ILLINOIS NATURAL HISTORY SURVEY

1983 Progress Report

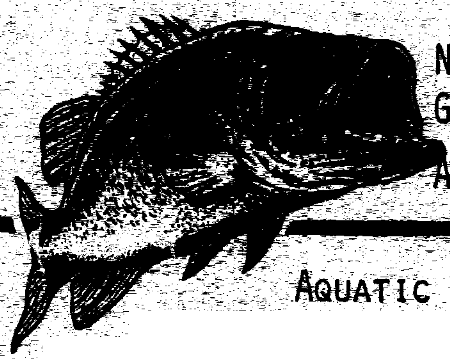
Ecological Structure and Function of Major Rivers in Illinois

"Large River LTER"

Aquatic Biology Section Technical Report

Richard E. Sparks, Project Director
Illinois Natural History Survey
River Research Laboratory
Havana, Illinois 62644

9 September 1983



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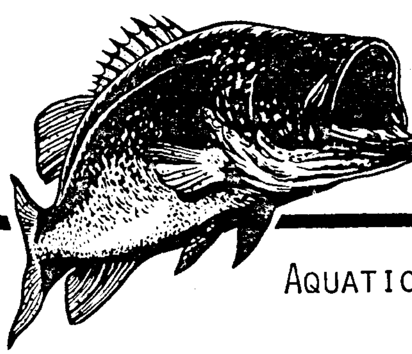

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Section 1: ACCOMPLISHMENTS

A. SCIENTIFIC ACCOMPLISHMENTS

Riverine Ecosystem Model

Our most important scientific achievement during the past year was the preliminary development of a model of carbon flow in our river ecosystem. The model is important because it properly emphasizes the lateral structure of our floodplain rivers and is based on the best available data and explanatory hypotheses we have been able to muster for the present. The model is a response to a suggestion from our External Advisory Committee and to our own sense that the precepts of the River Continuum Concept (Vannote et al., 1980) and the Discontinuum Concept of Ward and Stanford (1979) did not fit floodplain rivers very well. The model was developed at a workshop held 3 1/2 months ago, under the guidance of Dr. Richard Weigert, a member of our External Advisory Committee. The model is in a preliminary stage, but the major compartments and flows have been diagrammed and some of the descriptive equations written. We expect to write the computer algorithms this winter (1983-1984) and try computer runs with some of the compartments.

The lateral structure of our rivers consists of floodplain (55 to 70% of the total surface area within the boundaries of the floodplain, see Table below) and tailwaters, channel borders, side channels, and backwaters (including floodplain lakes and ponds).

Only 3 to 6% of the total area is occupied by the main channel, certainly a much smaller percentage than in a small stream or a river in a

Surface Area (hectares and %) of Compartments
Within Floodplain Boundaries at Mean Low Flow

	Main Chan	Chan Bord	Side Chan	Back Watr	Tail Watr	Total Water	Total Land
Miss. R.	3%	19%	<1%	8%		30%	70%
Pool 19	994	7327	36	3040	*	11,397	26,341
Miss. R.	5%	23%	1%	12%		41%	59%
Pool 26	839	3709	194	2020	*	6,762	9,678
Ill. R.	6%	19%	1%	18%	<1%	45%	55%
Peoria Pool	2138	6279	221	6097	29	14,764	18,224

Source: Gilbertson and Kelly, 1981.
* Tailwater not separated from main channel and channel border, but probably less than 1% of total water surface.

narrow V-shaped valley. Most of the surface area (27-37%) and volume of water in our system are in the channel border and backwaters. We identified the major compartments of the floodplain rivers in our original LTER proposal and in our 1982 Annual Progress Report. During our modeling workshop, we described the pattern of flows of water, sediment and nutrients between compartments (Figure 1). Dashed arrows in Figure 1 indicate flows which are intermittent. For example, when the discharge is high in the spring, water flows directly from the upstream channel borders either through or over the low navigation dams to the channel borders in the next pool downstream. During the summer low flow, most of the discharge is confined to the main channel. Although channel borders are contiguous to the main channel, physical, chemical and biological conditions are quite different from the main channel during low flow periods. Two major physical differences are current velocity and substrate type. The degree of isolation of the channel border during low flows is sometimes dramatic. For example, fluorescent dye injected in the main channel of Peoria Pool in

