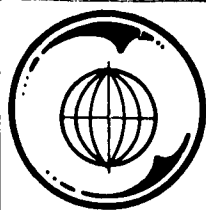


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TEXAS A&M UNIVERSITY  
REMOTE SENSING CENTER  
COLLEGE STATION TEXAS 77843

College of Agriculture  
College of Engineering  
College of Geosciences  
College of Science

TYPE I PROGRESS REPORT-NUMBER 1

Period: September 27, 1972 to November 27, 1972

TITLE: MONITORING THE VERNAL ADVANCEMENT AND RETROGRA-  
DATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION  
(MMC 667) (Contract No. NAS5-21857)

PRINCIPAL INVESTIGATOR: Dr. J. W. Rouse, Jr. (UN220)  
Remote Sensing Center  
Texas A&M University  
College Station, Texas 77843

PROJECT DESCRIPTION:

This regional study monitors the vernal advance-  
ment and retrogradation of natural vegetation (greenwave  
effect) using ERTS observations throughout the Great Plains  
Corridor. The greenwave effect is charted by using the  
relatively homogeneous rangeland vegetation systems of the  
Mixed Prairie region in the central United States as  
phenological indicators. ERTS multispectral scanner data  
and ground observations collected from the network of ten  
test sites are used to measure vegetation changes during the  
life-time of ERTS-1. Attention is given to observing  
seasonal drought and other bioclimatic influences which  
impact upon management and production in agriculture. The  
overall objective of this investigation is to determine the  
effectiveness of ERTS-type data in monitoring the vegetation  
conditions of direct concern to rangeland management and  
agri-business decisions in this region.

N73-18334

(E73-10302) MONITORING THE VERNAL  
ADVANCEMENT AND RETROGRADATION (GREEN WAVE  
EFFECT) OF NATURAL VEGETATION Progress  
Report, 27 Sep. - 27 Nov. 1972 (Texas  
&M Univ.) 18 p HC \$3.00 CSCI 08F

Unclas  
G3/13 00302

## ACCOMPLISHMENTS:

During the period covered by this report the following tasks were accomplished:

- a) Ten Great Plains Corridor ground truth data collection test sites (network test sites) were established.
- b) Not less than five sampling sites were selected at each of the rangeland test sites, and synecological characteristics were determined.
- c) A ground truth data collection format and procedures for terrestrial photography were developed for sampling vegetation conditions in conjunction with satellite overpass.
- d) Ground data collection was initiated and is continuing through the autumnal phase of the growing season at each of the test sites.
- e) Storage and cataloging procedures for ERTS imagery, aerial photography, and ground truth data were formatted.
- f) High-flight aerial photography was obtained by NASA for all except one of the ten network test sites. The aerial photography was

received, catalogued, and filed. The test sites were located on the photography and quality determinations made for each of the test site locations.

- g) Several standing order ERTS black and white images were received, filed, and manually evaluated for data quality and cloud cover. Retrospective product orders were initiated for color and digital tape products of useable ERTS data.
- h) Substantial progress was made toward developing operational techniques for locating and extracting test site data from MSS digital tapes.
- i) The development of analytical techniques for processing test site MSS data and for accumulative assimilation of the ground truth data for major categories was initiated.

#### SUMMARY OF SIGNIFICANT FINDINGS:

The asserted homogeneity of the Great Plains Corridor was established, as evidenced from test site characteristic determinations. First-look visual analysis of ERTS-1 black and white images reveals the ability to locate network test sites. Geological

formations associated with major vegetation types are readily apparent on the imagery. Grasslands are readily distinguishable from forested and cropped areas. Under magnification, pastures as small as five to ten acres can be recognized in areas of contrasting vegetation. Bodies of water (i.e. river, lakes and large farm ponds) are easily located on Bands 6 and 7. Urban areas and major highways are also easily observed and useful as landmarks.

#### DATA PRODUCT SUMMARY:

Receipt of ERTS-1 MSS data products both standing orders and retrospective product orders, has been much slower than desirable. No MSS color products were received during the reporting period, thus hampering first-look manual interpretation of vegetation conditions and changes.

