contracted (Order No. CA-960-PH6-77, September 8, 1975) with Professor Stebbins to expand the study. Mr. Ted Papenfuss, one of Stebbins' graduate students, was hired for this purpose. The study began as an extension of Stebbins' advanced education study, but through discussion with BLM, it was redirected to public school use. It extended from October, 1975 to February, 1977.

The report of findings titled, "A Survey of the Use of the California Deserts as a Teaching Resource by Public Schools in Southern California" was submitted to BLM in February, 1977. The Papenfuss study (hereafter designated as Phase I) centered on public schools in 7 southern California counties---Inyo, Kern, San Bernardino, Riverside, Los Angeles, San Diego, and Imperial.

Upon completion of the BLM contract, Stebbins felt that a more comprehensive investigation was needed and he obtained private funding for this purpose. This initiated Phase II. Florence Amamoto was hired to conduct the study. The acknowledgements section lists the agencies and

individuals who supported the Phase II effort. The budget for Phase II appears in Appendix II.

The present report summarizes findings from both the Phase I and II surveys. In including the earlier Phase I information we have been careful to avoid duplication of findings. Phase II expanded the coverage of Phase I to include public schools in Orange and Sacramento counties and private schools in all 8 southern California counties (the 7 counties of Phase I + Orange County). A statewide survey was made of use of the Desert by colleges and universities (hereafter called C-Us). Data from Papenfuss Phase I questionnairies on C-Us, not analyzed in the Phase I report, have also been included.

The data base for our survey has been sent to the BLM office in Riverside, California. Appendix III explains symbols used to simplify procedures throughout our study.

TEACHING AND RESEARCH IN THE DESERT

The Phase I and II surveys extended from October, 1975 to June, 1977, with most data obtained after September, 1976[2]. We regard our findings as indicative of a single year's use because of the regularity of most school activities.

Elementary and High School Use

Most of the public and private schools in 8 southern California counties, and the public schools in Sacramento County were contacted[3,4]. A few schools elsewhere in the State were also surveyed (Table I). We sent them approximately 3000 questionnaires of which close to 1,300 (43%) were

returned; of these 216 (17%) were positive. Through phone interviews we increased the latter to 335 (Table 1).

The 8 counties reported 132,374 person days---(p/d), (number of persons x days or fractions thereof)---of Desert use. Using the method of projection described below, we project minimal actual use to have been approximately 182,000 p/d. Adding information obtained from Sacramento county and spot-check returns from elsewhere in the State to projected use, brings the total to over 183,000 p/d. For a list of schools and person/days, see Appendix IV. Data is insufficient to estimate statewide use.

Where do the schools go in the Desert? Reported sites total 187 widely distributed localities (Fig. 1 and Appendix V). Many of them are the same ones used by the colleges and universities. In addition, some schools indicated general use of the Desert. State Parks and National Monuments are favored because of the facilities and security they afford, but many other areas are also heavily used. (See Note 5 for some of the more important ones.)

The most frequently mentioned topics of study were general science, ecology, biology, geology, and history. Other topics, infrequently listed, were astronomy, photography, archeology, rock-climbing, mineralogy, fossils, lapidary, art, recreation, and survival. General science and biology were the most common areas of study in the elementary schools; biology and geology in the junior high schools and high schools.

Among 1,082 respondents who are not now using the Desert, 683 (63%) indicated they would like to do so if certain needs could be met (see Appendix VI). In approximate order of importance these needs were money, transportation, information on facilities available, liability protection, administrative and

parental permission, and guidelines for field studies.

Projected School Use.--Since not every school that received a questionnaire returned it, the results of our survey do not report total student use of the Desert by Southern California counties. However, it is possible to estimate the total use. San Bernardino County was selected as the base county for projections because it is a large county containing both desert and non-desert schools.

Although every school in the county received a questionnaire, not every school returned one. The schools that returned questionnaires reported 34,259 student days. Each school that did not return a questionnaire was telephoned and out of the 230 schools called, 51 reported Desert use. This use was 45,652 student days. The total for San Bernardino was then 79,911 student days. From these data we can determine the percent of student use reported by questionnaires and the percent of student use contributed by non-responding schools that had to be telephoned.

There was not enough time to telephone the many schools that did not return questionnaires in the other counties, so we assumed that the percent of reported student use for San Bernardino County was proportional to the percent of reported use for other counties. In other words, a school in San Bernardino County that used the Desert is as likely to return a questionnaire as a school in another county that used the Desert.

After mail questionnaires had been received from all counties and total student use had been projected, we telephoned all non-responding schools in Imperial, Inyo, and Riverside counties. This allowed us to compare actual student use with projected use for these three counties. Since there was less than a five per cent error between projected totals and actual totals for

these three counties, we feel that this method of projection is suitable for southern California in general.

College and University (C-U) Use

We surveyed Desert use by nearly all California state colleges and universities, the University of California (all 9 campuses), most public community (or junior) colleges, and most private universities and colleges.[6] Emphasis was on use of the Desert by Life Science Departments. Of approximately 500 questionnaires sent to departmental chairmen, faculty, and graduate students, 228 (46%) were returned. One hundred and ninety reported Desert use.

Estimated teaching time by the C-Us totalled 47,617 person days, including participation by both faculty and students. C-U sites ranged widely over the Desert and included other sites in addition to many locations also visited by the public schools (Fig. 1). A total of 201 localities was reported. Some C-Us also indicated general use of the Desert. Estimated use (in person days) for both teaching and research was obtained for each site. Total person days reported for research was 12,522.

Courses commonly taught were (in approximate order of frequency): biology (natural history, zoology, general biology, field biology, etc.), plant taxonomy, ecology, California flora, geology, herpetology, ornithology, entomology, environmental studies, and mammalogy. Less common subjects were: evolution, wildlife management, remote sensing of resources, behavior, wilderness survival, aquatic biology, paleontology, soil science, ichthyology, invertebrate zoology, mineralogy, and resource management.

A number of major educational centers located in the Desert itself attract many students and teachers: notable are (1) the Philip L. Boyd Deep Canyon Desert Research Center and (2) the Living Desert Reserve at Palm Desert, Riverside County and (3) the Barstow Unified School District Research Station near Hinkley and (4) the California Desert Studies Consortium station at Soda Springs, San Bernardino County. Participants in the programs of these centers work not only at the centers themselves, but often range widely into other parts of the Desert.

Organized Groups

We obtained information on Desert use from curators, supervisors, and other representatives of the following nature study groups: San Bernardino County Museum, Los Angeles County Museum, San Diego Natural History Museum, Zoological Society of San Diego, Palm Springs Desert Museum, Living Desert Association, Anza-Borrego Desert Natural History Association, the Desert Research Institute (University of Nevada), Placerita Canyon Nature Center, and chapters of the National Audubon Society. Questionnaires were sent to 41 chapters of the Society in California; 22 were returned and 14 of these reported Desert use. Members of the Audubon Society, as individuals and in groups, go on field trips to many parts of the Desert.

A total of 8,838 p/d was reported by the Audubon groups. This is a highly conservative figure because several chapters either could not calculate or did not include in their estimate the use of the Desert by individual members. Furthermore, use is expected to increase. According to a Department of Agriculture study, bird watching is the fastest-growing outdoor sport in the country.[7] The same limitations

apply to some of the reports received from other organized groups. The non-Audubon groups reported a total of 3,997 p/d, 716 of which were classed as research. The grand total for organized groups was 12,835 p/d. The estimate is conservative; we made no concerted effort to survey organized groups.

Total Estimate for Desert Educational Use

Combining information reported by precollege, higher education, and the organized groups, we obtained a figure of 207,328 p/d; adding to this our projected public and private school use, we estimate a minimum of 256,892 p/d of educational use of the Desert by this group of respondents (548 persons) during a recent (since 1975) average year. We calculate our margin of error in interpreting results as less than 4 per cent.

Much educational use of the Desert has been long-term (Table 2). C-U respondents reported an average of 10 (range 1-40) years of use, and 20 organizations 16 (range 1-1/2 - 73) years of use. Among the latter, 12 Audubon Societies reported 18 (range 1-1/2 - 73) years of use.

A listing of localities visited by all educational groups appears in Appendix V. Numbers key to road maps that accompany the data base. The public and private schools and C-Us visited a total of 272 sites in the Desert.

DESERT RESEARCH

Many graduate students and professors, as well as persons associated with governmental agencies and private industry, are engaged in Desert research. Studies range from those pertaining to single plant and animal

species to investigations of entire desert ecosystems. Many are basic studies that show no immediate practical benefits. Others, however, are oriented more directly toward human needs. The following discussion gives an overview of research in the Desert. Appendix VII gives a list of topics studied. (See note 8 for a sample of research topics mentioned.)

Paleontology. Extensive studies of prehistoric life have been in progress in the California Desert for over 70 years. A series of vertebrate fossil faunas have been found extending over the last 65 million years--from Paleocene to Recent; invertebrate sites date from the early Cambrian, over 600 million years ago. The Paleocene site was found recently near the east end of the El Paso Mountains, apparently the only one in California in which land vertebrates have been discovered. South of Owens Lake is the "type section" of the fossiliferous Coso beds which are of early Pleistocene age. Fossil mammal discoveries in this area have played an important part in establishing a correlation between North American and European Pleistocene faunas. Famous and internationally known sites are the Barstow and Ricardo formations, respectively, about 12 miles north of Barstow and at and near Red Rock Canyon. They contain some of the richest vertebrate fossil faunas in California and are a priceless scientific and educational resource that cannot be duplicated anywhere else on earth. Paleontological exploration of these areas goes back to 1911 and study of the rocks at Ricardo to 1871. The Barstow Formation is the namebearer for one of the 17 major subdivisions of mammalian evolution over the last 60 million years in North America. Both Formations are known to all vertebrate paleontologists and are classical areas for science. Each has yielded approximately 100 kinds of extinct plants and animals and there is

additional new material coming to light. The Barstow beds contain over 200 localities; those of the Ricardo over 450.

Studies on fossil animals in the Desert have been conducted by the University of California, California Institute of Technology, the American Museum of Natural History, the Los Angeles County Museum, and the U. S. Geological Survey. The Desert has also contributed greatly to the paleobotanical investigations of Daniel Axelrod, Professor Emeritus, at the University of California, Davis. Paleontological research is growing in importance in the Desert as new sites are discovered and old ones are more intensively worked.

Zoology. A vast array of studies of animal life in the Desert has been conducted over many decades, and investigations continue to expand in scope and detail. For over 60 years, the University of California Museum of Vertebrate Zoology has been investigating the lives of vertebrate animals in California, including the Desert. Over 100 publications, including 7 books, address themselves to biological problems in the Desert. Many of the specimens in the Museum's collections have been obtained in the state's arid lands. These specimens are often accompanied by detailed field notes.

Studies conducted by the Museum's staff and students form the primary basis for much of the base-line information on the distribution and habits of terrestrial vertebrates in California and have contributed greatly to the management and protection of the State's wildlife. The Museum's collections of California vertebrates are the largest in the world and represent a major resource in studies of vertebrate evolution and in monitoring effects of environmental changes on wildlife. For example, the

the Museum's wild bird egg collection helped document the eggshell-thinning effect of DDT and contributed to the studies that led to the banning of this dangerous pesticide.

Despite many years of exploration, new species and varieties, and isolated populations of known forms, continue to be found in California. A new species of salamander was discovered in 1973 in the arid Inyo Mountains, and the Gila Monster was discovered recently in the little-studied eastern Mojave. This is the first convincing evidence for naturally-occurring populations of this animal in the state. The Museum's research program carries a strong mandate to conduct studies aimed at the protection and conservation of the state's vertebrate animal life. A private endowment supports much of this effort. Of most pressing concern are isolated populations of small size, often living in small patches of suitable habitat. Some are officially classed as threatened, rare, or endangered. Others remain to be discovered.

In addition to distributional and natural history studies, many zoological investigations have focused on the physiological adjustments made by desert animals in coping with environmental extremes. Thermoregulation and water metabolism have been given much attention. Professors and students at the University of California at Los Angeles and Riverside and Fullerton State University have been particularly active in such research. Beginning with the work of UCLA's Raymond Cowles and his student Charles Bogert, who studied the role of temperature in the lives of California Desert reptiles, a major investigation of temperature in the physiology, behavior, and evolution of vertebrate animals was launched. From the many thermal studies conducted in the California Desert came not only great advances in understanding of

mechanisms of temperature control, but also contributions to the understanding of such diverse phenomena as the evolution of fur and feathers and the extinction of the dinosaurs.

The invertebrate life of the Desert is abundant, varied, and different from that of most other arid lands of the southwest. Much speciation is occurring. There are often major differences in species populations from canyon to canyon in many desert mountain ranges and from dune to dune. Of particular interest are the ants. There are many species and they occur virtually everywhere in the desert. They perhaps account for as much as one third of the invertebrate biomass in some areas and are extremely important in food chain relationships. Studies of ants are being conducted at the Deep Canyon Desert Research Center of the University of California, Riverside, and by researchers at U.C., Berkeley and elsewhere. Important interactions occur between ants and plants. In the Vizcaino Desert of Baja California, we found that cactus (Opuntia) roots appeared to selectively penetrate the nests of the harvester ant (Pogonomyrmex) where moisture and nutrients were concentrated. A similar relationship perhaps exists between ants and plants in the California Desert.

Invertebrate studies are important in the development of biological controls of pests. In the Desert, experiments have shown the desirability of large natural buffer zones, about 10 miles wide, around agricultural areas. Wild, free-living predatory and parasitic insects move into the agricultural lands and attack the crop pests. A great reservoir of natural control species is thus available to cope with pest flare-ups.

Botany. The dearth of information on desert plants is so great and the probable benefits of their study so promising, that the National Science

Foundation has given extensive support to a major study of the vegetation of the southwestern United States by the New York Botanical Garden.

Studies of the creosote bush, a dominant desert shrub, conducted by Frank Vasek, Hyrum Johnson, and Leonel Sternberg, University of California, Riverside, are of special interest. Aerial photographs reveal that some creosote bushes are arranged in rings. The rings appear to have originated from a central point by vegetative segmentation, and the individuals that compose them are members of a clone. Cloning seems to be facilitated when the root crown is covered by wind or water-borne soil. The center of the bush dies, presumably due to draught, and new growth develops at the periphery. Ring expansion is very slow and is estimated to be less than 1 mm a year, even under optimal conditions. Undecayed wood at the center of a ring 30 cm in diameter was found to be approximately 580 years old;[9] another contained wood approximately 700 years old (radio-carbon dating). A ring 20.7 m (68 feet) in diameter has been observed, estimated to be over 5,400 years old.[10] It is speculated that some of the rings go back to the time when the creosote bush was first establishing itself following the last ice advance, some 10,000 years ago. The slow growth rate and plant fragments in fossil middens of woodrats,[11] which indicate vegetation changes in the Desert, have contributed to this theory. Painstaking biochemical studies have been performed to determine whether or not the members of a ring are all parts of an original fragmenting and expanding plant. These tests have required repeated trips to the Desert to study the same rings. Johnson Valley has extensive development of old rings and has been an important area of study, but the Valley is now open to ORVs. On occasion, workers have returned to find study plants damaged by these machines. A four-wheel drive vehicle has been driven through the 68

foot ring.

Desert botanical research has important practical aspects. Deserts are the largest remaining uncultivated land areas with potential for agricultural expansion. Much of the world's arid lands research is going on in Australia and southwestern United States, especially in the Mojave and Colorado Deserts. Many of our desert plants may prove to be important crop species. An example is jojoba (Simmondsia chinensis) under cultivation in Israel and the U.S. as a livestock forage plant and as a source of liquid wax from its seeds.[12] The wax is of such quality that it can replace sperm whale oil (obtained from an endangered species). Sperm oil is used in machinery that operates at high speeds and temperatures. All desert varieties of jojoba are important at this stage because it is unknown which ones may be most suitable for crop development.

Also of interest is the photosynthetic process in "carbon 4" plants.[13] Many desert species are of this type, including the salt-bushes (Atriplex). Such plants can fix carbon at high temperatures and with little water; hence the C4 system is better adapted for arid lands than the photosynthetic system found in the common C3 species. To understand the C4 photosynthetic pathway, we must know how it evolved. The many C4 plants in deserts are important in this regard. Knowledge of C4 plants is important to arid lands agriculture. Various weeds are of this type and new crop species may be developed. C4 plants already under cultivation are sugar cane, corn, sorghum, and the millets.

Halophytes are under study. They are salt-tolerant plants that take up salts from soils and exude the excess, or retain it and drop parts of their structure as they dry. The desert box thorn (Lycium) and Mesembryanthemum are examples. Salt tolerance is of importance to arid lands agriculture in the development of crop species, weed control, and soil desalinization. The

U. S. Salinity Laboratory at Riverside is investigating such tolerance in crop plants. Halophytes can be grown to remove salts from soil, thereby preparing the soil for more productive species, with less salt tolerance. Important desert research areas for the study of halophytes are the alkali flats, also sites attractive to ORV recreationists.

The University of California at Riverside and the Australian National University have undertaken a joint study of the ecology, physiology, and biochemistry of cacti in native and favorable exotic environments. One aspect of the study pertains to the action of cactus stomates, the "breathing pores." The stomates open at night when cacti take in most of their carbon dioxide, storing it in an acid medium, for use the next day in photosynthesis. In the daytime, water loss is minimized by closing the stomates. Cacti are used as forage plants. In some areas (Africa, Australia) they are a pest and knowledge of their physiology is important in their control.

Desert soils. The deserts of the earth are among the few remaining areas that still contain "virgin" soils, untouched by man. Agriculture disturbs the physical, chemical, and biotic structure of soils and base line areas are needed for study of natural processes in soils to better manage the manipulated ones. Soil-forming processes are slow and long-continued. Once disturbed, many equivalents of a human life-time may be required before soil returns to a state corresponding to its virgin condition. Indeed, such a return may never be achieved.

The most fragile Desert soils occur on elevated Pleistocene terraces. They are shallow, often only a few inches thick, and highly sensitive to mechanical disturbance.

SURVEY LIMITATIONS

It is important to emphasize that our study has covered thoroughly the Desert use of public and private schools only in southern California. Although college and university coverage was Statewide, we emphasized life science departments. We hope that the present study will be expanded; it would be of interest to determine use of the California Desert by educational institutions in contiguous Nevada and Arizona, and in other parts of the country, as well as by such college and university departments as geology, geography, archeology, etc. Many other C-U departments are using the Desert. By chance we found a history professor in one of the southern California junior colleges who takes his students into the Desert to write essays. An effort should also be made to increase the information on the Desert activities of organized nature-oriented groups, beyond that of the Audubon Society. There are also the many private indiviuals who go to the Desert for study and enjoyment of nature. While unorganized and unobtrusive, their numbers may be great.

DISTURBANCES TO TEACHING AND FIELD STUDIES

Respondents were requested to note any disturbances that interfered with their educational pursuits in the Desert. Disturbances were listed in alphabetical order on the questionnaires. Results are shown in Fig. 2. Off-road vehicles were ranked as most disturbing by all educational groups, followed by vandalism (schools and C-U groups) and urban and housing expansion (organizations). There is a relationship between ORVs and vandalism. Vandalism, which includes damage to study sites and equipment, and destruction of the natural objects of study, is aided by the mobility

of ORVs.

It will be noted that responses to multiple disturbances are not shown in the histogram for organizations. The sample was small. However, of the 17 respondents who ranked disturbances, 14 scored ORVs as highest. Reasons for the high scoring of ORVs are apparent. ORVs damage, and sometimes completely destroy, the subjects of study--geologic features, soil, plants, animals, fossils, and archeological sites.[14,15,16,17] They make it difficult to find protected sites for field observations and research. People who are interested in nature study avoid areas where ORVs occur because of the noise, dust, and threat of injury to persons on foot.[18] Many desert studies require months or even years of close attention, and a researcher's investment in his project grows with time. This emphasizes the vulnerability of desert research to the impact of vehicles. Moreover, a number of respondents reported they had abandoned research projects and teaching areas--one researcher even an area in a State Park--because of ORV disturbances.

Vehicles off-road can quickly degrade natural environments.[19] A single motorcycle travelling 20 miles impacts the soil of one acre; an average four-wheel drive vehicle does so in 6 miles of travel. Even a single ORV, under some conditions, can start deleterious changes in a natural community by spreading weeds. Tumbleweeds (Salsola) have been found growing in single motorcycle tracks. In some areas these plants have significantly altered the entire biotic community. F. R. Fosberg, an authority on alien plant species, has warned that unless it is desired to change the character of the vegetation, and thus much of the landscape of the desert, vehicular traffic in the desert must be limited to established roads.[20] A number of studies[21] have now documented the decline in abundance and diversity of native plants and animals in ORV areas on our wildlands.

Fossil sites are also highly vulnerable. The deposits of bones, shells, petrified wood, and leaf impressions are ripped apart, scattered, and pulverized. Tell-tale "signs," small fragments of bone and other fossil materials on the surface, that may lead a scientist to a new fossil discovery are obliterated. ORVs have entered the famous Ricardo deposits, the Cosos beds, and other important fossiliferous areas.

There are more subtle damaging effects. The behavior of resident animals that are still present in ORV use areas may be altered. There may be damage to hearing, interference with communication signals, and physiological stress induced by the noise, sight, ground vibrations, and fumes of vehicles. Desert iguanas experimentally subjected to motorcycle sounds at sound pressure levels found in the vicinity of ORV "pits" (areas of concentrated "ORV play") have suffered losses in hearing.[22] The sounds are transmitted with damaging force even into their burrows. Many desert animals have daily routines of activity and rest that provide little margin of safety if disrupted. In warmer weather some desert lizards are active only about 6 hours a day. Prolonged inactivity is necessary for survival when temperatures are high and humidity low. ORVs disrupt patterns of foraging, breeding, thermoregulation, and rest. They cause burrows to collapse, destroying refuges that are crucial to desert animals in escaping environmental extremes. By breaking desert crusts they make burrow construction for some animals difficult or impossible in some areas, because an intact crust is required to prevent collapse of burrows near the surface.

Any wild area is a complex mosaic of unique biotic features. No two square meters are quite the same. On a quarter mile walk in the desert, for example, one might intersect a communal egg-laying site for lizards; a hibernation site for snakes; an amphibian breeding area; special soil

conditions supporting growth of a community of rare plants; a wash bank containing burrows of tortoises; an isolated population of lizards found nowhere else in the area; a fossil site, and many features unseen and unknown. All are fragile and readily damaged by ORVs. Many are uncommon and several attract prime, breeding adults to a limited area. Such a range in biotic variety along short stretches in natural environments is not uncommon. Every time a vehicle is driven off-road in wild lands there is the risk of loss of or damage to unique biological resources.

HUMAN IMPACTS AND MANAGEMENT PLANS FOR THE DESERT

Until quite recently the Desert remained relatively undisturbed by man's activities. But now the pressure of rapid growth and economic and recreational demands threatens natural values. The Desert faces the same fate that has befallen many other natural places in the United States and elsewhere. Situated near high density population areas in southern California, the Desert serves as a safety-valve, relieving some of the effects of crowding and the pressures of city life. Its own rigors and the fact that its values were little known, once protected it from substantial intrusion by civilized man. However, with the popularization of campmobiles and off-road vehicles which provide comfort and mobility, the Desert, even remote areas, has become readily accessible and attractive for outings to large numbers of people.

Moreover, increasing demands for energy have intensified the search for sites for solar, geothermal, and atomic plants. Powerlines, housing, and agriculture are on the increase, and overgrazing has seriously disturbed natural environments in some parts of the Desert. Many of these developments conflict with each other, as well as with traditional, usually benign, uses

of the Desert, such as "on foot" recreation, sight-seeing, picnicking, tent-camping, nature study, and teaching and research.

MANAGEMENT RESPONSES: PLANS FOR THE DESERT

Since the late 1960's BLM has been studying the environment and use patterns in the Desert. The increasing pressures of use were becoming widely evident. Environmental damage in many areas was obvious, and problems of sanitation, littering, vandalism, traffic, and personal safety of Desert users were pressing. The planning effort was, in considerable measure, prompted by the very rapid increase in off-road vehicle recreation that began in the late 1960's. The Desert is easily damaged by mechanical impact. The natural environment recovers slowly, if at all. In 1973, President Nixon issued an Executive Order, no. 11644, pertaining to ORV regulation and control. It was recently amended but without much change by President Carter. The Order called upon federal agencies to prepare regulations controlling ORVs on lands under their custody.

