Long-Term Ecological Research Network Core Data Set Catalog



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LONG-TERM ECOLOGICAL RESEARCH NETWORK

CORE DATA SET CATALOG

Editors

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INTRODUCTION

Long-Term Ecological Research

Long-Term Ecological Research (LTER) is a program sponsored by the National Science Foundation's (NSF) Division of Biotic Systems and Resources (BSR). The program was developed to support research of ecological phenomena that occur on time scales of decades or centuries, periods of time not normally investigated with research support from the National Science Foundation. Long-term trends in natural ecosystems were not being systematically monitored and it was recognized that many ecological experiments are performed without sufficient knowledge of the year-to-year variability in the system.

LTER site-specific research has led to an accumulation of increasingly valuable data sets, revealing pattern and control at several levels of ecosystem organization. LTER investigators have focussed research efforts on five core areas: (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.

Emphasis on data management within LTER and a coordinated network of sites supports comparative analyses and testing of theoretical constructs at long temporal and broad spatial scales. The National Science Foundation and LTER scientists recognize the value of providing an opportunity for other scientists to collaborate on interest-related research, ready access to field sites with long-term availability, and well-documented and accessible records of background and corroborative data. The purpose of this volume is to increase the scientific community's awareness of the numerous multi-disciplinary studies which comprise LTER research.

The studies in this catalog are supported by the National Science Foundation's LTER Program and do *not* represent all research efforts conducted at a site. The LTER studies generally represent only a fraction of the work being conducted at each site.

Use of the LTER Data Catalog

This catalog provides a map and brief description of each LTER site, abstracts and relevant information about ongoing LTER studies at each site, and indices of core areas, subject matter, and investigators. Several of the LTER sites have only recently been supported by the National Science Foundation and are in the process of implementing LTER studies. The on-line version of the catalog, the Principal Investigator(s), or the Data Manager at each site should, therefore, be consulted for updates and information about new studies being implemented.

Names, addresses, telephone and fax numbers, and electronic mail addresses for the Principal Investigator(s) and Data Manager at each LTER site are included with the site descriptions. These individuals can provide information on how to contact specific investigators. Scientists interested in collaborative studies should contact the pertinent investigators at each LTER site.

Each data set page includes data set title, investigator(s), temporal and spatial resolution, an abstract of the study, data set code, site-specific code (where applicable), accessibility (data format), and proprietary limits.

The data set codes are an alphanumeric code that indicate the site (three letter abbreviation) and data set number, for example, AND022 represents H.J. Andrews Experimental Forest LTER Site data set number 22. (The site name abbreviations are given below.) These codes are located in the upper right corner on each data set page. Data set codes should be used when contacting a site for information on a particular data set (where site-specific codes are given, they should be used). The data set codes have been used to index each study.

Unless stated otherwise, the following conventions apply to accessibility codes:

(1) Bitnet, Internet, digital = ASCII file

(4) LD IBM fd = 360 K IBM 51/4" floppy disk

(2) tape = 9 track, 6250 bpi

(5) MAC fd = Macintosh floppy disk

(3) HD IBM fd = 1.44 mb IBM 3¹/₂" floppy disk

All studies have been indexed according to core area covered, subject matter, and investigator. Studies are identified in the indices by their respective data set code. Core areas, as identified under the LTER Program, are described both in the Introduction and the Core Area Index.

The site name abbreviations are listed in the same order (alphabetic by full name) as the sites appear in the catalog.

- AND = H.J. Andrews Experimental Forest LTER Site
- ARC = Arctic Tundra LTER Site
- BNZ = Bonanza Creek Experimental Forest LTER Site
- CDR = Cedar Creek Natural History Area LTER Site
- CPR = Central Plains Experimental Range LTER Site
- CWT = Coweeta Hydrologic Laboratory LTER Site
- HFR = Harvard Forest LTER Site
- HBR = Hubbard Brook Experimental Forest LTER Site
- JRN = Jornada LTER Site
- KBS = Kellogg Biological Station LTER Site
- KNZ = Konza Prairie LTER Site
- LUQ = Luquillo Experimental Forest LTER Site
- NWT = Niwot Ridge/Green Lakes Valley LTER Site
- NIN = North Inlet Marsh-Estuarine System LTER Site
- NTL = North Temperate Lakes LTER Site
- SEV = Sevilleta LTER Site
- VCR = Virginia Barrier Island-Estuarine LTER Site

On-line Version of the LTER Catalog of Core Data Sets

The Catalog entries are on-line at the LTERNET computer system as ASCII text and in Wordperfect format. The files are located in directory ~ftp/catalog and are stored on a per site basis. Additional files include a subject index, an investigator index, site abstracts, and a reference guide.

Access methods include anonymous file transfer using FTP - File Transfer Protocol - over the Internet (host Iternet.washington.edu, Internet address 128.95.36.1), or dial-in over the phone system (phone 206-543-2115) using ASCII text transfer or the Kermit program. Automatic mail reply for subsets of the files will be enabled later.

For more information you can obtain the most recent reference guide to the on-line catalog (including details of access methods), by sending any message to Internet address HelpCtlg@LTERnet.washington.edu (or Bitnet address HelpCtlg@LTERnet). For more general help on the LTERNET information system, send any message to Help@LTERnet.washington.edu (or Help@LTERnet on Bitnet).

In addition to the files that are presently on-line, we plan to maintain the Catalog, or parts of it (indices, etc.), in a relational database management system based on the SQL query language standard. This will allow easy file exchange and query. Information on the status of this implementation, and other relevant details, are also summarized in the reference guide returned by the 'HelpCtlg' function.

Questions regarding the on-line version of the catalog should be addressed to:

Rudolf Nottrott College of Forest Resources AR-10 University of Washington Seattle, WA 98195 (206) 543-8492 rnott@lternet.washington.edu (Internet) RNOTT@LTERNET (Bitnet) FAX: (206) 685-0790

Core Data Sets



H.J. ANDREWS EXPERIMENTAL FOREST LTER SITE

Site Name:	H.J. Andrews Experimental Forest
Institutional Affillation:	Oregon State University U.S. Forest Service, Pacific Northwest Research Station
Location:	80 km east of Eugene, OR 44°14'N, 122°11'W elevation: 425 to 1,620 m area: 6,400 ha
Principal Biome:	Coniferous forest
Main Communitles:	Douglas firwestern hemlockwestern red cedar, true fir and mountain hemlock, first-order to fifth-order streams
LTER Research Topics:	Successional changes of composition, structure, and processes Nature of forest-stream interactions Population dynamics of forest stands Effects of nitrogen fixers on soils Patterns and rates of log decomposition Disturbance regimes in forest landscapes

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 (U.S. International Biological Program) because of the existing long-term database. 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 that 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 Research 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 85

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 responsibility for the site.

Six projects are included within the National Science Foundation's Long-Term Ecological Research program on the Andrews Forest and nearby research natural areas. These components address: 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) forest-stream interactions; 5) the decomposition patterns of coarse woody debris in terrestrial and aquatic environments; and 6) processes that maintain long-term site productivity. Other research emphases concern entomology, effects of disturbance by fire, geomorphic processes, forest management practices, and other mechanisms at stand and landscape scales.

Facilities:

Office, laboratory, and living facilities at the Andrews Forest are located near the main entrance on a terrace beside Lookout Creek. Facilities include bunkhouses with a capacity of capacity of about 55, three office/laboratory trailers and a herbarium/office (provides working space for 25-30), and a warehouse/shop. Two small camper trailers are available for special needs, and cabins at Mack Creek, McRae Creek, Wildcat Mountain, and Carpenter Mountain provide field accommodations.

Addresses:

Principal Investigator: Frederick J. Swanson Forestry Sciences Laboratory 3200 Jefferson Way Corvallis, OR 97331 (503) 750-7355 FAX: (503) 750-7329 swanson@fsl.orst.edu (Internet) fswanson@lternet.Washington.edu (Internet)

Site Director: Arthur McKee H.J. Andrews Experimental Forest P.O. Box 300 Blue River, OR 97413 (503) 822-3914 and 750-7350 FAX: (503) 750-7329 mckee@fsl.orst.edu (Internet) amckee@lternet.Washington.edu (Internet) Data Manager: Susan G. Stafford Forest Science Laboratory Oregon State University Corvallis, OR. 97331 (503) 737-2244 FAX: (503) 737-1393 Stafford@fsl.orst.edu (Internet) sstafford@lternet.Washington.edu (Internet)

Data Set Title: Dendrometer Measurements in Permanent Reference Stands

Investigator(s): Mark E. Harmon, Jerry F. Franklin, Sarah E. Greene

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/78 Sampling frequency: single measurements Number of sites: 125 Algorithms used to synthesize data (if applicable): STX

Abstract: Dendrometer is used to get an accurate estimate of volume and height for individual trees. Volume tables or regressions may be generated. This method accurately accounts for taper by measuring at consecutive points up the bole. Generally 30 trees per reference stand are measured, trying to get a representative sample of diameter classes. Readings are begun at DBH. These values are then entered into a specific program (STX) which calculates tree volume per tree and for the entire stand. Study locations are in OR, WA, CA, WY, and CO. Data are available for species from the genera of *Abies, Chamaecyparis, Picca, Pinus, Pseudotsuga, Thuja, Tsuga*, and *Sequoia*.

Data Set Code: AND001

Site-Specific Code: TV009

Accessibility: digital, tape

Data Set Title: Respiration Patterns of Logs in H.J. Andrews Experimental Forest

Investigator(s): Mark E. Harmon

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/86 Sampling frequency: monthly Number of sites: 6 Algorithms used to synthesize data (if applicable):

Abstract: Study to examine the seasonal and successional patterns of respiration losses for four dominant softwood species. This is a split-plot design, with six blocks or sites, four species (*Abies amabilis, Pseudotsuga menziesii, Thuja plicata, Tsuga heterophylla*), and two positions (top and side). Periodically this set of logs is examined for respiration rates. Cylinders, 25 cm diameter and 25 cm tall, are mounted on logs in top and side positions. Drain holes have been installed on the top mounted cylinders to prevent waterlogging of the log. Periodically the cylinders are capped and CO₂ evolved is trapped in 0.1 N NaOH solution. Because of the variation in respiration rate, the amount of solution has varied from 20 to 80 ml. Exposed solutions are then processed by first adding excess BaCl solution, filtering the precipitate and then titrating with 0.1 N HCl. Solutions vary in the degree they absorb CO₂. The final calculated value has been adjusted to reflect the changes in trap efficiency brought about by CO₂-absorption.

Data Set Code: AND002

Site-Specific Code: TD20

Accessibility: digital, tape

Data Set Title: Coarse Woody Debris Density and Nutrient Content

Investigator(s): Mark E. Harmon

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/82 Sampling frequency: single measurement Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this study is to describe the external characteristics of coarse woody debris in various decay classes and to measure the density and nutrient content of these logs or snags. Logs or snags of known age or decay class are sampled for density and nutrient content. Changes in these parameters are related to either age, using regression, and/or are averaged for decay class. These data are combined with TD12 to predict biomass and nutrient stored in coarse woody debris. Study locations are in the Pacific Northwest, the Rocky Mountains, and the Yucatan Penisula. Investigated genera include *Picea, Abies, Beacarna, Brosium, Bursera, Taburia*, and *Talisia*.

Data Set Code: AND003

Site-Specific Code: TD22

Accessibility: digital, tape

✓ AND004

Data Set Title: Stream Cross Section Profiles: H.J. Andrews and Hagen Creek

Investigator(s): Gordon E. Grant, Frederick J. Swanson, George W. Lienkaemper

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/14/78 Sampling frequency: annually Number of sites: 8 Algorithms used to synthesize data (if applicable):

Abstract: This study was established to monitor changes in channel geometry (width, depth) in response to storms and movement of large organic debris in a range of stream sizes. Streams generally have cobble to boulder beds and extensive accumulations of large organic debris both within and marginal to the active channel. Five sites (Mack Creek clearcut and old growth, lower and middle Lookout, and Cold Creek) are located on the H.J. Andrews Experimental Forest; the other two sites are on north and south forks of Hagen Creek located approximately 15 km west of the Andrews. The Hagen Creek sites were designed to document channel changes following debris removal and streamside logging in the riparian corridor; logging has been indefinitely postponed, however. Drainage areas of surveyed streams range from 0.6 to 61.1 km². Between 11 to 22 cross sections were surveyed at each site using a builder's level and stadia rod. Cross sections were regularly spaced at 20 m at the two Hagen Creek and the Mack Creek clearcut sites and irregularly spaced at the other sites to sample a range of channel environments (pools, riffles). Cross sections are generally resurveyed annually except in years which did not have significant storms.

Data Set Code: AND004

Site-Specific Code: GS02

Accessibility: digital, tape

Data Set Title: H.J. Andrews Watershed Streamflow Summaries

Investigator(s): Gordon E. Grant, Frederick J. Swanson, Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1953 Sampling frequency: continuously Number of sites: 9 Algorithms used to synthesize data (if applicable):

Abstract: Streamflow from selected small watersheds has been continuously monitored at the Andrews since 1953. The objective of these studies have been several-fold: to evaluate long-term changes in hydrology associated with various management treatments, notably clearcut logging; to provide baseline data for affiliated nutrient, water chemistry, and sediment transport studies; and to characterize the hydrologic regime of old-growth forests at different elevations. The nine sites consist of three sets of paired watershed experiments (WS 1, 2, 3; 6, 7, 8; and 9, 10) and Mack Creek, a larger (6.0 km²), old-growth watershed. Drainage areas for the paired watersheds range from 9 to 100 ha and elevations range from 460 to 960 m. Watersheds 2, 8, and 9 are forested controls. Treatments include 100% clearcut (WS 1, 6, and 10), patch cut with roads (WS 3), and shelterwood cut (WS 7). All treated sites were calibrated against controls for at least 8 years prior to treatment. Streamflow is measured continuously with Leopold-Stevens A-35 recorders. The master stream for the H.J. Andrews, Lookout Creek, has a U.S. Geological Survey stream gauging station with a drainage area of approximately 63 km²; records for this site are maintained by the U.S.G.S.

Data Set Code: AND005

Site-Specific Code: HF04

Accessibility: digital, tape

Data Set Title: H.J. Andrews WS 1, 2, and 3 and Miscellaneous Suspended Sediment Grab Samples

Investigator(s): Gordon E. Grant, Frederick J. Swanson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1953 Sampling frequency: during storms Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: The objective of this study was to quantify the long-term effects of two intensities of timber harvest on sediment delivery at seasonal and yearly time scales. A paired watershed approach was used to compare differences in total sediment flux over a 30-year period. The three small forested catchments (WS 1, 2, and 3) in this study are located in the H.J. Andrews Experimental Forest in the Western Cascade range of Oregon, a steeply dissected landscape underlain by mixed volcanic rocks and vegetated with 400- to 500-year-old stands of Douglas fir and hemlock. Sampling of suspended and bedload sediment was initiated in 1957 and continued through 1988 on all three watersheds which have drainage areas of 96, 60, and 10 ha respectively. Three different treatments were compared: a 100% clearcut watershed without roads completed in 1966 (WS 1), a 25% harvested patch-cut watershed with 6% of area in roads completed in 1963 (WS 3), and a forested control (WS2). Vertically integrated, suspended sediment grab samples were taken in pint milk bottles from the head end of each flume during and between storms. Samples are taken at as near the same time as possible at each watershed, with samples taken on rising leg, peak, and falling leg, where possible. Sediment was measured by EPA and OSU labs prior to 1963. From Water Year 1963 through 1976, sediment quantity and concentrations were measured with the Gooch crucible filtration technique. In November, 1977, sediment measurements were moved to Corvallis FSL (CCAL) and the method changed to a larger GF/C filter paper. On November 23, 1983, this was changed to a GF/F filter paper. All samples are screened before filtering, removing bedload sediment (greater than 2 mm).

Data Set Code: AND006

Site-Specific Code: HS03

Accessibility: digital, tape

Data Set Title: Post-Logging Community Structure and Biomass Accumulation

Investigator(s): Jerry F. Franklin, Charles B. Halpern

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/76 Sampling frequency: annual (1976-81), 2-4 yr (1983-89) Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Patterns of plant succession and biomass accumulation following clearcut logging of an old-growth Douglas fir/western hemlock forest. These data contain post-logging compositional and structural information. A total of thirty-six 10 m x 15 m slope corrected plots are located randomly within four habitat types in proportion to habitat abundances. Data collected include: (1) visual estimates of canopy cover for all herbaceous species, for ground surface categories (i.e., bare ground, stone, litter, log, stump), and for mosses and lichens within 45 Daubenmire plots (along three 15-m lines, 15 plots per line); (2) line intercept cover for woody species along the same three 15-m lines; (3) overstory tree cover in canopy and understory classes within the entire 10 m x 15 m plot; and (4) a tally of seedling and sapling trees in the 10 m x 15 m plot.

Data Set Code: AND007

Site-Specific Code: TP41

Accessibility: digital, tape

Data Set Title: Plant Biomass Dynamics Following Logging and Burning in H.J. Andrews

Investigator(s): Jerry F. Franklin, Charles B. Halpern

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/79 Sampling frequency: 2-4 yr (1979-1990) Number of sites: 2 Algorithms used to synthesize data (if applicable): a series of biomass equations available on request (TP72)

Abstract: This study documents patterns of plant succession after clearcut logging and slash burning on two experimental watersheds. The study was initiated in 1962 (see data set TP09 for 1962-77 data). Both watersheds were dominated by old-growth and mature Douglas fir/western hemlock forest prior to logging. Plots were classified into one of six pre-disturbance plant communities, one of nine soil series, and one of four soil disturbance classes resulting from logging and burning. A total of 131 plots are evenly spaced on six transects within three cutting units on Watershed 1 (total of 25 ha logged), 61 plots on Watershed 3. Data collected include: (1) visual estimates of canopy cover for all vascular plant species, for ground surface categories (i.e., bare ground, stone, litter, log, stump), and for moss and lichen; (2) stem diameters and other biomass parameters (e.g., numbers of stems or stem heights) for all tall woody species and some herbaceous taxa to generate biomass estimates; and (3) basal or DBH stem diameters for tagged trees(> 1.4 m tall). Cover estimates and biomass measurements are taken within 2 m x 2 m plots. Trees (> 1.4 m tall) are tagged, measured, and checked for mortality in circular, 250 m² plots centered on the 2 m x 2 m plots. A subset of plots have had photos taken since 1963.

Data Set Code: AND008

Site-Specific Code: TP73

Accessibility: digital, tape

Data Set Title: H.J. Andrews Tagged Log Inventory

Investigator(s): Stanley V. Gregory, George W. Lienkaemper

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/82 Sampling frequency: annual Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Woody debris larger than 10 cm in diameter and 1 m in length was tagged in the stream channel and floodplain for a 1.1-km reach (350 m in clearcut; 750 m in old-growth forest) of Mack Creek. Mack Creek is a third-order stream in a 500-year-old conifer forest. Each piece is numbered, and the following characteristics are described: longitudinal position, geomorphic location, log dimensions, decay class, origin, moss cover, root wad, and channel angle. The reach is reinventoried annually in October. New debris is tagged and described each year.

Data Set Code: AND009

Site-Specific Code: GS06

Accessibility: digital, tape

Proprietary limits: 10/01/90

Data Set Title: Population Studies of Rainbow and Cutthroat Trout in the H.J. Andrews Forest

Investigator(s): Stanley V. Gregory

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/75 Sampling frequency: annual Number of sites: 17 Algorithms used to synthesize data (if applicable):

Abstract: Fish populations and habitat structure have been assessed in more than 17 streams within and in the vicinity of the H.J. Andrews Experimental Forest. These include local population assessments in streams (150-300 m in length) and basins (greater than 40 km in length). Fish species included are rainbow trout, cutthroat trout, bull trout, chinook salmon, and mountain whitefish. Population assessment methods include multiple pass electroshocking and diver observation. Size class distributions and length and weight relationships are available for all electroshocking assessments, and visual approximations.

Data Set Code: AND010

Site-Specific Code: AS06

Accessibility: digital, tape

Proprietary limits: 10/01/90

Data Set Title: H.J. Andrews Watershed 1 and 3 Plant Succession Data 1962-1977

Investigator(s): Jerry F. Franklin, Charles B. Halpern

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/62 Sampling frequency: annual (1962-1973), 2 yr (1974-1977) Number of sites: 2 Algorithms used to synthesize data (if applicable): a series of biomass equations available on request (TP72)

Abstract: This study documents patterns of plant succession after clearcut logging and slash burning on two experimental watersheds. See data set TP73 for post-1977 data. Both watersheds were dominated by old-growth and mature Douglas fir/western hemlock forest prior to logging. Plots were classified into one of six pre-disturbance plant communities, one of nine soil series, and one of four soil disturbance classes resulting from logging and burning. A total of 131 plots are evenly spaced on six transects on Watershed 1 (entire 100 ha logged); 61 plots lie on 10 transects within three cutting units on watershed 3 (total of 25 ha logged). Canopy cover and frequency of herbaceous taxa, ground surface categories (i.e., bare ground, stone, litter, log, stump), and moss and lichen obtained from nine 0.33 m x 0.33 m subplots within one quarter of a 2 m x 2 m plot; cover of woody species estimated form entire 2 m x 2 m plot. A subset of plots have had photos taken since 1963.

Data Set Code: AND011

Site-Specific Code: TP09

Accessibility: digital, tape

Data Set Title: Tree Permanent Plots of the Pacific Northwest

Investigator(s): Jerry F. Franklin, Mark E. Harmon, Arthur W. McKee, Sarah E. Greene

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1910 - 1989 (stand-specific) Sampling frequency: 5 years or longer for measurements, 1-5 years for mortality checks Number of sites: 143 Algorithms used to synthesize data (if applicable):

Abstract: This study is designed to examine the rates of succession, and measure mortality and growth in representative forest types in the Pacific Northwest. Permanent plots with tagged trees were established in forest stands selected to represent various forest types and stages of succession. At intervals of 1-10 years, stands are reinventoried to examine growth, ingrowth and mortality.

Data Set Code: AND012

Site-Specific Code: TV010

Accessibility: digital, tape

Data Set Title: Stream - Upland Wood Decay Experiment

Investigator(s): Mark E. Harmon

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/04/85 Sampling frequency: every 4 years Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: This study examines and contrasts the decay of small logs in a stream channel to those on an upland site. It also examines the movement of small logs in a third- to fourth-order stream. Three species (*Alnus rubra, Pseudotsuga menziesii, Tsuga heterophylla*) of logs, 20-30 cm diameter, about 2.5 m long were added to a stream channel and adjacent upland site. Thirty logs of each species were added to each site (total n = 180). Periodically two logs of each species will be removed from each site. The exterior dimensions of each log were measured, logs were tagged, and position of each log in upland and stream sites noted. Volume of heartwood, sapwood, inner bark, and outer bark on end of each log were noted. Density of these substrates also determined for each end of each log.

Data Set Code: AND013

Site-Specific Code: TD17

Accessibility: digital, tape

Data Set Title: H.J. Andrews Forest Reference Stand Litterfall Study

Investigator(s): Mark E. Harmon, Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/76 Sampling frequency: 3-4 weeks Number of sites: 6 Algorithms used to synthesize data (if applicable):

Abstract: Seasonal and annual rates of litterfall have been sampled at six permanent plots picked to represent a range of habitats and elevations. From 1976 to 1990 fine litter was collected in six traps (1 m x 1 m) at each site at 3- to 4-week intervals unless buried by snow. Since 1990 litter has been collected in six traps 29 cm in diameter (0.066 m^2) .

Data Set Code: AND014

Site-Specific Code: TL01

Accessibility: digital, tape

Data Set Title: Riparian Geomorphic Surface-Vegetation Relationships

Investigator(s): Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/86 Sampling frequency: single measurement Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: Reaches of four streams (0.5 to 3+ km) were mapped for geomorphic surfaces on the valley floor including alluvial fans. Phytosociological data (% cover, presence, live/dead tree density, basal area) were collected on randomly picked geomorphic surfaces. Multivariate techniques were used to group geomorphic surfaces and plant communities and to test the strength of association between surfaces and communities. Cores were taken from the largest trees and shrubs on the surface to determine time since last major disturbance or creation.

Data Set Code: AND015

Site-Specific Code: GV09

Accessibility: digital, tape

Proprietary limits: 06/01/91

Data Set Title: Recovery of Riparian Vegetation Following Debris Torrent

Investigator(s): Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/86 Sampling frequency: 1986-89 yearly, every other year from 1991 on Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The study documents recovery processes of riparian vegetation following a large debris torrent in a third-order stream. Permanently monumented belt transects of $0.2 \text{ m} \times 0.5 \text{ m}$ microplots at 2 m spacing were established across the stream in six different reach types (debris jam, above jam, below jam, gravel bar, mapped reach, debris fan). Life form, species cover, and density are recorded. Size enlarged to 1 m x 1 m plots on 1989, original miniplots measured as well.

Data Set Code: AND016

Site-Specific Code: GV15

Accessibility: digital, tape

Data Set Title: Structure and Composition of Riparian Vegetation in and Around the H.J. Andrews Experimental Forest.

Investigator(s): Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/82 Sampling frequency: one-time for a subset, every 5 years for a subset Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: This study measures biomass of riparian vegetation strata. It characterizes phenology of leaf-out and leaf fall, and determines the spatial distribution of foliar biomass, and timing and amount of annual foliar inputs to streams. Remanent transects of 1 m x 1 m and 5 m x 5 m plots were established along 100-150 m reaches of third-order streams in four vegetation types which represent different serial stages.

Data Set Code: AND017

Site-Specific Code: TP98

Accessibility: digital, tape

Data Set Title: NADP Precipitation Chemistry

Investigator(s): Arthur W. McKee, Stanley V. Gregory

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/13/80 Sampling frequency: weekly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The National Atmospheric Deposition Program (NADP) wet/dry sampler is located in a cleared area at the Andrews Forest Headquarter Site at 425 m elevation. Precipitation samples are collected every Tuesday morning. pH and conductivity are measured at the site, and the samples mailed to a Central Chemical Laboratory at the University of Illinois. Samples are analyzed for Ca, Mg, K, Na, NH₄, NO₃, SO₄, PO₄, pH, and conductivity. The dry precipitation bucket is collected the first Tuesday of every even month and mailed to the University of Illinois for the same analyses.

Data Set Code: AND018

Site-Specific Code: CP01

Accessibility: digital

Proprietary limits: none, but use must be recorded and acknowledged

Data Set Title: H.J. Andrews Rainwater Samples: Long-Term Precipitation Chemistry Patterns

Investigator(s): Arthur W. McKee, Stanley V. Gregory

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/15/68 Sampling frequency: 1-3 weeks Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Precipitation chemistry is sampled at a low elevation site (425 m) and a mid elevation site (915 m). Samples are collected in polyethylene containers and sampled at 3-week intervals. Beginning in 1985 the low elevation collections were made daily or after every storm. Since October 1988, both site's samples have been collected and analyzed on a weekly basis. Samples are analyzed for pH, alkalinity, conductivity, total P, ortho-P, total N, NO₃-N, suspended sediment, Si, Na, K, Ca, Mg, SO₄-S, and Cl. In October 1988, the mid elevation station was replaced with an NADP-type wet/dry deposition sampler.

Data Set Code: AND019

Site-Specific Code: CP02

Accessibility: digital,tape

Proprietary limits: none, but use must be recorded and acknowledged

Data Set Title: H.J. Andrews Watershed Grab Samples: Long-Term Stream Chemistry Patterns

Investigator(s): Arthur W. McKee, Gordon E. Grant, Stanley V. Gregory

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/28/73 Sampling frequency: weekly, monthly Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Describes long-term patterns of nutrient output from: 1) a first-order, old-growth watershed (WS 9), 2) a first-order watershed after clearcutting (WS 10), 3) a second-order old-growth watershed (WS 2), 4) a second-order watershed logged and burned in 1966 (WS 1), and 5) a third-order old-growth watershed (Mack Creek). Research provides baseline environmental monitoring data for studying nutrient availability for stream organisms, and recovery patterns of disturbed watersheds. Old-growth stands are approximately 450 years old and are dominated by *Pseudotsuga menziesii* and *Tsuga heterophylla* at lower elevations and also by *Abies amabilis* at the higher elevations. Grab samples were taken monthly from 1972 to 1978, with additional samples taken during storms. After 1978, weekly samples were taken until October 1982. Proportional samplers replaced these grab samples at this time. See CF02. Chemical analysis includes pH, conductivity, alkalinity, carbon, sulfur, chloride, suspended sediment, total N, NO₂, NO₃, NH₃, total P, Ortho-P, Na, K, Ca, Mg, and silica.

Data Set Code: AND020

Site-Specific Code: CF01

Accessibility: digital

Proprietary limits: none, but use must be recorded and acknowledged
Data Set Title: H.J. Andrews Watershed Proportional Samples: Long-Term Stream Chemistry Patterns

Investigator(s): Arthur W. McKee, Gordon E. Grant, Stanley V. Gregory

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/21/68 Sampling frequency: every 3 weeks Number of sites: 7 Algorithms used to synthesize data (if applicable):

Abstract: Stream water chemistry was sampled at seven watersheds to characterize the timing and amount of elemental losses in undisturbed conditions. Three watersheds were manipulated to determine the effects of logging on rates of nutrient release. Watersheds vary in size (first- to third-order), elevation, vegetation types, and aspect. Samples are analyzed for suspended sediment, alkalinity, pH, NH₄, NO₃, NO₂, dissolved organic N, ortho-P, total P, Na, K, Ca, Mg, Si, SO₄, and Cl.

Data Set Code: AND021

Site-Specific Code: CF02

Accessibility: digital

Data Set Title: H.J. Andrews Primary Meteorological Station at Headquarters

Investigator(s): Frederick A. Bierlmaier, Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/10/72 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Climatic summaries and documentation for the primary meteorological station H.J.Andrews Experimental Forest, 1972 to present. The site is located at an elevation of 426 m. 44°15'N, 122°10'W, in the Willamette National Forest. Automatic digital data loggers and sensors are used to measure air temperature, dewpoint temperature, wind speed, precipitation, and solar radiation. The quasi-Mediterranean climate has mild, moist winters and warm, dry summers.

Data Set Code: AND022

Site-Specific Code: MS01

Accessibility: digital

Data Set Title: H.J. Andrews Climatic Station at Watershed 2

Investigator(s): Donald L. Henshaw, Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 12/01/51 Sampling frequency: continuous Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: This climatic station on watershed 2 at the Andrews Forest continuously records precipitation, relative humidity, and air temperature. It provides the longest baseline record for studies at the H.J. Andrews Forest. The precipitation record is available at any temporal resolution, while relative humidity and air temperature have been quantified daily.

Data Set Code: AND023

Site-Specific Code: MS02

Accessibility: digital

Data Set Title: H.J. Andrews High-Elevation Meteorological Station

Investigator(s): Frederick A. Bierlmaier, Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/87 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: A high-elevation (1,280 m) meteorological station was installed in a clearcut Measurements include: air and soil temperature, soil moisture, relative humidity, snow moisture equivalency in both clearcut and shelterwood; and solar radiation, precipitation, and wind speed and duration in the clearcut.

Data Set Code: AND024

Site-Specific Code: MS03

Accessibility: digital

Data Set Title: H.J. Andrews Forest Rain Gauge Network

Investigator(s): Arthur W. McKee, Donald L. Henshaw

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/18/63 Sampling frequency: continuous, weekly, every 3 weeks Number of sites: 24 Algorithms used to synthesize data (if applicable):

Abstract: The rain gauge network provides baseline information on variation in precipitation across a wide range of site conditions within the H.J. Andrews so that studies of vegetation composition and productivity, as well as hydrology and modelling, could use a more accurate estimate of precipitation for a particular study site than would be possible using just a single monitoring station. Regression relationships between short-term monitoring of these sites and the long-term record at watershed 2 are used to estimate precipitation at network sites.

Data Set Code: AND025

Site-Specific Code: MS04

Accessibility: digital

Proprietary limits: none, but use must be recorded and acknowledged

Special Comments: Eight sites were initiated before 1970, the remaining 16 sites were initiated in 1979.

Data Set Title: Air, Soil, and Stream Temperature in Various Habitats in and Around the H.J. Andrews Forest

Investigator(s): Frederick A. Bierlmaier, Arthur W. McKee, Donald L. Henshaw

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/17/70 Sampling frequency: continuous Number of sites: 25 Algorithms used to synthesize data (if applicable):

Abstract: Air, soil, and stream temperature are continuously monitored at selected habitats in and around the H.J. Andrews Forest. Several sites are in permanent vegetation plots. Since 1987, several sites also have other variables measured.

Data Set Code: AND026

Site-Specific Code: MS05

Accessibility: digital, charts

Proprletary limits: none, but use must be recorded and acknowledged

Special Comments: Nineteen of the sites are available in automated record, the remaining six are archived as recording charts.

Data Set Title: H.J. Andrews Snow Survey

Investigator(s): Arthur W. McKee

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 12/31/78 Sampling frequency: monthly Number of sites: 30 Algorithms used to synthesize data (if applicable):

Abstract: The H.J. Andrews snow survey provides a baseline for characterizing variation in snow depth, moisture, and duration in the western Cascades for hydrologic modelling and to distinguish differences in the microclimates of dominant plant communities. Differences in snow accumulation in clearcut and adjacent closed forest microclimates are also studied.

Data Set Code: AND027

Site-Specific Code: MS07

Accessibility: digital

Data Set Title: Plant Component Biomass Equations and Data for the Pacific Northwest

Investigator(s): Joseph E. Means

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 01/01/61 Sampling frequency: unscheduled Number of sites: many Algorithms used to synthesize data (if applicable):

Abstract: This dataset contains data on biomass, leaf area, and sometimes other measurements (e.g., crown area) of plants collected in the Pacific Northwest. Data on diameters, height, length and number (e.g., of fronds) is also included for use as independent variables in regression equations. Many regression equations are presented for predicting plant components. Documentation is provided for each equation.

Data Set Code: AND028

Site-Specific Code: TP72

Accessibility: digital

Proprletary limits: available with permission of investigator



ARCTIC TUNDRA LTER SITE

Site Name:	Arctic LTER Site
Institutional Affillation:	Marine Biological Laboratory University of Alaska Clarkson University University of Minnesota University of Cincinnati University of Kansas University of Wisconsin
Location:	360 miles north of Fairbanks, AK 68°38'N, 149°34'W elevation: 760 m area: 18,100 ha
Principal Biome:	Arctic tundra, lakes, and streams
Main Communities:	Tussock tundra, heath tundra, riverine willows, oligotrophic lakes, headwater streams
LTER Research Topics:	Movement of nutrients from land to stream to lake Changes due to anthropogenic influences Controls of ecological processes by nutrients and by predation

Climate Synopsis:

Low arctic climate with long, cold winters and short, cool summers. Annual precipitation is 20 to 30 cm with 50% falling as snow. Average temperature is -7°C. July mean temperature varies from 8°C to 15°C.

Narrative:

The Toolik Lake arctic research site is at 760 m elevation in the northern foothills of the Brooks Range, Alaska. The location was chosen in 1975 to take advantage of the wide range of ecosystem types made accessible by the newly constructed Alaska Pipeline and Haul Road. Nearby are found all of the common types of arctic tundra as well as a number of lakes and streams of various sizes. The entire region is underlain by permafrost, with continuous daylight from mid May to late July and a snow-free season normally lasting from late May to late September.