An ERTS data product receipt and order "quick-look" chart is being developed. It will be included in subsequent progress reports and will show ERTS-1 products ordered and received.

#### SCHEDULED ACTIVITIES:

The following activities are planned for the next reporting period:

- a) Specific vegetation measurements obtained during the autumnal phase of the growing season will be plotted against time for all samples obtained at the network test sites.
- b) Statistical summaries of the late summer and fall ground data will be completed and an evaluation made with respect to attaining the study objectives.
- c) All ten network test sites will be located on ERTS-1 imagery and manual interpretation made of recognizable vegetation characteristics at each of the test sites.
- d) Image descriptors will be assigned for all ERTS imagery on file.
- e) Computer analysis of the MSS digital data for each of the test sites will be initiated.
- f) Comparisons will be made of spectral signatures obtained for the same site on two dates and related to ground truth data collected at the time of satellite overpass.

PUBLICATIONS:

Deering, D.W. and R.H. Haas, 1972. Great Plains Corridor Rangeland Test Sites. Tech Memo RSC-63. Remote Sensing Center, Texas A&M University. 11p. (in-house report; see Appendix)

APPENDIX

Technical Memorandum RSC-63  
Great Plains Corridor Rangeland Test Sites

By

D. W. Deering and R. H. Haas

Ten existing rangeland study sites have been selected to provide data in support of ERTS-1 Great Plains Corridor investigations. Each of the selected locations had an ongoing rangeland research program underway prior to the initiation of the current study. Photographs and vegetation data are collected periodically by cooperators at each of the locations to provide a data base for the Great Plains Corridor investigation.

The ten rangeland study sites range from southern Texas to North Dakota. Three primary sites and one secondary site are in Texas. Two of the primary sites in Texas and all primary sites in the other five Corridor states lie within the Mixed Prairie grassland association, which defines the Great Plains Corridor. An additional secondary site was established at Chickasha, Oklahoma.

Each of the study sites are herewith generally described with respect to location, climate, kind of vegetation and soils. Sampling sites within each study area are generally defined. Data collected periodically from these sampling sites will reveal the vegetational and climatic

changes over time for each study site.

#### College Station (Study Site No. 1)

The College Station, Texas study site consists of two separate areas of privately owned rangelands; one in north central and one in south central Brazos county. Ten sampling sites were selected by Vegetation Systems Laboratory personnel of Texas A&M University's Remote Sensing Center after careful scrutiny of recent aerial photographs of rangeland surrounding College Station followed by ground reconnaissance. The sampling sites were selected to represent typical rangelands and grazing management found in the College Station area.

The study site lies within the Southwestern Prairies Cotton and Forage land resource region, the Texas Claypan land resource area and the Texas Post Oak Savannah vegetation area. Mean annual temperature is 66°F, and the average precipitation is 38.9 inches annually. The study site has an average frost-free season of 260 days with March 7 being the average date for the last killing frost and November 22 the first in the fall.

Five of the sampling sites are located on fine sandy loam and clay loam Blackland Prairie soils on a somewhat arbitrarily bounded study area of about 600 acres. The remaining five sampling sites are located on formerly



forested Coastal Plain soils and represent a study area of about 500 acres. Most of the pastures have been artificially seeded to bermudagrass, native grasses, and mixtures and some are intensively managed. Five of the sampling sites are designated as primary sites and are sampled at the time of each satellite overpass. The other five are designated as secondary sites and are sampled when obvious vegetation changes occur coinciding with satellite overpass.

#### Sonora (Study Site No. 2)

The Texas A & M University Agricultural Research Station at Sonora is located approximately 20 miles SSE of Sonora, Texas. It contains 3400 acres of native rangeland in the Edwards Plateau vegetation area and lies within the Southwestern Plateaus and Plains Range and cotton land resource region and the Edwards Plateau land resource area. An average precipitation of 22.7 inches is received annually and mean annual temperature is 67°F. This study site has an average frost-free season of 205 days. The average date of the last killing frost is April 10 and the first in the fall is November 1.

Five sampling sites are located on the low stony hills range site, which is dominated by stony clay and silty clay soils. Dominant perennial species on these

sampling sites are curlymesquite grass and sideoats grama. Herbage yield for this site ranges from about 1000 lb./acre when the range is in fair condition to about 2500 lb./acre in low excellent condition. The five sampling sites are representative of the area's rangeland from the standpoint of condition and grazing treatment.