The planning process for the Desert is now far advanced: areas have been set aside for ORV recreation; a BLM public education center has been established at Barstow, California; and many critical habitats and species populations have been identified, and protection areas designated. Maps have been published showing places for recreational vehicle use. BLM now has police power and a staff of desert rangers. Planning for the entire Desert is to be completed by 1980.

The plans published by BLM have occasioned considerable controversy. Many conservationists feel the agency has been far too generous in accommodating ORVs on the public lands. The scientific community, the desert biologist and environmentalists--who have studied the natural features of

the Desert--appear unanimous in voicing concern over the damage already caused by off-road driving.[29] On the other hand, many ORV recreationists believe their interests have been unduly restricted.

There is now far more data available on the Desert's natural values and on the effects of various kinds of human impact on the Desert than when BLM first began publishing its management plans for the Desert. The present report adds further to this expanding data base. It may be necessary to re-examine the multiple use concept as applied to open natural terrain such as is found in arid lands. It is not possible, in our judgement, to protect wildland values, while at the same time allowing a geographically fine-grain interplay of many uses. The broad Desert expanses, notable for their silence, the delicate and precariously situated biota. The lack of screening vegetation, which in forests impedes the sight and sounds of human and vehicle activity, all call for special planning. It is evident from our studies that off-road vehicle recreation and teaching and research in the Desert are incompatible. The two activities must be physically well separated. Otherwise the education pursuits will be driven out and the areas usurped by ORVs. Such displacement is already affecting non-mechanized forms of recreation in many parts of our country.[23]

CONCLUSIONS

Importance of the Desert in Education

Natural environments in the California Desert have great value for both teaching and research, and thus for society as a whole. The educational benefits multiply and are passed on to the future. Research will provide better understanding of the Desert and, through teaching, knowledge of the

natural values there will spread. This will lead to an increase in appreciation of the Desert and to better management of its resources. Thousands of scientists, teachers, and students have used or are now using the Desert. Many academic disciplines are represented--botany, zoology, ecology, geology, soil science, geography, etc. Some users come from other states and from abroad--Australia, New Zealand, Africa, India, the middle east, and Europe.

The natural lands of the California Desert constitute a unique teaching and research facility. There appears to be no other place on earth where such a biologically and historically rich desert environment has been subjected to such breadth of study over such a long period by a variety of academic disciplines. The Desert is logistically well situated for such investigations. The arid lands of southwestern United States, Mexico, and, in particular, the California Desert, and the desert lands of Australia and Israel are emerging as important foci for arid lands research. These are the areas where manpower, funding, and proximity provide opportunities which are difficult to match elsewhere, and where research and teaching programs are exerting an important guiding influence on the use and mananagement of desert lands throughout the world.

Importance of the Desert for Basic Research

The California Desert offers outstanding opportunities for basic research in arid lands biology. Basic research, that conducted primarily to gain understanding of natural phenomena, in the past, has proven to be of utmost importance to human needs. Frequently, it is more productive than applied research. The Desert, because of its biologic variety and varied environmental conditions, offers unusual opportunities for the study of

adaptations of wild plants and animals to the rigors of desert life. The scarcity of water, temperature extremes, and intense sunlight have placed great demands on the living fabric. Varied topography, climate, and soil conditions provide a fertile field for the study of processes of speciation.

Importance of the Desert for Applied Research

Applied research is also being extensively pursued. Arid lands constitute the largest remaining portion of the planet with possibilities for major agricultural expansion. Significant current studies are those dealing with C4 plants, cactus research, halophytes, forage plants, plants as indicators of soil fertility and the depth of the water table, and use of native insects in biological control. The abundant shrub growth of our arid lands has been little studied. The potential of wild shrubs for benefitting man is great.[24] Desert plant species act as a genetic bank upon which we can draw to protect and improve cultivated species. The pharmaceutical properties of such plants should be more fully investigated. Many species may make important contributions to medical science. The cost to society of the loss of wild lands in the Desert thus must be regarded as extremely high.

Special Areas Needing Protection

Our survey has helped identify a number of areas that we believe should be managed primarily for their wild land values and long-term use for non-mechanized recreation, nature-study, teaching, and research (see Note 5). These areas, which already have a long tradition of such use, include: (1) the Kelso Basin, including Kelso Dunes, Soda Dry Lake, and flanking mountains--Providence Mountains and the Granites. This is an outstanding natural area, as yet little disturbed by man. It may well qualify

for National Park or Monument status. The area presently vies with Death Valley, Joshua Tree National Monument, and Anza-Borrego State Park, in popularity as a place to take school groups. Eighty-one respondents reported use of the area--more than listed for Death Valley or Anza-Borrego State Park. (2) the Pisgah and Amboy lava flows. They contain alternating patches of pale wind-blown sand and black lava, offering a remarkable mixture of sand and rock-dwelling organisms. (3) Jawbone Canyon area. This and nearby Red Rock Canyon contain major fossil deposits. (4) the Algodones Dunes and adjacent mesas. The area has one of the richest dune biotas in the world--containing many endemic plants and animals. Major sections of it should be designated for teaching and research and non-mechanized recreation.

Harmful Effects of Human Impact

Desert lands are particularly vulnerable to mechanical disturbances, overgrazing, and other kinds of human impact. Activities that damage or destroy soil structure and vegetation will increase water erosion and wind erosion. Dust can be expected to increase,[25] accompanied by property damage, soil loss, and perhaps increased health hazards.[26] Following the Barstow-Vegas motorcycle race, November 30, 1974, dust fall in one area was recorded as approximately 30 percent above normal during a period of one month.[27] Plant cover-damaging activities may increase the ground surface albedo, and light reflectance from the Desert surface may increase. A recent study of drought conditions in the Sahara[28] suggests that processes decreasing plant cover may be reinforced by decreases in rainfall, thus perhaps initiating or perpetuating droughts. The possibility of similar biogeophysical feedback mechanisms operating in our arid lands, including

the California Desert, should be investigated.

In the open unobstructed terrain of the Desert, environmental features lie exposed, readily visible, accessible, and vulnerable. The Desert's antiquities are especially in danger. These include ancient creosote bushes; rock pavements that have remained undisturbed and exposed to the sun for 2,000 years; rare plant and animal species, remnant populations found nowhere else; fossil deposits; and prehistoric and historic human artifacts.

SUMMARY OF RESULTS: CALIFORNIA DESERT TEACHING AND RESEARCH SURVEY

(Applicable to one recent year's use of the Desert)

A. Public and Private Schools

(1) Most of the public and private schools in 8 southern California counties in or near the Desert (part of Los Angeles County excepted) were queried as to teaching use. Approximately 3,000 questionnaires were mailed. Three hundred and thirty-five respondents estimated a total of 132,374 person days (p/d) of use. We project actual use to have been at least 182,000 p/d. Adding spot-check returns from elsewhere in the State to projected use, brings the total to over 183,000 p/d. There is insufficient data to estimate Statewide use.

(2) Many additional schools would go to the Desert if funds, transportation, and other needs were met. Out of 1,082 negative returns, 683 (63%) expressed such a desire.

(3) A total of 187 specific sites of use, widely distributed over the Desert, were reported.

(4) Topics most commonly studied were general science and biology by elementary schools and biology and geology by junior high school and high schools.

B. Colleges and Universities

(1) Approximately 500 questionnaires were sent to nearly all California State colleges and universities, all campuses of the University of California, most community (or junior) college, and most private universities and colleges. We centered attention on life science departments. One hundred and ninety respondents estimated a total of 47,617 person days of use in teaching and

12,522 in research. Information is inadequate to estimate Statewide use.

(2) A total of 201 sites visited was reported.

(3) Common topics taught were biology, natural history, ecology, plant taxonomy, herpetology, ornithology, entomology, environmental studies, and mammalogy.

C. Organized Groups

Forty-one State Chapters of the National Audubon Society were contacted. Fourteen reported Desert use and estimated a total of 8,838 p/d. Audubon Society members travel widely over the Desert. We also surveyed Desert use by 9 museums, natural history organizations and other nature-oriented groups; they reported 3,997 p/d for a combined total of 12,835 person days.

D. Total Person Days and Sites Visited

The grand total for reported educational use (548 respondents) was 207,328 p/d and for projected use was 256,893 p/d. Two hundred and seventy-two sites were visited. These figures are regarded as conservative.

E. Duration of Use

College and University respondents reported an average of 10 (range 1 - 40) years of Desert use, and 20 organizations, 16 (range 1-1/2 - 73) years of use. Among the latter, 12 Audubon Societies reported 18 (range 1-1/2 - 73) years of use.

F. Disturbances

Among disturbances interfering with teaching, research, and nature-study activities in the Desert, ORVs were ranked number one by all groups.

ACKNOWLEDGEMENTS

We wish to thank the many people and agencies who helped make the present survey possible. Funds for the project were provided chiefly by contract with the Bureau of Land Management (Order no. CA-960-PH6-77, Sept. 8, 1975), and through contributions from the following Audubon Societies: Laguna Hills, Pasadena, Pomona Valley, Santa Monica Bay, San Bernardino, and Sea and Sage. A major gift was made by the Santa Monica Bay Audubon Society through their Desert Seminar held in Lancaster, California, on April 22-24, 1977. Program corrdinators were Keith and Pamela Axelson. Other southern California Audubon chapters and the Western Regional Office of the National Audubon Society helped in the promotion of the Seminar. In addition, gifts were received from the Desert Protective Council, Mrs. Frank Stockton of Bakersfield, and Dr. Keith Justice. Norma Wilbur, consultant, Curriculum and Instruction, Science, Office of the Los Angeles County Superintendent of Schools, aided with the distribution of the questionnaires. Persons who helped with fund-raising were Pamela and Keith Axelson, Norwood Hazard, Harriet Allen, Barbara Carlson, Arden Brame, Michael Long, and Glenn Stewart. Students at the University of California who assisted with data analysis were Laura Johnson, Peter Escherich, Sam Sweet, Brad Cella, Douglas Eakin, Eric Gold, Pat Cregan, Karen Noack, Stephen Greefkens, Susan Hilinski, Ann Singer, Teresa Shayler, Jennie Dusheck, Jean Cunnington, and Walter Stern. Alice Landauer supervised handling of funds and personnel matters. Dr. Nathan Cohen reviewed the manuscript and Gene Christman prepared the figures. We wish to acknowledge the advice and assistance provided by Neil Pfulb, Robert Badaracco, and Kristin Berry of the Bureau of Land Management. Finally, we thank the many respondents who faithfully completed our questionnaires and whose efforts made this report possible.

NOTES

[1] Three major biophysiographic regions are present--the Great Basin in the north, the Sonoran Desert in lowlands to the south and the Mojave Desert between, each with a characteristic biota. We will use the term "the Desert" for simplicity.

[2] The data base for this report is available at the BLM office in Riverside, California.

[3] California, Departmentof Education, California Public School Directory, 1975 Edition (Sacramento: 1975).

[4] California, Department of Education, California Private School Directory (Sacramento: 1975).

[5] Areas of particularly heavy use by schools (precollege, college, and university combined) were as follows (number of respondents reporting use at each site in parentheses):

Inyo Co.--Death Valley area (67), Owens Valley (25), Saline Valley (11);
San Bernardino Co.--Kelso Dunes (28), Providence Mtns. (25), Morongo Valley (22), Barstow (19), Pisgah Crater (18), Soda Dry Lake area (17), Granite Mtns. (12), Calico Mtns. (22);
Kern Co.--Mojave (20), Red Rock Canyon - Jawbone area (22);
Los Angeles Co.--Pearblossom (15), Devil's Punchbowl (13);
Riverside Co.--Joshua Tree National Monument (87), Palm Desert Area (including Living Desert Reserve and Deep Canyon) (51), Palm Springs Area (34), Chuckwalla Mtns. (Jaeger Preserve) (11);
San Diego Co.--Anza-Borrego State Park (40), Borrego Springs (Borrego Valley) (14);
Imperial Co.--Salton Sea (33), Sand Hills (Algodones Dunes), including East Mesa and Glamis (30).

[6] G. R. Hawes and P. N. Novalis, The New American Guide to Colleges (New York: Signet Books, 1976).

[7] N. C. Chriss, "Birding Take Wing in Flight of U.S. Fancy," Los Angeles Times, May 14, 1977, p. 1.

[8] Some sample research topics under study mentioned by respondents (the numbers in parentheses are the total number of titles listed for each subject). Plants (61): diversity and germination characteristics of desert annuals; physiology of halophytes--Atriplex and others; age of creosote bushes; C4 photosynthesis in desert plants; cactus physiology; effect of grazing on desert plants; Basin sagebrush as an indicator of soil conditions and water availability.

Invertebrates (26): fairy shrimp and other crustaceans of the playas; the role of ants in desert ecosystems; endemism and adaptations of dune insects; desert insects in biological control of pests of arid lands agriculture. Mammals (33): effect of burros and cattle on desert habitats; thermoregulation, water balance, and population dynamics in desert mammals; population densities of Desert bighorn sheep. Birds (12): changes in diversity and population densities of birds in fir habitat on Clark Mountain; biology of the chukar partridge. Reptiles and amphibians (19): energetics of the desert tortoise; rehabilitation of captive tortoises to desert life; effect of motorcycle sounds on the hearing of desert lizards; homing behavior of the red-spotted toad. Fish (7): impact of introduced fishes on native fishes in the Desert; fresh-water fishes in the Salton Sea; temperature and salinity tolerance of the fish Tilapia in Salton Sea. Geology and soil science (18): sources and causes of dust in windblown areas; satellite remote sensing of desert features; geothermal potential of the Salton Sea trough; geology of Pleistocene lake basins; microbial ecology of desert soils. General (14): biological survey of the Granite Mountains; ecology of desert sand dunes; effects of motorcycle racing on desert plant and animal communities. A total of 190 research titles was reported.

[9] F. C. Vasek, H. B. Johnson and D. H. Eslinger, "Effects of Pipeline Construction on Creosote Bush Scrub Vegetation of the Mojave Desert," Madrono, 23(1): 1-13 (January 2, 1975). See p. 11.

[10] L. Sternberg, "Growth Forms of Larrea tridentata," Madroño, 23(8): 408-417 (October 1976), see p. 415.

[11] P. V. Wells and R. Burger, "Late Pleistocene History of Coniferous Woodland in the Mojave Desert," Science, 155(3770): 1640-1647 (March 31, 1967).

[12] H. S. Gentry, "Plant a Seed and Save a Whale," California Native Plant Society Newsletter (October 1972), originally published in the Saguaroland Bulletin, 25(4): 44-47.

[13] O. Björkman and J. Berry, "High-efficiency Photosynthesis," Scientific American, 229 (4): 80-93 (October 1973).

[14] H. G. Wilshire and J. K. Nakata, "Off-road Vehicle Effects on California's Mojave Desert," California Geology, 29(6): 123-132 (June 1976). A publication of the California Division of Mines and Geology.

[15] Geological Society of America, Committee on Environment and Public Policy, Impacts and Management of Off-Road Vehicles (May 1977), 8 pp. Report of a panel convened by the Geological Society of America on September 12 and 13, 1976, at Asilomar, California.

[16] R. C. Stebbins, "Off-Road Vehicles and the Fragile Desert," American Biology Teacher, 36(4):203-208 (April) and (5): 294-304 (May), 1974.

17 R. Bruce Bury, R. A. Luckenbach, and S. D. Busack, "Effects of Off-Road Vehicles on Vertebrates in the California Desert," U. S. Fish and Wildlife Service, Wildlife Research Report 8: 1-23 (1977).

18 R. Badaracco, "Conflicts Between Off-Road Vehicle Enthusiasts and Other Outdoor Recreationists--the ISD Syndrome," in the Proceedings of the Symposium on the Physical, Biological, and Social Impacts on the California Desert, May 1976, (Los Angeles: Southern California Academy of Sciences, 1977).

19 See Wilshire, note 14 above.

20 See Stebbins, note 16 above.

21 See Stebbins, note 16 above; Bury, note 17 above; and also Richard L. Bury, Robert C. Wendling, and Stephen F. McCool, Off-Road Recreation Vehicles--A Research Summary, 1969-1975 (College Station, Texas: Texas Agricultural Experiment Station, Texas A and M University System, July 1976) 84 pp.

22 M. C. Bondello, "The Effects of High-Intensity Motorcycle Sounds on the Acoustical Sensitivity of the Desert Iguana, Dipsosaurus dorsalis," California State University, Fullerton, master's thesis, 1976. xi + 38 pp. See p. 31.

23 See Badaracco, note 18 above.

24 C. M. McKell, "Shrubs--A Neglected Resource of Arid Lands," Science, 187 (4179): 803-809 (March 7, 1975).

25 L. W. Bowden, J. R. Huning, C. F. Hutchinson and C. W. Johnson, "Satellite Photograph Presents First Comprehensive View of Local Wind: The Santa Ana," Science, 184 (4141): 1077-78 (June 7, 1974). See p. 1078.

26 J. C. Loofbourow and D. Pappagianis, Coccidioidomycosis: An Occupational Hazard for Archaeologists (Society for California Archaeology, December 1971). 7 pp. See p. 4. Special Report No. 2 of the Society for California Archaeology, Riverside.

27 M. L. Villalobos, "Dustfall Study of the 1974 Annual Motorcycle Race, Barstow to Las Vegas," San Bernardino County Air Pollution Control District Report TSD-TR-75-1 (February 22, 1975), in U.S., Department of the Interior, Bureau of Land Management, 1974 Barstow-Las Vegas Motorcycle Race Evaluation Report (March 1975), Appendix 6, see p. 13.

28 J. Charney, P. H. Stone and W. J. Quirk, "Drought in the Sahara: A Biogeophysical Feedback Mechanism," Science, 187(4175): 434-435.

29 See the petition signed by 145 scientists, requesting reduction of off-road vehicle recreation on natural resource lands in the California Desert, sent to Ed Hastey, State Director of the BLM, October 29, 1975.

Figure 1:

Sites Visited by Educational Institutions
Conducting Teaching and/or Research in the California Desert
Because of the scale of the map not all sites could be shown.

DVNM -- Death Valley National Monument

JTNM -- Joshua Tree National Monument

ABSP -- Anza-Borrego State Park

We have included in our survey some semiarid localities outside the Desert boundary along its western edge. A complete listing of all sites is on record in the Bureau of Land Management office in Riverside, California.

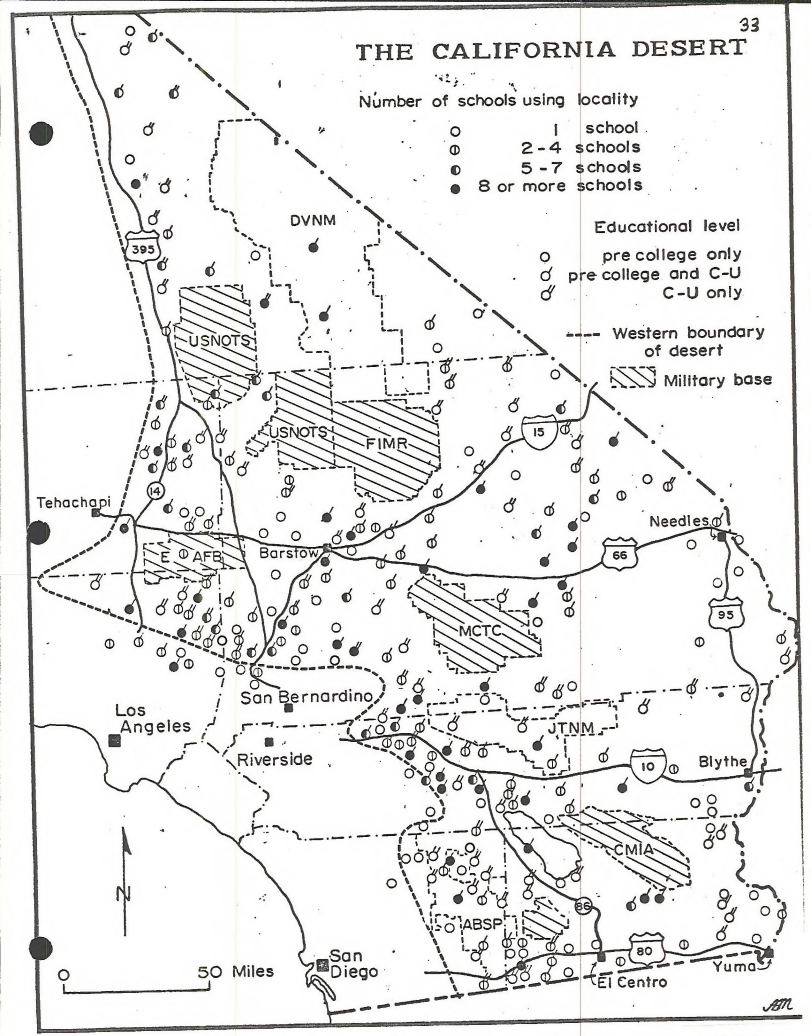
THE CALIFORNIA DESERT
Number of schools using locality
1 school
2-4 schools
5-7 schools
8 or more schools
Educational level
pre college only
pre college and C-U
C-U only
Western boundary of desert
Military base
DVNM
USNOTS
USNOTS
FIMR
MCTC
JTNM
CMIA
ABSP
E AFB
Barstow
Tehachapi
Needles
Blythe
Yuma
El Centro
San Bernardino
Riverside
Los Angeles
San Diego
395
15
14
66
95
10
8
80
N
50 Miles

FIGURE 1

Figure 2:

Disturbances in the Desert

Explanation: Shows disturbances to educational and nature study use of the Desert, as noted by questionnaire respondents. Respondents were asked to check any combination of the disturbance categories listed. The responses are shown graphically by the solid and open bars. The solid bars indicate the frequency with which each disturbance category was checked, as a percentage of all responses. For example, the total number of responses from public and private schools designating category 4 as a disturbance comprise approximately 27% of the 195 responses.

Respondents who identified more than one category were asked to rank the categories from most disturbing to least disturbing. The distribution of items ranked as most disturbing is indicated by the shaded bars.[1] For example, over 60% of the 37 public and private school respondents who identified more than one disturbance ranked category 4 as the most disturbing. The disturbance categories listed in the questionnaire are shown in the following key. Category numbers refer to the numbers shown on the horizontal axis of the graphs.

KEY

Public and Private Schools and Organizations

0 no disturbance
1 energy developments
2 hunting
3 mining
4 off-road vehicles
5 overgrazing
6 road and highway construction
7 urban or housing expansion
8 vandalism
9 other

Figure 2 - continued

Colleges and Universities

The same designations apply, but two categories, agricultural expansion and weed intrusion, were added:

5a agricultural expansion

8a weed intrusion

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[1] In a few instances respondents marked only a single disturbance as number one. Such responses were included in the ranking analysis.

