A MODEL FOR BIOMASS ASSESSMENT

E-023

SUBMITTED BY:

Dr. Stephen J. Walsh
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Dr. George P. Malanson
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Dr. John D. Vitek
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Dr. David R. Butler
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&

in conjunction with

USDA/Agricultural Research Service

SUBMITTED TO:

Dr. Norman N. Durham, Director
Water Research Center
Oklahoma State University

March 14, 1983

Introduction

The surface of the earth is a complex system responding to the input of energy, natural and human. Human use of the surface for maximum agricultural efficiency requires knowledge of the interactions of all variables involved in the system. Broad categories of phenomena, including the atmosphere (weather and climate), biosphere (vegetation, fauna, and human activity), hydrosphere (precipitation, runoff, infiltration, fluvial erosion, and evapotranspiration), and the lithosphere (soil, topography, and parent material), can be identified as the major variables in any assessment. Assessment of interactions requires data from various sources. The emergence of remote sensing as a source of data for assessments in the last decade permits the development of more accurate predictive models. Refinements in data acquisition, such as improved resolution, the use of radar, and the correlation of detailed surface observations with satellite overpasses, provide researchers with the capability to assess inter-relationships and create accurate models.

A conceptual model, Figure 1, illustrates the interaction of the Department of Geography/CARS and the USDA/Agricultural Research Service with components of the natural system for the purpose of creating a predictive model for biomass assessment. CARS, the remote sensing center at Oklahoma State University, plus ARS of the USDA bring different skills to this joint research effort. ARS is actively engaged in collecting field data from the Little Washita River watershed in south-central Oklahoma. Rain gauges, stream gauges, measures of biomass, and plant reflectivity constitute one aspect of data needed for model development. CARS will provide data from Landsat, specifically related to the thematic mapper, and radar images obtained from aircraft to assess the land cover of the study area. Characteristics of soil have been provided by the SCS. In addition, a previous research effort, Stadler & Walsh (1982-83), investigated the assessment of evapotranspiration from remotely sensed data through the use of a computerized geographic information system.

Study Area

The Agricultural Research Service (USDA) has maintained and operated a dense network of recording raingauges on a study reach of the Washita River basin in central Oklahoma (Figure 2). This network covers a 1,500 square mile area of the southern Great Plains with gauges spaced on a 3- by 3- mile square grid. In addition to this network from which measurements of rainfall input have been made continuously for more than 20 years, 50 sub-drainage areas and small watersheds have been instrumented to measure runoff, sediment yield and water quality for hydrologic and erosion research studies. Consequently, a large statistical data base exists from which hydrologic and erosional processes have been modeled for small field size watersheds.

General Approach

The general approach to be taken extends the use of satellite data, specifically Landsat 4, to biomass research. Ground truth monitoring stations will be established on a large basin watershed in an effort to relate surface measurements to data collected by Landsat 4. Time and spatial measurements at the various ground sites will be related to specific satellite scenes during

Figure 1. Conceptual Framework

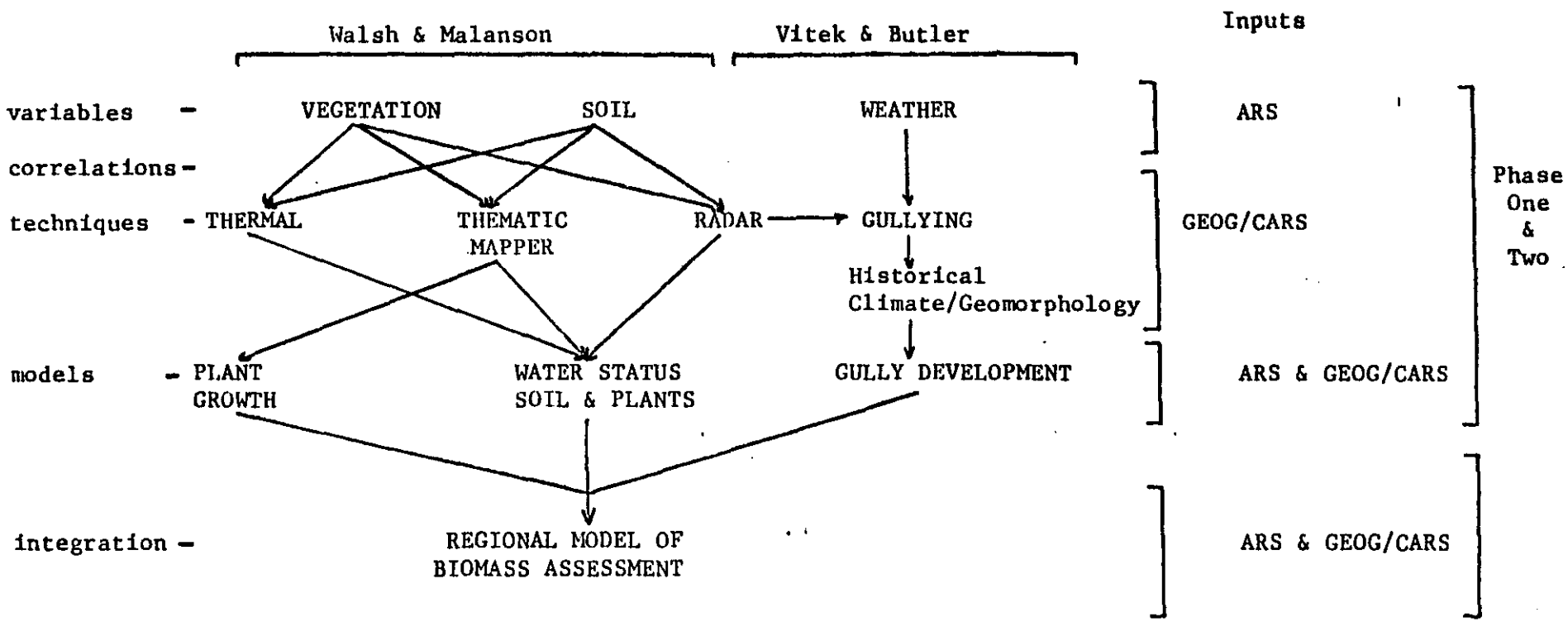
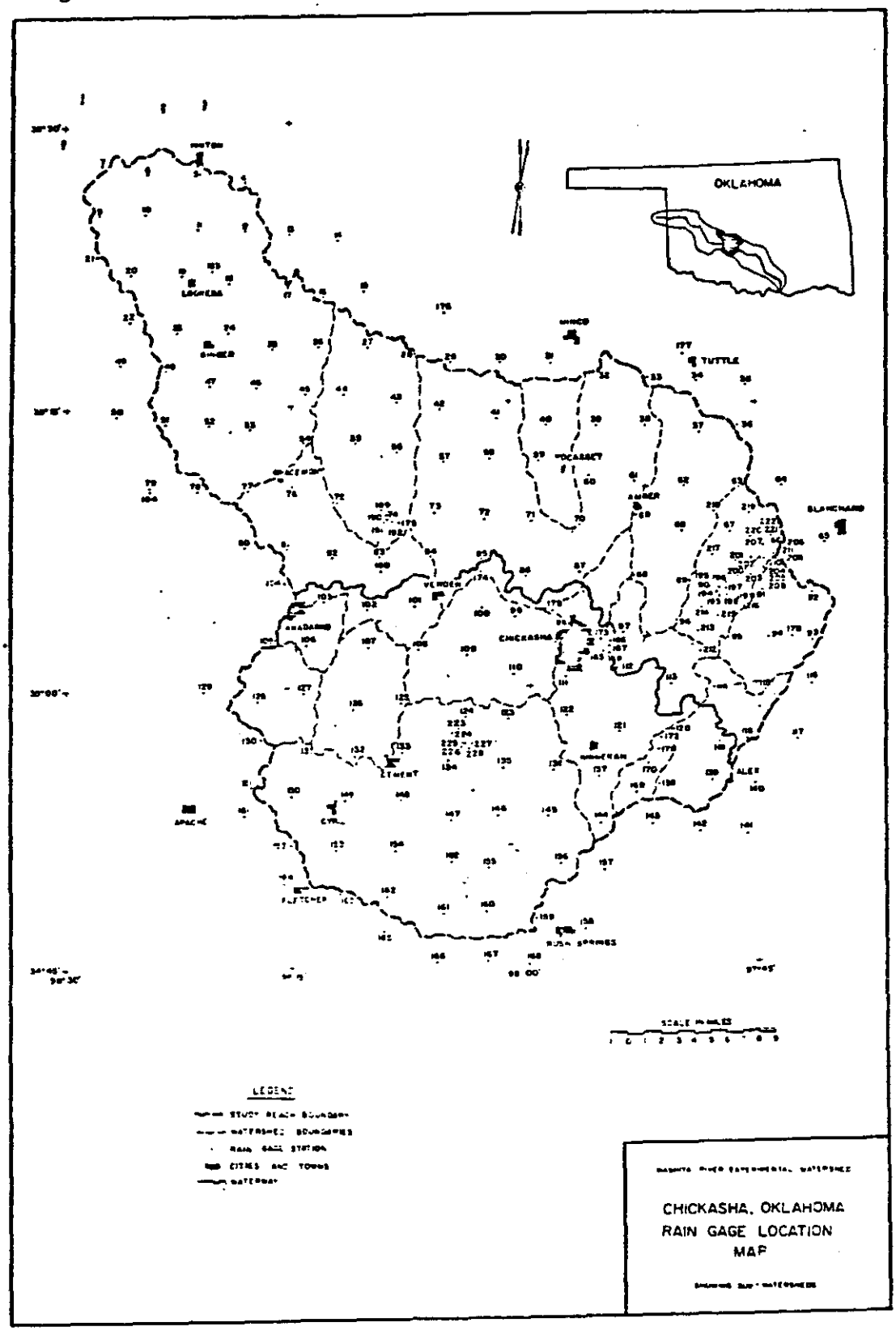


Figure 2.