Long-term aquatic research at Toolik Lake began in 1975, and terrestrial ecologists began working there in 1976. Since then, about 25-30 senior investigators have worked at Toolik Lake, with many projects maintained continuously for over 10 years. Funding has come primarily from

the National Science Foundation, with major additional support from the Department of Energy and the U.S. Army Research Office.

The arctic LTER program at Toolik Lake is designed to build on this extensive research base, to provide core funding for ongoing, long-term experiments, and to link terrestrial, lake, and stream studies more explicitly than has been possible in the past. The heart of the program is a series of parallel, whole-ecosystem experiments in lakes, streams, and the major terrestrial ecosystem types. The experiments are of two kinds: "top-down" manipulations of herbivores or predators, and "bottom-up" manipulations of nutrient availability. The overall goal is to understand and to separate the role of animal consumers versus plant/nutrient responses as controls over terrestrial and aquatic ecosystems. A second major goal is to advance understanding of how mineral nutrients move over the arctic landscape, from terrestrial to aquatic ecosystems. To do this we are developing a model of nutrient transport in a tundra watershed, combined with the use of stable isotopes as tracers to identify major sources, sinks, and pathways of element cycling.

Facilities:

The laboratory and sleeping facilities are owned and managed by the University of Alaska, on land owned by the Bureau of Land Management. The research camp is on the shore of Toolik Lake. The camp is normally open from early May to late September, but it is accessible year-round by road from either Prudhoe Bay or Fairbanks, Alaska. There are five heated and electrically powered laboratory trailers, a heated and powered kitchen/dining/meeting building, two warehouse/shop trailers, and five dormitory trailers. Boats are available for aquatic research. The camp capacity is 40 people, including four full-time staff.

Addresses:

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Data Set Title: Population Size and Growth of Arctic Grayling

investigator(s): Linda A. Deegan, Bruce J. Peterson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/10/85 Sampling frequency: 3 times during ice-free period Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Arctic Grayling from the Kuparuk River and Oksrukuyik Creek were captured, measured, weighed, and tagged. Tagged fish were monitored for growth over the summer season as well as from year to year. Population estimates were made by mark and recapture.

Data Set Code: ARC001

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: contact investigators

Data Set Title: Zooplankton Communities in Toolik Lake

investigator(s): W. John O'Brien

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/10/75 Sampling frequency: weekly during ice-free period Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Vertical zooplankton tows were taken at two stations in Toolik Lake. The stations were located near the deepest part of the lake (20 m) and in a shallow arm (5 m). Samples were preserved and later sorted for density, species composition, and community comparisons.

Data Set Code: ARC002

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: contact investigator

Data Set Title: Climate Data for Toolik Lake Area

Investigator(s): Gaius R. Shaver, James A. Laundre

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/10/88 Sampling frequency: hourly

• Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Climatic/meteorological data for the Toolik Lake area were collected using an automated weather station with a datalogger. Parameters measured include lake water depth, temperature and light penetration to 2 m, wind speed and direction, precipitation, relative humidity, barometric pressure, pan evaporation (during non-frozen periods), air temperature, solar radiation, and soil temperature. Snow depth is collected by another group.

Data Set Code: ARC003

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: contact investigators

Data Set Title: Physical and Chemical Data for Toolik Lake

Investigator(s): Michael C. Miller

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/20/75 Sampling frequency: weekly during ice-free period Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Depth profiles of Toolik Lake were taken at the deep station. Parameters measured were temperature, conductivity, oxygen, pH, light penetration, and alkalinity. Primary production was measured using the assimilation of ¹⁴CO₂ by algae.

Data Set Code: ARC004

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: contact investigator

Data Set Title: Stream Discharge for Kuparuk River

Investigator(s): Bruce J. Peterson

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 07/12/83 Sampling frequency: daily during ice-free period Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Stage height readings were taken daily during the ice-free season at the Dalton Highway crossing of the Kuparuk River. Stage height/discharge calibrations were made at a number of various stages. Discharge was then calculated from the stage height/discharge curve.

Data Set Code: ARC005

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: contact investigator



BONANZA CREEK EXPERIMENTAL FOREST LTER SITE

Site Name:	Bonanza Creek Experimental Forest
Institutional Affiliation:	University of Alaska, Fairbanks U.S. Forest Service, Pacific Northwest Research Station, Institute of Northern Forestry
Location:	25 km west of University of Alaska campus on the Parks Highway 64°45'N, 148°00'W elevation: 120 to 470 m area: 5,000 ha
Principal Biome:	Taiga (Northern Boreal Forest)
Main Communities:	Upland, south aspect permafrost free; upland, north aspect permafrost dominated; lowland, permafrost dominated; floodplain, permafrost free
LTER Research Topics:	Successional processes in taiga forests of interior Alaska Life history, facilitative, and competitive interactions with regard to plant species relations through succession Plant-mediated changes in resource availability and changes in carbon (energy) availability for decomposers through succession Herbivory control of plant species composition through succession

Climate Synopsis:

Continental climate with cold winters and warm, dry summers. The temperature ranges from -50°C to +30°C. At Fairbanks, the mean monthly temperature is -25°C in January and +16°C in July. Annual precipitation averages 286 mm, and about 30% falls as snow.

Narrative:

The Bonanza Creek Experimental Forest (BCEF) is a 5,000 ha research area located approximately 20 km west of Fairbanks in interior Alaska. BCEF was established in 1963 by the U.S. Forest Service to provide an area for basic and applied research in typical upland and floodplain landscapes in the taiga of interior Alaska. The research area is part of the Tanana Valley State Forest and is leased to the Forest Service by the State of Alaska. It has been used extensively as a research site for conifer and hardwood ecosystems by scientists from the Institute of Northern Forestry and the University of Alaska. The area includes a section of the Tanana River floodplain at an elevation of approximately 120 m and adjacent uplands rising to a ridge crest of 470 m. The experimental forest is within the zone of discontinuous permafrost, and many studies within the forest have examined the relationships between permafrost and forest site productivity. In 1983 a wildfire burned through about 2,000 ha of the upland segment

of the forest, providing opportunities to study many aspects of secondary succession in a number of different ecosystem types. The 1988 Rosie Creek fire resulted in extensive areas of early secondary successional sites on upland and lowland locations

The LTER studies at BCEF deal with successional processes in floodplain and upland locations. The research examines the premise that the pattern of succession is determined primarily by the initial soil, physical, and chemical environment of the site, and by the life history traits of component species; rate of successional change is determined by vegetation-caused changes in environment and ecosystem function. Through a set of four corollary hypotheses, research is designed to test this central question by focusing on important controls of ecosystem structure and function.

Study plots established to examine these hypotheses consist of three replications of five floodplain and three upland turning points of the white spruce successional sequences. These plots include a long-term control and several treatments. Two permanent weather stations -- one on the floodplain of Tanana River and the other on a broad ridge about midway in an elevational transect in the forest -- have been established to monitor climate. In addition, weather data are being collected throughout the year at one replication of each of the turning points.

Facilities:

Main office, laboratory and living facilities are located on the University of Alaska campus at Fairbanks. The Experimental Forest is located about 25 km west of town. Access to upland sites is from the Parks Highway, and a network of forest roads. Access to floodplain sites is by riverboat.

Addresses:

Principal Investigators: Keith Van Cleve Forest Soils Laboratory University of Alaska Fairbanks, AK 99775-0082 (907) 474-7114 FAX: (907) 474-7439 Inres@acad3.fai.alaska.edu (Internet)

Leslie A. Viereck Institute of Northern Forestry 308 Tanana Drive Fairbanks, AK 99775-5500 (907) 474-3324 FAX: (907) 474-3350 fflav@acad3.fai.alaska.edu (Internet) Data Manager: Phyllis C. Adams Institute of Northern Forestry 308 Tanana Drive Fairbanks, AK 99775-5500 (907) 474-3318 FAX: (907) 474-3350 Itpca@acad3.fai.alaska.edu (Internet) Data Set Title: Climate Data From Bonanza Creek Experimental Forest for Two Meteorological Stations and Eight Experimental Sites

Investigator(s): Leslie A. Viereck

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/87 Sampling frequency: every 5 min, recorded hourly Number of sites: 10 Algorithms used to synthesize data (if applicable): arithmetic average, vector average, regression equations

Abstract: All meteorological data for the Bonanza Creek Experimental Forest LTER site are included in this data set. Climatic data are collected at the two meteorological stations, one in the upland portion of the forest and one adjacent to the Tanana River on the floodplain. Additionally, weather stations are located at each of eight successional study sites. Parameters measured at the meteorological stations include: soil temperature at 5, 10, 20, 50, 100, and 200 cm depths, soil moisture at 5, 10, and 20 cm depths, air temperature, relative humidity, precipitation (rain and snow), global radiation, photosynthetically active radiation, wind speed, wind direction, and evaporation. Parameters measured at the study sites include: soil temperature, soil moisture (at the upland sites), air temperature, relative humidity, photosynthetically active radiation, and precipitation (sampled weekly). Also depth to seasonal frost and permafrost are recorded weekly at each site.

Data Set Code: BNZ001

Site-Specific Code: MET

Accessibility: paper, digital

Proprietary limits: Annual summary report will be distributed each year. Data sets will be made available on request.

Data Set Title: Vegetation of the Bonanza Creek Experimental Forest LTER Study Sites

Investigator(s): Leslie A. Viereck

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/88 Sampling frequency: 1-5 years Number of sites: 24 Algorithms used to synthesize data (if applicable): frequency and cover, basal area (m²/ha) and density (#/ha) for trees and shrubs.

Abstract: This data set is the result of surveys of the vegetation of the 24 LTER study sites in Bonanza Creek Experimental Forest. The 24 sites represent three replications each of five successional stages of primary succession on the floodplain of the Tanana River and three stages of succession following wildfire in the uplands. Data include percent cover of all species based on twenty 1 m² or 4 m² plots and stem maps of all trees and large shrubs in a 50 m x 60 m.plot. Plots in young stages of succession will be remeasured every two years; those in older stages every five years. Also included in this data set are annual seed fall and total litter. Some information on biomass in these stages is available. Although most sites were established in 1988 some sites have vegetation plots that have been sampled periodically for the last 25 years.

Data Set Code: BNZ002

Site-Specific Code: VEG

Accessibility: paper, digital

Proprietary limits: Access limited until data is published, but available to other investigators with permission.

Data Set Title: Artificial Communities of Spruce and Alder on Young Floodplain Sites in Bonanza Creek Experimental Forest

Investigator(s): F. Stuart Chapin, III, Tricia L. Wurtz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/89 Sampling frequency: every 2 to 5 years Number of sites: 6 Algorithms used to synthesize data (if applicable): relative growth rate, relative production rate, arithmetic means

Abstract: This study considers the relative roles of competition and facilitation in primary succession on the boreal forest floodplain of Bonanza Creek Experimental Forest. Alder (Alnus tenuifolia Nutt.) is an early colonist of young floodplain sites, where it contributes greatly to soil development through the addition of nitrogen to the soil. Spruce [Picea glauca (Moench.) Voss] typically colonizes such sites later; it becomes established beneath a canopy of alder and willow (Salix spp.) which is sometimes overtopped by young balsam poplar (Populus balsamifera L.). White spruce is thus subject to both potentially positive and negative influences of alder: possible competition for light (and other resources) before it has overtopped the alder canopy, and possible facilitation via added soil nitrogen that may extend over much of its lifetime. The net balance of these effects on the floodplain successional sequence is not known. Three types of 20 m x 20 m artificial communities are being established on each of six replicate early successional sites: pure spruce (planted at 1 m spacing), spruce mixed with alder (spruce planted at 1 m spacing, alder planted between spruces), and pure spruce with added N fertilizer. Fertilizer additions will mimic the natural fixation of N by alder. Relative growth rates of alder and spruce will be determined, and soil N pools and tissue nutrient content measured every two to five years. The main evaluation of this experiment will come after 15 to 20 years.

Data Set Code: BNZ003

Site-Specific Code: VEG

Accessibility: paper, digital

Proprietary limits: available after publication by investigators

Data Set Title: Treatment Plot Tree Growth

Investigator(s): John A. Yarie, Keith Van Cleve

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/15/89 Sampling frequency: annually Number of sites: 18 Algorithms used to synthesize data (if applicable):

Abstract: The objective of this project is to evaluate the influence of differential forest floor substrate quality on the growth rate of forest trees and large shrubs. Four 10 m x 15 m or 15 m x 15 m plots were treated with sucrose, sawdust, fertilizer or were controls at 18 successional sites in both upland and floodplain locations. A complete census of all trees and shrubs over 2.54 cm at breast height was carried out prior to treatment in 1989. Approximately 550 trees were fitted with diameter bands to estimate the tree growth response over the next 20 years. These bands will be read on an annual basis. The entire plot will be reinventoried on a five-year cycle.

Data Set Code: BNZ004

Site-Specific Code: VEG

Accessibility: paper, digital

Proprietary limits: after publication or with permission

Data Set Title: Forest Floor Chemistry

Investigator(s): Keith Van Cleve, Christen T. Dyrness, John A. Yarie

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/88 Sampling frequency: once per five years Number of sites: 18 Algorithms used to synthesize data (if applicable):

Abstract: The objective of this study is to evaluate forest floor chemistry in primary floodplain and upland secondary successional forests. Three replicate sites in each of three successional stages are being studied in upland and floodplain locations. Ten replicate samples of the forest floor were collected in each of the study sites. The 01 and 02 horizons were separated in each case. In addition to horizon and total biomass, structural organic chemistry, inorganic chemistry, and secondary plant chemical analysis will be conducted on these forest floor samples.

Data Set Code: BNZ005

Site-Specific Code: SOL

Accessibility: paper, digital

Proprietary limits: availability dependent on publication by investigators

Data Set Title: Litterbag Decomposition Study

Investigator(s): Keith Van Cleve, John A. Yarie, Christen T. Dyrness

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/89 Sampling frequency: variable Number of sites: 18 Algorithms used to synthesize data (if applicable):

Abstract: The objective of this project is to determine the rate of decomposition of leaf litter in different successional stages of upland and floodplain forests. Three replicate sites in each of three successional stages are being studied in floodplain and upland locations. This is a 10-year study with n = 10 at each sampling time. In addition to weight loss, structural organic chemistry, inorganic chemistry, and secondary plant chemical analysis will be conducted on litterbag material and related to the decomposition process in a successional context.

Data Set Code: BNZ006

Site-Specific Code: SOL

Accessibility: paper

Proprletary limits: availability dependent on publication by investigators

Data Set Title: Morphological, Chemical, and Physical Characteristics of Soils in Bonanza Creek Experimental Forest

Investigator(s): Christen T. Dyrness, Keith Van Cleve

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/87 Sampling frequency: every five years Number of sites: 24 Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this study is to characterize the basic properties of the soils at LTER study sites and to monitor over the long-term any changes in these soil properties. At each site four soil pits are excavated to at least a depth of 1 m immediately adjacent to the control plot. standard profile descriptions are made of the soil at each pit. Descriptions include soil horizon depth, thickness, color, texture, structure, consistence, rooting characteristics, and other special features. Large bulk samples are obtained by horizon. A portion of these samples is used for standard laboratory determinations of soil physical and chemical characteristics. In addition, a portion of the soil sample is archived for future reference. A composite soil profile description is available for each study site. Plans call for resampling soils at five-year intervals.

Data Set Code: BNZ007

Site-Specific Code: SOL

Accessibility: paper

Proprietary limits: availability dependent on publication by investigators



CEDAR CREEK NATURAL HISTORY AREA LTER SITE

Site Name:	Cedar Creek Natural History Area
Institutional Affiliation:	University of Minnesota
Location:	50 km north of Minneapolis-St. Paul, MN; just east of Bethel, MN, off U.S. Highway 65 45°24'N, 93°12'W elevation: 175 to 288 m area: 2,185 ha
Principal Biome:	Hardwood forest and tallgrass prairie
Main Communities:	Old fields, oak savanna, oak forest, conifer bog, Great Lakes, pine forest, wetland marsh and carr
LTER Research Topics:	Successional dynamics in old fields and savanna Primary productivity and disturbance patterns Nutrient budgets and cycles Climatic variation and the wetland/upland boundary Plant-herbivore dynamics

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 (CCNHA) is a 2,200 ha experimental ecological reserve operated by the University of Minnesota in cooperation with the Minnesota Academy of Science. It is located in Anoka and Isanti counties about 50 km north of Minneapolis and St. Paul, just east of Bethel, MN (east of U.S. Highway 65).

The first 500 acres of CCNHA were acquired in the early 1940's with the understanding that they would be kept in their natural condition and used for scientific and educational purposes. Funds for acquisition of additional land, development of permanent buildings and preparation of accurate maps became available from a variety of sources including personal contributions, the National Science Foundation, the Max Fleischmann Foundation, the Minnesota Natural Resources Commission, and the U.S. Land and Water Conservation Program.

Cedar Creek lies at the boundary between prairie and forest. It is a mosaic of uplands dominated by oak savanna, prairie, hardwood forest, pine forests, and abandoned agricultural fields and of lowlands comprised of ash and cedar swamps, acid bogs, marshes, and sedge **meedows.** Large tracts of the pre-agricultural ecosystems of the region are preserved within its boundaries as is a successional chronosequence of more than 80 old fields of known history. A program of prescribed burns, begun in 1964 in a large tract of native oak savanna, has 12 blocks with fire frequencies ranging from one per year, to one per seven years, to unburned controls These have diverged dramatically in their vegetation and soils in response to fire frequency and some areas are now exhibiting characteristics not seen in this region since settlement in the 1800's. The soils of Cedar Creek, derived from a glacial outwash sandplain, span five of the ten soil orders. Upland soils are nitrogen poor; numerous nutrient addition experiments performed in both old fields and native savanna have shown that nitrogen is the major soil resource that limits plant growth.

The Cedar Creek LTER combines long-term experimentation and observation to examine the controls of successional dynamics and spatial patterning in ecosystems at the prairie-forest boundary. The LTER project has established more than 1,100 permanent, long-term experimental field plots, 1,400 permanent monoculture or competition garden plots, as well as 2,300 permanent observational plots distributed across a chronosequence of 22 old fields. Our studies focus on hypotheses concerning the direct, indirect, and feedback effects of various species and ecosystem elements on each other. Although we study whole ecosystem processes, a major goal of our project is to understand underlying mechanisms that control these processes. Work focuses on 1) mechanisms of plant competition for nutrient(s) and light; 2) dynamics of carbon and nitrogen in the soil; 3) controls of the primary productivity, species competition and species diversity of grasslands; 4) herbivory, including feedback effect of herbivores on soils and plants; 5) disturbance; and 6) modeling and ecological theory.

Facilities:

Cedar Creek has 10 permanent buildings, including a year-round laboratory and office building, 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. Facilities are typically booked each summer, so it is important to request space as soon as possible. Major items of equipment include IBM-PS2, XT, AT, and PC Sun Workstations and Macintosh computers (access to Cray II, Cyber 205, and VAX is available), Campbell meteorological station, NH₄ and NO₃ autoanalyzers, Carlo-Erba C-N-S analyzer, spectrophotometers, and analytical balances.

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Data Set Title: Fenced Microplots (MICRO)

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1982 Sampling frequency: yearly Number of sites: 3 (54 plots each); 1 (45 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to measure the effect of NH_4NO_3 addition on vegetation not under the stress of mammalian herbivory. The experiment is being conducted in fields A, B, C, and D. There are eight different NH_4NO_3 levels with other nutrients added to ensure that N is the limiting nutrient, and a control which receives no nutrients. The treatments are A, B, C, D, E, F, G, H, and I as defined in NUTRADD.DOC in the "microplot" strategy. There are six replicates of the nine treatments in fields A, B, and C and five replicates in field D. The treatments were randomly assigned to the plots except in field B where a randomized block design was used; two blocks each half the field. In fields A, B, and C, the plots are in 6 x 9 grid and are 4 m x 4 m in size with 1 m aisles between plots. In field D the plots are 1.5 m x 4 m in size and are placed in a 3 x 17 grid. The plots are enclosed by a fence to keep out mammalian herbivores. To build the exclosure galvanized welded-wire hardware cloth with 6 mm x 6 mm openings was buried to a depth of 84 cm. Additional hardware cloth extends 60 cm above the ground, and poultry netting extends to 1.8 m above the ground. Gophers were trapped and removed as they appeared. Fertilizer is applied twice per year, once in early May and once in late June.

Data Set Code: CDR001

Site-Specific Code: CDR.E001

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line

Data Set Title: Fenced Microplots, Disked (MICRO)

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1982 Sampling frequency: yearly Number of sites: 3 (54 plots each) Algorithms used to synthesize data (if applicable):

Abstract: This experiment is exactly the same as CDR001 except the ground where the plots were established was thoroughly disked before establishment. This experiment is only being conducted in fields A, B, and C.

Data Set Code: CDR002

Site-Specific Code: CDR.E002

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Single Nutrients (SINGN)

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1982 Sampling frequency: yearly Number of sites: 4 (36 plots each) Algorithms used to synthesize data (if applicable):

Abstract:

This experiment is being conducted within the fenced areas of fields A, B, C, and D. The purpose of this experiment is to determine the effect of various nutrients on vegetation. There are eight different nutrients and a control. The different nutrients are N, P, K, Ca, Mg, Na, H₂O, and a combination of trace metals. There are 36 plots in each field, four replicates of the nine treatment levels. The plots are 1 m x 4 m and are laid out in a 4 x 9 grid. The grid was divided into quarters and treatments were assigned with a randomized block design.

Data Set Code: CDR003

Site-Specific Code: CDR.E003

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line.

Data Set Title: Small Mammal Grids (MAMML)

Investigator(s): Nancy J. Huntly, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 1-3 years Number of sites: 1 (64 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to look at the effect of NH_4NO_3 addition in an unfenced area. The experiment is located in field E. There are four different treatments, C, F, H, and I as defined in NUTRADD.DOC in the "microplot" strategy. The plots are 4 m x 4 m and are laid out in an 8 x 8 grid with 1 m aisles.

Data Set Code: CDR004

Site-Specific Code: CDR.E008

Accessibility: paper, ³⁴" tape, IBM HD (5³⁴") fd, IBM LD fd, currently being put on-line.

Data Set Title: Small Mammal Grids, Disked (MAMML)

Investigator(s): Nancy J. Huntly, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 1-3 years Number of sites: 1 (64 plots) Algorithms used to synthesize data (if applicable):

Abstract: This experiment is identical to CDR004 except the ground was disked thoroughly before the plots were laid out.

Data Set Code: CDR005

Site-Specific Code: CDR.E009

Accessibility: paper, ¹⁴" tape, IBM HD (5¹⁴") fd, IBM LD fd, currently being put on-line.
Data Set Title: Small Mammal Grids, Control (MAMML)

Investigator(s): Nancy J. Huntly, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 1-3 years Number of sites: 1 (64 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment was to measure herbivore effects over a large area that had not been manipulated rather than the 4 m x 4 m treatment I plots in CDR004 and CDR005. None of the plots in this experiment received any nutrients. Otherwise, the construction of this experiment is identical to CDR004 and CDR005.

Data Set Code: CDR006

Site-Specific Code: CDR.E010

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Unfenced Microplots (UNFMC)

Investigator(s): Richard S. Inouye, Nancy J. Huntly

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 1-3 years Number of sites: 3 (48 plots each) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to measure the effect of NH_4NO_3 addition on vegetation under herbivore pressure. This experiment is located in fields A, B, and C. There are three treatment levels, two nitrogen levels, and a control. The treatments are E, G, and I as defined in NUTRADD.DOC under the "microplot" category. There are 16 replicates of the three treatments for a total of 48 plots in each field. Treatments are randomly assigned to the plots. The plots are 4 m x 4 m and are laid out in a 6 x 8 grid with 1 m aisles.

Data Set Code: CDR007

Site-Specific Code: CDR.E011

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line.

Data Set Title: Burned Microplots (BRNMC)

Investigator(s): Richard S. Inouye, David G. Tilman, Nancy J. Huntly, John Tester

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 4 years Number of sites: 1 (24 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment was to determine what effect different fire frequencies have on old field vegetation. This experiment is being conducted in field B. There are four different burn treatments: 1) controls which are not burned, 2) plots burned every year, 3) plots burned every other year, 4) plots burned every fourth year. There are six replicates of each treatment, randomly assigned to the 24 plots. Plots are 8 m x 8 m and are placed in a 3 x 8 grid with 2 m walkways. Plots are marked with colored rebar at each corner. Burning is done in the spring.

Data Set Code: CDR008

Site-Specific Code: CDR.E012

Accessibility: paper, 34" tape, IBM HD (534") fd, IBM LD fd, currently being put on-line.

Data Set Title: Old Field Survey (OFIELD)

Investigator(s): David G. Tilman, Richard S. Inouye, Nancy J. Huntly, John Tester

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1983 Sampling frequency: 6 years Number of sites: 20 (100 plots each), 2 (150 plots each) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this survey was to survey natural patterns of soil nutrients, particularly nitrogen, vegetational abundance, species composition, and herbivore populations. In the survey, 2,300 1 m x 0.5 m quadrats were sampled in 22 different fields. In 20 fields four transects were laid out. In two fields six transects were laid out. Twenty-five quadrats were placed a distance of 1.5 m apart along each transect. The transects were 40 m long and 25 m apart. In field 21, the transects were not parallel. In fields A, B, and C, the transects ran along the edge of the treatment I macroplots. Small mammals are snap-trapped along transects (five traps/transect at 10-m intervals) yearly in late August - early September. Grasshoppers are sweep-sampled along transects one to three times per year.

Data Set Code: CDR010

Site-Specific Code: CDR.E014

Accessibility: paper, 1/4" tape, IBM HD (51/4") fd, IBM LD fd, currently being put on-line.

Data Set Title: Fish Lake Burn Compartments (FLBRN)

Investigator(s): John Tester, David G. Tilman, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1984 Sampling frequency: 8 years Number of sites: 12 (24 plots each) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to see what effect burning patterns have on vegetation. The survey was conducted in 12 different compartments. Four transects, 50 m long and 25 m apart, were established in each compartment. Six quadrats were marked along each transect at 0, 10, 20, 30, 40, and 50 m. The quadrats are 1 m x 1.5 m in diameter. Sections were defined by dividing the transects in half and taking the area between transects. This creates six 25 m x 25 m sections.

Data Set Code: CDR011

Site-Specific Code: CDR.E015

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Fish Lake Burn Compartments (FLBRN)

Investigator(s): John Tester, David G. Tilman, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1984 Sampling frequency: 8 years Number of sites: 12 (24 plots each) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to see what effect burning patterns have on vegetation. The survey was conducted in 12 different compartments. Four transects, 50 m long and 25 m apart, were established in each compartment. Six quadrats were marked along each transect at 0, 10, 20, 30, 40, and 50 m. The quadrats are 1 m x 1.5 m in diameter. Sections were defined by dividing the transects in half and taking the area between transects. This creates six 25 m x 25 m sections.

Data Set Code: CDR011

Site-Specific Code: CDR.E015

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: N, pH Response Surface and Microorganisms (SORG)

Investigator(s): Tom Hankinson, Ed Schmidt, David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1984 Sampling frequency: 3 years Number of sites: 1 (48 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to measure the effect of NH_4NO_3 addition and different levels of pH on microorganism populations. The experiment is located in field B. This experiment was laid out as a full factorial design with three nitrogen levels and four pH levels. The nitrogen levels are E, G, and I as defined in NUTRADD.DOC in the "microplot" category. The pH levels strived for are 4.0, 5.5, 6.5, and controls. The experiment has four replicates. The treatments were randomly assigned to the 48 plots. The plots are 4 m x 4 m and are laid out in **a** 6 x 8 grid.

Data Set Code: CDR012

Site-Specific Code: CDR.E024

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Phenology of Fertilization (PHEN)

Investigator(s): Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1985 Sampling frequency: yearly Number of sites: 2 (35 plots each) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to determine the effects of adding different levels of NH_4NO_3 at different times during the growing season. This experiment is being conducted inside the fenced areas of fields A and B. See CDR001 for description of fence construction. There are seven treatments: six combinations of three fertilization dates and two nitrogen levels, and one control. There are five replicates of each treatment for 35 plots in each field. The nitrogen levels are E, G, and I and are defined in NUTRADD.DOC in the "microplot" strategy. The times of fertilization are roughly May, June, or July. The plots are laid out in a 5 x 7 grid and are 1.5 m x 3.5 m in area. Aisles are 1 m wide in field A and 0.75 m wide in field B.

Data Set Code: CDR013

Site-Specific Code: CDR.E025

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Monoculture and Competition Gardens

Investigator(s): D. Wedin and David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1986 Sampling frequency: yearly Number of sites: 1 (14 plots) Algorithms used to synthesize data (if applicable):

Abstract: This experiment is designed to determine the relationships between plant traits, successional status, and resource reduction for five grass species that were grown for three years in monoculture in replicated field plots on soils prepared to have different availabilities of nitrogen. It also determines the results of competition experiments among various combinations of these species as well as the differing feedback effects of each species on soil nitrogen mineralization rates.

Data Set Code: CDR014

Site-Specific Code: CDR.E026

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line.

Data Set Title: Unfenced Microplots Light x Nitrogen (UNFLN)

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1987 Sampling frequency: 2 years Number of sites: 1 (24 plots) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this experiment is to measure the effect of NH_4NO_3 addition and light shading on vegetation under herbivore pressure. This experiment is located in field B. The plots of this experiment are those in CDR007 (UNFMC). Two factors are tested in this experiment. A nitrogen addition factor with two levels and a light penetration factor with two levels. Nitrogen addition levels are I and G (see NUTRADD.DOC). The light penetration levels are 1 (100% light penetration) and 2 (20% light penetration). The light penetration levels are achieved by using a black shade, reducing light penetration by 80%. The support for the shades is made of steel T-posts and 2 x 4 lumber. There are 12 replicates of the four treatments. Each plot is 2 m x 2 m. The treatments were laid out in a randomized block arranged in a split plot design where nitrogen was assigned to the main plot and light penetration assigned to subplots.

Data Set Code: CDR015

Site-Specific Code: CDR.E036

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Old Field Allocation Survey (OFALLOC)

Investigator(s): Scott Gleeson, David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1987 Sampling frequency: 8 years Number of sites: 37 (5 plots each) Algorithms used to synthesize data (if applicable):

Abstract: Objective: to assess biomass allocation trends in the field in relation to gradients of successional age and soil nitrogen. Methods: the objective was approached in three ways: A) 37 old fields of various ages were surveyed for aboveground and belowground biomass, soil N, and light penetration. Five strips (1 m x 10 cm) were clipped in each field for aboveground biomass (sorted to grasses and forbs; will be sorted to leaf and stem), and three root cores (to 30 cm) taken per strip (rinsed, dried, and weighed). Two light measurements and one pooled N sample (three cores; available and total N) were taken per strip. B) 35 abundant species of known successional status were harvested from the field (usually 15 individuals per species), Including roots contained in a core 20 x 30 cm, dried, sorted to stem, leaf, and root, and weighed. These data can be combined with the old field survey results (CDR010) to estimate successional trends in allocation. C) Root cores will be taken from microplots in fields A, B, C, and D, all treatments. This will be an estimate of root biomass to be combined with the aboveground samples (CDR001) to assess root/shoot trends in response to manipulation of soil N in fields of different age.

Data Set Code: CDR016

Site-Specific Code: CDR.E042

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Nitrogen X Disturbance (Field B)

Investigator(s): Scott Wilson, David G. Tilman

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 1988 Sampling frequency: 3 times/summer Number of sites: 1 (104 plots) Algorithms used to synthesize data (if applicable):

Abstract: There are four levels of nitrogen, corresponding to treatments A, C, E and G in CDR001, applied at the same time as in that experiment. There are four levels of soil disturbance: level 1: undisturbed, level 2: one pass with a 7 HP Honda rear-tined rototiller with the elevator set at the second notch (from the top), level 3: two passes or however many required to produce about 50% bare ground, and level 4: three passes or however many required to produce 100% bare ground. This requires three passes in some plots but five or six in others. In addition, all woody vegetation not destroyed by tilling is cut at the base. Rototilling is applied in late April. Each fertilization treatment receives each disturbance treatment, for a total of sixteen treatments. There are four replicates of each of the sixteen treatments. In addition, the four extreme ends (lowest N, lowest disturbance; highest N, lowest disturbance, etc.) are replicated an additional ten times. Treatments are applied in a completely randomized design. Each of the 104 plots is 5 m x 5 m. Measurements taken at CDR017 will include: 1) species abundances, 2) community biomass allocation to leaves/roots/stems/flowers, 3) aboveground and belowground NPP, and 4) rates of nitrogen mineralization.

Data Set Code: CDR017

Site-Specific Code: CDR.E052

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Plant Competition Under Different Nitrogen Levels

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1988 Sampling frequency: yearly Number of sites: 1 (14 plots) Algorithms used to synthesize data (if applicable):

Abstract: This is the new garden plot experiment located next to the CDR014 gardens. This garden contains monocultures of major grass species from across the grassland biome of North America, and also three legume species (CDR020). The design and purpose are similar to CDR014, except the plots are larger. The basic experimental design consists of growing plants in monoculture and in various competitive combinations on each of 14 different soil mixtures. Each soil mixture has 26 subplots. Each subplot, which is 1.2 m x 1.2 m, is a unique treatment. Thus, there are no replicates of a treatment within a soil mixture. Rather, the experiment is a regression experiment, with the regression variable being the experimentally imposed level of total soil nitrogen. At the time the seeds were planted, each plot was fertilized with a mixture of P, K, Ca, Mg, and trace metals. Plots 1 through 23 were planted with different combinations of the following species: *Schizachyrium scoparium, Andropogon gerardi, Bouteloua gracilis, Panicum virgatum, Agropyron smithii*, and *Buchloe dactyloides*. A belowground gopher fence and an aboveground rodent/deer fence was built around the area.

Data Set Code: CDR018

Site-Specific Code: CDR.E055

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Tree Competition Garden

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1989 Sampling frequency: yearly Number of sites: 1 (48 plots) Algorithms used to synthesize data (if applicable):

Abstract: This experiment was set up adjacent to CDR018 in the high disturbance, garden area. Black soil (1.75 inches) was added to the Cedar Creek Natural History Area (CCNHA) sandy soil to make four 10' x 54' plots. The soil was rototilled and aluminum flashing was installed to edge the plots and divide them into fourty-eight 5' x 9' plots. This nitrogen-poor soil will be fertilized monthly with varying amounts of NH₄NO₃. Seeds were planted with six replicates of each of the following treatments:

- 1. Agropyron repens monoculture
- 2. Schizachyrium scoparium monoculture
- 3. Pinus strobus monoculture
- 4. Quercus ellipsoidalis monoculture
- 5. Agropyron repens + Quercus ellipsoidalis on half
- 6. Agropyron repens + Pinus strobus on half
- 7. Schizachyrium scoparium + Quercus ellipsoidalis on half
- 8. Schizachyrium scoparium + Pinus strobus on half

The competition plots were split, with half invaded by seed and half to be invaded by seedling. For treatments 5-8, the right or left sides were chosen at random, to plant the tree seeds.

