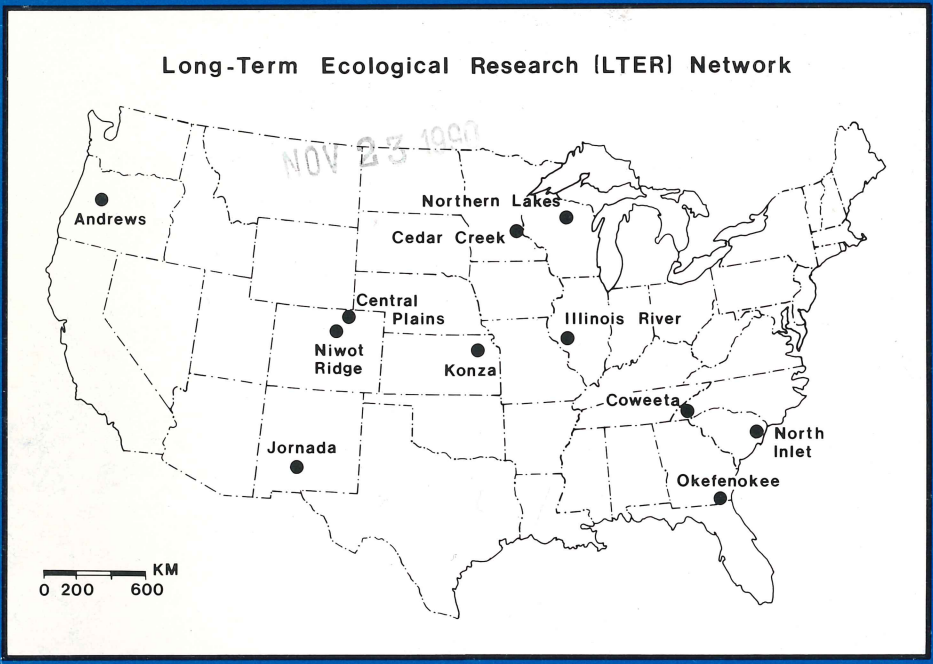
LONG-TERM ECOLOGICAL RESEARCH IN THE UNITED STATES

A Network of Research Sites 1984



LONG-TERM ECOLOGICAL RESEARCH IN THE UNITED STATES
A Network of Research Sites 1984

(3rd edition, revised)

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Kathryn P. Ingraham

Additional copies available from:
Long-Term Ecological Research Network
Forestry Sciences Laboratory
3200 Jefferson Way
Corvallis, OR 97331

MEMORANDUM

TO: Prospective Investigators
FROM: Division Director, Biotic Systems and Resources, National Science Foundation
RE: Extensive Use of Long-Term Ecological Research Sites

The Division of Biotic Systems and Resources (BSR) has undertaken the support of research on long-term ecological phenomena at a national network of sites (Long-Term Ecological Research, LTER). An initial objective in establishing these site-specific projects was to provide the environmental biology research community with the opportunity to utilize the sites for research projects. Appropriate projects could be either short- or long-term and could focus on any phenomena manifest at the sites.

It is BSR's intention to promote such extensive use of LTER sites. We expect that investigators will perceive possible benefits of several types including: 1) opportunity to interact with other scientists performing interest-related research; 2) ready access to field sites with long-term availability; and 3) well-documented and accessible records of background and corroborative data.

Arrangements for such collaboration must be made with personnel at each LTER site (see brochure). Availability of necessary accommodations must be documented in each proposal. Proposals should be submitted via normal means, in accordance with standard NSF guidelines, and to the appropriate disciplinary programs.

LONG-TERM ECOLOGICAL RESEARCH IN THE UNITED STATES

A Network of Research Sites

The 1984 Long-Term Ecological Research Program Coordinating Committee is composed of the coordinating principal investigators or their representatives:

NATIONAL SCIENCE FOUNDATION
J. T. Callahan, ex officio
Program Officer of NSF
Division of Biotic Systems and Resources
National Science Foundation
Washington, DC 20550

H. J. ANDREWS EXPERIMENTAL FOREST
(Coniferous forest)
Jerry Franklin, Chairman
Forestry Sciences Laboratory
3200 Jefferson Way
Corvallis, OR 97331

CEDAR CREEK NATURAL HISTORY AREA
(Oak Savannah)
G. David Tilman
Department of Ecology and Behavioral Biology
University of Minnesota
318 Church Street SE
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CENTRAL PLAINS EXPERIMENTAL RANGE
(Grassland)
William K. Lauenroth
Department of Range Science and Natural Resource Ecology Laboratory
Colorado State University
Fort Collins, CO 80523

COWEETA HYDROLOGIC LABORATORY
(Deciduous forest)
D. A. Crossley, Jr.
Institute of Ecology
University of Georgia
Athens, GA 30602

ILLINOIS AND MISSISSIPPI RIVERS
(Temperate rivers)
Richard E. Sparks
Illinois Natural History Survey
River Research Laboratory
Box 599
Havana, IL 62644

JORNADA
(Desert)
Walter G. Whitford, Vice Chairman
Department of Biology
New Mexico State University
Las Cruces, NM 88003

KONZA PRAIRIE RESEARCH NATURAL AREA
(Tallgrass prairie)
G. R. Marzolf
Division of Biology
Kansas State University
Manhattan, KS 66506

NIWOT RIDGE/GREEN LAKES VALLEY
(Alpine tundra)
Patrick J. Webber
INSTAAR
Campus Box 450
University of Colorado
Boulder, CO 80309

NORTH INLET
(Coastal marine)
F. John Vernberg
Baruch Institute
University of South Carolina
Columbia, SC 29208

NORTHERN LAKES
(Northern temperate lakes)
John J. Magnuson
Laboratory of Limnology
North Park Street
University of Wisconsin
Madison, WI 53706

OKEFENOKEE NATIONAL WILDLIFE REFUGE
(Freshwater wetland)
Bernard C. Patten
Institute of Ecology
University of Georgia
Athens, GA 30602

LONG-TERM ECOLOGICAL RESEARCH (LTER)

Long-Term Ecological Research (LTER) is a pilot program supported by the National Science Foundation's Division of Biotic Systems and Resources (BSR). The program was developed from 1976 to 1979 when the first open competition for support was announced. LTER acknowledges:

1. That there are ecological phenomena that occur on time scales of decades or centuries; periods of time not normally investigated with research support from NSF.
2. That many ecological experiments are performed without sufficient knowledge of the year-to-year variability in the system. Interpretation is, therefore, difficult. This is especially true when the system in which the experiment is performed is not at equilibrium.
3. That long-term trends in natural ecosystems were not being systematically monitored. Unidirectional changes that were observed could not be distinguished from cyclic changes on long time scales.
4. That a coordinated network of sites was not available to facilitate comparative experiments. Furthermore, data management was not being coordinated between research sites. Therefore, comparative analyses could not be performed and theoretical constructs could not be conveniently tested.
5. That examples of natural ecosystems were being converted to uses incompatible with ecological research.
6. That advances in ecological research have often treated phenomena at higher or lower levels of organization as insignificant or constant or by oversimplification. This problem can be alleviated by performing intensive investigations at single sites, leading to an accumulation of overlapping information. Through time, site specific research will generate increasingly valuable data sets, revealing pattern and control at several levels of ecosystem organization.

Initial convergence of the LTER effort was encouraged by requiring that sites address research efforts in five core areas. These were (1) pattern and control of primary production; (2) spatial and temporal distribution of populations selected to represent trophic structure; (3) pattern and control of organic matter accumulation in surface layers and sediments; (4) pattern of inorganic inputs and movements of nutrients through soils, groundwater, and surface waters; and (5) pattern and frequency of disturbance to the research site.

The institutions serving in support of LTER sites are committed to encourage collaborative research by scientists at other institutions. LTER sites should be considered regional or national research facilities. If you are interested in using these facilities, please contact directly the sites identified in this brochure.

