A TRIP TO THE GRAND CANYON EXPERIMENT STATION

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An exploratory investigation of the Creation Research Society Grand Canyon Experiment Station and surrounding area is discussed. Possible future projects are offered and a catalogue of some local plants and animals is given.

Introduction

Dr. John Meyer and I began a trip May 10, 1983 to explore the research potential at the Grand Canyon Experiment Station (GCES). Our goal was to attend to the land survey and study the site and surrounding area for future work. We had undertaken similar ventures in the past and some of them have led to the production of research papers.[1]

Leaving the Santa Clarita Valley of California, we crossed the Mohave desert from Palmdale to Needles. Against a backdrop of dark, hilly lava beds dotted with glistening teddybear cacti and ungainly Joshua trees we discussed possible research that could be done at GCES.

Research Potential

We encourage readers to comment on the appropriateness, feasibility, or creationist perspectives for any of these proposals and to suggest alternative ideas that are not listed.

1. Lichens Growth. Like Rutherford Platt, many botanists assume that these little mutualistic tapestries of fungus and algae grow so slowly (only a few millimeters per year) that some of the larger lichen masses must be very old.

> Growth rate is erratic, and any estimate of the age of a lichen is guesswork. The plants have no annual increment of growth, they are seemingly independent of the passage of seasons, they live in their own time dimension. It may take fifty years for a flat lichen to grow an inch across. . . . The timelessness of lichens is revealed in their luxuriance on granite where the face of the stone has been undisturbed by other plants or by man for centuries, as in the Arctic or on mountaintops.[2]

The lava outcrops on our acreage are splashed with lichens of green, orange, and other colors (front cover). Experiments on lichen growth could be easily initiated by cleaning rock areas and observing the rate at which the lichens are restored.

2. Analyze the Growth of Juniper. Even though there are no junipers on the site, there are scattered junipers thriving on a ridge a few yards to the east and others about one-half mile west (see Figure 1). Some questions readily presented about the junipers could be investigated. What factors govern their growth here and elsewhere in Arizona? Could their distribution offer an explanation of the dispersal of life after the Flood? Some southwestern farmers destroy juniper forests to foster pasture development. Is this a wise practice? If so, how can the growth of juniper best be suppressed? Did farmers of the past destroy juniper to develop pasture?

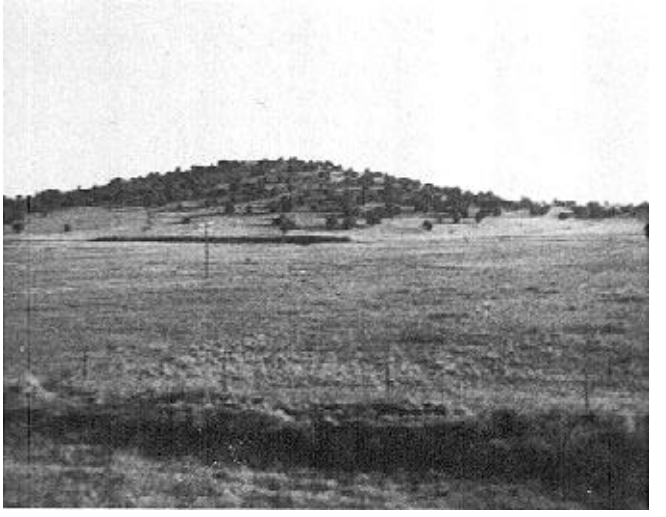

Figure 1. Tall shadows are cast by junipers in the evening sunlight, looking southwest from Highway 89 near the GCES.

3. Search for New Crops. American agriculture is based precariously on the production of a few main plant and animal cash crops. This practice leads to unexpected overproduction with attendant economic catastrophe for numerous growers. Do we as creationists believe that the Creator has placed valuable materials in many other plants? Could we help broaden the farming base by introducing alternative crops geared to the agriculture of the southwest?

The jojoba bean, a source of a very useful oil, and the winged bean *(Psophocarpus tetragonolobus),* a plant that is almost totally edible, are two possible desert crops. While these two may not survive the rigors of the 4400 foot climate at the station, others may be developed.

As a new crop is developed, so must a market arise simultaneously. This challenging proposal involves several facets. There are massive federal agencies grappling with the same issue but perhaps we as creationists have a David's stone that others might neglect—a well-founded belief that the Creator has produced many plants and animals for man's direct use and benefit. It may be that this search would be outside the generally acknowledged objectives of CRS.

4. Limits of Plant "Kinds." Through experiments in hybridization, determine limits of plant "kinds."

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How far will crosses between similar species occur and show fertility for offspring? Chino Valley offers the land, water and a milder climate necessary to investigate this. There is a significantly longer growing season here than in the vicinity of Flagstaff, Arizona.

