25. Sommerfeld, A. 1952. Electrodynamics, Academic Press, p. 276.
26. Poor. 1922. *Op. cit.*
27. Barnes. 1983. *Op. cit.*, (Reference 20, chaps. 10 and 11).
28. Barnes, Pemper and Armstrong. *Op. cit.*
29. Barnes. 1983. (Reference 20) p. 127.
30. *Ibid.*, p. 158.
31. *Ibid.*, pp. 64-66, 116-117.
32. Barnes, T. G. Unpublished manuscript.
33. *Ibid.*

A REPORT OF ACTIVITY ON THE GRASSLANDS EXPERIMENT STATION FOR 1983

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Abstract

The research potential at the Creation Research Society Grasslands Experiment Station is discussed. A list of plants and animals available for study is given. Plant succession studies have been initiated.

Introduction

In years past much of the Great Plains region of central North America was covered with shortgrass and tallgrass prairies. The vast majority of this open prairie grassland has, with the advent of permanent settlement, disappeared or changed markedly due to the cultivation of crops, range grazing of livestock and the industrialization of the area. Very little land in the U.S. that was once prairie grassland now retains its original character in terms of species composition and relative abundance.

The Creation Research Society is fortunate to have access to a small plot of such original prairie grassland in southwestern Oklahoma (see cover illustration). The land is approximately seven miles southeast of the town of Weatherford, located on the extreme northwest corner of Section 11, R14W, T11N, of the soil survey map for Washita County, Oklahoma.[1] The 3.5 acre plot has never been under plowed cultivation although it has been subject to winter livestock grazing for at least 70 years.

Physical Description of the Plot and Climatological Data

The soil type is described as Quinlan-Woodward complex (5-12 percent slope).

> This complex consists mainly of small areas of shallow and moderately deep, well drained, sloping and strongly sloping soils on ridge crests and hillsides on uplands . . . The Quinlan and Woodward soils are so intermingled that they could not be separated in mapping at the scale used.
>
> Quinlan loam makes up 45 to 60 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 19 inches, is red calcareous loam. Light red calcareous sandy siltstone is below a depth of 19 inches.
>
> Natural fertility and the organic matter content are low. Permeability is moderately rapid, and runoff is rapid. The available water capacity is low, and the root zone is shallow.
>
> Woodward loam makes up 20 to 35 percent of each mapped area. Typically the surface layer is reddish brown calcareous loam about 8 inches thick. The subsoil, which extends to a depth of 32 inches, is yellowish red calcareous loam. It is underlaid by red calcareous sandy siltstone.
>
> Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is medium to rapid, depending on the slope. The root zone is moderately deep.[2]

The climate for this region of southwest Oklahoma is generally characterized by precipitation averaging 28 inches of annual rainfall and eight inches of snow/sleet annually, mild winters and long, hot summers. The average length of the growing season is 210 days with the average date of the first freeze being November 2 and the last freeze April 5.[3]

Wind tends to be from the south, with northerly winds prevalent in winter months. Strongest winds are usually in March, while August is generally the calmest month.

Traditionally, the "driest" month is January, and May is the "wettest." A secondary maximum of precipitation usually occurs in September. Most of Oklahoma experiences thunderstorms on the average of 50 days each year. Tornadoes are also not infrequent in this area of Oklahoma.[4]

More detailed data are available in the table of Climatological Means and Extremes for Weatherford, Oklahoma, included in Appendix A.

Botanical Description of the Plot

Preliminary research into the types of species present on the plot, their relative abundance, and their distribution over the plot are summarized in the species list in Appendix B, and the species distribution map.

The Gramineae family (grasses) accounted for the largest estimated portion of total groundcover (Figure 1), as was to be expected. Other families well represented in their area of coverage at the plot include the Leguminosae, Compositae, and Solanaceae. See Figures 2 and 3.

The impression gained from the preliminary studies of the plot is one of two distinct floral communities, for working purposes labelled as "upslope" (below the dashed line on the species distribution map), and "downslope" (above the dashed line). These areas can be noted on the cover illustration.

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Representative plant associations for each community are listed below:

Upslope: *Andropogon hallii, A. scoparius, Chrysothamnus sp., Hedyotis nigricans, Bromus japonicus.*

Downslope: *Acacia angustissima, Apocynum cannabinum, Aristida sp., Bromus japonicus, Chrysothamnus sp., Grindelia sp., Melilotus alba, M. officinalis, Solanum carolicense, Andropogon scoparius.*

Figure 1. Sand Bluestem grass, *Andropogon hallii,* on the upslope portion of the plot.