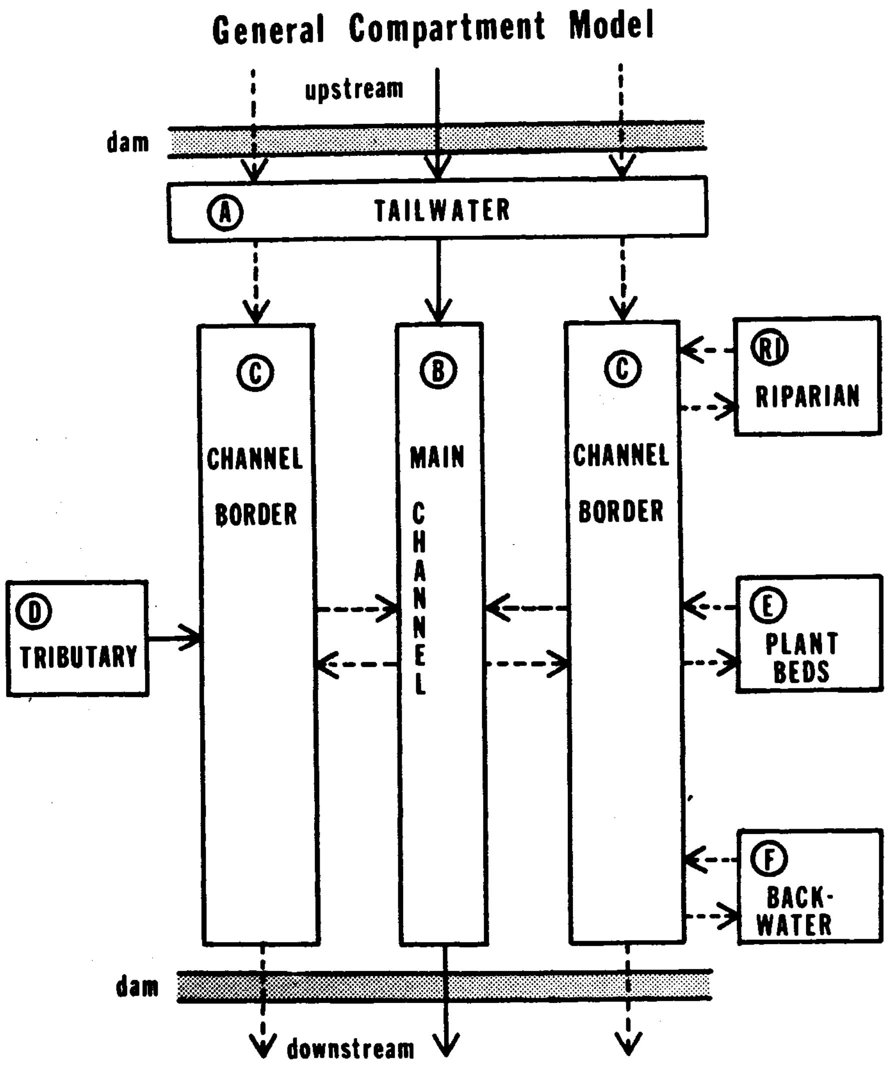


Figure 1. Compartments and flows within the river ecosystem.

July, 1979 showed virtually no lateral mixing as it traveled downstream through Peoria Lake (Personal communication, 8 September 1983, Donald Schnepper, Hydrologist, Water Quality Section, Illinois State Water Survey, Peoria, Illinois 61601).

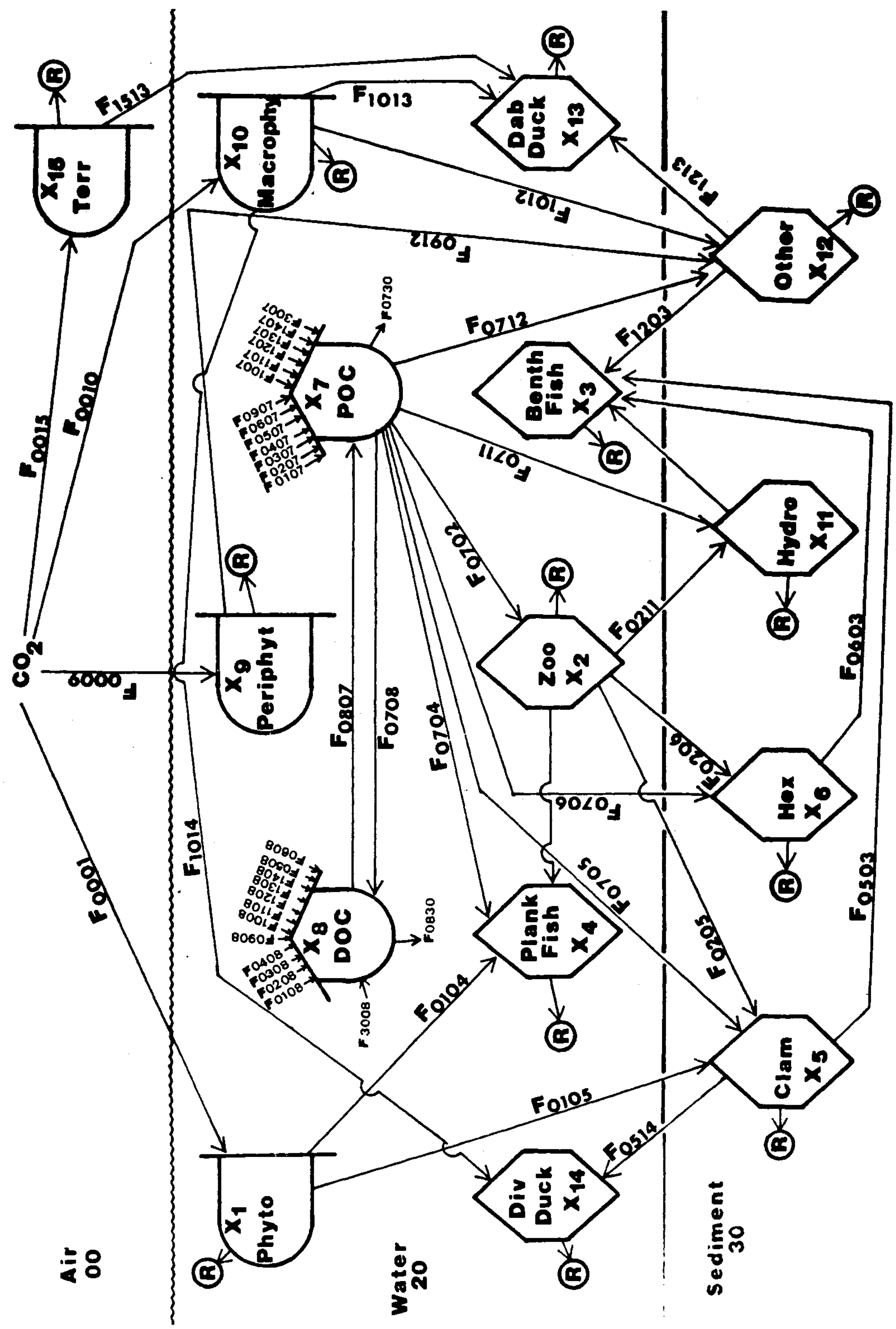
Submergent plant beds can develop within the channel border and create a distinct compartment (E in Figure 1) where turbidity and current velocity are low and a distinct invertebrate fauna develops and persists during plant senescence in the fall and floods in the spring.