5. Catalogue Chromosome Data. For species in certain key Arizona genera we could perform our own chromosome counts. A CRS worker might easily undertake the collection and "fixing" of flowers. This "fixing" is a rapid chemical killing of tissue in such manner that cells and tissues are prevented from undergoing major structural changes. He could assimilate existing data on chromosomal counts as well, and begin orienting them in creation perspective to determine real boundaries of Genesis "kinds." Dr. John N. Moore started this work several years ago.[3]

6. Restore Native Grass Cover. Vegetation maps of Arizona show that these 2.5 CRS acres originally supported native shortgrass prairies. Small quadrats within our station, now covered by weeds, could be restored to native grassland. This could be coupled with a study of climatic trends that developed after the Flood to establish the original grassland cover.

7. Studies Using the Surrounding Areas. The GCES may become a base of study for the many sites of scientific interest within a 200 mile radius of Chino Valley. The south rim of the Grand Canyon is 110 miles from the site. Appendix A contains a partial list of some other important areas accessible in a few hours from the GCES. Once the lab has been erected and a researcher secured, creation studies can be undertaken at these outstanding natural landmarks.

John Meyer suggested, for example, that GCES could be used as a base for field experiments involving breeding studies and evaluation of genetic relationships between Kaibab and Albert squirrels, using the isolated ponderosa pine forests a few dozen miles to the west as "natural-cages." In other studies the many facets of plant and animal distribution brought about by the Grand Canyon and the Colorado River in northern and western Arizona could be investigated.

8. Reinvestigate Hakatai Shales for Pollen Content. In 1966 Clifford Burdick[4] reported finding fossil angiosperm and gymnosperm pollen in Precambrian Hakatai Shale strata at the Grand Canyon. Recently, using a slightly different technique than Burdick's, Arthur Chadwick reported his failure to replicate Burdick's results.[5] Perhaps CRS should study pollen grains present in Hakatai and other strata.

Figure 2. The Sonoran desert is seen here in late bloom, on a side trip near Alamo Rd. which leads southeastward away from Interstate 40 near Yucca, Arizona. In the foreground at the far left globemallow is seen with brittle bush at the center. Yucca stands in the far right background and creosote bush in center background. GCES is close to several fine desert regions that research in these unique ecosystems could be undertaken.

Trip Observations

From Yucca, Arizona we left I-40 to go southwest by way of Alamo Road which was level but dusty. We had an undisturbed view of the Sonoran desert in late bloom (Figure 2) and groves of sahuaro cacti that carpeted the nearby hills and buttes. We counted at least 30 turkey vultures hovering on rising air columns while following this bypath. These lofty fliers manifest red heads and white rear wing surfaces as they serenely search for carrion. John tallied more than 15 lark buntings which are flashy black birds. They unfurl white wing bars, like the mocking-bird, when they dart from shrub to shrub.

As we continued southwestward on route 93 we passed through broad canyons with high qualitv sahuaro scenery. But the plant which is by far most prevalent throughout the entire southwest, from the hills near Palmdale to El Paso (and even farther east) is the creosote bush. This short, spreading shrub has small, sticky, two-forked leaves. Its yellow flowers appear in April or May (Figure 3) and its fuzzy fruits resemble spiders (Figure 4).

Figure 3. Flower center and two-parted leaves of the creosote bush. These shrubs cover vast sections of the southwestern United States.

Turning northward on route 97 toward Bagdad, Arizona we learned that Bagdad is the site of a large copper mining pit. We were unable to explore that as the road to the pit was closed to the public. Near Bagdad we chose a side road which twisted and turned

Figure 4. The fuzzy fruits and two-pronged tiny leaves of creosote bush. This plant contains an anti-oxidant which some workers feel could be developed as a cancer treatment.

upward through dense stands of tough scrub oak and small sugar bush trees similar to Southern California chaparral territory. One high valley was dotted with junipers and pinyon pine trees alternating with steep pastures where herds of long-horned cattle grazed. Dazzling white blossoms of blazing star, rusty stalks of dried curled dock, and the bright yellow blooms of goldenbush lined the edge of this lonely one-lane mountain thoroughfare.

From Bagdad we followed route 96 downward until we crossed the Santa Maria River, through Kirkland, Arizona until we entered the Prescott National Forest. There we encountered scrub oak chaparral with juniper and finally ponderosa pine were observed at higher altitudes.

Prescott

At the corner of Iron Springs Road and Skyline, we stopped in a fragrant yellow pine forest to watch birds and identify plants (Figure 5). John saw chipping sparrows and western bluebirds and I was able to locate three different species of oak growing together; emory, Arizona white, and scrub. Although the first two have oblong, leathery leaves, they can be distinguished as the former has olive drab foliage with smooth undersurfaces while the leaves of the latter have an overall bluish color with tiny, starlike, brown hairs on the lower surfaces. The Arizona white oak is not one of the true white oaks. It is a "live" oak. But one real white oak, gambel oak, is found in the Prescott area. Continuing into Prescott we saw shrubs as mountain mahogany, mountain lilac and manzanita in a type of mixed chaparral, a pine and juniper community (Figure 6).