OKLAHOMA
TUTTLE
BLANCHARD
CHICKASHA
LEGEND
CHICKASHA, OKLAHOMA
RAIN GAGE LOCATION
MAP

the growing season. The relationships developed will be used to determine parameter values required by the models. Four ground sites, representing two major landuses on the Little Washita River watershed, have been established in the fall of 1982 to determine soil-water-plant biomass status for range and crop landuses. Hand-held radiometer measurements for Landsat 4 bands are being made on satellite overpasses and interim dates. Biomass clippings, soil moisture, and surface, air, and soil temperature measurements are being compiled also on these dates. Climatic variation across the area is measured continuously from the raingauge network and from a climatic station maintained in the area.

Additional field data are required and a larger number of sample sites are needed to appropriately investigate the variation within the watershed for model development. The USDA/ARS are providing some field technicians, equipment, and research scientist time. This proposal calls upon OSU to slightly exceed the USDA/ARS cost-share and to principally direct OSU funds toward radar images, Landsat digital data, and to some field equipment. The remotely sensed data are the primary materials for landcover assessment. The field equipment will allow an OSU field team to increase sampling capacity. Subsequent research efforts will benefit from this equipment which does not duplicate existing devices.

The OSU Center for Applications of Remote Sensing will process all aircraft and satellite data. Through the recent launching of Landsat 4, greater spectral, spatial, and radiometric resolution are now available for greater precision in landcover evaluation.

Vegetation-Water Analysis

The amount and condition of vegetation are important parameters in models of basin hydrology (Crawford and Linsley, 1966). The combination of the Thematic mapper, thermal, and radar imagery from Landsat 4 may provide an accurate and economical source of current data on vegetation. Weigand et al. (1982) discussed the use of remote sensing to assess the effect of drought on plant canopy development. We will evaluate the new higher resolution sensors launched in 1982 for use in monitoring canopy development and for detecting actual evapotranspirative processes. These sources of data can be used in hydrological models to assess evapotranspiration, drought stress, and crop growth, and to address general questions of soil and water conservation.

We will determine which Landsat data source, or combination of sources, best predicts the variables of importance in hydrological models. Total foliar cover, leaf area index (LAI), and biomass will be measured at ground stations by line intercept, point intercept, and clipping and weighing methods (Mueller-Dombois and Ellenberg, 1974). Actual transpirative processes will be computed by measuring the diffusion resistance of leaves, leaf temperatures, and leaf water potential. These values are used in models of water movement from the soil, through the plant, and into the atmosphere (Nobel, 1974). Measurements will coincide with Landsat overflights.

The soil water status will also be measured. ARS has neutron probes and will sample soil moisture to 1.0m depths with these at selected points. These probes will be supplemented by soil samples for gravimetric measures of soil moisture. We will expand the area of soil moisture measurement to coincide with the measures of plant moisture with soil hygrometers buried at extended sample locations. We can then quickly sample soil and plant moisture at a given site without disturbance.

The eventual goal of this work on vegetation and soil is to be able to use satellite data to update models of crop growth, drought stress, and soil and water conservation for large regions. At this stage we will establish which remote sensing variables correlate with which ground truth variables. We will use path analysis and regression to construct simple predictive models. Future work will develop the simple models into regional models designed for soil and water management.

Gully Analysis

Surface erosion has a major impact on biomass in Oklahoma as well as other agricultural areas. Erosion removes soil and plant nutrients, thereby reducing biomass productivity. Changes in climate coupled with changes in landuse and landcover can be correlated with erosion. The present configuration of the surface can be mapped for comparison with conditions in the past and the future.

Assessing past climatic changes in Oklahoma is possible through examination of annual growth rings in post oak (Harper, 1961) and other tree species (Fritts, 1976). Growth patterns in tree-rings in trunks and roots may also provide data on dates of gully erosion inception and rates of gully development (LaMarche, 1966; Graf, 1977; Carrara and Carroll, 1979), as can historical documentation and past aerial photos.

Climatic (Bariss, 1971, 1977; Graf, 1980) and human agents (Graf, 1979; Bariss and Bronger, 1981) have been cited as causes of gully erosion in the Great Plains and semi-arid west. In the case of climatic agents, tree-ring (dendrochronologic) analysis allows construction of a chronology of climatic change as well as a chronology of gully erosion, particularly in areas where historical data are geographically and temporally limited. In the case of the human agent, chronologies of gully development and rates of erosion are also available in the dendrochronologic record.

Through analysis of (1) the twenty years of instrumented meteorologic data available in the study area; (2) rates of gully erosion; (3) historical documentation; and (4) comparisons with the tree-ring record for this period, a model of climatic factors likely to enhance gully development can be developed. Dendrochronologic data then allow assessment of the likelihood of gully erosion in the past, and with the historic data, provide a predictive base for assessing the return interval of climatic conditions conducive to gully erosion.

Correlation of erosion with climate, landuse and landcover is an essential component of a major model of biomass change. Field measurements on gullies, however, require many man-hours. Can field measurements be replaced by assessment of the surface with aircraft radar? This remote sensing technique has shown promise in assessing changes in topography. If topography, namely points of accelerated erosion, can be monitored, a model of surface change can be integrated with a model of biomass change to create a predictive model for vegetation/water assessment.

Headwater migration of stream erosion occurs in response to the input of energy (precipitation), change in landcover (accelerate overland flow), change in base level (disruption equilibrium), or human activity of various sorts. Once initiated, gully erosionmay proceed at a rapid rate. Based upon air photos in the 1930's, rates of change over 50 years can be calculated. Periodic coverage during the past 50 years allows rates of change to be assessed for short and long term periods. Accurate measurements of the present conditions are necessary to analyze previous conditions. Field measurements can be correlated with aerial photographs. Once the present conditions are known, the ability of radar to assess these conditions can be evaluated.

Radar has been used to efficiently derive morphometric characteristics of a gully network. Significant information regarding size, shape, configuration, and other attributes of the surface can be derived. Sequential radar images over a period of time can allow assessment of rates and forms of gully development, providing input which with paleogeomorphic, soils, vegetation, and meteorologic data allows the construction of a model of gully development.

BUDGET: July 1, 1983 - June 30, 1984

ITEM	Oklahoma State Univ.	USDA - ARS
SALARY & WAGES		
Dr. Stephen J. Walsh Associate Professor	0.00	0.00
Dr. John D. Vitek Associate Professor	0.00	0.00
Dr. David R. Butler Assistant Professor (2.0 months @ 50%)	1,890.00	0.00
Dr. George P. Malanson Assistant Professor (2.0 months @ 50%)	1,890.00	0.00
To Be Determined Graduate Research Assistant (2.0 months @ 75%) (10.0 months @ 50%)	1,500.00 5,000.00	0.00 0.00
To Be Determined Graduate Research Assistant (2.0 months @ 75%) (4.0 months @ 25%)	1,500.00 1,000.00	0.00 0.00
To Be Determined USDA Technician (150 man days)	0.00	15,000.00
Dr. Arlin Nicks USDA Research Scientist (80 man days)	0.00	5,000.00
Dr. Frank Schibe USDA Research Scientist (80 man days)	0.00	5,000.00
TOTAL - OSU -	$12,780.00	0.00
TOTAL -USDA/ARS -	0.00	$25,000.00

BUDGET: continued

ITEM	Oklahoma State Univ.	USDA - ARS
Materials & Supplies		
Landsat Digital Tapes	6,000.00	0.00
Radar Images	2,500.00	0.00
Computer Tapes	150.00	0.00
Aerial Photographs	250.00	0.00
Duplication	200.00	0.00
Miscellaneous	250.00	0.00
TOTAL - OSU -	$9,350.00	
TOTAL - USDA/ARS -		0.00
Equipment		
Hand-held Spectrometer	5,000.00	5,000.00
Increment borers (3)	330.00	0.00
Increment holsters (3)	30.00	0.00
Sharpening tool	210.00	0.00
Tree Ring Software	300.00	0.00
Dewpoint microvoltmeter	1,565.00	0.00
Leaf hygrometer	207.00	0.00
Soil hygrometers	707.00	0.00
Power supply	153.00	0.00
Manual & tapes	97.00	0.00
TOTAL - OSU	$8,599.00	
TOTAL - USDA/ARS		$5,000.00
Travel		
8,200 miles @ .22/mile	1,800.00	0.00
12 nights lodging @ $24/day	288.00	0.00
48 days per diem @$18/day	864.00	0.00
TOTAL - OSU	$2,952.00	
TOTAL - USDA/ARS		0.00
Other		
Cartography	500.00	0.00
Data Processing	3,500.00	0.00
TOTAL - OSU	$4,000.00	
TOTAL - USDA/ARS		0.00

BUDGET SUMMARY:

PROJECT TOTAL

OSU CONTRIBUTION - $37,681.00

USDA/ARS CONTRIBUTION - $30,000.00

References Cited

Bariss, Nicholas, 1971. Gully formation in the loesses of central Nebraska. Rocky Mountain Social Science Journal 8(2), 47-59.

Bariss, Nicholas, 1977. Gullying in a semi-arid loess region of North America. Great Plains-Rocky Mountain Geographical Journal 6(2), 125-132.

Bariss, Nicholas, and Arnt Bronger, 1981. Natürliche und anthropogene Owragibildung in verschiedenen Klimazonen: Ein Beitrag zur Morphodynamik in Lössgebieten. Zeitschrift für Geomorphologie N.F. 25(2), 180-202.

Carrara, Paul E., and Thomas R. Carroll, 1979. The determination of erosion rates from exposed tree roots in the Piceance Basin, Colorado. Earth Surface Processes 4, 307-317.

Fritts, H.C., 1976. Tree Rings and Climate. Academic Press, London, 567pp.

Graf, William L., 1977. The rate law in fluvial geomorphology. American Journal of Science 277(2), 178-191.

Graf, William L., 1979. The development of montane arroyos and gullies. Earth Surface Processes 4, 1-14.

Graf, William L., 1980. Fluvial processes in the lower Fremont River basin. In Utah Geological Association 1980 Henry Mountains Symposium (M.D. Picard, ed.), Salt Lake City, 177-183.

Harper, Horace J., 1961. Drought years in central Oklahoma from 1710 to 1959 calculated from annual rings of post oak trees. Proceedings of the Oklahoma Academy of Science 41, 23-29.

LaMarche, Valmore C., 1966. An 800-year history of stream erosion as indicated by botanical evidence. U.S. Geological Survey Professional Paper 550-D, D83-D86.