Data Set Code: CDR019

Site-Specific Code: CDR.E069

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Data Set Title: Legume Competition Garden

Investigator(s): David G. Tilman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1989 Sampling frequency: yearly Number of sites: 1 (168 plots) Algorithms used to synthesize data (if applicable):

Abstract: This experiment was established on top of subplots 24, 25, and 26 of CDR018. Sheet metal was installed to divide the subplots into four equal parts. The resulting 12 subsubplots (4 per subplot = 12 per plot) were planted according to the following treatments where LC = *Lespedeza capitata*, AC = *Amorpha canescens*, PP = *Petalostemum purpureum*, and SS = *Schizachyrium scoparium*:

1. LC seed on top of established SS

- 2. AC seed on top of established SS
- 3. no seed added to established SS
- 4. PP seed on top of established SS
- 5. AC seed vs SS seed
- 6. LC seed vs SS seed
- 7. PP seed vs SS seed
- 8. LC seed vs AC seed vs PP seed vs SS seed
- 9. AC seed
- 10. LC seed
- 11. bare ground (no seeds added)
- 12. PP seed

Data Set Code: CDR020

Site-Specific Code: CDR.E070

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line.

Data Set Title: Invasion of Old Fields by Trees

Investigator(s): Richard S. Inouye, Taber Allison

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/82 Sampling frequency: variable Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Replicated deer exclosures (n = 3) were built at the margins of two old fields. All trees in controls and exclosures were tagged, mapped, examined for browsing damage, and measured annually (maximum height) from 1983 through 1989. Pocket gopher mounds were mapped on these plots every year from 1986 to 1989. Future sampling will be done at variable intervals, probably every 3-5 years. Successive 20-m strips of a field cultivated in rye have been abandoned each year since 1977. In 1988, trees were tagged, mapped, and measured (maximum height) in all strips. Trees were remeasured and additional trees were tagged in 1989. These plots will be sampled at variable intervals, probably every 2-3 years.

Data Set Code: CDR021

Site-Specific Code: CDR.E007

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Proprietary limits: 1995

Data Set Title: Yearly and Between-Field Variation in Grasshopper Populations of an Old-Field chronosequence

Investigator(s): Nancy J. Huntly, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/84 Sampling frequency: monthly (summer only) Number of sites: 19 Algorithms used to synthesize data (if applicable): field-wise summaries

Abstract: Grasshoppers are sampled monthly throughout the summer season by sweepsampling along four permanent transects in each of 19 successional old-fields, which were abandoned from agriculture between 1927 and 1983. These are the same transects along which small mammal populations are sampled yearly and along which species composition of yegetation is quantified periodically, but less often.

Data Set Code: CDR022

Site-Specific Code: CDR.E014

Accessibility: paper, 4" tape, IBM HD (54") fd, IBM LD fd, currently being put on-line.

Proprietary limits: Access limited, but available with permission from investigators, until subsets are published.

Data Set Title: Yearly and Between-Field Variation in Small Mammal Populations of Successional Old-Fields

Investigator(s): Nancy J. Huntly, Richard S. Inouye

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/84 Sampling frequency: yearly Number of sites: 19 Algorithms used to synthesize data (if applicable): field-wise summaries

Abstract: Small mammals are sampled each summer in late August and early September by snap-trapping along four permanent transects in each of 19 old-fields. Six species occur regularly in these samples: *Peromyscus maniculatus, Microtus pennsylvanicus, Sorex cinereus, Blarina brevicauda, Zapus hudsonius,* and *Mus musculus.* Pocket gopher disturbance has been estimated along these transects less frequently, but is now a regular part of the annual survey. Grasshoppers, vegetation, and soils are also sampled regularly along these transects.

Data Set Code: CDR023

Site-Specific Code: CDR.E014

Accessibility: paper, 14" tape, IBM HD (514") fd, IBM LD fd, currently being put on-line.

Proprietary limits: Access limited, but available with permission from investigators, until subsets are published.

Data Set Title: Plant Community and Soil Development During Secondary Succession in the Presence and Absence of Major Herbivores (Gophers, Large Vertebrates, Grasshoppers)

investigator(s): Richard S. Inouye, Nancy J. Huntly

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/89 Sampling frequency: yearly Number of sites: 15 Algorithms used to synthesize data (if applicable):

Abstract: Major herbivores were excluded from fifteen 12 m x 12 m plots in a newly abandoned old-field. Main treatments include gopher removals, all large vertebrate removals, and controls. Smaller (3 m x 12 m) grasshopper removals are nested within main treatments. Gopher disturbance will be quantified throughout the summer season. Soils (including N mineralization) and vegetation will be sampled regularly on 100-point grids within each plot.

Data Set Code: CDR024

Site-Specific Code: CDR.E064

Accessibility:

Proprietary limits: Access limited, but available with permission from investigators, until subsets are published.

Data Set Title: Distribution of Wetland Plant Species in Relation to the Level of the Water Table

Investigator(s): Eville Gorham, Martha M. Phillips

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/88 Sampling frequency: < annually; focus will be on occasional sampling in normal as well as in unusually wet or dry years Number of sites: 15 wetlands, 21 transects, 181 plots Algorithms used to synthesize data (if applicable):

Abstract: Permanent plots were set up in 1988 for long-term monitoring of a number of wetlands at the Cedar Creek Natural History Area (CCNHA). This data set on the current composition and characteristics of these wetlands is being used for 1) between-site comparisons and analysis of wetland plant species distribution in relation to the water table level, and 2) for detection of possible changes in species composition, size, water levels, and soil characteristics over time due to climate change. Sites were chosen to cover a range of wetland types at CCNHA. The current 21 transects, established in 15 wetlands, vary from 25 m to 85 m, depending on the size and type of wetland. In large sites, transect lines run from the upland margin inward for at least 25 m or until the point where species composition is relatively constant. In most small sites, the transects cross the entire site. Plots 1 m² are located every 5 m along each transect. Types of data collected so far: Vegetation: Vegetation data are collected for all transects within a one-week period during the last week in July. Species presence and visual estimates of percent cover are recorded for each plot. The location along the transect where major species appear and disappear is recorded and total species lists for the sites are made. Water: Because of the dry conditions of the past 3 years there has been no standing water in any of these wetlands at the time the vegetation was surveyed. Measurements of spring water levels along the transects were made in May 1989 and wells have been put into five of these sites (as part of the hydrology study at CCNHA). Transect lines are being surveyed for the change in height from beginning to end. Soil: Soil samples were collected in June and July 1989 alongside plots in 12 sites and analyzed for moisture content, bulk density, pH, organic matter by loss on ignition, and extractable ammonium and nitrate. Portions of the samples have been saved for further analyses (e.g., for total N). Soil samples will again be collected in the same sites in 1990.

Data Set Code: CDR025

Site-Specific Code: CDR.E079

Accessibility: IBM LD fd

Proprietary limits: Available as papers are written. Limited use for certain agreed purposes when initial data base completed.

Data Set Title: Meteorologic Measurements at Cedar Creek Natural History Area

Investigator(s): data available from Mark W. Seeley, Minnesota Extension Climatology Office

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/87 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable): daily averages, totals, minima and

Abstract: Meteorological measurements include air temperature, precipitation, wind speed and direction, soil temperature, and relative humidity.

Data Set Code: CDR026

Site-Specific Code: CDR.E080

Accessibility: summary of growing season on paper; original hourly data available on IBM HD (54") fd, and LD fd from Minnesota Extension Climatology Office

Proprietary limits: data set is public

Data Set Title: Atmospheric Deposition - Wet and Dry - at Cedar Creek Natural History Area

Investigator(s): data available from Catherine P. Malave, Minnesota Pollution Control Agency

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/??/84 Sampling frequency: weekly Number of sites: 1 Algorithms used to synthesize data (if applicable): arithmetic average and volume-weighted average

Abstract: Precipitation is collected continuously in an Aerochem-Metrics wet-only sampler. Solutions are analyzed weekly for pH and inorganic cations and anions. Ambient air gases and particulates are collected on a low-volume filterpack sampler. Filters are analyzed weekly for SO_2 , HNO_3 , and inorganic cations and anions. Methodology has changed during the study.

Data Set Code: CDR027

Site-Specific Code: CDR.E081

Accessibility: summary on paper; original data available on IBM HD (54") fd and LD fd from Minnesota Pollution Control Agency.

Proprietary limits: data set is public

Data Set Title: Productivity, Organic Matter Dynamics, and Nutrient Dynamics in Forests of Cedar Creek Natural History Area

investigator(s): Dave F. Grigal, Dave K. Walters, Alan R. Ek, Peter S. Homann

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/??/88 Sampling frequency: varies with parameter Number of sites: 17 Algorithms used to synthesize data (if applicable):

Abstract: Seventeen 140-m² plots cover a range of forest types including oak savannah, closed-canopy oak, northern hardwood, pine, cedar, and low-land hardwood. Trees were mapped and diameters measured when plots were established; remeasurements will be made at 10-year Intervals. The plots serve as focal points for short-term (1-2 year) studies of litterfall, forest floor dynamics, nitrogen mineralization, and organic matter distribution.

Data Set Code: CDR028

Site-Specific Code: CDR.E082

Accessibility: paper, IBM LD fd

Proprietary limits: varies with type of data

Data Set Title: ARC/INFO GIS Layers for Cedar Creek Natural History Area

Investigator(s): James K. Engstrom, David F. Grigal

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/89 Sampling frequency: 1977 and 1938 Number of sites: Algorithms used to synthesize data (if applicable):

Abstract: Vegetation type, size, and density maps were produced by photo-interpreting 1938 and 1977 aerial photography. These maps were entered along with roads, section corner and boundary layers from USGS 7½ minute quadrangles into the ARC/INFO GIS package. This information will be combined with oak wilt, climate, soils, and prescribed burn history to analyze vegetation change over time under different burn treatments.

Data Set Code: CDR029

Site-Specific Code: CDR.E083

Accessibility: 4" tape

Proprietary limits: 1992

Data Set Title: Groundwater Dynamics and Chemistry at Cedar Creek Natural History Area

Investigator(s): Mark W. Basiletti, Dave F. Grigal

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/89 Sampling frequency: monthly to quarterly Number of sites: 87 Algorithms used to synthesize data (if applicable):

Abstract: Eighty-seven piezometers (cased bore holes) were installed along topographic transects within the Cedar Creek Natural History Area. Depth to water table is measured at each well at a monthly to quarterly interval. Water samples are collected periodically and analyzed for pH and major cations and anions.

Data Set Code: CDR030

Site-Specific Code: CDR.E084

Accessibility: 1/4" tape

Proprietary limits: 1992

CENTRAL PLAINS EXPERIMENTAL RANGE



90

CENTRAL PLAINS EXPERIMENTAL RANGE LTER SITE

Site Name:	Central Plains Experimental Range (CPER) - Shortgrass Steppe
Institutional Affiliation:	USDA, Agricultural Research Service (ARS) Colorado State University
Location:	50 km east of Fort Collins, CO, adjacent to Pawnee National Grassland 40°49'N, 104°46'W elevation: 1,650 m area: 6,280 ha
Principal Biome:	Grassland
Main Communities:	Shortgrass steppe, floodplain shrubland, salt meadow
LTER Research Topics:	Hydrologic cycle and primary production Microbial responses Disturbance and ecosystem recovery 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

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 max-min range of 17°C. Annual precipitation averages 311 mm and has ranged between 110 and 580 mm over the past 34 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 (IBP). It is less than a one-half 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*, *Gutierrezia sarothrae*, and

ranges from 60 to 180 g/m² depending on soil water availability. 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; aboveground and belowground grazing; and long-term meteorological monitoring. Associated studies on other grassland sites include organic matter and nutrient cycling, effects of atmospheric pollutants, soilplant 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, disturbance and ecosystem recovery, 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 m²) with office, laboratories, dining/meeting room, and kitchen. Storage/sample-processing building (134 m²) with facilities for washing and drying samples. Dormitory with six rooms; five capable of double occupancy and one with four beds. Largeanimal handling and holding pens. Residence for site manager.

Addresses:

Principal Investigators: William K. Lauenroth Department of Range Science and Natural Resource Ecology Laboratory Colorado State University Fort Collins, CO 80523 (303) 491-7581 FAX: (303) 491-0279 bill@geococcyx.cfnr.colostate.edu (Internet)

Ingrid C. Burke Department of Forest and Wood Science and the Natural Resource Ecology Laboratory Colorado State University Fort Collins, CO 80523 (303) 491-1620 FAX: (303) 491-0279 indy@saccharum.nrel.colostate.edu (Internet)

Data Manager: Thomas B. Kirchner Natural Resource Ecology Laboratory Colorado State University Fort Collins, CO 80523 (303) 491-1986 FAX: (303) 491-0279 tom@chloris.nrel.colostate.edu (Internet) TOMNREL@CSUGOLD (Bitnet) **Data Set Title:** Response of Shortgrass Steppe Plant Communities to Long-Term (50 Years) Grazing Cattle

Investigator(s): David G. Milchunas, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/84 Sampling frequency: 1984, 1986, 1990, and every-other-year thereafter Number of sites: 12 Algorithms used to synthesize data (if applicable):

Abstract: Long-term light, moderate, and heavy cattle grazing treatments and ungrazed exclosures were established at the CPER in 1939. This study examines plant species density and basal cover on the heavy grazed and ungrazed treatments, and the interactions of grazing with landscape topography (uplands and lowlands) and temporary differences in abiotic conditions. The data collected are the same as that for the water, nitrogen, water plus nitrogen, and white-grub large scale disturbances (CPR004), thereby allowing comparisons of long-term succession among a variety of control and disturbed sites

Data Set Code: CPR001

Site-Specific Code:

Accessibility: tape (9 track, 8 mm), digital

Proprietary limits: contact investigator

Data Set Title: Carbon Dynamics and Net Belowground Primary Production of Shortgrass Steppe Plant Communities

Investigator(s): David G. Milchunas, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/85 Sampling frequency: annually Number of sites: 8 Algorithms used to synthesize data (if applicable):

Abstract: Eight large plots were heavily labeled with carbon 14 for the purpose of assessing the implications of short- and long-term carbon dynamics on estimates of aboveground, crown, and root production using carbon 14 dilution, C-14 turnover, and traditional harvest methods. Plots were sampled 4 times in 1985, 3 times in 1986, 2 times in 1987 and 1989, and annually thereafter. Supplementary root biomass samples are taken monthly through the growing season from unlabeled plots 3 m north of each C-14 plot. Short-term data include respiration, translocation, and incorporation of labile carbon into structural tissue. Long-term data includes turnover of aboveground, crown, and root tissue and the incorporation into soil carbon pools.

Data Set Code: CPR002

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigator

Data Set Title: Aboveground Net Primary Production and Nitrogen Yield of Shortgrass Steppe Plant Communities

Investigator(s): David G. Milchunas, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/83 Sampling frequency: annually Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: ANPP is estimated on upland, backslope, and lowland topographical positions in caged, moderately grazed grassland, and in an ungrazed upland community. The ungrazed upland community was fenced in 1969, and provides a link with earlier linternational Biological Program data. Clipping is by species. Samples for the dominant grass and forb, and all other species combined, are analyzed for total nitrogen to provide estimates of N yield. Neutron probe soil water is monitored through the growing season at these sites.

Data Set Code: CPR003

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigator

Data Set Title: Recovery of Shortgrass Steppe Plant Communities From Large-Scale (1 ha) Disturbances

Investigator(s): David G. Milchunas, William K. Lauenroth

Temporal and Spatlal Resolution Initiation of study (mm/dd/yy): 07/01/71 Sampling frequency: biannually Number of sites: 9 Algorithms used to synthesize data (if applicable):

Abstract: Control, water, nitrogen, and water-plus-nitrogen treatments were initiated in 1971. The experimental design consists of two replicates of factorial combinations of water and nitrogen, with each treatment a 1-ha area, and the treatments applied from 1971-1975. Large areas of white-grub disturbance, created in 1976, adjacent to the nutrient disturbances are also sampled. Sampling consists of plant density and basal cover. Years of data available are 1971-72, 1975-77, 1982-89, with sampling biannually thereafter.

Data Set Code: CPR004

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigators

CPR005

Data Set Title: Weather Data

Investigator(s): William J. Parton, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/82 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: These data are collected within an exclosure that has been ungrazed since 1969. Included are wind speed and direction, precipitation, air and soil temperatures, and relative humidity. Supporting data include daily recordings of open-pan evaporation, relative humidity, and temperature with a hygrothermograph, and precipitation and evapotranspiration with a weighing lysimeter.

Data Set Code: CPR005

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: available on request

Data Set Title: Soil Water Dynamics at the Central Plains Experimental Range

investigator(s): William J. Parton, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/87 Sampling frequency: biweekly (May-October), monthly (November-April) Number of sites: 6 Algorithms used to synthesize data (If applicable):

Abstract: Soil water is estimated for several depths, beginning at 15 cm, using a neutron moisture gauge. The data are summarized as volumetric percent water by depth increment by date. Information about specific procedures and calibrations are available on request.

Data Set Code: CPR006

Site-Specific Code:

Accessibility: paper and magnetic media

Proprietary limits: Available on request

Data Set Title: Soil and Vegetation Pattern on Catenas at the Central Plains Experimental Range

Investigator(s): William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/79 Sampling frequency: 1981, 1989 Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Soil and vegetation are sampled over five catenas in a single pasture (21N). Canopy and basal cover are estimated for each species at fixed distances along each catena. Soil cores are collected in conjunction with plant cover samples. Soil variables assessed include texture, pH, carbon, and nitrogen. Soil variables are summarized by both depth and horizon.

Data Set Code: CPR007

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: Limited availability

CPR00

Data Set Title: Recovery of Shortgrass Steppe Plant Communities From Small-Scale (0.1-10 m²) Disturbances

Investigator(s): Debra P. Coffin, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/84 Sampling frequency: annually Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Effects of disturbance size and type on shortgrass plant communities have been evaluated for small-scale disturbance since 1984. Plant cover and density by species are obtained yearly for artificially produced disturbances of three sizes (0.2, 0.8, 1.8 m²) of two sites differing in soil texture (sand, loam, sandy clay loam), and for four dates during the growing season when the disturbances were produced. In addition, abandoned western harvester ant nest sites of similar size and data are sampled for plant cover and density. Areas killed by white grubs (5-100 m²) have been sampled five times since 1977. Areas killed by cattle fecal pats (< 0.2 m²) have been sampled yearly since 1987.

Data Set Code: CPR008

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigators
CPR009

Data Set Title: Population Dynamics of Bouteloua gracilis

Investigator(s): Debra P. Coffin, William K. Lauenroth

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/89 Sampling frequency: yearly Number of sites: 10 Algorithms used to synthesize data (if applicable):

Abstract: Population dynamics of *Bouteloua gracilis* has been evaluated since 1989 for 10 sites based on soil texture and intensity of grazing by cattle. Number and height of flowering culms, number of viable seeds, and weight of reproductive structure were determined on an individual plant and community-level basis. Sampling will continue on an annual basis.

Data Set Code: CPR009

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigators

Data Set Code:

Site-Specific Code

Accessibility:

Proprietary limits:

Data Set Title: Effects of Cattle Grazing and Landscape Position on the Turnover of Carbon and Nitrogen in Shortgrass Steppe Plant Communities

Investigator(s): David S. Schimel, Ingrid C. Burke, William J. Parton

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 06/01/89 Sampling frequency: 1 per year for 2 years, 1 per 5 years for 25 years Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: We have initiated a long-term N-15 tracer study across a grazing and landscape gradient at the CPER. The goals of the study are 1) to follow the incorporation of N into labile and recalcitrant soil organic matter fraction over the long-term; and 2) to evaluate the influence of landscape position and grazing on these processes.

Data Set Code: CPR010

Site-Specific Code:

Accessibility: magnetic media

Proprietary limits: contact investigator

Data Set Title: Effects of Long-Term (50 Years) Cattle Grazing on the Breeding Behavior of Songbirds at the Central Plains Experimental Range

Investigator(s): Ronald Ryder

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/72 Sampling frequency: weekly counts done annually 1968-1972 and every 5 years since Number of sites: 6 Algorithms used to synthesize data (If applicable):

Abstract: Six 8-ha plots are censused for breeding pairs during the growing season (April 15 to August 15). Two plots are located in each of three long-term grazing pastures (light, moderate, and heavy grazing intensity). Data are summarized in terms of numbers and estimated biomass production.

Data Set Code: CPR011

Site-Specific Code:

Accessibility: paper, magnetic media

Proprietary limits: contact investigator



COWEETA HYDROLOGIC LABORATORY LTER SITE

Site Name:	Coweeta Hydrologic Laboratory
Institutional Affiliation:	University of Georgia USDA, Forest Service, Southeastern Forest Experiment Station
Location:	The Coweeta Basin is located in the Nantahala Mountains, part of the Blue Ridge province of the southern Appalachian Mountains, 17 km south of Franklin, NC 35°N, 83°30'W elevation: 679 to 1,595 m area: 2,185 ha
Principal Biome:	Deciduous forest
Main Communities:	Eastern deciduous forest, white pine plantations
LTER Research Topics:	Long-term dynamics of forest ecosystems Ecosystem response to perturbation Input-output elemental dynamics in forested ecosystems Land-stream interactions Consumer regulation of ecosystem processes Atmospheric deposition Response to regional climatic change

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.

Narrative:

The Coweeta Hydrologic Laboratory is located in the mountainous terrain that supports moist stands of eastern deciduous forest. The laboratory has been a U.S. Department of Agriculture, Forest Service, research site for over 50 years and is one of the oldest, continuously operated research projects of its type in the world. The laboratory 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 include 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. Dormitory space and housing for graduate students and visiting scientists. At the

University of Georgia, laboratory space and equipment are available in the 25,000 sq. ft. ecology building.

Addresses:

Principal Investigator: Judy L. Meyer Institute of Ecology University of Georgia Athens, GA 30602 (404) 542-3363 FAX: (404) 542-6040 JMEYER@UGA (Bitnet) Site Director: Wayne T. Swank Coweeta Hydrologic Lab 999 Coweeta Lab Road Otto, NC 28763 (704) 524-2128 FAX: (704) 369-6768 USFS: S29L05A Data Manager: Gil Calabria Institute of Ecology University of Georgia Athens, GA 30602 (404) 542-2968 FAX: (404) 542-6040 GCALABRI@UGA (Bitnet)

CWT001

Data Set Title: Coweeta Climatic Measurements

Investigator(s): Lloyd W. Swift

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/01/35 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: This data set contains Level 1 climatic parameters for the main Coweeta Climatic Station. All the data have been collected daily and are summarized by the following parameters: monthly mean temperature, monthly maximum and minimum temperature, monthly total precipitation, and monthly mean global radiation.

Data Set Code: CWT001

Site-Specific Code: DS#138

Accessibility: paper, digital, tape

Data Set Title: Precipitation Chemistry: Coweeta Hydrologic Laboratory

Investigator(s): Wayne T. Swank

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/15/72 Sampling frequency: weekly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The precipitation chemistry is for bulk precipitation at the main Coweeta Climatic Station. Data were collected from 1972 through 1989 and include the following variables: pH, NO_3 -N, NH_4 -N, PO_4 , Cl, K, Na, Ca, Mg, SO_4 , and SiO_2 .

Data Set Code: CWT002

Site-Specific Code: DS#136

Accessibility: paper, digital, tape

Data Set Title: Streamflow Chemistry: Coweeta Hydrologic Laboratory

Investigator(s): Wayne T. Swank

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/28/71 Sampling frequency: weekly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The streamflow chemistry data are for WS 18, a mixed-hardwood control watershed. Data were collected from 1971 through 1989 and include the following variables: head, pH, NO_3 -N, NH_4 -N, PO_4 , Cl, K, Na, Ca, Mg, SO_4 , and SiO_2 .

Data Set Code: CWT003

Site-Specific Code: DS#137

Accessibility: paper, digital, tape

CWT004

Data Set Title: Clearcut Regeneration Study: WS 7 Coweeta Hydrologic Laboratory

Investigator(s): Lindsay R. Boring, Bruce L. Haines

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/10/77 Sampling frequency: annual/variable Number of sites: 25 plots Algorithms used to synthesize data (if applicable):

Abstract: This data set compares species composition and biomass across sites and over the first 6 years of regrowth with values for an adjacent, uneven-age, mixed hardwood forest (WS 18). Data collection took place during years 1, 2, 3, and 6 (1977, 1978, 1979, and 1982 respectively). Throughout the study, hardwood stems were sampled to determine diameter/ biomass relationships by fitting logarithmic transformed equations for leaf, bole, and branch biomass. These were coupled with plot survey data to estimate biomass of woody species, and destructive plot harvesting was used for herbaceous and vine biomass.

Data Set Code: CWT004

Site-Specific Code: DS#2

Accessibility: paper, digital, tape

Data Set Title: Ecology of Stream Invertebrates in a Forested and a Commercially Clearcut Watershed

Investigator(s): Martin E. Gurtz, J. Bruce Wallace

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/22/77 Sampling frequency: monthly Number of sites: 1 Algorithms used to synthesize data (if applicable): raw count per sample converted to number/m²

Abstract: This data set verifies the hypotheses that invertebrate community response to disturbance is dependent on physical stability of substrate, and that functional response of invertebrates is influenced by shifts in resource availability. Four Surber samples were collected each month in each of four substrates: rock face, cobble, pebble, and sand.

Data Set Code: CWT005

Site-Specific Code: DS#134

Accessibility: paper, digital, tape

CWT006

Data Set Title: Litterfall on Watershed 7

Investigator(s): Wayne T. Swank

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/74 Sampling frequency: biweekly Number of sites: 10 traps, 1 watershed Algorithms used to synthesize data (if applicable):

Abstract: Litter fall was sampled in three vegetation zones on WS 7 at Coweeta Hydrologic Laboratory. The three zones are core hardwood, oak-hickory, and oak-pine. Litter was sampled biweekly during leaf fall, sorted by species, and sorted by woody and non-woody parts. This watershed was clearcut by cable logging during 1977. The data set spans pre-cut and post-cut conditions.

Data Set Code: CWT006

Site-Specific Code:

Accessibility: paper, digital, tape

CWT007

pata Set Title: Tree Species Survey for Watershed 18

Investigator(s): Frank P. Day

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/70 Sampling frequency: Number of sites: 25 Algorithms used to synthesize data (if applicable):

Abstract: This data set documents the harvest of all plants less than one foot tall in 1 m² plots; measurements of basal diameters of all stems less than 1 in DBH but greater than 1 ft tall within 5 m² plots; and measurements of basal diameters of all stems greater than or equal to 1 in DBH in 25 m x 50 m plots.

Data Set Code: CWT007

Site-Specific Code: DS#105,106,107

Accessibility: paper, digital, tape



HARVARD FOREST LTER SITE

Site Name:	Harvard Forest
Institutional Affiliation:	Harvard University
Location:	110 km west of Boston, MA 42°32'N, 72°10'W elevation: 220 to 410 m area: 1,200 ha
Principal Biome:	Temperate deciduous-coniferous forest
Main Communities:	Hardwood-white pine-hemlock forest, spruce swamp forest, conifer plantations
LTER Research Topics:	 Long-term climate change, disturbance history, and vegetation dynamics Comparative ecosystem study of anthropogenic and natural disturbance Community, population, and plant architectural response to disturbance Forest-atmosphere trace gas fluxes Ecophysiology and micrometeorology Organic matter accumulation, decomposition, and mineralization Element cycling, fine root dynamics, and forest microbiology

Climate Synopsis:

Cool (July mean 20°C, January -7°C) and humid, with annual mean precipitation of 110 cm distributed fairly evenly through the year.

Narrative:

The central theme of the Harvard Forest LTER is a comparison of historically important physical disturbances and recent and projected chemical disturbances in terms of their effect on forest ecosystem structure and function. One fundamental question is whether chronic, low-level additions of pollutants can result in more lasting alteration of ecosystem function than does the historical regime of disturbance. Research topics include long-term climate change, disturbance history, and vegetation dynamics; comparative ecosystem study of human and natural disturbance; community, population, and plant architectural response to disturbance; forest-atmosphere trace gas fluxes; ecophysiology and micrometeorology; and organic matter accumulation, decomposition, and mineralization. Core experiments include re-creation of physical types of disturbance (catastrophic hurricane blowdown, smaller windthrows, and selective mortality of overstory species); simulation of chronic chemical disturbance by altering inputs of important nutrients or pollutants; and repetition of treatments to assess the range of variation in organism and ecosystem response. Synthesis of the research is aided through the application of remote sensing, GIS, and modelling.

The Harvard Forest contains three primary tracts: Prospect Hill (PH), Tom Swamp (TS), and Slab City (SC). Each tract is divided into 9 or 10 compartments, designated by Roman numerals (see map).

HFR001 weather station at Headquarters (PH I)
HFR002 three tracts: Prospect Hill, Tom Swamp, and Slab City
HFR003 4 ha site: PH I and VIII; 0.7 ha site: PH II
HFR004 oak-maple site: PH IV; red pine site: PH IV
HFR005 Harvard Forest site: PH; Pisgah site: Winchester, NH
HFR006 0.35 ha site: PH II; 0.6 ha site: TS I

Facilities:

Shaler Hall (15,00 sq. ft.) contains offices, research laboratories, classrooms, the Harvard Forest archives, a library of 22,00 volumes, dormitory accommodation for 25 persons and a dining room and kitchen. Common research space includes a photographic suite and darkroom, a graphics and mapping room, a projection and film analysis room for video microscopy, GIS facilities and computers, and laboratories for physiological microbiological, morphological, and nutrient studies. The Controlled Environment Facility (4,000 sq. ft.) is comprised of a head house, two research greenhouses, offices, laboratories, eight growth chambers, and a facility for microbiology and sterile culture work. A woods crew of three men and the forest manager are fully equipped for experimental manipulations, forestry operations, and maintenance. University-owned houses and apartments provide 12 additional residences. The Fisher Museum (10,000 sq. ft.) houses the Harvard Forest Dioramas, a lecture hall, and exhibits in forest ecology.

Addresses:

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Data Set Title: Meteorological Data

Investigator(s): David R. Foster

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/01/13 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Minimum temperature, maximum temperature, and 24-hour precipitation amounts the recorded daily.

Data Set Code: HFR001

Site-Specific Code:

Accessibility: paper, digital (some)

Data Set Title: Forest Inventory

Investigator(s): David R. Foster

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/15/36 Sampling frequency: variable Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Three forested tracts, comprising a total of 1,200 ha, are sampled every 10-30 years. Stand boundaries are located by ground survey (1936) or aerial photography (1946 and later). Each stand is sampled (sampling technique varies), noting tree species, DBH class, height class, canopy class, form, and condition. This data is best suited for studying large-scale changes in the forest.

Data Set Code: HFR002

Site-Specific Code:

Accessibility: paper, digital (some)

Data Set Title: Tree Maps

Investigator(s): David R. Foster

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/62 Sampling frequency: variable Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Two sites are sampled every 5-15 years: (1) 4 ha, mixed hardwoods, since 1962; (2) 0.7 ha, hemlock, since 1990. Standing trees (> 5 cm) are mapped, and species type, DBH, canopy class, and condition are recorded. Stumps, mounds, and fallen stems are also mapped.

Data Set Code: HFR003

Site-Specific Code:

Accessibility: paper, digital (some)

Data Set Title: Ecosystem Response to Chronic Nitrogen Additions

Investigator(s): John D. Aber, Jerry M. Melillo, Knute J. Nadelhoffer, Paul A. Steudler

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 05/08/88 Sampling frequency: variable Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Nitrogen is being added as ammonium nitrate at rates of 50 and 150 kg/ha-yr in oakmaple and red pine stands. Measurements include nitrogen mineralization, litter decomposition, tree growth, foliar chemistry, litter chemistry, and CH_4 , CO_2 , and N_2O fluxes.

Data Set Code: HFR004

Site-Specific Code:

Accessibility: paper, digital (some)

Data Set Title: Post Hurricane Vegetation Response

Investigator(s): David R. Foster

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/38 Sampling frequency: variable Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Plot level regeneration following the 1938 hurricane is measured at Harvard Forest (since 1938) and at Pisgah (Winchester, New Hampshire, since 1984). Measurements include tree species, DBH, canopy position, and estimates of ground cover. Local topography, soil type, landuse history, pre-hurricane vegetation, and hurricane damage have been recorded. Sampling intervals range from one to 30 years.

Data Set Code: HFR005

Site-Specific Code:

Accessibility: paper

Data Set Title: Hurricane Simulation

Investigator(s): David R. Foster, John D. Aber, Jerry M. Melillo, Knute J. Nadelhoffer, Paul A. Steudler, Fakhri A. Bazzaz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/20/89 Sampling frequency: variable Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Trees will be pulled down to simulate hurricane damage in two mixed hardwood plots: (1) 0.35 ha, September 1989; (2) 0.6 ha, September 1990. In the first plot, the extent of damage, changes in microtopography, and vegetation regeneration will be measured. In the second plot, vegetation will be measured and mapped before the pulldown. After the pulldown, selected areas will be treated with chronic nitrogen addition and/or deer exclosure. Measurements will include the extent of damage, changes in microtopography, micrometeorological conditions, vegetation regeneration, litter chemistry, and trace gas fluxes.

Data Set Code: HFR006

Site-Specific Code:

Accessibility: paper, digital (some)



HUBBARD BROOK EXPERIMENTAL FOREST LTER SITE

Site Name:	Hubbard Brook Experimental Forest
Institutional Affiliation:	U.S. Forest Service, Northeastern Forest Experiment Station
Location:	Near West Thornton, NH, about 200 km north of Boston, MA 43°56'N, 71°45'W elevation: 229 to 1,015 m area: 3,160 ha
Principal Biome:	Northern hardwood forest
Main Communities:	Northern hardwood forest in various developmental stages; spruce-fir, aquatic habitats include both streams and lakes
LTER Research Topics:	Vegetation structure and production Dynamics of detritus in terrestrial and aquatic ecosystems Atmosphere-terrestrial-aquatic ecosystem linkages Heterotroph population dynamics

Climate Synopsis:

Humid continental climate with short, cool summers and long, cold winters. Annual precipitation is 130 cm, July mean temperature is 19°C, and January mean temperature is -9°C. A continuous snowpack of about 1.5 m develops each winter.

Narrative:

Long-term ecosystem research has been conducted at the Hubbard Brook Experimental Forest since it was established in 1955 by the USDA, Forest Service, as a center for hydrologic research in New England. In 1963, the Forest Service and Dartmouth College (through G.E. Likens, F.H. Bormann, and N.M. Johnson) developed a cooperative agreement to conduct studies of nutrient cycling at Hubbard Brook as the first step in a comprehensive study of a northern hardwood forest ecosystem and associated stream and lake ecosystems. Since its inception, the Hubbard Brook Ecosystem Study (HBES) has made major contributions to environmental science which have facilitated policy decisions regarding the management of terrestrial and aquatic ecosystems. Over the past 26 years the National Science Foundation has continually provided support for the HBES to 1) evaluate the changing nature of biogeochemical inputs and outputs of the northern hardwood forest ecosystem and their effects on the terrestrial ecosystems and the interconnected aquatic ecosystems; 2) examine and compare the role of disturbance in governing the structure, function, and development of the northern hardwood forest ecosystem and its effect on outputs; and 3) develop ecological principles governing the structure, function, and development of forested watersheds and to attempt to incorporate these principles in decision-making processes.