We contacted the Forest Supervisor Office of the Prescott National Forest (See Appendix B for the address of establishments in Prescott). From a display in the office we learned there are 14,000 cattle and

Figure 5. A forest of ponderosa or "yellow" pine stands near the corner of Iron Springs Road and Skyline. Some of these pine forests could serve as natural "cages" for the study of tassel eared squirrels. Three different species of oak also thrive in this region, west of Prescott.

Figure 6. Traveling further east toward Prescott, one finds a patchwork of chaparral, pine, and juniper forests which make for some high quality scenery.

28,000 sheep in the vicinity of Prescott as well as pronghorn antelope, deer, turkeys, mountain lions and small game. A Multiple Use Sustained Yield Act was passed in 1960 assuring availablity of recreation, forage, water, timber and wildlife from the forest. The USDA Forest Service manages the timber and the conversion of chaparral range into productive grassland. Forest Service personnel assured us that research projects may be conducted in the forest if properly planned with them.

Colleges in Prescott

A state supported junior college, Yavapai College, serves about 6000 students with 800 of these full-time students in Prescott. At the Learning Resources Center (Figure 7) in the Stadler Building we found a collection of books and journals that will be of assistance in future research efforts. An "Arizona Index" includes an extensive list of literature on the natural history of Arizona. Appendix C lists some items found in their library.

Figure 7. Pyramidal poplar trees line the walk near the Stadler Building, Learning Resources Center where the library of Yavapai College is located. Materials in this library should be of significant help as GCES research projects develop.

Embry Riddle Aeronautical University is a four year institution centering on air science and related fields. The enrollment is about 1000.

Prescott College has a two to four year curriculum specializing in outdoor leadership and "wilderness challenge." This college is six years old and has about 100 students.

Prescott has a city library and several museums of historical and anthropological interest.[6] City buses in downtown Prescott are replicas of old fashioned trollies. Located only 22 miles south of the GCES, this town offers numerous cultural and educational advantages for research workers.

Chino Valley, Paulden and the GCES

Leaving Prescott we saw Fort Whipple Veteran's Hospital which was named after Fort Whipple Military Post, established around 1864 when Arizona became a US territory with Prescott as its capital. Continuing on route 89 we passed beautiful Watson Lake and a picturesque rock formation known as Granite Dells (Figure 8). Scrub oaks, pinyon pines, and junipers grow near these magnificent boulders.

Some miles above Granite Dells one enters the Chino Valley area which has horse ranches, cattle farms, and quarries. In addition to many homes, trailer parks, and alfalfa fields, greater Chino Valley contains clusters of offices, banks, shops and churches. Chino Valley boasts its own police force and a forest ranger station.

Figure 8. Watson Lake and the Granite Dells rock formation are located about 2 miles north of Prescott on Highway 89. Good examples of all stages in the spherical weathering of Precambrian granite can be found at this location.

The GCES is about six miles north of the town of Chino Valley on route 89. Just beyond the Harper Realty Company our land is the second 2.5 acre lot north of that structure (Figures 9 and 10). One mile south is an historical marker indicating the site of Del Rio Springs which was the original camp for the offices of the territorial government from January through May of 1864. This was later moved to Prescott.

We spent periods at the plot watching birds, collecting plants and discussing a land survey. Appendix D is a preliminary list of the plants here and at nearby localities. Approximately one-third or less of our land

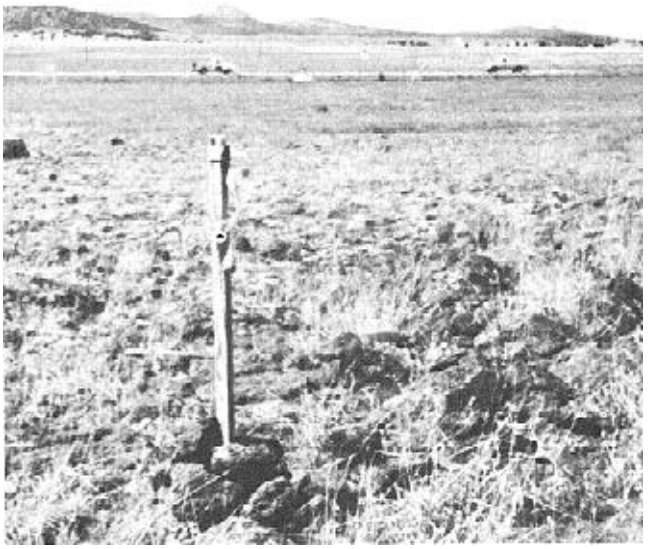

Figure 9. This realtor's stake is seen near the southeast corner of our GCES land, looking west. Less than 1/3 of our land has lava rocks dotted with lichens (foreground) while the major share appears to be tillable soil.