Many of the compartments and intermittent flows shown in Figure 1 are controlled by factors directly or indirectly related to discharge, which simplifies the modeling. For example, development of the macrophyte compartment is indirectly controlled by discharge because light penetration is a function of water turbidity and depth, both of which are functions of discharge. As long as the timing and magnitude of discharge varies within certain limits, submerged macrophytes can develop and control physical conditions within the bed. The plants control turbidity by preventing the influx of sediment-laden water from the main channel and by damping wind-driven waves and anchoring the hydrosoil. Timing is obviously important -- submerged macrophytes develop during stable low flow periods in summer, but not in winter.

Once the flows into and out of a particular compartment are set for a particular time interval, dynamics within the compartment will be modeled according to Figure 2. Not every compartment will have all the components shown. It may be necessary to subdivide some compartments such as particulate organic carbon (POC) into bacteria and nonliving detritus, but our guiding principle is to increase the complexity of the model only to the degree necessary to explain production patterns in key organisms, such as

Figure 2 (opposite). Components and carbon flows within a compartment.

NOTE: Clam = fingernail clams
Benth fish = benthic (bottom-feeding) fish
Dab Duck = dabbling ducks
Div Duck = diving ducks
DOC = dissolved organic carbon
Hex = *Hexagenia*, genus of burrowing mayflies
Hydro = *Hydropsyche*, genus of net-spinning caddisflies
Macrophy = aquatic macrophytes
Periphyt = periphyton
Phyto = phytoplankton
Plank Fish = planktiverous fish
POC = particulate organic carbon, includes bacteria and non-living detritus
Terr = terrestrial compartment (mudflats, corn fields, floodplain forest)
Zoo = zooplankton


Air
00
Water
20
Sediment
30
CO2
X1 Phyto
X2 Zoo
X3 Benth Fish
X4 Plank Fish
X5 Clam
X6 Hex
X7 POC
X8 DOC
X9 Periphyt
X10 Macrophy
X11 Hydro
X12 Other
X13 Dab Duck
X14 Div Duck
X15 Terr
F0001
F0009
F0010
F0015
F1513
F1013
F1012
F0912
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Mayflies (Hexagenia bilineata and H. limbata) or patterns in key processes, such as photosynthesis and respiration.

Succession and Perturbation as Documented in the Sediments

We are examining sediments in our rivers and associated lakes and backwaters to: (1) determine effects of man on rate processes, such as sedimentation and carbon flux into sediments, (2) reconstruct the history of our sites, including both natural and man-induced events, and (3) characterize the existing physical and chemical nature of the bottom, which furnishes the habitat, and in some cases, the nutrient supply for the biota.

Since dating of sediments is necessary for purposes (1) and (2) above, considerable attention has been devoted this past year to two complementary dating techniques: cesium-137 and lead-210. Cesium-137 analysis has been completed for cores at six locations. Sedimentation rates are estimated by noting the first appearance of horizons associated with the testing of nuclear weapons. Rates measured range from 1 cm/yr in Lake Peoria to greater than 3 cm/yr near the dam at Pool 19. These rates agree with long-term average sedimentation rates based on presence of old soil horizons (before dams and diversions) and on the horizon in the Illinois River where fingernail clams disappear (1955).