The theme of the LTER program at Hubbard Brook Experimental Forest is ecosystem response and ecological development in northern hardwood watersheds following large-scale

disturbance, and the overall goal of the study is to improve our understanding of mechanisms whereby ecosystem energy, water, and nutrient budgets change in response to disturbance. An integrated set of experiments and material budget studies will be used to achieve this goal. These studies will focus on 1) vegetation structure and production, including population demography and forest growth; neighborhood competition and individual tree growth and survival; and herbicide effects on succession, biomass, and nutrient accumulation; 2) the dynamics of detritus, including organic matter processing in streams; forest floor accumulation and dissipation; supply mineralization and leaching of coarse woody debris; and formation and disruption of organic debris on streams; 3) atmosphere-terrestrial-aquatic ecosystem linkages, including long-term trends in precipitation and streamwater chemistry; dry deposition inputs and chemistry; hillslope hydrology and hydrologic modeling; and the effects of disturbance on the H⁺ cycle; and 4) long-term studies of heterotroph populations, including population dynamics of breeding birds and phytophagous insects; forage quality and herbivory by white-tailed deer; and population dynamics of the ubiquitous fungal pathogen *Armillaria*.

Facilities:

Office, laboratory, and living facilities are located at the entrance to the Hubbard Brook Experimental Forest, and include: 1) the U. S. Forest Service Station with a research laboratory, several offices, overnight housing for about 12 persons, and a large warehouse/shop; and 2) the Pleasant View Farm facility and Henrietta K. Towers' laboratory with housing for about 16, four large analytical laboratories, and a dry laboratory, shop, and warehouse.

Addresses:

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Charles T. Driscoll Department of Civil Engineering Syracuse University Syracuse, NY 13210 (315) 443-3434 CDRISCOL@SUNRISE (Bitnet) cdriscol%sunrise.bitnet@suvm.acs.syr.edu (Internet) Data Manager: Cindy Veen U.S. Forest Service Forestry Sciences Laboratory P.O. Box 640 Durham, NH 03824 (603) 868-5692 FAX: (603) 868-1538 USFS S24L06A CFEDERER@UMDARS (Bitnet)

Data Set TItle: Hubbard Brook Precipitation

Investigator(s): James W. Hornbeck, C. Anthony Federer

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/56 Sampling frequency: daily, weekly Number of sites: 6, 22 Algorithms used to synthesize data (if applicable): prorating of weekly totals by daily data, then Theissen weighting to obtain daily values for each watershed

Abstract: Precipitation data has been collected with a network of standard and recording rain gauges since 1956. The standard gauge data is collected weekly, then prorated to daily values using the recording gauge data. The daily standard gauge data is then converted to a daily watershed value using a Theissen weighting.

Data Set Code: HBR001

Site-Specific Code:

Accessibility: microcomputer bulletin board

Data Set Title: Hubbard Brook Streamflow

Investigator(s): James W. Hornbeck, C. Anthony Federer

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/56 Sampling frequency: daily Number of sites: 8 Algorithms used to synthesize data (if applicable):

Abstract: Daily streamflow data have been collected at the gauged watersheds at the Hubbard Brook Experimental Forest since 1956. Instantaneous and interval streamflow data for varying times (one minute to 12 hours) have also been determined for the watersheds. Each gauge consists of a 90° or a 120° sharp-crested V-notch weir. Water level in the V-notch stilling basin is recorded continuously on Stephens A-35 streamflow recorders. The time-gauge height pairs are converted to streamflow rate at each digitized time and then to streamflow for the interval between each pair of digitized times. The streamflow rates are then integrated to daily and monthly totals.

Data Set Code: HBR002

Site-Specific Code:

Accessibility: microcomputer bulletin board, tape

pata Set Title: Hubbard Brook Temperature

Investigator(s): C. Anthony Federer

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/56 Sampling frequency: daily Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Daily maximum, minimum, and mean temperatures from up to five locations at the Hubbard Brook Experimental Forest have been measured since 1956 using mechanical hygro-thermographs in weather shelters. Temperatures are stored as degrees C.

Data Set Code: HBR003

Site-Specific Code:

Accessibility: microcomputer bulletin board

Data Set Title: Hubbard Brook Soil Temperature, Snow, and Frost

Investigator(s): C. Anthony Federer

Temporal and Spatial Resolution

Initiation of study (mm/dd/yy): 01/01/59 for soil temperature data, 1956 for snow data Sampling frequency: approximately weekly for soil temperature, weekly for snow and fros Number of sites: 1, soil temperature; several, varied - snow and frost Algorithms used to synthesize data (if applicable):

Abstract: Soil temperature data have been collected approximately weekly at one location ir the Hubbard Brook Experimental Forest (HBEF) since 1959. Sensors are replicated (1 and 2) at depths of 1, 3, 6, 9, 12, 18, 24, and 36 inches. The sensors are Colman temperature-moisture units. Snow course data have been collected approximately weekly at a network of standard rain gauges at the HBEF from 1956 to the present when there was snow on the ground. Each measurement for the snow data consists of the average of 10 points measuring snow depth and water content using a Mt. Roses snow tube. The presence or absence of frost in the ground is checked at two points adjacent to each snow course by probing with a ski pole. The percentage of total probe locations having frost is recorded for each snow course. At the first two snow points having frost, a hole is dug into the soil and the depth of frost is measured. The two depths are averaged.

Data Set Code: HBR004

Site-Specific Code:

Accessibility: microcomputer bulletin board

Data Set Title: Hubbard Brook Solar Radiation, Wind, and Humidity

Investigator(s): C. Anthony Federer

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/07/81 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (If applicable):

Abstract: Solar radiation, wind speed and direction, and relative humidity have been recorded at the automatic weather station at the Hubbard Brook Experimental Forest headquarters since 1981. The data is sampled once a minute and recorded hourly by a Campbell CR-21 data logger. Interruptions in the data are frequent, exist for various periods of time, and occur for one, some, or all of the sensors. Only the daily totals are available on the microcomputer bulletin board.

Data Set Code: HBR005

Site-Specific Code:

Accessibility: microcomputer bulletin board

Data Set Title: Soil Solution Chemistry in an Undisturbed Northern Hardwood Forest

Investigator(s): Charles T. Driscoll

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/84 Sampling frequency: monthly Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Soil solutions are collected in zero tension lysimeters at the three elevations near watershed 6 at the Hubbard Brook Experimental Forest. Lysimeters are located beneath Oa and E horizons and within the Bs2 horizon. Two or three replicates are present for each horizon at each site. Samples are analyzed for DOC, pH, Ca, Mg, K, Na, Si, alkalinity, $SO_4^{2^\circ}$, NO_3° , Cl^{\circ}, total Al, non-labile monomeric Al, and labile monomeric Al. During the dry months (July - August) some lysimeters do not yield samples. Limited data also exist for lysimeters in watershed 5 (clearcut in 1983).

Data Set Code: HBR006

Site-Specific Code:

Accessibility: microcomputer bulletin board (future)

Proprietary limits: none, once data is downloaded to microcomputer bulletin board

Data Set Title: Longitudinal Stream Chemistry in an Undisturbed Northern Hardwood Forest watershed

Investigator(s): Charles T. Driscoll

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/10/82 Sampling frequency: monthly Number of sites: 6 Algorithms used to synthesize data (if applicable):

Abstract: Monthly stream samples are collected from watershed 6 at the Hubbard Brook Experimental Forest in central New Hampshire. Samples are analyzed for DOC, pH, Ca, Mg, Na, K, $SO_4^{2^\circ}$, NO_3° , alkalinity, Cl, total Al, Si, labile monomeric Al, and non-labile monomeric Al. The six sampling sites form a longitudinal transect from 730 m elevation to 500 m elevation. In addition, limited data is available on similar transects in watershed 5 (clearcut in 1983), and watersheds 7 and 8.

Data Set Code: HBR007

Site-Specific Code:

Accessibility: microcomputer bulletin board (future)

Proprietary limits: none, once data is downloaded to microcomputer bulletin board

Data Set Title: Forest Inventory of Hubbard Brook Reference Watershed 6

Investigator(s): Thomas G. Siccarna, F. Herbert Bormann, Gene E. Likens, Robert H. Whittaker

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/15/65 Sampling frequency: 5 years Number of sites: 1 Algorithms used to synthesize data (If applicable): 1) standard phytosociological analysis, 2) biomass and production, 3) dead trees (standing), 4) nutrient calculation

Abstract: This data set consists of an inventory of live stems (in 1965) 2 cm DBH on two of 10 m x 10 m plots on the reference watershed (6) of the Hubbard Brook Experimental Forest. In 1977 this was expanded to a total inventory of all stems 10 cm DBH (live and dead) on 208 25 m x 25 m plots. This level has been maintained in the subsequent samplings (1982 and 1987). In those later samplings a subset of plots was sampled for the 2-10 cm size class.

Data Set Code: HBR008

Site-Specific Code:

Accessibility: paper, digital, Hubbard Brook bulletin board (microcomputer)

Proprietary limits: after publication of primary analysis or by permission of investigators

Special Comments: EDEX 4.1.1.1, EDEX 4.1.1.2, EDEX 4.1.1.3, EDEX 4.1.1.4

Data Set Title: Trace Metals in PPT and Streamwater at the Hubbard Brook Experimental Forest

Investigator(s): Thomas G. Siccama, William H. Smith, Neil Scott, Gene E. Likens, Charles T. Driscoll

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/75 Sampling frequency: monthly or weekly Number of sites: 1 or 2 Algorithms used to synthesize data (if applicable): 1) input/output budgets, 2) patterns of concentration vs. flow rates, 3) seasonality

Abstract: Precipitation and streamwater samples are collected once a month (or twice a month in summer) and sent to the University of Missouri Trace Substances Laboratory for analysis. Analyses are for Pb, Ni, Cd, Cu, Mn, Fe, and Zn. We are currently routinely sampling the reference watershed (6) and the recently clearcut watershed (5) in the Hubbard Brook Experimental Forest. Watersheds 2, 4, and 8 were studied for two-year periods in the late 1970's. Summary analyses are completed through 1988.

Data Set Code: HBR009

Site-Specific Code:

Accessibility: paper, digital, Hubbard Brook bulletin board (microcomputer)

Proprietary limits: after publication of primary results or by permission of investigators

Special Comments: EDEX 4.10.1, EDEX 4.10.2

Data Set Title: Quantitative Forest Floor Mass, Organic Matter, and Chemistry at the Hubbard Brook Experimental Forest

Investigator(s): Thomas G. Siccama, Arthur H. Johnson, Chris E. Johnson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/15/76 Sampling frequency: 5 years Number of sites: 1 Algorithms used to synthesize data (if applicable): 1) spatial patterns, 2) accumulation/decomposition rates, 3) chemistry

Abstract: The forest floor has been quantitatively sampled on the reference watershed (6) of the Hubbard Brook Experimental Forest in 1976, 1977, 1978, 1982, and 1987 using a 15 cm x 15 cm template. Material has been dried (80°C), ground, and analyzed for Pb, Zn, and Cu and loss on ignition. Material has been physically preserved in JARS (Jointly Accessible Research Samples), a library of nearly 7,000 physical data samples.

Data Set Code: HBR010

Site-Specific Code:

Accessibility: paper, digital, Hubbard Brook bulletin board (microcomputer)

Proprletary limits: after publication of primary results or with permission of living investigators

Special Comments: EDEX 4.8.4, EDEX 4.8.5, EDEX 4.8.6, EDEX 4.8.7, EDEX 4.8.10; also JARS 887-995, JARS 1589-1646, JARS 956-1241, JARS 1716-1895, and JARS 1242-1319
Data Set Title: Hubbard Brook Ecosystem Study Long-term Chemical Data

Investigator(s): Gene E. Likens

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/25/63 Sampling frequency: weekly Number of sites: 16 (7 first-order streams, 3 lake inlet streams, 1 lake outlet, 4 bulk precipitation collectors, 1 wet/dry precipitation collector) Algorithms used to synthesize data (if applicable):

Abstract: Chemical data have been collected, analyzed, and stored since the inception of the Hubbard Brook Ecosystem Study. There has been little change in the procedures for collection, or in the location of each collection site. All samples have been collected in HCI-washed, deionized water-rinsed, polyethylene containers. In general, samples have been measured for pH at HBEF, and then shipped to a supporting laboratory (currently at the Institute for Ecosystem Studies in Millbrook, NY) for analyses of Ca, MG, K, Na, Al, NH₄, pH, SO₄, NO₃, Cl, PO₄, and SiO₂. Any changes in analytic technique have been documented, and each involved parallel analyses for up to one year. The concentration data listed are in mg/l, except for hydrogen ion as pH.

Data Set Code: HBR011

Site-Specific Code:

Accessibility: microcomputer bulletin board (after April 1990)

Proprietary limits: data to 1980 will be available as of April 1990. Data to 1985 will be available soon thereafter. A five-year lag will be applied between collection and public availability.

Special Comments: Codes to identify missing data must be interpreted using the accompanying text file, which will be available at the time the data are loaded to the public access system.

Data Set Title: Revegetation Surveys on a Disturbed Watershed (WS 2) at the Hubbard Brook Experimental Forest

Investigator(s): William A. Reiners

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1969 Sampling frequency: 1, 2, 3, 5, 11, 20 years Number of sites: 70 plots Algorithms used to synthesize data (if applicable):

Abstract: During the winter of 1965-1966, watershed 2 at HBEF was clearcut and all trees left on site. During the summers of 1966-1968 the watershed was treated with a herbicide to prevent regrowth. Populations were sampled on 70 plots of WS 2 during 1969, 1970, 1971, 1973, 1979, and 1988, representing years 1, 2, 3, 5, 11, 20 of succession. The following data have been collected: 1) density to species level, 2) aboveground biomass, 3) aboveground productivity, and 4) aboveground pools by tissues, species, biomass, and productivity for ash, Ca, Mg, K, Na, Fe, Mn, Cu, Zn, P, S, and N. Allometric and chemical data were collected on all or parts of these populations in 1971, 1973, and 1988.

Data Set Code: HBR012

Site-Specific Code: WS2

Accessibility: tape or disk+

Proprietary limits: available upon request of investigator

Special Comments: Data are organized in various ways in Lotus 123. Sets can be supplied according to kinds of data requested. First utilization is retained by W.A. Reiners.

Data Set Title: Revegetation Surveys on Stripcut WS 4 at the Hubbard Brook Experimental Forest

Investigator(s): C. Wayne Martin, James W. Hornbeck

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/??/70 Sampling frequency: 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 15, 17, 19 years Number of sites: 57 Algorithms used to synthesize data (if applicable):

Abstract: One-third of WS 4 was clearcut in October 1970, one-third in September 1972, and one-third in October 1974 in a series of progressive strips. Regrowing vegetation has been measured on 57 plots in 1971, 1972, 1973, 1974, 1975, 1976, 1978, 1980, 1982, 1984, 1985, 1987, and 1989. Not all plots were resurveyed each year. Stems < 2.5 cm dbh were counted on four subplots per plot. Stems 2.5 cm - 10 cm dbh were counted by species on one 25 m² plot per plot. Separate plots were harvested to produce biomass equations or to test published equations. Results for 1971-1980 were published in Martin and Hornbeck 1989 (USDA Forest Service Res. Pap. NE-625).

Data Set Code: HBR013

Site-Specific Code:

Accessibility: digital

Proprietary limits: upon request after publication of data

Data Set Title: Revegetation Surveys on Stripcut WS 101 at the Hubbard Brook Experimental Forest

Investigator(s): C. Wayne Martin, James W. Hornbeck

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 11/??/70 Sampling frequency: 1, 2, 3, 5, 7, 10, 15 years Number of sites: 48 plots Algorithms used to synthesize data (if applicable):

Abstract: In November 1970, the 12-ha watershed 101 at the HBEF was clearcut as a stemonly commercial block clearcut. Regrowing vegetation has been remeasured on 48 plots in 1971, 1972, 1973, 1975, 1977, 1980, and 1985. Stems < 2.5 dbh were measured by species on 4-m² subplots per plot. Stems 2.5 cm - 10 cm dbh were measured on one 25 m² plot per plot. Separate plots were harvested to produce or test biomass conversion equations. Results for 1971-1980 were published in Martin and Hornbeck 1989 (USDA Forest Service Res. Pap. NE-625).

Data Set Code: HBR014

Site-Specific Code:

Accessibility: digital

Proprletary limits: upon request after publication of data



JORNADA LTER SITE

Site Name:	Jornada, consisting of the Jornada Experimental Range and New Mexico State University Ranch
Institutional Affiliation:	New Mexico State University USDA, Agriculture Research Service
Location:	40 km north of Las Cruces, NM 32°30'N, 106°45'W elevation: 1,318 to 1,501 m area: 104,166 ha
Principal Biome:	Subtropical desert
Main Communities:	Playa grassland, basin grassland, swale shrubland, mesquite dunes, bajada shrubland, basin shrubland, piedmont grassland, swale grassland, mountain shrubland
LTER Research Topics:	Desertification Factors affecting primary production Nitrogen cycling Direct and indirect consumer effects Organic matter transport and processing Vertebrate and invertebrate population dynamics

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; average minimum is 3.3°C in January. Summer precipitation occurs as intense, convective thunderstorms that are localized and of short duration. 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 focuses on desertification based on the hypothesis that desertification has altered a previous, relatively uniform distribution of water and nitrogen by increasing their temporal and spatial heterogeneity, leading to changes in community composition and biogeochemical processes in these arid ecosystems. The research work is organized around a series of three types of models: 1) process models based on underlying mechanisms; 2) ecosystem models defined on the basis of a biotic community in an average square meter of ecosystem types; and 3) a dynamic landscape model incorporating geographical information systems.

We hypothesize that system responses to climatic fluctuation differ among landscape units because of different spatial patterns of water and organic matter redistribution and subsequent

nitrogen availability plus intrinsic differences among types of vegetation. System components and processes are expected to respond with time lags that are a function of the life history characteristics and physiological attributes of the component populations. Intensive studies of landscape units that have undergone varying degrees of desertification during the past 100 years provide data necessary to understand and develop general models of the process.

Current studies include system responses to nitrogen enrichment and ammonia volatilization, demography of ant colonies, activity of termites, denitrification, decomposition of roots, litter fall, net primary production, soil water profiles, nitrogen mineralization, activity of lagamorphs, organic matter transport and run-off, and soil-animal relationships. These data are collected at varying intervals depending upon season and nature of the process or organism being studied.

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 makes living quarters at Jornada unnecessary. Visiting investigators often camp at the base of the mountains. Two mobile homes are available at nominal rent. Laboratory equipment and space are available on a permission-share basis at NMSU.

Addresses:

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Site Manager: John P. Anderson Department of Biology New Mexico State University Las Cruces, NM 88003 (505) 646-4465 janderso@nmsu.edu (Internet) Data Manager: David C. Lightfoot Department of Biology New Mexico State University Las Cruces, NM 88003 (505) 646-5818 FAX: (505) 646-1517 dlightfo@nmsu.edu (Internet)

JRN001

Data Set Title: Jornada Weather Station Data

Investigator(s): John P. Anderson, Walter G. Whitford

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/83 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable): volt readings converted to appropriate units

Abstract: Data are from a fully automated weather station located at the Jornada LTER site. Wind speed, wind direction, relative humidity, rainfall, incoming radiation, air temperature, and soil temperature are measured continuously. Hourly means are recorded on a data logger. The weather station is located near Mt. Summerford on a 30 m x 30 m site covered with natural vegetation and fenced with a 5' chain-link fence. Supporting data include weekly recorded evaporation from an evaporative pan.

Data Set Code: JRN001

Site-Specific Code: JWEATHER

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access unlimited

JRN002

Data Set Title: Jornada Precipitation Data

Investigator(s): John P. Anderson, Walter G. Whitford

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/18/81 Sampling frequency: monthly Number of sites: 1 (1981 on), 14 (1989 on) Algorithms used to synthesize data (if applicable):

Abstract: Precipitation is collected from graduated cylinders and automated tipping bucket and weighing bucket rain gauges. One site, in a creosote bush community, has been sampled since 1981. Sampling began in 1989 at 13 additional sites among creosote bush, tarbush, mesquite, and grassland communities.

Data Set Code: JRN002

Site-Specific Code: JORNRAIN

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access unlimited

Data Set Title: Jornada Wet/Dry Precipitation Chemistry Data

Investigator(s): William H. Schlesinger, John P. Anderson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 12/05/83 Sampling frequency: monthly (dry precipitation) and rainfall events Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Data for NO_3 , NH_4 , CI, SO₄, Ca, Mg, Na, K, total N, and total P from an Aerometrics wet/dry precipitation collector. Wet precipitation is sampled after every rainfall event. Dry precipitation is sampled once each month. The wet/dry precipitation collector is located at the Jornada weather station.

Data Set Code: JRN003

Site-Specific Code: WDIONS

Accessibility: paper, digital, LD IBM fd

Data Set Title: Soil Surface Rainfall Runoff and Sediment Transport Data From Termite Exclusion Plots

Investigator(s): Tim J. Ward, Susan Bolton, William H. Schlesinger

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/09/82 Sampling frequency: rainfall events Number of sites: 1 (8 plots) Algorithms used to synthesize data (if applicable):

Abstract: Data set contains rainfall, runoff, and sediment yield information from eight 2 m x 2 m natural rainfall runoff plots located in a creosote bush community on a piedmont slope. Four of the plots were treated with chlordane to remove termites from the soil. Two of the plots in each treatment are situated under shrub canopies, and two have no shrub canopies. Total water volume, suspended matter, sediments, % organic matter, and water chemistry are measured for each rainfall event as of fall 1989.

Data Set Code: JRN004

Site-Specific Code: HYDTERM

Accessibility: paper, digital, LD IBM fd

Data Set Title: Soil Surface Rainfall Runoff and Sediment Transport Data From Desert Shrublands and Grasslands.

Investigator(s): Tim J. Ward, Susan Bolton, William H. Schlesinger

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/89 Sampling frequency: rainfall events Number of sites: 3 (12 plots) Algorithms used to synthesize data (if applicable):

Abstract: Data set contains rainfall, runoff, and sediment yield information from twelve 2 m x 2 m natural rainfall runoff plots (plus four control plots from termite exclusion experiment: JRN004). Four plots are located in each of two different creosote bush communities and two sets of four plots are located in two different grama grassland communities. Each set of four plots is divided into two plots with low vegetation cover, and two plots with high vegetation cover. Total water volume, suspended matter, sediments, % organic matter, and water chemistry are measured for each rainfall event.

Data Set Code: JRN005

Site-Specific Code: HYDRUN

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access limited with permission of principal investigators

JRN006

Data Set Title: Jornada Soil Water Content Data

Investigator(s): Wesley M. Jarrell, Ross A. Virginia

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/05/82 Sampling frequency: monthly Number of sites: 16 Algorithms used to synthesize data (if applicable): neutron count values converted to soil water content using regression equation

Abstract: Monthly soil water content data calculated from a neutron probe (Campbell Model 503DR hydroprobe). Neutron probe readings are taken at 10 depths from 30 to 300 cm below the soil surface at 30-cm increments at 15 plots throughout the Jornada Basin (since July 1989), and at five depths from 30 to 130 cm at numerous stations across a piedmont gradient (since May 1982).

Data Set Code: JRN006

Site-Specific Code: WATCON, NPPSWC

Accessibility: paper, digital, LD IBM fd

Data Set Title: Vegetation Spatial and Temporal Pattern Data From a Piedmont Slope Gradient

Investigator(s): John P. Anderson, Laura Huenneke

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/82 Sampling frequency: annually Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Three parallel 2.7 km long transects, 50 m apart, trend northeasterly from the base of Mt. Summerford across a piedmont slope, to an intermittently flooded playa. Two transects were established in 1982, and a third in 1986. One transect has been amended with nitrogen annually since 1982, one remained untreated with nitrogen until one application in 1986, and the third transect established in 1986 has never been treated with nitrogen. Vegetation line intercept cover data is measured from 30-m transect lines which are located at 30-m intervals, and perpendicular to each of the three treatment transects. Vegetation was measured once each year until 1986, and once every five years since 1986.

Data Set Code: JRN007

Site-Specific Code: TRANSVEG

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access limited with permission of principal investigators

Data Set Title: Vegetation Pattern and Response to Grazing Release Across a Piedmont Slope Gradient.

Investigator(s): John P. Anderson, Laura Huenneke

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/10/82 Sampling frequency: 5 years Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Vegetation cover data are collected from two transects following two fencelines (east and west) down a piedmont slope from Mt. Summerford and parallel to the Jornada vegetation transects. Thirty-meter line intercept transects are established every 50 m along each fence, with 15 m of each transect outside the fence in livestock grazed areas, and 15 m inside the fence, in area ungrazed since 1982. Each 30-m intercept line is divided into six 5-m sections from which cover of perennial plants are measured every five years.

Data Set Code: JRN008

Site-Specific Code: FENCEVEG

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access limited with permission of principal investigators

JRN009

Data Set Title: Net Primary Production Data From Desert Grasslands and Shrublands

Investigator(s): Laura F. Huenneke

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/25/89 Sampling frequency: 3 times per year Number of sites: 15 Algorithms used to synthesize data (if applicable): plant canopy dimensions converted to biomass with regressions based on reference harvests; production = net positive increment in biomass over season

Abstract: Permanent 1 m x 1 m quadrats were established in 15 sites: three sites each in grama grassland, creosote bush, tarbush, mesquite, and playa vegetation. In each site, 49 quadrats are arranged on a 10-m grid. At the end of each season, (winter - February/March; spring - April/May; summer - September/October), the canopy dimensions of all plants within the permanent quadrats are recorded. Harvests are made outside the quadrats to furnish regressions for green biomass; production is estimated as the net positive increment of green biomass for each species in the quadrat.

Data Set Code: JRN009

Site-Specific Code: JORNNPP

Accessibility: paper, digital, LD IBM fd

Proprietary limits: access limited until subsets published with permission of investigator

Data Set Title: Termite Foraging Activity in Desert Grasslands and Shrublands

Investigator(s): Walter G. Whitford

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/22/89 Sampling frequency: annually Number of sites: 12 Algorithms used to synthesize data (if applicable):

Abstract: Termite foraging activity is measured as consumption of paper roll baits located on grids at each of three grama grassland, four creosote bush, three mesquite, and two tarbush sites. Termite foraging activity is measured as weight change in baits over an annual activity period.

Data Set Code: JRN010

Site-Specific Code: TERMITE

Accessibility: paper, digital, LD IBM fd

Proprietary limits: one year after collection date with permission of investigators

Data Set Title: Lizard and Ground-Dwelling Arthropod Population Data From Desert Grasslands and Shrublands

Investigator(s): Walter G. Whitford, David C. Lightfoot

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/16/89 Sampling frequency: monthly Number of sites: 12 Algorithms used to synthesize data (if applicable):

Abstract: Data for captures of lizards and ground-dwelling arthropods from 12 pitfall trap grids located at three grassland, four creosote bush, three mesquite, and two tarbush sites. Each grid contains 16 traps. Lizards are marked and released. Sampling is conducted once each month for a two-week period. Data include capture-recapture data for lizards, including species, sex, age class, weight and length, and species and numbers of individuals of arthropods.

Data Set Code: JRN011

Site-Specific Code: LIZRDPIT, ARTHRPIT

Accessibility: paper, digital, LD IBM fd

Proprietary limits: one year after collection date with permission of investigators

Data Set Title: Rabbit, Bird, and Lizard Population Data From Desert Grasslands and Shrublands

Investigator(s): Walter G. Whitford, David C. Lightfoot

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/08/89 Sampling frequency: monthly Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Data for numbers of individuals of species of rabbits, birds, and lizards recorded from five 1-km transects. One transect is located in each of creosote bush, mesquite, tarbush, grama grassland, and playa communities. Transects are sampled once each month.

Data Set Code: JRN012

Site-Specific Code: ANMLTRAN

Accessibility: paper, digital, LD IBM fd

Proprietary limits: one year after collection date with permission of principal investigators

KBS LTER Site



KELLOGG BIOLOGICAL STATION LTER SITE

Site Name:	W.K. Kellogg Biological Station
Institutional Affiliation:	Michigan State University
Location:	10 km NNE of Kalamazoo, MI 42°24'N, 85°24'W elevation: 288 m area: 1,000 ha
Principal Biome:	Row crop agriculture
Main Communities:	Conventional corn/soybean cultivation, low-input corn/legume cultivation, perennial biomass (<i>Populus</i> sp.) cultivation, native successional communities
LTER Research Topics:	Agricultural productivity Nutrient availability/organic matter dynamics Herbivory and pathogenesis Plant competition

Climate Synopsis:

Average precipitation is 92 cm annually, well distributed throughout the year. Mean annual temperature is 9°C, with a minimum monthly temperature in January of -5°C and a maximum monthly temperature in July of 22°C. Annual snowfall is variable; > 2 m/yr is common.

Narrative:

The 1,000 ha W.K. Kellogg Biological Station has been administered by Michigan State University as a primary research facility since its 1929 deeding to the university by Kellogg. In its early years the Station was devoted to wildlife, forestry, and soil conservation research; during the past 20 years a research emphasis on ecology, production agronomy, and forest genetics has led to well-established and internationally recognized programs in each of these fields. The mission of the Station, supported by 10 year-round resident faculty from several university departments, in addition to campus-based faculty and visiting scientists, puts a primary emphasis on maintaining an environment for interdisciplinary research in ecology, agriculture, and natural resources.

LTER research is centered on agricultural ecosystems with particular emphasis on ecological constraints on agronomic productivity and on the environmental impact of agriculture in the larger landscape. The overall aim of the project is to test the global hypothesis that management based on ecological concepts can effectively substitute for reliance on chemical subsidies in production-level agronomy. By imposing a range of management treatments on a series of experimental plots, investigators are testing specific hypotheses that follow from the general hypotheses that nutrient subsidies can be minimized by manipulating plant-microbe interactions, that herbicide

subsidies can be minimized by manipulating crop-weed interactions, and that pesticide subsidies can be minimized by manipulating plant-insect-pathogen interactions.

Experimental treatments include conventionally farmed cropping systems, organic-based low-input systems, perennial woody biomass systems (*Populus* clones harvested on a 5-year rotation cycle), and native old-field vegetation (see site map and main communities list). A variety of experimental manipulations at a subplot level allow specific-factor hypotheses to be tested.

Facilities:

The Kellogg Biological Station has a number of major buildings, including a new 32,000 sq. ft. research building with 12 major research laboratories, a University branch library (9,000 volumes, 160 current periodicals), an auditorium, offices, and supporting service areas (including darkrooms, isotope counting, instrument, and microscope rooms; environmental chambers; autoclaves; graphic facilities; and a VAX 11/780 computer with various workstations and major software support). Four field laboratories provide further space for processing field samples and conducting *in situ* studies. The main LTER field site is a 40-ha area adjacent to an all-weather road and 2 km from the main station laboratory. An additional 20 ha is used as an ancillary site for small-plot, low-input management trials and other pilot experiments, and the entire 1,000 ha KBS landscape is available for associated experiments.

Addresses:

Principal Investigator: G. Philip Robertson Kellogg Biological Station Michigan State University Hickory Corners, MI 49060 (616) 671-2267 FAX: (616) 671-2351 robertson@msukbs (Bitnet) Data Manager: John Gorentz Kellogg Biological Station Michigan State University Hickory Corners, MI 49060 (616) 671-2221 FAX: (616) 671-2351 JGORENTZ@LTERNET (Bitnet)

Data Set Title: Kellogg Biological Station Pond Laboratory Meteorological Station

Investigator(s): John B. Gorentz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/23/83 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Wind direction and speed, solar radiation (gcal/cm²/min), photosynthetically active radiation (uE/m²/sec), rainfall, air temperature, and relative humidity are recorded hourly.

Data Set Code: KBS001

Site-Specific Code:

Accessibility: digital

Proprietary limits: none

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Data Set Title: Kellogg Biological Station Weighing Lysimeter Meteorological Station

Investigator(s): Ted Loudon, Francis J. Pierce

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/18/87 Sampling frequency: hourly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Wind direction and speed, total solar radiation (MJ/m^2) , net solar radiation (MJ/m^2) , rainfall, air temperature, and relative humidity are recorded hourly in connection with measurements of evapotranspiration and deep percolation from a 6 m^2 in-ground weighing lysimeter. The lysimeter and fetch area are planted to continuous alfalfa.

Data Set Code: KBS002

Site-Specific Code:

Accessibility: digital

Proprietary limits: none

Data Set Title: Kellogg Biological Station Baseline Spatial Variability Study

Investigator(s): G. Philip Robertson, James R. Crum, Boyd G. Ellis, Diana Freckman, Stuart H. Gage, Kay L. Gross, Kasey M. Klingensmith, Wesley M. Jarrell, L. Patrick Hart, Daniel L. Lawson, John L. Lockwood, Eldor A. Paul, Karen A. Renner, J. Mark Scriber

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/88 Sampling frequency: once Number of sites: 1 Algorithms used to synthesize data (if applicable): geostatistical algorithms in Robertson (1987; Ecology 68:744)

Abstract: Results from a study of spatial variability conducted across the main experimental area (45 ha) at KBS prior to dividing the site into 1-ha experimental plots. During the 1988 growing season a stratified unaligned sampling scheme was used to collect 400-600 samples across the site (uniformly planted to a single variety of soybeans) for 1) geomorphological characteristics (microtopography, soil horizon depths, bulk density, texture); 2) soil chemical characteristics (pH, NO₃, NH₄, total C, total N, moisture, inorganic P, trace metals); 3) soil biological characteristics (N mineralization potentials, microbial biomass C, microbial biomass N, fungal/bacterial ratios, nematodes and other soil invertebrates; seed bank size); 4) plant characteristics (rate of crop phenological development, crop biomass at maturity, crop N content, weed species abundance, weed biomass at peak standing crop); and 5) insect characteristics (major pest and predator species). Most soil samples were taken before crop emergence, plant phenology samples were taken throughout the growing season, biomass samples were taken at physiological maturity, and insect samples were taken continuously. Dried soil and plant samples are archived for potential future analyses.

Data Set Code: KBS003

Site-Specific Code:

Accessibility: digital

Proprietary limits: access with permission after 5/1/92

Special Comments: Data set contains data for each variate at each sample point as well as semivariograms and an interpolation file derived by kriging at 3-m intervals across the site.