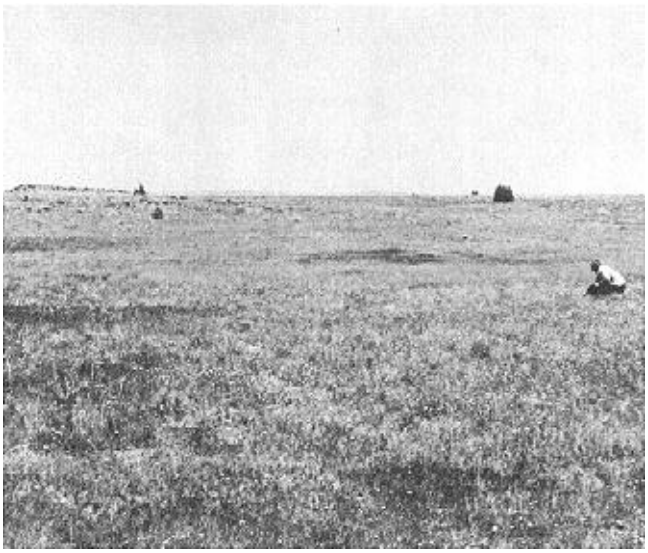

Figure 10. Direct view of the GCES land, looking northeast, with author studying herbs and grasses. The San Francisco Mountain peaks near Flagstaff are faintly visible in the background. It was in these mountains that William Hart Merriam performed his classical studies on temperature as a factor in determining the altitudinal and latitudinal distribution of plants. Photo by John Meyer.

has lava rock dotted with lichens. The remainder of the ground appears to be tillable and is presently covered with grasses and other herbs such as the yellow mariposa lilies (Figure 11), pink globe mallows, and white tidy tips. There is also a small grass that grows in tubular clusters looking like elongated ridges of moss (Figure 12). I was unable to identify this grass and would appreciate suggestions.

Among the many birds seen here, the horned larks and sweet singing meadowlarks prevailed. John Meyer has prepared a list of birds encountered at specific locations for Appendix E.

While on site we discussed digging a well, constructing fencing and the ultimate plans for a laboratory. Water is available on the site since neighbors directly south hit water at 85 feet and went below 100 feet for their well in June of 1983. CRS is committed to develop the station but only as interest money from the Laboratory Project Fund will permit. When completed, the mailing address will be Paulden, Arizona which is a small settlement a few miles north.

Figure 11. Mariposa lily is a small but striking plant. Spots and other markings on petals serve as cues and nectar guides to visiting insects whose spectrum of vision is somewhat different than our own. Photo by John Meyer.

Figure 12. Note the bunchy tubular mound of grass (indicated by arrow) growing in a crescent shape near the ball-point pen. This grass was common on the CRS land.

Figure 13. The paintbrush is seen here and there in Chino Valley. Photo by John Meyer.

Adjacent Areas

Ten miles north is Prescott National Forest. Here we enjoyed rolling landscapes of fragrant juniper, oak, pinyon pine, and cowania forests interspersed with grasslands.

We stopped at Hell Canyon which lies exactly on the 35th parallel and was the site of a famous route traveled by Indians, missionaries, and trappers. An historical marker told us between 1857 and 1859 Lt. E. F. Beale and his well-known camel corps made exploration here for a road.

One mile south along a forest road we saw a roadrunner trotting jauntily between the holly-grape shrubs. At intervals bright paint brush blossoms blurted out a red contrast to the sandy soil (Figure 13). Exploring roads west of route 89 directly north of GCES we saw nine pronghorn antelopes. These crisply marked, graceful animals demonstrate that there is opportunity for game and wildlife studies. Appendix F contains a list of mammals observed in this vicinity.

There are Indian ruins in several localities as evidenced by those about one-half mile across route 89 and directly southwest of GCES (Figure 14). From the top of this large mound, facing northeast is an excellent view of GCES (Figure 15).