#### Throckmorton (Study Site No. 3)

The Texas Experimental Ranch near Throckmorton, Texas is operated by the Texas Agricultural Experiment Station. The ranch encompasses 7200 acres of native rangeland in the Texas Rolling Plains vegetation area and is an integral component of the Mixed Prairie grassland association. It lies within the Central Rolling Red Prairies of the Central Great Plains Winter Wheat and Range land resource region. Annual precipitation is about 24.9 inches. Mean annual temperature is 65°F, and the frost-free season lasts about 211 days. April 12 is the average date of the last killing frost, and November 9 is the average date of the first fall frost.

Eleven sampling sites have been established throughout the ranch such that all grazing treatments, consisting of four grazing systems and two levels of use (moderate and heavy), and an ungrazed enclosure are sampled. All grazing treatments, including the enclosure, are represented by a

sampling site on the same soil type of the rolling hills range site — one of the most abundant and important forage producing sites on the ranch. Texas wintergrass and side-oats grama are the dominant perennials on this range site, although buffalograss and three-awns are abundant as well. Forage production on the rolling hills range site is about 2000 lb/acre. Four additional sampling sites are located on range sites of greater and lesser productivity than the rolling hills range sites.

Five sampling sites, which were selected by Throckmorton Experimental Ranch personnel, are designated as primary sites and are sampled at the time of each satellite overpass. The remaining six sites were selected by Vegetation System Laboratory personnel, designated as secondary sites, and are sampled when there are obvious changes in the vegetation coinciding with satellite overpass.

Woodward (Study Site No. 4)

The U.S. Southern Great Plains Field Station at Woodward, Oklahoma is operated by the Agriculture Research Service, USDA. The grazing study pastures are located approximately 15 miles WNW of the main field station. The study site lies within the Central Great Plains Winter Wheat and Range land resource region in the Central Rolling Red Plains. Average annual precipitation is 23 inches and

mean annual temperature is 60°F. The study site has a 198 day average frost-free season with April 12 being the average date of the last killing frost and November 17 the first in the fall.

The Woodward sampling sites are on hummocky and dunal loamy fine sands and fine sands and occur in native rangeland pastures totaling approximately 400 acres. The dominant perennials on these sites include sand sagebrush, sand dropseed, sand lovegrass, thin paspalum, little bluestem, and sand bluestem. On good condition ranges the herbage yield varies around 1300 to 1400 lb/acre. The five sampling sites will monitor vegetation changes for a continuous, moderate yearlong grazing treatment and a "rest renewal rotation" grazing system.

#### Hays (Study Site No. 5)

The Hays, Kansas study site consists of two separate areas, each with five sampling sites. Hays Area A is the Kansas Agricultural Experiment Station's Fort Hays Branch research pastures, and Hays Area B is the Fort Hays Kansas State College farm pastures. These areas are located about three miles WSW of Hays, Kansas. The study site lies within the Central Great Plains Winter Wheat and Rangeland resource region in the Rolling Plains and Breaks. The study areas receive an average annual

precipitation of 22.9 inches and have a mean annual temperature of 55°F. The frost-free season lasts about 168 days. April 29 is the average date of the last killing frost, and October 14 is the first in the fall.

Hays Area A consists of 260 acres of native rangeland which is divided into eight contiguous pastures, each of which is approximately 30 acres in size. All eight pastures are in good or excellent condition and are being grazed continuously. Degree of use is moderate. All five sampling sites are located on clay uplands with silty clay loam soils. The dominant perennial species are bluegrama, buffalograss, and western wheatgrass. Herbage yield averages about 3000 to 4000 lb/acre.

Hays Area B consists of two pastures totaling 1200 acres which have been moderately grazed for about 35 years. The five sampling sites are located on limy uplands.

The two Hays study site sampling areas will enable a valid comparison of range site differences as expressed over time.

#### Sand Hills (Study Site No. 6)

Research is conducted at the Sand Hills study site by the Nebraska Agricultural Experiment Station. The study site is in the Nebraska Sand Hills within the Western Great Plains Range and Irrigated land resource region.