Data Set Title: KBS Main Cropping System Experiment

Investigator(s): G. Philip Robertson, James R. Crum, Boyd G. Ellis, Stuart H. Gage, Kay L. Gross, Kasey M. Klingensmith, L. Patrick Hart, Daniel L. Lawson, John L. Lockwood, Eldor A. Paul, Keith Paustian, Kurt S. Pregitzer, Karen A. Renner, J. Mark Scriber, Alvin J.M. Smucker

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/88 Sampling frequency: monthly to every 5 years Number of sites: 8 cropping/native successional systems in 6 replicate blocks Algorithms used to synthesize data (if applicable):

Abstract: Data for the main cropping system experiment at KBS. Cropping systems were established in spring 1988: 1) standard chemical input corn/soybean rotation conventionally tilled; 2) standard chemical input corn/soybean rotation no-tilled; 3) low chemical input corn/ soybean/wheat rotation ridge tilled; 4) zero chemical input corn/soybean/wheat rotation ridgetilled; 5) Populus clones on short-rotation (4 year) harvest cycle; 6) continuous alfalfa; 7) early successional community on historically tilled soil; 8) early successional community on never-tilled soil. Systems 1-7 are installed in 0.9 ha plots in each of six replicate 5-ha blocks; system 8 is replicated in four 0.06-ha plots 200 m off-site on the same soil series. For each cropping system (and for a number of microplot treatments nested within the main treatment plots) the following baseline variates are being measured (some are described in greater detail in other data set descriptions): 1) plant characteristics, including species distributions and abundances, net aboveground productivity by functional group (crop vs. weeds, selected weed species), economic yields, tissue C and N contents, seed bank composition, root biomass at physiological maturity; 2) soil chemical and physical characteristics, including soil moisture, pH, inorganic N and P pools, total C, N, and P pools, bulk density; 3) soil biological characteristics, including microbial biomass C and N, N mineralization rates (buried bags), fungal/bacterial ratios, invertebrate populations, fungistasis; and 4) insect and pathogen dynamics, including distributions and abundances of major insect pests and predators and of Fusarium pathogens.

Data Set Code: KBS004

Site-Specific Code:

Accessibility: digital

Data Set Title: KBS Plant Community Resource Partitioning Experiment

Investigator(s): Kay L. Gross, Kurt S. Pregitzer

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: varies Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: Results from a set of experimental subplots within selected crop and successional communities (see KBS004) designed to determine how plants partition resources and whether crop-weed interactions vary in response to resource levels. Effects of N fertilizer on community production and partitioning at the species level determined by manipulating fertilizer inputs in the historically tilled early successional community and high chemical input CT and NT corn/soybean treatments. Competitive effects examined in the conventionally tilled (CT), no-till (NT), and poplar treatments by determining how crop density affects growth and nitrogen uptake in the presence and absence of competing weeds.

Data Set Code: KBS005

Site-Specific Code:

Accessibility: digital

Data Set Title: Distribution and Composition of Seed Bank in Crop and Successional Communities

Investigator(s): Karen A. Renner, Kay L. Gross

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/??/88 Sampling frequency: every two years Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: The distribution and composition of the weed seed bank in treatments 1-7 of the main cropping system experiment (see KBS004) is periodically evaluated to determine 1) how well the seed bank predicts weed abundances and composition in subsequent years, and 2) how changes in disturbance (tillage) and plant species (cropping systems) affect the bank. Composite soil samples to two depths are periodically elutriated to determine seed densities, species composition, and viabilities of seven target species which are dominant on the site.

Data Set Code: KBS006

Site-Specific Code:

Accessibility: digital

Data Set Title: Root Production and Turnover in Crop and Early Successional Communities

InvestIgator(s): Alvin J.M. Smucker, Kurt S. Pregitzer, Kay L. Gross

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: biweekly during growing season Number of sites: varies Algorithms used to synthesize data (if applicable):

Abstract: Root production and turnover to depth of 1.5 m measured by minirhizotron and microvideo camera methods in alfalfa, populus, and never-tilled native succession plots of main cropping system experiment (see KBS004). Root numbers determined from video images taken at 1.2-cm intervals (2.16 cm²).

Data Set Code: KBS007

Site-Specific Code:

Accessibility: digital

Data Set Title: Insect Dynamics in Crop and Native Successional Communities

Investigator(s): Stuart H. Gage, J. Mark Scriber

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: weekly during growing season Number of sites: 210 Algorithms used to synthesize data (if applicable):

Abstract: Insect herbivory and predation in the main cropping system experiment (see KBS004). Goals are to quantify the abundance and distribution of key pest and beneficial insects in each of several different crop-treatment combinations, and to quantify and model how predators and pests respond to an array of cultural and chemical manipulations over time.

Data Set Code: KBS008

Site-Specific Code:

Accessibility: digital

pata Set Title: Pathogen Equilibria in Crop and Early Successional Communities

Investigator(s): L. Patrick Hart, John L. Lockwood

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: annually Number of sites: 1-4 (6 blocks) treatments Algorithms used to synthesize data (if applicable):

Abstract: Populations of *Fusarium graminearum* (corn stalk rot pathogen), fungistatic capacity of soils, and suppressiveness of soils to *F. graminearum* in main cropping system experiment (see KBS00'4). Measurements taken to test effects of disturbance and litter cover on pathogen presence and suppression.

Data Set Code: KBS009

Site-Specific Code:

Accessibility: digital

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Data Set Title: Gene Transfer Experiment

Investigator(s): W.E. Holben, James M. Tiedje

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: quarterly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Results from a field plot experiment to examine mechanisms of gene transfer in soil. Field plots (4 treatments x 2 replicate blocks) have been treated differentially with 2,4-D; populations of 2,4-D-metabolizing bacteria determined using plasmid gene probes and MPN plate counts.

Data Set Code: KBS010

Site-Specific Code:

Accessibility: digital

Data Set Title: Microbial Biomass Dynamics in Crop and Successional Communities

investigator(s): Eldor A. Paul, Michael J. Klug

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: 3 times per year Number of sites: 8 treatments in each of 6 blocks Algorithms used to synthesize data (if applicable):

Abstract: Measurements of soil microbial biomass C and N by chloroform fumigation incubations (CFIM) and of bacterial and fungal biomass by direct microscopy in the main cropping system experiment described in KBS004.

Data Set Code: KBS011

Site-Specific Code:

Accessibility: digital

Data Set TItle: Soil Invertebrates in Crop and Successional Communities

Investigator(s): Daniel L. Lawson, Michael J. Klug, Diana Freckman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: 3 times per year Number of sites: treatments 1-8, blocks 1-4 Algorithms used to synthesize data (if applicable):

Abstract: Soil invertebrates were sampled from the main cropping system experiment (KBS004) via 7.5 cm diameter soil cores. Invertebrates were extracted using modified Tullgren funnels for microarthropods and macroarthropods and Baermann funnels for soil nematodes (Freckman, UC-Riverside). Arthropods are classified to the lowest proctical taxon and further classified, when possible, to functional feeding specialization (e.g., fungivore, bacterivore).

Data Set Code: KBS012

Site-Specific Code:

Accessibility: digital
Data Set Title: Nitrous Oxide (N₂O) and CO₂ Fluxes From Cropped and Early Successional Communities

Investigator(s): Kasey M. Klingensmith, G. Philip Robertson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/01/89 Sampling frequency: varies (daily, weekly, monthly) Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Results from a study of N₂O and CO₂ fluxes from soybean/corn cropping systems either no-till (NT) or conventionally tilled (CT; moldboard plow) and either N-fertilized (180 kg/ha N) or not N-fertilized in a complete factorial design with four replicate blocks (2 x 2 x 4 treatment plots) plus the never-tilled early successional sites (n = 4 replicates) noted in KBS004. Fluxes are measured using static chambers 30 cm x 30 cm x 14 cm high placed on semipermanent bases installed in the surface soil of each plot. Gas samples are taken from each plot at 15-minute intervals for 90 minutes per sample day, once per week or keyed to rainfall events.

Data Set Code: KBS013

Site-Specific Code:

Accessibility: digital

KBS014

Data Set Title: Water Movement in KBS Landscapes

Investigator(s): James R. Crum, Marty Rosek

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/90 Sampling frequency: weekly during growing season Number of sites: 2 transects Algorithms used to synthesize data (if applicable):

Abstract: Measurements of water movement through and within two landscape transects of approximately 12% slope. Neutron probe access tubes to 1.5 m depth installed along a Kalamazoo soil series transect and along an Oshtemo series transect. Also time domain reflectometry (TDR) probes inserted horizontally into soil horizons above and below textural boundaries in 12 soil pits along these two transects.

Data Set Code: KBS014

Site-Specific Code:

Accessibility: digital

KBS015

Data Set Title: Soil Moisture Changes in Crop and Early Successional Communities

Investigator(s): G. Philip Robertson, James R. Crum, Francis J. Pierce

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/90 Sampling frequency: weekly to daily Number of sites: 8 treatments x 6 blocks Algorithms used to synthesize data (if applicable):

Abstract: Analyses of soil moisture in upper 15 cm and upper 50 cm of soil profile in each plot of the main cropping system experiment described in KBS004. Nondestructive measurements taken with replicate time domain reflectometry (TDR) probes installed semipermanently in each plot. Gravimetric samples taken monthly to 15 cm.

Data Set Code: KBS015

Site-Specific Code:

Accessibility: digital

Data Set Title: Dinitrogen Fixation by Hairy Vetch (*Vicia villosa* L.) in a Low-Chemical Input Cropping System

Investigator(s): Dana J. Barclay, G. Philip Robertson

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/01/90 Sampling frequency: weekly Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Measurements of dinitrogen fixation potential (acetylene reduction assay) and biomass and N accretion in hairy vetch used as a winter cover in low-chemical input cropping systems. Aboveground biomass accumulation is measured in the low-chemical input cropping system described in KBS004, and aboveground and belowground biomass (roots, nodules) and N₂ fixation by intact nodules is measured in a subset of ancillary plots with different levels of available soil nitrogen.

Data Set Code: KBS016

Site-Specific Code:

Accessibility: digital

KBS017

Data Set Title: KBS National Weather Service Station

Investigator(s): contact John B. Gorentz for information

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/25 (approx.) Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Minimum and maximum temperature, precipitation, and depth of snow cover are recorded daily.

Data Set Code: KBS017

Site-Specific Code:

Accessibility: KBS VAX system (in part) and printed National Weather Service summaries

Proprietary limits: none

KBS018

Data Set Title: Kellogg Biological Station Herbarium

Investigator(s): Stephen J. Tonsor, Kay I. Gross, Susan Kalisz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/04/40 Sampling frequency: variable Number of sites: various Algorithms used to synthesize data (if applicable):

Abstract: The KBS Herbarium contains over 6,000 specimens, with emphasis on various lifeforms of plants in southwestern Michigan.

Data Set Code: KBS018

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: none

Special Comments: Contact S. Tonsor regarding access to the herbarium. Specimen label information is accessible via an on-line database.



KONZA PRAIRIE LTER SITE

Site Name:	Konza Prairie Research Natural Area
Institutional Affiliation:	Kansas State University
Location:	10 km south of Manhattan, KS 39°05'N, 96°35'W elevation: 366 m area: 3,487 ha
Principal Biome:	Tallgrass prairie
Main Communities:	Tallgrass prairie, gallery forest, prairie stream
LTER Research Topics:	Role of fire, grazing, and climate in a tallgrass prairie ecosystem

Climate Synopsis:

Temperate mid-continental climate. Yearly mean temperature is 13°C with a range of 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 20°C to 33°C). Annual precipitation is 835 mm of which about 75% occurs in the growing season. Mean snowfall for January is 150 mm with an annual total of 521 mm. Mean annual windspeed is 5 m/s from the south.

Narrative:

Tallgrass or bluestem prairie is one of the major ecosystem types of the conterminous United States (exceeded in area only by eastern deciduous forest). Undisturbed examples of tallgrass prairie are rare because this ecosystem type has been extensively converted to agroecosystems.

Konza Prairie is representative of the Flint Hills, a dissected upland with chert-bearing limestone layers. The ridges are usually flat with shallow, rocky soils, whereas the larger and wider valleys have deep permeable soils. The steep-sided hills are characterized by exposed Permian limestone and shale strata that prevented cultivation.

When acquired in the 1970's, the majority of Konza Prairie was dominated by native prairie species, especially big bluestem, indiangrass, little bluestem, and switchgrass. Lowland areas with deep soils now have patches of these and other tallgrasses that grow to 2 to 3 m by late summer. Gallery forests on lower Kings Creek are dominated by bur and chinquapin oaks with green ash, hackberry, elm, and black walnut often common. The KSU herbarium contains more than 450 species of vascular plants collected from Konza Prairie. Woody plants have been mapped according to species and size on some portions of the site. Species lists have also been developed for a number of animal groups including birds, mammals, reptiles, amphibians, and aquatic invertebrates.

Konza Prairie is managed to provide an array of burning and grazing (especially bison) treatments to facilitate research to evaluate the effects of fire and grazing on plant composition,

KONZA PRAIRIE LTER SITE

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Institutional Affiliation:	Kansas State University
Location:	10 km south of Manhattan, KS 39°05'N, 96°35'W elevation: 366 m area: 3,487 ha
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Main Communities:	Tallgrass prairie, gallery forest, prairie stream
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Konza Prairie is managed to provide an array of burning and grazing (especially bison) treatments to facilitate research to evaluate the effects of fire and grazing on plant composition,

primary production, consumer density and diversity, nutrient dynamics, soil chemistry, and hydrology. This natural prairie also serves as a reference site for comparison to manipulated agricultural systems.

Fire, started both by lightning and aboriginal man, influenced patterns and processes in the tallgrass prairie. To understand these effects, a series of spring burning treatments (primarily areas burned at 1-, 2-, 4-, 10-, and 20-year intervals) are maintained on watershed units. These experimental burns are conducted in April before the dominant warm-season grasses begin active growth. Treatment boundaries follow watershed divides to facilitate analysis of hydrologic and nutrient responses to fire and frequency of fire. An extensive soil water/groundwater monitoring system has been installed by the USGS on one of these watersheds.

Bison were introduced into a fenced area of nearly 500 ha encompassing several different burn treatments in 1987. The area affected by bison will be enlarged to 1,100 ha in 1991. Bison, free-ranging within the fenced area, are able to choose between burned and unburned prairie and among sites representing an array of topographic/physiographic conditions. Cattle grazing still occurs sporadically on parts of the Konza Prairie but not on the primary LTER research watersheds.

Facilities:

The proximity of Konza Prairie to the Kansas State University campus and Manhattan reduces the need for on-site facilities. However, limited laboratory and office space and living accommodations are available and can be provided to researchers, especially those with short-term needs.

Addresses:

Principal Investigator: Timothy R. Seastedt Division of Biology Ackert Hall Kansas State University Manhattan, KS 66506 (913) 532-7627 FAX: (913) 532-6653 TRSEAS@KSUVM (Bitnet) Data Manager: John M. Briggs Division of Biology Ackert Hall Kansas State University Manhattan, KS 66506 (913) 532-6629 FAX: (913) 532-6653 KONZA@KSUVM (Bitnet) imb@andro.konza.ksu.edu (Internet)

Data Set Title: Prairie Precipitation

Investigator(s): John M. Briggs

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/82 Sampling frequency: variable Number of sites: 10 Algorithms used to synthesize data (if applicable):

Abstract: Data set contains daily records of precipitation on 11 rain gauges at 10 sites on the Konza Prairie Research Natural Area. Three of the rain gauges have 7-day clocks (one revolution per week), while the other eight have 24-hour clocks (one revolution per day). The Konza headquarters weather station has one of each type and both are operated year-round. The remaining rain gauges are operated from April 1 to November 1. Precipitation amounts are recorded in mm. These data, as others that describe climate, are recorded to help interpret long-term trends and short-term variations in other LTER data.

Data Set Code: KNZ001

Site-Specific Code: APT01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

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Data Set Title: Soil Moisture

Investigator(s): Alan K. Knapp

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/83 Sampling frequency: variable Number of sites: 6 Algorithms used to synthesize data (if applicable): expressed as kg/m³

Abstract: Data set contains measurements of soil moisture (% volume) at various depths (25-200 cm) in deep soils for watersheds burned at one- and four-year intervals and for unburned watersheds. Soil moisture measured by the neutron probe method. These data, as others that describe climate, are recorded to help interpret long-term trends and short-term variations in other LTER data.

Data Set Code: KNZ002

Site-Specific Code: ASM01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Meteorological Data

investigator(s): John M. Briggs

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/22/82 Sampling frequency: hourly, daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The following weather data are included in this data set: hourly mean temperature; mean relative humidity; mean wind speed; total precipitation; total solar radiation; wind direction (sampled on the hour); daily mean, maximum, and minimum air temperature; total precipitation; and total solar radiation. These data are collected by a CR-21 micrologger at headquarters on Konza Prairie. These data, as others that describe climate, are recorded to help interpret long-term trends and short-term variations in other LTER data.

Data Set Code: KNZ003

Site-Specific Code: AWE01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Bird Checklist

investigator(s): John L. Zimmerman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/71 Sampling frequency: weekly Number of sites: variable Algorithms used to synthesize data (if applicable):

Abstract: Presence of all bird species, including documented nest records, on Konza Prairie Research Natural Area. Data is recorded on a weekly basis throughout the year.

Data Set Code: KNZ004

Site-Specific Code: CBC01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Bird Dates

Investigator(s): John L. Zimmerman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/71 Sampling frequency: variable Number of sites: variable Algorithms used to synthesize data (if applicable):

Abstract: Dates of occurrence for all bird species are recorded for the Konza Prairie Natural Area.

Data Set Code: KNZ005

Site-Specific Code: CBD01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Bird Nests

Investigator(s): John L. Zimmerman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/71 Sampling frequency: variable Number of sites: variable Algorithms used to synthesize data (if applicable):

Abstract: Dates for documented records of breeding by bird species as evidenced by active nest or dependent fledglings. Contents of nest (number of eggs, number of young), cowbird parasitism, nest placement, and location by Konza Prairie Research Natural Area grid squares are included in each record.

Data Set Code: KNZ006

Site-Specific Code: CBN01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Bird Populations

Investigator(s): John L. Zimmerman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/81 Sampling frequency: semi-annually Number of sites: 16 Algorithms used to synthesize data (if applicable): expressed as relative frequency and density as birds/km

Abstract: Records of birds by species giving perpendicular distance of sighting from transect line. Census is conducted in January and June. Transects are conducted in gallery forest, attenuated gallery forest, 20-year burn grassland watersheds, annually burned grassland watersheds, and grassland watersheds on a 4-year burn cycle.

Data Set Code: KNZ007

Site-Specific Code: CBP01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Census of Greater Prairie-Chicken Leks

Investigator(s): John L. Zimmerman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/81 Sampling frequency: annually Number of sites: variable Algorithms used to synthesize data (if applicable): expressed as numbers/lek

Abstract: Location of all prairie-chicken leks on Konza Prairie Research Natural Area with an estimate of numbers of birds on each lek during a one-time visit in late April. The purpose is to monitor populations on a year to year basis.

Data Set Code: KNZ008

Site-Specific Code: CPC01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Seasonal Summary of Numbers of Small Mammals for Prairie LTER Traplines

Investigator(s): Donald W. Kaufman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/81 Sampling frequency: variable Number of sites: variable Algorithms used to synthesize data (if applicable):

Abstract: Data set contains seasonal summaries of the number of individuals of each species of small mammal caught on each grassland census line. Each record contains trapline, year of last fire, and number of individuals per species. These live trap records are based on daily captures during 4-day trapping periods for each of the permanent census lines. Small mammals were initially censused during spring, summer, and autumn (autumn 1981 to spring 1988), but summer censuses were discontinued beginning in 1988. Originally, censuses were conducted using 20 traplines in 10 fire-grazing treatments (one annual, one 4-year, and one 20-year burn site to be grazed by bison; one annual, four 4-year, one 10-year, and one 20-year burn site to be left ungrazed). Additional traplines were added in autumn 1984 (4 traplines; two 2-year burn sites to be left ungrazed) and in autumn 1985 (4 traplines; one annual and one 10-year burn site with both sites to be left ungrazed). In spring 1989, censuses were reduced to 14 traplines in seven burn treatments studied since autumn 1981 (one annual, one four-year, and one 20-year burn treatment to be grazed by bison; one annual, two 4-year, and one 20-year burn treatment to be left ungrazed).

Data Set Code: KNZ009

Site-Specific Code: CSM04

Accessibility: paper, digital, tape, HD IBM (d, LD IBM (d

Data Set Title: Prairie Litterfall

Investigator(s): Timothy R. Seastedt

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/81 Sampling frequency: monthly Number of sites: 12 Algorithms used to synthesize data (If applicable): expressed as g/collector (mass) and % by weight (nutrient concentration)

Abstract: Litter falling to the soil surface of tallgrass prairie was measured using 5 cm x 100 cm litterfall troughs. Mass, nitrogen, and phosphorus content are measured monthly or seasonally. Variables of interest include burning frequency and soil type.

Data Set Code: KNZ010

Site-Specific Code: NPL01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Throughfall

Investigator(s): Timothy R. Seastedt

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/19/82 Sampling frequency: variable Number of sites: 2 Algorithms used to synthesize data (if applicable): expressed as mm of rainfall (amount) and ug/l (nutrient concentration)

Abstract: Amounts and nutrient content of water passing through the canopy of tallgrass prairie are compared to similar measurements of bulk precipitation. Measurements include nitrate, ammonia, phosphate, organic nitrogen, and organic phosphorus content of bulk precipitation and throughfall. Variables of interest include vegetation type and amounts, time of year, and time since burning.

Data Set Code: KNZ011

Site-Specific Code: NTF01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Aboveground Primary Production

investigator(s): Alan K. Knapp

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/01/84 Sampling frequency: annually Number of sites: 12 Algorithms used to synthesize data (if applicable): expressed as g/0.1 m²

Abstract: Data set contains estimates of standing crop biomass (grams per 0.1 m²) of live graminoids, forbs, and woody plants, current year's dead, and previous year's dead vegetation on watersheds under various burning and grazing treatments.

Data Set Code: KNZ012

Site-Specific Code: PAB01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Gallery Forest Litterfall

Investigator(s): Timothy R. Seastedt

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/81 Sampling frequency: monthly Number of sites: 60 Algorithms used to synthesize data (if applicable): expressed as g/0.25 m²

Abstract: Litterfall of a Kansas gallery forest is measured with 60 deep-dish litterfall collectors. Mass of wood, seed, and foliage are recorded separately.

Data Set Code: KNZ013

Site-Specific Code: PGL01

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Reproductive Effort of Dominant Grasses on Konza Prairie

Investigator(s): David C. Hartnett

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/82 Sampling frequency: annually Number of sites: 18 Algorithms used to synthesize data (If applicable):

Abstract: Data set contains estimates of flowering stem height (m), density (number/m²), production (g/m²), and total seed weight (g) and production (g/m²) for *Andropogon gerardii*, *A. scoparius*, and *Sorghastrum nutans* on two soil types (shallow and deep) with six burn-grazing treatment combinations. Sampling done once a year in October (end of growing season).

Data Set Code: KNZ014

Site-Specific Code: PRE02

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd

Data Set Title: Vegetation Species Composition on Konza Prairie

Investigator(s): David. C. Hartnett

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/01/82 Sampling frequency: bimonthly Number of sites: 21 Algorithms used to synthesize data (if applicable):

Abstract: Canopy coverages and frequencies of vascular plant species recorded in 20 circular 10-m² plots in each of six treatments. Treatments include three ungrazed watersheds and three similar watersheds that will be grazed by native herbivores (bison) beginning in 1991. In each case one of the three watersheds is unburned, another burned annually in April, the third burned every four years in April. In each treatment two soils are sampled: a lower-slope deep fertile nonrocky soil (tully silty clay loam), and a shallow rocky soil (florence cherty silt loam) on level to gently sloping ridges. Sampling is done three times (late spring, mid-summer, and early fall) during the growing season.

Data Set Code: KNZ015

Site-Specific Code: PVC02

Accessibility: paper, digital, tape, HD IBM fd, LD IBM fd



LUQUILLO EXPERIMENTAL FOREST LTER SITE

Site Name:	Luquillo Experimental Forest
Institutional Affiliation:	Center for Energy and Environment Research, University of Puerto Rico Institute of Tropical Forestry USDA, Forest Service, Southern Forest Experiment Station
Location:	30 km southeast of San Juan, PR 18°18'N, 65°47'W elevation: 100 to 1,070 m area: 11,231 ha
Principal Biome:	Wet tropical forest
Main Communities:	Tabonuco forest, palo Colorado forest, palm brake, dwarf forest montane streams
LTER Research Topics:	Patterns of disturbance in space and time Ecosystem response to different patterns of disturbance Land-stream interactions Effect of management on ecosystem properties Integration of ecosystem models and geographic information systems

Climate Synopsis:

The Luquillo Experimental Forest (LEF) of Puerto Rico has a wet tropical climate with yearround rainfall that is seasonally less during February-May. Annual precipitation ranges from 233 cm/yr at 100 m elevation to 470 cm/yr at 716 m elevation. Upper slopes have additional water input from clouds. Mean monthly temperatures range from 17°C to 27°C and vary inversely with elevation.

Narrative:

Research at the site began over 100 years ago with a series of botanical explorations. Portions of the LEF were protected by the Spanish Crown as early as 1860 and transferred to the United States Government in 1898. Since then the area of protected forest has increased to 11,231 ha. In 1939 the U.S. Forest Service established a research station whose mission was to study and manage the LEF. Today the Institute of Tropical Forestry (ITF) is among the oldest tropical forestry research institutions in the hemisphere and is the oldest among U.S. Government facilities. The rich research tradition at the site is documented by the more than 300 publications based on work at the site.

Current research directions emphasize the use of long-term research plots and experimental manipulations of gauged watersheds to examine ecosystem processes. ITF maintains over 20 permanent plots throughout the LEF which cover the full range of natural and introduced forest

types. Some of these plots have continuous data sets stretching back for over 40 years. In addition, sites used in the Atomic Energy Commission irradiation project in the 1960's continue to be monitored for long-term changes and successional trends.

The goal of the proposed LTER research is to tie studies of disturbance regime and forest structure and dynamics into a landscape perspective. The two primary research questions address 1) the relative importance of different disturbance types within the four life zones in the LEF, and 2) the importance of the biota in restoring ecosystem productivity after disturbance.

Facilities:

The El Verde Field Station (EVFS) with living and laboratory facilities for up to 25 scientists is maintained by the Center for Energy and Environment Resources (CEER) in the LEF. The EVFS provides a library, comprehensive collections of local flora and fauna, three permanent walk-up towers offering access to the canopy and a 25-m canopy walkway, electricity at one of the walk-up towers, a field laboratory with light meters, balances, microscopes, pH meters, hoods, etc., line power backed up by a generator, and gas, air, and vacuum lines. The Biology Department of the University of Puerto Rico (Rio Piedras) maintains a second field station in the palo colorado forest of the LEF. Among the resources available through ITF are a woodshop, analytical laboratory for soils and vegetation, research nursery with automatic watering system, tropical forestry library with 55,000 documents, 10,000 bound volumes, 100 journal subscriptions, map, film, and slide collection, microfilm of the entire Oxford forestry collection, FAO documents and journal listings from larger libraries (e.g., Oxford, University of Georgia, University of Florida, National Agriculture Library) in microfiche, and computerized literature searching facilities, and a research herbarium with over 95% of the 700+ tree species in Puerto Rico.

Addresses:

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Ariel E. Lugo ITF Call Box 25000 Rio Piedras, PR 00928-2500 (809) 766-5335/5336 FAX: (809) 250-6924 A_GILLESPIE@UPRENET (Bitnet) Data Manager: Eda C. Melendez CEER GPO Box 363682 San Juan, PR 00936 (809) 767-0334/0338 FAX: (809) 758-0815 E_MELENDEZ@UPRENET (Bitnet) Data Set Title: Bisley 40 m x 40 m Grid Points Site Classification

Investigator(s): Frederick N. Scatena

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/88 Sampling frequency: once a year Number of sites: 2 (Bisley 1 and 2, Luquillo Experimental Forest) Algorithms used to synthesize data (if applicable):

Abstract: Topographic and geomorphic characteristics of nodes of Bisley grids.

Data Set Code: LUQ001

Site-Specific Code: LTERDBAS31

Accessibility: paper

Proprietary limits: unrestricted

Data Set Title: Bisley 40 m x 40 m Vegetation Data Summary, Basal Area, and Stem Per Plot

Investigator(s): Frederick N. Scatena

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/88 Sampling frequency: annually Number of sites: 2 (Bisley 1 and 2, Luquillo Experimental Forest) Algorithms used to synthesize data (if applicable):

Abstract: Vegetation data summary, basal area, and stem per plot of Bisley 40 m x 40 m plots.

Data Set Code: LUQ002

Site-Specific Code: LTERDBAS30

Accessibility: paper, LD IBM fd, HD (54") IBM fd

Proprietary limits: Unrestricted

Special Comments: includes graph of basal area/ha and map.

LUQ003

Data Set Title: Bisley 40 m x 40 m Vegetation Data, 10-Meter Diameter Circular Plots

Investigator(s): Frederick N. Scatena

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/88 Sampling frequency: annually Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Data from permanent vegetation plots in Bisley watersheds.

Data Set Code: LUQ003

Site-Specific Code: LTERDBAS32

Accessibility: paper

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Data Set Title: Bisley Stream Channel Data: Description, Site Index, and Raw Data for the Heaton/Leatourneau Transects

Investigator(s): Frederick N. Scatena, Kate Heaton, Al Leatourneau

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/19/88 Sampling frequency: Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Site index, descriptions, and vegetation data from stream channel transects on two Bisley experimental watersheds at the Luqillo Experimental Forest.

Data Set Code: LUQ004

Site-Specific Code: LTERDBAS28

Accessibility: paper, LD IBM fd, HD (514") IBM fd

Proprietary limits: Unrestricted

LUQ005

Data Set Title: Canopy Gap Survey at El Verde

Investigator(s): Nicholas V.L. Brokaw

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 11/01/89 Sampling frequency: varies Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The survey of gaps at El Verde covers about 35 ha, including the 9-ha grid. The 35 ha includes forest on the southwest side of the Rio Sonadora south to the Forest Service Road, and forest on the northeast side of the Sonadora. The boundary line for the North Sonadora area begins where the road crosses the north branch of the Sonadora, going northwest to the Prieta, along the Prieta to the 9 ha grid, along the east and north boundaries of the grid, to the south boundary of Nora Devoe's northern plot, and from there to Route 186. Within this area, the canopy gap area of all recent gaps (September 1989) are marked with yellow flagging and have been roughly measured. Each gap has a unique identifying number. Canopy gap area is determined by measuring with a rangefinder, or estimating, the length of the long and short axes of the hole in the canopy and using these figures to calculate the area of an ellipse as an approximation of the gap area. With this information, gathered over the long-term, the rates of gap creation and size class distribution of gaps can be determined directly with a periodic census of new gaps in the area. Data on the mode of treefall, whether by uprooting or snapping off, of live trees or of snags were taken.

Data Set Code: LUQ005

Site-Specific Code: LTERDBAS 8

Accessibility: paper

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Data Set Title: Weekly Stream Chemistry From El Verde and Bisley

Investigator(s): Clyde E. Asbury

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/15/87 Sampling frequency: weekly Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: This data set contains results of chemical analyses for dissolved and particulate constituents in several streams at the Bisley and El Verde sites. The results were obtained from grab samples that have been collected weekly from quebradas (streams) Bisley1, Bisley2, and Bisley3 at Bisley and Quebrada Sonadora at El Verde since June 1987. The data set includes data for the following: Na⁺, K⁺, Ca⁺⁺, Mg⁺⁺, SO₄⁻⁻, Cl⁻, SiO₂, NO₃⁻, NH₄⁻, total dissolved N, soluble reactive P, and dissolved organic C, all measured on filtered (0.45 um) samples. Also included are data on fine particulate C, fine particulate N, pH, conductivity, temperature, and stream stage.

Data Set Code: LUQ006

Site-Specific Code: LTERDBAS20

Accessibility: paper, LD IBM fd, HD (54") IBM fd

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Data Set Title: Circular Plot Bird Counts

Investigator(s): Robert B. Waide

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/10/89 Sampling frequency: at least twice a year Number of sites: 4 Algorithms used to synthesize data (If applicable):

Abstract: Long-term population studies of birds were initiated in 1989 at the two principal LTER sites at EI Verde and Bisley. Fixed-radius circular plot counts were taken at grid points within both the EI Verde 9 ha grid and Bisley watersheds 1 and 2. Counts were taken a minimum of 60 m apart beginning after dawn and continuing until 1230 hours. The number of counts varied from 25 to 33 depending on the sampling date. At each grid point, the observer (Waide) counted all birds heard or seen in a 10-minute period. Birds detected within 25 m were recorded separately from birds detected outside this radius. The distance to birds that were seen was estimated in meters and recorded on the data sheet. Birds that were only heard were recorded using the letter "H" for each individual. Counts were conducted during the breeding season in 1990. Five circular plot counts were conducted using the same methodology in each of two plots scheduled for harvesting at the Bisley site (Silver plots). Only one count was conducted per day in each plot. Subsequent counts were conducted after Hurricane Hugo in February 1990.

Data Set Code: LUQ007

Site-Specific Code: LTERDBAS23

Accessibility: paper, LD IBM fd, HD (514") IBM fd

Proprletary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.
Data Set Title: Coqui Transect Data

Investigator(s): Lawrence L. Woolbright

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/14/89 Sampling frequency: annually Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Relative abundance of all size classes of *Eleutherodactylus coqui* was measured along control and experimental transects in a variety of disturbance regimes.

Data Set Code: LUQ008

Site-Specific Code: LTERDBAS25

Accessibility: paper

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Data Set Title: LTER GIS - ERDAS Files

Investigator(s): Neil Burns, William T. Lawrence

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/21/85 Sampling frequency: once Number of sites: UTM coordinates of the El Yunque quadrangle Algorithms used to synthesize data (if applicable): band ratios

Abstract: PC-ERDAS-compatible GIS information provided by Neil Burns, a University of Georgia/NASA Stennis Space Center Co-op student. The data consists of several files and includes a portion of a January 21, 1985, Landsat Thematic Mapper scene covering the forest area, a digital elevation model (DEM), a series of digitized "features" from the same topographical sheets, and a supervised vegetation classification based on spectral ratios and elevation data.

Data Set Code: LUQ009

Site-Specific Code: LTERDBAS34

Accessibility: LD IBM fd, HD (514") IBM fd

Proprietary limits: distribute only GIS files, not TM image

Special Comments: files: LUQTM.LAN and *.GIS/documentation available

Data Set Title: Maximum Temperature at El Verde Since 1974

Investigator(s): Alejo Estrada-Pinto, Roberto Trinidad

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/13/74 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (If applicable):

Abstract: Maximum temperature has been measured at the El Verde Field Station of the Center for Energy and Environment Research (formerly Puerto Rico Nuclear Center) since 1964. This data set includes the collection procedures, the raw data for the period of record, and summary statistics. The raw data is updated weekly and the checked and corrected data is available to researchers at the site. A computer file of the checked and corrected data is available from the Terrestrial Ecology Division.

Data Set Code: LUQ010

Site-Specific Code: LTERDBAS16

Accessibility: LD IBM fd, HD (54") IBM fd

Proprietary limits: unrestricted

Data Set Title: Minimum Temperature at El Verde Since 1974

Investigator(s): Alejo Estrada-Pinto, Roberto Trinidad

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/13/74 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Minimum temperature has been measured at the El Verde Field Station of the Center for Energy and Environment Research (formerly Puerto Rico Nuclear Center) since 1964. This data set includes the collection procedures, the raw data for the period of record, and summary statistics. The raw data is updated weekly and the checked and corrected data is available to researchers at the site. A computer file of the checked and corrected data is available from the Terrestrial Ecology Division.