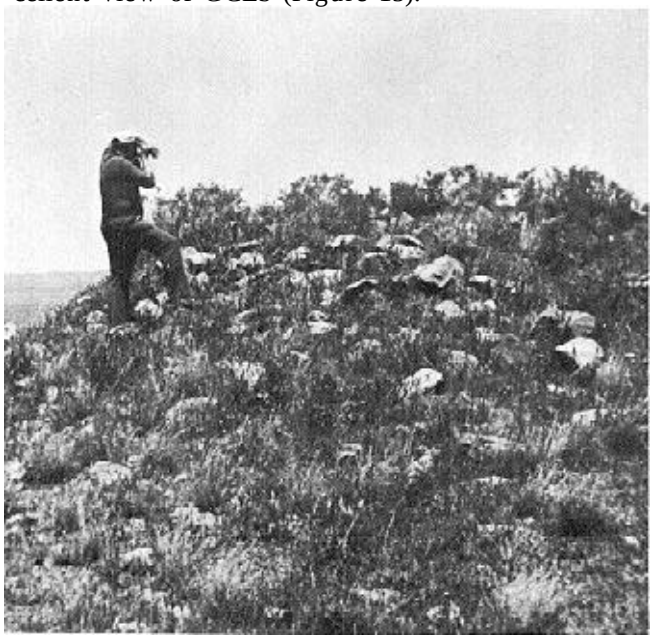

Figure 14. John Meyer photographing rocks atop the mound of Indian ruins southwest of the GCES. Although special permission and various regulations surround such inquiry, Chino Valley would be a choice area for studying Indian anthropology.

We learned that a group of local people near Gunsight is establishing its own astronomical observatory and gathering data each evening on stars and planet. John Meyer writes that:

> The clarity of the atmosphere and the usual freedom from cloud cover suggest interesting possibilities for studies using groud-based optical astronomy in analyzing origins. Perhaps the astronomy oriented CRS members can suggest appropriate low-budget projects using relatively small telescopes.[7]

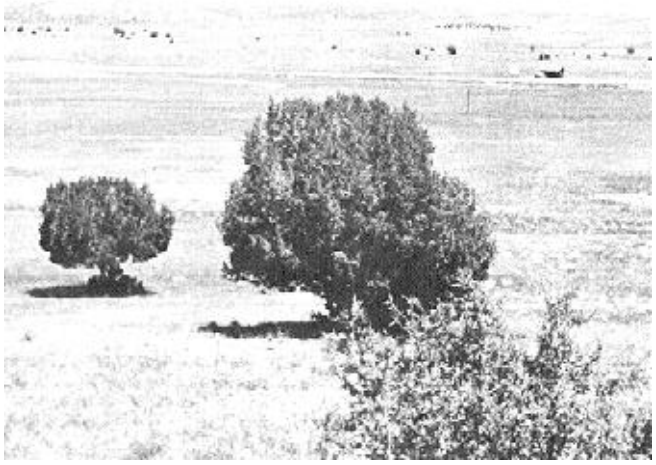

Figure 15. Looking northeastward from the top of the Indian mound there is a clear view of the Harper Realty Building and the GCES land across Highway 89. Pronghorn antelope range these rolling lands and illustrate the fact that research on wildlife could be easily enacted — in consultation with proper authorities, of course.

Figure 16. Sunset at Sullivan Lake. The cottonwood seen in the foreground is a common sight in riparian habitats throughout the southwest. Clear skies and 4400 foot altitudes make this area a choice location for astronomical activities.

Sullivan Lake, about one mile north of GCES (Figure 16), offers opportunity for work in aquatic biology. The lake and adjacent land is owned by the city of Prescott. It was established early in the 1900's as a

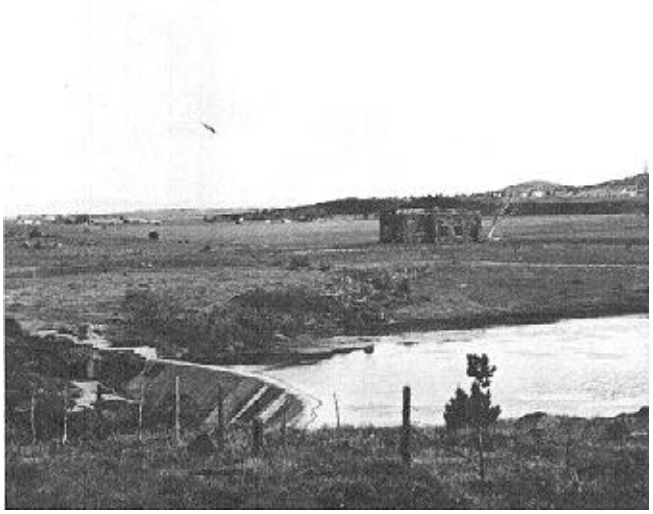

Figure 17. Dam is seen at the left, and in the center an abandoned swimming lodge which once served the city of Prescott. Photo by John Meyer.

swimming area for residents of Prescott. The one large building seen in Figure 17 was a lodge while the smaller stone structures dotting the basin were bath houses in the late 1920's and early 1930's. This lake was obviously filled in to a large extent since there is but a vestige of water left above the dam and the bath houses are now many feet inland from the borders of the present lake. Beyond the dam to the east is a steep gorge and a railroad which is parallel to an access road (Figure 18). The abrupt canyon below Sullivan Lake:

> . . . marks the beginning of the head-waters of the Verde River. At Sullivan Lake several normally dry washes coalesce, providing drainage for a basin of well over 5000 square miles including the southwest slopes of the Coconino Plateau well north of Seligman.[8]

Figure 18. This gorge and canyon eastward below Sullivan Lake mark the beginning of the head-waters of the Verde River. This lake and gorge serve as the drainage basin for a large portion of northern Arizona.