H. J. ANDREWS EXPERIMENTAL FOREST LTER SITE
(see pages 2-3)

CEDAR CREEK NATURAL HISTORY AREA LTER SITE
(see pages 4-5)

H. J. ANDREWS EXPERIMENTAL FOREST LTER SITE

SITE NAME: H. J. Andrews Experimental Forest

INSTITUTIONAL AFFILIATION: Oregon State University
U. S. Forest Service
Pacific Northwest Forest and
Range Experiment Station

LTER RESEARCH TOPICS: Composition, structure, and process changes during succession
Nature of forest-stream interactions
Population dynamics of forest stands
Effects of nitrogen fixers on soils
Log decomposition patterns

PRINCIPAL BIOME: Coniferous forest

MAIN COMMUNITIES: Douglas fir, western hemlock, redcedar
True fir and mountain hemlock
Streams

EXISTING DATA BASES:

Maps of geology, soils; lists of flora, fauna; historical record
Meteorological and physical measurements including radiation, temperature, wind speed and direction, precipitation, snow cover, soil water content, groundwater level, watershed discharge, and stream morphology
Atmospheric, terrestrial, and aquatic chemistry measurements
Measures of terrestrial and aquatic primary production and decomposition
Terrestrial and aquatic population records

CLIMATE SYNOPSIS:

Quasi-mediterranean climate with mild, wet winters and warm, dry summers. Annual precipitation is about 250 cm, January mean temperature is 2° C, and July mean temperature is 20° C.

NARRATIVE:

The H. J. Andrews Experimental Forest was established in 1948 by the U. S. Forest Service to examine the effects of different logging methods on reforestation, erosion, and water quality. It has become an active site for research on coniferous forest and stream ecosystems. In 1969, the Andrews Forest was selected as an intensive study site by the Coniferous Forest Biome (International Biological Programme) because of the existing long-term data base. It was also designated a Biosphere Reserve by UNESCO in 1975 because it contains good examples of forest and stream ecosystems common throughout the Pacific Northwest. Since 1977, the National Science Foundation has supported a baseline monitoring program which includes climatic variables, streamflow, stream water chemistry, atmospheric deposition, litterfall, and successional changes in the composition and structure of the vegetation. Oregon State University, the Pacific Northwest Forest and Range Experimental Station, and the Willamette National Forest have shared administrative responsibility for the Andrews Forest since 1977. Current management is directed toward maintaining the research value of the site and enhancing it wherever possible. More than 60 separately funded research projects are now using the Andrews Forest. These are coordinated by a committee of scientists and administrators from the institutions and agencies sharing responsibilty for the site.

Five new projects are being initiated under the National Science Foundation's Long-Term Ecological Research program on the Andrews Forest and nearby research natural areas. These studies will investigate: 1) succession in northwestern forests with an emphasis on environmental control of natality and mortality of important species; 2) long-term changes in primary production and soil physical and chemical properties in stands having different densities of an early successional shrub species which fixes nitrogen; 3) density-dependent mortality processes in young Douglas fir stands; 4) cumulative downstream effects on aquatic ecosystem production, composition, and structure of standard forest management practices; and 5) the decomposition patterns of coarse woody debris in different terrestrial and aquatic environments.

FACILITIES:

Office, laboratory, and living facilities at the Andrews Forest are located near the main entrance on a terrace beside Lookout Creek. Current facilities include eight bunkhouse trailers with a capacity of 55; four office/ laboratory trailers and a herbarium/ office which provide working space for 35-40; and a warehouse/ shop. In addition, two small camper trailers are available for special needs, and small cabins at Mack Creek and McRae Creek provide overnight space for scientists working there.

LOCATION: 80 km east of Eugene, Oregon.
latitude: 44°14' N
longitude: 122°11' W
elevation: 425 to 1,620 m

ADDRESSESS:

Principal Investigator:
Dr. Jerry Franklin
Forestry Sciences Lab.
3200 Jefferson
Corvallis, OR 97331
(503) 757-4362

Site Director:
Arthur McKee
H. J. Andrews Experimental Forest
P. O. Box 300
Blue River, OR 97413
(503) 822-3914

INVESTIGATORS:

Kermit Cromack - Decomposition patterns
Kenneth Cummins - Forest-stream interactions
Jerry Franklin - Succession, decomposition patterns
Stan Gregory - Forest-stream interactions, decomposition patterns
James Hall - Forest-stream interactions
Mark Harmon - Decomposition patterns
Jack Lattin - Succession, decomposition patterns
Arthur McKee - Succession, forest-stream interactions
David Perry - Population dynamics of stands
Tim Schowalter - Succession
Jim Sedell - Forest-stream interactions
Phil Sollins - Changes in primary production
Fred Swanson - Succession, forest-stream interactions
Richard Waring - Succession

CEDAR CREEK NATURAL HISTORY AREA LTER SITE

SITE NAME: Cedar Creek Natural History Area

INSTITUTIONAL AFFILIATION: University of Minnesota

LTER RESEARCH TOPICS:
- Primary productivity
- Nutrient budgets
- Soil chemistry
- Climatic variation
- Plant and herbivore dynamics
- Succession in oak savannah

PRINCIPAL BIOMES:
- Hardwood forest
- Tall grass prairie

MAIN COMMUNITIES:
- Oak savannah
- Oak forest
- Conifer bog
- Great Lakes pine forest
- Old fields
- Wetland marsh and carr

EXISTING DATA BASES:
- Check lists of plants and vertebrates
- Maps of land use history, vegetation, soils, and topography
- Aerial photographs
- Climatological data
- NADP wet and dryfall chemistry
- Primary productivity of selected sites
- Telemetry data on movement and behavior of selected vertebrates
- Plant species abundances in permanent quadrats in 22 old fields
- Effects of N and Mg on early succession
- Biotic disturbance patterns
- Effects of deer enclosure and of small mammal enclosure on vegetation.
- Effects of nitrogen fertilization on herbivore dynamics (small mammals and grasshoppers) and on vegetation

CLIMATE SYNOPSIS:

Continental climate with cold winters, hot summers, and precipitation scattered throughout the year. Mean temperatures are 22.2 ° C in July and -10 ° C in January. Precipitation averages about 66 cm per year, with June and August being the wettest months.

NARRATIVE:

Cedar Creek Natural History Area is a 2,185 ha Experimental Ecological Reserve located 50 km north of Minneapolis-St. Paul on a large glacial outwash sand plain. It is managed by the University of Minnesota. Cedar Creek has been the site of ecological research ranging from Lindeman's studies of Cedar Bog Lake to work on primary productivity, nutrient cycles, and secondary succession to radiotelemetry of animal habitat use and movement patterns. Cedar Creek includes a wide array of habitat types, ranging from oak savannah to prairie to deciduous hardwood forests. Its soils, mainly derived from the outwash sand, span five of the ten soil orders.

Since its establishment in the 1940s, Cedar Creek has been managed to maximize present and future ecological research opportunities. For instance, a program of prescribed burnings was instituted 20 years ago on the oak savannah and has resulted in an array of habitats which differ in their fire history. Similarly, agricultural fields have been abandoned on a regular schedule to

give old fields of various known ages and past agricultural usages. In addition to such terrestrial habitats, Cedar Creek includes numerous streams, bogs, lakes, swamps, and marshes which are available for aquatic research.

LTER research is centered on the mechanisms whereby soil processes, interspecific plant competition, and herbivores influence the diversity and species composition of natural plant communities. Long-term observational and experimental studies of the relationships between primary productivity, nutrient budgets, soil chemistry, climatic variation, and plant and herbivore dynamics are being performed in four different stages in the secondary successional sequence of the oak savannah. The research is an attempt to understand succession through a synthesis of population, community, and ecosystem perspectives combined with long-term experimental manipulations of natural communities. The research includes detailed observations of large plots and experimental manipulations of smaller plots. Manipulations, which will be continued for the duration of this project, include: 1) different levels of nitrogen fertilization with all other elements supplied in excess; 2) fertilization with each of six nutrient elements applied singly; 3) disturbance-nitrogen interactions; 4) gopher removal; 5) deer removal; 6) insect removal; and 7) fire.