Crawford, N.H. and R. K. Linsley. 1966. Digital simulation in hydrology: Standford Watershed Model IV. Standford University Department of Civil Engineering Technical Report 39.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. New York: Wiley.

Nobel, P. S. 1974. Biophysical plant physiology. San Francisco: Freeman.

Weigand, C. L., P. R. Nixon, and R. D. Jackson. 1982. Drought detection and quantification by reflectance and thermal response. Proceedings: International Symposium on Plant Production and Management Under Drought Conditions, October, 1982, Tulsa, Oklahoma.

VITAE

STEPHEN J. WALSH
February, 1983

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EDUCATION

Degree	School	Major	Minor	Year
Ph.D.	Oregon State University Corvallis, Oregon 97331	Resource Geography	Resource Management	August, 1977
M.S.	Oregon State University Corvallis, Oregon 97331	Resource Geography	Physical Geography	January, 1975
B.S.	Fitchburg State College Fitchburg, Mass. 01420	Physical Geography	Earth Sciences	June, 1973

EXPERIENCE

Organization	Date	Title
Department of Geography Oklahoma State University Stillwater, Oklahoma	July 1, 1981 to Present	Associate Professor
Center for Applications of Remote Sensing Oklahoma State University Stillwater, Oklahoma	September 1979 to Present	Organizer and Director
Department of Geography Oklahoma State University Stillwater, Oklahoma	June 1978 to June 30, 1981	Assistant Professor
Department of Geography Oklahoma State University Stillwater, Oklahoma	September 1977 to June 1978	Visiting Assistant Professor
Environmental Remote Sensing Applications Laboratory (ERSAL) Oregon State University Corvallis, Oregon	June 1975 to June 1977	Research Assistant
Department of Geography Oregon State University Corvallis, Oregon	September 1973 to June 1975	Teaching Assistant
Chemeketa Community College Salem, Oregon	March 1975 to June 1975	Geography Instructor

PROFESSIONAL INTERESTS

Organizations

Oklahoma Academy of Science; Association of American Geographers; American Society of Photogrammetry and Remote Sensing; Society of the North American Cultural Survey; Sigma Xi.

Participated in

Presentation, "Analysis of Stone and Sand and Gravel Statistics for Selected Counties in Oregon," Oregon Academy of Science, March, 1975.

Project Head—Inventory and identification of natural area preserves within the State of Oregon. These natural areas exhibit relatively undistrurbed natural vegetation, unique vegetation, and/or unique geologic or hydrologic characteristics. The inventorying was achieved by use of high altitude color infrared aerial photo interpretation, and LANDSAT satellite data; Environmental Remote Sensing Applications Laboratory, (ERSAL), Oregon State University, Corvallis, Oregon, June, 1975 to June, 1977.

Workshop, "Digital Processing of LANDSAT Data," Oregon State University Computer Center and ERSAL, September, 1975.

Remote sensing proposal review consultant for the National Park Service, Pacific Northwest Region, January, 1977.

Investigator, Oregon State Water Resources Department; involving the use of U-2 color infrared aerial photography for land use classification of various drainage basins to evaluate water uses and needs, February, 1977.

Use of the General Electric Image 100, Tektronix Digitizing System, and the IDIMS Computer System at the EROS Data Center South Dakota for surface cover type mapping, particularly conifer tree species differentiation through use of LANDSAT digital tapes and other Remote Sensing Techniques, March, 1977.

Presentation, "Uses of Remote Sensing in Resource Management"--National Park Service Regional Center Headquarters, Denver, Colorado, August 31, 1977.

Presentation, "Remote Sensing and Its Use in Resource Management," Oklahoma Academy of Science, November, 1977.

Vice-Chairman Elect of the Oklahoma Academy of Science, Geography Section, November, 1977.

Presentation, Aerial Photography Workshop to the Tulsa, Oklahoma Metropolitan Area Planning Commission; focus: land use differentiation through use of aerial photography and orthophotography, also identification of urban structures; residential, commerical, industrial, etc., November, 1977.

Participated in: (continued)

Director, Remote Sensing Symposium: "Remote Sensing Applications in Resource Management," March 15-16, 1978, Oklahoma State University. Discussion topics: forestry, land use, water rsources, and wildlife management; the Symposium featured nationally recognized speakers in the field of remote sensing. The Remote Sensing Symposium which was offered through Arts and Sciences Extension was supported in part by the National Aeronautics and Space Administration (NASA).

Presentation, "Differentiation and Mapping of Coniferous Tree Species Within Crater Lake National Park, Oregon, through use of LANDSAT Digital Tapes," National Meeting of the Association of American Geographers, New Orleans, Louisiana, April, 1978.

Chairman-Elect of the Oklahoma Academy of Science, Geography Section, November, 1978.

Workshop, "Remote Sensing," NASA-Earth Resources Laboratory, Slidell, Louisiana, April, 1978.

Organizer and Participant, Remote Sensing Workshop, NASA Earth Resources Laboratory, Slidell, Louisiana, July 17-18, 1978.

Statistical Techniques and Data Display, Seminar, CONOCO Petroleum Company, Ponca, City, Oklahoma, February, 1979.

Presentation, "Terrestrial and Aquatic Vegetation Mapping," U.S. Corps of Engineers, Tulsa, Oklahoma, July, 1978.

Presentation, "Wildlife Habitat Mapping Through Remote Sensing Techniques," U.S. Fish and Wildlife Service, Tulsa, OKlahoma, July, 1978.

Association of American Geographers, Paper Review, The Professional Geographer, October, 1978.

National Science Foundation, Proposal Review, January, 1979.

Forest Hydrology Seminar, Broken Bow, Oklahoma, Oklahoma State Department of Forestry and U.S. Forest Service, June, 1978.

Presentation, "Remote Sensing in Oklahoma," Oklahoma Academy of Science, Edmond, Oklahoma, November, 1979.

Presentation, "Wetlands Mapping Through Remote Sensing," U.S. Army Corps of Engineers, Navigation Branch, Tulsa District, U.S. Environmental Protection Agency, Southwest District, Waterways Experiment Station, Vicksburg, Mississippi, December, 1979.

Presentation, "Agricultrual Mapping and Monitoring," OSU Soil Conservation Society, April, 1979.

Participated in: (continued)

Presentation, "Map and Photographic Interpretation," National Science Foundation Funded Workshop, Oklahoma State University, June, 1979.

Presentation, "Wildlife Habitat Mapping and Monitoring," U.S. Army Corps of Engineers, Environmental Branch, Tulsa Diistrict, June, 1979.

Presentation, "Mapping of Natural Area Preserves Through Color Infrared Aerial Photopraphy," Oklahoma Department of Tourism and Recreation, September, 1979.

Workshop Arranged and Participated, "Remote Sensing-Digital Processing," NASA/Earth Resource Laboratory, NSTL Station, Mississippi, May, 1979.

Presentation, "A Vegetation Analysis of Crater Lake National Park, Oregon, Utilizing LANDSAT II Digital Tapes and High Flight U-2 Infrared Imagery," Sixth Annual Science and Resource Management Conference, Pacific Northwest Region, National Park Service, Oregon State University, Corvallis, Oregon, April, 1979.

Workshop, "Techicques of LANDSAT Digital Processing," NASA/Earth Resources Laboratory, Mississippi, January, 1980.

Presentation, "Reconnaissance and mapping of Natural Resources," Oklahoma Governor's Mini-Cabinet on Natural Resources, February, 1980.

Presentation, "Remote Sensing and Digital Processing," Institute of Electrical and Electronics Engineers, Tulsa Section, March, 1980.

Presentation, "Urban Change Detection for Population Modeling," Public Service Company of Oklahoma, Tulsa, Oklahoma, May, 1980.

Workshop, "Techniques of Computer Modeling for Planning and Policy," University of Massachusetts, June, 1980.

Presentation, "Mapping of Forest Clearcuts in Southeast Oklahoma," Weyerhaeuser Company, Wright City, Oklahoma, July, 1980.

Presentation, "Remote Sensing of Water Resources," OSU Water Research Seminar Series, October, 1980.

Panel Member, "Academic Training in Remote Sensing and Industrial and Government Needs," Joint Meeting, Southwest AAG and American Society of Photogrammetry, Denton, Texas, October, 1980.

Presentation, "Role of Center for Applications of Remote Sensing in Oklahoma," Oklahoma Academy of Science, November, 1980.

Map Production, "Center Pivot Irrigation, 1973 and 1978: Cimarron, Texas, and Beaver Counties, Oklahoma," Center for Applications of Remote Sensing, February, 1981.

Participated in: (continued)

"Operational Land Remote Sensing Program," Austin, Texas, sponsored by TNRIS and NOAA, Invited panel participant," Landsat in a University Setting, April, 1981.

Chairman, Nominations Committee, AAG Remote Sensing Speciality Group, May, 1981.

Workshop Oranizer, "Remote Sensing: Digital Processing of Landsat-Satellite Data," Oklahoma State University Faculty and Administrators, June, 1981.

"Second Landsat/Geobased Information System Symposium," Biloxi, Mississippi, sponsored by NASA/Earth Resources Laboratory, Poster Session and Invited Data Base Participant, July, 1981.

Presentation, "Mechanics of Monitoring Forest Clearcuts and their Regeneration," Seventh International Symposium on Machine Processing of Remotely Sensed Data, Purdue University, Laboratory for Applications of Remote Sensing, West Lafayette, Indiana, June, 1981.

Presentation, "Remote Sensing and Information Systems," Horizons in Water Research Institute, Oklahoma State University, Stillwater, Oklahoma, April, 1982.

Visiting Professor, Bush Residencies in Applied Geography, "Resource Management and Environmental Assessment Through Landsat Data Acquisition and Analysis," Bemidji State University, Minnesota, February 1-12, 1982.

Proposal Reviewer, Geography and Regional Science Division, National Science Foundation, April, 1982.

Presentation, "Geographic Information System Approach to Water Resource Management," OSU Water Resource Research Institute Conference, Horizons in Water, April, 1982.

Presentation, "Incorporation of Socioeconomic Data in Geogrpahic Information Systems," OK Dept. of Economic and Community Affairs, April, 1982.