Both Sullivan Lake and the GCES land have an elevation of about 4400 feet. Temperature data are recorded in Appendix G. We found the early mornings in May rather nippy. Although the growing season near Paulden is generous compared to Flagstaff, Arizona it will never rival Orange County, California for raising plants.

Other Helpful Agencies

The secretary for the Yavapai County Agricultural Agent explained the procedures for securing soil tests. She also related some agricultural features of the Prescott region and a unique ordinance, established by early ranchers and still in force, prohibiting the production of pigs.

The staff of the Soil Conservation Service gave us numerous soil books. In the soil survey for the western part of Yavapai County,[9] it appears that the CRS plot contains an Abra gravelly, sandy loam. Concerning these soil areas the county soil manual states:

> Slopes range from 0 to 30 percent. Elevation ranges from 4000 to 5,500 feet. The vegetation is dominantly grass on the plains and pinyon pine and juniper on the alluvial fans. Annual precipitation is 11 to 16 inches. The average annual temperature is 50° to 57°, and the frost-free period is 145 to 180 days. . . . These soils are used mainly for range, wildlife habitat, and watershed catchment areas. Small areas in the Chino Valley are used for irrigated crops and homesites.[10]

At the Soil Conservation office I saw a display of several native grasses and suggest that CRS might initiate a program of study on reintroduction of these original species. California biologists have recently become interested in the stipa needle grass, naming it the "State Grass" since it once evidently covered large sections of the central valley and foothills.

Looking Ahead

Following our visit to the site John Meyer and I discussed some steps which seem to lie ahead in the development of GCES.

1. Fence the land.
2. Drill a well.
3. Provide a highway access.
4. Hire a part-time person to undertake summer studies as was done at the CRS Grassland Experiment Station in Weatherford, Oklahoma.
5. Build a lab and hire a full-time researcher.

We are convinced that the door for a highly productive program at Paulden, Arizona stands wide open. With your help, we will enter it.

Acknowledgements

I wish to thank Dr. John Meyer for his help in planning this venture and then accompanying me. Some of the photographs and appendices are credited to Dr. Meyer. I appreciate the hours of travel and corre-

spondence by Dr. Emmett Williams in leading us to this choice site. We appreciate the valuable advice of Dr. Walter Lammerts and for accompanying Dr. Williams and me on two trips to select the site.

The minor expenses incurred during this trip for gasoline mileage and photography were covered by interest income from the CRS Laboratory Project Fund. I extend special appreciation to the many donors to that fund who have made this purchase of land possible. Such gifts "keep on giving" because only the interest is used to purchase land or develop the station while the fund stands intact. Your continuing contributions may be mailed to:

CRS Laboratory Project
5093 Williamsport Drive
Norcross, Georgia 30071

APPENDICES

Appendix A

Important points for possible research within one morning's drive (approximately 200 mile radius) of The GCES. Some of these are merely listed while others include a phone number and/or mailing address:

1. Arizona Sonora Museum. (602) 883-1380. Rt. 9, Box 900, Tucson, AZ 85743.
2. Arizona State University. (602) 965-9011. Tempe, AZ 85743.
3. Boyce Thompson Southwestern Arboretum. (602) 689-2811. P.O. Box AB, Superior, AZ 85273. These people publish a journal entitled "Desert Plants" which contains many articles pertinent to Arizona research projects.
4. Desert Botanical Garden of Arizona. (602) 941-1217. 1201 N. Galvin Pkwy., Phoenix, AZ 85008.
5. Grand Canyon Caverns. Located on old Route 66. (602) 422-3223.
6. Grand Canyon National Park Service Library. (602) 638-2411. P.O. Box 129, Grand Canyon, AZ 86023. Also at Grand Canyon is a museum of natural history.
7. Havasu Lake National Wildlife Refuge.
8. Imperial National Wildlife Refuge.
9. Joshua Forest Parkway.
10. Kofa National Wildlife Refuge.
11. Lowell Observatory. Located in Flagstaff along with several other major observatories.
12. Meteor Crater. Located between Flagstaff and Winslow.
13. Mogollon Rim country with its steep escarpments.
14. Northern Arizona Museum. (602) 774-5211. Flagstaff, AZ. Note, they publish "Plateau" magazine which frequently contains articles of origins significance.
15. Northern Arizona University. (60) 523-9011. Box 6022, Flagstaff, AZ 86011.
16. Oak Creek Canyon.
17. Organ Pipe Cactus National Monument. (602) 256-2983.
18. Painted Desert. (602) 524-6228.
19. Petrified Forest National Park. (602) 524-6228.
20. Sierra Ancha Experimental Forest. (602) 524-6228.
21. San Francisco Peaks towering 12,670 feet above sea level just north of Flagstaff.
22. Sunset Crater National Monument. A large volcanic cone northeast of Flagstaff.
23. Sycamore Canyon Wilderness Area. 47,000 acres covering parts of the Coconino, Kaibab, and Prescott National Forests.
24. University of Arizona. (602) 621-2211. Tucson, AZ.
25. Yavapai Museum (½ mile east of Visitor Center, Grand Canyon south rim).