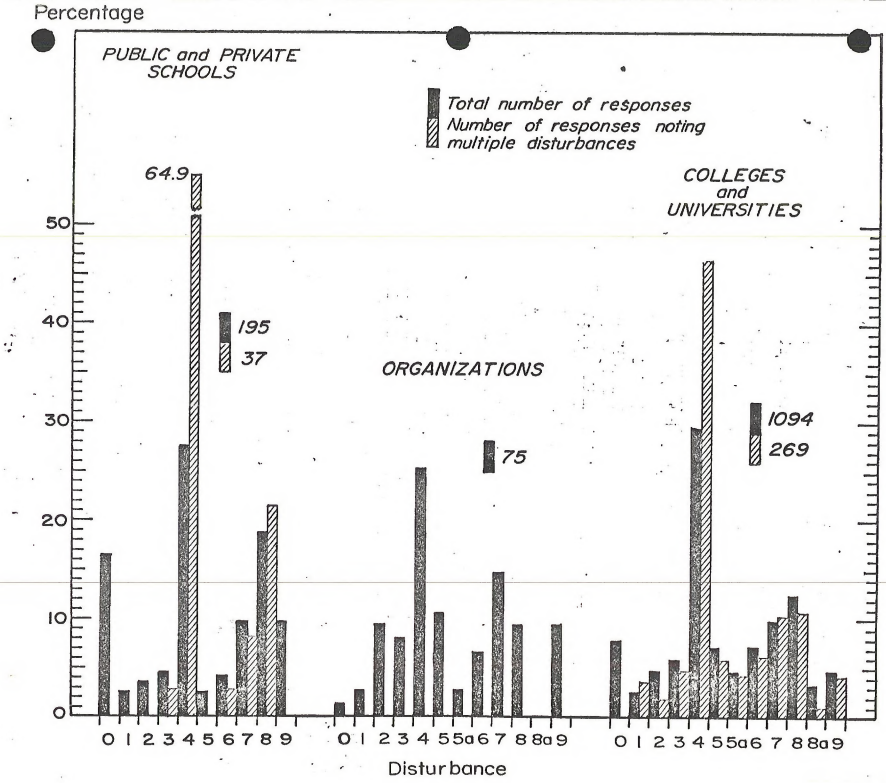
Percentage
PUBLIC and PRIVATE SCHOOLS
Total number of responses
Number of responses noting multiple disturbances
64.9
195
37
ORGANIZATIONS
75
COLLEGES and UNIVERSITIES
1094
269
50
40
30
20
10
0
0 1 2 3 4 5 5a 6 7 8 8a 9
0 1 2 3 4 5 5a 6 7 8 8a 9
0 1 2 3 4 5 5a 6 7 8 8a 9
Disturbance

FIGURE 2

Table 1

Teaching and Research Use of the California Desert Reported by Educational Institutions in the State of California for a Recent School Year

(Numbers of respondents reporting Desert use are indicated in parentheses; projected estimates are indicated with an asterisk)

Public Schools County	Total Person Days[1] - Teaching Reported	Projected and Reported
Inyo (12)	3,133	3,133
Kern (15)	5,120	13,500*
San Bernardino (88)	79,911	79,911
Los Angeles (44)	7,541	27,000*
Riverside (67)	12,118	12,118
Orange (25)	4,160	7,500*
San Diego (16)	10,115	28,500*
Imperial (29)	6,897	6,897
Sacramento (2)	170	170
Other Counties (10)	1,163	1,163
Private Schools (27)	3,379	3,379
Totals (335)	133,707	183,271

Table 1 - continued

Colleges and Universities	Total Person Days	
	Teaching	Research
University of California (59)	8,913	4,217
Private Universities (12)	2,004	288
State Universities (54)	11,813	6,393
State Colleges (6)	718	318
Community Colleges (39)	20,842	278
Private Colleges (20)	3,327	1,028
Totals	47,617	12,522

1/ See text

TABLE 2

Reported Length of Time Organizations and College and University Professors and Students Have Used the California Desert

(The figures are based on data extracted from 184 C-U and 20 organization questionnaires. They indicate the total number of respondents whose estimate fell within a given category. C-U respondents often gave duration-of-use figures for more than one site; because we wished to emphasize the extent of long-term use only, the longest estimate given by each respondent was used.

Institution or Group	Years of Use						
	1-5	6-10	11-15	16-20	21-25	26-30	over 30
University of California (9 campuses)	31	15	10	3	6	3	2
Private Universities	4	6	0	2	0	2	0
State Universities	19	16	13	5	4	0	1
State Colleges	2	3	1	0	0	0	0
Community Colleges	6	7	1	2	0	1	0
Private Colleges	6	4	3	2	1	2	1
Organizations	7	6	1	2	0	1	3
TOTALS	75	57	29	16	11	9	7

INDEX TO APPENDICES

APPENDIX I

Teaching and Research in the California Desert, Conducted by Institutions of Higher Education in California

(A sampling based on a survey, primarily of the life sciences, December 1974)

(Released June, 1975)

By

Robert C. Stebbins

The Bureau of Land Management (BLM), under its California Desert Plan Program, is currently developing management plans for some 12 million acres of National Resource Lands under its jurisdiction in the California Desert. The "Desert" as considered here is that delineated by the BLM Recreation Vehicle Plan shown in Fig. 1. Little information has so far been obtained on the uses of the desert by educational institutions. The present document is an initial step in filling this need. It has only scratched the surface. Its purpose has been to call attention to the importance of making an exhaustive survey, before final plans are made for management of the California Desert lands. BLM must move rapidly in developing its program to protect Desert values. The Desert is being damaged by uncontrolled growth.

Information presented here was gathered over a period of two weeks. I phoned 35 professors, chiefly in the life sciences (botany, zoology, ecology), at the University of California Berkeley (all nine campuses), Stanford, University of Southern California, and San Diego State. I asked them for information on their use of Desert lands in teaching and research. A draft statement was then sent to each respondent for comment. Information presented herein has been checked for accuracy, and is now available for use in resource management analyses.

With a few minor exceptions no investigation was made of Desert use by the other university departments that have interest in the Desert, such as geology, soil sciences, archeology, geography, mining, engineering, and physics. The life science survey itself was incomplete. The results, nevertheless, were impressive. It is hoped they will provide the stimulus for a much needed in-depth study, that will include the pertinent departments in all institutions of higher learning in the State, both public and private. It would also be desirable, so far as possible, to check Desert use by high schools and grammar schools at least those in or near the Desert. Funding of such a survey can be amply justified by the evidence already gathered in the present cursory survey. It would be most unfortunate to finalize a Desert management program without fully taking into account educational and research use of the Desert.

THE UNIVERSITY OF CALIFORNIA

BERKELEY CAMPUS

Botany

Herbert Baker. He and his graduate students go on annual informal research field trips to the Desert.

Dale Johnson and John Strother. Doing research on plants of the family Compositae, many of which occur in the Desert.

Watson Laetsch. Pointed out that deserts are important as a source of plant specimens and information useful to the teaching and research program in the U. C. Berkeley Botanical Garden. He commented on the current research interest in plants with C4 photosynthesis (See Bjorkman, 1974). All desert saltbushes (Atriplex) and certain other desert species are of this type. The C4 system is adapted to arid lands. C4 plants of direct importance to man are sugar cane, corn, sorghum, millets, and various species of weeds. Study of photosynthesis in these plants should contribute to arid lands agriculture and control of weeds. To understand the photosynthetic pathway, one must know how it evolved. Desert species will contribute to this understanding. C4 plants are able to fix carbon more efficiently than C3 species; they can do it with little water and at high temperature.

Robert Ornduff. Studying Gold Fields (Lasthenia), plants well represented in the Desert.

Nancy Vivrette. Studying halophytes, particularly Box Thorn (Lycium) and Mesembryanthemum. Study of salt tolerance is important to arid lands agriculture in the development of crop species, weed control, and soil desalinization. The United States Salinity Laboratory, near the University of California Riverside Campus, is investigating salt tolerance of crop plants. Scripps Institution is trying to breed salt tolerant species. Salt tolerant weeds, such as Mesembryanthemum, are entering agricultural lands in Baja California as the lands are cleared. Some halophytes exude salt. Others, such as certain succulents, retain it and then drop parts of their structure as they dry. In this way they redistribute salt. Therefore, halophytes can be grown to remove salt from the soil and then harvested. Halophyte research has application in our own arid lands. Water now coming from the Colorado River to agricultural lands in the Imperial Valley has to be treated before use because of its high salt content. Salt levels increase with evaporation, as the water is brought in open canals through hot, dry lands.

Important desert research areas for the study of halophytes are the alkali flats. Unfortunately, these areas are attractive to off-road vehicles (ORVs) and halophytic vegetation is being destroyed by these machines.

Entomology

Evert Schlinger. He has studied insects in the agricultural lands of the Imperial Valley and surrounding desert. He emphasized the need for large desert buffer zones, about ten miles wide, around agricultural areas. Such zones can aid in providing control of insect pest species. Predatory and parasitic wild insects move into the agricultural lands and attack the crop pests. A great reservoir of natural control species is thus available to cope with pest flare-ups. The beneficial effects of such desert buffer zones have been directly observed.

Dr. Schlinger noted that insect life in the desert is abundant, endemic, and varied, and that much speciation is occurring. Major differences are noted from canyon to canyon in many desert mountain ranges, and from dune to dune.

For persons interested in the insects of the California Desert, a report by Saul Frommer is available on endangered species and the use of the desert by entomologist.

Soils

Hans Jenny. He observes that the most fragile soils in the Desert occur on old Pleistocene terraces where soils are shallow and underlaid by a caliche layer of calcium carbonate. Weathering of local rocks, and calcium carbonate liberated elsewhere and blown into the area, provide calcium which goes into solution with rainfall. The calcium is carried downward as the water penetrates and, upon evaporation and transpiration by plants, chrystalizes out at a depth depending on the amount of rainfall and nature of the soil. In the elevated lands of the desert, the caliche layer may be only a short distance beneath the surface. Such lands are especially vulnerable to soil loss from ORV activity.

Organized Research Units

Museum of Paleontology

Joseph Gregory. Paleontological research in the California Desert has been going on for some 70 years. A whole series of faunas have been found that existed over the last 60 million years. There are

fossil localities from the early Oligocene (in Death Valley) and late and middle Miocene on to Recent times. Recently a Paleocene site was found. Much of the Desert has not yet been explored and many exposures look promising. John C. Merriam, the man who first systematically excavated the LaBrea Tar Pits, worked in the Desert around the turn of the century. He studied areas in the Mohave around Barstow and at Red Rock Canyon (the Ricardo Area). Chester Stock, a professor at the California Institution of Technology, and a student of Merriam's, also worked in the Desert. More recently the late R. A. Stirton worked in the Desert and two of his students have continued studies there--Richard Tedford, of the American Museum of Natural History, and Michael Woodburn. The latter has reported recently on discoveries east of Barstow. Malcolm McKenna discovered the Paleocene deposit 15 to 20 miles south of Inyo Kern, near the east end of the El Paso Mountains. David Whistler, of the Los Angeles County Museum, did a thesis on the Ricardo. Evert Lindsay, of the University of Arizona, has done thesis work on rodents of the Barstow paleofauna. Studies have also been made by parties from the American Museum of Natural History and the U. S. Geological Survey. The California desert has also contributed enormously to the paleobotanical research of Daniel Axelrod, now at U. C. Davis.

The paleontological evidence clearly demonstrates that the region now occupied by the California Desert was not desert 20 million to 9 or 10 million years ago. It was, instead, a savannah with great herds of grazing animals and their accompanying predators.

Sagehen Field Station

Some of the summer classes make trips to the Owens Valley.

Museum of Vertebrate Zoology (MVZ)

The Museum of Vertebrate Zoology has engaged in California Desert research for a period of over 60 years. Many faculty members and students have worked there and studies continue. Over 100 publications, six of them books, address themselves to biological problems in the California Desert. In recent years, interest in desert research has increased and a proportionally greater number of MVZ publications can be expected to deal with California Desert biology. Currently several staff members and students are conducting research in the Desert. In general, the Desert is also an important source of specimens and information for the teaching program of the Museum and Department of Zoology. Thousands of specimens in the Museum's collection, many accompanied by detailed notes, have been obtained over the years in the California Desert. These specimens are an important and irreplaceable scientific resource.

Ned Johnson. He is conducting an on-going study in the Desert on the north slope of Clark Mountain, San Bernardino County. In 1939 a field party from MVZ discovered a small breeding avifauna in the

isolated stand of white firs there. A detailed list of species and a census of each species was obtained. This established a reliable base line for the study of population changes in an "insular" avifauna in a remote habitat undisturbed by man and his animals. In recent years Dr. Johnson has conducted annual censuses of the fir-dependent birds that breed on this mountain top island. Striking and unpredicted changes have occurred since the original studies three and one-half decades ago. Apparently in response to subtle changes in the average summer climate, a number of species characteristic of the interior of southwestern United States have become established on this isolated mountain. Several of these forms occur nowhere else in California. These data will form a unique contribution to insular biogeographic theory. Among the topics to be elucidated are (1) derivation of the colonizing bird fauna, (2) colonization rates, (3) avifaunal turnover, (4) avifaunal disequilibrium, and (5) absence of competitive release. Repeated annual censuses, each lasting a week or more, are intended for the next eight years so that a complete decade of annual counts is available. No comparable information has ever been gathered previously for any insular fauna.

William Lidicker. He and his students are utilizing the Desert in (1) studies of the genetic structure of populations of mammals, with particular attention to isolated and semi-isolated populations on the periphery of ranges, and (2) taxonomic studies of mammals, particularly kangaroo rats. In addition he has a current PhD. student working on physiological adaptations, feeding behavior, and morphological variation in a species of kangaroo rat (Dipodomys microps). Several of this student's study areas are in the California Desert.

James Patton. He and his students are analysing the genetic structure of desert populations of small mammals--pocket gophers (Thomomys) and pocket mice (Perognathus). Both are ubiquitous throughout the California Desert. Gophers are largely limited to soil patches around springs or exist as ephemeral populations. Pocket mice are nearly limited to southwestern deserts and are one of the most highly specialized mammals for desert life. Dr. Patton spends, on the average, six to twelve weeks annually in the desert examining various life history parameters of these species and collecting specimens. These activities have occupied him the past twelve years and will continue indefinitely into the future.

Robert Stebbins. He has conducted research on desert reptiles and amphibians intermittently for 30 years. Many of his scientific papers and books have incorporated information gathered on California Desert species. Many of these species have been subjects for scientific illustrations prepared by him. Such research and illustrating continues at the present time. Over this period the Desert has provided live animals for classroom study in vertebrate natural history and herpetology. The specimens, with accompanying data, are placed in the teaching

and research collections of MVZ. The herpetology class goes to the desert nearly every year for three or four days to study the herpetofauna in its natural setting. Currently he has two graduate students, Ron Marlow and Kristine Tollestrup, working on California Desert reptiles, and over the past 30 years 8 of his graduate students have done research in the Desert as part of their work for advanced degrees.

David Wake. He and some of his graduate students are working on isolated salamander populations in the Inyo Mountains.

DAVIS CAMPUS

Botany

Donald Kyhos. Studying plants of the genus Chaenactis in the Desert.

Jack Major. Plant ecologist. His graduate student, David Randall, is doing his PhD. thesis on vegetation patterns in Saline Valley, Inyo County.

Entomology

Richard M. Bohart. Many graduate students go to the Desert to study insects. Currently about a dozen trips occur in the spring and four or so in the fall. Dr. Bohart has been studying insects in the Algodones Dunes (Imperial Sand Hills). He traps wasps there by placing out elderberry sticks which are attractive to these insects as nesting sites. He is encountering difficulty with ORVs because they knock down the stick traps. He commented on the importance of studying insects in natural areas. In parts of the world, such as western Europe, there are few such areas left and study of the natural behavior of insects is greatly limited. In a natural area, herbivorous, predatory and parasitic insects are in balance. Study of the parasites and predators in natural communities provides information that can be applied to practical problems of insect pest control. The California Desert is extremely rich in insect life. Except for parts of northern Baja California it is different from other southwestern deserts, and thus is unique.

IRVINE CAMPUS

Ecology

Keith Justice. He is an ecologist and a member of the Department of Population and Environmental Biology, which was formerly under the

chairmanship of Richard E. MacMillen. Dr. MacMillen is now on sabbatical leave in Australia. Both Dr. Justice and Dr. MacMillen are engaged in research on mammals in the California Desert.

The Irvine Campus gives a terrestrial ecology course titled, "Terrestrial Super Course", with emphasis on field work. It is conducted by three faculty members and three teaching assistants, and enrolls approximately 25 students. Students are totally immersed in the work of the course for a full quarter and spend ten-day blocks of time in the field at frequent intervals. They investigate a variety of habitats and desert studies constitute approximately one-third of the activities of the course. Dr. Justice is a faculty sponsor of an N.S.F. student-oriented study titled "Desert Land Use and Management in California--Its Ecological and Sociological Consequences." The study is part of an N. S. F. program designed to encourage student involvement in mission-oriented research. The present grant was for $20,000 over the period March 1974 to January 1975. Russell Davis was the student leader. Twelve students participated for about three months. The students studied attitudes of Desert recreationists and effects of human activities, including ORV use, on Desert ecology. BLM documents were consulted and a questionnaire was prepared, which was sent to conservationists, ORV and other recreationists, and other Desert users. Both pro- and anti-ORV groups were contacted. One part of the ecological study considered the effect of ORVs on desert plants. To assess ORV impact on perennials, sap pressure and evidence of stem breakage, etc. were measured in control and ORV areas.

ORVs are very difficult to exclude from protected lands. The University of California Natural Lands and Water Reserves System has had difficulty with them at the Burns Piñon Ridge Reserve in the foothills of the San Bernardino Mountains north of Yucca Valley. The Reserve includes about one-half section of land at an altitude of 3,500 to 4,500 feet. University students participated in construction of fences after other efforts failed to keep out ORVs. Now the fences are repeatedly broken down; posts are ripped up and wires cut.

LOS ANGELES CAMPUS

Ecology

Martin Cody. Ecologist. A general ecology course is given in which there are one or two trips to the desert each quarter. The course is given once or twice a year, and enrolls 150 to 180 students. Undisturbed Desert, suitable for ecological studies, is becoming difficult to find. A community ecology course is given every year, or every other year. Usually one trip is taken to the Desert; about 30 students enrolled. There is also a community ecology course held

completely in the Desert. It enrolls 20 to 25 students. They engage in individual research projects. Formerly this course used the area near the Granite Mountains. Objections of local land owners and harrassment by ORVs led to abandonment of this site. Dr. Cody remarked that it is now barely worthwhile to take a class within 300 miles of Los Angeles because of a variety of disturbances. He formerly studied birds near Amboy Crater until ORVs drove him out.

He noted that the natural environment in the more remote parts of the Desert is now ecologically stable. Human activities are distrupting this stability. The Desert will equilibrate at a quite different community structure.

The Desert is an outstanding place to teach ecology. Plants are well spaced because of aridity and many species can be easily found and distribution and population density determined. Animals, when abroad on the surface, are also quite easily detected. It is as if one took a more densely packed living community, such as that found in chaparral, and stretched it out some 100 times.

Zoology

George Bartholomew. He estimated the use of the California Desert by UCLA's classes in the biological sciences. Approximately 350 students go to the desert repeatedly each year. The students are distributed among classes in vertebrate biology (one big trip to the Desert each year, involving approximately 200 students), herpetology, ornithology, ecology, and botany (two courses in plant systematics with some 50 students). Add to this graduate students in ecology, natural history, etc., use of the desert by faculty, and a figure of approximately 400 is reached. He estimated that since 1953, he has had at least 15 students who have worked on problems in desert biology for their doctoral theses. Currently there are probably somewhere between 30 to 50 graduate students in ecology and natural history doing projects that relate in some way to desert biology. Among his own group are the following: Alan French, working on seasonality of hibernation; David Vleck, studying energetics of burrowing activity in pocket gophers; Timothy Casey, studying temperature control in sphynx moths. Dr. Bartholomew has an NSF research grant for the study of energetics and breeding cycles in desert rodents.

George Gorman. His herpetology class spends from three to four weekends every year in the desert; enrollment is approximately 20 students. A field ecology class goes to the desert for two weeks to ten days every year between quarters, or during the quarter; enrollment approximately 20 students. Current PhD. students are Gary Adest, studying niche dimensions in the desert lizards, Callisaurus and Uma, and Robert Harwood, using desert animals such as Dipsosaurus and Uma in the study of digestive efficienty in reptiles.

Ornithology.

Thomas Howell. He has a graduate student, Glenn Walsberg, who is studying the behavioral ecology of the Phainopepla (Phainopepla nitens), a desert-dwelling bird.

Dr. Bartholomew pointed out that the actual amount of money being spent on desert research could be obtained from Frances James, Associate Program Director, of the General Ecology Section of NSF.

SAN FRANCISCO CAMPUS (Medical School)

Malcolm Miller. He has used the California Desert for many years in his studies of reptilian biology and continues to do so. He depends on the entire herpetofauna for studies of the evolution of auditory systems. He is interested in the desert not only as a source of animals for his investigations but as a place where their undisturbed behavior can be studied in the field. Man's auditory mechanism has been derived from the reptiles, therefore it is the reptilian mechanism which must be studied to understand our own. It is a relatively simple mechanism and easily investigated, but it is also easily damaged, even by decible levels as low as 60. The reptilian auditory sensitivity warns of the danger from noise pollution in our own environment. Dr. Miller presumes that reptiles near Edwards Air Force Base in the Desert will have ear damage. He also expects damage in high use ORV areas. Damage may include destruction of the sensory hair cells. It can be seen with the scanning electron microscope.

RIVERSIDE CAMPUS

Biology.

Hyrum Johnson. Plant ecologist. Dr. Johnson and his graduate students have been studying the effect of paved and unpaved roads on plant productivity in the Desert. Some of their work is related to plans for an Edison power plant in the southern Mojave. Plant variety and productivity may be enhanced to about 100 yards on either side of paved roads in some instances. Enhancement is also present, but less pronounced, in the vicinity of unpaved roads. There also appears to be an increase in some kinds of animals. There seems to be a limit as to how big a road can get before it loses its overall stimulating effect. A freeway may be too big to cause a net increase in production because the edge effect is no longer able to compensate for the extensive area taken out of production by the road surface. In heavy ORV use areas, the enhancement effect disappears.

Biotic enhancement along roads appears to result from improved local soil moisture conditions. Run-off water from the pavement flows into the adjacent soil. On dirt roads dust on the road surface may act as a mulch to prevent surface evaporation.

Dr. Johnson commented on ORV effects. Studies have been made at Johnson Valley in the Mojave Desert. ORVs greatly decreased productivity at the pit and out from it to about one and a half to two miles. At one site over 85% of the soil's surface was covered by vehicle tracks out to that distance. The pit itself was denuded of vegetation. There was an over-all decrease in biomass in the area. Burroweed bushes sustain more damage than creosote bushes. Twenty to 30% of the plants were obliterated. In a gradient inward toward the pit, the diversity of annuals decreased greatly. On rocky slopes ORVs followed routes suitable for travel. They may produce a roadside effect, resembling that described earlier, but it is of greatly limited scope and it is characterized by weed intrusion. If ORVs are eliminated from an area, some weedy growth may come in in a year or so--tumbleweed, mustard, and filaree. Filaree is already widespread in many parts of the desert.

At the present time it is difficult at some localities to distinguish between the effects of man and nature in the Desert. Along Interstate 10, beyond Desert Center, large dikes have been constructed to channel run-off water (from the Chuckwalla and Little Chuckwalla Mountains) beneath the highway. In this area excellent desert wash vegetation occurs--smoke tree, palo verde, ironwood, Hymenoclea. Many of the "channel" washes are natural. There are also extensive sheet wash areas. There are places where mile after mile of smoke trees, ironwoods (the latter almost forming forests) and ocotillos have died due to a change in water flow, possibly caused by the channeling activities of man. Channeling affects the sheet water flow. Ocotillos west of Desert Center (about 20 miles east of Indio) and large numbers of creosote bushes are dead, or at least appear to be so, evidently killed by drought. Such "natural" dieoffs are also evident in other parts of the Desert.

Botany

George Gillete. He spoke of studies on longevity in desert plants. The creosote bush is of particular interest. Some bushes may be two or three thousand years old. Aerial photographs reveal that creosote bushes tend to be arranged in rings and appear to have originated from a central point, perhaps by some kind of vegetative fragmentation. The phenomenon is under study. Desert plants can be used as indicators of the depth of the water table and soil fertility. Basin sagebrush (Artemisia tridentata) is helpful in the latter regard.

Dr. Gillete reiterated the importance of C4 crop plants to arid lands agriculture. Arid lands constitute a very large portion of the remaining undeveloped agricultural land on earth. Most of the world's arid land research is going on in Australia and southwestern United States, particularly in the Mojave and Colorado Deserts. These deserts are a crucial laboratory for the future of such agriculture.

Cacti (Opuntia) are under study. Stomates of these plants open at night. It is then that they take in most of their carbon dioxide and store it (in an acid medium). It is available the next day for use in photosynthesis. By holding the stomates closed during the day, water loss is minimized. In some areas the plant is a pest and knowledge of its physiology is important in its control. Dr. Gillete mentioned the potential importance of goat nut (Simmondsia chinensis) as a desert livestock forage plant and a source of high quality oil, useful in lubricating machinery that runs at high speeds and temperature. The oil is a suitable replacement for sperm whale oil, obtained from an endangered species.

People come to study in the California Desert from distant foreign lands--Australia, Israel, United Kingdom--and from many parts of the United States.

Zoology

Wilbur Mayhew. He made a general comment on the use of the desert by U. C. Riverside. Professors and students in field botany, field zoology (vertebrates and invertebrates), plant ecology, animal ecology, paleontology, structural geology, archaeology, and geography use the Desert. The Deep Canyon Desert Research Laboratory and the Agricultural Department are doing arid lands research there. Dr. Mayhew gives a year course on vertebrates. Some time each quarter is spent in the Desert. Between 20 and 50 students are enrolled each quarter.

Earth Sciences - Geography

Persons involved in desert research are Leonard Bowden, James Huning, Charles Hutchison, and Claude Johnson. They authored an article which appeared recently in Science on satellite observations of the apparent effect of the Santa Ana winds on the production of dust from ORVs.