Presentation, "Geologic Prospecting" Phillips Petroleum Company, April, 1982.

Presentation, "CARS: Uses by Foresters," Society of American Foresters, Oklahoma Division, September, 1982.

Presentation, "Information Systems and Geologic Investigation," Oklahoma Geological Survey, October, 1982.

Presentation, Utilization of Automated and Conventional methods in Surveying and Mapping, USGS, Rolla, Missouri--

Invited poster presentations:

W. Anthony Blanchard, Stephen J. Walsh, Margaret A. Williams. "Poster, The Oklahoma Geographic Information Retrieval System: A Method of Environmental Assessment," and Frank Mynar, Stephen J. Walsh, and Mark S. Gregory. "Poster, Computer Enhancement of Remotely Sensed Data for Lineament Detection," October, 1982.

Participated in: (continued)

Presentation, "The Oklahoma Geographic Information Retrieval System: A Strategy for Resource Management," Southwest AAG, Hot Springs, Arkansas, October, 1982.

Publications

Report: "Inventory of State-Owned Lands for Potential Natural Areas (Southern Oregon)," Environmental Remote Sensing Applicatins Laboratory, Oregon State University, Corvallis, Oregon, March, 1976, pp. 55.

Report: "Inventory of State-Owned land for Potential Natural Areas (along Central Oregon Coast)," Environmental Remote Sensing Applications Laboratory, Oregon State University, Corvallis, Oregon, March, 1976, pp. 48.

Report: "Inventory of State-Owned Lands for Potential Natural Areas (Northeast Oregon)," Environmental Remote Sensing Applications Laboratory, Oregon State University, Corvallis, Oregon, December, 1976, pp. 41.

"Analysis of Stone and Sand and Gravel Statistics for Selected Counties in Oregon," Oregon Academy of Science Proceedings, Spring, 1975. (Abstract)

Ph.D. Dissertation: "An Investigation Into the Comparative Utility of Color Infrared Aerial Photography and LANDSAT Data for Detailed Surface Cover Type Mapping Within Crater Lake National Park, Oregon," National Park Service, August, 1977.

"Differentiation and Mapping of Coniferous Tree Species Within Crater Lake National Park, Oregon, Through Use of LANDSAT Digital Tapes," Association of American Geographers National Meeting, New Orleans, Louisiana, April 9-12, 1978, Abstract.

Report: "Stream-Bank Erosion as Detected by LANDSAT Data," Oklahoma Conservation Commission, Oklahoma City, Oklahoma, pp. 19, August, 1978.

Report: "Choctaw Indian Nation Land Resource Inventory," Choctaw Indian Nation, Oklahoma with J. D. Vitek, July, 1979, pp. 21.

Report: "Mapping of Wetland-Vegetation of Pond Creek Bottoms," DeQueen, Arkansas, U.S. Army Corps of Engineers, Navigation Branch, Tulsa District, Tulsa, Oklahoma, with W. A. Blanchard, pp. 20, March, 1980.

Report: "Inventory of Clearcuts in Southeast Oklahoma Through Remote Sensing Techniques," Oklahoma Department of Wildlife Conservation, Annual Performance Report, June, 1980, pp. 15.

"Introductory Physical Geography," Oklahoma State University Independent and Correspondence Study Program, with R. J. Vaughan and M. Garrett, August, 1978, pp. 90.

"Coniferous Tree Species Mapping Using LANDSAT Data," Remote Sensing of Environment, Volume 9, February, 1980, p. 11-26.

Report: "Evacuation Planning and Land Use Mapping Within the Emergency Planning Zone Around Blackfox Nuclear Power Station, Inola, Oklahoma," Public Service Company of Oklahoma, Tulsa, Oklahoma, November, 1980, with Drs. Tweedie, Hagle, Rowland, and Rhoten.

Report: "OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems (Annual Report, September 1, 1979 to August 31, 1980)," NASA Headquarters, Washington, D. C., December, 1980, pp. 40.

Report: "Wetlands Mapping Along the Deep Fork of the North Canadian River, Oklahoma," U.S. Army Corps of Engineers, December, 1980, with W. A. Blanchard, pp. 96.

"Estimating Evacuation Times for Populations Located Near High-Risk Installations," American Association for the Advancement of Science, January, 1981, with Drs. Rhoten, Hagle, Rowland, and Tweedie. Abstract.

"Analysis of Forest Clearcuts: Change Detection Using LANDSAT," Association of American Geographers National Meeting, Los Angeles, California, April 19-22, 1981, abstract for poster session with J. D. Vitek,and M. S. Gregory.

"Emergency Planning Around Nuclear Power Plants," Association of American Geographers National Meeting, Los Angeles, California, April 19-22, 1981, abstract for poster session with Drs. Tweedie, Hagle, Rowland, Rhoten, and Mr. Rabolt.

"Mechanics of Monitoring Forest Clearcuts and Their Regeneration," Seventh International Sumposium on Machine Processing of Remotely Sensed Data Proceedings, Purdue University, West Lafayette, Indiana, wtih M. S. Gregory, J. D. Vitek, June, 1981 p. 520-528.

Report: "Inventory of Clearcuts in Southwestern Oklahoma Through the Application of Landsat Data," Oklahoma Department of Wildlife Conservation, Oklahoma City, OK, August, 1981, pp. 65.

"Inventory of Clearcuts and Monitoring Vegetation Regeneration through Landsat Digital Data," Poster Presentation. Orono, Maine, August, 1981, with M. S. Gregory and J. D. Vitek. Abstract.

"Lineaments in Southeastern Oklahoma: Detection with Landsat Data," Oklahoma Geology Notes, with J. D. Vitek, August, 1981, p. 104-114.

"Surface Coal Mine Management and Assessment Through A Remote Sensing-Based Information System, AAG, San Antonio, Texas, with L. M. Bunse and W. A. Blanchard, September, 1981. Abstract.

Report: "Emergency Response Report to the Nuclear Regulatory Commission for the Black Fox Nuclear Power Station, Inola, Oklahoma," Preliminary Safety Analysis Report Public Service Company of Oklahoma, October, 1981, with S. W. Tweedie, R. R. Rhoten, and J. R. Rowland.

Report: "OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems (Annual Report, Sept. 1, 1980 to August 31, 1981), "NASA Headquarters, Washington, D.C., December, 1981, pp. 58.

Report: "Pilot Study: Oklahoma Geographic Information Retrieval System Applications to Surface Coal Mine Management, Oklahoma Department of Mines, with W. A. Blanchard, L. M. Bunse, June, 1982, pp. 79.

"Oceanus: The Marine Environment," Course Syllabus for Introductory Oceanography, Oklahoma State University Independent and Correspondence Study, with H. Kershaw, June, 1982, pp. 52.

"Landsat Digital Analysis of Forest Clearcuts and Reforestation", Remote Sensing for Resource Management, Soil Conservation Society of America (1982), with Stephen J. Walsh, John D. Vitek and Mark S. Gregory. (Edited by C. J. Johannsen and J. L. Sanders, Ankey, Iowa), Chapter 14, pp. 159-171.

"Applications of Population Projections and Remote Sensing for Nuclear Power Plant Licensing," The Social Science Journal, accepted publication, October, 1983, with Stephen J. Walsh, Ronald P. Rhoten, Stephen W. Tweedie, James R. Rowland, and Paul I. Hagle. October 1983, 23 pages.

"A Methodology for Estimating Emergency Evacuation Times," IEE Transactions on Systems, Man, and Cybernetics, with Stephen W. Tweedie, James R. Rowland, Paul I. Hagle, Ronald P. Rhoten, and Stephen J. Walsh, accepted for publication, 20 pages.

Abstract: "Surface Coal Mine Management and Assessment Through a Remote Sensing-Based Information System," National meeting of the Asoc. of Amer. Geographers Proceedings, Bunse, Walsh, Blanchard, April, 1982.

Report: "Oklahoma Geographic Information Retrieval System Applications to Survase Coal mine Management," OK Dept. of Mines, Blanchard, Bunse, Walsh, June, 1982, 79 pages.

Report: "OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems (Annual Report, Sept. 1, 1981 to August 31, 1982)," NASA Headquarters, Washington, D.C., December, 1982, 48 pages.

Report: Development of Landsat/Geobased Information System Requirements for an Oklahoma Substate Demonstration Project," NASA/Earth Resources Laboratory, NSTL Station, Mississippi, with J. D. Vitek and M. S. Gregory November 1982, 33 pages.

"Development of the Oklhaoma Geographic Information Retrieval System for Research Management Environmental Assessment," Oklahoma Geology Notes, December, 1982, 10 pages.

"Analysis of Landcover and Its Effects on Water Quality Within Stillwater Creek Watershed," Oklahoma Academy of Science Proceedings, November, 1982 acceptance pending review.

GRANTS AND CONTRACTS FUNDED

Principal Investigator, "Investigation into the Effects of Stream-Bank Erosion on Water Ouality as Detected by LANDSAT Data," Demonstration Project for Oklahoma State Conservation Commission, July, 1978, $1,500.

Principal Investigator, "Development and Equipment Acquisition for Center for Applications of Remote Sensing," Oklahoma State University, March, 1979, $215,000.

Principal Investigator, "Forest Clearcut Identification, Assessment, and Monitoring in Southeast Oklahoma Through LANDSAT Digital Processing," Oklahoma Department of Wildlife Conservation, July, 1979, $20,000.

Principal Investigator, "OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems," NASA, Washington, D. C., September, 1979, $165,000.

Principal Investigator, "Wetland Mapping Along the Deep Fork of the North Canadian River, Central Oklahoma," U.S. Army Corps of Engineers, Environmental Branch, November, 1979, $12,750.

Principal Investigator, "Wetland Vegetation Survey, Pond Creek Bottoms, Western Arkansas," U.S. Army Corps of Engineers, Navigation Branch, December, 1979, $1,974.

Principal Investigator, "Land Use Mapping Within the Emergency Planning Zone, Blackfox Nuclear Power Station, Inola, Oklahoma," Public Service Company of Oklahoma, December, 1979, $30,000.

Principal Investigator, "OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems," NASA, Washington D. C., May, 1980, $120,000.