FACILITIES:

Cedar Creek has 10 permanent buildings, including a year-round laboratory, a shop building, a storage building and work area, a winterized animal holding facility, four year-round family homes, and two summer cabins. There is a 12-person dormitory with a kitchen. The laboratory contains offices, two large work areas, an electronics laboratory, an analytical chemistry laboratory, an herbarium, an insect collection, and a mammal collection. Two jeeps are available for general use on premises. Major items of equipment include a Data General Nova minicomputer, IBM-XT microcomputers, Hewlitt Packard calculator with plotter, Texas Instruments Portable Data Terminal, oscilloscopes, spectrum analyzers, drying room, top-loading electronic balances interfaced to an Apple IIe microcomputer, and meteorological equipment.

LOCATION: 50 km north of Minneapolis-St. Paul, Minnesota.
- latitude: 45 ° 24' N
- longitude: 93 ° 12' W
- elevation: 175 to 288 m

ADDRESSES:

Principal Investigator:
Dr. G. David Tilman
Department of Ecology
and Behavioral Biology
University of Minnesota
318 Church Street SE
Minneapolis, MN 55455
(612) 373-2788

Site Director:
Dr. Richard Inouye
Cedar Creek Natural History Area
2660 Fawn Lake Drive NE
Bethel, MN 55005
(612) 434-5131

INVESTIGATORS:

David Grigal	- Soil science, ecology
Nancy Huntly	- Plant-herbivore interaction
Richard Inouye	- Evolution, plant ecology
Patrice Morrow	- Insect ecology
Donald Siniff	- Ecology, behavior, statistics
John Tester	- Ecology, behavior
David Tilman	- Ecology

CENTRAL PLAINS EXPERIMENTAL RANGE LTER SITE

SITE NAME: Central Plains Experimental Range (CPER) - Shortgrass Steppe

INSTITUTIONAL AFFILIATION: U. S. Department of Agriculture
-Agricultural Research Service (ARS)
Colorado State University

LTER RESEARCH TOPICS:
- Hydrologic cycle and primary production
- Key microbial responses
- Plant succession
- Plant and animal population dynamics
- Plant community structure
- Organic matter aggregation or degradation
- Influence of erosion cycle on redistribution of matter, nutrients, and pedogenic process
- Influence of atmospheric gases, aerosols, and particulates on primary production and nutrient cycles

PRINCIPAL BIOME: Grassland

MAIN COMMUNITIES:
- Shortgrass steppe
- Floodplain shrubland
- Salt meadow

EXISTING DATA BASES:
- Weather data from 1939
- Vegetation composition and productivity
- Element cycling
- Vertebrate communities and diets
- Invertebrate communities and distribution
- Effects of domestic livestock grazing

CLIMATE SYNOPSIS:

Extreme daily, seasonal, and long-term climatic variability in both range and predictability. Mean monthly temperatures range from -4 ° C to 22 ° C seasonally and have a daily average max-min range of 17 ° C. Annual precipitation averages 311 mm and ranged between 110 and 580 mm over the past 31 years of measurement. Approximately 70% of the mean annual precipitation occurs during the April-to-September growing season.

NARRATIVE:

CPER is a 6,280-ha (15,500-acre) tract of shortgrass rangeland administered by the USDA - Agricultural Research Service (ARS) and was the site for much of the intensive research conducted by Colorado State University during the Grassland Biome portion of the International Biological Programme. It is less than a one-hour drive from CPER to the campus.

The shortgrass steppe on CPER is dominated by shortgrasses (64%), succulents (21%), and half-shrubs (8%). The main species of these groups are Bouteloua gracilis and Buchloe dactyloides; Opuntia polyacantha; and Chrysothamnus nauseosus, Guteriezia sarothrae, and Erigonum effusum, respectively. Average above-ground net primary productivity is 125 g/sq.m and ranges from 180 to 60 g/sq. m depending on soil water. Major differences in vegetation structure occur in saltgrass meadows dominated by Distichlis stricta and Sporobolus asper, and on floodplains where the shrub Atriplex canescens is an important component.

CPER has been the site of major projects and programs of research. Large volumes of US-IBP Grassland Biome data concerning the structure and function of grassland ecosystems and the influence of various stress factors are available.

Current on-site studies include soil, root, and microorganism interactions affecting nutrient transformations; plant-animal interactions; additions, losses, and transformations of nitrogen; atmospheric deposition and gas analysis; above- and below-ground grazing; and long-term meteorological monitoring. Associated studies on other grassland sites include organic matter and nutrient cycling, effects of atmospheric pollutants, soil-plant associations, and plant genetic response to grazing.

Past and current research will provide an important base and source of information for accomplishing our LTER goals. Our core research will emphasize: 1) the relations between the hydrologic cycle and primary production, key microbial responses, plant succession, plant and animal population dynamics, and organic matter aggregation or degradation; 2) the nature of the erosion cycle and its influence on redistribution of matter, nutrients, and pedogenic processes; and 3) the influence of atmospheric gases, aerosols, and particulates on primary production and nutrient cycles.

FACILITIES:
- Main building (214 sq. m) with office, laboratories, dining/meeting room, and kitchen
- Storage/sample-processing building (134 sq. m) with facilities for washing and drying samples
- Dormitory with six rooms; five capable of double occupancy and one with four beds
- Large-animal handling and holding pens
- Residence for site manager

LOCATION: 50 km east of Ft. Collins, CO adjacent to Pawnee National Grassland.
- latitude: 40 ° 49'N
- longitude: 104 ° 46'W
- elevation: 1,650 m

ADDRESSES:

Principal Investigator:
Dr. William K. Lauenroth
Department of Range Science and
Natural Resource Ecology Laboratory
Colorado State University
Fort Collins, CO 80523
(303) 491-7581

INVESTIGATORS:

John Capinera	- Entomology
Vernon Cole	- Organic matter - belowground processes
David Coleman	- Organic matter - belowground processes
James Detling	- Plant ecophysiology
Robert Heil	- Soils
William Hunt	- Systems ecology
George Innis	- Systems analysis
Thomas Kirchner	- Systems ecology, data management
Donald Klein	- Microbiology
William Lauenroth	- Plant ecology
William Laycock	- Range management
Daniel Milchunas	- Plant ecology
William Parton	- Meteorology
Larry Rittenhouse	- Ruminant nutrition
Ron Ryder	- Ornithology
Marvin Shoop	- Range managment
Robert Woodmansee	- Soils, plant ecology

COWEETA HYDROLOGIC LABORATORY LTER SITE

SITE NAME: Coweeta Hydrologic Laboratory

INSTITUTIONAL AFFLIATION: University of Georgia
U. S. Forest Service
Southeastern Forest Experimental Station

LTER RESEARCH TOPICS:
- Long-term dynamics of forest ecosystems
- Ecosystem response to perturbation
- Input-output elemental dynamics in forested ecosystems
- Land-stream interactions
- Nitrogen dynamics in decomposition processes
- Consumer regulations of ecosystem processes

PRINCIPAL BIOME: Deciduous forest

MAIN COMMUNITIES:
- Eastern deciduous forest
- White pine plantations

EXISTING DATA BASES:
- Climatology
- Hydrology
- Water and sediment chemistry
- Throughfall and lysimeter chemistry
- Vegetation, leaf litter inputs, standing crops, and decay rates.
- Gaseous nitrogen transformations
- Soil and canopy consumers
- Aquatic fauna
- Organic and inorganic seston
- Primary aquatic production
- Allochthonous and autochtonous inputs
- Aquatic decomposition and nutrient spiraling

CLIMATE SYNOPSIS:

Average precipitation is 180 cm per year and is well distributed seasonally. Snow typically contributes less than 2%. Average annual temperature is 13° C with a 20 °C growing season temperature.

NARRATIVE:

The Coweeta Hydrologic Laboratory is located in mountainous terrain which supports moist stands of eastern deciduous forest. The lab has been a United State Department of Agriculture Forest Service research site for 50 years and is one of the oldest, continuously operating research projects of its type in the world. The lab has participated in numerous international programs and has served as a site for interdisciplinary ecosystem research in cooperation with scientists from many universities and other agencies. Our major focus is to develop information on the long-term dynamics of forested ecosystems. Research is concentrated at the ecosystem-process level in terrestrial and stream studies. Objectives are documenting: 1) long-term trends in ecosystem responses; 2) responses to anthropogenic influences; 3) long-term changes in input-output nutrient dynamics; and 4) process-level changes during ecological succession.