Philip L. Boyd - Deep Canyon Desert Research Center.

Irwin P. Ting. U. C. Riverside Professor of plant physiology and Director of the Research Center. The Center is part of the

University of California Natural Land and Water Reserves System An annual report provides information on activities. Dr.Ting emphasized the importance of arid lands agriculture. The arid portion of north Africa is expanding. Agriculture of the future will depend on understanding desert plants. The Research Center has many visitors from California, elsewhere in the United States, and abroad. In 1974 visitors came from the Phytotron in Paris. U. C. Riverside and the Australian National University have undertaken a joint study of the ecology, physiology, and biochemistry of cacti in native environments and favorable exotic environments. Australia and NSF are each contributing approximately $23,000. The action of cactus stomates are one aspect of the study.

The Phytotron group is doing work on carbon dating. There is evidence that plants discriminate in taking in isotopes, which may affect the validity of the carbon-dating method.

William Jennings. Principal editor and administrative aid, Deep Canyon Desert Research Center and U. C. Riverside College of Natural and Agricultural Sciences. Mr. Jennings provided the following information on distinguished visitors to the Deep Canyon Research Center.

H. Saint Girons, National Museum of Natural History, Paris. Dr. Girons studied the comparative ecology and histology of the endocrine glands of reptiles. He worked mainly with lizards but also to some extent with rattlesnakes.

Hans Elias, University of Heidelberg, on sabbatical in 1969. He visited the Center in connection with work he was doing at the Chicago Medical School, on kidney function in small rodents--kangaroo rats, etc. He plans to return this spring.

M. C. Joshi, India. He came on a Danforth Indian Fellowship about ten years ago, and studied the ecology of sand dune vegetation.

Alexander Shrift of the Kaiser Medical Foundation, made a brief visit about ten years ago.

T. K. Virupaksha carried out investigations on selenium-accumulating plants.

Mr. Jennings stated that five to seven classes a year come to the Center. Some of these are from U. C. Riverside; others come from other campuses. Last year 854 persons signed in at the Center, 414 U. C. affiliated, 210 non-U. C. There was a total of 3,973 man-hours of research for all U. C. and 1,119 man hours for non-U.C. There were 341 undergraduate (U. C. and others), 104 graduate, and 179 faculty and other researchers. Many long-range researchers return several times a year and many work away from the Center building and may seldom if ever sign in. In addition there are many casual one-time visitors.

SAN DIEGO CAMPUS

Michael Soulé. Timothy Pront, in collaboration with R. C. Lewontin of Harvard, is working on populations of Drosophila in "island habitats" in the Desert. The Desert has been used by the class in evolutionary biology; enrollment approximately 25 students.

SANTA BARBARA CAMPUS

Botany

J. Robert Haller. Plant taxonomy. He has a large class that studies the vegetation of California. Approximately 120 students are enrolled. Trips are made on at least four occasions in spring to the low Desert in and peripheral to Anza Borrego State Park. His class has now been practically driven into the State Parks because of lack of security. Dr. Haller stated that Dr. Langford from Ontario, Canada, spent a year in residence at U. C. Santa Barbara, working on plant ecology in the Desert.

Cornelius Muller. He gives a senior course in ecology of biotic communities; enrollment approximately 20 students. A single three-day trip is taken to the Desert. Field observations are made and data gathered to be analyzed on return. Approximately half of the subject matter of the course depends on the Desert trip. The class makes a transect study on a bajada in the area between Hole-in-the-Wall and Essex. Until recently, this fine expanse of undisturbed desert was a regular study site. It has now been disturbed by a northward shift in the position of U. S. Highway 40. There has also been some damage by ORVs and two miles have been irreparably disrupted by military manoeuvers (there was a military post there in 1942 to 1945). Recovery has been extremely slow. General Patton had a big post at the south end of Joshua Tree National Monument and the area has scarcely recovered. Dr. Muller mentioned that across the highway from the Patton encampment a little road crosses the mountains. Somebody took a jeep off-road and deliberately ran down many ocotillo clumps. He mentioned several PhD. projects: Paul Fontaine is studying the ecological relationships of creosote bush; Steven Timbrook the systematics of Langloisia. Good stands of creosote bush and ocotillo are becoming increasingly difficult to find.

Dale Smith. Plant systematist. He and his graduate students are studying the systematics of desert flowering plants and ferns. They utilize the Desert for field experiments and obtain material for laboratory investigations.

Zoology

Joseph Connell. He gives an ecology course and has taken his class to the Desert at least once a year; enrollment was approximately 15 to 20 students. At the present time these trips have been discontinued. Dr. Connell mentioned that Dr. Mary Erickson, now retired, took her vertebrate natural history class to the Desert.

Geology

Robert Norris. He takes his geology class to the Desert, at least one trip per year. He also uses the area in his research. ORVs are damaging land forms and they interfere with class studies. In the western part of the Imperial Valley there existed a fine example of an undisturbed barchan dune which was used in class work. ORVs have now reduced it to a lump of sand. The Algodones Dunes, as land forms, are being adversely affected by ORVs. [One of Dr. R. C. Stebbins' graduate students recently traversed the length of the dune system and was unable to find any area suitable for a control plot in connection with his work on the Fringe-toed Lizard (Uma notata). ORV activity is evidently now present in all parts of the dunes.] Dr. Norris mentioned that the south end of the dunes includes an unusual variety of small dune forms which have been used in field studies. These delicate land forms are now being rapidly destroyed by ORVs.

SANTA CRUZ CAMPUS

Kenneth Norris. He gives a one quarter course in natural history of California with an enrollment of approximately 25 students. A four-day trip to the Desert is taken each quarter.

Ray Collett. Dr. Collett is a geographer and botanist. He uses the Desert in environmental studies.

STANFORD UNIVERSITY

Paul Ehrlich. He made the following comments: He is a member of the population biology group. Richard Holm occasionally uses the Desert. Harold Mooney gives a physiological ecology course with an enrollment of approximately 15 students. He also has interests in the Desert. He is doing studies of the physiological ecology of creosote bush and other desert shrubs. Dr. Ehrlich states that the population biology group uses the Desert a lot and wants to be able to do so in the future. The group is incensed over ORV activities in the Desert. Such activity is severaly inhibiting research as well as doing extensive damage.

UNIVERSITY OF SOUTHERN CALIFORNIA

Jay Savage. He provided the following information on USC's use of the Desert: Some 8 faculty members and some 15 graduate students are engaged in Desert research. Several major courses use the Desert in teaching. Approximately 500 undergraduates are involved each year. Trips are taken by courses in ecology, geology, botany, and herpetology. The herpetology class, enrollment around 18 students, takes two trips each of four days duration. Dr. Chew specializes in water metabolism and energy flow, chiefly in mammals. He gives course work in ecology. He formerly took class trips to the Palmdale area in the Mojave Desert until land developments seriously disturbed the natural ecology there. He then took his classes to Joshua National Tree Monument but abandoned work there because he was no longer allowed to trap small animals for field study. He has now reduced his use of the Desert because of increasing disturbances.

Richard Stone. Geologist. He has received major grants for the study of geology. He has a summer field course and makes special trips to the desert.

SAN DIEGO STATE UNIVERSITY

San Diego State has been using the Desert for decades. George Cox, Ted Cohen, and Boyd Collier, all work on the ecology of invertebrates. Dr. Collier also studies community and plant ecology. Richard Etheridge gives course work in herpetology and ornithology. The herpetology course enrolls approximately 10 to 12 students and two weekend trips a year are taken to the Desert. The course is given once a year. Dr. Hunsacker gives a course in vertebrate natural history which also goes to the Desert. Graduate students are working on life history problems in the Desert, such as homing in chuckwallas and the life history of Petrosaurus (Tom Cozens). There are also graduate studies under way on desert mammals.

Theodore Cohn. Entomology. He has a long-term project on camel crickets in the dune areas. The study has been in progress for ten years.

Biology

Boyd Collier provided the following information: The general ecology course has about 156 students and is given in the fall and spring semesters. The class visits the area in or near Anza Borrego Park and also uses the Algodones Dunes. There are about a dozen field

trips a year. The class avoids areas used by ORVs. The population community ecology course, with some 18 students, goes to the Desert once a year. The advanced ecology course, with approximately 18 students, makes varied use of the Desert. The Department of Zoology uses the Desert quite extensively. Dr. Collier makes little professional use of the Desert now because of lack of security there.

SUMMARY AND CONCLUSIONS

It is evident from the foregoing survey that natural environments in the California Desert are of great value to teaching and research. Higher education alone appears to have a multi-million dollar investment in the Desert. Hundreds of teachers and students have used or are now using the California Desert lands. A minimum estimate for last year's use by U.C. life sciences alone is some 40 faculty, over 50 graduate students, and some 650 undergraduates. Many academic disciplines are represented---botany, zoology, ecology, geology, soil science, paleontology, archaeology, geography, etc. Undoubtedly many State universities, high schools and some elementary schools also use the Desert. There appears to have been no study of such use; an investigation is urgently needed. At the present time biological research and teaching in the desert are in retreat, limited to ever more remote areas as natural environments deteriorate.

It is important to recognize the social contribution of such use of our wild lands. It performs an important public service without damaging the resource. Research will provide better understanding of our wild lands and, through teaching, knowledge of the natural values in the Desert will spread. This will lead to better management of our Desert resources.

The natural lands of the California Desert constitute a unique teaching and research facility. There appears to be no other place on earth where such a biologically and historically rich desert environment has been subjected to such breadth of study over such a long period by a variety of academic disciplines. It is logistically well situated for such investigations. In addition to the heavy use made by scientists, educators and students in California, the Desert is visited by scholars from abroad. The arid lands of southwestern United States, Mexico and, in particular, the California Desert, and the desert lands of Australia and Israel are emerging as important foci for arid lands research. These are the areas where manpower, funding, and proximity provide opportunities which are difficult to match elsewhere. The research and teaching programs in these areas are exerting an important guiding influence on the use and management of desert lands throughout the world.

The California Desert offers outstanding opportunities for basic research in arid lands biology. Basic research, that conducted primarily to gain understanding of natural phenomena, historically has proven to be of utmost importance to human needs. Frequently, it is more productive than applied research. The California Desert, because of its biologic variety and varied environmental conditions, offers unusual opportunities for the study of adaptations of wild plants and animals to the rigors of desert life. The scarcity of water, temperature extremes, and intense sunlight have placed great demands on the living fabric. Varied topography, climate, and soil conditions provide a fertile field for the study of processes of speciation.

Applied research is also being extensively pursued. Arid lands of the earth constitute the largest remaining portion of the planet suitable for major agricultural expansion. Significant current studies are those dealing with C4 plants, cactus research, halophytes, forage plants (such as goat nut), plants as indicators of soil fertility and the depth of the water table, and use of native insects in biological control. Desert species act as a genetic bank upon which man can draw to protect and improve cultivated species. Many desert plants may also have pharmaceutical or medical values.

The cost to society of the loss of wild lands in the Desert must be regarded as extremely high. Rapid expansion of off-road vehicle recreation is the latest and perhaps the greatest threat to the Desert. It is highly damaging to the natural environment for it destroys vegetation, fauna, soil, and soil microbes. By denuding the landscape, it increases the reflectance of the desert's surface, which may have the potential of initiating conditions of increased aridity (Charney, et al, 1975). Loss of plant cover and damage to the surface will increase water and, in particular, wind erosion (Bowden, et al, 1974). Severe dust problems can be expected to develop. ORV recreation drives out virtually all other forms of desert recreation and teaching and research functions. At the same time it makes great demands on dwindling supplies of fossil fuels. BLM estimated that 167,200 gallons of gasoline would be expended on the Barstow-Vegas Race, November 30, 1974. (See Final Environmental Impact Statement of Proposed Barstow-Las Vegas Motorcycle Race, October 1974, VII-1). Society must decide whether the personal and sociological values currently derived from ORV recreation warrant the very high price we must now (and in future) pay for this transient form of destructive pleasure. At the present rate of environmental damage caused by ORVs, I predict that natural ecosystems over much of the California Desert will sustain catastrophic and irreversible damage by the turn of the century (perhaps sooner). Probably before that, fossil fuels will be at such high premium recreational vehicle activity will have declined to insignificant levels. We may at that sad time be faced with a Desert in shambles.

Insect Taxonomy Laboratory, California
Department of Food and Agriculture
Sacramento

(Comments by Alan Hardy, Systematic Entomologist)

John Pinto of UC-Riverside is studying blister beetle behavior and systematics, and ion excretion when availability of water is greatly limited. Eric Edney of UCLA (from southern Africa) is studying physiology and water regulation in desert insects. Mary Seeley, who is visiting with William Hamilton of UC-Davis, came here to study the Desert. She is the director of the Namib Desert Research Station and is interested in comparing the ecology of the two desert areas. Dr. Hamilton, who has studied tenebrionid beetles in South Africa, is now working with Dr. Seeley. Howard Evans, formerly of Harvard's Museum of Comparative Zoology, has studied desert wasps. He is now at the University of Colorado. Stanley Williams of San Francisco State University has an interest in scorpions in the Glamis area, Imperial County, and in the southwestern deserts generally. People in the Insect Taxonomy Laboratory of the Department of Food and Agriculture who are studying desert insects are Marius Wasbauer (Hymenoptera), Fred Andrews (Coleoptera), and Alan Hardy (Scarabaeids), etc. John Doyen, University of California, Berkeley, and Constantine Slobodchikoff, University of Arizona, have a $30,000 grant to study the effects of ORVs on tenebrionid beetles of the coastal dune areas. Dr. Doyen is also studying these insects in inland dunes for comparison. E. L. Sleeper, California State University at Long Beach, has been conducting an insect survey since 1957 at Joshua Tree National Monument. He is now working with the desert biomes project at Mercury, Nevada.

Dr. Hardy points out that in order to protect California agriculture from insect pests, one first has to know the native species in order to recognize intruders. The desert constitutes a great reservoir of insect life potentially useful in biological control work. Natural environments are needed as reservoirs of potentially useful species to cope with present and future pest problems.

APPENDIX II

Financial Statement

Survey of Teaching and Research in the California Desert

CALIFORNIA DESERT STUDY

Source of funding		Fund #	Allocation
	MVZ Martens	36960	$1,000.00
	NLWRS	54354	1,000.00
	Pasadena Aud	54048	200.00
	Pomona Aud	54048	100.00
	Desert Protective Council	54048	200.00
	San Bernardino Val Aud	54048	200.00
	Ms. Frank Stockton	54048	50.00
	Sea and Sage Aud	54048	200.00
	Laguna Hills Aud	54048	50.00
	Santa Monica Bay Aud Soc	54048	1,000.00
	Keith Justice		5.00
	Desert Protective Council		500.00
	TOTAL		$4,505.00

Expenditures attached

Payroll	$4,179.39	
Supplies	1,001.80	
	$5,181.19	
Overdraft		$ 676.19

PAYROLL

March	Amamoto	$394.68
April	Amamoto	394.68
April	Sweet	200.00
April	Papenfuss	200.00
May	Amamoto	364.65
June	Amamoto	377.52
July	Amamoto	766.08
July	Johnson	608.48
January	Escherich	65.76
February	Escherich	460.50
April	Amamoto	394.68
August	Amamoto (84 hrs.)	383.04
September	Johnson (84 hrs.)	358.68
TOTAL		$4,179.39

Expenditures (Supplies)

	Date	Amount
Cleo's Xerox	12/1	$ 28.98
Camera Shop (photos)	1/3	8.10
Scientific Photo	1/12	5.40
Storehouse (file pockets)	2/3	28.00
Scientific Photo	2/9	8.15
Rand McNally - maps	2/10	136.73
Garage (vehicle use)	1/18	5.92
Storehouse (envelopes)	2/23	21.42
Mailing Div. (stamps	2/23	131.00
Central Dup. (MVZ envelopes)	2/23	28.01
" " (Petition - 7 pp - 50 cc)	2/23	7.35
" " (Carter ltr - 50 cc)	2/23	5.25
" " (List of letter recipients)	2/23	4.20
H. R. Ellis (rubber stamps)	2/23	5.22
Central Dup. (Questionnaire-2000)	3/3	54.80
" " " 100	3/7	4.80
" " " 225	3/9	12.97
Mailing Division (stamps)	3/10	261.00
" " (bulk mail-501 pcs)	3/15	33.11
Central Dup. (Questionnaire)	3/22	12.00
Mailing Div. (bulk mail-463 pieces)	3/25	27.89
Central Dup. (questionnaire-250 cc)	4/4	4.65
" " " 600 cc	4/4	9.20
Mailing Division (bulk mail - 246 pcs)	4/7	24.15
" " (bulk & lst class)	4/14	38.42
Travel/Stebbins	4/20	88.53*
Central Dup. (200 cc questionnaire)	4/22	2.90
Central Dup. (100 cc survey)	4/26	3.20
Mailing Div. (bulk mail-263 pcs)	4/26	18.57
Mailing Div. (lst class-63 pcs)	4/28	16.80
Mailing Div. (lst class-67 pcs)	6/1	18.60
Central Dup. (125 cc)	6/21	1.92
Mailing Div. (lst class-107 pcs)	6/23	16.10
Xerox/Zoology Dept.	8/19	10.20
Storeroom (file pockets)	9/30	6.84
TOTAL		$1,001.80

*To attend desert seminar (Oakland, Burbank round trip)

APPENDIX III

An Explanation of Abbreviations Used in California Desert Teaching and Research Survey

Counties

Inyo	In
San Bernardino	SB
Kern	K
Riverside	R
Imperial	Im
San Diego	SD
Orange	O
Los Angeles	LA
Sacramento	S
Out of State	OS

Type of School

Public Elementary	PE
Junior High	JH
Public High School	PHS
Junior College	JC
Community College	CC
Private College	PrC
Public College	PC
University	U
University of California	UC
Private University	PU
State University	SU
Private	Pr, followed by abbreviation for type of school (e.g. PrE, PrJH, etc)

Subject (public and private school survey)

Science	sci.	Geology	geol
Biology	bio.	Photography	photo
Earth science	es	Weather	w
Archeology	arch	Environmental sci.	es.
Chemistry	chem	Ecology	ecol

Disturbances

0 = no disturbance
1 = energy developments
2 = hunting
3 = mining
4 = ORVs
5 = over-grazing
5a = agricultural expansion
6 = roads and highways
7 = urban and housing expansion
8 = vandalism
8a = weed intrusion
9 = other (specify)

Persons

Robert C. Stebbins	=	RCS
Ted Papenfuss	=	P or PT
Papenfuss Public College Survey	=	TPPC
Florence Amamoto	=	F

Localities

Mojave Desert	=	MD
Joshua Tree National Monument	=	JT
Death Valley National Monument	=	DVNM
Anza Borrego State Park	=	AB
Living Desert Reserve	=	LDR
State Park	=	SP

Remarks

Valuable area = V

Miscellaneous

Telephone interview	=	Tel or t
Duplicate data (not used)	=	D
Audubon Society	=	AS or A
Person days *	=	p/d

* When a range was given by respondents, we took an average.

Institutions

University of California, Berkeley	=	UCB
University of California, Davis	=	UCD
University of California, Irvine	=	UCI
University of California, Los Angeles	=	UCLA
University of California, Riverside	=	UCR
University of California, San Diego	=	UCSD
University of California, Santa Barbara	=	UCSB
University of California, Santa Cruz	=	UCSC

Public and Private Schools Using the California Desert

(Numbers in parentheses refer to student days spent in the Desert during a representative recent school year)

	Elementary	Junior High	High School
Imperial County			
29 schools 6,897 p/d	Westmorland Union (1020) Rockwood (65) Ben Hulse (75) Washington (180) DeAnza (120) McCabe Union (960) Harding (60) Fremont (60) Mulberry (80) Magnolia (30) Meadows (150) Westside (86) Emmet S. Finley (125) Heber (85) Mains Elem. and Hoffman (66) Jefferson (120) Dool (54) Phil Swing (216) Myron D. Witter (140) J. W. Oakley (30) Niland (45)	Wilson (2500) Kennedy (120) Holtville (100)	San Pasqual (20) Calexico (120) Central Union (60) Brawley (60) Calipatria (150)

	Elementary	Junior High	High School
Inyo County			
12 schools 3,133 p/d	Death Valley (540) Tecopa-Francis (150) Inyo County--all 6th grade (1500) Owens Valley (10) Round Valley (40) Lo-Inyo (110) Bishop Union El. Dist. (Elm St. and Home St.) (324)	Shoshone (150)	Death Valley (282) Owens Valley (17) Lone Pine (10)
Kern County			
15 schools 5,120 p/d	Fairfax-Virginia Ave. (150) Haven Drive (28) Taft Primary (200) Robert P. Ulrich (1600) Vieweg (120) Las Flores (40)	Forbes (600) Jacobsen (60) Joshua (400) Lincoln (27) Murray (75) Thompson (225)	Tehachapi (200) Burroughs (1380) Mesquite (90)
Los Angeles County			
44 schools 7,541 p/d	Eastside Union (70) Horace Mann (90) Arma J. Shull (45) McKinley (7) Sierra (100) Rowland (90) Lincoln (37)	El Roble (120) Jordan (200) E. J. Toll (500) Park View (150) Sandbury (100) Oak Ave. (300) Fairgrove (60) Oak (64) Sycamore (25) Luther Burbank (400) Del Norte (300)	Antelope Valley (455) J. Francis Poly (600) Gladstone (480) John Glenn (450) Granada Hills (1125) La Canada (150) La Puente (60) Monrovia (300) William Neff (5) Rowland (150) Quartz Hill (270) San Antonio (135) West Covina (50)

	Elementary	Junior High	High School
Los Angeles County (cont'd.)		Fitz (12) Alvarado (60) Goddard (100) Monterey Highlands (25)	Northridge (40) Sylmar (14) Warren (12) Glendora (70) Hoover (60) Hart (40) Gahr (20) John Burroughs (180) Ganesha (20)
Orange County			
25 schools 4,160 p/d	Silverado (150) Fremont (20) Carl E. Gilbert (90) Taft (125) Buena Terra (45) James Franklin (15)	Brea (150) Rancho San Joaquin (60) Ensign (300) Lincoln (40) Maude B. Davis (240) McPherson (30) Dale (120) Washington (100) Portola (40)	Fountain Valley (200) Savannah (25) Tustin and Foothill (1345) Huntington Beach (200) La Habra (60) Estancia (40) Edison (120) Pacifica (45) Westminster (100) Dana Hills (500)
Riverside County			
67 schools 12,118 p/d	Oasis (95) Mecca (420) Hemmerling (190) Sunshine (9) Magnolia (63) Ramona (90) West Riverside (36) Theodore Roosevelt (300) Eagle Mt. and Kaiser (200)	Good Hope (280) Nellie N. Coffman (300) Letha Raney (140) Alessandro (350) Raymond Cree (100) Dateland (128) Palm Desert (90) Woodrow Wilson (150) Chemawa (40)	El Camino (150) Norte Vista (70) San Jacinto (30) Hemet (120) Perris (210) John W. North (375) Eagle Mountain (8) Arlington (105) Continuation (70)

	Elementary	Junior High	High School
Riverside County (cont'd.)	Cathedral City (550) Agua Caliente (200) Perris Primary (90) Arnold Heights (120) Hyatt (353) Hawthorne (75) Emerson (80) Victoria (120) Desert Hot Spring (285) Filex J. Appleby (180) Hemet (60) Eisenhower (720) Coronita (75) Palm View (240) Andrew Jackson (260) Hoover (400) Vista del Monte (60) Castle View (208) Bryant (20) Elsinore (120) Westside (300) John F. Kennedy (58) Summit (120) Seaview (90) Idyllwild (60) Temecula (100) Hamilton (155) George Washington (365) Rancho Mirage (400) Katherine Finchy (790) Cielo Vista (300) Central (90) Acacia (120) Cahuilla (100)	Peter Pendleton (60) Thomas Jefferson (150) John Kelley (180)	La Sierra (40) Palo Verde (225) Twin Palms (80)