Principal Investigator, "Hardware Additions for CARS Computer System," OSU Presidential Challenge Grant, May, 1980, $20,000.

Principal Investigator, "Identification of Natural Area Preserves Through Remote Sensing Techniques," Oklahoma Department of Tourism and Recreation and Ozark Regional Commission, June, 1980, $16,000.

Principal Investigator, "Forest Clearcut Identification, Assessment, and Monitoring in Southeast Oklahoma Through LANDSAT Digital Processing," Oklahoma Department of Wildlife Conservation, July, 1980, $30,000.

Principal Investigator, "Land Use Change and Water Quality Analysis, Stillwater Creek, Oklahoma," U.S. Department of the Interior, October, 1980, $15,840.

Principal Investigator, "Pilot Study: "Identification of Potential Non-Point Sources of Water Pollution, Ft. Cobb Reservoir, Oklahoma," Oklahoma Conservation Commission, May, 1981, $6,000.

Principal Investigator, "Strip-Mine, Reclamation of Surface Coal Mines, Oklahoma Department of Mines, June 1, 1981, $10,000.

Principal Investigator," OSU Center for Applications of Remote Sensing: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems," NASA, September, 1981, $100,000.

Principal Investigator, Development of Requirements for a sub-state Landsat/Geobased Information System; NASA/Earth Resources Laboratory, Mississippi, September, 1981, $17,950.

Principal Investigator, Development of Analysis Models for a Landsat-based Energy Information System," Oklahoma State University Energy Institute, September, 1981, $4,725.

Co-Principal Investigator, "Development of a Model for Regional Evapotranspiration Estimates Through Use of Satellite Date," Oklahoma State University Water Research Institute, July 2, 1982, $12,000.

Principal Investigator, "Geographic Information System Framework for Energy Analysis, "Oklahoma State University Energy Institute, July, 1982, $7,500.

Principal Investigator, "Detection of Non-point Source Pollution in Selected Oklahoma Watersheds through Remote Sensing and Ancillary Data," Oklahoma Conservation Commission, July, 1982, $13,500.

Principal Investigator, "Pilot Study: Waterbody Detection Through Processing of Landsat MSS Digital Data," Oklahoma Water Resource Board, May, 1982, $2,000.

Principal Investigator, "Design of a Landsat-Based Geographic Information System for Energy and Resource Analysis, "OSU Institute for Enrgy Analysis, July, 1982, $7,500.

Principal Investigator, "CARS: A Program for Remote Sensing Applications to Oklahoma's Resource and Environmental Problems," NASA/Washington, D.C., September, 1982, $100,000.

COURSES TAUGHT

Remote Sensing (Introduction and advanced)

Physical Geography

Climatology

Oceanography

World Regional Geography

Geography of the United States

MASTER'S THESES

Frank Mynar, "Application of Computer Enhancement Techniques to Landsat Digital Data for the Detection of Geologic Lineaments," Major Professor, 1982.

Larry Bunse, "Development of a Geographic Information System for Surface Coal Mine Management," Major Professor, 1982.

Susan Berta, "Detection of Alpine Rock Glaciers in Southern Colorado," Minor Professor, 1982.

Roxane DiPiazza, "Site Selection for Wind Power Generation," Major Professor, 1982. (Thesis in Progress).

Margaret Williams, "Evapotranspiration: Remote Sensing Detection and Measurement," Major Professor, 1982, (Thesis in progress).

VITA

George Patrick Malanson

Department of Geography
Oklahoma State University
Stillwater, OK 74078
(405) 624-6521, 6024

114 1/2 W. Elm Ave.
Stillwater, OK 74074
(405) 743-4075

Birth: 12 July 1950, Clinton, MA

Education:

1968-1972, B.A. (Art, South Asia Area Studies)	Williams College Williamstown, MA
1973, language school (Hindi)	U.S. Department of State Foreign Service Institute Rosslyn, VA
1974-1975, part-time (Geography)	Georgia State University Atlanta, GA
1976-1978, M.S. (Geography)	University of Utah Salt Lake City, UT

(Thesis: "Distribution of plant species in hanging gardens of the Narrows, Zion National Park, Utah" under J. Kay)

1978-present, doctoral (Geography)	University of California Los Angeles, CA

(Dissertation: "Demographic simulation of post-fire succession of Californian coastal sage scrub" under W.E. Westman)

Awards and Honors:

1981 University Fellowship, University of California
1978 Outstanding Graduate Student Award, Department of Geography, University of Utah
1972 Dean's List, Williams College
1971 Dean's List, Williams College

Research Grants:

1983 Research Grant, Association of American Geographers
1982 Chancellor's Patent Fund Research Grant, University of California, Los Angeles
1981 Conference Travel Grant, University of California
1980 Research Travel Grant, University of California
1980 Library Search Grant, University of California
1979 Conference Travel Grant, University of California
1978 University of Utah Student Research Grant in Geography
1977 Research Grant, Zion Natural History Association
1977 University of Utah Student Research Grant in Geography
1977 Research Grant-in-Aid, Sigma XI, the Scientific Research Society of North America

Publications:

Malanson, G. P. 1980. Habitat and plant distributions in hanging gardens of the Narrows, Zion National Park, Utah. Great Basin Naturalist 40: 178-182.

Malanson, G. P. and Kay, J. 1980. Flood frequency and the assemblage of dispersal types in hanging gardens of the Narrows, Zion National Park, Utah. Great Basin Naturalist 40: 365-371.

Malanson, G. P. 1982. The assembly of hanging gardens: effects of age, area, and location. American Naturalist 119: 145-150

Malanson, G. P. and O'Leary, J. F. 1982. Post-fire regeneration strategies of Californian coastal sage shrubs. Oecologia 53: 355-358.

Malanson, G. P. 1982. Modeling post-fire succession in coastal sage scrub. In Dynamics and Management of Mediterranean-Type Ecosystems. USDA Forest Service. General Technical Report PSW-58, p. 616.

Rogers, G. F., Travis, R. W., and Malanson, G. P. 1980. An insular geography approach to equilibrium number of physician specialties across urban centers. Social Science and Medicine 14D: 45-54.

Westman, W. E., O'Leary, J. F., and Malanson, G. P. 1981. The effects of fire intensity, aspect, and substrate on postfire growth of Californian coastal sage scrub. In N.S. Margaris and H. A. Mooney, eds. Components of Productivity of Mediterranean Regions. The Hague: W. Junk, p. 151-179.

Unpublished research reports:

Malanson, G. P. and Van Pelt, N.S. 1978. Area description and vegetation map, Intermountain Power Project Site, Millard and Juab Counties. Report from the University of Utah Center for Remote Sensing and Cartography to the Utah State Division of Wildlife Resources.

Malanson, G. P. 1980. Vegetation maps of the Escalante Park Project preference-right coal lease tracts. Report and maps submitted to the Archaeology Division, ESCA-Tech Corp.

Unpublished papers presented at conferences:

Malanson, G. P. 1978. Dissimilarity of hanging garden communities. 74th Annual Meeting of the Association of American Geographers, New Orleans.

Malanson, G. P. 1979. Cognition and settlement of the Uintah Basin, Utah. 41st Annual Meeting of the Association of Pacific Coast Geographers, Santa Barbara.

Malanson, G. P. 1980. Simulation of species importance values in succession. 76th Annual Meeting of the Association of American Geographers, Louisville.

Malanson, G. P. 1981. A multiple pathway model of post-fire succession in Californian coastal sage scrub. 77th Annual Meeting of the Association of American Geograpers, Los Angeles.

Malanson, G. P. 1982. Simulation of post-fire succession in coastal sage scrub. 78th Annual Meeting of the Association of American Geographers, San Antonio.

Malanson, G. P. 1982. Fire management in Californian coastal sage scrub. 44th Annual Meeting of the Association of Pacific Coast Geographers, Long Beach.

Malanson, G. P. 1982. Demographic simulation of post-fire succession in Californian coastal sage scrub. Annual Meeting of the Ecological Society of America, University Park, PA.

Malanson, G. P. 1982. Wildland fuel and fire effects. Annual Meeting of the Great Plains-Rocky Mountain Division, AAG, Laramie.

Malanson, G. P. 1982. A comparison of the conceptual soundness of two indices of ecological similarity. Annual Meeting of the Southwest Division, AAG, Hot Springs.

Rogers, G. F., Travis, R. W., and Malanson, G. P. 1979. Physician specialty distribution across urban centers. Annual Meeting of the National Council on Geographic Education, Mexico City.

Van Pelt, N. S., Malanson, G. P., and Petersen, J. F. 1978. Ecological studies in the Utah canyonlands: a review and appraisal. 1st Annual Meeting of the Association for Arid Lands Studies, Denver.

Teaching experience:

1977-1978 Teaching practicum, Department of Geography, University of Utah, assisting one quarter each for "Conservation of Natural Resources" and "Biogeography".

1978-1980 Teaching assistant, Department of Geography, University of California, Los Angeles, conducting discussion/lab sections in "Man and the Earth's Ecosystems" 4 quarters, "Biogeography" 2 quarters, and "Physical Environment" 1 quarter.

1980 Instructor, Los Angeles Community College District faculty seminar on ecological field methods, 1 day.

Teaching experience, cont.:

1982-1983 Visiting Assistant Professor, Department of Geography, Oklahoma State University, teaching two sessions of "Introduction to Physical Geography" and one section of "Conservation of Natural Resources" each semester, plus a graduate seminar on "Recovery Processes in Damaged Ecosystems".

Employment experience:

1974-1975 Illustrator/draftsman, Graphics Branch and Emergency Operations Center, Ft. McPherson, GA

1976 Cartographic draftsman, Wm. Moore Survey and Mapping Co., 146 Grafton St., Shrewsbury, MA

1977-1978 Research assistant, Department of Geography, University of Utah, Salt Lake City, UT (land use assessment and mapping for proposed suburban development in northern Utah, and vegetation mapping for proposed power plant sites in southern Utah on NASA grant to M.K. Ridd and R.M. McCoy, PIs)

1980 Biogeographer, Archaeology Division, ESCA-Tech Corp., 3001 Red Hill Ave., Costa Mesa, CA

1980-1981 Research associate, Department of Geography, University of California, Los Angeles, CA (assembling a computer model of post-fire succession of coastal sage scrub, on NSF grant to W.E. Westman, PI)

Membership in professional groups:

American Association for the Advancement of Science
Association of American Geographers
California Botanical Society
Ecological Society of America

Professional activities:

1976-1977 Student representative, Graduate Studies Committee, Department of Geography, University of Utah

1977-1978 Chairman, Student Advisory Committee, Department of Geography, University of Utah

1980-1981 Graduate Student Representative, Department of Geography, University of California, Los Angeles

1981 Student representative, Resource Geographer Search Committee, Department of Geography, University of California, Los Angeles.