Work has begun to use lead-210 in dating sediment in the study area. Radiochemical separation procedures have been developed and standardized with reference samples. Preliminary results indicate that the levels of unsupported Pb-210 in Milman Lake (Pool 19) are not significantly above Ra-226 supported Pb-210 levels. This is probably the result of soil being the major sediment source for the lake which dilutes any atmospherically derived Pb-210. Work is underway for other sites in Pool 26, Pool 19, and selected backwater lakes of the Illinois River.

Palynological studies to develop a 200- and 2000-year vegetation history of the sites were initiated ahead of the schedule in our original proposal, by Dr. James King, Head of Scientific Sections, Illinois State Museum. A very dry summer made it possible to use the Illinois State Geological Survey drilling equipment in a temporarily dry lake bed and a seven-meter core was obtained from the river flood plain at the junction of the Illinois and Mississippi Rivers in Pool 26.

The Illinois River has been greatly perturbed by man, particularly in the upstream reaches near Chicago and this upstream/downstream pattern is documented in the sediments. A progressive downstream attenuation in the concentration of some heavy metals has been found in the sediments of the backwater lakes of the Illinois River (Figure 3) and parallels the increase in density and diversity of benthic organisms. The contrast between the upper and lower Illinois River samples is striking for Cd, P, Pb, Sn, Zn, and other metals where concentrations vary by factors of ten or more. This upstream/downstream contrast is not as dramatic for most of the other elements. Note that the site of our intensive sampling in 1984, Peoria Lake, is in the middle of this river reach.

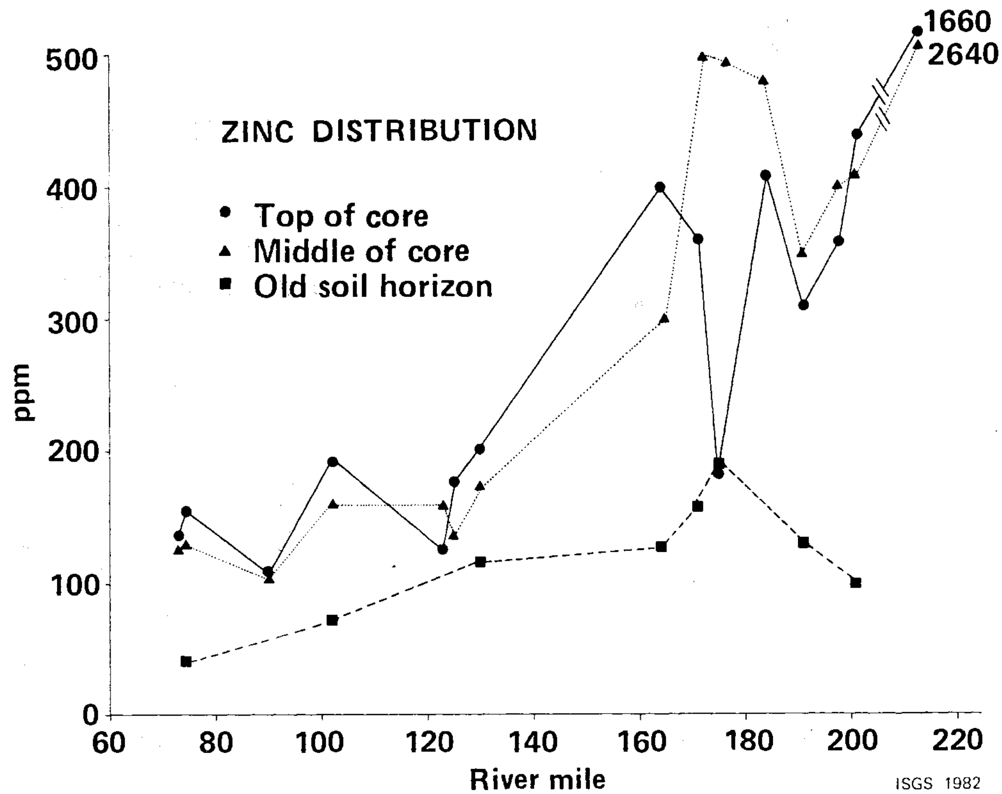

Figure 3. Concentration of zinc in sediments of backwater lakes associated with the Illinois River.

We extended the sampling upstream and downstream in 1983 by collecting sediment in Pool 26 just above the existing dam (downstream of Illinois River mile 0), in the lower Illinois River (miles 3 and 6), and in the upper Illinois River (miles 212, 216, and 287). We anticipate that the samples from mile 3 and 6 will provide nearly pristine, or baseline values. The preliminary results from mile 287 samples include Zn concentrations of 2600 ppm and Pb of 400-740 ppm which are the most highly polluted sediments yet found in lakes in Illinois.

In Pool 19, forty-four major and trace elements have been measured. Concentrations of most elements are uniform in each core and between sites within the pool, confirming the relatively pristine status of the site. We had predicted the lack of surface enrichment of anthropogenic elements (Cd, Pb, Zn) because of the rural nature of the site.