Data Set Code: LUQ011

Site-Specific Code: LTERDBAS17

Accessibility: LD IBM fd, HD (54") IBM fd

Proprietary limits: unrestricted

Data Set Title: Rainfall and Throughfall Bisley Watersheds

Investigator(s): Frederick N. Scatena, Angel L. Caln

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/??/87 Sampling frequency: daily, weekly Number of sites: Bisley watersheds, Towers, LEF Algorithms used to synthesize data (if applicable):

Abstract: Daily rain gauges. There are four tipping buckets located at each of the following sites: Bisley, the Gate, Sabana, and Catalina. Two bulk collectors are located at Bisley and Sabana in addition to the tipping buckets.

Data Set Code: LUQ012

Site-Specific Code: LTERDBAS26

Accessibility: paper

Proprietary limits: unrestricted

Data Set Title: Rainfall at El Verde Since 1964

Investigator(s): Alejo Estrada-Pinto, Roberto Trinidad

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/64 Sampling frequency: daily Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Rainfall has been measured at the El Verde Field Station of the Center for Energy and Environment Research (formerly Puerto Rico Nuclear Center) since 1964. The data set includes collection procedures, the raw data for the period of record, and summary statistics. The raw data is updated weekly and the checked and corrected data is available to researchers at the site. A computer file of the checked and corrected data is available from the Terrestrial Ecology Division.

Data Set Code: LUQ013

Site-Specific Code: LTERDBAS14

Accessibility: LD IBM fd, HD (54") IBM fd

Proprietary limits: unrestricted.

Data Set Title: Revegetation Project: Cecropia Study at El Verde

Investigator(s): Nicholas V.L. Brokaw

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/??/89 Sampling frequency: everytime gap census is performed Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: While surveying the gaps at EI Verde the number and height of *Cecropia* saplings found in gaps were recorded. Since this species is mostly restricted to gaps, an estimate of the total population of *Cecropia* in the regeneration size classes in the forest can be obtained. (There are others along the edges of the Sonadora and Prieta.) The abundance, dispersion, and size class distribution of the *Cecropia* population is an index of disturbance in tabonuco forest.

Data Set Code: LUQ014

Site-Specific Code: LTERDBAS22

Accessibility: paper

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Special Comments: These data are gathered each time the census gap at El Verde is performed.

Data Set Title: Vegetation Profile and Canopy Height

Investigator(s): Nicholas V. L. Brokaw

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/30/89 Sampling frequency: yearly Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Vegetation height profile and canopy heights are being constructed from data taken on 5 m x 5 m grid systems in Tabonuco Forest (in the southwest corner of the 9-ha grid at El Verde), Colorado Forest (a couple of hundred meters from the shelter nearest the eastern end of the Tradewinds Trail), and in Cloud Forest (near the trail leading to the plane wreck on Pico del Oeste). The Tabonuco grid is 1.08 ha, with 475 grid points; the others are one ha each, with 451 grid points each. The presence or absence of vegetation (leaves or wood) within height intervals along a vertical line above each point in the grid is recorded. Vegetation "hits" on the line are recorded with a pole held vertically and marked at 0.5-m intervals to 3.0 m. The height of the vegetation above 3.0 m is estimated, and checked with an "optical tape measure." The maximum canopy height above each point is also recorded.

Data Set Code: LUQ015

Site-Specific Code: LTERDBAS21

Accessibility: paper

Proprietary limits: Restricted. Permission from the investigator is necessary to request this data from Data Management.

Data Set Title: Weather Data From New Towers or Rooftop at El Verde (EV Weather Datalogger)

Investigator(s): William T. Lawrence

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/06/89 Sampling frequency: every 15 minutes Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: This data set forms part of the environmental monitoring effort. The goal is collection and archiving of a continuous set of long-term climatic data records for the use of other investigators and for the assessment of long-term change at the Luquillo LTER.

Data Set Code: LUQ016

Site-Specific Code: LTERDBAS33

Accessibility: LD IBM fd, HD (514") IBM fd

Proprietary limits: Restricted. Ask for R. Waide's permission.

Special Comments: Data on cassettes given directly to entry person.

Data Set Title: Anole Multiple Mark and Resight Studies

Investigator(s): Douglas P. Reagan

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/18/89 Sampling frequency: annually, but not 1990 because the towers were destroyed during the hurricane Number of sites: 1 (El Verde Study Area - Grid) Algorithms used to synthesize data (if applicable):

Abstract: The population distribution research area of the LEF LTER is designed to gather information on the distribution and abundance of key plant and animal species within the forest under different disturbance regimes. Multiple mark and resight studies were conducted to determine the population density of *Anolus stratulus* at one undisturbed forest site and one site in a partially regnerated treefall gap. Tower surveys were conducted in order to access individuals in the forest canopy.

Data Set Code: LUQ017

Site-Specific Code: LTERDBAS5

Accessibility: paper

Proprietary limits: Restricted until results are presented in a report and/or published

Data Set Title: Anoline Lizard Food Habits

Investigator(s): Douglas P. Reagan

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 10/30/89 Sampling frequency: annually Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The stomach contents of 10 adult individuals of each of three anole species (*Anolis gundlachi, A. evermanni,* and *A. stratulus*) were collected to determine the number, type, and volume of prey consumed following Hurricane Hugo.

Data Set Code: LUQ018

Site-Specific Code: LTERDBAS24

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Accessibility: paper

Proprietary limits: Restricted until results are presented in a report and/or published. Permission from the investigator is necessary to request this data from Data Management.



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
Location:	45 km northwest of Boulder, 85 km from Denver, CO 40°03'N, 105°37'W elevation: 2,900 to 4,060 m area: 710 ha
Principal Biome:	Alpine tundra and alpine riparian
Main Communities:	Fellfield, herbaceous tundra, shrub tundra, cliffs and talus, glacial lakes, streams, wetlands
LTER Research Topics:	Climate, soil and water movement Geomorphology, paleoecology Plant communities, disturbance and recovery Roots and soils Vertebrate populations, aquatic invertebrates Decomposition, nutrient cycling Ecosystem models

Climate Synopsis:

Mid-latitude continental climate modified by high elevation and extreme relief. Low air temperatures at all times of the year. Annual mean temperature at 3,743 m elevation is -3.7°C. The January mean temperature is -13.2°C and the July mean temperature is 8.2°C, with a range of -19.8°C to 14.2°C. Most of the mean annual precipitation of 930 mm occurs in the winter months as snow. Approximately one-third of the precipitation is lost as evapotranspiration, and the remainder is lost as runoff or through percolation into the soil.

Narrative:

The alpine study area is reached by an unimproved road from the Mountain Research Station (2,895 m) which goes to within about 2 km of the primary tundra research site, the Saddle (3,525 m), which is then reached on foot. The D-1 research site at 3,743 m, also reached by foot trail, is approximately 3 km farther. The Martinelli slope study site (3,380 m) is located approximately 1 km southwest of the Saddle in the treeline zone.

The Green Lakes Valley is south of and adjacent to the western half of Niwot Ridge. It includes the Arikaree Glacier (3,798 m), Wetland and Green Lake 4 (both 3,560 m), and Albion (3,250 m) sites. The Green Lakes Valley and Martinelli sites are located within the City of Boulder Watershed. The city controls access to the watershed.

Niwot Ridge, where the alpine study sites are located, is part of the Roosevelt National Forest and has been designated a Biosphere Reserve (UNESCO) and an Experimental Ecological

Reserve (USDA Forest Service). The Niwot Ridge/Green Lakes Valley area features a variety of glacial features, glacial lakes and moraines, cirques and talus slopes, patterned ground, and permafrost.

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, buildozers, and other support equipment; plumbing, electrical, woodshops, garage.

Addresses:

Principal Investigator: Nel Caine INSTAAR Campus Box 450 University of Colorado Boulder, CO 80309 (303) 492-6198 FAX: (303) 492-6388 caine_tn@cubldr.colorado.edu (Internet) Data Manager: Rick Ingersoll INSTAAR Campus Box 450 University of Colorado Boulder, CO 80309 (303) 492-4771 FAX: (303) 492-6388 ingersoll_r@cubldr.colorado.edu (Internet) Data Set Title: Climatological Data From Niwot Ridge, East Slope, Front Range, Colorado

Investigator(s): David E. Greenland, Mark V. Losleben

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 10/01/52 Sampling frequency: 30 seconds, stored every hour Number of sites: 3 Algorithms used to synthesize data (if applicable): arithmetic average, vector average, point sample

Abstract: Climatological data were collected from three Niwot Ridge climate stations throughout the year: Como (C-1), Saddle (initiated 7/01/81), and Niwot (D-1). Parameters measured were temperature, precipitation, relative humidity, solar radiation, barometric pressure, wind speed, wind direction, and run of wind. Other supporting data include temperature and solar radiation measurements from two Green Lakes Valley sites, Green Lake 4 (D-4) and Arikaree Glacier, as well as temperature, precipitation, solar radiation, and wind run data for A-1 (2,195 m) and B-1 (2,591 m) climate stations.

Data Set Code: NWT001

Site-Specific Code: C-1, D-1, Saddle

Accessibility: paper, digital, tape

Proprietary limits: available at cost

Special Comments: not all parameters indicated have been measured since initiation of study

Data Set Title: Pocket Gopher (*Thomomys talpoides*) Disturbance in Alpine Tundra, Front Range, Colorado

Investigator(s): James C. Halfpenny

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/80 Sampling frequency: weekly (during summer) Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Burrowing activity was mapped at a 1-m resolution across six plant communities at two sites. The Saddle grid is 17.5 ha and the Martinelli grid consists of twenty-five 3-m² rectangular plots. Activity was classified into summer mounds or winter casts. Maps were digitized for combination with other "layers" in the Niwot Ridge GIS, particularly vegetation maps.

Data Set Code: NWT002

Site-Specific Code: Saddle, Martinelli

Accessibility: paper, digital

Proprietary limits: currently available

Data Set Title: Lake-Ice Clearance and Freeze-Up Within an Alpine Watershed, Front Range, Colorado

Investigator(s): T. Nelson Caine

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/03/81 Sampling frequency: approximately weekly Number of sites: 1 (includes 7 lakes) Algorithms used to synthesize data (if applicable):

Abstract: Records were based upon intermittent observation of extent of ice cover on seven alpine lakes, dependent on observers being present for other reasons. Dates of freeze-up and lake-ice clearance are available with visual estimates of percent ice cover at various dates prior to complete meltout in spring.

Data Set Code: NWT003

Site-Specific Code: Green Lakes Valley

Accessibility: paper

Proprietary limits: available on request

Data Set Title: Seasonal Water Flow Within an Alpine Watershed, Front Range, Colorado

Investigator(s): T. Nelson Caine

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/24/81 Sampling frequency: weekly (summer) Number of sites: 3 Algorithms used to synthesize data (if applicable): volume per unit time (m³/day), trapeziodal integration of hourly values to daily totals, after conversion by empirical ratings

Abstract: These data consist of seasonal flow records for the entire Green Lakes Valley, Upper Green Lakes Valley, and for the Martinelli Snowpatch. Estimates for five intermediate sites in the drainage can be made via empirical regressions from weekly observations. Hourly stage-discharge files were maintained at the three major sites.

Data Set Code: NWT004

Site-Specific Code: Green Lakes Valley, Martinelli, Green Lake 4, Albion

Accessibility: paper, digital

Proprietary limits: available on request

Data Set Title: Peak Season Small Mammal Surveys on Niwot Ridge, Front Range, Colorado

Investigator(s): James C. Halfpenny

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/30/81 Sampling frequency: annually Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: Small mammals were live trapped within each of six plant communities on approximately August 15 each year. After determination of gender, reproductive status, weight, and health, the animals were permanently tagged and released. Derived measures included density, biomass by community, survivorship, home range, and various measures of life history strategy. Species trapped included pikas (*Ochotona princeps*), marmots (*Marmota flaviventris*), deer mice (*Peromyscus maniculatus*), and voles (*Microtus* spp. and *Phenacomys intermedius*).

Data Set Code: NWT005

Site-Specific Code: Saddle

Accessibility: paper

Proprietary limits: currently available

Data Set Title: Temporal and Spatial Variation in Snowpack in an Alpine Environment, Front Range, Colorado

Investigator(s): James C. Halfpenny

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/82 Sampling frequency: weekly to monthly Number of sites: 2 Algorithms used to synthesize data (if applicable): arithmetic average, snow depth (cm), snow meltout (date)

Abstract: Snow depth was measured approximately monthly at the 88 points that comprise the Saddle grid. This grid was also used to make weekly maps of snowpack position during the growing season. These data were used to determine the relationship between snowmelt and flowering of *Acomastylis rossii*, an ubiquitous species in the Saddle. Snow depth was also measured biweekly at the southern edge of each of 25 permanent plots adjacent to the Martinelli Snowpatch.

Data Set Code: NWT006

Site-Specific Code: Saddle, Martinelli

Accessibility: paper, digital

Proprietary limits: available at cost

Data Set Title: Spatial and Temporal Variation in Soil Moisture, Niwot Ridge Saddle, Front Range, Colorado

Investigator(s): Marilyn D. Walker

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/21/82 Sampling frequency: weekly to monthly (during summer) Number of sites: 1 Algorithms used to synthesize data (if applicable): arithmetric average, percent gravimetric soil moisture

Abstract: Gravimetric soil moisture measurements have been taken outside of, but adjacent to, each of 14 permanent plots at weekly or less frequent intervals throughout the growing season. Soil moisture varied greatly both temporally and spatially, and has been considered to be a major factor controlling the composition of and production within tundra plant communities.

Data Set Code: NWT007

Site-Specific Code: Saddle

Accessibility: paper, digital

Proprietary limits: available at cost

Data Set Title: Stream Water Quality Within an Alpine Watershed, Front Range, Colorado

Investigator(s): T. Nelson Caine

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/82 Sampling frequency: weekly to monthly Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The data set includes analytical results of dissolved major ions, SiO_2 , pH, and conductance in stream waters collected from nine locations within Green Lakes Valley. Sampling was at a weekly interval at seven sites along the main drainage channel and two tributary channels during the summer and at a monthly interval at only two sites during "winter" (November - April). Supporting data included field observations and stream discharge.

Data Set Code: NWT008

Site-Specific Code: Green Lakes Valley

Accessibility: paper, digital

Proprietary limits: available through 1988

Data Set Title: Peak Season Standing Crop Data for Tundra Communities on the Niwot Ridge Saddle, Front Range, Colorado

Investigator(s): Marilyn D. Walker

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 08/03/82 Sampling frequency: annually Number of sites: 1 Algorithms used to synthesize data (if applicable): arithmetic mean, aboveground biomass per unit area (g/m²)

Abstract: Estimates of annual primary production were made from clip harvests taken within 12 permanently marked plots representing six plant communities. Harvested material was separated into eight aboveground standing crop and four composite fractions and weighed. These data can be used to evaluate the effects of temporal and spatial variation in various environmental factors (e.g., snow depth and distribution, soil moisture) on composition of and production within individual plant communities.

Data Set Code: NWT009

Site-Specific Code: Saddle

Accessibility: paper, digital

Proprietary limits: available at cost

Data Set Title: Temporal and Spatial Variation in Plant Phenology on the Saddle, Niwot Ridge, Front Range, Colorado

Investigator(s): James C. Halfpenny, Marilyn D. Walker

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/19/83 Sampling frequency: weekly (summer) Number of sites: 1 Algorithms used to synthesize data (if applicable): arithmetic average, number of inflorescences per plant, number of leaves per plant, length of longest leaf

Abstract: Weekly phenological data (number of inflorescences per plant, number of leaves per plant, and length of longest leaf per plant) have been recorded for permanently tagged specimens of *Acomastylis rossii* and *Bistorta bistortoides* within 14 permanent plots on the Saddle. These data have been used as indices of plant growth and development within three different tundra communities. Variability has been related to annual climate variation as well as to spatial variation in snowpack and growing season snow moisture. In addition, the location of *Acomastylis rossii* in various phenological states was mapped for the entire Saddle grid.

Data Set Code: NWT010

Site-Specific Code: Saddle

Accessibility: paper, digital

Proprietary limits: available at cost

Data Set Title: Soil Interstitial Water Chemistry Within an Alpine Watershed, Front Range, Colorado

Investigator(s): M. Iggy Litaor

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/24/83 Sampling frequency: weekly to monthly (during summer) Number of sites: 3 Algorithms used to synthesize data (if applicable): volume-weighted mean concentration (mg/l), arithmetic average, total flux

Abstract: Soil solution chemistry within an alpine watershed has been characterized through an extensive network of tension and zero-tension samplers. Numerous parameters have been measured, including specific conductance, pH, cations (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+), anions (F, CI, NO_3^- , dissolved P, SO_4^{-2}), alkalinity, DOC, COOH, AI (total, organic, monomeric), and metals (Mn, Fe, Mo, Pb, Zn, Cu, Ni, Cd, Cr, B, Ba). These data have been used to quantify fluxes of nutrients and potentially toxic substances within an alpine watershed, as well as to evaluate the effects of disturbance (e.g., pocket gopher activity) and acid deposition.

Data Set Code: NWT011

Site-Specific Code: Green Lakes Valley, Martinelli, Wetland

Accessibility: digital

Proprietary limits: available with some restrictions

Special Comments: analyses for some of the parameters listed above were not done for the entire study period

Data Set Title: Chemistry of Atmospheric Deposition in Upper Montane Forest and Alpine Tundra, Front Range, Colorado

Investigator(s): Mark V. Losleben

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/83 Sampling frequency: weekly Number of sites: 2 Algorithms used to synthesize data (if applicable): concentration (mg/l)

Abstract: Two National Atmospheric Deposition Program (NADP) sites, located at 2,591 m elevation in upper montane forest (Sugarloaf) and 3,525 m elevation in alpine tundra (Niwot Ridge Saddle), collected precipitation samples on a weekly basis. These were analyzed for pH, conductivity, and metals at the Central Analytical Laboratory in Champaign, Illinois.

Data Set Code: NWT012

Site-Specific Code: Saddle (CO02), Sugarloaf (CO94)

Accessibility: paper, digital

Proprietary limits: available free from Natural Resource Ecology Laboratory, Colorado State University

Special Comments: The Sugarloaf site (CO94) was established 10/01/1988

Data Set Title: ARC/INFO Hierarchical GIS Layers for Niwot Ridge, East Slope, Front Range

Investigator(s): Donald A. Walker, Marilyn D. Walker

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1987 Sampling frequency: annually to every 5 years Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: The ARC/INFO GIS database is in different stages of development at various sitespecific scales, from regional scale to the point quadrat plot. At the microregion scale (10 x 10 km), a SPOT image was classified to vegetation type, a USGS digital elevation model (DEM) provided topography for the area and USGS 71/2 minute quadrangles were digitized for water features, roads, and structures. At the mesosite scale (500 m x 500 m) there are three study areas: the Saddle, Martinelli, and Wetland. The Saddle contains a 350 m x 500 m 88-point permanent grid staked every 50 m. The permanent grids at the Martinelli and Wetland areas will be finished within two years, although the Martinelli now conatins a smaller 25-point permanent grid. A the Saddle, topographic and vegetation maps were created from aerial photos flown in 1987. Vegetation and topographic maps for the Martinelli and topographic maps for the Wetland will be completed by September 1990. At the microsite scale (1 m x 1 m), permanent quadrat plots were established at the Martinelli and the Saddle. Vegetation species were recorded at permanent points spaced 10 cm apart using a a point quadrat. Canopy structure will be measured during the summer 1990. For the Saddle, 100 points were sampled at each of the 88 prid points. At the Martinelli, 300 points were sampled for vegetation as well as gopher disturbance at each of 25 grid points.

Data Set Code: NWT013

Site-Specific Code: Saddle, Martinelli, Wetland

Accessibility: paper, digital, tape

Proprletary limits: available after initial publications



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
Location:	1.6 km north of Georgetown, SC on U.S. Highway 17 33°30'N, 79°13'W elevation: 2 m area: 7,085 ha
Principal Biome:	Coastal marine
Main Communities:	Salt marsh, estuarine benthic, intertidal, barrier island, open beach, inshore oceanic
LTER Research Topics:	Patterns and control of primary production Dynamics of selected populations Organic accumulation Patterns of inorganic contributions Patterns of site disturbances

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. These studies cover a wide spectrum, from the molecular to the ecosystem to the landscape level.

The primary research area is a 2,630 ha, high-salinity marsh that 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 freshwater marshes border the Winyah Bay side of Hobcaw Barony.

The LTER program involves 23 principal investigators who are concerned with biological, chemical, geological, and physical components of the North Inlet Estuarine-Marshland Ecosystem as well as the marsh - highland interaction. 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 column and interstitial water collections are analyzed for inorganic and organic constituents. Physical measurements of the water column 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 database.

Facilities:

The Institute occupies three floors of modern laboratories, offices, and support space in the Earth and Water Sciences Center on the Columbia campus. Excellent analytical equipment, computer facilities, and a marine science library are available to the more than 70 faculty associates and 36 full-time employees of the Institute.

The Field Laboratory in Georgetown has the modern equipment necessary for the analysis of chemical and biological samples. An on-site computerized meteorological station documents hourly changes in atmospheric and water column parameters. A running seawater system and a variety of microcomputers and terminals connected to the mainframe in Columbia are available to resident and visiting scientists.

The Field Laboratory serves as a base for research operations in the North Inlet, Winyah Bay, Murrells Inlet, and Santee estuaries, and adjacent ocean areas. Also associated with the Baruch Institute are the University of South Carolina's managed research sites at the Santee River, Pritchard's Island (near Beaufort), and Wando River (Charleston Harbor). Access to the variety of tidal marsh, beach, and upland habitats is available by vehicles and small (up to 21 ft. long) boats located at the Georgetown facility. A large conference center and six modern dormitories (which can accommodate a total of 76 persons) are used by visiting scientists throughout the year.

Addresses:

Principal Investigator: F. John Vernberg Baruch Institute University of South Carolina Columbia, SC 29208 (803) 777-5288 FAX: (803) 777-3935 JVERNBER@LTERNET (Bitnet) Site Director: Dennis M. Allen Marine Field Laboratory P.O. Box 1630 Georgetown, SC 29442 (803) 546-3623 FAX: (803) 546-1632

Data Manager: William K. Michener Baruch Institute University of South Carolina Columbia, SC 29208 (803) 777-3926 FAX: (803) 777-3935 WMICHENE@LTERNET (Bitnet) Data Set Title: Climate Data From North Inlet Meteorological Station With Water Parameters

Investigator(s): Björn Kjerfve

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/03/79 Sampling frequency: every 6 minutes, stored every hour Number of sites: 1, with backup from other sites Algorithms used to synthesize data (if applicable): arithmetic average, vector average, or point sample

Abstract: This data set includes climatic/meteorological data for the North Inlet LTER site as well as a number of water quality parameters. The data set includes are radiation, wind speed, wind direction, atmospheric pressure, air temperature, rainfall, humidity, tidal water elevation, water temperature, water conductivity, all measured at Oyster Landing. Other supporting data include sporadic measurements of tide at Clambank, rainfall at various locations, and current and salinity measurements at various locations, and daily salinity data (Daily Water Sample) from Town Creek.

Data Set Code: NIN001

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: All weather station data, with the exception of salinity (e.g., conductivity), can be accessed freely by all LTER investigators without special permission. Other supporting data are not on-line but can be made available.

NIN002

Data Set Title: North Inlet National Weather Service Station

Investigator(s): Daniel S. Taylor, William K. Michener

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 12/01/86 Sampling frequency: daily Number of sites: 1, with backup from others when necessary Algorithms used to synthesize data (if applicable):

Abstract: Air temperature (minimum and maximum), relative humidity, and precipitation data are recorded daily at a permanent National Weather Service station. The station is located on land at a position adjacent to the Oyster Landing dock (site of the meteorological station which records hourly measurements - see NIN001). Data are digitally encoded every Monday.

Data Set Code: NIN002

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: data available one week after collection

Data Set Title: Estuarine Surface Water Nutrient Chemistry and Water Quality Data for Clambank and Oyster Landing

Investigator(s): Elizabeth R. Blood

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/01/81 Sampling frequency: daily Number of sites: 3 Algorithms used to synthesize data (if applicable): arithmetic and geometric average, point measurements

Abstract: Nitrogen (total, dissolved organic, particulate, ammonia, nitrate-nitrite), phosphorus (total, dissolved organic, particulate, ortho-phosphate), and carbon (dissolved organic) have been measured on estuarine surface-water samples collected 1 m below the surface. Daily samples have been collected continuously since February 1, 1981. Particulate organic carbon was measured from April 1981 to April 1987. Tidal height, water temperature, salinity, and surface conditions are recorded for each sample collected. Dissolved organic nitrogen, particulate phosphorus, and dissolved organic carbon are the major nutrient fractions. Distinct seasonal patterns were identified, with most nutrients positively correlated with temperature. Interannual variation in the seasonal patterns are related to freshwater input from a mesohaline bay or terrestrial system. Episodic phenomena (hurricanes, tropical storms, droughts) enhance nutrient concentrations and modify water quality parameters.

Data Set Code: NIN003

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: monthly means and standard errors for all parameters available five years from time of collection; additional data available with permission of investigator

Data Set Title: Long-Term Variations in Phytoplankton Biomass in North Inlet Estuary

Investigator(s): Richard G. Zingmark

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/08/78 Sampling frequency: daily Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Measurements of phytoplankton biomass were begun on September 8, 1978. Water samples are collected daily at 1000 hours EST from 0.5 m depth in 1-liter amber bottles and analyzed fluorometrically for chlorophyll *a* and phaeophytin *a*. Initially, one site in North Inlet Estuary (Town Creek) was sampled. Beginning February 2, 1981, two additional sites were added to the sampling protocol (Clambank Creek and Oyster Landing Creek). The data set for Town Creek consists of 8 years, 4 months, of continuous daily measurements (September 8, 1978 to April 27, 1987). Town Creek was sampled every third month, beginning in May 1987. The Clambank Creek and Oyster Landing Creek data sets consist of continuous daily measurements beginning February 2, 1981, and we plan to continue monitoring chlorophyll *a* and phaeophytin *a* at this daily sampling frequency.

Data Set Code: NIN004

Site-Specific Code:

Accessibility: paper, digital, tape

Proprletary limits: access by permission of investigator

NIN005

Data Set Title: Suspended Sediment

investigator(s): Leonard R. Gardner

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/12/81 Sampling frequency: daily Number of sites: 2 Algorithms used to synthesize data (if applicable): see below

Abstract: Suspended sediment data are collected as part of the Daily Water Sample at Oyster Landing and Clambank (collected daily at 1000 hours EST). Three hundred ml of sample is filtered through a preweighed glass-fiber filter, dried at 100°C and weighed to determine the total suspended sediment. The filter is then ashed at 400°C for one hour and reweighed. The weight of the remaining sediment is taken as an estimate of the inorganic suspended sediment (ISS) while the weight loss due to ashing is taken as an estimate of the organic suspended sediment (OSS). Statistical and time series analyses of the first 5 years of data indicate that the concentration of ISS and OSS follow a yearly cycle with the highest concentration in summer and lowest in winter. Concentrations correlate most closely with water temperature with only weak, inverse correlations to salinity and tide height. The ratio of OSS to ISS shows no discernable temporal pattern or correlations with temperature, salinity, and tide. These observations suggest that suspended sediment is controlled primarily by temperature-regulated bioturbation of bottom sediments.

Data Set Code: NIN005

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: monthly means after two years, daily values after five years
Data Set Title: Precipitation Chemistry

Investigator(s): Elizabeth R. Blood

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/23/83 Sampling frequency: storm event Number of sites: 2 Algorithms used to synthesize data (if applicable): arithmetic and geometric means; concentrations converted to kg/ha (nutrient concentration x pprecipitation)/watershed area

Abstract: Precipitation chemistry and volume have been collected on a storm event basis since May 23, 1985. Cations, sulfate, chloride, pH, and volume were initiated May 23, 1983. In January 1984, nitrogen (ammonia, nitrate-nitrite, dissolved organic) and phosphorus (orthophosphate, dissolved organic) analyses were added to the data set. Precipitation volume averages 50 inches per year with the greatest volume occurring during summer months. Hurricanes and tropical storms contribute 10-25% of annual precipitation volume. Precipitation is acidic with acidity dominated by sulfuric acid. Oceanic influences are important with ion balance dominated by sulfate, chloride, and sodium. Inorganic nutrients are low due to limited landuse development.

Data Set Code: NIN006

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary Ilmits: all data through 1985 available. Precipitation volume and pH data available. The remaining chemistry data available with permission of investigator

Special Comments: locations: North Boundary Road and Oyster Landing

NIN007

Data Set Title: Spartina Production

Investigator(s): James T. Morris

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: monthly Number of sites: 4 Algorithms used to synthesize data (if applicable): see below

Abstract: Spartina alternillora production on the vegetated salt marsh surface is monitored with a non-destructive census method: individual stems are tagged and measured monthly in permanent plots. Plots are located in the creek bank and in the high tide marsh (short *Spartina* zone) at Oyster Landing and Goat Island. Creek bank plots were initiated in 1986. Weight of individual stems are estimated from allometric equations derived from earlier stem harvests. Main data sets in mass storage contain plant heights for each month and plot since 1984. Other data sets result from height/weight conversions and are monthly biomass and production. Plant density data sets are also generated.

Data Set Code: NIN007

Site-Specific Code:

Accessibility: paper, digital, tape

NIN008

Data Set Title: Motile Epibenthos, Macrozooplankton

Investigator(s): Dennis M. Allen

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 01/20/81 Sampling frequency: biweekly Number of sites: 2 sites for 4 years, then 1 site Algorithms used to synthesize data (if applicable): abundance = number per cubic meter

Abstract: Three consecutive tows of an epibenthic sled fitted with a 365-micron mesh net were used to collect small (1-25 mm) motile animals from the bottom of a tidal creek every two weeks at the midday low tide. Pericarid crustaceans (i.e., mysids, amphipods), chaetognaths, hydromedusae, larval shrimps and crabs, and larval fishes dominated the catches. Mean densities were compared to determine temporal patterns of abundance and utilization of subtidat epibenthic habitats. Summer species richness and abundance were much higher than winter. Distinct seasonal assemblages were identified. Year to year variations in abundance were sometimes large, and for larval fishes, related to salinity regimes during the coldest months. Short-term studies revealed tidal and diel patterns which have suggested mechanisms of larval dispersion.

Data Set Code: NIN008

Site-Specific Code:

Accessibility: paper, digital, tape

Data Set Title: Zooplankton (153 um)

Investigator(s): Stephen E. Stancyk

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/20/81 Sampling frequency: biweekly Number of sites: 1 Algorithms used to synthesize data (if applicable): Abundance = number of organisms per cubic meter

Abstract: This data set consists of counts of zooplankton from a station in Bread and Butter Creek, sampled biweekly with paired vertical oblique tows of at least 90 sec duration, on an ebbing tide, using a 30-cm mouth diameter, 153-um mesh net with a G.O. flowmeter. Samples are preserved in 10% formalin and enumerated to species for dominant copepods (*Acartia tonsa, Paracalanus crassirostris, Centrophages hamatus, Oithona colcarva, Eurytemora affinis,* others) and to major group for others (barnacle nauplii, polychaete larvae, bivalve larvae, crab zoeae, etc.). All counts are adjusted to number of organisms/m³. Samples have been collected since January 1981.

Data Set Code: NIN009

Site-Specific Code:

Accessibility: paper, digital, tape

Data Set Title: Fishes, Shrimps, and Crabs: Oyster Landing Basin

investigator(s): Dennis M. Allen

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 4/15/83 Sampling frequency: biweekly Number of sites: 1 Algorithms used to synthesize data (If applicable): abundance or biomass per unit effort or per m²

Abstract: Two collections with a ¼-inch mesh bag seine were made every 2 weeks to determine temporal variations in the fish and motile macrocrustacean fauna utilizing a high marsh creek. Low tide collections in a midcreek pool indicated most common fish species. Shrimps and crabs occur as juveniles. Length measurements have provided estimates of growth during the period of occupancy each year. Abundance data demonstrates patterns of seasonal migration and recruitment as well as responses of resident species to major changes in salinity (runoff from uplands) and temperature. Short-term sampling efficiency studies have provided means of estimating resident population size for species which vary considerably in susceptibility to capture. This data set forms the basis of expanded studies (recruitment and predation experiment; flux estimates; secondary production)

Data Set Code: NIN010

Site-Specific Code:

Accessibility: paper, digital, tape

Data Set Title: Size of the Feeding Population of White Ibises (*Eudocimus albus*), an Avian Secondary Consumer

Investigator(s): Keith L. Bildstein

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/15/84 Sampling frequency: every 7-14 days during the breeding season Number of sites: 1 Algorithms used to synthesize data (if applicable): see below

Abstract: White ibises (*Eudocimus albus*) are long-legged, wading birds that feed mainly on crustaceans, aquatic insects, and fishes. At the North Inlet LTER site ibises breed on Pumpkinseed Island, a 9-ha, tidally-inundated marsh island in Winyah Bay south of North Inlet. Ibises feed on fiddler crabs (*Uca* spp.) and other prey on the exposed surfaces of North Inlet. Each breeding season the number of ibises feeding on a 65-ha portion of the Bly Creek basin of North Inlet is counted during a series of dawn-to-dusk hourly counts. Counts are made from an 18.5-m tower along the edge of the marsh, and from a road that borders approximately two-thirds of the plot. Ibises are diurnal feeders at the site. On count days, we arrive at the site before dawn, and record when the first birds arrive and when the last birds leave, as well as counting the total number of birds at the site on an hourly basis throughout the day. Counts were begun June 1984. Since 1985, we have initiated counts in late March each year, and have continued to count birds through early August. Counts are made approximately every 14 days between March and early May each year, and then weekly through the remainder of the season. The resulting data set includes (1) times of arrival and departure of white ibises at the feeding site, and (2) hourly counts of the numbers of birds present.

Data Set Code: NIN011

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: data are available five years after collection or with investigator's permission

Data Set Title: Size of the Nesting Population of White Ibises (*Eudocimus albus*), an Avian Secondary Consumer

Investigator(s): Keith L. Bildstein

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/??/79 Sampling frequency: 2-6 times per breeding season, as needed (see below) Number of sites: 1 Algorithms used to synthesize data (if applicable): see below

Abstract: White ibises (Eudocimus albus) are long-legged, wading birds that feed mainly on crustaceans, aquatic insects, and fishes. At the North Inlet LTER site ibises breed on Pumpkinseed Island, a 9-ha, tidally inundated marsh island in Winyah Bay south of North Inlet. Ibises, which are the most numerous wading birds breeding on the island, have bred at this traditional colony site at least since 1967. Each breeding season ibis nests are counted on Pumpkinseed Island by taking a series of photographs of the island from fixed-wing aircraft flying at approximately 150 m during a series of 2-6 flights timed to document peak numbers of nests, and to assess the effects of extreme high tides on the survivorship of eggs and nestlings. Slides of these photographs are projected, and the number of nests is counted (white ibises are the only white-plumaged species nesting in certain portions of the island, making correct identification relatively certain). Counts are limited to those portions of the island in which ibises are known (by ground-truthing) to be incubating eggs. As pairs usually spend less than one minute exchanging incubation duties at this time, the number of ibises counted is assumed to represent the number of active nests. Comparisons of these counts with ground counts of the same areas indicate 95% agreement of the results. The difference between counts taken immediately before and after extreme high tides in the area are used to assess the number of nests abandoned as a result of tidal inundation. The resulting data set includes (1) the peak number of ibis nests at the site each year, and (2) the percent of this number abandoned as a result of tidal inundation.