	Elementary	Junior High	High School
San Bernardino County			
88 schools 79,911 p/d	Apple Valley (200) Adelanto (2200) Barstow Unified (6150) Barton (126) Belvedere (250) El Rancho (300) George Air Force Base (480) Helendale (180) Joshua Circle (5500) Juniper (360) Lincoln (120) Los Flores (240) Mariana (9600) Mesa Grande (1200) Mitchell (120) North Park (60) North Shore (126) Oasis (400) Palm Vista (360) Parkside (30) Phelan (350) H. R. Sheppard (170) Victorville (850) Wrightwood (460) Yucca Loma (1200) Zimmerman (120)	Colton (40) Etiwanda (60) Mary P. Henck (180) Pitcher (188) Trona (562)	Chaffey (240) Montclair (150) Needles (612) Trona (900) Upland (175)
San Diego County			
16 schools 10,115 p/d	Kit Carson (40) County Outdoor Education Program-6th grade (900) Del Rio (40) Oceanside Unified (1200) Sunnyside (100) Walker (105)	La Presa (245) Parkway (150)	Clairemont (30) Escondido Union (Dist.) (120) Monte Vista (45) Mount Miguel (120) San Dieguito Adult (30) Sweetwater Union (6750) Torrey Pines (200) Valhalla (40)

	Elementary	Junior High	High School
Sacramento County			
2 schools 170 p/d		Arden (110)	Elk Grove (60)
Other Counties			
10 schools	Pinecrest (Tuolumne Co.) (60)	DeAnza (Ventura Co.) (150)	Redwood (Marin Co.) (160)
1,163 p/d		Georgetown (El Dorado Co.) (75)	Miramonte (Contra Costa Co.) (200) Middletown (Lake Co.) (24) Cubberley (Santa Clara Co.) (160) Dos Pueblos (Santa Barbara Co.) (60) Alleghany (Sierra Co.) (24) Mount Diablo Unified School District (250)
Private Schools			
27 schools	Saint Mary (Apple Valley) (20)	Christian-Lutheran School (La Mesa) (12)	La Jolla Country Day (San Diego) (15)
3,379 p/d	Saint Mary (Palmdale) (105)	Jack and Jill (La Puente) (40)	Desert Sun School (Idyllwild) (120)
	Sequoyah (Pasadena) (96)	Valley Christian (San Bernardino) (80)	Notre Dame (Riverside) (50)
	Palm Valley (Palm Springs) (300)	Barstow Christian School (Barstow) (75)	Mater Dei (Santa Ana) (75)
		Fairview Jr. Academy (Highland) (20)	Catalina Island School (Avalon) (40)
		Clairbouin (San Gabriel) (75)	Louisville (Woodland Hills) (200)
		St. Bernardine's (Woodland Hills) (200)	Bishop Alemany (Mission Hills) (30) St. Augustine (San Diego) (70) Polytechnic School (Pasadena) (142)

Elementary	Junior High	High School
	Mesa Grande S.D.A. Jr. Academy (Calimesa) (157)	
	Meadows Oaks School (Calabasas) (120)	
	Eldorado (Orange) (60)	
	Ideal Community School (Agoura) (750)	
	Mardan (Special Education) (Costa-Mesa) (80)	
	San Fernando Valley Christian (Supulveda) (137)	
	Oakwood (North Hollywood) (420)	

APPENDIX V

Explanation of Symbols:

1. Brackets enclose private schools.

2. Parenthetical numbers are total person/days for all the schools that visit each locality.

3. Asterisks indicate schools not represented in Phase I report (February, 1977).

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Imperial County

1.	Bird Refuge (60)	Fremont Elem. (Im)
2.	Brock's Experimental Farm-All American Canal (50)	*Hoover Elem. (R) Kennedy Jr. (Im)
3.	Calcite Canyon	Montgomery Jr. (SD)
*4.	Cargo Muchacho Mts. (9)	*U. of Pacific-Anderson
*5.	Carrizo Marsh (& Wash) (30)	*U. of San Diego-Dingman
6.	Coyote Mountain (252)	*San Diego State U.-Gastric Montgomery Jr. (SD)
*7.	Crufixion Thorns (120)	*Jefferson Elem. (Im)
*8.	Davies Valley	*UC, Riverside-Pinto
9.	East Mesa (130)	*Imperial Valley College-Persche *UCLA-Edney *UCLA-Nobel
		Harding Elem. (Im) *John W. North H.S. (R)
*10.	El Centro (86)	*Westside Elem. (Im)
*11.	Fossil Canyon (80)	*Dana Hills H.S. (O)
12.	Glamis (571)	*CSU, Chico-Cliff *CSU, Fullerton-Brattstrom *CSU, Fullerton-McClanahan Grossmont College *San Diego State U.-Cox *UC, Davis-Schuster *UC, Irvine-Bennett *UC, Riverside-Pinto *UC, Santa Barbara-Smith *U. of Pacific-Anderson Walker Elem. (SD)
13.	Heber Beach (210)	De Anza Elem. (Im) *Heber Elem. (Im) Rockwood Elem. (Im) Westmoreland Union Elem. (Im)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Imperial County (continued)

14.	Imperial Dam (12)	*UC, Davis-Barbour Kennedy Jr. (Im) San Pasqual H.S. (Im)
15.	Indian Pass	Grossmont Adult School (SD)
*16.	Indian Wash	*UC, Riverside-Pinto
*17.	Milpitas Wash (31)	*CSU, Fullerton-Brattstrom
*18.	Mountain Springs (1)	*San Diego State U.-Cox
19.	Obsidian Butte	Grossmont College
20.	Ocotillo (344)	*Grossmont College-Kaningsor *San Diego State U.-Gastic *San Diego State U.-Novack *UCLA-Gorman *UCSC-Luckenbach *[St. Augustine H.S. (SD)]
21.	Ogilby	Grossmont College
22.	Oyster Shell Beds Near Yuha (62)	*Natural History Museum, San Diego
23.	Painted Gorge (106)	Harding Elem (Im) *Mains Elem. & Hoffman School (Im) *Mulberry Elem. (Im)
*24.	Palo Verde Rd.	*UC, Santa Cruz-Norris
25.	Pebble Terrace (Palo Verde Mountains)	Grossmont Adult School (SD)
26.	Picacho	San Pasqual H.S. (Im)
27.	Plaster City	Chaffey College *San Diego State U.-Cohn
28.	Quechan Farms	San Pasqual H.S. (Im)
29.	Salton Sea (3720)	Cal Poly Pomona-Baskin *Cal Poly Pomona-Stewart *Cal Poly Pomona-Szijj *Citrus College-Stevens *Clairemont Men's College-Brown *College of the Desert-Burrage & Bowie *CSU, Fullerton-Brattstrom *CSU, Long Beach-Collins *CSU, Los Angeles-Soltz

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Imperial County (continued)

29. Salton Sea (continued)

*Fullerton College-Schoenherr
*Moorpark College-Schwalm
*Pomona College-Oglesby
*Pomona College-Wirtz
San Bernardino Valley College-Clopine
*San Bernardino Valley College-Horner
*Santa Ana College-Baker
*Santa Monica College-Hoffman
*UC, Davis-Barbour
*UC, Riverside-Mayhew
*UC, Santa Barbara-Norris

Imperial Elem. (Im)
*Mecca Elem. (R)
*Paul Swing Elem. (Im)
*Sea View Elem. (R)
*Westside Elem. (R)
*[Fairview Jr. Academy (SB)]
*Good Hope Jr. (R)
Kennedy Jr. (Im)
*[Mesa Grande S.D.A. Jr. Acad. (R)]
Calipatria H.S. (Im)
Clairemont H.S. (SD)
*[Desert Sun School (R)]
*Glendora H.S. (LA)

*El Dorado A.S.
*Laguna Hills A.S.
*Living Desert Assoc.
*Natural History Museum, San Diego
*Palm Springs Desert Museum
*Pasadena A.S.
*Pomona Valley A.S.
*San Bernardino Valley A.S.
San Bernardino County Museum
*San Diego A.S.
*San Fernando Valley A.S.
*Santa Monica Bay A.S.

*30. San Felipe Creek (52)

*San Diego State U.-Novacek
*UC, Riverside-Mayhew

*31. Sand Hills (Algodones Dunes, Glamis Dunes) (139)

*Cal Poly Pomona-Stewart
*Humboldt Stat U.-Sawyer
*San Diego State U.-Cohn
*San Diego State U.-Zedler
*UC, Berkeley-Schlinger
*UC, Irvine-MacMillen
*UC, Riverside-Mayhew
*UC, Santa Cruz- Luckenbach
*UC, Santa Cruz-Norris

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Imperial County (continued)

*31.	Sand Hills (continued)	*Monrovia H.S. (LA)
*32.	Sand Hills (e. of Brawley) (164)	*Pacific Union College-Muth *J.W. Oakley Elem. (Im) *Magnolia Elem. (Im) *Holtville Jr. (Im)
33.	Senator Wash	San Pasqual H.S. (Im)
34.	Signal Mountain	Harding Elem. (Im)
35.	Sunbeam Lake	Westmoreland Union (Im)
*36.	Sunrise Butte	*San Diego State U.-Cohn
*37.	Wash 6 mi. E. Junct. Hwy. 98 & 52 (16)	*U. of San Diego-Dingman
38.	Yuha Desert (25)	*San Diego State-Zedler

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Inyo County

*1. Bristlecone Pine Forest

*2. Cerro Gordo (149)

3. Darwin Canyon (471)

4. Death Valley (5711)

*Bishop Union Elem. Dist. (In)
*UC, Berkeley-Meyer
*Silverado Elem. (O)
*[Meadow Oaks School (LA)]
Chaffey College
*CSU, Hayward-McGinnis
*Pierce College-Meyer
*UC, Davis-Kyhos
*Whittier College-Wadsworth
*Barstow College-Vencill
Cerro Coso College-Brubaker
Cerro Coso College-Westbrook
Chaffey College-Dickey
*Citrus College-Stevens
*CSU, Fresno-Haas
*CSU, Fresno-Merrill
*CSU, Fullerton-Hanes
*CSU, Hayward-Baalman
*CSU, Hayward-Brooks
*CSU, Los Angeles-Vance
*CSU, Stanislaus-Grillos & Hackwell
*CSU, Stanislaus-Williams
Cuesta College-Bowen
*Fullerton College-Schoenherr
*Humboldt State U.-Sawyer
*Loma Linda U.-Brand & Harris
*Pierce College-Meyer
*Pomona College-Philips
San Bernardino Valley College-Clopine
*San Fransisco State College-Savory
*San Jose State College-Harvey
*Santa Ana College-Bates
*Sierra College-Berkstresser
*Sonoma State College-Sherman
*Stanford University-Mooney
*UC, Berkeley-Hildreth
*UC, Berkeley- Johnson
*UC, Davis-Webster
*UC, Riverside-Mayhew
UC, Santa Barbara-Mahall
*UC, Santa Barbara-Norris
*UC, Santa Cruz-Cameron

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Inyo County (continued)

4. Death Valley (continued)

*UC, Santa Cruz-Luckenbach
*UC, Santa Cruz-Norris
*U. of Pacific-Anderson
*U. of Utah-Ehleringer

Argyll Academy (LA)
*Bishop Union Elem. Dist. (Inyo)
Death Valley Elem. (Inyo)
*Lo-Inyo Elem. (In)
*Round Valley Elem. (In)
Shoshone Elem. (In)
Tecopa-Francis Elem. (In)
*Arden Inter. (Sacto)
*El Roble Inter. (LA)
*Fairgrove Jr. (LA)
*Georgetown Jr. (El Dorado)
La Presa Jr. (SD)
Lincoln Jr. (K)
*Maude B. Davis Middle (O)
*Monterey Highlands (LA)
*[Valley Christian (SB)]
*Alleghany H.S. (Sierra)
*Cubberly H.S. (Santa Clara)
Death Valley H.S. (In)
Granada Hills H.S. (LA)
*[Ideal Community School (LA)]
Inyo County Grades 1-12 (In)
*John Burroughs H.S. (LA)
*Lone Pine H.S. (In)
*[Mardan (LA)]
*[Mater Dei (LA)]
*Middletown H.S. (Lake)
*Owens Valley H.S. (In)
*[Polytechnic School (LA)]
*Mt. Diablo Unified School Dist. (Contra Costa)

*Desert Research Institute
*Laguna Hills A.S.
*Living Desert Assoc.
*Mt. Shasta A.S.
*Pasadena A.S.
*Pomona Valley A.S.
*San Bernardino Valley A.S.
*Stockton A.S.

*5. Deep Springs Valley (539)

*CSU, Fresno-Merrill
Sierra College-Berkstresser
*UC, Irvine-Carpenter
*UC, Santa Barbara-Timbrook
*UC, Santa Cruz-Norris

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Inyo County (continued)

*5. Deep Springs Valley (continued)	*Silverado Elem.(0)
6. Eureka Valley (156)	*CSU, Chico-Dempsey *CSU, Fresno-Merrill *CSU, Hayward-Brooks *Fullerton College-Schoenherr *Humboldt State U.-Sawyer *UC, Berkeley-Johnson *UC, Davis-Major
7. Haiwee Reservoir	*UC, Santa Barbara-Haller
*8. Inyo Mountains (314)	*Chaffey College-Kellogg *CSU, Fresno-Moore *Occidental College-Patterson *UC, Berkeley-Johnson *Bishop Union Elem. Dist. *Mt. Shasta A.S.
9. Little Lake (34)	*Barstow College *Chaffey College-Kellogg *Citrus College-Trent *UC, Santa Barbara-Haller
10. Lone Pine	*UC, Berkeley-Johnson *UC, Santa Barbara-Haller
11. Nopah Mountains (8)	Barstow College Sierra College-Berkstresser
12. Owens Dry Lake (111)	Barstow College Chaffey College *Claremont Colleges-Erikson *Claremont Men's College-Brown *Pierce College-Meyer *UC, Berkeley-Hay
13. Owens Valley (619)	*Cerro Coso College-Brubaker *Chaffey College-Dickey *Chaffey College-Kellogg *Citrus College-Damron *Citrus College-Stevens *CSU, Los Angeles-Vogl *Cuesta College-Brown Palomar College *Pierce College-Meyer *Sonoma State-Sherman *UC, Berkeley-Hay *UC, Berkeley-Johnson *UC, Berkeley-Lidicker

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Inyo County (continued)

13. Owens Valley (continued)	*UC, Berkeley-Vivrette *UC, Davis-Bohart *UC, Riverside-Pinto *UC, Santa Barbara-Norris *UC, Santa Barbara-Timbrook *U. of Washington-Kenagy *USC-Stone *Whittier College-Wadsworth *Arden Intermediate (Sacto) *Georgetown Jr. (El Dorado) *Monterey Highlands (LA) Inyo County Grades 1-12 (In) U.S. Geological Survey
14. Panamint Mountains (184)	Barstow College *Calif. Lutheran College-Collins *CSC, Stanislaus-Williams *CSU, Hayward-Brooks *CSU, Sacramento-Livezey *Mills-Kasapligil *San Bernardino Valley College-Clopine *Stanford-Mooney *UC, Riverside-Pinto
*15. Poleta Folds, White Mountains (33)	*Chaffey College-Kellogg
16. Saline Valley (480)	*Barstow College-Vencill *CSU, Fresno-Merrill *CSU, Sacramento-Livezey *Fullerton College-Schoenherr *Pierce College-Meyer *UC, Berkeley-Johnson *UC, Davis-Major UC, Santa Barbara-Koehler *UC, Santa Barbara-Norris UC, Santa Barbara-Smith UC, Santa Barbara-Timbrook *Santa Monica Bay A.S.
17. Shoshone (32)	UC, Santa Cruz-Cameron Shoshone Elem. (In) Death Valley H.S. (In)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Inyo County (continued)

18.	Tecopa	Tecopa-Francis Elem. (In)
*19.	Waucoba Mountain (10)	*UC, Berkeley-Hay

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Kern County

1. Boron		*San Bernardino Valley College-Clopine Fairfax Elem. (K) Fairfax-Virginia Elem. (K)
*2. Butterbredt Cyn., Spg.	(319)	*Santa Monica College-Hoffman *San Fernando Valley A. S. *Santa Monica Bay A.S.
*3. California City	(1458)	*CSC, Stanislaus-Williams *CSU, Fresno-Chesemore *CSU, Fresno-Ervin *CSU, Fresno-Haas *CSU, Fresno-Hawbecker *CSU, Hayward-McGinnis *Dana Hills H.S. (O)
4. Castle Buttes		Forbes Jr. (K)
5. China Lake	(216)	Cerro Coso College-Brubaker *CSU, Fresno-Haas *CSU, Long Beach-Collins *Orange Coast College-James *UC, Berkeley-Hay Thompson Jr. (K) *Elk Grove H.S. (Sacto) *Stockton A.S.
*6. Clay Mine Rd. Area	(60)	*Antelope Valley H.S. (LA)
7. Desert Tortoise Reserve (Cantil)	(210)	*Bakersfield College-Lawrence *UC, Santa Cruz-Luckenbach
8. Edwards Air Force Base	(35)	*[St. Mary's Elem. (LA)] Thompson Jr. (K)
9. El Paso Mountains	(51)	Cerro Coso College-Brubaker *Pierce College-Meyer *UCLA-Thompson Forbes Jr. (K) *Dana Hills H.S. (O) *Goddard H.S. (LA) L.A. County Museum
10. Garlock Fault		Barstow College U.S. Geological Survey

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Kern County (continued)

11. Horse Canyon (232)	Robert P. Ulrich Elem. (K) Joshua Jr. (K) Arlington H.S. (R) *Santa Monica Bay A.S.
12. Jawbone Canyon (118)	Bakersfield College-Laurence *Cal Poly, San Luis Obispo-Andoli Cerro Coso College-Westbrook Pierce College-Meyer Santa Monica College-Hoffman Joshua Jr. (K) L.A. County Museum *Zoological Society of San Diego
13. Kelso Creek (214)	*Santa Monica Bay A.S.
*14. Koehn Lake	UC, Berkeley-Lidicker
15. Last Chance Canyon (188)	*Cal Poly, San Luis Obispo-Andoli *CSU, Fresno-Moore *UCLA-Thompson *Zoological Society of San Diego
16. Mojave (546)	Bakersfield College *CSC, San Bernardino-Harrington *CSU, Fresno-Hawbecker *CSU, Hayward-Brooks *Moorhead College-Schwalm Palomar College- *Pierce College-Meyer *UC, Berkeley-McColl *UC, Davis-Bohart *UC, Davis-James *UC, Irvine-Bennett *UC, Santa Barbara-Norris *Buena Terra Elem. (O) Etiwanda Elem. (SB) Fairfax Elem. (SB) Fairfax-Virginia Ave. Elem. (K) *Monterey Highlands Elem. (LA) *[St. Mary's (SB)] Jacobsen Jr. (K) Thompson Jr.

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Kern County (continued)

17. North Edwards (2)	*UCLA-Adest *UCLA-Recht
18. Rainbow Ridge	Grossmont Adult School (SD)
19. Randsburg (145)	*Chaffey College-Kellogg *CSU, Fresno-Haas *Pierce College-Meyer RobertP. Ulrich Elem. (K) Forbes Jr. (K) Haven Drive Jr. (K) *Dana Hills H.S. (O)
20. Red Rock Canyon (214)	Antelope Valley College-Stewart *Bakersfield College-Lawrence Barstow College *Cal Poly, San Luis Obispo-Roest Cerro Coso College-Brubaker Chaffey College *Pierce College-Meyer *UC Davis-Webster Robert P. Ulrich Elem. (K) Haven Drive Jr. (K) *[Meadow Oaks School (LA)] *Antelope Valley H.S. (LA) *Hart H.S. (LA) *John Burroughs H.S. (LA) *La Habra H.S. (O) *Quartz Hill H.S. (LA)
21. Rosamond (49)	CSU, Northridge-Dale
22. Walker Pass (104)	*Chaffey College-Kellogg *CSC, Stanislaus-Williams *CSU, Fresno-Hawbecker *UC, Santa Barbara-Haller *U. of Pacific-McNeal

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Los Angeles County

1. Acton (112)	Cal Poly, Pomona-Baskin *Sandbury Jr. (LA) *John W. North H.S. (R) Sylmar H.S. (LA)
*2. Alpine Buttes (71)	*Loyola Marmount-Towner *Quartz Hill H.S. (LA)
3. Antelope Valley	*Antelope Valley College-Newkirk *Cal Poly, San Luis Obispo-Holland *CSU, Los Angeles-Soltz *CSU, Los Angeles-Vogl *Pierce College-Meyers *Rio Hondo College-Williams *UC Riverside-Pengelley
4. Big Rock Creek (132)	*Citrus College-Stevens *Antelope Valley H.S. (LA)
5. Bob's Gap (164)	*Cal Poly, Pomona-Stewart *UCLA-Miller
6. N. of Wrightwood along Hwy. 138 to Palmdale (26)	*Loma Linda U.-Lathrop
7. Devil's Punchbowl (765)	*Citrus College-Stevens *Pierce College-Hopper *Pierce College-Thomas Adelanto Elem. (SB) H.R. Sheppard Elem. (SB) Los Flores Elem. (SB) *[St. Mary's Elem. (LA)] Eastside Union (LA) *E.J. Toll Jr. (LA) *Fairgrove Jr. (LA) *Muir Jr. (LA) *Antelope Valley H.S. (LA) *John Burroughs H.S. (LA)
*8. Fairmont Butte (16)	*Loyola Marmount U.-Towner
*9. Gorman Area (25)	*Antelope Valley College-Stewart
*10. Hi Vista (27)	*Antelope Valley College-Stewart *San Bernardino Valley College-Horner

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Los Angeles County (continued)

11. Little Rock Reservoir (112)	*CSU, Los Angeles-Hanson *Occidental College-Hand
	Horace Mann (LA)
	*Santa Monica Bay A.S.
12. Littlerock Wash (35)	*UCLA-Adest
*13. Lovejoy Buttes (35)	*UCLA-Adest *UC, Riverside-Mayhew
14. Palmdale-Lancaster (1378)	*Antelope Valley College-Stewart *Calif. Lutheran College-Collins *CSU, Los Angeles-Vance *LA Valley College-Bio. Dept. *Orange Coast College-James *Pierce College-Mardin *UC, Berkeley-McColl *UC, Davis-Barbour *UC, Davis-Kyhos *UCLA-Cody UCLA-Howell *UCLA- Thompson *San Fransisco State U.-Miller
	*[Jack & Jill (LA)] *Lincoln Elem. (LA) *Sierra Elem. (LA) *E.J. Toll Jr. (LA) *Monterey Highlands Jr. (LA) *Park View Int. (LA) *Antelope Valley H.S. (LA) LA Baptist H.S. (LA) *Quartz Hill H.S. (LA)
	*Davis A.S.
*15. Pearblossom (1520)	*CSC, Dominguez Hills-Morafka *CSC, San Bernardino-Harrington *CSU, Northridge-Weston *Pierce College-Hopper *UC, Davis-Barbour *UCLA-George *UC, Riverside-Shoemaker *UC, Santa Barbara-Haller *UC, Santa Barbara-Rothstein *USC-Abbott *Ventura College-Casella

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Los Angeles County (continued)

*15.	Pearblossom (continued)	*Muir Jr. (LA) *Hoover H.S. (LA) *Huntington Beach H.S. (O) *La Habra H.S. (O)
16.	Saddleback Butte State Park, Piute Butte Lake (1174)	*Antelope Valley College-Stewart *Cal Poly, Pomona-Stewart *Cal Poly, San Luis Obispo-Andoli *Cal Poly, San Luis Obispo-Gambs *Cal Poly, San Luis Obispo-Holland *Cal Poly, San Luis Obispo-Johnson *Cal Poly, San Luis Obispo-Roest *Occidental College-Morton *UCLA-Adest *[Sequoyah Elem. (LA)] *[St. Mary's Elem. (LA)] Granada Hills H.S. (LA) Zoological Society of San Diego
*17.	Three Sisters Hills (34)	*Loyola Marmount-Towner *Sycamore Jr. (LA)
*18.	Valyermo-Benedictine Retreat House	*[Alverno H.S. (LA)]
19.	Vasquez Rocks (260)	*[St. Bernardine's Grade School (LA)] *Jordan Jr. (LA)
20.	Wrightwood (60)	*Gladstone H.S. (LA)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County