Appendix B

Offices and other establishments in Prescott and Chino Valley, AZ, that may be of help in matters pertaining to research at the GCES:

1. Chino Valley Ranger Station, P.O. Box 485, Chino Valley, AZ 86323. (602) 636-2302.
2. Prescott College, 220 Grove Ave., Prescott, AZ 86301. (602) 778-2090.
3. Prescott Chamber of Commerce, 117 West Goodwin, Prescott, AZ 86301. (602) 445-2000.
4. U. S. Department of Agriculture Forest Service, Forest Supervisor, Prescott National Forest, 344 S. Cortez, Prescott, AZ 86301. (602) 445-1762.
5. U. S. Department of Agriculture Soil Conservation Service. 1555 Iron Springs Road, Prescott, AZ 86301. (602) 445-7990.
6. Yavapai College, 1100 E. Sheldon, Prescott, AZ 86301. (602) 445-7300.
7. Yavapai County Agricultural Agent, Yavapai County Annex #2, Room 5, 500 S. Marins, Prescott, AZ 86301. (602) 445-5690.

Appendix C

A few examples of the resource materials available in the library at Stadler Building Learning Resources Center, Yavapai College.

1. A large set of materials entitled Arizona Natural History QE85.43.
2. Arizona General Soil Map. Produced by the USDA Soil Conservation Service and the University of Arizona Agricultural Experiment Station.
3. Arizona Natural Vegetation Map. This gives considerable detail regarding the distribution of general plant types such as grassland, chaparral, pine forests, etc. It is evidently available through the U. S. Forest Service.
4. Geology of Yavapai Co: a bibliography. Feb. 1982. 56 sheets. QE105.A654.
5. Journal of The Arizona-Nevada Academy of Science. Membership Secretary, Rm. A-3114, Physical Science Center, Arizona State University, Tempe, AZ 85287. Three issues are printed each year. Vol. 1, #2, contains an article (pp. 60-67) by Rittastings dealing with the change in vegetation and stream flow in Arizona during the last 100 years. The author attributes loss of grassland to overgrazing but admits that climate change may have been the "gun," the "trigger" of which was pulled by overgrazing.
6. Prescott National Forest Map. Available through Prescott National Forest Headquarters in Prescott. Prescott National Forest lies both to the east and to the west of the GCES with a narrow strip of privately owned land in between.
7. Smith, W. L. 1974. Established natural areas in Arizona. Arizona Academy of Science, Planning Division—Office of Economic Planning and Development.
8. Soil Survey of Yavapai County, Arizona—see reference 9 of this present paper. This volume contains extensive coverage of soil types, vegetation, wildlife associations, and climatological data as well as complete aerial photographs of the area.
9. U. S. Geological Survey Map. The Paulden vicinity map covers the immediate area of GCES. Both the Paulden vicinity map and the USGS index maps for the state are available from the U.S.G.S., Denver Distribution Section, Federal Center, Building 41, Denver, Colorado 80225.
10. Visitor's guide to Yavapai County. 1977. Outdoor Arizona. 49:13-52. December.

Appendix D — Plant life.

Plant life at the GCES and land nearby such as the Indian ruins and neighboring lots:

bladderpod. *Lesquerella intermedia.*
brome grass. *Bromus sp.*
daisy fleabane. *Erigeron divergens.*
gilia, golden. *Linanthus aureus.*
grass growing in small tubular mats.

globemallow, gooseberry. *Sphaeralcea grossulariaefolia.*
globemallow, small leaved. *S. parvifolia.*
lily, mariposa. *Calochortus nuttallii.*
lupine, *Lupinus sp.*
prickly pear. *Opuntia sp.*
snakeweed. *Gutierrezia microcephala.*
tidy tips, white. *Layia glandulosa.*
vervain. *Verbena bipinnatifida.*