Precipitation is about 18 inches annually and mean annual temperature is 47°F. The frost-free season lasts an average of 152 days with May 4 the average date of the last killing frost and October 3 the first in the fall.

The five sampling sites are situated along U.S. Highway 83 between Valentine, Nebraska and an area 30 miles south of Valentine. They are located on fine sand and loamy fine sand soils, which produce 400 to 600 pounds of forage per acre. Two of the sites are on sub-irrigated rangelands which produce up to 2000 lb/acre. Dominant perennials vary from one site to another but include sand reedgrass, blue grama, needle-and-thread, sand bluestem, sand lovegrass, prairie cordgrass, switchgrass, and big bluestem.

#### Cottonwood (Study Site No. 7)

The Cottonwood Range and Livestock Experiment Station is operated by South Dakota State University's Agricultural Experiment Station. The study site lies within the Pierre Shale Plains and Badlands of the Western Great Plains Range and Irrigated land resource region. Average annual precipitation is 15.2 inches. Mean annual temperature for the study site is 45° and the frost-free season lasts about 136 days. The average date of the last killing frost is May 14, and the average date of the first killing frost in the fall is September 27.

The five sampling sites are located on clayey range sites with silty clay soils that are variously dominated by these perennial species: blue grama, buffalo-grass, western wheatgrass, and Texas wintergrass. Forage yield varies from about 900 lb/acre for ranges in low fair condition to over 2000 lb/acre for ranges in excellent condition. The sampling sites will enable detection of vegetation change differences over time between summer use and winter use pastures and between light, moderate, and heavy stocking rates.

Mandan (Study Site No. 8)

The Northern Great Plains Research Center at Mandan, North Dakota is operated by the Agricultural Research Service of the USDA. The 900 acre research area is in the Rolling Soft Shale Plain of the Northern Great Plains Spring Wheat land resource region. It receives about 15.9 inches of precipitation annually and has a 42°F mean annual temperature. The 138 day average frost-free period begins about May 11 and ends about September 26.

All five sampling sites are located on silt loam soils of the silty range site. These sites are dominated by the perennials western wheatgrass, blue grama, needle-and-thread, pinegrass, and scurfpea and yield about 2400 lb of forage per acre. These sampling sites are located

within a 32 acre pasture which has received good management with moderate grazing. The range condition of this pasture is low excellent.

#### Weslaco (Study Site No. 9)

The Rio Grande Soil and Water Research Center at Weslaco, Texas is operated by the Agricultural Research Service of the USDA and is designated as a secondary study site. The study site is in the Rio Grande Plain area of the Southwestern Plateaus and Plains Range and Cotton land resource region. Average annual precipitation for this South Texas Plains vegetation area is 17.5 inches, and mean annual temperature is 74°F. The frost-free season lasts about 309 days with the average date of the last killing frost being February 7 and December 22 the first in the winter.

The five sampling sites are located on fine sandy loam soils of sandy loam range sites in fair range condition. The dominant perennial grass species include hooded windmillgrass, Texas grama, gummy lovegrass, and red threeawn. All five sites lie within a 600 acre continuously heavily grazed pasture.

#### Chickasha (Study Site No. 10)

The Southern Great Plains Watershed Research Center at Chickasha, Oklahoma is operated by the Agricultural



Research Service of the USDA and is designated as a secondary study site. It is in the Central Rolling Red Prairies of the Central Great Plains Winter Wheat and Range land resource region. Average annual precipitation for the 1500 acre watershed area is 27 inches. The mean annual temperature is 62°F and the average frost-free season is 216 days. The average date of the last killing frost is March 31, and the average date of the first killing frost is November 2.

The sampling sites are located on silt loam soils. These prairie range sites were subjected to contrasting grazing pressures in the past — from severe to moderate, but they are currently considered to be in good or excellent range condition. Herbage yield on these sites varies from 700 lb/acre to 6300 lb/acre. Dominant perennial species are little bluestem, Scribner's panicum, blue grama, sideoats grama, Indiangrass, silver bluestem, hooded windmillgrass, tall dropseed, and western ragweed.