Zoological Description of the Plot

This region of western Oklahoma is situated between native shortgrass prairie to the west and tallgrass prairie to the east. There are also many relic intrusions of mixed oak/juniper communities. Unfortunately, many of these have recently been cleared to increase tillable acreage. The ecotonal location of the Grasslands Experiment Station provides excellent species diversity of both plants and animals. Both "eastern" and "western" species of amphibians, reptiles, birds and mammals are found in the immediate vicinity of the plot.

Appendix C contains partial species lists of the more abundant animals found in the area. Only permanent residents or those known to reproduce are listed. Of course, many migrating birds visit the vicinity twice a year and some species winter in the area. Those are excluded from this list.

Research Accomplished or Initiated to Date

1. A series of plant collections was made at the plot, beginning the first week in July and continuing about once a week through the first week in September. The collected specimens were pressed and identified. The pressed specimens were then mounted on herbarium sheets and labeled as a start towards a permanent herbarium collection for the prairie plot. The identities of the herbarium specimens were confirmed by comparison with other regional collections.

2. The collections and visits to the plot also led to the development of a partial species list for the plot, along with a roughly mapped estimation of topographic and species distribution data.

Figure 2. Yucca and grass on upslope portion of the plot.

3. Two 1m x 1m square plots were spaded up at the plot on August 26 and 27, at the locations marked on the map. The upslope area was dug down and spaded over to a depth of approximately 8 - 10 inches over the entire sample area. At this depth the very hard calcareous underlayer was reached limiting root penetration. The downslope area was spaded over to a depth of 10 - 12 inches (see Figure 4). Both areas were permanently marked by paint-tipped iron rods driven in at the corners. Ultimately, this will allow further study to be done on the course of plant succession on these plots.

4. Two soil samples, also taken from upslope and downslope areas, were extracted and sent for analysis to the local soil conservation office. The results indicated no major differences in soil pH (7.7 upslope, 7.9 downslope) or nitrogen levels between the two, but large differences in the amounts of potassium and phosphorus available. The upslope area contained 298 lbs/acre of potassium compared to 421 lbs/acre for the downslope. The downslope area, however, contained 17 lbs/acre of phosphorus compared to 37 lbs/acre on the upslope sample.

Figure 3. Clover on the downslope portion of the plot.

Figure 4. Spaded area on the downslope portion of the plot.

Future Directions of Research

The research done in 1983 was primarily designed to initiate further long-term studies of various aspects of this prairie plot and the grassland floral and fauna species which inhabit it. With this in mind, several areas of continuing interest and research are indicated:

1. The herbarium collection now started, should be expanded to cover the entire range of species present at the plot and include the entire growing season. Expansion to include species from surrounding areas would also be quite useful.

2. Some type of transect study or quadrat sampling analysis should be undertaken to establish accurate species representation and distribution information. Eventually a plot composition study could be published using this data.

3. A year-to-year follow-up on the successional changes on the small disturbed areas is necessary. Possibly a larger study of this type might be initiated.

4. Some attempt could be made to isolate and identify the factors responsible for the division between "upslope" and "downslope" communities at the plot. Tentatively, these observed differences are attributed to the soil type differences and depth of horizon involved in the Quinlan-Woodward soil distinction discussed earlier.

5. In the past most small mammal studies have been conducted in relatively undisturbed areas such as wildlife refuges or open rangelands. Notable exceptions dealt only with investigations of crop damage and methods to control mammal nests. Fleharty, in a recent paper in the *Journal of Mammalogy*[5], argues that since agriculture is here to stay, investigations must be made on mammals inhabiting man-made ecosystems. The Grasslands Experiment Station is ideally situated in prime wheatland and future studies could be done to determine the effects of wheat farming on small mammal population dynamics.

Apart from the contributions to general scientific knowledge in the areas of botany, zoology and ecology, the work done at the plot could also serve as a basis for future understanding of the events leading up to and the factors involved in the perpetuation of prairie grasslands in a post-Noahic flood scenario. Future ecological studies using the rich diversity of plants and animals at the Grasslands Experiment Station may perhaps cast additional light on the entire origins question.

"But now ask the beasts, and let them teach you; and the birds of heaven and let them tell you, or speak to the earth, and let it teach you, and let the fish of the sea declare to you." (Job 12:7-9).