FACILITIES:

On-site laboratories for climate measurement, hydrology, water chemistry, and related analyses. Limited space for visiting investigators. At the University of Georgia, laboratory space and equipment are available in the 25,000 sq. ft. ecology building.

LOCATION: The Coweeta Basin is located in the Nantahala Mountains, part of the Blue Ridge province of the southern Appalachian mountains. The site is 17 km south of Franklin, North Carolina.

latitude: 35 ° N
longitude: 83 ° 30' W
elevation: 679 to 1,592 m

ADDRESSES:

Principal Investigator:
Dr. D. A. Crossley, Jr.
Institute of Ecology
University of Georgia
Athens, GA 30602
(404) 542-7832

Site Director:
Dr. Wayne T. Swank
Southeastern Forest Experimental Station
Coweeta Hydrologic Laboratory
Route 1, Box 216
Otto, NC 28763
(704) 524-2128

INVESTIGATORS:

Cory W. Berish	- Tree-ring analysis and root studies
Lindsay R. Boring	- Forest succession and nutrient dynamics
D. A. Crossley, Jr.	- Consumers, decomposition
John Fitzgerald	- Sulfur dynamics
Clayton S. Gist	- Consumers
Willard H. Grant	- Geology
Bruce L. Haines	- Nutrient cycling
Judy L. Meyer	- Stream processes
William H. Murdy	- Vegetation processes
George R. Parker	- Vegetation processes
Donald L. Phillips	- Stand dynamics
J. Dan Pittillo	- Vegetation inventory
H. L. Ragsdale	- Vegetation and nutrient dynamics
Wayne T. Swank	- Hydrology, input-output dynamics
J. Bruce Wallace	- Stream proceeses
Jackson R. Webster	- Stream processes

CENTRAL PLAINS EXPERIMENTAL RANGE LTER SITE
(see pages 6-7)

COWEETA HYDROLOGIC LABORATORY LTER SITE
(see pages 8-9)

ILLINOIS AND MISSISSIPPI RIVERS LTER SITE
(see pages 12-13)

JORNADA LTER SITE (see pages 14-15)

ILLINOIS AND MISSISSIPPI RIVERS LTER SITE

SITE NAME: Illinois River and Upper Mississippi River (Large River)

INSTITUTIONAL AFFILIATION: Illinois Department of Energy and Natural Resources
- Natural History Survey, Water Survey, and Geological Survey Divisions

Western Illinois University
- Department of Biological Sciences

LTER RESEARCH TOPICS:
- Succession and perturbation
- Water, sediment, and nutrient budgets in habitat compartments
- Relationships between community structure and geomorphic structure and hydrologic regime
- Sources, sinks, distribution, and processing of organic matter

PRINCIPAL BIOME: Temperate freshwater

MAIN COMMUNITIES:
- Freshwater marsh
- Northern floodplain forest
- Off-shore and mud-bottom benthos
- Submergent and floating aquatic plant beds
- Phytoplankton, zooplankton
- Firm substrate community in swift current

EXISTING DATA BASES:
- Hydrology, weather, and water quality
- "Benchmark" data from 1900 on fishes, plankton, and benthos from the Illinois River
- Annual surveys of fishes and waterfowl
- Commercial fishing statistics
- Recent surveys of aquatic and floodplain vegetation
- Sediment characteristics and sedimentation rates
- LTER core data since 1982

CLIMATE SYNOPSIS:

Continental climate with summer maxima averaging just under 38 ° C and winter minima about -23 ° C. Annual precipitation averages 89 cm and varies from 58 to 122 cm. More than half the average annual precipitation occurs during the growing season with 70 to 80% from thunderstorms. Annual snowfall averages 64 cm. The rivers generally freeze over during December and January.

NARRATIVE:

The Natural History Survey began ecological research on the Illinois River and its backwaters and floodplain in 1876 and since the 1940s has participated in studies of the Upper Mississippi River. Today, the broad objectives of the long-term inter-institutional research supported by NSF are: 1) to explain the basis and controls of productivity in large floodplain rivers; 2) to determine temporal and spatial patterns of nutrient inputs, losses, and utilization; 3) to examine effects of natural and man-made perturbations, including droughts, floods, navigational dams, barges, and contaminants, on key species and processes; and 4) to define relationships between community structure and hydrology and geomorphology. Specific research approaches include: 1) reconstruction of historical and pre-historical disturbances, using cores from sediments and old trees; 2) sampling and modeling of populations of key producers and consumers; 3) sampling and modeling of water, sediment, and carbon flows in habitat compartments; and 4) analyses of successional patterns in natural floodplain lakes and navigational pools.

Three field stations are located in or near three reaches of the rivers selected for long-term study. The Alice Kibbe Life Science Station of Western Illinois University is on a limestone bluff overlooking the Mississippi River near Keokuk Pool, the oldest impoundment on the Mississippi. The second study reach will include the newest impounded reach on the Mississippi, when new dam no. 26 is completed in 1987, just upstream from St. Louis. This site is easily accessible from the Natural History Survey Laboratory at Grafton. The third site, the middle reach of the Illinois, includes a natural mainstem lake at Peoria and the Chautauqua National Wildlife Refuge at Havana, where a Natural History Survey Laboratory has been located since 1939.

FACILITIES:

Laboratory and office space can be made available at the two river research laboratories, located at Havana and Grafton, Illinois, on the Illinois River. The Alice Kibbe Life Science Station is located near Warsaw, Illinois, on Pool 20 of the Mississippi River. Laboratory and office space is limited during the summer teaching session but can be made available at other times.

LOCATION:

	Latitude	Longitude	Elevation
Pool 19, Mississippi River	40 ° 30' N	91 ° 21' W	163 m
Pool 26, Mississippi and Illinois Rivers	38 ° 59' N	90 ° 30' W	127 m
Peoria Lake, Illinois River	40 ° 51' N	89 ° 31' W	134 m

ADDRESSES:

Principal Investigator and Peoria Lake Site Director:
Dr. Richard E. Sparks
Illinois Natural History Survey
River Research Laboratory
Box 599
Havana, IL 62644
(309) 543-3950 and 543-3105

Pool 26 Site Director:
Dr. Kenneth S. Lubinski
Illinois Natural History Survey
Pool 26 River Research Lab.
R.R.1, Box 221
Grafton, IL 62037
(618) 786-3317

Pool 19 Site Director:
Dr. Richard V. Anderson
Biological Sciences, 322 Waggoner Hall
Western Illinois University
Macomb, IL 61455
(309) 298-1553 and 298-1546

INVESTIGATORS:

Rodger Adams	- Sediment transport
Richard Anderson	- Fresh water ecology, invertebrate ecology
Nani Bhowmik	- Fluvial geomorphology, hydrodynamics
Frank Brookfield	- Data management
Richard Cahill	- Chemistry, radioisotope dating
Misganaw Demissie	- Civil engineering, hydraulics
Robert Gorden	- Ecosystems, energy flow, microbial ecology
David Gross	- Fluvial geomorphology, geology, paleoecology
James King	- Palynology, paleoecology
Kenneth Lubinski	- Pollution and fisheries ecology, aquatic toxicology
Paul Risser	- Ecosystems
Richard Sparks	- River ecology, pollution ecology
Wayne Wendland	- Meteorology, climate, tree rings, archaeology
Michael Wiley	- Systems modeling, population dynamics, competition

JORNADA LTER SITE

SITE NAME: Jornada, consisting of Jornada Experimental Range and New Mexico State University Ranch

INSTITUTIONAL AFFILIATION: New Mexico State University

LTER RESEARCH TOPICS: Factors limiting primary production
Experimental applications of nitrogen
Lysimeter studies
Effects of autocorrelated variables
Vertebrate and invertebrate populations

PRINCIPAL BIOME: Desert

MAIN COMMUNITES: Playa grassland
Swale shrubland
Basin grassland
Bajada shrubland
Piedmont grassland
Mountain shrubland

EXISTING DATA BASES:
Class A weather records since 1915 supplemented by site-specific records
Data sets of varying detail and time periods on vegetation, mammals, ants, termites, decomposition, shrub associated insects, reptiles, amphibians, and physical and chemical properties of soil

CLIMATE SYNOPSIS:
Climate is characterized by abundance of sunshine, wide range between day and night temperatures, low relative humidity, evaporation rate averaging 229 cm per year, and variable precipitation. Average maximum temperature in June is 36 ° C; the average minimum is 3.3 ° C in January. Summer precipitation occurs as intense, convective thunderstorms that are localized and of short duration. The average annual precipitation is 230 mm with 52% occuring between July 1 and September 30. Five severe droughts have occurred during the past 100 years.