Work in progress:

Manuscripts submitted:

Gradient modeling and archaeology. revising for Journal of Scientific Archaeology with E. Ingbar.

Post-fire succession in Californian coastal sage scrub: the role of basal resprouts. submitted to Madrono with W. E. Westman

Fire interval as a niche axis in Californian coastal sage scrub. Submitted to Oecologia.

Linked Leslie matrices for the simulation of succession. Submitted to Ecological Modelling.

Coastal sagė scrub in the fire management scenario of southern California. Submitted to Annals, Association of American Geographers.

Fire history of Venturan subassociatons of Californian coastal sage scrub. Submitted to Journal of Biogeography.

Intensity as a third factor of disturbance regime and its effect on community diversity. Submitted to American Naturalist.

The rise and fall of the Uintah Valley Indian Reservation: perception and policy. Submitted to Yearbook of the Utah Geological Association.

Papers Scheduled for presentation:

Analysing Gaussian distributions of species importance values. Special session on methodology in biogeography at the 79th Annual Meeting of the Association of American Geographers, Denver, April 1983.

Research in progress:

Linking simulations of fire behavior and heat release with simulations of soil heat flow.

Future research scheduled:

Recovery of chaparral on sites differing in fire interval and fire intensity (with J.F. O'Leary)

Periodicity and magnitude of mass wasting events, the maintenance of slide paths, and their utility as fuel breaks in fire management plans in Glacier National Park (with D. Butler)

March 1983

JOHN D. VITEK

VITA

Personal Data

Date of Birth: August 16, 1942
Place of Birth: St. Paul, Minnesota
Family: Wife - Margaret Children - Mark and Alan
Social Security Number: 395-40-1601

1019 W. Osage Dr.
Stillwater, OK 74074
(405) 624-0892

Professional Experience

Assistant Dean, Graduate College & Associate Professor of Geography, Oklahoma State University, 1982 -
Coordinator of Environmental Sciences, Oklahoma State University, 1982 -
Associate Professor of Geography, Oklahoma State University, 1980-82
Assistant Professor of Geography, Oklahoma State University, 1978-80
Assistant Professor of Physical Geography, Univ. of Michigan-Flint, 1974-78
Chairman of Physical Geography, Univ. of Michigan-Flint, 1976-77
Visiting Professor of Geology, University of Michigan-Ann Arbor, Summer 1977
Assistant Professor of Geogrpahy, State Univ. of New York - Buffalo, 1971-74
Part-time Instructor of Geography, University of Iowa, 1976-70
Cartographer, Department of Geography, Northern Illinois University, 1965-67

Education

Ph.D. University of Iowa, Iowa City, 1973 (Geography)
M.A. University of Iowa, Iowa City, 1970 (Geography)
B.S. Wisconsin State University, Stevens Point, 1964 (Mathematics & Geography)

Publications

Books - Coates, Donald R. & Vitek, John D. (eds.), 1980, Thresholds in Geomorphology; Allen & Unwin, Boston, 498 pages.

Norris, Robert E., Harries, Keith D., & Vitek, John D., 1982, Geography: An Introductory Perspective; C.E. Merrill, Columbus, 472 pages.

Norris, R.E., Harries, K.D., & Vitek, J.D., 1982, Instructor's Manual to Accompany Geography: An Introductory Perspective; C.E. Merrill, Columbus, 126 pages.

Rooney, J.F., Zelinsky, W., Louder, D., Pennington, C., & Vitek, J.D., 1982, This Remarkable Continent: An Atlas of United States and Canadian Society and Cultures; Texas A & M Press, College Station, 316 pages.

Chapters in Books

Vitek, J.D. & Marsh, W.M., 1978, Landslide Hazard Mapping for Local Land Use Planning; in Environmental Analysis, William M. Marsh, Editor, McGraw-Hill Publishing Co., p. 235-249.

Coates, D.R. & Vitek, J.D., 1980, Perspectives in Geomorphic Thresholds; in Coates, D.R. & Vitek, J.D. (eds.), Thresholds in Geomorphology, Allen & Unwin, Boston, p. 3-23.

Walsh, S.J., Vitek, J.D., & Gregory, M.S., 1982, Landsat digital analysis of forest clearcuts and reforestations; in Johannsen, C.J. and Sanders, J.L. (editors), Remote Sensing for Resource Management, Soil Conservation Society of America, p. 159-171.

Articles

Vitek, J.D., 1973, Patterned ground: A quantitative analysis of pattern; Proceedings, Association of American Geographers, vol. 5, p. 272-275.

Vitek, J.D., 1973, The mounds of south-central Colorado: Are they similar of different?; Proceedings, Middle States Division, Association of American Geographers, vol. 7, p. 50-53.

Vitek, J.D. & Deutch, A.L., 1974, Knickpoints in the Badlands, South Dakota: An analysis of examples in homogeneous material; Proceedings, Association of American Geographers, vol. 6, p. 40-43.

Vitek, J.D., 1975, Preparation and use of isopleth maps of landslide deposits: Comment; Geology, vol. 3 (no. 4), p. 217.

Vitek, J.D. & Richards, D.G., 1978, Incorporating inherent map error into flood hazard analysis; Professional Geographer, vol. XXX, no. 2, p. 168-173.

Vitek, J.D., 1978, The morphology and pattern of earth mounds in south-central Colorado; Arctic and Alpine Research, vol. 10 (no. 4), p. 701-714.

Hanson, P.O., Vitek, J.D., & Hanson, S., 1979, Awareness of tornadoes: The importance of an historic event; The Journal of Geography, vol. 78, (no. 1), p. 22-25.

Hanson, S., Vitek, J.D., & Hanson, P.O., 1979, Natural disaster: Long-range impact on human response to future disaster threats; Environment and Behavior, vol. 11 (no. 2), p. 268-284.

Vitek, J.D. & Rose, E.M., 1980, Preliminary observations on a patterned fen in the Sangre de Cristo Mountains, Colorado, U.S.A.; Zeit. fur Geomorphologie, vol. 24 (no. 4), p. 393-404.

Gregory, M.S., Walsh, S. J., & Vitek, J.D., 1981, Mechanics of monitoring forest clearcuts and their regeneraton; in Seventh International Symposium on Machine Processing of Remotely Sensed Data, Purdue University (LARS), 520-528.

Vitek, J.D., Deutch, A.L., & Parson, C.G., 1981, Summer measurements of dissolved ion concentrations in alpine streams, Blanca Peak region Colorado; The Professional Geographer, vol. 33 (no. 4), p. 436-444.

Walsh, S.J. & Vitek, J.D., 1981, Lineaments in southeastern Oklahoma: Detection with Landsat data; Oklahoma Geology Notes, vol. 41 (no. 4) p. 104-114.

Vitek, J.D. & Berta, Susan M., Improving perception of and response to natural hazards: The need for local education; forthcoming, The Journal of Geography.

Giardino, John R., Vitek, J.D., & Salisbury, N.E., 1983, Landscapes of South-Central Colorado: forthcoming in Association of American Geographers Field Trip Guide 1983.

Vitek, J.D., 1983, Stone Polygons: Observations on the rates of surficial activity; submitted for review in Fourth International Permafrost Conference, Polar Research Board.

Publications

Miscellaneous

Vitek, J.D., 1973, Patterned ground: A quantitative description of pattern; Geological Society of American, Abs. with Program, vol. 5 (no. 2), 232.

Vitek, J.D., 1973, An analysis of mounds in south-central Colorado; Geological Society of America, Abs. with Program, vol. 5 (no. 7), p. 850-851.

Van Dusen, P., Marsh, W.M., & Vitek, J.D., 1975, Environmental impact statement for the new south Flint runway, Bishop airport, Flint, Michigan; 63 pages.

Walsh, S.J. & Vitek, J.D., 1979, Choctaw Indian Nation Land Resource Survey, Southeast Oklahoma, 21 pages.

Vitek, J.D., Deutch, A.L. & Parson, C.G., 1980, Variation in the dissolved loads of alpine streams; Geological Society of America, Abs. with Program, vol. 12 (no. 1), p. 17.

Vitek, J.D., 1980, Physical Geography by P. Gersmehl, Wm. Kammrath, and H. Gross; in Professional Geographer, vol. 32 (no. 4), p. 490-491.

Gregory, M.S. & Vitek, J.D., 1981, Development of Landsat/ Geobased Information System Requirements for an Oklahoma Substate Demonstration Project; Interim Report, NASA, Contract Number 13-184.

Gregory, Mark S., Walsh, S.J., & Vitek, J.D., 1982, Inventory of Clearcuts in Southeastern Oklahoma Through the Application of Landsat Data; Final Report, R-132-R-2-1-1, The Oklahoma Department of Wildlife Conservation, 83 pages.

Vitek, J.D., 1983, Book Review of "Analyzing Natural Systems" by D.J. Basta and B.T. Bower (editors); forthcoming in The Professional Geographer.

Vitek, J.D., 1983, Book Review of "Water Shortage: Lessons in Conservation from the Great Califonria Drought - 1976-77" by Richard A. Berk; forthcoming in Social Science Quarterly.

Vitek, J.D., 1983, First Annual American Geomorphological Field Conference - Meeting Summary; forthcoming in The Professional Geographer.

Presentations at Professional Meetings

Vitek, J.D., 1973, Patterned ground: A quantitative description of pattern; Geol. Soc. Am., Abs. with Prog., v. 5 (no. 2) p. 232.

Vitek, J.D., 1973, Patterned ground: A quantitative analysis of pattern; Assoc. of Am. Geog., v. 5, p. 272-275.