Two methods were employed in 1983 to speed up the characterization of the river bottom in our study sites: continuous recording of sampling position with a radar unit, and novel use of a gamma-ray sonde. This characterization is particularly important in the reach of the Mississippi between the old locks and dam 26 and the site of construction of the new locks and dam, 3.3 km downstream, because construction is already perturbing the area and we want to follow changes which are likely to occur rapidly when the dam is finally closed.

A Motorola Miniranger III radar navigation system was loaned to us by the Upper Mississippi River Basin Association and installed in the 8-m diesel powered research boat of the Illinois State Geological Survey. This instrument provides a printed paper tape listing the time of day and the distance in meters to two radar transponders placed at known shore locations. That record provides the locations for sediment samples and continuous bathymetric profiles. Most of Pool 26 is not accumulating fine grained sediment, and in fact significant erosion of sediment is occurring near the new construction.

A gamma-ray sonde, a device normally used down oil wells and other types of drill holes was adapted for use in traverses across the Mississippi River. The sonde, connected to the logging truck parked on shore, was towed by boat to the middle or far side of the river, dropped to the bottom and winched horizontally back to the truck, while natural-gamma radiation was recorded continuously. A marker buoy attached to the sonde provided a reference point for collection of grab samples, typically 5 to 25 samples per traverse. Counts per second of natural-gamma radiation in the river showed a high positive correlation with laboratory measurements of clay-size bottom sediment percentages.

In addition to physical characterizations of the bottom and sediments, we made some preliminary measurements of carbon in the sediments of the channel borders of Pool 19. We estimate the net loss of C to sediments to be on the order of 300 g m^{-2} per year. This value is tentative, because of analysis problems (see Section 2), but it indicates that trapping of organic matter in bottom sediments may be the dominant factor in the carbon budget of some of the river compartments we are modeling.

Effects of the 1973 Flood and 1976-77 Low Flow on Succession

Analysis of sediment cores is one approach to reconstructing the history of our sites -- another is to use historical data sets. We took a retrospective look at our data on benthic macroinvertebrates in a main channel border area of Pool 19 (Montrose Flats) to assess the affects of the record flood of 1973 and the record low flow of 1976-77. In addition, we measured the surface area occupied by beds of submergent and floating aquatic macrophytes and the area actually covered by leaves (coverage) on aerial photographs taken by the Soil Conservation Service, the U.S. Fish and Wildlife Service, and our own LTER program. The 1973 flood was the flood of record at St. Louis, although it was not the discharge of record. It now takes less flow in the upper Mississippi to produce a major flood because levees constrict the floodplain, and drainage systems in cities and agricultural areas speed runoff into tributaries. The drought in the upper Midwest in 1976-77 caused the record low flow. In the spring of 1977, the discharge did not even reach the mean for the period of record -- a remarkable divergence from the normal pattern of a May-June flood (Figure 4).

The normal pattern of succession in a main channel border is as follows: (1) The surface area and volume occupied by the main channel border are expanded initially by construction of navigation dams. (2) As fine, organically rich sediments accumulate in the main channel border, the bottom is colonized by mud-burrowing benthos, such as fingernail clams, Musculium transversum, and mayflies Hexagenia. (3) Sedimentation causes the bottom to rise into the euphotic zone and submerged aquatic macrophytes establish themselves. (4) Emergent macrophytes, such as lotus, Nelumbo lutea, and arrowhead, Sagittaria latifolia, become established as the bottom rises farther. (5) Eventually moist soil plants, including moisture-tolerant trees, such as willows, become established. Stage 3 is accompanied by changes in the macroinvertebrate fauna, from the burrowers to