NARRATIVE:
The Jornada LTER focus is on questions dealing with temporal and spatial variability in desert ecosystems. We hypothesize that system responses to fluctuations in climatic conditions differ on various parts of a desert watershed because of spatial patterns of run-off and infiltration and available nutrients. System components and system processes are expected to respond with time-lags that are a function of life history characteristics or physiological attributes of the component populations.

To provide the data necessary to meet the objectives of the LTER program and to test the hypothesis concerning spatial and temporal patterns, we have installed two parallel 2,700-m transects with sampling stations at 30-m intervals. Because earlier work showed that variation in primary production is not predictable from rainfall and because other studies implicated nitrogen as a controlling factor, we fertilized one transect with ammonium nitrate. Data collection frequency varies with data type. Maximum and minimum air temperatures and rainfall at each station are recorded weekly. Vegetation is monitored by a photographic technique at 2-week intervals. Other data sets collected at 2-week

intervals include soil moisture (neutron probe), ants, and termites. The frequency of sampling of decomposition rates, vertebrates, soil fauna, soil nitrogen, etc., varies depending upon the season and nature of the process or organism being sampled.

Addditional studies designed to examine responses of the system to supplementary water and nutrients are being conducted in three of the vegetation types on the watershed: Bouteloua eriopoda grassland, Larrea tridentata shrub assemblage, and annual-perennial herbaceous plant zone. Parameters measured in these studies include vegetation composition, productivity and phenology, decomposition, and soil nitrogen. Large and small lysimeters are providing data on water and nutrient movement in desert soils.

The Jornada LTER site encompasses the watershed on which the US/IBP Jornada Validation site was located. Intensive ecological work on the playa (dry lakes) and surrounding area was initiated in 1970, and an upland area in the creosotebush assemblage was added in 1971. There has been a continuous series of research projects conducted on the watershed since those dates. The LTER watershed of approximately 580 ha that is excluded from grazing is only a small part of the 104,166-ha USDA Jornada Experimental Range - New Mexico State University Ranch rangeland research complex. Research publications dealing with land, water, and vegetation resources, grazing, range management, animal science, and ecology of range species have appeared regularly since 1900 and form the basis of a long-term record.

FACILITIES:
The proximity to Las Cruces (less than a 30-minute drive) makes living quarters on the Jornada unnecessary. Visiting investigators often choose to camp at the base of the mountains; camping is pleasant much of the year. Laboratory equipment and space are available on a permission-share basis on the campus at NMSU. The site director and coordinating investigator should be contacted to arrange for use of these facilities.

LOCATION: 40 km north of Las Cruces, New Mexico.
latitude: 32 ° 30' N
longitude: 106 ° 45' W
elevation: 1,318 to 1,501 m

ADDRESSES:
Principal Investigator and Site Director:
Dr. Walter G. Whitford
Department of Biology
New Mexico State University
Las Cruces, NM 88003
(505) 646-3921

INVESTIGATORS:

Marsha Conley	- Animal ecology and data synthesis
Walt Conley	- Vertebrate ecology
Gary Cunningham	- Plant physiological ecology
Fred Fisher	- Biogeochemistry
Steve Loring	- Soil arthropds and arthropod ecology
John Ludwig	- Plant ecology
William McKay	- Social insects and desert ecosystems
Walt Whitford	- Nutrient dynamics and desert ecosystems
Petrus Wierenga	- Soils physics
John Zak	- Mycological ecology

KONZA PRAIRIE RESEARCH NATURAL AREA LTER SITE

SITE NAME: Konza Prairie Research Natural Area (KPRNA)

INSTITUTIONAL AFFILIATION: Kansas State University

LTER RESEARCH TOPICS: Role of fire, grazing, precipitation, and drought in a tallgrass prairie ecosystem

PRINCIPAL BIOME: Tallgrass prairie

MAIN COMMUNITIES: Tallgrass prairie
Gallery forest
Prairie stream

EXISTING DATA BASES:
Vegetation analyses from 1971
U.S. Geological Survey hydrological record from 1979
LTER core measurements from 1981

CLIMATE SYNOPSIS:
Temperate mid-continental climate. Yearly mean temperature is 13 ° C with a range of extremes from 6 ° C to 19 ° C. The January mean temperature is -3 ° C (range -9 ° C to 3 ° C) and the July mean is 27 ° C (range 27 ° C to 33 ° C). Annual precipitation is 835 mm of which 21 mm falls in July and 101 mm falls in January. Mean snowfall for January is 150 mm with an annual total of 521 mm. Mean annual wind speed is 11 mph from the south.

NARRATIVE:
Tallgrass or bluestem prairie, a major ecosystem type, once covered up to 6.8% of the conterminous United States (exceeded only by eastern deciduous forest). Undisturbed examples of this ecosystem are rare because the prairie has been extensively converted to agricultural crop production.

Konza Prairie Research Natural Area (KPRNA) is representative of the Flint Hills, a dissected upland with hard chert- and flint-bearing limestone layers, resulting in steep-sided hills on which are exposed Permian limestone and shale layers. The ridges are characteristically flat, with shallow, rocky soils. The larger and wider valleys have deep permeable soils.

When acquired in the 1970s, the majority of KPRNA was exclusively dominated by vigorous native prairie species. Lowland areas with deep soils now have patches of these tall grasses that grow to 3 m by late summer. Gallery forests on Lower Kings Creek are dominated by chinquapin oak and bur oak. Green ash, hackberry, elm, sycamore, and walnut are other frequent species. The KSU herbarium contains more than 400 species collected from KPRNA. Woody plants have been mapped according to species and size on some portions of the Natural Area.

Konza Prairie is managed to approximate the condition of the presettlement ecosystem in order to provide for research that will compare natural with manipulated systems, account for the stability over geologic time of this important ecosystem, evaluate productivity and interactions of various components of the system, and evaluate the influences of the interval between fires and grazing by native ungulates.

Fire, started both by lightning and American Indians, influenced the nature of the presettlement prairie. Beginning in 1972, a number of burning treatments have been applied in order to approximate presettlement burning conditions and to investigate the effects of fire. Prescribed major burns are set when the warm-season dominant grasses begin active

growth. Small burns are done at other seasons. Part of the long-term research objective is to determine which of these treatments yields a condition that can be called "control" or "reference". The treatment boundaries follow watershed divides, thus facilitating the study of hydrologic and nutrient responses to treatments. The burning treatments involve the season of burning, the interval between burns, and burning in reference to annual rainfall.

FACILITIES:
The proximity of Konza Prairie to the city of Manhattan and Kansas State University campus reduces the need for on-site facilities. Even so, the on-site facilities are presently good and potentially excellent. Some rough lab space can be made available on the site, but finished space awaits renovation. Living accomodations are limited and, as a rule, are not available on the site.