*1. Banning-Cabazon (155)	*Claremont Grad. School-Scogin *CSU, Los Angeles-Pitkin *UC, Davis-Kyhos *UCLA-Wyles *Gahr H.S. (LA)
*2. Berdoo Canyon (60)	*UC, Riverside-Pinto *Monrovia H.S. (LA)
3. Blythe Area (225)	*CSU, Fullerton-Brattstrom *Pierce College-Hopper *UC, Santa Barbara-DeWolfe Felix J. Appleby (R) Magnolia H.S. (O) Palo Verde H.S. (R)
*4. Box Canyon (305)	*CSU, Sacramento-Baad *Long Beach City College-Frietas *Loyola Marmount U.-Towner *Sonoma State College-Sherman *UCLA-Walsberg *UC, Riverside-Pinto *UC, Riverside-Vasek *UC, Santa Barbara-Haller *Alessandro Jr. (R) *Goddard Jr. (LA)
*5. Chocolate Mountains (51)	*La Verne College-Neher *Mulberry Elem. (Im)
6. Cholla Cactus Garden (10)	*Santa Ana College-Baker
*7. Chuckwalla Mountains, Jaeger Preserve, Corn Springs (914)	*Cal Poly, Pomona-Brum *Cal Poly, Pomona-Stewart *Chaffey College-Kellogg *CSU, Fullerton-Adams *CSU, Fullerton-Brattstrom *Loma Linda U.-Lathrop *Occidental College-Patterson *Pierce College-Hopper *Goddard Jr. (LA) *Fountain Valley H.S. (O) *San Antonio H.S. (LA) Living Desert Assoc.
9. Cleveland St. Drain (70)	*Claremont Men's College-Brown

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County (continued)

10.	Coachella Area (2568)	*College of the Desert-Burrage & Bowie *CSU, Long Beach-Loomis & Clover *CSU, Los Angeles-Hanson *San Fransisco State U.-Savary *UC, Davis-Bohart *UCLA-Edney *Elsinore Elem. (R) *Thomas Jefferson Int. (R) Clairemont H.S. (SD) *[St. Augustine H.S. (SD) Living Desert Assoc. Palm Springs Desert Museum
12.	Cottonwood Canyon (16)	*Rio Hondo College-Williams
*13.	Cottonwood Springs (186)	*Long Beach City College-Frietas *Santa Ana College-Baker *Eagle Mt. Elem. & Kaiser Elem. (R) *John Kelley Jr. (R)
14.	Coyote Canyon	*John W. North H.S. (R)
*15.	Dead Indian Creek	*[Desert Sun School (R)]
*16.	Deep Canyon	*Norte Vista H.S. (R)
*17.	Desert Ctr. (150)	*Cal Poly, Pomona-Stewart *[Sr. Juliana Elem. & Jr. (O)]
*18.	Desert Hot Springs (70)	*Santa Ana College-Baker *Monrovia H.S. (LA)
*20.	Ford Dry Lake (7)	*[Mesa Grande S.D.A. Jr. Academy (SB)]
21.	Granite Mountains	*UC, Davis-Kyhos
*23.	Indian Wells, Pinyon Flats (80)	*UC Berkeley-Pitelka
*24.	Indio Area (91)	*Cal Poly, Pomona-Stewart Cal Poly, Pomona-Szijj *San Francisco State U.-Savary UC, Riverside-Farley *James Franklin Elem. (O) La Presa Jr. (SD) *Woodrow Wilson Int. (R)
25.	Joshua Tree (7294)	*Arma J. Shull Elem. (LA) *Arnold Heights (R)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies

& Nature Organizations

Riverside County (continued)

25. Joshua Tree (continued)

*Citrus College-Damon and Trent
*Bakersfield College-Lawrence
*Fullerton College-Schonherr
*Long Beach City College-Ramos and Frietas
*Los Angeles Southwest College-Woodleg
*Moorepark College-Schwalm
*San Bernardino Valley College-Horner
*Ventura College-Casella
*College of Alameda-Luther
*Rio Hondo College-Williams
*Santa Monica College-Hoffmann
*Santa Ana College-Bates
*San Bernardino State College-Harrington
*Sonoma State College-Sherman
*CSU, Sacramento-Baad
*CSU, Los Angeles-Vance
*CSU, Hayward-Baalman
*CSU, Humboldt-Sawyer
*CSU, Fullerton-Hanes
*UC, Berkeley-Lidicker
*[Biola College-Payne]
*[Calif. Lutheran College-Collins]
*[Chapman College-Mortenson]
*[Claremont Colleges-Eriksen]
*[Claremont Mens College-Brown]
*[La Verne College-Neher]
*[Mills College-Kasapligil]
*[Point Loma College-Hyde]
*[Pomona College-Wirtz and Phillips]
*[Whittier College-James]
University of the Pacific-McNeal
Loma Linda University-Lathrop

Belvedere Elem. (SB)
*Eagle Mt. Elem. & Kaiser Elem. (R)
*Hamilton Elem. (R)
H.R. Sheppard Elem. (SB)
Joshua Circle Elem. (SB)
*Katherine Finchy Elem. (R)
Oasis Elem. (SB)
Palm Vista Elem. (SB)
*[Sequoyah Elem. (LA)]
*Sunshine Elem. (R)
*Taft Elem. (O)
*Troth St. School (R)
*Victoria Elem. (R)
Zimmerman Elem. (SB)
*Alvarado Int. (LA)
Brentwood Jr. & H.S. (LA)
*[Clairebourn Jr. (LA)]
Colton Jr. (SB)
*Dale Jr. (LA)
*Del Norte Jr. (LA)
*El Roble Jr. (LA)
[*Fairview Jr. Acad. (LA)]
*Good Hope Jr. (R)
*John Kelley Jr. (R)
Mary P. Henck Jr. (SB)
*McPherson Jr. (LA)
*Valley Christian Jr. (SB)
*[Catalina Island School ( )]
*Continuation H.S. (R)
*Dana Hills H.S. (O)
*Eagle Mt. H.S. (R)
*Edison H.S. (O)
*Fountain Valley H.S. (O)
Granada Hills H.S. (LA)
*Hemet H.S. (R)
*Hoover H.S. (LA)
*Huntington Beach H.S. (O)
*[Ideal Community School (LA)]
*John Burroughs H.S. (LA)
*La Habra H.S. (O)
*La Sierra H.S. (R)
*[Louisville H.S. (LA)]
*Monrovia H.S. (LA)
*Norte Vista H.S. (R)
*Pacifica H.S. (LA)
Roland H.S. (LA)
*San Antonio H.S. (LA)
*Savannah H.S. (O)
*Tustin H.S. (O)
Twin Palms H.S. (R)
*Westminster H.S. (O)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County (continued)

25.	Joshua Tree (continued)	Davis A.S. L.A. County Museum Laguna Hills A.S. Living Desert Assoc. Pasadena A.S. Pomona Valley A.S.
26.	Lake Cahuilla (563)	*Hoover Elem. (R) *Katherine Finchy Elem. (R) *Palm View Elem. (R) *Theodore Roosevelt Elem. (R) *Thomas Jefferson Int. (R)
27.	Magnesia Spring Canyon (400)	*Rancho Mirage (R)
28.	Mecca Hills (172)	*CSU, LA-Vance *San Francisco State U.-Gabel *Whittier College-Wadsworth *James Franklin Elem. (R) *Woodrow Wilson Int. (R)
*29.	Orocopia Mountains (18)	*Cal Poly, Pomona-Stewart *Pierce College-Meyer *Whittier College-Wadsworth *[Clairebourn Jr. (LA)]
30.	Painted Canyon (32)	*CSU, Long Beach-Collins *Norte Vista H.S. (R)
*31.	Palm Canyon (13)	*McPherson (O) Coachella Valley A.S.
32.	Palm Desert Area (4706) (Deep Canyon and Living Desert Preserve)	Cal Poly, Pomona-Szijj *CSU, Fullerton-McClanahan *Long Beach City College-Frietas *Moorpark College-Reynolds *Orange Coast College-James *Pomona College-Wirtz *UC, Berkeley-Pitelka *UC, Berkeley-Schlinger *UCLA-Chin *UCLA-Hespenheide *UCLA-Nobel

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County (continued)

32. Palm Desert Area (continued)

*UC, Riverside-Mayhew
UC, Riverside-Moore
*USC-Abbott
*U of Utah-Ehleringer

*Agua Caliente Elem. (R)
*Andrew Jackson Elem (R)
*Cahuilla Elem. (R)
*Castle View Elem. (R)
*Cathedral City Elem. (R)
*Central Elem. (R)
*Cielo Vista Elem. (R)
*Eagle Mt. Elem. & Kaiser Elem. (R)
*Emerson Elem. (R)
*George Washington Elem. (R)
*Hoover Elem. (R)
*Hyatt Elem. (R)
*Idyllwild Elem. (R)
*John F. Kennedy Elem (R)
*Katherine Finchy Elem. (R)
*Mecca Elem. (R)
*Oasis Elem. (R)
*[Palm Valley Elem. (R)]
*Palm View Elem. (R)
*Perris Primary (R)
*Summit Elem. (R)
*Theodore Roosevelt Elem. (R)
*Vista del Monte Elem. (R)
*Westside Elem. (R)
*Alessandro Jr. (R)
*Dateland Elem. (R)
*Fitz Int. (LA)
*Palm Desert Int. (R)
*Peter Pendleton Jr. (R)
*Raymond Cree Jr. (LA)
*Sycamore Jr. (LA)
*Thomas Jefferson Int. (R)
*[Desert Sun School (R)]
*Elk Grove H.S. (SAC)
*Hemet H.S. (R)
Monrovia H.S.(LA)

Desert Research Assoc.

*33. Palm Springs Area (3148)

Cal Poly, Pomona-Szijj
*CSU, Hayward-Baalman
*CSU, Long Beach-Loomis & Clover
*Orange Coast College-James
*Pasadena City College-Babel
*Santa Ana College-Magnum
UC, Davis-Schuster
*UC, Irvine-Bennett

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County (continued)

*33.	Palm Springs Area (continued)	*UCLA-Wyles *UC, Riverside-Mayhew *UC, Riverside-Pengelley *USC-DeWeese
		*Acacia Elem. (R) *Cathedral City Elem. (R) *Cielo Vista Elem (R) *Eagle Mt. Elem & Kaiser Elem. (R) *Fremont Elem. (O) *Hemet Elem. (R) *Hemmerling Elem. (R) *[Jack & Jill Jr. (LA)] *Katherine Finchy Elem. (R) *Magnolia Elem. (R) *Mecca Elem. (R) *[Palm Valley Elem. (R)] *West Riverside Elem. (R) *E.J. Toll Jr. (LA) *Good Hope Jr. (R) *La Presa Int. (SD) *Nellie N. Coffman (R) *Foothill H.S. (O) *Perris H.S. (R) *San Jacinto H.S. (R) *St. John's H.S. (R)
		San Bernardino Valley A.S.
35.	Pushawalla Canyon (73)	*CSU, Fullerton-Weintraub UCLA
36.	Rice (198)	*CSU, Fullerton-Brattstrom *CSU, Fullerton-Presch
37.	Riverside Mountains (6)	*St. Mary's College-Leitner
38.	Sand Dunes near 1000 Palms (10)	*Santa Ana College-Baker
*39.	Snow Creek (63)	*Cal Poly, Pomona-Stewart *CSU, Northridge-Weston
		*Katherine Finchy Elem. (R) *[Desert Sun School(R)]
*40.	Thermal Airport	*Mecca Elem. (R)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

Riverside County (continued)

41. Thousand Palms (313)	*Cal Poly, Pomona-Brum *UCLA-Adest *UCLA-Gorman *UC, Riverside-Mayhew *UC, Riverside-Vasek
	*[Desert Sun School (R)] *Gahr H.S. (LA) Monrovia H.S. (LA)
	Coachella Valley A.S.
*42. White Wash (30)	*Central Elem. (R)
*43. Whitewater Canyon (302)	*Cal Poly, Pomona-Stewart *Cal Poly, Pomona-Szijj *Pierce College-Hopper *UCLA-Hespenheide
	*[Desert Sun School (R)] *Hemet H.S. (R) *John W. North H.S. (R)
44. Whitewater River	*UC, Riverside-Mayhew
*45. Wiley Wells (60)	Gladstone H.S. (LA)
46. Windy Point (63)	*Pierce College-Meyer *UC, Riverside-Farley *UC, Riverside-Mayhew *UC, Riverside-Shoemaker

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County

1. Adelanto (516)	*Whittier College-James George Air Force Base Elem. (SB)
2. Afton Canyon (47)	Barstow College CSC, San Bernardino-Harrington UC, Riverside-Mayhew *[Mesa Grande S.D.A. Jr. Academy (SB)]
*3. Amargosa River, Saratoga Springs (325)	CSU, Los Angeles-Soltz *Orange West Coast College-James *UC, Riverside-Mayhew *UC, Riverside-Moore
	*El Dorado A.S. San Bernardino County Museum *San Fernando Valley A.S.
4. Amboy Crater (140)	*CSU, LA-Vance *Pierce College-Meyer *UC, Irvine-Rundel
	*Silverado Elem. (O) *Lincoln Jr. (O) *Fountain Valley H.S. (O) *John Burroughs H.S. (LA) John Glenn H.S. (LA) Needles H.S. (LA) *Norte Vista H.S. (R)
5. Apple Valley (13)	Los Flores Elem. (SB) Mariana Elem. (SB)
*6. Avawatz Mountain area (11)	*La Verne College-Neher
*7. Baker	San Bernardino Valley College-Clopine San Bernardino County Museum
8. Barstow (3118)	*Barstow College-Vencill *CSU, Hayward-McGinnis *CSU, LA-Vance *San Jose State U.-Balgooyen *UC, Berkeley-McColl *UCLA-George UCLA-Miller *UCLA-Wyles
	Barton Elem. (SB) Belvedere Elem. (SB) *Bryant Elem. (SB) Etiwanda Elem. (SB) *Hyatt Elem. (R)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

8. Barstow (continued)	*Chemawa Middle School(R) Perris H.S. (R)
9. Barstow (Lead Mt.)	Chaffey College
10. Bearclaw Canyon	Needles H.S. (SB)
11. Black Canyon-Lucerne (134)	*CSU, LA-Vance *Dool Elem. (Im) North Shore Elem. (SB) Phelan Elem. (SB) *Goddard Jr. (LA) *John W. North H.S. (R) Montclair H.S. (SB) Barstow Unified School Dist. (SB)
*12. Burns Reserve (35)	*UC, Irvine-Rundel *UCLA-Hespenheide *UC, Riverside-Mayhew
13. Cadiz	Barstow College UC, Irvine-Rundel John Glenn H.S. (LA)
14. Cadiz (Marble Mountain Region) (43)	*Citrus College-Trent *CSC, Dominguez Hills-Morafka Needles H.S. (SB)
15. Cady Mts. (43)	*L.A. Pierce College-Thomas Phelan Elem. (SB) Forbes Jr. (K)
16. Cajon Pass (378)	Chaffey College-Dickey Juniper Elem. (SB) Yucca Loma Elem. (SB) *Sycamore J. H. (LA) *Foothill H.S. (O) *Ganesha H.S. (LA)
17. Calico Mountains (689)	North Shores Community College Adult Ctr. (SD) *UC, Riverside-Cooper Adelanto Elem. (SB) Apple Valley Elem. (SB) Barton Elem. (SB) Helendale Elem. (SB) Joshua Circle Elem. (SB) Mitchell Elem. (SB) North Shore Elem. (SB)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

17.	Calico Mountains (continued)	Parkside Elem. (SB) Phelan Elem. (SB) *Silverado Elem. (O) Tecopa-Francis Elem. (In) Yucca Loma Elem. (SB) Colton Jr. (SB) *Del Norte Jr. (LA) *[Fairview Jr. Acad. (SB)] *Good Hope Int. (R) *Lincoln Jr. (O) *Maude B. Davis Middle (O) Dos Pueblos H.S. (SB) *Gladstone H.S. (LA)
18.	Chemhuevi Mountains	Needles H.S. (SB)
19.	Cima Dome (100)	Barstow College *Cal Poly, Pomona-Stewart *San Fransisco State U.-Gabel
20.	Clark Mountains (328)	*Chaffey College-Kellogg *CSU, Fullerton-Jones *CSU, LA-Hendrickson *UC, Berkeley-Johnson *UC, Riverside-Mayhew *Whittier College-Wadsworth Forbes Jr. (K)
*21.	Coyote Wells (20)	*CSU, Chico-Cliff
*22.	Cronese Lakes (25)	*Orange Coast College-James *[Mesa Grande S.D.A. Jr. Acad. (SB)]
*23.	Dale Dry Lake (20)	*UC, Riverside-Mayhew *UC, Riverside-Shoemaker
24.	Daggett	Thomson Elem. (SB)
25.	Deep Creek Park	Yucca Loma Elem. (SB)
*26.	Devil's Playground (51)	*CSU, Fresno-Ervin
*27.	Dry Lake (E. of Sheephole Mts.) (5)	*[Mesa Grande S.D.A. Jr. Acad. (SB)]
28.	Dumont Dunes	Barstow College *San Diego State U.-Cohn *UC, Riverside-Mayhew
29.	Early Man Site (150)	*Summit Elem. (R) Yucca Loma Elem. (SB)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

*30.	Earp (73)	CSU, Fullerton-Jones
31.	El Mirage Dry Lake (106)	*Victor Valley College-Irwin Phelan Elem. (SB) *Fairgrove Jr. (LA)
*32.	Four Corners (20)	*Elk Grove H.S. (Sacto)
*33.	Fry Mountains	*UC, Riverside-Mayhew
*34.	Granite Mountains (697)	*Cal Poly, Pomona-Stewart *CSU, Fresno-Erwin *CSU, LA-Hendrickson *CSU, LA-Soltz *Long Beach City College-Ramos *UCLA-Cody *UC, Riverside-Mayhew *UC, Santa Cruz-Norris *Goddard Jr. (LA) *[Mesa Grande S.D.A. Jr. Acad. (SB)] *Dana Hills H.S. (O) *Fountain Valley H.S. (O)
*35.	Gravel Hills, Dry Lakes (near Cuddleback Dry Lake) (195)	*CSU, Northridge-Weston
*36.	Halloran Springs (15)	*UC, Davis-Barbour
37.	Harper Dry Lake	Phelan Elem. (SB)
38.	Helendale	Helendale Elem. (SB)
39.	Hesperia (52)	*UC, Berkeley-Schlinger *UC, Riverside-Mayhew Juniper Elem. (SB) Mesa Grande Elem. (SB) *Arlington H.S. (R)
40.	Hinkley (80)	Chaffey College *UC, Santa Cruz-Luckenbach

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

41. Hole In The Wall (129)	Barstow College *Citrus College-Trent *CSU, Sacramento-Livezey *[Mesa Grande S.D.A. Jr. Acad. (SB)] *Arlington H.S. (R) *Dana Hills H.S. (O) *La Puente H.S. (LA)
42. Ivanpah Mountains	Barstow College
*43. Johnson Valley	UC, Santa Cruz-Luckenbach
*44. Kelso (56)	*San Jose State U.-Harvey *UC, Santa Barbara-Rothstein *Portola Jr. (O)
45. Kelso Dunes (795)	Barstow College Cal Poly, Pomona-Stewart *Cal Poly, Pomona-Stewart Chaffey College-Dickey *CSU, Chico-Dempsey *CSU, Fullerton-Presch *CSU, Hayward-Baalman *CSU, LA-Soltz *CSU, Sacramento-Livezey *Humboldt State U.-Sawyer *Orange Coast College-James *San Diego State U.-Cohn *San Diego State U.-Cox *San Fransisco State U.-Savary *San Fransisco State U.-Swoveland *UC, Irvine-MacMillan *UC, Riverside-Mayhew *UC, Riverside-Pinto *UC, Santa Barbara-Rothstein *Whittier College-Wadsworth Adelanto Elem. (SB) *Silverado Elem. (O) *Lincoln Jr. (O) *Monterey Highlands (LA) *Portola Jr. (O) *Dana Hills H.S. (O) *Fountain Valley H.S. (O) *San Antonio H.S. (LA) *Zoological Society of San Diego

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

46.	Kingston Mts. (48)	Barstow College *CSU, Fresno-Moore
47.	Lake Manix	Barstow College
48.	Lanfair Valley (Piute Creek) (22)	Barstow College *College of Alameda-Luther
49.	Lanfair Valley (N. of Goff's Station)	Needles H.S. (SB)
50.	Lava Beds (20)	*Portola Jr. (O)
51.	Lava Mts.	U.S. Geologic Survey
*52.	Little San Bernardino Mountains (66)	*Occidental College-Patterson
53.	Lone Pine Canyon	Victor Valley College
54.	Lucerne Valley (914)	Barstow College *Biola College-Payne *Cal Poly, Pomona-Brum *Chaffey College-Kellogg *Claremont Colleges-Erikson *CSU, Fullerton-Hanes *L.A. Valley College-Bio. Dept. *UC, Berkeley-Johnson *UC, Riverside-Vasek
55.	Lynx Mountain	Barstow Unified School Dist. (SB)
56.	Marble Mountains (318)	Chaffey College-Dickey *Chaffey College-Kellogg *Citrus College-Trent *CSU, Fresno-Moore *Pierce College-Meyer San Bernardino Valley College-Clopine *Lincoln Jr. (O) *Dana Hills H.S. (O) *La Puente H.S. (LA) *Pacifica H.S. (O)
*57.	Mesquite Dry Lake (2)	*[Mesa Grande S.D.A. Jr. Acad. (SB)]
*58.	Mid Hills (194)	*Citrus College-Damron *Citrus College-Stevens *[Mesa Grande S.D.A. Jr. Acad. (SB)]
*59.	Mining Ghost Town (25)	Portola Jr. (O) La Puente H.S. (LA)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

60. Mitchell Caverns (234)	Barstow College *CSU, Fullerton-Presch San Bernardino Valley College-Clopine *San Bernardino Valley College-Horner *Hamilton Elem. (R) *Silverado Elem. (O) *Portola Jr. (O) *La Puente H.S. (LA) *Monrovia H.S. (LA)
61. Mojave Narrows	Adelanto Elem. (SB) H.R. Sheppard Elem. (SB) Mesa Grande Elem. (SB) Yucca Loma Elem. (SB) *Pomona Valley A.S. *San Fernando Valley A.S. *Santa Monica Bay A.S.
62. Mojave River	Victorville Elem. (SB)
63. Mormon Rocks	Yucca Loma Elem. (SB)
64. Morongo Valley (1307)	*Chaffey College-Kellogg *Claremont Graduate School-Scogin *CSU, Long Beach-Collins *CSU, Los Angeles-Soltz *Loma Linda U.-Brand & Harris *Pierce College-Hopper *Pomona College-Wirtz *Rio Hondo College-Williams *UC, Irvine-MacMillen *UCLA-Thompson *UC, Riverside-Mayhew *UC, Riverside-Vasek *USC-Stone *Cahuilla Elem. (R) North Park Elem. (SB) *[Mesa Grande S.D.A. Jr. Acad. (SB)] *Monterey Highlands Jr. (LA) *Washington Int. (O) *Hemet H.S. (R) *Coachella Valley A.S. *Pasadena A.S. *Pomona Valley A.S. *San Fernando Valley A.S. *Santa Monica Bay A.S.