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References

1. Soil survey of Washita County, Oklahoma. 1975. U.S. Dept. of Agriculture. Soil Conservation Services.
2. *Ibid.*, p. 22.
3. England, Gary. 1975. Oklahoma weather. England and May: Oklahoma City. pp. 52-54.
4. *Ibid.*, p. 9.
5. Fleharty, E. D. and K. W. Navo. 1983. Irrigated cornfields as habitats for small mammals in the Sandsage Prairie Region of western Kansas. *Journal of Mammalogy* 64(3):367-379.

Taxonomic Keys and Reference Manuals Used in Identification of Plant and Animal Species

Burt, William H. 1964. A field guide to the mammals. Houghton Mifflin Co.: Boston.
Conant, Roger. 1958. A field guide to reptiles and amphibians. Houghton Mifflin Co.: Boston.
Hitchcock, A. S. 1971. Manual of the grasses of the United States (Vol. I & II). Dover Publications: New York City.
Peterson, Roger T. 1963. A field guide to the birds of Texas. Houghton Mifflin Co.: Boston.
Waterfall, U. T. 1979. Keys to the flora of Oklahoma. Oklahoma State Univ. Press: Stillwater.

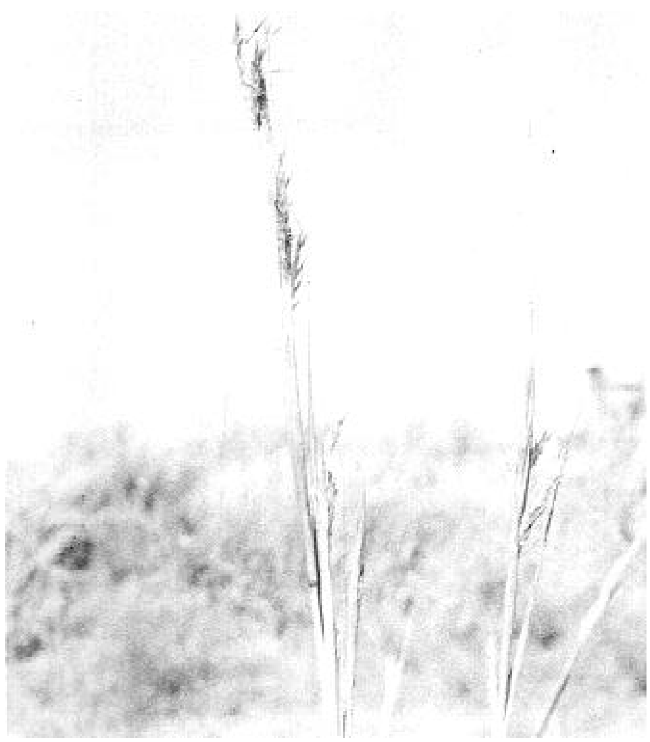

Figure 5. Sand Bluestem grass.

APPENDICES

APPENDIX A

Climatological Means and Extremes for Weatherford, Oklahoma*

MONTH	TEMPERATURE MEANS Daily Maximum	Daily Minimum	Monthly	TEMPERATURE EXTREMES Record High	Record Low	PRECIPITATION TOTALS Mean	Maximum Monthly	Mean Snow, Sleet	MEAN NUMBER OF DAYS Precip. .10 In. or More	Precip. .50 In. or More	90° and Above	32° and Below
Jan.	49.3	25.7	37.5	92	−12	1.00	4.31	2.0	2	0	0	22
Feb.	54.4	29.3	41.7	90	−14	1.03	3.76	1.8	2	1	0	15
Mar.	63.9	36.8	50.4	103	− 2	1.53	5.49	1.9	4	1	0	12
Apr.	72.9	46.9	59.9	98	20	2.75	8.52	0.2	5	2	1	2
May	80.6	55.9	68.3	104	30	4.54	13.04	0	8	4	5	0
June	90.2	65.4	77.8	111	43	4.28	13.78	0	5	2	18	0
July	95.4	69.2	82.3	112	52	2.52	7.86	0	5	2	25	0
Aug.	95.6	68.6	82.1	115	45	2.52	8.82	0	4	1	28	0
Sept.	87.5	61.0	74.3	109	32	2.57	8.22	0	3	1	16	0
Oct.	75.4	49.5	62.6	100	14	2.59	11.45	Trace	4	2	3	1
Nov.	61.9	36.5	49.2	92	9	1.13	7.44	0.3	2	0	0	11
Dec.	51.2	28.0	39.7	89	− 7	1.24	4.56	1.8	3	1	0	20
Year	73.2	47.7	60.5	115	−14	27.70	43.69	8.0	47	17	96	83

*Prepared from Oklahoma Weather, England, G.; Page 106.