LOCATION: 10 km south of Manhattan, Kansas.
latitude: 39 ° 05' N
longitude: 96 ° 35' W
elevation: 366 m

ADRESSESS:

Principal Investigator:
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Division of Biology
Kansas State University
Manhattan, KS 66506
(913) 532-6643

Site Director:
Dr. Lloyd C. Hulbert
Konza Prairie Research Natural Area
Division of Biology
Kansas State University
Manhattan, KS 66506
(913) 532-6620

INVESTIGATORS:

Marc Abrams	- Plant ecology
Ted Barkley	- Plant systematics, Great Plains flora
Ted Evans	- Insect ecology
Elmer Finck	- Vertebrate ecology
Joe Gelroth	- Site manager
Frank Gilliam	- Soil chemistry, plant ecology
Marty Gurtz	- Stream ecology, aquatic entomology
Lloyd Hulbert	- Fire in prairie vegetation regulation and soil
Don Kaufman	- Mammalian population ecology
Alan Knapp	- Plant ecology
Dick Marzolf	- Stream ecology, reservoir limnology
Tim Seastedt	- Nutrient cycling, soil invertebrates
John Zimmermen	- Avian population ecology

NIWOT RIDGE / GREEN LAKES VALLEY LTER SITE

SITE NAME: Niwot Ridge and Green Lakes Valley

INSTITUTIONAL AFFILIATION: University of Colorado
-Institute of Arctic and Alpine Research

LTER RESEARCH TOPICS: Climate, Water and soils
Paleoecology, Treeline
Communities, Ecophysiology, Recovery
Mammals, Aquatic communities, Aquatic invertebrates
Lake productivity

PRINCIPAL BIOMES: Alpine tundra
Subalpine forest

MAIN COMMUNITIES: Alpine tundra
Spruce-fir, lodgepole pine, and aspen forests
Glacial lakes and streams

EXISTING DATA BASES:
Climate data from 2,200, 2,600, 3,048, and 3,750 m (since 1952)
Climate data from intermediate and special sites (few years)
Lake bathymetry, physical and chemical property surveys, pollen analyses
Primary production at 3,500 m (three years)
Floral survey, voucher collections, aerial photographs
Environmental atlas of the area
Atmosphere chemistry, wet- and dry-fall precipitation chemistry
Extensive literature dealing with many aspects of geoecological studies

CLIMATE SYNOPSIS:
High elevation, mid-continental climate with cold, wet winters and cool, dry summers. Yearly mean temperature is 1 ° C (3,048 m) and -4 ° C (3,750 m). At 3,048 m, the January mean temperature is -13.2 ° C and the July mean is 8.5 ° C with a range of extremes from -37 ° C to 19 ° C. Eighty percent of the 102 cm of precipitation falls as snow from September to May. Lakes are frozen from October to May. Mean annual wind speed is 10.3 m/sec.

NARRATIVE:
The study site is easily reached from the Mountain Research Station (MRS), a field research and teaching facility administered by the University of Colorado's Institute of Arctic and Alpine Research (INSTAAR). MRS is surrounded by protected lands including the Indian Peaks Wilderness Area, City of Boulder Watershed, and Roosevelt National Forest. The main research area is Niwot Ridge which is located in the Roosevelt National Forest and has been designated as an Experimental Ecological Reserve and as a Biosphere Reserve. Researchers may work in the Green Lakes Valley, an area completely closed to the public, by special agreement with the City of Boulder. The Niwot Ridge / Green Lakes Valley area features a variety of glacial and periglacial landforms (including glaciers, glacial lakes, talus slopes, patterned ground, and permafrost), alpine and subalpine plant communities, and animals (including trout, ptarmigans, pikas, marmots, elk, deer, bears, and coyotes).

The University of Colorado LTER (CULTER) program seeks to integrate its studies with a perspective of the past provided by paleoenvironmental studies. CULTER researchers believe that current plant and animal communities are not in equilibrium with the climate but lag behind due to directional changes in the climate since the end of glaciation. It is hypothesized that moderate disturbances of the environment will hasten community development to conditions that are in equilibrium with the current environment. Historical and baseline data are being collected to determine the time frame for changes in the alpine

region. Pollution levels and disturbances are being monitored to provide comparative information for the future, because expansion of the Denver megalopolis and development of the Colorado energy industry will bring dramatic changes to this region. Short- and long-term studies on other components of the tundra system will provide pieces to the ecosystem puzzle. CULTER plans to develop management guidelines for the study area and the surrounding mountain regions through its current studies.

FACILITIES:
Research building with wet and dry laboratories supplied with gas and air, soils room, darkroom, herbarium, library, and classroom
Microcomputers, plotters, digitizer
Small research buildings on the tundra
One-room classroom building
Summer dining hall
Shower and laundry facilities
24 summer cabins, 14 winter cabins
Snowmobiles, snowplows, bulldozers, and other support equipment
Plumbing, electrical, and woodshops, and garage

LOCATION: 45 km northwest of Boulder; 85 km from Denver, Colorado.
latitude: 40 ° 03' N
longitude: 105 ° 37' W
elevation: 2,900 to 4,060 m

ADDRESSES:

Principal Investigator:
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Coordinating Investigator:
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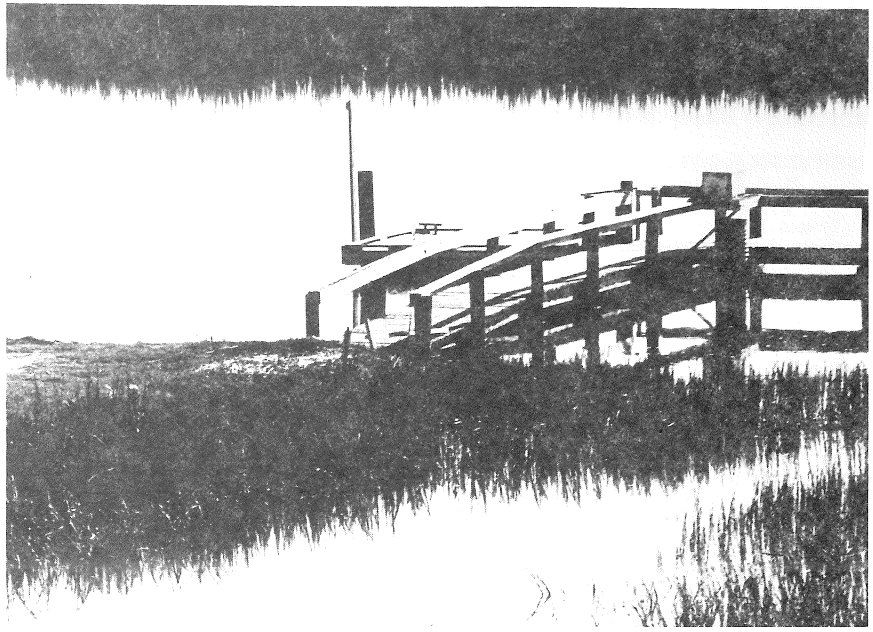
Mountain Research Station
University of Colorado
Nederland, CO 80466
(303) 492-8841
(303) 492-6241

INVESTIGATORS:

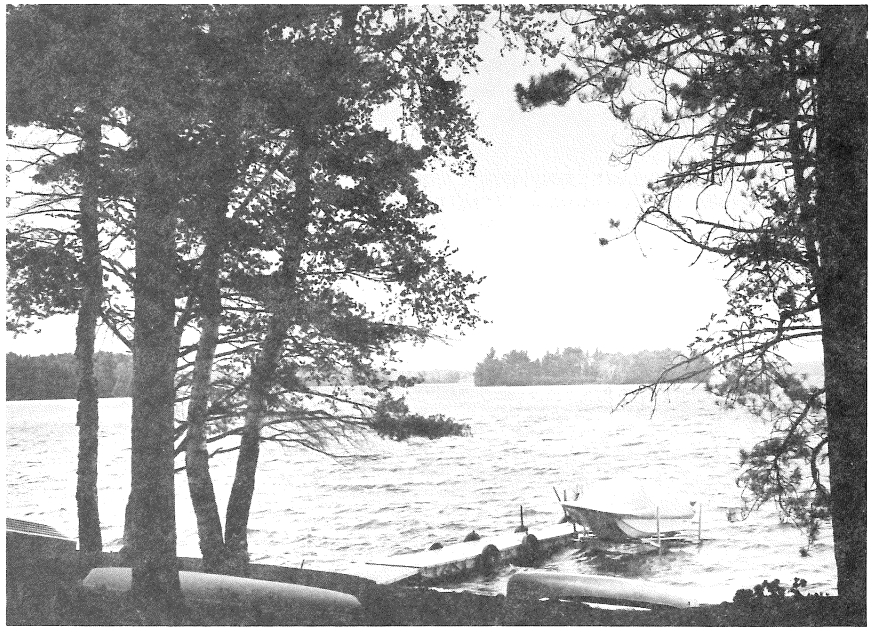
John Andrews	- Paleoecology
Roger Barry	- Climate
Erik Bonde	- Ecophysiology
Peter Birkeland	- Water, soils
Charles Brendecke	- Water, soils
Bill Briggs	- Paleoecology
John Bushnell	- Aquatic invertebrates
Nel Caine	- Water, soils
Scott Elias	- Paleoecology
JoAnn Flock	- Ecophysiology
David Greenland	- Climate
Kathy Hansen-Bristow	- Treeline
Jim Halfpenny	- Consumers, mammals
Jack Ives	- Treeline
Vera Komarkova	- Disturbances, data management
Vera Margraf	- Paleoclimatology
Harvey Nichols	- Paleoecology
Susan Short	- Paleoecology
Sam Shushan	- Ecophysiology
Chuck Southwick	- Consumers, mammals
Dale Toetz	- Lake productivity
Mike Thurman	- Water, soils
Pat Webber	- Communities
Jay Windell	- Consumers, aquatic communities