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

65. Mountain Pass (672)	Chaffey College *USC-Stone
*66. Mountains Behind Big Bear Lake (18)	*Arlington H.S. (R)
67. Mule Canyon	Barstow College Montclair H.S. (SB)
*68. Needles (38)	Cal Poly, Pomona-Szijj *Pierce College-Nardin *Arlington H.S. (R)
69. New York Mountains (327)	Barstow College Cal Poly, Pomona-Brown *Chaffey College-Kellogg *CSU, Los Angeles-Hendrickson *Pierce College-Thomas *Santa Ana College-Bates *UC, Berkeley-Smith *UCLA-Cody *UCLA-Thompson *UC, Riverside-Pinto *UC, Santa Cruz-Norris
*70. Newbury (147)	*CSU, Fresno-Haas *Victor Valley College-Irwin *Gladstone H.S. (LA)
*71. Old Woman Springs (111)	*CSC, San Bernardino-Harrington
72. Opal Mountain (20)	*Sandburg Jr. (LA) Grossmont Adult School (SD)
73. Ord Mountain (212)	*La Verne College-Neher *Occidental College-Patterson *Pomona College-Wirtz *Victor Valley College-Irwin Barstow Unified School Dist. (SB)
74. Owl Canyon, Rainbow Basin (893)	Barstow College San Bernardino Valley College-Clopine *Sierra Community College *UC, Santa Cruz-Luckenbach *USC-Stone Victor Valley College *Whittier College-Wadsworth Helendale Elem. (SB) Mitchell Elem. (SB)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

74. Owl Canyon, Rainbow Basin (continued)
*Summit Elem. (R)
Thomson Elem. (SB)
*[Barstow Christian School (SB)]
Ella B. Pitcher Jr. (SB)
*Foothill H.S. (O)
Barstow Unified School Dist. (SB)

*75. Phelan (10)
UC, Riverside-Mayhew
*Ganesha H.S. (LA)

*76. Pinon Hills (170)
*Hart H.S. (LA)
*Rowland H.S. (LA)

77. Pioneer Town (620)
UC, Irvine-Justice

78. Pisgah Crater (722)
Barstow College
Chaffey College-Dickey
*Chaffey College-Kellogg
*CSU, LA-Vance
*Humboldt State U.-Lawlor
*Pierce College-Meyer
San Bernardino Valley College-Clopine
*UC, Irvine-Justice
*UCLA-Adest
UCLA-Chin
*UC, Riverside-Mayhew
*UC, Santa Cruz-Norris
Apple Valley Elem. (SB)
Yucca Loma Elem. (SB)
Ella B. Pitcher Jr. (SB)
*Fountain Valley H.S. (O)

79. Providence Mountains (504)
Barstow College
Cal Poly, Pomona-Brown
*Cal Poly, Pomona-Stewart
*College of Alameda-Luther
*CSU, Fresno-Ervin
*CSU, Hayward-Baalman
*CSU, LA-Hendrickson
*Pierce College-Meyer
*Santa Ana College-Bates
*UC, Irvine-MacMillen
*UCLA-Cody
*UC, Santa Barbara-Schlesinger
UC, Santa Barbara-Smith
UC, Santa Barbara-Timbrook
*UC, Santa Cruz-Luckenbach
*UC, Santa Cruz-Norris
*Victor Valley College-Irwin
Victor Valley College

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

79.	Providence Mountains (continued)	Adelanto Elem. (SB) *Fountain Valley H.S. (O) *La Habra H.S. (O) Needles H.S. (SB) L.A. County Museum *Zoological Society of San Diego
80.	Rabbit Dry Lake	Montclair H.S. (SB)
81.	Red Mountain (32)	*San Bernardino Valley College-Horner
82.	Ridgecrest (33)	Cerro Coso College-Westbrook *CSU, Fresno-Hawbecker
84.	Rodman Mountains (Newbury Lava Flows, Sheep Springs) (78)	Barstow College *CSU, Fullerton-McClanahan McKinley Elem. (LA)
85.	Sacramento Mountains	*UC, Riverside-Mayhew Needles H.S.(SB)
*8	Salt Beds (Bristol Dry Lake) (5)	*La Puente H.S. (LA)
87.	Searles Lake (266)	*CSU, Fresno-Merrill *UC, Berkeley-Hay *E.J. Toll Jr. (LA) *Dana Hills H.S. (O) Trona H.S. (SB)
*88.	Shadow Mountains (33)	*Whittier College-Wadsworth
*89.	Sheephole Mountains (94)	*Citrus College-Trent *UC, Davis-Kyhos Lincoln Jr. (O)
90.	Sidewinder Mountain	H.R. Sheppard Elem. (SB)
*91.	Sidewinder Valley (68)	*UC, Santa Cruz-Luckenbach *Victor Valley College-Irwin
*92.	Silver Dry Lake (2)	*[Mesa Grande S.D.A. Jr. Acad. (SB)]
93.	Silverwood Lake	Los Flores Elem. (SB) Mesa Grande Elem. (SB)
9	Snaggletooth Mountain	Needles H.S. (SB)
95.	Soda Lake, Soda Springs, Zzyzx Springs (3928)	Barstow College *Cal Poly, Pomona-Stewart

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

95. Soda Lake, etc... (continued)	*Cal Poly, San Luis Obispo-Gambs *CSC, Dominguez Hills-Morafka *CSC, San Bernardino-Harrington *CSC, Stanislaus-Grillos & Hackwell *CSU, Fullerton-Brattstrom *CSU, Fullerton-Jones *CSU,Fullerton-McClanahan *CSU, Fullerton-Presch *CSU, Fullerton-Weintraub *CSU, Long Beach-Loomis & Clover *CSU, Los Angeles-Kay *CSU, Los Angeles-Soltz Grossmont College *UC, Riverside-Mayhew *Del Norte Jr. (LA)
96. Stoddard Mountains (43)	*CSU, Hayward-McGinnis *U. of the Pacific-McNeal
97. Stoddard Valley	*UC, Riverside-Mayhew Barstow Unified School Dist (SB)
*98. Topak Marsh (160)	*[Louisville H.S. (LA)]
99. Trona (113)	Barstow College Chaffey College San Bernardino Valley College-Clopine *E.J. Toll Jr. (LA) Trona Jr. (SB) Trona H.S. (SB)
100. Troy Dry Lake (203)	*Chaffey College-Kellogg Phelan Elem. (SB)
101. Turtle Mountains (30)	*Arma J. Shull Elem. (LA) Needles H.S. (SB) Grossmont Adult School (SD)
102. Twenty-nine Palms (181)	*Claremont Graduate School-Scogin *CSU, Chico-Cliff *CSU, Chico-Dempsey *CSU, Fresno-Haas *Mills College-Kasapligil *Pacific Union College-Muth *UC, Santa Barbara-DeWolfe *Eagle Mountain Elem. & Kaiser Elem. (R) *James Franklin Elem. (O) *Magnolia H.S. (O) Monrovia H.S. (LA)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Bernardino County (continued)

103.	29 Palms Oasis	Palm Vista Elem. (SB)
104.	Victorville (104)	Cal Poly, Pomona-Szijj *Pierce College-Meyer *Pierce College-Meyers *Pierce College-Nardin *UC, Berkeley-McColl Victor Valley College-Smith *Magnolia Elem. (R) Victorville Elem. (SB)
105.	Victor Valley	Joshua Circle Elem. (SB)
106.	Whipple Mountains (22)	*Cal Poly, Pomona-Brum *St. Mary's College-Leitner *UC, Riverside-Mayhew Needles H.S. (SB)
107.	Yucca Valley (644)	*Cal Poly, Pomona-Brum *Chaffey College-Kellogg *Claremont Colleges-Erikson *Pierce College-Hopper *San Francisco State U.-Swoveland *UC, Irvine-MacMillen *James Franklin Elem. (O) Chaffey H.S. (SB) *Palm Springs Desert Museum

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Diego County

1. Anza Borrego (4855)

Del Rio Elem. (SD)
Kit Carson Elem. (SD)
*Vista Del Norte Elem. (R)
Colton Jr. (SB)
*Ensign Middle School (O)
*Good Hope Jr. (R)
Jefferson Jr. (SD)
*McPherson Jr. (O)
*Oak Ave. Inter. (LA)
Parkway Jr. (SD)
*Rancho San Joaquin (O)
Central Union H.S. (Im)
*[Desert Sun School (R)]
*[El Dorado H.S. (O)]
*Estancia H.S. (O)
*Hemet H.S. (R)
*John Burroughs H.S. (LA)
Monte Vista H.S. (SD)
Mount Miguel H.S. (SD)
Outdoor Ed. Program (SD)
*Pacifica H.S. (O)
San Dieguito H.S. (SD)
*[St. Augustine H.S. (SD)]
Sweetwater H.S. District (SD)
Valhalla H.S. (SD)
William Noff H.S. (LA)

*Anza Borrego Desert Natural History Assoc.
*Davis Audubon Soc.
*El Dorado Aud. Soc.
*Laguna Hills Aud. Soc.
*Living Desert Assoc.
*Mt. Shasta A.s.
*Natural History Museum, San Diego
*Pasadena A.S.
*San Bernardino Valley A.S.
*Zoological Society of San Diego

2. Banner Grade

*UC, Santa Barbara-Haller
Outdoor Ed. Program (SD)

3. Borrego Badlands (126)

*San Diego State U.-Gastic

4. Borrego Mountains (210)

*CSU, Chico-Stensrud

5. Borrego Palm Canyon (20)

*U. of San Diego-Dingman

*6. Borrego Sink

Carl E. Gilbert Elem. (O)

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Diego County (continued)

7. Borrego Springs & Valley (711)	*CSU, Chico-Cliff *San Diego State U.-Cox *Santa Ana College-Magnum *Santa Monica College-Hoffman *UC, Berkeley-Schlinger *UC, Berkeley-Vivrette *UC, Irvine-Rundel *UCLA-Gorman *UC, Santa Barbara-Haller Fremont Elem. (Im) *Goddard Jr. (LA) Claremont H.S. (SD) Escondido Union H.S. Dist. (SD) *[La Jolla County Day (SD)] *Natural History Museum, San Diego
8. Bow Willow (158)	*San Diego City College-Stecker *U. of San Diego-Dingman Oceanside H.S. (SD) *San Diego A.S.
9. Clark Wells (200)	Torrey Pines H.S. (SD)
10. Coyote Canyon (108)	*Loma Linda U.-Lathrop *Pacific Union College-Muth *John W. North H.S. (R)
11. Fish Creek Wash (70)	*Loma Linda U.-Lathrop *Pierce College-Meyer *U. of San Diego-Phillips Montgomery Jr. (SD)
12. Jecumba Area (28)	*San Diego State U.-Wedberg *UC, Berkeley-Lidicker
13. Laguna Mountains	Kit Carson Elem. (SD)
*14. Los Coyotes Indian Reservation	*Hamilton Elem. (R)
15. Rockhouse Canyon (195)	*San Diego State U.-Novacek
*16. San Felipe Creek, Yaqui Well, Tamarisk Grove (14)	*San Diego State U.-Cohn *San Diego State U.-Cox *[Mesa Grande S.D.A. Jr. Acad. (R)]
17. Santa Rosa Mountains (138)	*Chaffey College-Kellogg *U. of Wyoming-Turner

Areas Visited by Public & Private Schools, Colleges & Universities, & Audubon Societies & Nature Organizations

San Diego County (continued)

18. Split Mountain Gorge (210) *CSU, Chico-Stensrud

19. Vallecito Desert (44) *U. of San Diego-Phillips

*20. Warner Springs (66) *Tustin H.S. (O)

A. Schools Interested in Using Desert, but Not Now Using It

	Elementary	Junior High	High School
Imperial County			
2 E	Lincoln	De Anza	
1 JH	McKinley		
0 HS			
Inyo County			Bishop Union
1 HS			
Kern County	Wingland	Emerson	Bakersfield High
	Vieweg	Golden State	Foothill
15 E	Harris		Vista
	General Shafter		Mesquite
2 JH	Rosedale Union		Bakersfield Adult
	Rafer Johnson		
5 HS	Parkview		
22	Greenfield District		
	Myrtle Ave.		
	Fairview		
	Fairfax		
	Richland		
	Palm Ave.		
	Longfellow		
	Fremont		
Los Angeles County	Mann Wilson	Wilson	Santana
	Burbank	Sierra Vista	San Marino
102 E	Allen Ave.	Fred M. Sparks	Beverly Hills
	Carver	Stephens	Workman
35 JH	Fairgrove	Columbus	Carson
	Ramona	Madison	Rosemead
27 HS	Ralph W. Emerson	Sepulveda	Torrance
164	Gladston St.	Curtiss	Whittier
	Cerritos	Carmenita	Los Altos
	Charles H. Lee	Foothills	San Gabriel
	Gonsalves	Edgewood	San Dimas
	Esther Lindstrom	Monroe	Marshall Fund.
	Valley View	Center	Burbank Unif.
	La Verne Heights	Charles Drew	Canyon
	Grazide	John Adams	Mt. View
	R.D. White	Foothill	Garey
	Cullen	Oliver Wendell Holmes	Baldwin Park
	La Fetra	George W. Carver	John Muir
	Sparks	Killingsworth	Alhambra
	Collegewood	Emerson	Royal Oak
	Sunkist	Mt. Gleason	Bassett
	Lassalette	Luther Burbank	Glendale
	Roosevelt	Fremont	Arcadia
	Cloverly	Fern	Park Ave.
	Janson	Durfee	San Marino
	Orangewood	Ynez	Santa Ana

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Los Angeles County (continued)	Vineland	Lone Hill	Mark Keppel
	Norwood	Marshall	
	Sumner	Huntington	
	El Centro	Ramona	
	Stoneman	Andres Duarte	
	Evergreen	Dana	
	Merwin	South Pasadena	
	Lincoln	Roosevelt	
	Bradoaks	Grandview	
	New Lexington		
	Roosevelt		
	Concordia		
	Foster		
	Northam		
	Lexington		
	Baldwin Stocker		
	Edison		
	De Anza		
	Elwin		
	Balboa		
	Rowland		
	Montrose		
	El dorado		
	Thomas Erwin		
	Cortez		
	Newhall		
	Longden		
	Verdugo Woodlands		
	Arroyo		
	Lincoln		
	La Canada		
	Cleveland		
	Emery Park		
	Bizby		
	Condit		
	Enders		
	Villacorta		
	Shirpser		
	Vista del Valle		
	Franklin		
	Yorba		
	Ada E. Clegg		
	Loma Alta		
	Mt. View		
	Manzanita		
	Rio Vista		
	Gladstone		
	Amar		
	Van Wig		
	Paradise Canyon		
	Ekstrand		
	Paul Revere		

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Los Angeles County (continued)	James Madison		
	Hurley		
	Workman Ave.		
	Savannah		
	Brightwood		
	Farjardo		
	Baldwin		
	J.C. Fremont		
	Cogswell		
	Bidwell		
	Sellers		
	Park		
	Mint Canyon		
	Hillcrest		
	La Subida		
	Washington		
	Tonopah		
	Sycamore		
	Mountain Ave.		
	Florence E. Flanner		
	Leona H. Cox		
	Sulphur Springs		
	Victor Hodge		
	La Puente		
Orange County	Sun View	Wilshire	El Toro
	Linda Vista	Yorba	Palo Verde
100 E	Aliso	Dr. Leroy Daig	Buena Park
10 JH	Topaz	Tuffree	McNally
10 HS	Glenn L. Martin	Fremont	Indio
120	Lincoln	Willard	Canyon
	Loma Vista	A.G. Currie	Wintersburg
	Crescent	Carr	Western
	Mariposa	Sowers	Loara
	Katella	Appollo	Louis Lake
	Heim		
	Mildred Morrow		
	Bryant		
	Sierra Vista		
	Gilbert		
	Sierra		
	Hayden		
	Dr. Peter Marshall		
	Rose Drive		
	Zeyen		
	Dr. Albert Schweitzer		
	Rosita		
	Lomarena		
	Madison		
	Emery		
	Palisades		
	DeMille		
	Centralia		

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Orange County (continued)	Ben Franklin		
	Skylark		
	El Toro Marine		
	Loara		
	Washington		
	Guin Foss		
	Hoover		
	R.F. Hazard		
	Thorman		
	Westmont		
	Robert Gisler		
	J.H. McGaugh		
	Sequoia		
	Dr. C.C. Violette		
	Ladera Palma		
	Cook		
	James Monroe		
	Tamura		
	Laguna Road		
	Fletcher		
	Victoria		
	Smith		
	R.M. Pyles		
	Sunnyside		
	Monroe		
	Crown Valley		
	James Guinn		
	Del Cerro		
	Greentree		
	University Park		
	Red Hill		
	Tustin Memorial		
	Midway City		
	Richard Henry Lee		
	Cordillera		
	Hansen		
	Beswick		
	La Veta		
	Killybrooke		
	Pleasant View		
	Golden View		
	Carver		
	Mitchell		
	Samuel E. Talbert		
	Adams		
	Van Buren		
	Theodore Roosevelt		

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Orange County (continued)	Dr. Russell James Madison Mesa View Rolling Hills J.O. Harper Fairmont Bernardo-Yorba De Portola O'Neill Paularino Ford Robert Burke Edison Woodcrest Pacific Drive Gladys Wallace Harry C. Fulton Morris Urbain H. Plavan Sunset Lane Wakeham Daniel T. MacKay Los Coyotes Harbor View Golden Hill		
Riverside County 26 E 10 JH 14 HS — 50	Jackson Moreno Armada Little Lake Lincoln Harrison Edward Hyatt Longfellow Home Gardens San Jacinto Adams Highland Myra Linn Parkridge El Cerrito	Norco University Heights Central Sierra Hemet Mission Perris Valley Coombs Jarupa Murrieta	Moreno Valley Continuation Corona Indio Banning Moreno Valley Abraham Lincoln Ramsey Ramona Rubidoux Twin Pines Norco Elsinore Alessandro Kokell

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Riverside County (continued)	Coronita Van Buren La Granada Ina Arbuckle George Washington Machado Riverview Norco Highgrove Edgemont Valley View		
Sacramento County 50 E 9 JH 10 HS — 69	James McKee Twin Lakes H.W. Harkness North Avenue Larchmont Parkway Fairbanks Cowan Community Williamson Mark Hopkins Earl LeGette Leimbach Aroche Union Camellia Dewey Pony Express John Sloat Mairemont Elder Creek Clayton B. Wire Winterstein McClellan William Land Creekside Albert Schweitzer Allison Kenneth Ave. Coyle Avenue Maple Thomas Kelly Marvin Marshall Mather Heights Cosumnes Oakdale Northridge Cambridge Heights	Barrett Intermediate California A. Einstein Foothill Farms Rio Linda Campos Verdes Peter Lassen Mitchell San Brannan	Kinney Mira Loma Norte del Rio Grant Union Cordova Sacramento Mesa Verde Valley Rio Americano Bella Vista

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
Sacramento County (continued)	Ethel Phillips Palisades Lichen Clarksburg Skycrest Elk Grove Thomas Edison Deterding Dillard Caroline Jedediah Smith Orville Wright David Reese Green Oaks		
San Bernardino County 17 E 4 JH 2 HS — 23	Central Vermont Crestline Linda Vista Sycamore Edison Redwood Los Serranos Mary Tone Walnut Ave. Baldy View D Street Myers Mission Del Norte Live Oak Preston	Shandin Hills Frisbie Los Amigos Serrano	Eisenhower Yucca Valley
San Diego County 34 E 13 JH 12 HS — 59	Jefferson Bancroft Darnall Rolando Park Pacific View Rosebank Madison Ave. San Luis Rey Encinitas Central Ross Carlton Oaks Magnolia Sessions Rancho Mt. Vernon Cajon San Rafael Westwood Vallecitos Rose	Mountain Empire Emerald Earl Warren Pershing Ramona Dana Hidden Valley Hale Meadowbrook Memorial Lakeside Spring Valley James E. Potter	El Camino Midway Adult Mt. Carmel El Cajon Valley Hoover Montgomery La Palma San Pasqual Chaparral Carlsbad Helix Granite Hills

Schools Interested in Using Desert, but Not Now Using It (continued)

	Elementary	Junior High	High School
San Diego County (continued)	San Marcos		
	Los Altos		
	Holmes		
	MacDonnel		
	Central		
	Meridian		
	Lakeview		
	John Adams		
	Encanto		
	Longfellow		
	La Presa		
	John Otis		
	Rancho Santa Fe		
	Mason		

Schools Interested in Using Desert, but Not Now Using It (continued)

Private Schools

Elementary	Junior High & K-8	High School
Holy Name of Mary (LA)	Our Lady of Guadalupe (K)	Bishop Amat (LA)
Panorama Baptist (LA)	West Covina Christian (LA)	St. Genevieve (LA)
Trinity-First Lutheran (LA)	So. Hills Acad. (LA)	Crespi (LA)
Canoga Park Lutheran (LA)	St. Louis of France (LA)	Holy Martyrs Ferrahian Armenian (LA)
Lutheran School of the Foothills (LA)	San Gabriel Christian (LA)	San Fernando Valley Acad. (LA)
San Gabriel Mission Grammar (LA)	All Souls (LA)	S.G. Mission (LA)
Zion Lutheran (LA)	St. John Eudes (LA)	Providence (LA)
St. Francis Xavier (LA)	St. Bridget of Sweden (LA)	St. Francis (LA)
Holy Redeemer (LA)	St. Madeleine's (LA)	First Lutheran (LA)
Miss Paula's School, Inc. (LA)	Pasadena Christian(LA)	Gerhard Kohn (O)
Our Lady of Grace (LA)	Our Lady of Lourdes (LA)	Rosary (O)
Pasadena Town & Country School (LA)	Westminster Acad. (LA)	Heritage (O)
Pinecrest (LA)	Antelope Valley Adventist (LA)	Servite (O)
Christ Lutheran (LA)	First Lutheran (LA)	Riverside Christian (R)
Holy Family (LA)	Pomona First Baptist (LA)	The Bishop's Schools (SD)
St. Mark's School (LA)	Lutheran (LA)	Christian (SD)
Valley Park (LA)	St. Pancratius (LA)	Academy of Our Lady of Peace (SD)
Light & Life Christian (LA)	Our Lady (O)	University (SD)
St. Martin's Parish School (LA)	St. Paul's Lutheran (O)	Ontario Christian (SB)
Pathway Christian (LA)	St. John's Lutheran (O)	
Grace Lutheran (O)	St. Anthony Claret (O)	
Park Private Day School (O)	Baptist Christian (R)	
Prince of Peace Lutheran (O)	Precious Blood (R)	
Peace Lutheran (O)	Riverside S.D.A. (R)	
Orange Coast Christian (O)	Stella Maris Acad. (SD)	
Crescent Ave. Christian (O)	St. Theresa Acad. (SD)	
Prince of Peace (O)	St. John's Episcopal (SD)	
St. Justin Martyr (O)	Grace Lutheran (SD)	
Christ Lutheran (O)	St. Mary Star of the Sea (SD)	
Corona Christian Day (R)	El Cajon Valley Christian (SD)	
George Phelps (R)	Grace Lutheran (SD)	
Holy Spirit (SD)	Calvin Christian (SD)	
St. Paul's (SD)	Sacred Heart Acad. (SD)	
Tecate Christian (SD)	St. James Acad. (SD)	
El Cajon 7th Day Adventist (SD)	Mt. View Christian (SB)	
St. Michael (SD)		
St. Margaret's (SB)		
California Learning Ctr. (SB)		
First Lutheran (SB)		
C.E.D.I. (SB)		
Ontario 7th Day Adventist (SB)		
Cypress Ave. Christian (SB)		

Schools Interested in Using Desert, but Not Now Using It (continued)

Elementary	Junior High & K-8	High School
Private Schools (Spec. Ed.)		Other Harmony Ctr. (LA) Almansor Ed. Ctr. (LA)
Scattered Responses		
Belleview (Tuolomne)	Lompoe (SB)	Frontier (Ventura)
Le Grand Union (Merced)	Prescott (Modesto)	Willow Glen (Santa Clara)
Linda Vista (Santa Clara)	Valle Vista (Santa Clara)	Live Oak (Sutter)
Main (SB)	Robert Louis Stevenson (Napa	Maple (SB)
Summerland (SB)	Dartmouth (Santa Clara)	Lower Lake (Lake)
Clarence Ruth (SB)	Silverado (Napa)	Delta (Contra Costa)
McKinley (SB)	Downieville (Sierra)	Los Robles (SB)
La Canada (SB)	John C. Fremont (Ventura)	Abraham Lincoln (Santa Clara)
Charles Wright (Merced)	John Muir (Santa Clara)	Gunderson (Santa Clara)
Louise Van Meter (Santa Clara)	John Steinbeck (Santa (Clara)	Santa Barbara (SB)
Lakewood (Santa Clara)	Edwin Markham (Santa (Clara)	Santa Ynez Valley (SB)
Miano (Merced)	Lower Lake (Lake)	Leland (Santa Clara)
Gardner (Santa Clara)	Ridgeview (Napa)	Novato (Marin)
Jollyman (Santa Clara)	Curtis Creek (Tuolomne)	Newbury Park (Ventura)
Empire Gardens (Santa Clara)	Hoover (Santa Clara)	
Crescent Park (Santa Clara)	Santa Barbara (SB)	
Snelling-Merced Falls (Merced)	Mae Hensley (Stanislaus)	
Trace (Santa Clara)	Tenaya (Groveland)	
Simonds (Santa Clara)	Ocean View (Ventura)	
Summerville (Tuolomne)		
Kirk (Santa Clara)		
Loyola (Santa Clara)		
Allen (Santa Clara)		
Rachel L. Carson (Santa Clara)		
Booksin (Santa Clara)		
D.M. Bagby (Santa Clara)		
Majestic Way (Santa Clara)		
Columbia (Tuolomne)		
Henry Hammer (Santa Clara)		
Schallenberger (Santa Clara)		
Lewiston (Trinity)		
Burns Valley (Lake)		
East Lake (Lake)		
Oak Hill (Lake)		
Elwood (SB)		
Mountain View (SB)		
Slater (Santa Clara)		
Valley View (Santa Clara)		
Monroe (SB)		
Harding (SB)		
Wilson (SB)		
Reed (Santa Clara)		