Data Set Code: NIN012

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: data are available five years after collection or with investigator's permission

Data Set Title: North Inlet Subtidal Macrobenthos

Investigator(s): Robert J. Feller

Temporal and Spatial Resolution initiation of study (mm/dd/yy): 01/20/81 Sampling frequency: biweekly Number of sites: 1 Algorithms used to synthesize data (if applicable): arithmetic averages of number/m²

Abstract: Benthic infauna are collected biweekly with an 18 cm² core (0-5 cm depth) in a softbottom tidal creek within North Inlet. Eight replicate cores are collected at random and sieved through 0.5 mm mesh. Animals retained are counted, identified, and archived. Numerically dominant individuals are identified to species. Most common taxa are polychaete worms and oligochaetes.

Data Set Code: NIN013

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: biweekly means of major taxa are available

Data Set Title: Meiobenthos Abundance, Copepod Species Data

Investigator(s): Bruce C. Coull

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/07/72 Sampling frequency: monthly to 1981; biweekly thereafter Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: The meiobenthic data set (LTTAXA) consists of replicate standardized counts of 11 major taxa (nematodes, copepods, copepod nauplii, ostracods, gastrotrichs, ciliates, turbellarians, polychaete larvae, bivalve larvae, others) and total meiofauna collected at two subtidal sites (one mud, one sand) since September 1972. Additionally, all copepods are identified to species in another data set (LTCOPES); adults are identified to sex and distinguished from copepodites. From 1972 through 1980, collections were made monthly; starting in 1981, collections have been fortnightly.

Data Set Code: NIN014

Site-Specific Code:

Accessibility: paper, digital, tape

Proprietary limits: data through 1983 is available; remainder will be available when published



NORTH TEMPERATE LAKES LTER SITE

Site Name:	North Temperate Lakes (Trout Lake Station)
Institutional Affiliation:	Center for Limnology, University of Wisconsin (Madison)
Location:	320 km north of Madison, WI 46°00'N, 89°40'W elevation: 500 m area: 10,000 ha
Principal Biome:	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
LTER Research Topics:	Groundwater hydrology and chemistry Paleolimnology Physical and chemical limnology Producer and consumer ecology

Climate Synopsis:

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

Narrative:

The North Temperate Lakes (NTL) LTER site is located in the Northern Highlands Lake District which includes all of Vilas and parts of Iron, Price, and Oneida counties in Wisconsin and Gogebic County in Michigan. This area encompasses 10,000 km² and contains thousands of lakes. Seven lakes (Allequash, Big Muskellunge, Crystal, Crystal Bog, Sparkling, Trout, and Trout Bog) are studied intensively as the primary LTER lakes. The primary LTER lakes reflect the heterogeneity in the lake district; the lakes range from 0.01 to 10.61 km² in area, 2.5-38 m maximum depth, 4.6-7.3 summer pH, 12-85 uS cm⁻¹ at 20°C in conductivity at spring mixis and contain one to 33 fish species. The seven lakes include oligotrophic, mesotrophic, and dystrophic lakes; most are dimictic, one is meromictic. All the primary study lakes lie within the same groundwatershed. By choosing lakes along a groundwater flow path we can study important linkages between groundwater flow and lake chemistry and biology. (The map shows the seven primary study lakes [Magnuson, J.J., B.J. Benson, and T.K. Kratz. 1990. *Freshwater Biology* 23: 145-159]; the pattern of groundwater flow was determined by seismic refraction [map modified from Okwueze, E.E. 1990. Ph.D. Thesis, University of Wisconsin-Madison].) Our research is organized around five major goals: 1) to perceive long-term trends in physical, chemical, and biological properties of lake ecosystems; 2) to understand the dynamics of internal and external processes affecting lake ecosystems; 3) to analyze the temporal responses of lake ecosystems to disturbance and stress; 4) to evaluate the interaction between spatial heterogeneity and temporal variability of lake ecosystems; 5) to expand our understanding of lake-ecosystem properties to a broader, regional context. The sampling program outlined below is designed to support these research goals.

We have tried to match the frequency of parameter measurement with the time scale over which the parameter varies. In addition to a wide selection of physical and chemical parameters, aspects of all major trophic levels are also monitored. Many physical, chemical, and planktonic parameters are measured at the same station on the lake at the same times. Physical limnology and plankton are sampled biweekly during the ice-free season and every 6 weeks during the icecovered season. Chemical limnology is measured every four weeks during the ice-free season and every 6 weeks during the ice-covered season except for major ion chemistry which is measured quarterly. Sediment traps are deployed during the ice-free period for 3-week intervals. A network of monitoring wells is sampled monthly to characterize regional groundwater flow in the study area and sampled annually to characterize the regional groundwater chemistry.

Biotic components which are measured annually include: aquatic macroflora, pelagic macroinvertebrates, crayfish, benthic macroinvertebrates, and fish. Sampling of the fish assemblages is done at littoral zone sites with seine, minnow, or crayfish traps, fyke nets, and a boat-mounted electroshocker. Pelagic fish assemblages are measured with gill nets, trammel nets and sonar.

Meteorological measurements for the site are stored as hourly and daily averages. An instrumented raft measures micrometeorological parameters from which lake evaporation can be calculated. Ice duration on the primary study lakes is recorded each year.

Within the past few years, NTL researchers have added remote sensing and geographic information system technologies to our site's capabilities. An RS/GIS database for the NTL study area has been initiated with the following data layers: presettlement land cover, Land Economic Inventory, land cover based on Landsat 5 TM, vegetation change (1863-1988), soils, soil slope, soil parent material, soil texture, aggregated soil texture, water color, water temperature, water turbidity, bathymetry, and topography.

Facilities:

The modern, all-season laboratory is a two-story structure located about 35 m from the shore of Trout Lake. The 10 small laboratories are well equipped. Noteworthy equipment includes a radioisotope facility with a liquid scintillation counter; high-quality dissecting and compound microscopes, including an inverted scope and a computerized plankton sizing system; an HPLC; flourometers; spectrophotometers; an autotitrator; analytical balances; a spectral radiometer; and a microcomputer facility consisting of Apple IIe's, Macintosh SE's, MAC II's, and IBM PS/2 models 60 and 70. Three aquarium rooms contain direct lines to epilimnetic and hypolimnetic Trout Lake water. In addition, there are office facilities and a modest research library. Boats, motors, and various other field gear are also available for visitor use. Three modern houses can accommodate 21 researchers year-round. Summer-only cabins can house an additional 12 scientists.

Addresses:

Principal Investigator: John J. Magnuson Center for Limnology University of Wisconsin-Madison Madison, WI 53706 (608) 262-3014 FAX: (608) 262-0454 jmagnuson@lternet.washington.edu (Internet) JMAGNUSON@LTERNET (Bitnet) Data Manager: Barbara Benson Center for Limnology University of Wisconsin-Madison 680 N. Park St. Madison, WI 53706 (608) 262-2573 FAX: (608) 262-0454 bbenson@lternet.washington.edu (Internet) BBENSON@LTERNET (Bitnet) Data Set Title: Physical Limnology of North Temperate Lakes Primary Study Lakes

Investigator(s): John J. Magnuson, Carl J. Bowser, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/81 Sampling frequency: biweekly during ice-free season, every 6 weeks during ice-covered season Number of sites: 7 Algorithms used to synthesize data (if applicable): light extinction coefficient calculated by regression

Abstract: Parameters characterizing the physical limnology of the seven primary lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes and unnamed lakes 27-02, and 12-15) are measured at one station in the deepest part of each lake at 0.25-m to 1-m depth intervals depending on the lake. Parameters include lake level (measured at the shoreline), water temperature, vertical penetration of photosynthetically active radiation (PAR), secchi disk depth, dissolved oxygen, ice thickness, and snow depth on lake. Additional derived parameters include PAR extinction coefficients for the water column and the epilimnion, and percent oxygen saturation. Auxiliary data include time of day, air temperature, wave height, cloud cover, and wind speed and direction.

Data Set Code: NTL001

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: These measurements are made concurrently with parameters listed in chemical (NTL002) and plankton (NTL003) databases. Derived data sets containing epilimnetic averages and hypsometrically weighted averages over depths are also available.

Data Set Title: Chemical Limnology of North Temperate Lakes Primary Study Lakes

Investigator(s): Carl J. Bowser, David E. Armstrong, John J. Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/22/81 Sampling frequency: every 4 weeks during ice-free season and every 6 weeks during ice-covered season except for major ion chemistry which is measured quarterly Number of sites: 7 Algorithms used to synthesize data (if applicable):

Abstract: Parameters characterizing the chemical limnology of the seven primary lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes and unnamed lakes 27-02, and 12-15) are measured at one station in the deepest part of each lake at the top and bottom of the epilimnion, midthermocline, and top, middle, and bottom of the hypolimnion. These parameters include total nitrogen, total dissolved nitrogen, nitrate, ammonia, total phosphorus, total dissolved reactive silica, field pH, air equilibrated pH, total alkalinity, total inorganic carbon, dissolved inorganic carbon, total organic carbon, dissolved organic carbon, total organic carbon, manganese, and specific conductance.

Data Set Code: NTL002

Site-Specific Code:

Accessibility: paper, digital

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: These measurements are made concurrently with parameters listed in physical (NTL001) and plankton (NTL003) databases. Derived data sets containing epilimnetic averages and hypsometrically weighted averages over depths are also available.

Data Set Title: Plankton in North Temperate Lakes Primary Study Lakes

Investigator(s): Thomas M. Frost, Timothy K. Kratz, John J. Magnuson, Michael S. Adams

Temporal and Spatial Resolution

Initiation of study (mm/dd/yy): 01/01/81, except primary productivity which began spring 1985

Sampling frequency: biweekly during ice-free season, every 6 weeks during ice-covered season

Number of sites: 7 (primary production 3)

Algorithms used to synthesize data (if applicable): hypsometrically weighted pooled samples for zooplankton; computer program to calculate productivity based on productivity and light relationships and light available in lake

Abstract: Planktonic data include chlorophyll *a*, phytoplanktonic primary production, and zooplankton species abundance. These parameters are measured concurrently with physical limnology in the deepest part of each lake. Chlorophyll samples are collected from the seven primary study lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes and unnamed lakes 27-02, and 12-15) at two to 10 depths and analyzed spectrophotometrically. Primary production on three lakes (Crystal, Sparkling, Trout) is measured using C14 laboratory incubation under controlled temperature and light conditions. Zooplankton samples are collected from the seven primary lakes at two to nine depths using a 2 m long Schindler Patalas trap and with vertical tows using a Wisconsin net. Zooplankton samples are preserved in buffered formalin and archived. Data are summed over sex and stage and integrated volumetrically over the water column to provide an estimate of organisms per liter for each species. Phytoplankton samples are collected, stored in Lugol's, and archived.

Data Set Code: NTL003

Site-Specific Code:

Accessibility: paper, digital, Mac fd

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: These measurements are made concurrently with parameters listed in physical (NTL001) and chemical (NTL002) databases. Derived data sets containing epilimnetic averages and hypsometrically weighted averages over depths are also available for chlorophyll *a* and phaeopigment concentrations.

Data Set Title: Sediment Deposition in North Temperate Lakes Primary Study Lakes

Investigator(s): David E. Armstrong, Timothy K. Kratz, Carl J. Bowser

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/02/82 Sampling frequency: every 3 weeks during ice-free season Number of sites: 3 Algorithms used to synthesize data (if applicable):

Abstract: Settling particulate matter is collected using sediment traps deployed in the water column below the epilimnion. Collections are made at one or two stations in Trout, Sparkling and Crystal lakes. Traps are deployed during the ice-free period for three-week intervals. Mass deposition rates are calculated from the dry-weight of material collected. Material is also analyzed for carbon, nitrogen, phosphorus, silica, and selected other constituents.

Data Set Code: NTL004

Site-Specific Code:

Accessibility: paper, digital

NTL005

Data Set Title: Aquatic Macroflora Composition and Biomass in Trout Lake, Wisconsin

Investigator(s): Timothy K. Kratz, Michael S. Adams

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/81 Sampling frequency: annually Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: These data were collected to document and characterize the submersed macroflora of Trout Lake to evaluate the long-term stability of this component and to interface with investigations of other compartments of the ecosystem. Four sites along the shoreline of Trout Lake have been sampled annually in August along permanent line transects. Parameters include biomass per m² for individual species at three depths and frequency data by species by depth along the transect. This information will be used to determine the annual variability of the submersed macroflora and to provide information on the effects of the invasion of an introduced crayfish. In addition, macrophyte surveys were conducted on Sparkling, Crystal, and Trout lakes during 1981 and on Weber (Firefly Lake) during 1984. Species lists and maps of the macrophyte distributions were prepared. In Trout, Crystal, and Weber lakes, biomass per species, total crop, and relative frequency were determined.

Data Set Code: NTL005

Site-Specific Code:

Accessibility: paper, digital, Mac fd

NTL006

Data Set Title: Pelagic Macroinvertebrates in North Temperate Lakes Primary Study Lakes

Investigator(s): John J. Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/10/82 Sampling frequency: annually Number of sites: 7 (plus 4 additional sites on Trout Lake) Algorithms used to synthesize data (if applicable):

Abstract: Five vertical tows are done at the deepest point of each of the seven lakes (Allequash, Big Muskellunge, Crystal, Sparkling,Trout, and the bog lakes 27-02 and 12-15), using a 1-mm mesh net with a 1-m wide mouth. On Trout Lake four additional sites are sampled, at 10 m, 15 m, 20 m, and 25 m depths, with three tows done at each site. All samples are taken in darkness. Samples are preserved and counted, yielding numbers caught. Derived data include density.

Data Set Code: NTL006

Site-Specific Code:

Accessibility: paper, digital, Mac fd

Data Set Title: Crayfish in North Temperate Lakes Primary Study Lakes

Investigator(s): John J. Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/29/81 Sampling frequency: annually Number of sites: variable depending on year and lake Algorithms used to synthesize data (if applicable): catch per unit effort

Abstract: LTER core data include catch in cylindrical traps baited with beef liver. Traps are placed at fyke net locations in seven study lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes, and unnamed lakes 27-02, and 12-15). Individuals are identified to species and counted. In Trout Lake more detailed surveys are conducted each August to track distribution of the invading species *Orconectes rusticus*. Additional data sets consists of pre-LTER sets (initiated in late June 1972) gathered by Capelli (Ph.D. dissertation) and Lorman (Ph.D. dissertation). Most of pre-LTER data is detailed distribution in Trout Lake, and community composition in other area lakes.

Data Set Code: NTL007

Site-Specific Code:

Accessibility: paper, digital, MAC fd

Data Set Title: Benthic Macroinvertebrates in North Temperate Lakes Primary Study Lakes

Investigator(s): John J. Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 08/20/81 Sampling frequency: annually Number of sites: 4-7 in each of 7 lakes Algorithms used to synthesize data (if applicable):

Abstract: Macroinvertebrates are collected from selected shoreline and deep water locations in the seven primary takes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes, and unnamed lakes 27-02, and 12-15) using modified Hester-Dendy samplers. Samplers are placed at tyke net and gill net locations (see fish dataforms) in August and retrieved 3-4 weeks later. Macroinvertebrates are preserved in ethanol. At the present time, only the macroinvertebrates from Trout Lake (1981-1985) and Crystal Lake (1982, 1985, 1987) samples have been identified and counted.

Data Set Code: NTL008

Site-Specific Code:

Accessibility: paper

NTL009

Data Set Title: Fish in North Temperate Lakes Primary Study Lakes

Investigator(s): John J. Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/29/81 Sampling frequency: annually Number of sites: multiple sites (gear dependent) on 7 lakes Algorithms used to synthesize data (if applicable):

Abstract: Data are collected annually to enable us to track the fish assemblages of seven primary lakes (Allequash, Big Muskellunge, Crystal, Sparkling, Trout, and bog lakes 27-02 and 12-15). Sampling is done at six littoral zone sites per lake with seine, minnow, or crayfish traps, and fyke nets; a boat-mounted electroshocker samples four littoral transects. Vertically hung gill nets are used to obtain two pelagic samples per lake from the deepest point. A trammel net samples across the thermocline at two sites per lake. Parameters measured include species identification and lengths for all fish caught, and weight and scale samples from a subset. Derived data include catch per unit effort, growth, and size and age distribution by species, lake, and year. Dominant species vary from lake to lake. Perch, rockbass, and bluegill are common, with walleye, *Micropterus* spp, and *Esox* spp as major piscivores. Cisco are present in the pelagic waters of three lakes, and the introduced species, rainbow smelt, is present in two. The bog lakes contain mudminnows.

Data Set Code: NTL009

Site-Specific Code:

Accessibility: paper, digital

Data Set Title: Determination of Pelagic Fish Abundance in North Temperate Lakes Primary Study Lakes

Investigator(s): John J Magnuson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/27/81 Sampling frequency: annually Number of sites: 5 Algorithms used to synthesize data (if applicable):

Abstract: Data are collected along a set of transects in each of five lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout), using a Simrad 70 khz machine with the transducer suspended in front of the boat. Transects are run on two nights and two days in late summer. The returning acoustic signal is recorded on audio tape, as well as on paper charts. The recorded signal is analyzed using the HADAS package to produce fish densities, by size, for each discrete depth in the lake.

Data Set Code: NTL010

Site-Specific Code:

Accessibility: paper, audio tape, digital (some)

Data Set Title: Groundwater Flow in the Area Surrounding the North Temperate Lakes Primary Study Lakes

Investigator(s): Carl J. Bowser, Mary P. Anderson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy):: 07/10/80 Sampling frequency: monthly Number of sites: 21 wells (more in some years) Algorithms used to synthesize data (if applicable): Flow models based on Darcyus law. Finite difference models using both 2D and 3D networks.

Abstract: Monthly head measurements from a network of 21 monitoring wells are used to characterize regional groundwater flow in the Trout Lake area. A concentrated network of 30 wells along a groundwater flow path between two of the lakes permitted a better resolution of groundwater flow paths, velocities, and chemistry than is found in most studies. An associated data set (Chemistry of Groundwater in the Area Surrounding the North Temperate Lakes Primary Study Lakes, NTL012) contains groundwater chemistry. Groundwater discharge into lakes can have a significant effect on lake chemistry.

Data Set Code: NTL011

Site-Specific Code:

Accessibility: paper, digital, MAC fd

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: Digitization of data currently in progress. This data is tied with data set NTL012 on well water chemistry.

Data Set Title: Chemistry of the Groundwater in the Area Surrounding the North Temperate Lakes Primary Study Lakes

Investigator(s): Carl J. Bowser, Mary P. Anderson, Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/25/82 Sampling frequency: annually (currently) Number of sites: 11 wells (more in some years) Algorithms used to synthesize data (if applicable):

Abstract: A network of 11 monitoring wells is used to characterize regional groundwater chemistry in the Trout Lake area. A concentrated network of 30 wells along a groundwater flow path between two of the lakes permitted a better resolution of groundwater flow paths, velocities, and chemistry than is found in most studies. Chemical parameters measured include dissolved oxygen, pH, total alkalinity, calcium, magnesium, sodium, potassium, chloride, sulphate, iron, and dissolved reactive silica. An associated data set (Groundwater Flow in the Area Surrounding the North Temperate Lakes Primary Study Lakes, NTL011) contains monthly well water level measurements. Chemical data are available at a quarterly sampling frequency for some years. Analysis of the major chemical elements shows that some groundwater exhibits substantial seasonal variance. Chemical data are incorporated into a computerized chemical reaction model (PHREEQE) to evaluate minerals that control water composition, and critical solid/liquid reactions that occur along flow paths. Groundwater discharge into lakes can have a significant effect on lake chemistry.

Data Set Code: NTL012

Site-Specific Code:

Accessibility: paper, digital (subset)

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: Digitization of data is in progress. These data are tied with data set NTL011 on well water levels.

Data Set Title: Lake Evaporation from Sparkling Lake, Wisconsin

Investigator(s): Carl J. Bowser, Timothy K. Kratz

Temporal and Spatial Resolution

Initiation of study (mm/dd/yy): 05/15/89 Sampling frequency: one minute; averaged to hourly and daily values Number of sites: 1 Algorithms used to synthesize data (if applicable): Evaporation is calculated using both energy budget and mass transfer techniques.

Abstract: Questions relating to the flux of solute elements to and from lakes require accurate water budgets. Evaporation rates are a critical component of the water budget of lakes. An instrumented raft is put on the lake over the ice-free season to measure micrometeorological parameters from which evaporation can be calculated. Raft measurements of relative humidity and air temperature (2 m height), wind velocity (1, 2, and 3 m heights), and water temperatures at 1-m intervals are combined with measurements of total long-wave and short-wave radiation data from a nearby shore station to determine evaporation by the energy budget technique. Comparable evaporation estimates from mass transfer techniques are calibrated against energy budget estimates to produce a lake-specific mass transfer technique alone.

Data Set Code: NTL013

Site-Specific Code:

Accessibility: digital, Mac fd

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: Data are measured every minute, averaged to one hour periods and recorded using Campbell dataloggers. Twenty-four averages are calculated and stored from the one hour averages.

Data Set Title: Meteorological Data for Trout Lake Area

Investigator(s): Carl J. Bowser, Timothy K. Kratz, Tim W. Meinke

Temporal and Spatial Resolution

Initiation of study (mm/dd/yy): 04/28/88 Sampling frequency: hourly and daily averages Number of sites: 1

Algorithms used to synthesize data (if applicable): One-minute intervals averaged to hourly and daily means. Precipitation at 5-minute intervals

Abstract: Meteorological measurements are being gathered at a site on the Noble F. Lee Municipal airport north of Minocqua, WI for three purposes: 1) to supplement the data from the raft on Sparkling Lake used for evaporation calculations, and 2) to provide standard meteorological measurements for the North Temperate Lakes site, and 3) to measure radiation for primary production studies in the study lakes at the site. The following parameters are measured at 1-minute intervals and stored as 1-hour and 24-hour averages: 1) air temperature, 2) relative humidity, 3) wind speed and direction at 1.5 m above ground, 4) total long-wave radiation, 5) total short-wave radiation, 6) photosynthetically active radiation (PAR), 7) soil temperatures at 5, 10, and 50 cm depths, and 8) total precipitation. Precipitation data are summed for 5-minute intervals during periods of detectable precipitation. Data are accessible to investigators at any time via phone modem.

Data Set Code: NTL014

Site-Specific Code:

Accessibility: digital, Mac fd

Proprietary limits: access limited until subsets published, but available with permission

Special Comments: Data are measured every minute, averaged to one-hour periods and recorded using Campbell CR21X dataloggers. Twenty-four hour averages are calculated from the one-hour averages and stored. Coded data are archived in ASCII format (for Macintosh or IBM), and transferred to EXCEL files for data analysis.

Data Set Title: Ice Duration in North Temperate Lakes Primary Study Lakes

Investigator(s): Timothy K. Kratz

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): Fall 1981 Sampling frequency: annually Number of sites: 7 Algorithms used to synthesize data (if applicable):

Abstract: Data include day of freeze-up and thaw of seven primary lakes (Allequash, Big Muskellunge, Crystal, Sparkling, and Trout lakes, and unnamed lakes 27-02, and 12-15). Observations are made daily during times of freeze and thaw.

Data Set Code: NTL015

Site-Specific Code:

Accessibility: paper, digital, Mac fd

Proprietary limits: access limited until subsets published, but available upon request



SEVILLETA LTER SITE

Site Name:	Sevilleta National Wildlife Refuge Magdalena Mountain Research Area Bosque del Apache National Wildlife Refuge Sierra Ladrones Wilderness Area
Institutional Affiliation:	University of New Mexico U.S. Fish and Wildlife Service U.S. Forest Service, Bureau of Land Management
Location:	The northern boundary is 75 km south of Albuquerque, NM 34°00' to 34°25'N; 106°30' to 107°15'W elevation: 1,350 to 3,450 m area (total): 168,690 ha
Principal Blome:	Transition between conifer woodland, Great Basin Shrub Steppe, Great Plains Grassland, and Chihuahuan Desert
Main Communities:	Subalpine conifer forest, subalpine grassland, Montane conifer forest, conifer woodland/savanna, shortgrass steppe, creosote bush, desert grassland, mesquite dunes, sand dunes, shrub steppe, cottonwood gallery forest, riverside marsh, salt cedar gallery forest, tallgrass swales, mountain shrubland.
LTER Research Topics:	Landscape dynamics in a biome interaction zone Semiarid watershed ecology Climate change detection in a sensitive landscape Biospheric/atmospheric interactions Paleobotany/archaeology: past influences on landscapes Plant/animal population dynamics in a biome tension zone Physiological ecology of organisms at their range boundary Genetic change in organisms at their range boundary Microbial dynamics: role in gas flux Species interaction in high-diversity ecotonal landscapes Animal control of landscape heterogeneity Scale dependent/independent nature of spatial and temporal variability

Climate Synopsis:

Climate is characterized by a combination of abundant sunshine, low humidity, and high variability in most factors. The area exists in the boundary between several major air mass zones which contributes to the dynamics of the local climate. Precipitation on the Sevilleta ranges from < 100 mm to 600 mm with an average of 280 mm. Average annual precipitation on the Magdelena Mountains is 430 mm. Summer precipitation occurs as intense thunderstorms often accounting for over one-half of the annual moisture. El Nino and La Nina events influence

winter precipitation and marked variations occur on an interannual basis. Mean monthly temperatures range from -2.5°C to 27°C.

Narrative:

The Sevilleta LTER was initiated as the Sevilleta National Wildlife Refuge, a former Spanish land grant now administered by the U.S. Fish and Wildlife Service. The LTER recently has been expanded to a research area of approximately 3,600 km² that ranges from Rio Grande riparian forests ("bosque") and Chihuahuan Desert to subalpine forests and meadows. Four dedicated research areas comprise the core sites: Sevilleta National Wildlife Refuge (100,000 ha), Bosque del Apache National Wildlife Refuge (25,300 ha), Sierra Ladrones Wilderness Study Area (28,390 ha), and the Magdalena Mountains Research Area (15,000 ha Cibola National Forest). The research region spans the Rio Grande basin with elevations ranging from 1,350 m at the Rio Grande to 2,195 m in the Los Pinos Mountains in the east, to 2,797 m at Ladrone Peak in the northwest, and to 3,450 m in the Magdalena Mountains to the southwest.

Topography, geology, soils, and hydrology, interacting with major air mass dynamics, provide a spatial and temporal template that has resulted in the region being a transition zone for a number of biomes. The region contains communities representative of, and at the intersection of, Great Plains Grassland, Great Basin Shrub Steppe, Chihuahuan Desert, Interior Chaparral, and Montane Coniferous Forest. The elevational gradient of the Magdalena Mountains provides further transitions for Interior Chaparral, Pinyon-Juniper Woodland, Petran Montane Conifer Forest, Petran Subalpine Conifer Forest, and Subalpine Grassland. The regional location at the junction of a number of biomes is critical for quantifying: 1) gradient relationships with distance, 2) the scale-dependent or independent nature of spatial variability, 3) how steep gradients influence system properties, 4) integrated responses across the region, and 5) biome responses to climate change. Many species of these communities are at their distributional limits. For example, 54 plant species terminate their distributions within the Sevilleta and some represent major life forms and physiologies, such as the C3 perennial grasses. Reptiles provide a dramatic example as 47 of the 58 species end their distributions in the vicinity of the Sevilleta (33 are northern limits of desert species). An important feature of the biodiversity of this region is the number of examples of sympatric swarms of closely related species. This sympatry attords opportunities for studying the evolutionary differentiation of species.

The primary core site is the Sevilleta where three major transects (3 km wide, boundary to boundary), capture the variation of topography, geology, and biome transitions. These transects allow multiple scale studies from intensive measures on the 1 km² vegetation plots to remote sensing from space. A network of different size watersheds (from 20 ha to 350,000 ha) is being studied for the influence of short- and long-term climatic variation on the hydrology and ecology of ephemeral streams. Watershed size is a surrogate for scale and enables study of the consequences of scale-dependent biotic responses. Mammals, reptiles, amphibians, and arthropods are censused regularly at locations representing the habitat differences in the region (e.g., desert to mountain top). Two major experiments are in progress. A fertilization experiment is evaluating alternative limiting factors of moisture and nutrients for competing physiologies (C₃ vs. C₄) or competing species from different biomes (e.g., Chihuahuan perennial grass vs. Great Plains perennial grass). A large scale, factorial experiment is evaluating antelope grazing and fire interactions. Exclosures and burning after El Nino years (large fuel build-up) allow a test of the role of fire and herbivory on ecosystem processes and movement of biome edges.

Our approach in all of our research is to measure ecological parameters over gradients ranging from small scale (microtopographic redistribution of water) to medium (watershed-level topographic redistribution of water and species) to large (regional biome transitions and between LTER sites). The climatic factors combined with high species diversity, heterogeneous topography and soils provide a complex template for ecological studies of species response, population/community dynamics and functional and structural properties of ecosystems. A major hypothesis is that biological response to climate change will be reflected in a transition zone before it occurs within a biome.

Facilities:

In addition to laboratories at the University of New Mexico, Albuquerque, and New Mexico Tech, Socorro, on-site facilities are being expanded. The U.S. Fish and Wildlife Service maintains an office, a maintenance shop, garage, and heavy construction equipment. A University of Mew Mexico field station being constructed includes offices, living quarters, laboratories, computer facilities, and conference rooms.

Addresses:

Principal Investigator: James R. Gosz Department of Biology University of New Mexico Albuquerque, NM 87131 (505) 277-2265 FAX: (505) 277-0304 jgosz@sevilleta.unm.edu Project Coordinator: Robert Parmenter Department of Biology University of New Mexico Albuquerque, NM 87131 (505) 277-7619 FAX: (505) 277-0304 parmentr@sevilleta.unm.edu Data Manager: James Brunt Department of Biology University of New Mexico Albuquerque, NM 87131 (505) 277-9342 FAX: (505) 277-0304 jbrunt@sevilleta.unm.edu Data Set Title: Meteorological Data from the Sevilleta National Wildlife Refuge

Investigator(s): James R. Gosz, Douglas I. Moore, Clifford N. Dahm, Manuel C. Molles

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/14/89 Sampling frequency: hourly Number of sites: 6 Algorithms used to synthesize data (if applicable): means, vector average, total

Abstract: This data set includes meteorological data from six stations for Sevilleta National Wildlife Refuge. Included variables are temperature, relative humidity, wind speed, maximum wind speed, minimum wind speed, wind direction, precipitation, and solar radiation. In addition, some soil parameters including soil temperature at 1 and 10 cm and soil moisture potentials at 10 and 30 cm (using gypsum blocks), are also contained in the data set.

Data Set Code: SEV001

Site-Specific Code: Met/ppt

Accessibility: Internet, tape

Proprletary limits: available immediately after archival

Data Set Title: Precipitation Chemistry from the Sevilleta National Wildlife Refuge

Investigator(s): James R. Gosz, Carlton S. White, Douglas I. Moore, Clifford N. Dahm, Manuel C. Molles

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/17/89 Sampling frequency: weekly to monthly Number of sites: 20 Algorithms used to synthesize data (if applicable):

Abstract: This data set includes precipitation chemistry from 20 funnel collectors on the Sevilleta National Wildlife Refuge. Variables measured include volume, $N0_3$ -N, NH_4 -N, Ca, Mg, Na, K, Cl, SO₄, and conductivity. Sample collection depends on frequency of significant precipitation events.

Data Set Code: SEV002

Site-Specific Code: Met/chem

Accessibility: Internet, tape

Proprietary limits: as quality assurance is completed and data are archived
Data Set Title: Lightning Strike Information for New Mexico

Investigator(s): James R. Gosz, Douglas I. Moore

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/88 Sampling frequency: continuous Number of sites: a statewide network of radio sensors Algorithms used to synthesize data (if applicable):

Abstract: This data set includes all cloud to ground lightning strikes within the boundaries of the state of New Mexico as detected by the lightning location system operated by the U.S. Bureau of Land Management Boise Interagency Fire Center. The data includes the time (GMT), latitude, longitude, peak current, and number of return strokes for each lightning strike.

Data Set Code: SEV003

Site-Specific Code: Met/Ilp

Accessibility: please inquire

Proprietary limits: please inquire

Data Set Title: Plant Line-Intercept Transects for Analysis of Vegetation in Transition Zones

Investigator(s): James R. Gosz, Herb O. Grover, Bruce T. Milne, Brad H. Musick

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/89 Sampling frequency: twice annually Number of sites: 7 Algorithms used to synthesize data (if applicable): lag-ordination

Abstract: These data are from transects placed to evaluate temporal and spatial dynamics in vegetation transition zones (e.g., black grama grassland/creosote bush scrubland) at a 1-cm resolution. Four sites were sampled twice in 1989, once in late May, and once in early August to monitor potential responses in "cool season" and "warm season" plants. Six sites will be sampled in 1990. Each site consists of a 1-km² box that contains 1,600 m to 2,000 m of transect length.

Data Set Code: SEV004

Site-Specific Code: plant/transect

Accessibility: Internet, tape

Proprietary limits: Available as quality assurance is completed and data are archived

SEV005

Data Set Title: Fertilizer Plots

Investigator(s): James R. Gosz, Diane L. Marshall, Charles S. Wisdom

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 03/01/89 Sampling frequency: semiannually Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Fertilized and control plots (625 m² each) are established each year to evaluate interactions between precipitation and nutrient limitation. Two sites are studied: Blue Grama-Black Grama representing two C_4 species from different biomes; *Oryzopsis*-Black Grama representing a C_3 - C_4 community. Quadrats are sampled twice a year for aboveground live and dead biomass, root biomass, and nutrient content of each species. Photographs of each plot are taken and digitized.

Data Set Code: SEV005

Site-Specific Code: plant

Accessibility: Internet, tape

Data Set Title: Sevilleta Plant Demography

Investigator(s): Diane L. Marshall, Charles S. Wisdom

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/10/89 Sampling frequency: biannually Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: This data set pertains to responses of plant growth and reproduction to short- and long-term variation in abiotic and biotic aspects of the environment. Several perennial life forms, including tree (Juniper and Pinus), shrub (Larrea) and grass (Oryzopsis and Sporobolus), are being monitored at 1-3 of four sites which differ in elevation and topography as well as edaphic and annual precipitation chracteristics. The sites represent optimal or marginal/transitional zones for particular species and permit specific hypotheses to be tested (e.g., relative impact of wet vs. dry years on C₃ [Oryzopsis] vs. C₄ [Sporobolus] grasses. Demographic measurements are made biannually, after the 'wet' (fall) and 'dry' (spring) seasons. For tree and shrub species, estimates of growth and reproduction are based on branch demography. Ten replicate branch tips each of 10-20 individuals per species per site are monitored. For Juniper, Pinus, and Larrea, vegetative growth of branch as well as reproduction are monitored. Additional measurements include needle length for Pinus and leaf production, leaf size, and branchlet reproduction for Larrea. For Oryzopsis and Sporobolus, which are both bunch grasses, basal diameter, leaf length, and reproduction are monitored for 100 individuals per species per site. Demographic data coordinate with physiological measurements (see Sevilleta Plant Physiology, SEV007) to elucidate the physiological bases of changes in growth and reproduction.