KONZA PRAIRIE RESEARCH NATURAL AREA LTER SITE (see pages 16-17)

NIWOT RIDGE / GREEN LAKES VALLEY LTER SITE (see pages 18-19)



NORTH INLET LTER SITE (see pages 22-23)



NORTHERN LAKES LTER SITE (see pages 24-25)

NORTH INLET MARSH-ESTUARINE SYSTEM LTER SITE

SITE NAME: North Inlet (Hobcaw Barony)

INSTITUTIONAL AFFILIATION: University of South Carolina
-Belle W. Baruch Institute for
Marine Biology and Coastal Research

LTER RESEARCH TOPICS: Patterns and control of primary production
Dynamics of selected populations
Organic accumulation
Patterns of inorganic contributions
Patterns of site disturbances

PRINCIPAL BIOME: Coastal marine

MAIN COMMUNITIES: Salt marsh
Estuarine benthic
Intertidal
Barrier island
Open beach
Inshore oceanic

EXISTING DATA BASES:
- Climatic data (five years) and meteorologic data (two years)
- Daily water samples - nutrient and physical measurements (six years)
- Meiofauna sampling (twelve years)
- Subtidal biological population data (three years)
- Primary production data (three years)

CLIMATE SYNOPSIS:
Maritime influenced climate. Typical yearly air temperature ranges from -4 ° C to 36 ° C; water temperature ranges from 3 ° C to 33 ° C. Rainfall averages 115 cm per year. Rare ice/snow.

NARRATIVE:
Hobcaw Barony is a 17,500 acre (7,085 ha) tract of forest located near Georgetown, South Carolina. The property was set aside in perpetuity for the study of marine biology, forestry, and wildlife through the will of Belle W. Baruch. The LTER study site at North Inlet represents one of the most pristine marsh estuaries on the east coast. Interdisciplinary research programs at the Belle W. Baruch Institute for Marine Biology and Coastal Research of the University of South Carolina add to our basic and applied knowledge of both the commercial and ecological values of the coastal zone.

The primary research area is a 2,630 ha high-salinity marsh which is separated from the Atlantic Ocean by sandy barrier islands and bordered on the west by loblolly and longleaf pine forests. Tidal amplitudes are on the order of 2 m and the seasonal water temperature range is 3 ° C to 33 ° C. Wetland habitats include exposed and sheltered sandy beaches; intertidal mudflats and oyster beds; submerged algae beds; sand, shell, and mud benthic habitat; rock jetty; and bird rookery islands. More than 1,200 ha of brackish and fresh water marshes border the Winyah Bay side of Hobcaw Barony.

The LTER program involves 16 principal investigators who are concerned with biological, chemical, and physical components of the North Inlet Estuarine-Marshland Ecosystem. The LTER Population Dynamics program examines the abundance, distribution, and life history patterns of zooplankton, motile epibenthos, benthic macrofauna, meiofauna, and fishes.

Primary production rates for Spartina grasses and phytoplankton are determined on a regular basis. Water columns and interstitial water collections are analyzed for inorganic and organic constituents. Physical measurements of the water columns and weather are constantly monitored. Full-time LTER technicians and three principal investigators are located at the field laboratory. Visiting investigators are encouraged to meet with the staff and examine the data base.

The Baruch Institute has published more than 520 papers and books on studies conducted in North Inlet over the past 15 years. The Belle W. Baruch Library in Marine Sciences, a publication by the University of South Carolina Press, consists of symposia publications related to coastal marine subjects; twelve volumes have been published.

FACILITIES:
- Two research buildings (14,000 sq. ft.) with 18 laboratory rooms; running sea water available in each building
- Aquarium building (1,600 sq. ft.) with various sized aquaria and running sea water
- Dormitories with cooking facilities can accommodate approximately 75 persons
- Kimbel Meeting Lodge (2,450 sq. ft.) with seating capacity of 100 persons; kitchen facilities present
- Boats and general field collecting gear are available; general laboratory equipment is available by contacting the Director
- Computer center

LOCATION: 1.6 km north of Georgetown, South Carolina on US 17.
latitude: 33 ° 30' N
longitude: 79 ° 13' W
elevation: 2 m above sea level

ADDRESSES:

Principal Investigator:	Site Director:
Dr. F. John Vernberg	Dr. Dennis M. Allen
Baruch Institute	Marine Field Laboratory
University of South Carolina	P.O. Box 1630
Columbia, SC 29208	Georgetown, SC 29208
(803) 777-5288	(803) 546-3623

INVESTIGATORS:

Dennis M. Allen	- Secondary production, invertebrates
Elizabeth Blood	- Site coordinator, nutrient dynamics
Bruce C. Coull	- Meiofauna, population dynamics
Richard F. Dame	- Primary production, vascular plants
John M. Dean	- Fish populations, secondary production
Donald G. Edwards	- Statistical evaluation
Robert J. Feller	- Population dynamics, secondary production
Leonard R. Gardner	- Geochemistry, primary production
Bjorn J. Kjerfve	- Physical oceanography
Henry N. McKeller	- Nutrient modeling
James Morris	- Primary production, photosynthesis, respiration
Douglas D. Nelson	- Sediments
Stephen E. Stancyk	- Zooplankton
F. John Vernberg	- Physiological ecology
Thomas Wolaver	- Nutrient dynamics
Richard G. Zingmark	- Primary production, algae

NORTHERN LAKES LTER SITE

SITE NAME: Northern Lakes (Trout Lake Biological Station)

INSTITUTIONAL AFFILIATION: University of Wisconsin (Madison)

LTER RESEARCH TOPICS: Groundwater hydrology and geochemistry
Paleolimnology
Physical and chemical limnology
Producer and consumer ecology

PRINCIPAL BIOMES: Northern temperate lakes
Mixed conifer-deciduous forest

MAIN COMMUNITIES: Oligotrophic, dystrophic, eutrophic lakes
Temporary forest ponds
Warm and cold streams
Sphagnum-leatherleaf bog
Conifer swamp
Aspen-birch forest
Red oak-sugar maple forest
Jackpine forest
Red pine-white pine forest

EXISTING DATA BASES:

Historical data (1924-1942) on the chemistry, flora, and fauna of the lakes

Survey of all lakes by Department of Natural Resources (1960-62), including physical and chemical parameters

Lake Mendota data base (1890s to present) including five years of primary productivity data (1976-1980)

Climatological data as early as 1890s from five stations within 45 km (including NADP site 5 km from station)

Wisconsin Department of Natural Resources Five-Lake Project fish population data (1954 to present)

Land use, cover photography, and maps from 1931, 1955, 1968, 1979

CLIMATE SYNOPSIS:

Continental climate with an average annual temperature of less than 5 ° C. Mean monthly max/min temperatures range from -17/-6 ° C (January) to 26/13 ° C (August). The area receives approximately 76 cm of precipitation, about 30% of which falls in the spring. Snow cover averages 127-152 cm for about 120 days each year. Lakes are ice covered from late November to late April.