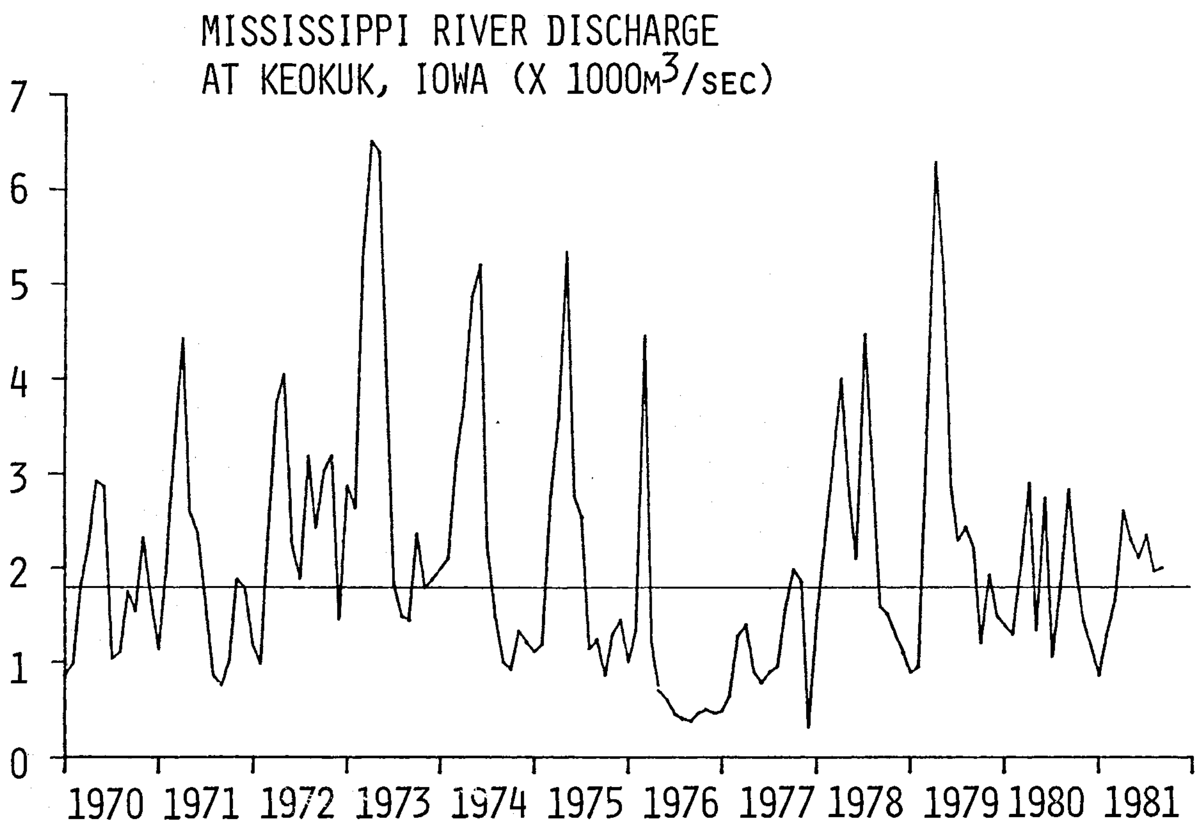

Figure 4. Mississippi River discharge. Horizontal line shows the average for the period of record, 1878-present.

species such as dragonfly and damselfly nymphs which use aquatic plants as a physical substrate, and snails, such as Helisoma trivolvis, which graze on periphyton attached to the leaves.

We knew that the submerged aquatic macrophytes normally grow to a depth of appoximately one meter in the main channel border and that the bottom was rising at the rate of 3 cm/yr, so we could predict that submerged aquatic plants would rapidly expand in the late 1980's or early 1990's. However, we also felt that a major flood could set succession back by scouring away sediments, plants and invertebrates.

The observed pattern offered some surprises. First, the flood of 1973 produced no measurable change in the total biomass and species composition of benthic macroinvertebrates (Figure 5). One species of fingernail clam, M. transversum, comprised 90% of the biomass both before and after the 1973 flood (Figure 5). The benthos evidently was not scoured away by the flood. Examination of sediment cores from the same areas may show whether there was any change in net annual sediment deposition during 1973. Although we have no information on the area occupied by plant beds immediately before and after 1973, it appears that the flood did not reduce the area or leaf coverage below 1963 levels (see Table below).

YEAR	AREA (ha)	COVERAGE (ha)
1963	107	41
1975	123	52
1977	375	150
1978	311	124
1982	362	183