Vitek, J.D., 1973, The mounds of south-central Colorado: Are they similar or different?; Proceedings, Middle States Division, Assoc. Am. Geog., v. 7, p. 50-53.

Vitek, J.D., 1973, An analysis of mounds in south-central Colorado; Geol. Soc. Am., Abs. with Prog., v. 5 (no. 7), p. 850-851.

Vitek, J.D. & Deutch, A.L., 1974, Knickpoints in the Badlands, South Dakota: An Analysis of examples in homogeneous material; Proceedings, Assoc. Am. Geog., v. 6, 40-43.

Vitek, J.D. & Rose, E.M., 1976, The characteristics of an alpine string bog; Geol. Soc. Am., ABS. with Prog., v. 8 (no. 4), p. 515-516.

Vitek, J.D., Hanson, P.O., & Hanson, S., 1977, The Flint tornado of 1943: What is the impact on human behavior 22 years later?; Prog. Abs. Assoc. Am. Geog., p. 68.

Wicher, D., Vitek, J.D., & Parson, C.G., 1977, Ionic concentration in an Alpine stream; Prog. Abs., Asoc. Am. Geog., p. 84-85.

Vitek, J.D., 1978, Natural hazards: Perception and planning for local events; Southwest Division, Assoc. Am. Geog., Houston, Texas.

Vitek, J.D., Parson, C.G., & Dueutch, A.L., 1979, Dissolved load of alpine streams in the Sangre de Cristo Mountains, Colorado; Prog. Abs., Assoc. Am. Geog., p. 87.

Vitek, J.D., 1979, Summary presentation of workshop results; Fourth Annual Natural Hazards Workshop, University of Colorado, Boulder.

Vitek, J.D., Deutch, A.L., & Parson, C.G., 1980, Variation in the dissolved loads of alpine streams; Geol. Soc. Am., Abs. with Prog., v. 12, (no. 1), p. 17.

Berta, S.M. & Vitek, J.D., 1980, Improving perception of and response to natural hazards: The need for local education; Southwest Division, Assoc. Am. Geog., Denton, Texas.

Walsh, S.J., Vitek, J.D., & Gregory, M.S., 1980, Landsat digital analysis of clearcut location and reforestation in southeast Oklahoma; Remote Sensing for Resource Management, Soil Conservation Society of America, Kansas City, Missouri. (poster session)

Walsh, S.J., Vitek, J.D., & Gregory, J.S., 1981, Analysis of forest clearcuts: Change detection using Landsat; Prog. Abs., Asoc. Am. Geog., p. 37.

Walsh, S.J., Gregory, M.S., & Vitek, J.D., 1981, Inventorying forest clearcuts and monitoring vegetation regeneration through Landsat digital data; U.S. Forest Service, Inplace Resources Inventories, Orono, Maine.

Vitek, J.D., 1982, Stone Polygons: Preliminary observations on the rate of development; Prog. Abs., Asoc. Am. Geog., San Antonio, Texas, p. 34.

Vitek, J.D. & Tarquin, Pamela, 1982, Characteristics of relict stone polygons, Sangre de Cristo Mountains, Colorado; Southwest Division, Assoc. Am. Geog., Hot Springs, Arkansas.

Vitek, J.D., 1983, Description and analysis of sub-alpine lag surface; Assoc. Am. Geog., Accepted for presentation, Denver meeting, April 1983.

Awards, Grants & Honors

1964 - Dean's Honor List, Wisconsin State University, Stevens Point

1970 - NSF Trainee, University of Iowa, Iowa City

1976 - Special Merit Award, The University of Michigan - Flint

1978 - Tenure and Associate Professor, The University of Michigan - Flint

1979 - N.S.F. Travel Funds Grant for Participants in the Ninth Annual Binghamton Geomorphology Symposium

1979 - Walsh, S.J. & Vitek, J.D., Inventory of Clearcuts in Southeast Oklahoma Through the Applications of Landsat Data; Oklahoma Department of Wildlife Conservation ($20,000)

1980 - Walsh, S.J. & Vitek, J.D., Inventory of Clearcuts in Southeast Oklahoma Through the Application of Landsat Data, Part Two; Oklahoma Department of Wildlife Conservation (30,000)

1980 - Tenure and Associate Professor, Okahoma State University

1981 - Elected to Oklahoma State Chapter of Sigma Xi

1982 - Appointed Assistant Dean of the Graduate College

1982 - Appointed Co-ordinator of Environmental Sciences

1982 - Recipient of a Distinguished Service Award from The Society for the north American Cultural Survey (SNACS)

1983 - Determination of Physico-chemical Interaction Responsible for production of Acid Water and Dissolution of Toxic Metals from the Abandoned Lead/Zinc mines in northeastern Oklahoma, by Burks, S.L., Kent, D.C., and Vitek, J.D., to O.S.U. Water Resources Research, $83,000.

Professional Organizatons (current)

Association of American Geographers, 1967 -
Co-chairman, Geomorphology Specialty Groups, 1978-80.
Chairman, Geomorphology Specialty Groups, 1980-81
American Association for the Advancement of Science, 1974-
Geological Society of America, 1970-
Binghamton Geomorphology Symposium - Chairman of Steering Committee, 1979-
Sigma Xi, 1981-
American Geomorphological Field Group, 1982-

Current Research

A. Development of stone polygons in the Sangre de Cristo Mountains, Colorado. This is the eighth year of a study to investigate rates of surficial movement of stones in the centers of the polygons. Data collected through the seventh year of this study will be presented at the Fourth International Permafrost meeting, Fairbanks, Alaska in July 1983.

B. 1983 will be the seventh year of collecting data on the development of a sub-alpine lag surface at 12,000 feet in the Sangre de Cristo Mountains. A preliminary statement of the first six years of record will be presented at the AAG meeting in Denver, April 1983.

C. Statistical analysis of fabrics in a Mount Mestas rock glacier will be undertaken with John R. Giardino, Texas Tech University. Goal is to produce a paper from the data during 1983.

D. Geomorphological mapping of the Culebra portion of the Sangre de Cristo Range in southern Colorado and northern New Mexico. This is a joint effort with John R. Giardino, Texas Tech University. I will map the west wide of the range and he the east. We will then combine our efforts into a joint publication.

E. Development of a patterned fen (string bog) in the Sangre de Cristo Mountains. Beginning in the summer of 1983, additional research will be undertaken on rates of change and hydrology of the bog.

F. Surface geomorphology of the Tar Creek Watershed in northeast Oklahoma is being mapped and analyzed in conjuction with a grant. The purpose of the project is to assess how acid mine water is recharged, overland flow plus infiltration rates will be assessed.

Courses Taught

University of Iowa (1967-1970)
- Cartography
- Field Techniques

State University of New York - Buffalo (1971-1974)
- Introduction to Physical Geography
- Climatology
- Cartography
- Thematic Cartography
- Theory and Techniques of Landform Analysis
- Seminar in Physical Geography

University of Michigan - Flint (1974-1978)
- Geomorphology
- Advanced Geomorphology
- Introduction to the Geosciences
- Cartography
- Surveying & Mapping
- Natural Hazards
- Environmental Issues
- Climatology
- Physical Geography of the City

University of Michigan - Ann Arbor (1977)
- Geology Field Camp (8 weeks)

Oklahoma State University (1978-)
- Physical Geography (Introductory)
- Physical Geography (Advanced - Slopes and Slope Processes)
- Climatology
- Biometeorology
- Natural Hazards
- Summer Field Seminar in Colorado
- Seminar: Slope Processes
- Cartography
- Field Observations & Mapping

Administrative Experience

1971-74 - SUNY-Buffalo
- Department - Co-Director of Undergraduate Majors
- Department - Member of the Graduate Committee

1974-78 - University of Michigan - Flint
- Special Assignments
  - Co-Chairman, Summer 1976
  - Department Chairman, 1976-77
- University Committee Assignments
  - Chairman, Curriculum Committee, 1976-77
  - Member, Curriculum Committee, 1976-78
  - Member, Student Affairs Committee, 1976-77
  - Member, Library and Instructional Resources Committee, 1976-78
  - Member, Urban Studies Interdisciplinary Program, 1974-77

Member, Council of Chairmen, 1976-77
Member, Science Building Subcommittee, 1974-77
Member, Honors Program Steering Committee, 1977-78

1978- - Oklahoma State University
Department, Member of the Graduate Committee, 1978-81, 1982-
Department, Member of the Travel Committee, 1980-82
Arts & Science, Member, Task Force on Special A&S Degree Requirements, 1982
Arts & Science, Member, Classroom Advisory Committee, 1981-82
Arts & Science, Member, Curricular Affairs Committee
Assistant Dean of the Graduate College, 1982-
University Curriculum Committee, 1982-
Graduate Faculty Council, 1982-
University Task Force on Student Retention, 1983-
Program Coordinator, Environmental Sciences, 1982-
Environmental Sciences Review Committee, 1982

VITA

David R. Butler
Department of Geography
Oklahoma State University
Stillwater, Oklahoma 74078
(405) 624-6250 or 624-9059 (Home)

PERSONAL

Born:	April 14, 1952, in Lincoln, Nebraska
Health:	Excellent, no limitations
Marital Status:	Married, no children

EDUCATION

1978-1982	University of Kansas, Lawrence, Kansas Degree: Doctor of Philosophy in Geography
1976-1977	McMaster University, Hamilton, Ontario, Canada Graduate Studies in Geography
1974-1976	University of Nebraska at Omaha Degree: Master of Science in Geography
1970-1974	University of Nebraska at Omaha Degree: Bachelor of Arts, Summa Cum Laude, Ranked #1 in the College of Liberal Arts and Sciences Major: Geography, 4.0 average (A=4.0) Overall Academic Average: 3.92

ACADEMIC HONORS, AWARDS, AND GRANTS

Postgraduate Level

Association of American Geographers Research Grant, 1983 (with George P. Malanson), $500.00.
Finalist, Warren Nystrom Award Competition, Association of American Geographers, 1983.
O.S.U. College of Arts and Sciences Dean's Starter Grant, 1983-84, $2500.00.