Data Set Code: SEV006

Site-Specific Code: plant/demog

Accessibility: Internet, tape

Proprietary limits: fall 1991

SEV007

Data Set Title: Sevilleta Plant Physiology

Investigator(s): Diane L. Marshall, Charles S. Wisdom

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/10/89 Sampling frequency: biannually Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: Physiological status of plants is monitorred in conjunction with the sampling schedule outlined in Sevilleta Plant Demography (SEV006). Several perennial life forms, including tree (*Juniperus* and *Pinus*), shrub (*Larrea*) and grass (*Oryzopsis* and *Sporobolus*), are being monitored at 1-3 of four sites which differ in elevation and topography as well as edaphic and annual precipitation characteristics. For the 1990 field season we are adding a spring annual, *Lesquerella*, to our sampling efforts at these same sites. Currently, water status (xylem potentials, bars) is monitored twice a year, in spring (after the 'dry' season) and fall (after the 'wet' season). Three replicate measurements are made on each of 10-20 individuals per species per site. Three measurements are made at pre-dawn and midday to determine the diurnal range of values for each plant. For the 1990 field season, we will also be measuring peak photosynthetic rates for selected individuals by gas exchange measurements and porometry. Together with demographic data, this data set permits assessment of the physiological bases of plant growth and reproduction in response to short- and long-term changes in abiotic and biotic aspects of the environment.

Data Set Code: SEV007

Site-Specific Code: plant/phys

Accessibility: Internet, tape

Proprietary limits: fall 1991

Data Set Title: Rodent Populations

Investigator(s): James H. Brown, James S. Findley, Robert R. Parmenter, Terry L. Yates

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/89 Sampling frequency: 2 times per year Number of sites: 39 Algorithms used to synthesize data (if applicable):

Abstract: Rodent populations are sampled in spring and summer in various habitats: grassland, creosote shrubland, pinyon-juniper woodland, cottonwood forest, subalpine forest, and subalpine meadow. On 24 sites mark-release methods are used; on 15 sites all animals are kept for museum specimens. Museum specimen preparations include skins, skulls, whole skeletons, and alcohol preservations; all specimens have tissue samples (liver, heart) taken for ultra-cold preservation for genetic analyses; some are karyotyped. All museum specimens are checked for internal parasites.

Data Set Code: SEV008

Site-Specific Code:

Accessibility: Internet, tape

Data Set Title: Reptile Populations

Investigator(s): Robert R. Parmenter, Howard L. Snell

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/90 Sampling frequency: 2 three-week periods per year Number of sites: 30 Algorithms used to synthesize data (if applicable):

Abstract: Reptile populations are sampled in spring and summer in various habitats: grassland, creosote shrubland, pinyon-juniper woodland, cottonwood forest, subalpine forest, and subalpine meadow. On 18 sites mark-release methods are used; on 12 sites, all animals are kept for museum specimens. Museum specimen preparations include skulls, whole skeletons, and alcohol preservations; all specimens have tissue samples (liver, heart) taken for ultra-cold preservation for genetic analyses; some are karyotyped. All museum specimens are checked for internal parasites.

Data Set Code: SEV009

Site-Specific Code:

Accessibility: Internet, tape

SEV010

Data Set Title: Arthropod Populations

Investigator(s): Clifford S. Crawford, Robert R. Parmenter

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 04/15/89 Sampling frequency: monthly Number of sites: 9 Algorithms used to synthesize data (if applicable):

Abstract: Ground-dwelling arthropods are sampled using 30 pitfall traps per site in various habitats: grassland, creosote shrubland, pinyon-juniper woodland, cottonwood forest, subalpine forest, and subalpine meadow. Specimens are identified to species. Classes include Arachnida, Chilopoda, Diplopoda, Crustacea (Isopoda), and Insecta. Insect orders include Thysanura, Collembola, Orthoptera, Hemiptera, Homoptera, Coleoptera, Hymenoptera (excluding ants).

Data Set Code: SEV010

Site-Specific Code:

Accessibility: Internet, tape

SEV011

Data Set Title: Thematic Mapper Images

Investigator(s): Herb D. Grover, Bruce T. Milne, Brad H. Musick

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 1988 Sampling frequency: 3 times per year Number of sites: 1 (100,000 ha) Algorithms used to synthesize data (if applicable):

Abstract: Thematic mapper digital imagery is acquired three times yearly (usually March, May, and September) to enable the detection of phenological changes in plant greenness. Phenology is characterized by responses of evergreen vegetation (March), cool-season species (May), and warm season species (September, at the end of the rainy season).

Data Set Code: SEV011

Site-Specific Code:

Accessibility: Internet, tape

Proprietary limits: As imposed by reseller

Data Set Title: Plant Litter Decomposition

Investigator(s): James R. Gosz, Robert R. Parmenter, Carlton S. White

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 02/01/90 Sampling frequency: 4 times annually Number of sites: 8 Algorithms used to synthesize data (if applicable):

Abstract: Bouteloua eriopoda, Juniperus monosperma, Oryzopsis hymenoides, Bouteloua gracilis, Larrea divaricata, Yucca glauca, Atriplex canescens, Pinus edulis, and Populus fremontii are being used in annual litterbag experiments. Three replicates per species are collected from each site (over a 2-year period). The first three species are placed at seven of the eight sites. Combinations of the other species are placed at select sites.

Data Set Code: SEV012

Site-Specific Code:

Accessibility: Internet, tape, paper

Data Set Title: Internal Parasites from Sevilleta Rodents and Reptiles

Investigator(s): Don W. Duzynski, Scott L. Gardner

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/89 Sampling frequency: 2 times per year Number of sites: 39 Algorithms used to synthesize data (if applicable):

Abstract: Rodents and reptiles collected in various habitats (grassland, shrubland, pinyonjuniper woodland, cottonwood forest, subalpine forest, and subalpine meadow) are dissected and examined for internal parasites, primarily Coccidians. The study addresses questions concerning climate dynamics and infection frequencies in wildlife populations. Parasite specimens are being deposited at the University of New Mexico with Donald Duzynski and at the University of California, Davis, with Scott Gardner

Data Set Code: SEV013

Site-Specific Code: animal/parasite

Accessibility:

Proprietary limits: inquiries to Don W. Duzynski

Data Set Title: Permanent Photo Plots

Investigator(s): James R. Gosz, Douglas I. Moore, Herb D. Grover, Bruce T. Milne

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/01/89 Sampling frequency: variable Number of sites: areawide network of plots Algorithms used to synthesize data (If applicable): Khoros Image Processing Software

Abstract: Permanent photo quadrats (3 m x 4 m) are photographed semiannually to annually. Photographs are digitized for analysis by computer image processing software. Newly disturbed areas (e.g., burns) have new quadrats established to follow community change.

Data Set Code: SEV014

Site-Specific Code:

Accessibility: please inquire

Proprietary limits: immediately after archival

Data Set Title: Burn x Antelope Exclosure Experimental Plots

Investigator(s): James R. Gosz, Douglas I. Moore, Clifford N. Dahm, Manuel C. Molles

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 09/01/90 Sampling frequency: semiannually Number of sites: 1 Algorithms used to synthesize data (if applicable):

Abstract: The role of lightning-caused wildfires and pronghorn antelope activity in influencing the primary production, flora, fauna, and nutrient cycles of a grassland ecosystem are being studied. Sixteen 9-ha plots are subjected to four treatments (four replicates each): (1) antelope exclosed, not burned; (2) antelope exclosed, burned; (3) antelope present, burned; (4) antelope present, not burned. Controlled burns are conducted in the year following an "El Nino" year. Measured variables on all sites include NPP, floral species diversity and distribution, population dynamics of rodents, reptiles, and arthropods, and soil nutrients/decomposition processes.

Data Set Code: SEV015

Site-Specific Code:

Accessibility: please inquire

Data Set Title: Stream Discharge

Investigator(s): Manuel C. Molles, Clifford N. Dahm

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/89 Sampling frequency: variable Number of sites: 8 Algorithms used to synthesize data (if applicable):

Abstract: Streamflow in the ephemeral streams we are studying occur frequently, are of short duration, and occur during intense thunderstorms. We are monitoring streamflow on these systems with a combination of time-lapse video and transverse stripes painted on the dry stream beds with lead-free surveyors' marking paint. Time-lapse video cameras are monitoring flows on two 10 ha basins, and one 350,000 ha basin. The cameras are currently being programmed to take a 2 second video image every five minutes during daylight hours but can be easily reprogrammed to take images of virtually any length and at any interval. Video tapes of flows may be viewed in the laboratory to record the date and duration of the flow, as well as flow stage height. The transverse stripes have been used to mark 33 locations within the study basins draining catchments ranging from 0.1 ha to 1,000 ha. The stripes are checked every 2 weeks for disturbance by streamflow. The data recorded are the occurrence of flows and the width of the peak flow.

Data Set Code: SEV016

Site-Specific Code: watershed

Accessibility: Internet, paper, tape

Proprietary limits: available after archival



VIRGINIA BARRIER ISLAND-ESTUARINE LTER SITE

Site Name:	Virginia Coast Reserve of The Nature Conservancy
Institutional Affiliation:	University of Virginia
Location:	2 km north of Oyster, VA, on State Route 600 37°30'N, 75°40'W elevation: 2 m area: 14,170 ha
Principal Blome:	Coastal marine
Main Communities:	Sandy intertidal, open beach, grassland, shrub thicket, mature pine forest, salt marsh, estuarine
LTER Research Topics:	Holocene barrier island geology Salt marsh ecology, geology, and hydrology Ecology/evolution of insular vertebrates Primary/secondary succession Life-form modelling of succession Climatology Disturbance and recovery

Climate Synopsis:

Storm-dominated maritime climate. Average annual temperature is 14.2°C. Monthly minimum and maximum temperatures are 3.2°C (January) and 25.0°C (July). Precipitation averages 105 cm/year.

Narrative:

The Virginia Coast Reserve (VCR) extends 100 km along the seaward margin of the Delmarva Peninsula. It encompasses 13 barrier islands (14,170 ha), broad intervening inlets, and extensive back-barrier islands, shallow bays, mud flats, and salt marshes. Tidal amplitude is 1.3 m. Hog Island and Hog Island Bay are the focal research sites within the VCR. The vegetation of the VCR is maritime in composition and appearance. This landscape has developed in association with Holocene sea-level rise. VCR studies cover a broad domain of scales of space and time:

1) Centenary to millennial scale changes in the landmass of the islands and marshes are recorded in the sediments (5,000 years B.P.). We are studying the interrelationships of secular climate change, sea-level rise, island formation and migration, and marsh accretion with data from sediment cores (± 100 year resolution).

2) Decadal to centenary scale changes in insular and marsh landforms and vegetation are recorded on historical maps and remote imagery. We are studying the interrelationships of storm events and landscape processes such as primary and secondary succession with data from historical records dating back to 1933.

3) Annual to decadal scale changes in the composition of the landscape, in the biota, and in the ecological and geological processes occurring on this landscape (i.e., productivity, decomposition, and sediment deposition/erosion) are determined by direct observations and experiments.

4) Monthly to annual scale variation in the measured rates of processes such as primary production are extrapolated to larger scales. Three coupled simulation models, including a biogeochemical process model, a succession model, and a landscape evolution model, are used both to guide and to synthesize studies of processes occurring on different scales of space and time.

Facilities:

Headquarters with three dorm rooms (capacity 12), equipped kitchen, library, computer (enhanced PC/AT), and wet-laboratory facilities (555 m²). Dry-laboratory and storage (450 m²), boats, and general field and laboratory equipment are available on-site. Associated, staffed facilities include the VCR Hog Island Station (Hog Island), the Old Dominion University (ODU) Barrier Island Research Station (Oyster), and the Virginia Institute of Marine Science/Eastern Shore Laboratory (Wachapreague). VIMS/ES has a sophisticated flow-through saltwater laboratory. Analytical laboratories, greenhouses, mainframe computers, and libraries are available at the University and, by prior arrangement, at ODU (Norfolk).

Addresses:

Coordinating Investigator: William E. Odum Department of Environmental Sciences University of Virginia Charlottesville, VA 22903 (804) 924-7761/924-0560 FAX: (804) 982-2137 wo@virginia.edu (Internet) Data Manager: John H. Porter Department of Environmental Sciences University of Virginia Charlottesville, VA 22903 (804) 924-7761/924-8999 FAX: (804) 982-2137 jhp7e@virginia.edu (Internet) Data Set Title: Long-Term Monitoring of Meteorology and Tides

Investigator(s): Luis M. Lagera, C. Randy Carlson, John H. Porter, William K. Nuttle

Temporal and Spatlal Resolution Initiation of study (mm/dd/yy): 04/15/89 Sampling frequency: hourly Number of sites: 2 Algorithms used to synthesize data (if applicable):

Abstract: Two LTER Level-3 weather stations at Brownsville and Hog Island have been in continuous operation since April 1989 (with some preliminary data for Brownsville for February - April). Data are collected each minute and recorded every hour. Parameters measured include temperature, humidity, wind speed, wind direction, precipitation, solar radiation, and photosynthetically active radiation. Tidal stations have been in operation with data collected on paper charts that are archived at the field laboratory. Equipment is being obtained to permit direct electronic logging of tidal information.

Data Set Code: VCR001

Site-Specific Code: WKN7S8904

Accessibility: digital

Proprietary Ilmits: distribution by permission of investigator

Data Set Title: Development of Soils on Barrier Island - Salt Marsh Boundaries

Investigator(s): Aaron L. Mills, Sonhail Al-abed, Linda K. Blum

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 05/15/89 Sampling frequency: variable Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: Soils were sampled at four sampling stations (two inland, two on the marsh) for the Hog island and Brownsville transects. Four pits were dug at each site and the soils were sampled at seven depths in each station. Three replications per sample were analyzed in the laboratory. From this procedure, baseline soil data and the distribution of different sulfur forms in the soils in various positions in the landscape can be determined. The sampling stations included soil catenas with upland well-drained soils, poorly drained soils with considerable distance from the marsh, and very poorly drained tidal marsh soils. On the island, organic matter was found to be concentrated in the concave of the dunes where the tree line starts. Soils on the barrier island are ranging from excessively well drained sandy soils (Udipsamment) with less than 0.5% total sulfur to very poorly drained sandy loam with more than 6.5% total sulfur (Sulfaquents).

Data Set Code: VCR002

Site-Specific Code: ALM7D8901

Accessibility: digital

Proprietary limits: distribution by permission of investigator

VCR003

Data Set Title: Characterization of Nutrient Pools on the Virginia Coast Reserve

Investigator(s): Jay C. Zieman, Richard T. Wetzel

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/12/89 Sampling frequency: variable/quarterly Number of sites: 20 Algorithms used to synthesize data (if applicable):

Abstract: This project characterizes 1) the bulk nutrients in the sediments, 2) the dissolved nutrients in the sediments, and 3) to some extent the water column, of VCR. Bulk sediment samples are collected by hand corer. Sediment nutrients are collected 1) by directly modified Chambers-Fourqurean lysimeters, and 2) by KCI extraction from cored samples. Sampling is done at 1) several areas on the mainland, principally in the Phillips Creek area, 2) mid-lagoon habitats, primarily on Middle Marsh Island, and 3) along several transects on Hog Island. On Hog Island, we established four primary marsh transects, two in the north and two in the south of the island. Ammonium, phosphate, carbon, salinity, and aeration are measured at stations located at fixed distances from marsh creeks.

Data Set Code: VCR003

Site-Specific Code: JCZ8801

Accessibility: digital

Proprietary limits: distribution by permission of investigator

VCR004

Data Set Title: Delmarva Peninsula Hurricane Records

Investigator(s): Bruce P. Hayden

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/1650 Sampling frequency: annual Number of sites: covers all of the east coast of Virginia, no sites per se Algorithms used to synthesize data (if applicable):

Abstract: This is an inventory of tropical storms on VCR from 1650 to the 1988. While tropical storms are infrequent (several landfalls per 100 years) the magnitude of the disturbance is great. Storm surges 10 feet plus are expected with waves of 17 to 23 feet offshore. The record being developed can serve as a benchmark when the next tropical storm comes. Comparisons of frequency and magnitude can be detailed and can be used in model studies. All of the major storms from 1620-1900 that impacted the Delmarva Peninsula have been identified and descriptive text located. Detailed meteorological records for tropical storms for the post-1900 period are available in-house.

Data Set Code: VCR004

Site-Specific Code: BPH8801

Accessibility: digital

Proprietary limits: distribution by permission of investigator

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Data Set Title: Marsh Grass Aboveground and Belowground Net Primary Production

Investigator(s): William E. Odum, Linda K. Blum, William K. Nuttle

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/??/88 Sampling frequency: monthly Number of sites: 4 (6 replicates) Algorithms used to synthesize data (if applicable):

Abstract: The purpose of this study is to compare (a) aboveground annual net primary production, (b) belowground annual net primary production, and (c) evapotranspiration of *Spartina alterniflora* along a transect across VCR. Permanent sampling sites were established during the first year on the mainland side near Brownsville, at a mid-bay island, and on the back side of Hog Island. Additional sites may be added in subsequent years. The objectives of the study are to compare primary production along gradients of differing geomorphological, hydrological, and geochemical conditions. Aboveground primary production of marsh cordgrass (*Spartina alterniflora*) has been established on a series of permanent plots. The methodology, developed by James T. Morris at the North Inlet LTER site, utilizes length-weight relationships of permanently marked plants. Sediment pore-water chemistry and hydrology are being monitored at the same sites.

Data Set Code: VCR005

Site-Specific Code: WO8802

Accessibility: digital

Proprietary limits: distribution by permission of investigator

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Data Set Title: Biogeography of Mammals on the Virginia Barrier Islands

Investigator(s): Raymond D. Dueser, John H. Porter

Temporal and Spatlal Resolution Initiation of study (mm/dd/yy): 07/01/75 Sampling frequency: variable Number of sites: 14 Algorithms used to synthesize data (if applicable):

Abstract: This project is designed to determine the relative influence of each of a suite of physical and biological attributes on the number and composition of mammal species found on an island. We recorded 4,064 nights of trapping on 14 surfaces (i.e., barrier islands, bayshore islands, and marsh islands) during 1988. These included nine previously sampled islands (Parramore, Revel, Hog, Cobb, Ship Shoal, Godwin, Mink, Myrtle, and Raccoon), and five islands where no trapping had been conducted previously (Crescent, Chimney Pole, Mockhorn, Skidmore, Rogue). We recorded 450 captures of 589 individuals, including 20 meadow voles, 201 house mice, and 368 rice rats. Meadow voles were captured on Parramore, Revel, Mockhorn, and Ship Shoal islands; house mice on Parramore, Hog, Myrtle and Raccoon islands; and rice rats on all islands except Godwin (which is a low marsh island). The results of the 1988+ trapping have been added to the cumulative (1975+) biogeographical data base.

Data Set Code: VCR006

Site-Specific Code: RDD6B8801

Accessibility: digital

Proprietary limits: distribution by permission of investigator

Data Set Title: Temporal and Spatial Distribution of Microbial Biomass, Growth, and Activity

Investigator(s): Aaron L. Mills, Linda K. Blum

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 07/01/88 Sampling frequency: monthly Number of sites: 10 Algorithms used to synthesize data (if applicable):

Abstract: Water quality monitoring at 10 permanent stations from the mainland salt marshes to Quinby Inlet was started in July 1988. These stations are sampled monthly for bacterial abundance, microbial activity (respiration and incorporation of acetate), dissolved organic carbon (DOC), particulate organic carbon (POC), pH, salinity, oxygen concentration, turbidity, temperature, and sediment characteristics.

Data Set Code: VCR007

Site-Specific Code: ALM7D8802

Accessibility: digital

Proprietary limits: distribution by permission of investigator

VCR008

Data Set Title: Aerial Photography Database for the Virginia Barrier Islands

Investigator(s): Robert D. Dolan

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 01/01/33 Sampling frequency: variable Number of sites: aerial photography not site specific Algorithms used to synthesize data (if applicable):

Abstract: Data is a listing of available aerial photography of the Virginia Coast Reserve. Information included is location of photography now (i.e., where it is held), agency filmed for, data, scale, type of film, project number, roll number, frames, and additional comments. The photography can be used to identify changes and historical trends taking place on the Virginia barrier islands.

Data Set Code: VCR008

Site-Specific Code: RD5Q8802

Accessibility: List: paper or digital. Photos: paper, film, some digital.

Proprietary limits: Distribution by permission of investigator

Data Set Title: Groundwater Budgets on Hog Island and at Brownsville

Investigator(s): Linda K. Blum, William E. Odum, George M. Hornberger, William K. Nuttle, Aaron L. Mills, Herman H. Shugart, Jay C. Zieman

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/01/89 Sampling frequency: weekly for selected periods Number of sites: 38 Algorithms used to synthesize data (if applicable):

Abstract: The objective of this project is to provide estimates of flow paths and rates of transport through the subsurface environment in upland areas at each end of the box transect from Hog Island to the mainland. This information is critical to understanding nutrient processes, plant zonation, and soil digenesis on Hog Island, and estimating the flux of nutrients between upland areas and the fringing marshes. Water levels are being measured weekly on all wells. Selected wells are monitored continuously by water level recorders. Some salinity data is also being collected at Brownsville and on Hog Island. Weekly water level measurements were collected from a transect of 21 wells at Brownsville. On the peninsula, 17 wells were drilled at a depth of approximately 15 feet below the surface, one at a depth of 158.75 feet, and one at 28.56 feet. Two wells (approximately 8 feet below the surface and penetrating the shallow aquifer) were hand-augured in the marsh on either side of the peninsula.

Data Set Code: VCR009

Site-Specific Code: WKN7S8901

Accessibility: digital

Proprietary limits: distribution by permission of investigator

Data Set Title: Small Mammal Population and Community Ecology

Investigator(s): Raymond D. Dueser, John H. Porter

Temporal and Spatial Resolution Initiation of study (mm/dd/yy): 06/21/88 Sampling frequency: variable Number of sites: 4 Algorithms used to synthesize data (if applicable):

Abstract: Live-trapping transects were established along four of the five permanent transects (1, 2, 4, and 5) on Hog Island. Traps are located every 12.5 m along the transect and alternately offset from the center of the transect (to minimize the effects of the path) by 4 m. This yields an inter-trap distance of 15 m. One Sherman live trap is placed at each station and baited with peanut butter. Species trapped are *Mus musculus* (house mouse), *Oryzomys palustris* (rice rat), and *Rattus norvegicus* (Norway rat).

Data Set Code: VCR010

Site-Specific Code: RDD6B8903

Accessibility: digital

Proprietary limits: distribution by permission of investigator

Indices

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CORE AREA INDEX

Core Area 1: Pattern and control of primary production

AND001	AND028	CDR008	CPR002	HFR005	KBS018	NIN002	NTL012	SEV005
AND007	ARC002	CDR010	CPR003	HFR006	KNZ001	NIN003	NTL014	SEV006
AND008	ARC003	CDR012	CPR005	JRN001	KNZ002	NIN004	NTL015	SEV007
AND011	ARC004	CDR013	CPR006	JRN002	KNZ003	NIN009	NWT001	SEV011
AND012	BNZ001	CDR014	CWT004	JRN007	KNZ012	NTL001	NWT006	SEV014
AND014	BNZ002	CDR015	CWT006	JRN008	KNZ013	NTL002	NWT007	SEV015
AND015	BNZ003	CDR016	CWT007	JRN009	KNZ014	NTL003	NWT009	VCR005
AND016	BNZ004	CDR017	HBR008	KBS001	LUQ001	NTL004	NWT010	VCR007
AND017	CDR001	CDR018	HBR012	KBS002	LUQ002	NTL005	NWT011	
AND022	CDR002	CDR019	HBR013	KBS003	LUQ003	NTL006	NWT012	
AND023	CDR003	CDR020	HBR014	KBS004	LUQ005	NTL007	NWT013	
AND024	CDR004	CDR024	HFR001	KBS005	LUQ012	NTL008	SEV001	
AND025	CDR005	CDR026	HFR002	KBS007	'LUQ014	NTL009	SEV002	
AND026	CDR006	CDR028	HFR003	KBS016	LUQ015	NTL010	SEV003	
AND027	CDR007	CPR001	HFR004	KBS017	NIN001	NTL011	SEV004	

Core Area 2: Spatial and temporal distribution of populations selected to represent trophic structure

AND001	AND026	CDR023	HFR001	KBS004	KNZ007	NIN008	NTL009	SEV001
AND007	AND027	CDR024	HFR002	KBS005	KNZ008	NIN009	NTL010	SEV002
AND008	ARC001	CDR025	HFR003	KBS006	KNZ009	NIN010	NTL014	SEV003
AND010	ARC002	CDR029	HFR005	KBS008	KNZ015	NIN011	NTL015	SEV004
AND011	ARC003	CPR001	HFR006	KBS009	LUQ003	NIN012	NWT001	SEV008
AND012	ARC004	CPR004	JRN001	KBS010	LUQ004	NIN013	NWT002	SEV009
AND015	BNZ001	CPR005	JRN002	KBS011	LUQ007	NIN014	NWT005	SEV010
AND016	BNZ002	CPR006	JRN007	KBS012	LUQ008	NTL001	NWT006	SEV011
AND017	CDR007	CPR007	JRN009	KNZ001	LUQ017	NTL003	NWT007	SEV013
AND022	CDR010	CPR008	JRN010	KNZ003	LUQ018	NTL005	NWT009	SEV015
AND023	CDR015	CPR009	JRN011	KNZ004	NIN001	NTL006	NWT010	VCR006
AND024	CDR021	CPR011	JRN012	KNZ005	NIN002	NTL007	NWT012	VCR007
AND025	CDR022	CWT005	KBS003	KNZ006	NIN007	NTL008	NWT013	VCR010

Core Area 3: Pattern and control of organic matter accumulation in surface layers and sediments

AND001	AND003	AND013	AND022	AND024	AND026	ARC003	ARC005	BNZ002
AND002	AND009	AND014	AND023	AND025	AND027	ARC004	BNZ001	BNZ005

Core Area 3: (continued)

BNZ006	CDR025	HBR010	KBS003	NIN001	NWT001	NWT011	SEV014	VCR009
BNZ007	CDR028	HFR001	KBS004	NIN002	NWT003	NWT012	SEV015	
CDR010	CPR003	HFR004	KBS011	N1N003	NWT004	SEV001	SEV016	
CDR014	CPR005	HFR006	KBS016	NIN005	NWT006	SEV002	VCR001	
CDR018	CPR006	JRN001	KNZ001	NTL001	NWT007	SEV003	VCR002	
CDR019	CPR007	JRN002	KNZ003	NTL002	NWT008	SEV004	VCR003	
CDR020	CPR010	JRN007	KNZ010	NTL003	NWT009	SEV005	VCR005	
CDR024	CWT006	JRN009	KNZ013	NTL004	NWT010	SEV012	VCR007	

Core Area 4: Pattern of inorganic inputs and movements of nutrients through soils, groundwater, and surface waters

AND004	AND025	CDR026	HBR001	JRN003	KBS014	NIN005	NWT003	SEV015
AND005	AND026	CDR027	HBR002	JRN004	KBS015	NIN006	NWT004	SEV016
AND006	AND027	CDR030	HBR006	JRN005	KBS016	NIN007	NWT006	VCR001
AND015	ARC003	CPR003	HBR007	JRN006	KNZ001	NTL001	NWT008	VCR002
AND018	ARC004	CPR005	HBR009	JRN007	KNZ002	NTL002	NWT011	VCR003
AND019	ARC005	CPR006	HBR011	JRN009	KNZ003	NTL011	NWT012	VCR007
AND020	BNZ001	CPR007	HFR001	KBS003	KNZ011	NTL012	SEV001	
AND021	BNZ004	CPR010	HFR004	KBS004	LUQ006	NTL013	SEV002	
AND022	BNZ005	CWT001	HFR006	KBS011	NIN001	NTL014	SEV003	
AND023	BNZ006	CWT002	JRN001	KBS012	NIN002	NTL015	SEV005	
AND024	BNZ007	CWT003	JRN002	KBS013	NIN003	NWT001	SEV012	

Core Area 5: Pattern and frequency of disturbance to the research site

AND005	ARC004	CPR006	HFR006	KBS006	KNZ006	NIN003	NWT001	SEV011
AND006	ARC005	CPR008	JRN001	KBS007	KNZ007	NÍN006	NWT002	SEV014
AND007	BNZ001	CWT001	JRN002	KBS008	KNZ008	NIN009	NWT003	SEV015
AND008	BNZ002	CWT002	JRN004	KBS009	KNZ009	NIN011	NWT004	SEV016
AND011	CDR002	CWT003	JRN005	KBS010	KNZ010	NIN012	NWT005	VCR001
AND015	CDR005	CWT004	JRN006	KBS011	KNZ011	NIN013	NWT006	VCR004
AND016	CDR008	CWT005	JRN007	KBS012	KNZ012	NTL001	NWT007	VCR006
AND017	CDR009	CWT006	JRN008	KBS013	KNZ014	NTL002	NWT008	VCR007
AND022	CDR011	CWT007	JRN009	KBS014	KNZ015	NTL003	NWT009	VCR008
AND023	CDR012	HBR003	JRN010	KBS015	LUQ009	NTL005	NWT010	VCR009
AND024	CDR017	HBR004	JRN011	KBS016	LUQ010	NTL006	NWT011	VCR010
AND025	CDR023	HBR005	JRN012	KBS017	LUQ011	NTL007	NWT012	
AND026	CDR024	HFR001	KBS001	KNZ001	LUQ012	NTL009	NWT013	
AND027	CDR026	HFR002	KBS002	KNZ002	LUQ013	NTL010	SEV001	
ARC001	CPR001	HFR003	KBS003	KNZ003	LUQ016	NTL013	SEV002	
ARC002	CPR004	HFR004	KBS004	KNZ004	NIN001	NTL014	SEV003	
ARC003	CPR005	HFR005	KBS005	KNZ005	NIN002	NTL015	SEV005	

SUBJECT INDEX

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acidic deposition (see deposition) acidic precipitation HBR011 NIN006 **NWT012** acoustics NTL010 aerial photography CDR029 NWT013 **VCR008** air temperature AND022 AND023 AND024 AND026 ARC003 BNZ001 CDR026 CPR005 CWT001 HBR003 HFR001 JRN001 KBS001 KBS002 KBS017 KNZ003 LUQ010 LUQ011 LUQ016 NIN001 NIN002 NTL001 NTL014 NWT001 SEV001 VCR001 alfalfa KBS007 algae NTL003 alkalinity ARC004 NWT011 aluminum HBR006 HBR007 NWT011 anions CDR027 CDR030 CWT002 CWT003 NIN006 NWT011 NWT012 SEV002 anoles LUQ017 LUQ018 aquatic plants NTL005 arthropods JRN011 KBS012 SEV010 atmospheric deposition (see deposition) avens NWT010

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barometric pressure ARC003 NIN001 NWT001
basal area LUQ002
basin surveys AND010
benthos NIN013 NIN014 NTL008
biodiversity KBS018
biogeochemistry HBR009 HBR011
biomass AND003 AND007 AND008 AND017 AND028 BNZ002 BNZ005 CPR011 CWT004 HBR008 HBR012 HBR013 HBR014 KBS003 KBS004 KBS011 KNZ010 KNZ012 (cont.) biomass (continued) NIN004 NIN007 NIN010 NIN013 NTL005 NWT005 biomass allocation CDR016 birds CPR011 JRN012 KNZ004 KNZ005 KNZ006 KNZ007 KNZ008 LUQ007 NIN011 NIN012 blowdown CDR009 HFR005 HFR006 breeding biology (also see reproduction) KNZ006 NIN012 burning (see fire)

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colonization VCR006

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NTL009 copepods NIN009 NIN014

- crayfish NTL007
- crop phenology KBS003
- crop rotation KBS003 KBS004 KBS005 KBS006 KBS007 KBS009 KBS011 KBS012 KBS013 KBS015
- crop yield KBS003 KBS004 KBS005 KBS016

D

debris torrent AND016 decomposition AND002 AND003 AND009 AND013 BNZ005 BNZ006 CPR002 HBR010 HFR004 HFR006 SEV012 SEV015 deer mice NWT005 dendrometer AND001 density (see population density) deposition, acidic HBR007 NWT011 deposition, atmospheric AND018 CDR027 JRN003 NWT012 deposition, dry CDR027 NWT012 SEV002 deposition, wet NWT012 SEV002 detritivores JRN010 detritus AND002 AND013 CWT005 disturbance AND004 AND008 AND011 AND016 AND020 AND021 BNZ002 CDR002 CDR005 CDR008 CDR009 CDR011 CDR017 CDR024 CDR029 CPR001 CPR003 CPR004 CPR008 CWT004 CWT005 HBR012 HBR013 HBR014 HFR005 HFR006 KBS004 KBS005 KBS006 KBS007 KBS009 KBS011 KBS012 KBS013 KBS015 KNZ010 KNZ014 KNZ015 LUQ005 LUQ008 LUQ014 NIN011 NIN012 NWT002 NWT011 NWT013 SEV014 VCR004

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 CDR006
 CDR007
 CDR010

 CDR015
 CDR022
 CDR023
 CDR024
 CPR001

 CPR009
 CPR010
 JRN008
 KBS008
 KNZ012

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 NWT005
 KNZ015
 NWT005
 KNZ016
 CDR026
 CPR005
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hurricane HFR005 HFR006 NIN003 NIN006 NIN011 NIN012 VCR004 hydrology AND005 AND027 JRN004 JRN005 KBS014 NTL011 NTL013 NWT003 NWT004 NWT006 NWT008

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K

karyotype SEV008 SEV009

L

lake ARC002 HBR011 NTL001 NTL002 NTL003 NTL007 NTL008 NTL011 NTL013 **NTL015** landscape topography CPR001 CPR003 larvae NIN008 NIN009 NIN013 leaf area AND014 AND028 legumes CDR020 KBS016 lek behavior KNZ008 light ARC003 ARC004 CDR008 CDR015 CDR016 NTL001 lightning SEV003 lignin BNZ004 limnology NTL001 NTL015 litter removal CDR008 litterfall AND014 CDR028 CWT006 KNZ010 KNZ013 littoral zone NTL007 NTL008 lizards JRN011 JRN012 LUQ017 (cont.)

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iogging AND005 AND006 AND007 AND008
AND011 AND020 AND021 CWT004 CWT005
CWT006 HBR012 HBR013 HBR014

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CDR001 CDR002 CDR003 CDR013 NIN003 NIN006 NTL002 NTL004 VCR003

0

old field CDR004 CDR005 CDR006 CDR007 CDR008 CDR010 CDR016 CDR021 organic matter AND004 AND009 CDR028 CPR010 JRN004 JRN005 KNZ010 VCR003 oxygen ARC004 NTL001 NTL012 VCR007

P

parasites SEV008 SEV009 SEV013
particulate matter NIN005 NTL004
phaeophytin NIN004
phenology AND017 CDR013 KBS003
 KNZ004 KNZ005 KNZ006 KNZ007 NWT006
 NWT007 NWT010 SEV011 SEV014
phosphorus AND019 AND020 AND021
 CDR003 CWT002 CWT003 HBR011 JRN003
 KBS003 KBS004 KNZ010 KNZ011 LUQ006
 NIN003 NIN006 NTL002 NTL004 SEV012
 VCR003
phytoplankton NIN004 NTL003
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