Plants noted at and near Sullivan Lake:
cottonwood. *Populus fremontii.*
paintbrush. *Castilleja sp.*
phlox. *Phlox longifolia.*

Plants noted west of Highway 89, near Gunsight.
bladderpod. *Lesquerella intermedia.*
deer-vetch. *Lotus mearnsii* (with some features of *L. wrightii*)
locoweed. *Astragalus sp.*
phlox. *Phlox longifolia.*
tidy tips, white. *Layia glandulosa.*

Plants noted near Hell Canyon and in the Prescott National Forest 10 miles north of G.C.E.S.
currant. *Ribes sp.*
desert rose. *Cowania mexicana.*
evening primrose. *Oenothera caespitosa.*
four o'clock. *Mirabilis.*
holly grape. *Berberis fremontii.*
juniper. *Juniperus monosperma.*
mullein. *Verbascum thapsus.*
manzanita. *Arctostaphylos sp.*
oak, scrub. *Quercus turbinella.*
pinyon pine. *Pinus edulis.*
prickly pear cactus. *Opuntia sp.*
yucca. *Yucca sp.*

Plants noted in the lower section of Prescott National Forest, near Ironwood Springs Rd. and Skyline.
box elder. *Acer negundo.*
juniper. *Juniperus monosperma.*
locoweed. *Astragalus sp.*
mountain mahogany. *Cercocarups (montanus?).*
oak, Arizona white. *Quercus arizonica.*
oak, emory. *Q. emoryi.*
oak, scrub. *Q. turbinella.*
pine, western yellow or ponderosa. *Pinus ponderosa.*

Plants noted in the desert along Alamo Rd.
creosote bush. *Larrea tridentata.*
sahuaro cactus. *Carnegia gigantea.*
wild rhubarb. *Rumex hymenosepalus.*

Appendix E — Bird life.

Prepared by John R. Meyer.

Birds noted directly at the GCES and nearby land such as the Indian ruins and neighboring lots.
crow. *Corvus brachyrhynchos.*
eastern meadowlark. *Sturnella magna.*
horned lark. *Eremophila alpestris.*
song sparrow (?). *Melospiza melodia.*

Birds noted at and near Sullivan Lake:
Bullock's oriole. *Icterus bullockii.*
cliff swallows. *Petrochelidon pyrrhonota.*
eastern meadowlark. *Sturnella magna.*
great blue heron. *Ardea herodias.*
kildeer. *Charadrius vociferus.*

Birds noted west of Hwy. 89 near Gunsight.
flycatcher. *Empidonax sp.*
horned lark. *Eremophila alpestris.*
king bird. *Tyrannus sp.*
red tailed hawk. *Buteo jamaicensis.*

Birds noted near Hell Canyon and in the Prescott National Forest about 10 miles north of GCES.
flycatcher. *Empidonax sp.*
road runner. *Geococcyx californianus.*
red tailed hawk. *Buteo jamaicensis.*

Birds noted in the lower section of Prescott National Forest near Ironwood Springs Rd. and Skyline:
chipping sparrow. *Spizella passerina.*
western bluebird. *Sialia mexicana.*

Birds noted in the desert along Alamo Rd.
Lark bunting. *Calamospiza melanocorys.*
turkey vultures. *Coragyps atratus.*

Appendix F

Mammals sighted on GCES land or in similar nearby habitats:
blacktail jackrabbit. *Lepus californicus.*
desert cottontail. *Sylvilagus auduboni.*
pronghorn antelope. *Antilocarpa americana.*
rock squirrel. *Citellus variegatus.*

Appendix G

Temperature data gathered on the mornings of May 12 and 13, 1983, at Sullivan Lake, Paulden, Arizona.

Time and date	lake water °C	soil temp. at 1" °C	air temp. °C	water bottle °C
5:30 a.m. 5-12-83	12	6	—3	0 (with ice crystals)
6:24 a.m. 5-13-83	9.5	3	—0.5	— (no ice crystals)

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   _____. 1975. The Grand Canyon: a winter ecology laboratory. *Bible Science Newsletter* 13(2):1 ff.
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   John Meyer is presently preparing a report on tassel eared squirrels of the Grand Canyon region. Ultimately he hopes to explore Shiva Temple and other areas for use of isolated pine forests in population and speciation studies on these squirrels.
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3. Moore, J. N. 1972. On chromosomes, mutations, and phylogeny. *Creation Research Society Quarterly* 9(3):159-171.
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7. Burdick, C. L. 1983. Personal correspondence.
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When The Origin of Species appeared in 1859 both naturalism and naturalism's surrogate for transcendent hope, the idea of Progress, were in ascendance. . . . Lebiniz had announced a "perfecting principle" operating throughout the universe and in its forms of life. In the 18th century Progressists like Diderot and Rousseau had plumped specifically for biological evolution.

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