Graduate Level

Doctoral Dissertation Defense Honors, 1982
National Science Foundation Doctoral Dissertation Research Grant EAR-8112316
University of Kansas Graduate School Dissertation Fellowship, 1980-81
University of Kansas Phi Kappa Phi Honor Society, 1981
Geological Society of America Research Grant, 1980
University of Kansas Graduate School Summer Fellowships, 1979 and 1980
University of Kansas Graduate School Travel Grants, 1979 and 1980
McMaster University Graduate Scholarship, 1976-77

Undergraduate Level

Outstanding Student, Department of Geography-Geology, University of Nebraska at Omaha, 1972-73 and 1973-74
University of Nebraska at Omaha Honors Scholarship, 1973-74
University of Nebraska at Omaha Regents Scholarship, 1970-73
Listed in "Who's Who Among Students in American Universities and Colleges, 1973-1974"
Phi Kappa Phi, Gamma Theta Upsilon, and Phi Eta Sigma Honor Societies

PROFESSIONAL MEMBERSHIPS

American Quaternary Association
Association of American Geographers
Biogeography Specialty Group, A.A.G.
Geomorphology Specialty Group, A.A.G.
Canadian Association of Geographers
International Mountain Society
Nebraska Academy of Sciences
Northwest Scientific Association
Society of Sigma Xi

AREAS OF INTEREST WITHIN GEOGRAPHY

Quaternary Paleoenvironments
Geomorphology
Dendrochronology and Natural Hazards Analysis
Palynology

PUBLICATIONS

Papers Published in Refereed Journals

Butler, David R., 1979a. Snow avalanche path terrain and vegetation, Glacier National Park, Montana. Arctic and Alpine Research 11(1), pages 17-32.

Butler, David R., 1979b. Dendrogeomorphological analysis of flooding and mass movement, Ram Plateau, Mackenzie Mountains, Northwest Territories. The Canadian Geographer 23(1), pages 62-65.

Butler, David R., 1980. Terminal elevations of snow avalanche paths, Glacier National Park, Montana. Northwest Geology 9, pages 59-64.

Butler, David R., 1982. Terrain variables and the distribution of mass-wasting sites, Canyonlands National Park, Utah. The Geographical Bulletin 22, pages 14-21.

Butler, David R., Reinterpretation of a late Pleistocene moraine in the Lemhi Mountains of Idaho, U.S.A. Accepted by Zeitschrift fur Geomorphologie, to be published in Volume 27, 1983.

Papers Published in Refereed Journals

Butler, David R., A late Quaternary chronology of mass wasting for a small valley in the Lemhi Mountains of Idaho. Accepted by Northwest Science, to be published in Volume 57, 1983.

Butler, David R., Rockfall hazard inventory, Ram River, Mackenzie Mountains, N.W.T. Accepted by The Canadian Geographer, to be published in Volume 27(2), 1983.

Butler, David R.; Curtis J. Sorenson; and Wakefield Dort, Jr. Differentiation of morainic deposits based upon geomorphic, stratigraphic, palynologic, and pedologic evidence, Lemhi Mountains, Idaho. In an as-yet untitled International Quaternary Association volume on alpine morainic deposits, A. A. Balkema, Rotterdam, 1983.

Butler, David R., Lichenometric dating in the Mountain Boy cirque, Lemhi Mountains, Idaho. Accepted by Journal of the Idaho Academy of Science, to be published in Volume 19, 1983.

Papers Submitted

Butler, David R., and Michael H. Winter. Dendrochronologic studies identify the end of the most recent Neoglacial episode. Submitted to Great Basin Naturalist.

Butler, David R., Observations on historic high magnitude mass movements, Glacier National Park, Montana. Submitted to The Mountain Geologist.

Abstracts Published from Papers Presented

Butler, David R., 1976a. Aerial-photo interpretation of mass-wasting deposits, Glacier National Park, Montana. Abstracts, American Quaternary Association Fourth Biennial Conference, Tempe, Arizona. Page 127.

Butler, David R., 1976b. Dendrogeomorphic and biogeographic studies of snow avalanche slopes, Glacier National Park, Montana. Proceedings, Nebraska Academy of Sciences. Pages 71-72.

Shroder, John F., Jr.; John R. Giardino; and David R. Butler, 1976. Dendrochronologic analysis of rock glaciers and snow avalanches. Abstracts, American Quaternary Association Fourth Biennial Conference, Tempe, Arizona. Page 115.

Butler, David R., 1978. Mass-wasting processes and landforms, Ram Plateau, Mackenzie Mountains, Northwest Territories, Canada. Proceedings, Nebraska Academy of Sciences. Page 40.

Butler, David R., 1979. Dendrogeomorphological analysis of floods and mass movement, Ram Plateau, Mackenzie Mountains, N.W.T., Canada. Program Abstracts, 75th Annual Meeting, Association of American Geographers, Philadelphia, Pennsylvania. Page 85.

Butler, David R., 1980. Relative-age dating and a late Quaternary chronology of glacial and mass-wasting deposits, east-central Lemhi Range, Idaho. Program Abstracts, 76th Annual Meeting, Association of American Geographers, Louisville, Kentucky. Page 53.

Abstracts Published from Papers Presented

Butler, David R., 1981. Distribution of mass-wasting sites, Canyonlands National Park, southeastern Utah. Program Abstracts, 77th Annual Meeting, Association of American Geographers, Los Angeles, California. Page 77.

Butler, David R.; Curtis J. Sorenson; and Wakefield Dort, Jr., 1981. Differentiation of morainic deposits using palynologic, pedologic, geomorphic, and stratigraphic evidence from the Lemhi Mountains of Idaho. Symposium Program Abstracts, INQUA Commission on the Genesis and Lithology of Quaternary Deposits, Symposium and Field Trip on the Genesis and Lithology of Morainic Deposits in an Alpine Environment, Wyoming and Idaho. Page 18.

Butler, David R. and William C. Johnson, 1982. Palynological interpretation of late Quaternary pond sediments near Gilmore, Lemhi Mountains, Idaho. Program Abstracts, 78th Annual Meeting, Association of American Geographers, San Antonio, Texas. Page 59.

Butler, David R., 1982. Regional implicatons of the late Quaternary chronology of glaciation and paleoenvironmental change, east-central Lemhi Mountains, Idaho. Great Plains-Rocky Mountain Divisional Meeting, Association of American Geographers, Laramie, Wyoming.

Butler, David R., 1983. Late Pleistocene paleoenvironments as interpreted from palynological analysis of glacial tills, Lemhi Mountains, Idaho. 79th Annual Meeting, Association of American Geographers, Denver, Colorado, April, 1983.

Butler, David R.; Curtis J. Sorenson; and Wakefield Dort, Jr., 1983. Late Quaternary glacial/interglacial sequence, east-central Lemhi Mountains, Idaho, U.S.A. Sixth Biennial Conference on Quaternary Research, York University, Downsview, Ontario, Canada.

SEMINAR PRESENTATIONS

Late Pleistocene Paleogeography of the Lemhi Mountains, Idaho. October 1, 1982. Department of Geography, Oklahoma State University, invited speaker.

Interpreting Late Pleistocene Paleoenvironments. November 1, 1982. Department of Geography, University of Oklahoma, invited speaker.

Physical Landscapes of the Northwest Territories of Canada. February 4, 1983. Department of Geography, Oklahoma State University, invited speaker.

Pollen Analysis and Paleoenvironments, Lemhi Mountains, Idaho. March 2, 1983. Department of Botany, Oklahoma State University, invited speaker.

FIELD RESEARCH

Summers, 1979, 1980 and 1981 — Field work for Ph.D. dissertation. Dissertation Title: Late Quaternary Glaciation and Paleoenvironmental Changes in Adjacent Valleys, East-Central Lemhi Mountains, Idaho.

FIELD RESEARCH

Summer, 1977 — Member of physical geography research team from McMaster University; Mackenzie Mountains, Northwest Territories, Canada. Work involved dendrochronologic analysis of mass movement and flood sites, and hydrologic and water chemistry studies.

Summer, 1975 — Field work for Master's thesis. Thesis Title: An Analysis of Slopes Affected by Snow Avalanches and Related Mass-Wasting Features in a Portion of Glacier National Park, Montana.

ACADEMIC EXPERIENCE

7/82-Present — Assistant Professor of Geography, Oklahoma State University
Courses- Quaternary Paleoenvironments
Physical Geography
Biometeorology

9/78-5/80 — Teaching Assistant, University of Kansas
Courses- Physical Geography
Environment and Man

9/76-8/77 — Teaching Assistant, McMaster University
Courses- Geography of the U.S.A.
Statistics

12/75-2/76 — Instructor of Geology, Iowa Western Community College, Council Bluffs, Iowa
Course- Introduction to Geology

9/74-5/76 — Teaching Assistant, University of Nebraska at Omaha
Courses- Physical Geology
Historical Geology

GRADUATE STUDENT SUPERVISION

Major Advisor For:

Mr. Jack G. Oelfke, thesis topic: "Mass-wasting events along the Lewis Overthrust, Glacier National Park, Montana: a natural hazards approach".

Committee Member For:

Mr. Ian Cherrill, thesis topic: "Identification of drought-stressed areas of agriculture using LANDSAT remote-sensing techniques (Oklahoma area)".

Mr. Carl Bryant, thesis topic: "Snow avalanche hazards in a portion of mountainous Washington".

OTHER WORK EXPERIENCE

9/77-7/78 — Planning Technician, Omaha-Council Bluffs Metropolitan Area Planning Agency. Work involved use of the computerized GBF-DIME file system for preparation of the Omaha metropolitan area for the 1980 Census of Population.

OTHER WORK EXPERIENCE

8/77-9/77 Environmental Planning Consultant, Central Plains Engineering and Architecture, Council Bluffs, Iowa. Provided advice on completion of environmental impact statements submitted to the U.S. Army Corps of Engineers.

REFERENCES

Dr. Curtis J. Sorenson
Department of Geography-Meteorology
University of Kansas
Lawrence, Kansas 66045

Dr. Wakefield Dort, Jr.
Department of Geology
University of Kansas
Lawrence, Kansas 66045

Dr. William C. Johnson
Department of Geography-Meteorology
University of Kansas
Lawrence, Kansas 66045