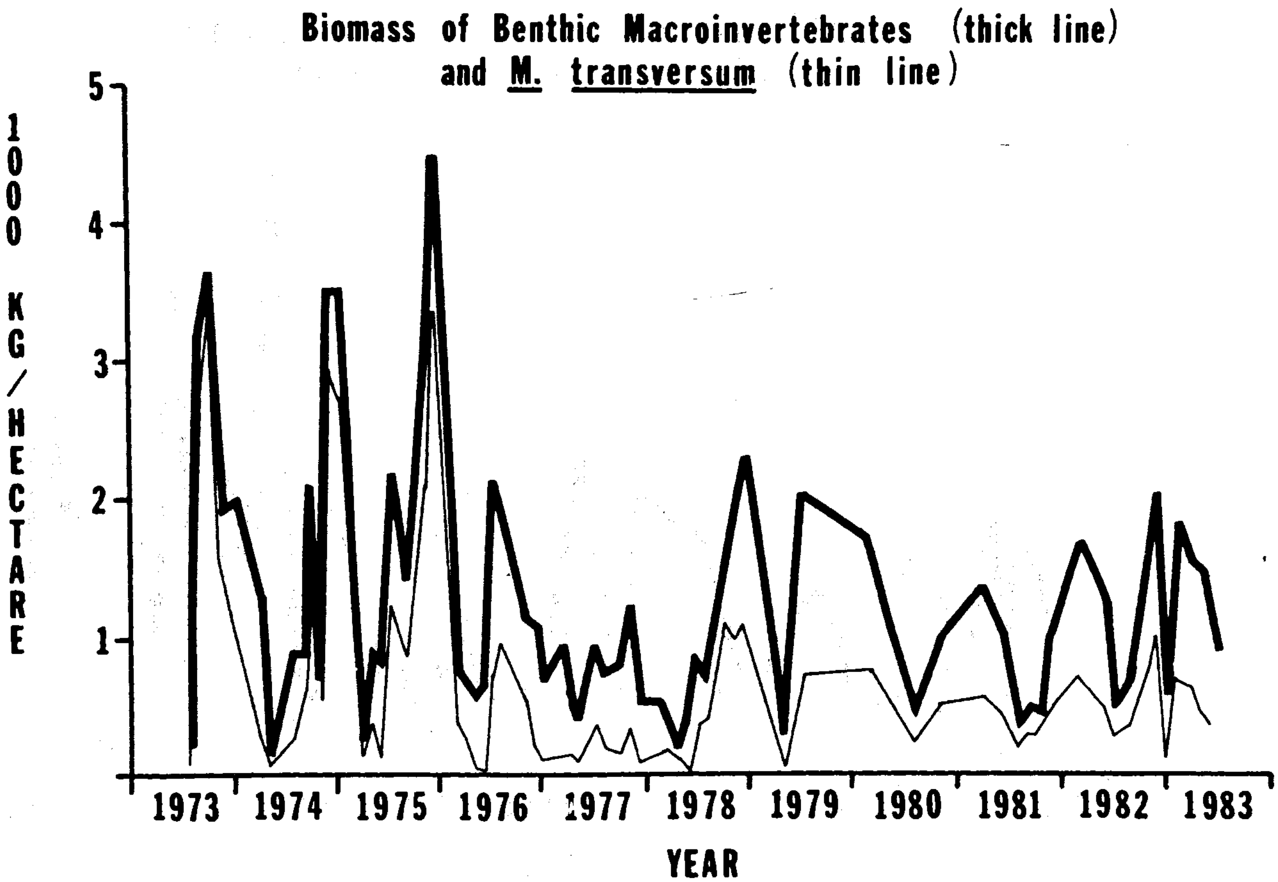

Figure 5. Biomass of the fingernail clam, *Musculium transversum*, and total biomass on Montrose Flats, Mississippi River.

In contrast to the 1973 flood, the low flow of 1976-77 had a marked effect on succession. The above table shows that the area occupied by macrophyte beds and covered by leaves tripled between 1975 and 1977, and the plants have persisted since that time, so that succession has been pushed forward.

The mechanism responsible for the initial increase in vegetation was the improvement in light penetration attributable to decreased soil erosion and sediment delivery to the Mississippi River. The Secchi disk readings listed below were taken in May, normally a time of increased turbidity associated with the spring flood.

Year	Depth at Which Disk was Visible
1975	21 cm
1976	40 cm
1977	80 cm

Seeds were evidently present in the sediments, or more likely, vegetative parts were washed into Montrose Flat by the normal flood in the spring of 1976. The plants presumably grew well in 1976 and got an unusually early start during the growing season of 1977 because of the absence of a spring flood and associated turbidity (Figure 4). The appearance of the plants at depths up to two meters in 1976-77 is not surprising, but it is remarkable that the plants have persisted on the Montrose Flats despite the return to normal flows and turbidity, beginning in the spring of 1978. Their persistence is probably explained by the fact that they rely on stored food reserves to grow upward into the euphotic zones. We found no sprouts from seeds in bottom samples from Montrose Flats taken this spring -- all new growth was from vegetative parts. For example, wild celery, Vallisneria americana, regrows from winter buds.

The low flow also triggered a dramatic decline in the population of fingernail clams probably because dilution of toxic materials was reduced (Figure 5). The persistence of the decline, however, is a direct result of the permanent change of a mud bottom with unimpeded current to a plant bed with little or no current. Waste discharges from sewage plants and industries along the Upper Mississippi River remained constant in 1976-77, while the Upper Mississippi essentially became a smaller river. In 1977 we happened to make a "baseline" survey of contaminants in sediments, plants, and invertebrates in Pool 19. When we realized that the flow was unusually low, we persuaded the sponsor, the U.S. Fish and Wildlife Service, to continue the study for one more year. In general, body burdens of heavy metals in fingernail clams were higher in the low flow year of 1977 than in the more typical year of 1978, and PCBs were much higher -- up to 1 ppm, a high level for such a short-lived organism. The growth of fingernail clams was reduced in 1976 and 1977, probably because of body burdens of contaminants. In 1976, the maximum individual shell length was only 8.3 mm, compared to 12.4 mm in 1974 and 1975. M. transversum begin to reproduce when they reach about 5 mm in shell length. In 1974 and 1975, the reproductive population numbered 5,000-6,000 clams m^{-2}. In 1976, the reproductive population was less than 1,000 m^{-2}.

From 1978 to the present, M. transversum has made up less than 50% of the total biomass, with another species, Sphaerium striatinum, certain snails, chironomid larvae, and leaches becoming more common.