APPENDIX B

Partial Species List

Group A: Widely distributed in large amounts and/or present in sizeable pure stands.

Acacia angustissima (Prairie Acacia, Sensitive Plant)
Andropogon hallii (Sand Bluestem) See Figure 5.
Andropogon scoparius var. neomexicanus (Little Bluestem)
Bromus japonicus (Cheatgrass, Japanese Chess)
Chrysothamnus sp.
Grindelia sp.
Hedyotis nigricans (Star Violet)
Melilotus alba (White Sweet Clover)
M. officinalis (Yellow Sweet Clover)
Solanum carolinense (Wild Tomato)
Sorghum halapensis (Johnson Grass)

Group B: Isolated individual plants or clumps, distributed over wide areas of plot.

Apocynum cannabinum (Indian Hemp)
Bouteloua curtipendula (Side-Oats Grama)
Elymus canadensis (Canada Wild Rye)
Eriogonum longifolium
Opuntia sp.
Stenosiphon virgatus
Tradescantia occidentalis (Western Spider-wort)
Yucca glauca (Yucca, Small Soapweed)

Group C: Isolated individual plants, relatively few on the plot, not widely distributed.

Cynodon dactylon (Bermuda Grass)
Dalea aurea (Golden Dalea)
Gaura biennis
Mentzelia stricta (Showy Blazing Star)
Oenothera serrulata
Physalis heterophylla (Clammy Ground Cherry)
Prunus angustifolia (Sand Plum, Chickasaw Plum)
Robinia pseudo-acacia (Black Locust)
Solanum rostratum
Stachys sp.

APPENDIX C

Partial Species List

Not all the species listed would necessarily be found at the plot at any given time. Most, however, would include it as part of their normal yearlong range of activities.

AMPHIBIANS:

Salamander
Ambystoma tigrinum (Tiger Salamander)

Frogs
Rana pipiens (Leopard Frog)
Rana catesbeiana (Bull Frog)
Acris crepitans (Cricket Frog)

Toads
Bufo cognatus (Great Plains Toad)
Bufo woodhousei (Rocky Mountain Toad)
Scaphiopus bombifrons (Plains Spadefoot Toad)
Scaphiopus couchi (Couch's Spadefoot Toad)

REPTILES

Turtles
Chelydra S. serpentina (Snapping Turtle)
Kinosternon flavescens (Yellow Mud Turtle)
Pseudernsys scripta elegans (Red-eared Turtle)
Terrapene o. ornata (Eastern Ornate Box Turtle)

Lizards
Phrynosoma cornutum (Texas Horned Lizard)
Eumeces obsoletus (Great Plains Skink)
Crotaphytus collaris (Collared Lizard)
Sceloporus undulatus (Fence Lizard)
Chemidophorus sexlineatus (Six-lined Racerunner)

Snakes
Leptotyphlops dulcis (Blind Snake)
Natrix rhombifera (Diamond-backed Water Snake)
Thamnophis sirtalis (Garter Snake)
Heterodon platyrhinos (Eastern Hognose Snake)
Coluber constrictor (Blue Racer)
Masticophis flagellum (Coach Whip)
Elaphe guttata (Corn Snake)
Elaphe obsoleta (Rat Snake)
Pituophis melanoleucus (Bull Snake)
Lampropeltis getulus (King Snake)
Holbrooki sayi (Speckled King Snake)
Lampropeltis calligaster (Prairie King Snake)

BIRDS

Corvus brachyrhynchos (Common Crow)
Troglodytes aedon (House Wren)
Mimus polyglottos (Mockingbird)
Toxostoma rufum (Brown Thrasher)
Turdus migratorius (Robin)
Lanius ludovicianas (Loggerhead Shrike)
Sturnus vulgaris (Starling)
Passer domesticus (House Sparrow)
Sturnella neglecta (Western Meadowlark)