Schools Interested in Using Desert, but Not Now Using It (continued)

Elementary	County or District
Scattered Responses	
Lincoln Glen (Santa Clara)	Rancho El Chorro Envir. Study Area (San Luis Obispo)
Shandon (San Luis Obispo)	Orinda School District (Contra Costa)
De Anza (Santa Clara)	Fort Bragg Unified School District (Mendocino)
Hacienda (Santa Clara)	Escondido Union (San Diego)
	San Joaquin County Outdoor School (Fresno)
	McSwain Unified School District (Merced)

B. Schools Not Using the Desert Nor Interested in Using It

	Elementary	Junior High	High School
Imperial County	Hedrick Hidalgo Desert Gardens Pine San Pasqual	Barbara Worth Frank M. Wright	Park Ave. Cont. Holtville Imperial
Inyo County	none	none	none
Kern County	Maple Panama Semitropic Caliente Richard B. Lynch Virginia Ave. Del Vista Frazier Park Delano Union	Cecil Ave.	Highland
Los Angeles County	Thomas M. Erwin Holly Ave. Garfield Foster Brightenwood Stowers Santa Anita Vejas T. Edison Dalton Willard Payne Monterey Ave. Providencia Santa Anita Monte Vista Golden Springs Thomas Jefferson Del Valle Wm. McKinley Wiley Canyon Los Altos Valencia George Washington Lee Rice Monterey Hills Glen Oaks Alcott Magnolia Stevenson Westmont Stanton Glenelder Granada	Olive Newton Roosevelt (Lakewood) Gaspar de Portola Roosevelt (Compton) J.H. Hull Porter First Ave. Lincoln Washington Haskell Ramona Jefferson Mesa Robles Arroyo Seco McKinley Newton Foothill Faye Ross	Calabasas David Gonzales La Puente El Segundo South Hills

Schools Not Using the Desert Nor Interested in Using It (continued)

	Elementary	Junior High	High School
Orange County	Sierra Vista	Kaiser	John F. Kennedy
	Gates	McComber	Brea-Olinda
	Eastbluff	Orangeview	Costa Mesa
	Patton		Bolsa Grande
	Hopkinson		Kenneth E. Mitchell
	Marjorie Vech		Nueva View
	Walter Knott		El Dorado
	Melbourne Gauer		Orange
	Anderson		
	Walnut		
	Betsy Ross		
	Parkside		
	Handy		
	John Marshall		
	Clara Barton		
	John R. Peterson		
	Harper		
	Cambridge		
	Marshall		
	Palmyra		
	Hermosa Dr.		
	Iva Meairs		
	Orchard		
	Sunkist		
	Heideman		
	Villa Park		
	R.H. Dana		
	Los Alamitos		
	Lindbergh		
	Richman		
	William T. Newland		
	Garden Park		
	Jack L. Weaver		
	Hettinga		
Riverside County	Jefferson	Matthew Goge	Polytechnic
	Liberty	Alessandro	Nueva Vista Cont.
	Mt. View	Wells	Beaumont
	Monroe	Arizona	
	Washington	Monte Vista	
	Alcott	Corona	
	Fremont		
	Foothill		
	Torrance		
	Alanza		
	Sunnymead		
	Margaret White		
	Mead Valley		
	Romoland		
	Madison		
	All en Orrenma		
	Glen Aron		

Schools Not Using the Desert Nor Interested in Using It (continued)

	Elementary	Junior High	High School
Riverside County	Wildomar NuView Hoffer John Adams Wellwood Ruth Brown Grant Manifer Collett Twinhill Highland Midland		
Sacramento County	Phoebe A. Hearst Del Paso Garden Valley Cordova Villa Hillsdale James W. Marshall Cordova Gardens Vineland S.B. Anthony Sierra Enterprise White Caleb Greenwood Rancho Cordova Fruitvale Mark Twain Roberts Pleasant Grove Samuel Kennedy Babcock E. Baker Woodlake Orchard Garfield Aero Haven Billy Mitchell Dyer Kelly Alpha Elverta Theodore Judah	Louis Pasteur Mills Riverview	Rio Linda Eastern Adult Ctr.
San Bernardino County	Lucerne Valley Arroyo Foothill Knolls Lincoln Kendall Anderson TMR	Fontana	San Bernardino Adult Twenty-nine Palms Colton Union Rim

Schools Not Using the Desert Nor Interested in Using It (continued)

San Diego County

Elementary	Junior High & K-8	High School & 7-12
Foster	La Mesa	Centre City Adult
San Altos	Oak Grove	Sweetwater
Crest	Woodrow Wilson	Educational Cultural
Crown Point	Spring Valley	Complex
La Jolla		Madison Evening
Loma Portal		
Albert Schweitzer		
La Mirada		
Pomerado		
Avocado		
Ada Harris		
Capri		
Henry C. Johnson		
Clair W. Burgener		
Pepper Drive		
Sherman		
Will Angier		
Marie Ellis		
Webster		
Solana Vista		
Carver		
Ramona		
Libby		
Greg Rogers		
Midland		
Valley Vista		
Stockton		
California Ave.		
Beaumont		
Stephen Decatur		
Del Mar Shores		
Naranca		
Oliver Hazard Perry		

Private Schools

Ridgecrest Christian (K)	Our Lady of Perp-	Valley Christian (LA)
Evans (LA)	etual Help (K)	La Salle (LA)
Valley Garden (LA)	St. Francis of Rome (LA)	Loma Linda Acad. (SB)
St. Didacus (LA)	Foothill Country Day (LA)	
Sacred Heart (LA)	St. Joseph (LA)	
Stephens Day (LA)	St. Genevieve (LA)	
Western Ave. Baptist (LA)	Annunciation (LA)	
Balboa Private (LA)	Incarnation	
St. Paul of the Cross (LA)	El Monte Christian (LA)	
St. Philip the Apostle (LA)	Valley Christian (LA)	
Shepherd of the Valley (LA)	St. Anne's (O)	
International Montessori (O)	Hawthorne Christian (O)	
Immaculate Heart (O)	Cornerstone Christian (SD)	
St. Joachim (O)	St. Charles Borromeo (SD)	
Blessed Sacrament (O)	St. Rose of Lima (SD)	
Riverside Christian Day (R)	Sacred Heart (SB)	
St. Francis (SD)		
St. Jude Acad. (SD)		

Schools Not Using the Desert Nor Interested in Using It (continued)

	Elementary	Junior High & K-8	High School & 7-12
Private Schools (continued)	Carden (SD) St. Patrick (SD) St. Lukes Lutheran Day (SD) Upland Christian Day & Pre School (SB) St. Adelaide (SB)		
Scattered Responses	Castro (Santa Clara) Cherry Chase (Santa Clara) Northwood (Santa Clara) Montclaire (Santa Clara) Noble (Santa Clara) McKinley (Santa Clara) Quito (Santa Clara) Portal (Santa Clara) Adams (SB) Hollister (SB) Monte Vista (SB) Hamilton (Santa Clara) Summerdale (Santa Clara) Belden (Santa Clara) Williams (Santa Clara) Horace Mann (Santa Clara) Kelseyville Primary (Lake) Hoaglin-Zenia (Trinity) Van Duzen (Trinity) Cox Bar (Trinity) Broadway (Santa Clara) Stevenson/Theuerkauf (Santa Clara) Kellogg (SB) Vieja Valley (SB) Aliso (SB) Fillmore (SB) Westwings (SB) Hapgood (SB) Erikson (Santa Clara) West Valley (Santa Clara) Stockmeir (Santa Clara) Graystone (Santa Clara) Benjamin Cory (Santa Clara) Frank L. Steindorf, Jr. (Santa Clara) Bachrodt (Santa Clara) Willow Glen (Santa Clara) Morgan Hill (Santa Clara) Douglas City (Trinity)	Quimby Oak (Santa Clara) Peter H. Burnett (Santa Clara) Bret Harte (Santa Clara) Gray Ave. (Sutter) El Camino (Santa Clara) La Colina (SB) Vandenberg (SB) Castillero (Santa Clara) Cabrillo (Ventura)	Anderson Valley (Mendocino) Sutter Union (Sutter) Southern Trinity (Trinity) Pioneer (Santa Cruz) Lompoc (SB) Pt. Arena Jt. Union (Mendocino)

Schools Not Using the Desert Nor Interested in Using It (continued)

District or County
Oak Grove (Santa Clara)
San Benito Co. Office of Education
Antioch Unified School District (Antioch)
Modesto City Schools (Modesto)
Tehama County of Education
Sonoma Co. Schools
Madera Co. Schools
Mendocino Co. Schools
Calaveras Co. Office of Education
Lakeport Unified School District (Lake)
Martinez Unified School District (Contra Costa)

APPENDIX VII

RESEARCH TOPICS

BOTANY

Age of Creosote bushes. F. C. Vasek (UC 36)

Air pollution damage to desert species. G. D. Brum (SU 6)

Annual plants - adaptations to desert environments. P. W. Rundel & T. Mulroy (UC 27)

Annual plant productivity. J. Vogl (SU 32)

Biosystematic survey of Langloisia. S. Timbrook (TPUC 16)

Cattle and plants; plant zones; geological areas. R. Vencill (PC 3)

Clark's Pass flora. C. E. Jones and T. Ericson. (SU 17)

Collection of plant specimens for teaching General Botany and Plant Morphology. L. Ehspamer (TPSU 4)

Comparative photosynthesis in desert shrubs. B. Mahall (TPUC 17)

Comparative phytochemistry of desert plants. R. Scogin (PrC 5)

Cytotaxonomy of Orobanchi Cooperi. L. R. Heckard (UC 48)

Desert plant life histories. P. H. Zedler, T. Ebert (SU 44)

Diversity of desert perennials. P. W. Rundel (UC 27)

Dune plant communities. W. Dempsey and ? Henry (SU 8)

Ecology of creosote bush (Larrea). M. L. Barbour (UC 18)

Ecophysiology of agave and cactus. P. Jordan and P. Nobel (UC 33)

Ecophysiology of desert shrubs. B. Smith and P. Nobel (UC 33)

Evolutionary relationships between Phacelia tanacetizolia and P. distans. P. F. Horner (PC 16)

Experimental taxonomy of Chaenactis. D. W. Kyhos. (UC 19)

Experimental taxonomy of Encelia. D. W. Kyhos (UC 19)

Experimental taxonomy of Eschscholtzia J. Clark (UC 19)

Ferns of New York Mountains. C. D. MacNeill (UC 2)

Flora of the Clark Mountains. B. Prigge (SU 33)

Flora of the desert-wildflowers. B. Collins (PrC 2)

Flora of the Granite, New York, Providence, Kingston Mountains, San Bernardino County, California. J. Hendrickson and R. F. Thorne (SU 33).

Foliar xeromorphy in California desert lilies. B. Kasapligil (PrC 11)

Genetic strategies of desert plants. R. Scogin (PrC 5)

Geophytic plants. W. Dempsey (SU 8)

Germination and growth requirements of desert annuals. N. Vivrette (UC 3)

Germination requirements of E. Mojave Desert annuals. ? Earson (SC 4)

Karyological and morphological in Linanthus. Robert Patterson (PrC 14)

Miscellaneous and monographic studies of Compositae. J. L. Strother (UC 4)

Mosses of California. ? Hotchkins and ? Jold (SU 7)

Palm oases of California. R. J. Vogl (SU 32)

Photosynthetic adaptation of plants. H. Mooney and others (PU 1)

Physiology and biochemistry of cactus. I. P. Ting (TPUC 10)

Plant succession, dry lakes. F. C. Vasek (UC 36)

Plant succession, Sacramento Mountains. F. C. Vasek (UC 36)

Pollination in desert manzanitas. G. C. Brum (SU 6)

Pollinization ecology of California Penstemons. Students of L. Szijj (TPSU 1)

Pollinization ecology of Chilopsis at Anza Borrego, Palm Springs, and Needles. Students of L. Szijj (TPSU 1)

Population dynamics of the Saguaro. G. D. Brum (SU 6)

Post-fire succession and herbivore utilization. R. J. Vogl (SU 32)

Reproductive biology of Asclepias. ? Lynch (UC 17)

Reproductive biology of Euphorbiacae. G. L. Webster, ? Lynch (UC

Reproductive biology of Kemeria, vascular plant, root parasite of other plants. F. Alameda (TPUC 5)

Salt uptake and zonation in Sarcobatus. N. Vivrette (UC 3)

Seed size of California plants in relation to environmental conditions. H. G. Baker (UC 1)

Sexual dimorphism in Simmondsia. P. W. Rundel (UC 27)

Study of hybridization between Cowania and Purshia. D. Koehler (TPUC 14)

Systematics of Eriastrum. R. Patterson. (PrC 14)

Systematics of Eriophyllinae (Compositae). D. E. Johnson (UC 5)

Systematics of Mentgelis. H. J. Thompson (UC 31)

Systematics of Pectis. D. Keil (SU 2)

Systematics of Pityrogramma triangularis - gold-backed fern. D. Smith (TPUC 15)

Taxonomy of Allium. D. McNeal (PU 3)

Temperature adaptation in Atriplex lentiformis. R. W. Pearcy (UC 22)

Tetracoccus ilioifolius: a study of the plant and its environment. N. Kindig (SU 51)

U. V. floral pattern research. F. C. Vasek (UC 36)

Vegetation analysis. F. C. Vasek (UC 36)

Vegetation of Saline Valley and relation to climate including local inputs of sun-radiation. D. Randall (UC 20)

ENTOMOLOGY

Bee pollination in Loasaceae: convergent evolution. H. J. Thompson (UC 31)

Biogeography of American bombidian beetles. K. W. Cooper (TPUC 12)

Biology and taxonomy of Meloidae. J. D. Pinto (UC 51)

Biology of the fruit fly, Drosophila. J. A. Moore (TPUC 11)

Biosystematics of the Tardigrada (water bears). R. O. Schuster (TPUC 1)

Collecting insects for Davis Entomology Dept. R. H. James (TPUC 2)

Dispersal of camel crickets (Macrobaenetes). T. J. Cohn (SU 46)

Ecology of desert ants. Susan Gordon (UC 15)

Ecology of Honey ants, genus Myrmecocystus. C. George (UC 56)

Energetics and water balance in scorpions. S. Yokota, G. Polis (UC 55)

External morphology of scorpions. M. L. Swoveland (SU 49)

Genetic load in desert Drosophila. M. Soule and ? Senner (UC 38)

Habitat restrictions of desert endemics. T. J. Cohn (SU 46)

Interaction between Camel crickets. T. J. Cohn (SU 46)

Life history of scorpions: Paruroctonis mesaensis. R. D. Farley (TPUC 9)

Mites of vertebrates in California deserts. R. B. Loomis (SU 53)

Neurophysiology of scorpion: Paruroctonis mesaemsis. R. D. Farley (TPUC 9)

Physiological ecology of desert arthropods. E. B. Edney, Frances, Cooper er al. (UC 34)

Physiological ecology of phyllopod crustacea. C. H. Eriksen, R. J. Brown (PrC 4)

Prey selection by robberflies. H. A. Hespenheide (UC 29)

Solpugid genus Chanbria in California dunes. W. E. Savary (SU 50)

Studies of tarantulas - behavioral studies, localities, incidence of burrows, etc. J. R. Gabel (SU 48)

Systematics of aculeate wasps. R. M. Bohart (UC 21)

Systematics of Neuroptera. P. A. Adams (SU 21)

Taxonomy of Miridae (plant bugs). J. D. Pinto (UC 51)

Temperature adaptation of sphinx moths. B. Heinrich, T. M. Casey (UC 8)

GENERAL

Analysis of vertebrate and vegetative biota of California City, western region (EIR). G. E. Lawrence (PC 2)

Biological survey of Granite-Kelso area. K. S. Norris and students (UC 45)

Ecology and energetics of desert vertebrates. B. Brattstrom (SU 18)

Ecology of desert sand dunes. G. W. Cox (SU 43)

The effects of off-road motorcycle racing on a desert community. A. Navarro (SU 43)

Environmental impact project - Lucerne Valley. W. Mayhew, F. Vasek, H. Johnson (UC 37)

Flora and fauna of Joshua Tree National Monument. R. B. Loomis and R. Clover (SU 53)

Inventory of Soda Springs fauna. R. B. Loomis and R. Clover (SU 53)

Playa resource inventory. C. H. Eriksen, R. J. Brown (PrC 4)

Resource nature areas for desert. K. S. Norris (UC 45)

Resident vertebrates at Soda Lake. C. Wood (SU 3)

Species list of animals and plants of Red Rock Canyon area, Saddleback Butte area, Puntley Park (Lancaster). A. M. Stewart (PC 1)

Zoogeography of desert vertebrates. R. Hirth (SU 13)

Zoogeography of sand dwelling animals. K. S. Norris (UC 45)

GEOLOGY AND SOIL SCIENCE

Analogs of Yuma terrain in Southwest U. S. Richard O. Stone and others (PU 14)

Columnar jointing in Joshua Tree National Monument. D. D. Trent (PC 22)

Depositional environments of the Reed-Deep Spring interval. J. N. Moore (SU 16)

Geology of the Lava Mts. Region. G. I. Smith (TPORG 2)

Geology of the Pleistocene lake basins. R. L. Hay, ? Gilbert, and others (UC 11)

Geothermal potential of Salton trough (NSF). L. W. Bowden (UC 50)

Hydrology of Soda Mts. Crum, Harrington (SC 4)

Microbiological ecology of desert soils. C. R. Weston and students (SU 34)

Petrology of the Bishop Tuff. E. W. Hildreth (UC 12)

Post Pleistocene biogeography of American deserts. D. E. Bixler (PC 29)

Remote sensing of California resources (NASA). L. W. Bowden (UC 50)

Stratography, structure and metamorphism of the Tucki Mtn - Skidoo area, Panamint Range. E. W. Hildreth (UC 12)

Study of desert surface conditions. R. O. Stone and others (PU 14)

Study of wind blown dust in desert areas. R. O. Stone and others (PU 14)

Tectonics along the Death Valley-Furnace Creek Fault Zone. J. H. Moore and R. Merrill (SU 16)

Utilization of aerial photography in desert regions. R. O. Stone and others (PU 14)

Volcanic correlations across Death Valley. E. W. Hildreth (UC 12)

HERPETOLOGY

Activity physiology of desert lizards. A. F. Bennett (UC 24)

Autecology of sidewinders, Crotalus cerastus. T. W. Brown (TPSU 3)

Callisaurus. T. Balgooyen (SU 52)

Collections made for San Bernardino County Museum. B. Sanders (TPORG 3)

Desert reptile color biology. K. S. Norris (UC 45)

Effect of motorcycle sounds on hearing in desert iguana. M. Bordelio (SU 18)

Effects of radio-telemetry collars on free ranging desert iguanas. H. Chin (TPUC 4)

The effect of temperature on digestive efficiency in the herbivorous lizards. M. Hoffman, Hillman, Harlow (PC 26)

General reptile and amphibian reproduction. B. Burrage (PrC 7)

Homing behaviour of Bufo punctatus. J. D. Weintraub (SU 20)

Population ecology of Sceloporus magister. J. D. Weintraub (SU 20)

Rehabilitation of captive desert tortoises. G. R. Stewart, J. Cook, A. Weber (SU 5)

Studies on desert tortoise. B. Sanders (TPORG 3)

Survey of bat populations in the eastern Mojave Desert. T. W. Brown with Patricia Brown - UCLA (TPSU 3)

Temperature regulation and social behaviour of desert amphibians and reptiles. B. Brattstrom (SU 18)

Temperature regulation study of Xantusia henshawi. R. W. Pitkin (SU 31)

Thermal ecology of montane reptiles. B. Burrage (PrC 7)

Thermoregulation of the desert iguana. S. McGinnis (SU 23)

Thermoregulation of toads of the genus Bufo. S. McGinnis (SU 23)

Water budgets of Uma scoparia. V. Shoemaker, Miomoch (UC 55)

Energetics of desert tortoises. R. Marlow (UCB)

Biology of leopard lizards. K. Tollestrup (UCB)

ICHTHYOLOGY

Biology of Stickleback fish: Gasterosteus aculeatus williamsoni.

J. N. Baskin (TPSU 2)

Genetic differences in life history traits in 2 populations of Amargosa pupfish.

D. L. Soltz and M. Hirshfield (SU 28)

Impact of introduced on native fishes. A. Schoenherr (PC 6)

Limnological studies: Soda Springs. D. Harrington, Crum, Given and Given (SC 4)

Niche partitioning in fresh water fishes. A. Schoenherr (PC 6)

Social behaviour and life history of the Amargosa pupfish. D. L. Soltz (SU 28)

Temperature and salinity tolerance and the distribution of Tilapia zillii in the Salton Sea. D. L. Soltz and B. Herbold (SU 28)

MAMMALOGY

Baseline data in areas where burro and/or cattle are presently or potentially involved in habitat alteration. T. Damson (PC 5)

Behaviour of desert woodrats. K. E. Justice (UC 26)

Climatic stress effects on desert vertebrates. W. W. Mayhew (UC 37)

Color adaptations of lava bed rodents. T. E. Lawlor (SU 40)

Commencing study of heteromyid microhabitats in western Anza Borrego desert and eastern Laguna Mtns. M. Novacek (SU 45)

Competition in desert woodrats. R. Moon (UC 26)

Desert bighorn Sheep count. R. D. Bates (PC 30)

Distribution and ecology of ring-tailed cat. K. Stager (TPORG 4)

Ecology and physiology of ground squirrels. Pengelley (UC 35)

Ecology of desert kit foxes. D. L. Chesemore. (SU 13)

Ecology of ground squirrels. W. O. Wirtz (PrC 23)

Energetics, activity, and reproduction of desert rodents. G. J. Kenagy and G. A. Bartholomew. (PU 9)

Energetics and water balance in jackrabbits. V. Shoemaker, K. Nagg, W. Costa (UC 55)

Food habits and foraging of desert woodrats. S. Thompson (UC 26)

Genecology of Dipodomys microps. B. Csuti (UC 14)

Natural history of Mojave Ground Squirrel, Spermophilus mojavensis. M. Recht (TPUC 6)

Physiological ecology of desert organisms (particular reference to water balance). L. McClanahan (SU 22)

Population dynamics of small mammals. G. Ford (UC 15)

Population studies of California leaf-nosed bats. P. Leitner (PrC 25)

Resource allocation among coexisting desert rodents. R. E. MacMillen and Morton (UC 28)

Rodent populations on arid lands. A. C. Hawbecker (SU 12)

Small mammal assessment. T. Gall (PU 4)

Small mammal survey. R. Dingman (PU 4)

Status of Joshua Tree National Monument Dipodomys microps. B. Csuti (UC 14)

Survey of bat populations in the eastern Mojave Desert. T. W. Brown (with Patricia Brown) (TPSU 3)

Systematics of Dipodomys merriami. W. Z. Lidicker (UC 14)

Systematics of pocketmice. D. F. Williams (SC 3)

Thermal ecology of desert life. B. Burrage (PrC 7)

Thermal experience desert rodents. W. O. Wirtz (PrC 23)

Water balance in desert mammals:

1. Comparative physiology of vertebrate excreting mechanisms
2. Plasma volume regulation
3. Ontogeny of thermoregulation

L. Hartman, K. Maxson, M. L. Morton, C. Maxwell (Pr C 13)

Water relations of non-captive desert rodents. R. E. MacMillen and Christopher (UC 28)

Woodrat reproduction study. J. G. Reynolds (PC 12)

ORNITHOLOGY

Zifaunal fluctuation on island of firs on Clark Mountain. N. K. Johnson (UC 13)

Banding studies of resident birds. C. T. Collins (SU 26)

Biology of Chukars. R. Zembal (SU 26)

Bushtit ecology - Providence Mountains. S. Ervin (SU 14)

Competitive relationships of two species of blackbirds. L. Szijj (TPSU 1)

Ecology and evolution of social systems in Phainopepla nitens. G. Walsberg (TPUC 3)

Host defenses against parasitic cowbirds. S. I. Rothstein (UC 42)

Song dialects in 2 subspecies of song sparrows. L. Szijj (TPSU 1)

Song patterns of Gambel's white-crowned sparrows. B. B. DeWolfe and D. D. Kaska (UC 43)

Speciation in Solitary Vireos in pinon-juniper woodlands of desert. N. K. Johnson (UC 13)

Survival rate of white-throated swift. C. T. Collins (SU 26)

Variation in Southwestern populations of cowbirds. S. I. Rothstein (UC 42)