NARRATIVE:

The Northern Highlands Lake District includes all of Vilas and parts of Iron, Price, and Oneida Counties in Wisconsin and Gogebic County in Michigan. This area encompasses 10,000 sq. km and contains thousands of lakes. Within a 10-km radius of the biological station at Trout Lake, there are 68 named lakes, 28 unnamed lakes, and 60 km of stream length. Vilas County lakes range in pH from 4.5 to 9.3 and in alkalinity from 0 to 2,400 microequivalents/ liter. This area has one of the largest concentrations of lakes in the world, comparable only to a complex on the Minnesota-Ontario border and to areas within Canada and Finland.

The diversity of lakes in the region provides an excellent opportunity for research. From 1924 to 1942, Birge, Juday, and their co-workers collected massive amounts of data on the regional lakes and laid the groundwork for the study of comparative limnology in North America. Their work gives a unique opportunity to assess long-term

changes in lake ecosystems. We have designed a research program that will allow us to use efficiently the data collected more than 50 years ago and at the same time provide information that will be invaluable to researchers 50 years in the future.

Our major goals are to establish a data collection, management, and analysis system that will: 1) detect long-term changes in the physical, chemical, and biotic features of lakes; 2) help us understand the linkages among climate, hydrology, biology, and water and soil chemistry; 3) detect lake features which enhance stability and resiliency to natural and anthropogenic disturbances.

The combination of the regional abundance of lakes, the historic data base, and the current research provides an invaluable setting for shorter-term research projects. We, at the Northern Lakes portion of LTER, welcome researchers to take advantage of the research opportunities at the Trout Lake Biological Station.

FACILITIES:

The all-season laboratory is a two-story structure located about 35 m from the shore of Trout Lake. Facilities include a chemistry and five research laboratories equipped with gas, natural and heated well water, Trout Lake water, compressed air, and electricity. Two animal rooms contain the usual laboratory utilities, as well as direct sources of epilimnetic and hypolimnetic lake water. The Station houses a microcomputer facility. Specialized research analytical equipment, such as a liquid scintillation counter, inverted microscope, and primary production incubation tanks, is available by special arrangement. Boats, a library-conference room, and workshop also are available for visitor use.

A modern year-round house can accomodate up to 12 researchers. During the summer, an additional 15 scientists can stay in seasonal housing on Station Grounds or nearby in space rented by the University.

LOCATION: 320 km north of Madison, Wisconsin.
latitude: 46 ° 00' N
longitude: 89 ° 40' W
elevation: 500 m

ADDRESSES:

Coordinating Investigator:
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Laboratory of Limnology
University of Wisconsin
Madison, WI 53706
(608) 262-2840

Site Director:
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Route 1, Box 76
Boulder Junction, WI 54512
(717) 385-2750

INVESTIGATORS:

Michael S. Adams - Macrophytes, paleolimnology
Mary Anderson - Hydrogeology
David Armstrong - Chemical limnology
Carl Bowser - Geochemistry
Thomas D. Brock - Microbial ecology
Thomas Frost - Zooplankton
Timothy Kratz - Wetland ecology, paleolimnology
John T. Magnuson - Consumer ecology
Robert Ragotzkie - Physical limnology

OKEFENOKEE NATIONAL WILDLIFE REFUGE LTER SITE

SITE NAME: Okefenokee National Wildlife Refuge

INSTITUTIONAL AFFILIATION: University of Georgia
U. S. Fish and Wildlife Service

LTER RESEARCH TOPICS: Successional dynamics
Lignocellulose degradation
Food webs
Effects of drought, fire, and human disturbance on the above

PRINCIPAL BIOME: Freshwater wetland

MAIN COMMUNITIES: Blackwater lakes and streams
Aquatic macrophyte marsh
Grass-sedge marsh
Shrub, cypress, gum, bay, and mixed swamps
Southern pine flatwoods

EXISTING DATA BASES:
Meteorological and water level data from 1950
River outflow
Aerial photography from 1941 and vegetation map
Nutrient input/output, hydrology, and methane flux
Breeding bird habitat and white ibis nutrient contribution
Invertebrate populations and biomass
Vertebrate populations, biomass, and trophic relations
Dendrochronological data
Emergent aquatic vegetation
Water chemistry

CLIMATE SYNOPSIS:
Warm temperate-subtropical climate with mild, wet winters; hot, wet summers; and dry autumns. Precipitation is 100 to 150 cm/year. Mean temperature in January is 11.7 ° C and in July is 27.1 ° C.

NARRATIVE:
The Okefenokee Swamp, located in southeastern Georgia and northern Florida, is one of the largest freshwater wetland complexes in the United States. The swamp watershed occupies 3,826 sq. km of which 1,775 sq. km (44%) is swamp proper. Because impermeable Miocene and Pliocene deposits immediately beneath the swamp inhibit vertical seepage, the swamp is above the regional water table and can be considered a perched watershed.

The Okefenokee is a spatially and temporally heterogeneous system fluctuating in response to variability of water balance, hydroperiod, and catastrophic disturbances. Spatial heterogeneity provides a number of wetland types for study. Swamp forests of large trees and shrubs, shrub thickets, marshes with grasses, sedges, and aquatic macrophytes are the most extensive habitats within the swamp. Vegetation has been classified into the following categories: islands - 8% (pine and flatwoods), marsh - 21%, shrub swamp - 34%, black gum and bay forests - 6%, and mixed cypress forest - 23% (cypress, bay, and black gum species).

Throughout history, disturbances have played a vital role in forming and maintaining the swamp's complexity. Natural phenomena such as drought, fire, and hydroperiod are important to swamp dynamics. Human intrusions such as boat trails and canals, lumbering, sill construction, and channelization have resulted in perturbations with potentially important ramifications for management.

Three general hypotheses currently motivate our empirical work at the ecosystem level: 1) Okefenokee Swamp is a detritus-based ecosystem in which most of the primary production enters a detrital reservoir composed principally of refractory organic matter, such as lignocellulose, which degrades slowly. The rate of conversion of these refractory organic substances determines the rate of nutrient recycling and organic supply to swamp food webs and the rate of organic matter accumulation in the soil-sediment component of the system. Only a small fraction of unaltered primary production is directly available to non-microbial consumers; 2) Water level is a major factor controlling patterns and rates of productivity, nutrient cycling, trophic dynamics, organic accumulation, succession, and life cycle dynamics within the swamp. Levels fluctuate according to an already documented annual cycle punctuated by periodic droughts and have been modified from historical patterns by construction, channelization, and logging; 3) Fire is also a major controlling factor in the dynamics of the abovementioned processes. A catastrophic destroyer of organisms and their populations in the short term, fire has different effects within the ecosystem over longer time frames. It produces rapid remineralization of organically bound nutrients and, as in other peat-forming wetlands, limits the rate of organic matter accumulation and alters successional pathways. Fire and its concomitants figure heavily in the mosaic distribution of habitats within the Okefenokee. Fire occurrence and intensity are closely correlated to water level.

FACILITIES:
A university trailer at Camp Cornelia can accommodate up to 14 researchers; it has a kitchen, a small laboratory (12' x 12') and limited storage space. Boats, outboard motors, pickup trucks, and field equipment are available for researchers. A U.S. Fish and Wildlife Service log building is available for storage and laboratory space

LOCATION: Camp Cornelia is 18 km south of Folkston, Georgia.
latitude: 30 ° 32' to 31 ° 7'N
longitude: 82 ° 8' to 82 ° 30'W
elevation: 37 m

ADDRESSES:

Principal Investigator:
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Project Manager:
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University of Georgia
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INVESTIGATORS:

M. Craig Barber	- Systems models
Ronald Beaner	- Microbial ecology
George Brook	- Hydrology
Michael J. Duever	- Hydrology, plant ecology
Byron J. Freeman	- Vertebrates, biogeochemistry
John Glasser	- Population ecology
Robert E. Hodson	- Microbial ecology
Jeff Luvall	- Vegetation, evapotranspiration
Jack Meeder	- Geology
Bernard C. Patten	- Ecosystem theory
Chris Trowell	- Archaeology, history

OKEFENOKEE NATIONAL WILDLIFE REFUGE LTER SITE (see pages 26-28)