Icterus glabula	(Baltimore Oriole)
Quiscalus quiscala	(Common Grackle)
Molothrus ater	(Common Cowbird)
Richmondena cardinalis	(Cardinal)
Melospiza melodia	(Song Sparrow)
Buteo jamaicensis	(Red-tailed Hawk)
Circus cyanens	(Marsh Hawk)
Cathartes aura	(Turkey Vulture)
Colinus virginianus	(Bob-white Quail)
Zenaidura macroura	(Mourning Dove)
Tyto alba	(Barn Owl)
Bubo virginianus	(Great Horned Owl)
Chordeiles minor	(Common Nighthawk)
Archilochus colubris	(Ruby-throated Hummingbird)
Charadrius vociferus	(Killdeer)
MAMMALS	
Didelphis marsupialis	(Opossum)
Cryptotis prava	(Least Shrew)
Scalopus aquaticus	(Eastern Mole)
Procyon lotor	(Raccoon)
Taxideo taxus	(Badger)
Mephitis mephitis	(Striped Skunk)
Canis latrans	(Coyote)
Citellus tridecemlineatus	(Thirteen-lined Ground Squirrel)
Geomys bursarius	(Plains Pocket Gopher)
Dipodomys ordi	(Ord Kangaroo Rat)
Peromyscus maniculatus	(Deer Mouse)
Peromyscus leucopus	(White-footed Field Mouse)
Neotoma floridana	(Eastern Wood Rat)
Rattus norregicus	(Norway Rat)
Sigmodon hispidus	(Hispid Cotton Rat)
Dasyp usnovemcinctus	(Armadillo)
Lepus californicus	(Blacktail Jackrabbit)
Sylvilagus floridanus	(Eastern Cottontail)

ICE AGES: THE MYSTERY SOLVED? PART I: THE INADEQUACY OF A UNIFORMITARIAN ICE AGE

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Abstract

The old astronomical theory of the ice ages, based on slight long-term changes in the earth's orbital geometry, is now believed to be the solution to the mystery of the ice ages. However, the changes in solar radiation are too small to cause an ice age, especially for the dominant eccentricity cycle. There are many problems with climate simulations, and research indicates it is practically impossible to initiate glaciation over Northeastern North America under uniformitarian conditions.

I) THE ASTRONOMICAL THEORY OF THE ICE AGES

A) Introduction

There are many theories of the ice age or ages, all of which have serious difficulties. However the astronomical theory of the ice ages has become popular recently. This theory states that ice ages resulted from differences in solar radiation due to cyclical variations in the geometry of the earth's orbit around the sun. These variations are: 1) changes in the eccentricity of the earth's orbit; 2) the precession of the equinoxes; and 3) changes in the tilt of the earth's axis. This theory is not new, but has existed over a hundred years. What is new, however, is its revival in the past 15 years due to statistical correlations with oxygen isotopes in deep-sea cores. Most earth scientists now believe that the long-standing mystery of the ice age has finally been solved. The purpose of this paper is to show in detail that the mystery remains unsolved within the uniformitarian framework.

B) Historical Development

1) EARLY ACCEPTANCE

The theory that long-term orbital variations have caused the ice ages is attributed to Milutin Milankovitch, a Yugoslavian meteorologist.[1, 2] However, several men before him believed that orbital variations caused the ice age. The astronomer, John Herschel, in 1830 was apparently the first to suggest that these variations might affect climate.[3] In 1842, Joseph Adhémar, a mathematician, published *Revolutions of the Sea*,[4] in which he theorized that the precession of the equinoxes was the mechanism for the ice ages in the hemisphere furthest away from the sun during winter. Parts of his theory were later proved wrong. James Croll elaborated on Adhémar's theory by including the eccentricity and obliquity cycles.[5] However, the latter concept was not well understood at that time. After detailed celestial mechanical calculations had been made by astronomers for all three orbital variations, Milankovitch derived the secular change in incoming solar radiation in the past for various latitudes. Consequently, he is credited with the theory, which is also called the Milankovitch theory or mechanism. As improvements in the orbital data of the planets became available, his calculations were updated several times. The recent calculations of Vernekar[6] and Berger[7-9] are the standard today. Berger is considered the most accurate because he used more terms in his series expansion equations, but Vernekar's results agree reasonably well with Berger's, especially for the past 400,000 years. (References to geological time or long ages in this paper are used for the sake of discussion and are not to be construed as belief in the uniformitarian, evolutionary time scale.)

Due to Milankovitch's influence in the 1920's, most European geologists accepted his theory by the 1940's. This was mainly due to apparent confirmation from the previous work of Penck and Bruckner on gravel terraces in the Alps.[10] They found four gravel terraces that they attributed to four ice ages, the timing of which seemed to fit the Milankovitch cycles. Penck and Bruckner's research was revised when others discovered more than one gravel deposit in each terrace. It is interesting that this new information conforms to the astronomical theory even better,[11] especially since no "absolute" dating was available at that time.

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