The changes in macrobenthos and vegetation in Pool 19 were reflected in the feeding habits of the migratory waterfowl which used the pool in the spring and fall. Of particular interest is the shift exhibited by the canvasback duck, which began to use Pool 19 in increasing numbers from 1955 to 1966 when their traditional feeding and staging areas in the upper Midwest deteriorated for a variety of reasons (Serie, Trauger and Sharp, 1983). A principal component of the diet of canvasbacks, lesser scaup, and other diving ducks on Pool 19 had been the fingernail clam, M. transversum. In 1976 and 1977, however, the ducks shifted from fingernail clams to plant materials, such as the winter buds of wild celery. Wild celery was not present in Pool 19 until the 1976-77 drought, when it appeared suddenly in many areas throughout the pool, including Montrose Flats, where it has persisted.

In summary, the low flow of record in 1976-77 apparently pushed succession forward in our study area, while the record flood of 1973 did not produce a detectable effect. We are now extending our analysis of these two major events to historical data available for the rest of Pool 19 and to other pools, to determine whether the changes we observed in our study area also occurred over the entire Upper Mississippi River system.

Water and Sediment Budgets

Collection of historical data on water and suspended sediment fluxes is essentially complete. The water record is generally excellent with 30- to 100-year records. Suspended sediment data is much less complete, with 6 years being the longest record on tributaries. Mississippi River suspended sediment data has been collected by the Rock Island District, Corps of Engineers for only 12 years.

Suspended sediment sampling has continued on Pool 19 at the main river sites and six selected tributaries to determine what happens to sediment within the pool. These tributaries range in drainage area from 55 km^2 to 11,200 km^2. As sufficient data are obtained a functional relationship between sediment load and drainage area will be developed by regression analysis. This function will then be used to estimate the sediment load entering Pool 19 from the ungaged drainage area.

Preliminary sediment budget calculations demonstrate clearly the impact of sediment entering a pool from local tributaries. Pool 19 has a local drainage area of 13,900 km^2 which is 4.5% of the drainage area at Lock and Dam 19. Eighty percent of the local drainage area is in the Skunk River basin, 11.1% is in the Henderson Creek basin, and 8.9% is in smaller, ungaged tributaries. Water discharge is contributed in very similar proportions by each input system and is discharged at Lock and Dam 19. Sediment fluxes are much different. For 1976 through 1979 water years (October 1 through September 30), the Skunk River contributed 25.3% of the annual sediment influx of 13,222,000 metric tons to Pool 19. If only the main channel sampling stations at Burlington (below Lock and Dam 18) and at Keokuk are considered, the suspended sediment transport rates are similar and the net deposition is 157,000 metric tons per year. Adding in the tributary sediment loads increases the net deposition rate to 3,872,000 metric tons per year, so the pool is still rapidly accumulating sediment, despite the fact that the dam is relatively low (15m) and was closed 70 years ago.

In conjunction with intensive biological sampling on Montrose Flats (main channel border) at river mile 375, we conducted vane-float studies of water velocity in the vicinity of the sampling sites. In October, 1982 a reverse flow or large eddy existed on the flats. The same eddy is visible in aerial photographs taken on other dates when the eddy entrained turbid water from Devils Creek. The eddy may be driven by shears along the main channel and inflow from Devils Creek, and is a largescale retention device for water, sediment, nutrients and plankton. The presence of the eddy may explain the abundance of filter feeding mayflies and fingernail clams which have been recorded here since the 1960's. At low flow conditions, this eddy has a cycle time for water of 3 to 8 days. If the water and sediment from Devils Creek enter the eddy instead of mixing with the main flow, most of the sediment would settle out in this cycle time.

Another water velocity measurement in May, 1983 did not detect an eddy, so we are not sure how persistent this phenomenon is. The flow in May was in a downstream direction, but at speeds about one-half the main channel speeds. Two sets of suspended sediment samples were also taken to determine any variation in concentration across the flats into the main channel. We would like to determine whether largescale eddies are general features of the upper Mississippi River.

Preliminary evaporation calculations were made for Pool 19. On an annual average, evaporation removes about 145 cfs or 4.2 m^3/sec compared to the average flow at Keokuk of 62,640 cfs or 1775 m^3/sec. Monthly averages range from 0.45 m^3/sec in January to 8.5m^3 in July.

Invertebrate Community Structure Along Longitudinal and Lateral Gradients

The macroinvertebrate community in Pool 19 is dominated by insects in upstream reaches and by mollusks and crustaceans in downstream reaches of the main channel and adjacent borders. Similarities between communities in the same compartment were high, irrespective of upstream/downstream location within the pool. These results are consistent with hypotheses in our original proposal and with the compartment model (Figure 1). Important attributes of the compartments, which seem to influence community structure, are water depth, substrate, proximity to the channel, and presence or absence of submerged macrophytes. Meiofauna, primarily nematodes, show higher densities and diversity in submerged vegetation, with decreases both toward the channel and toward the shore. The density and diversity of zooplankton increase in the lower reaches of Pool 19, which is a more lacustrine type of habitat.

Two of the hypotheses in our original proposal were that the size of particulate organic matter (POM) would decrease downstream in a pool, as it was processed, and that zooplankton populations would increase. We postulated an increase in zooplankton because the travel time down the length of the pool and the less turbulent water in the downstream reaches would create favorable conditions for phytoplankton, on which the zooplankters feed. A secondary hypothesis is that the net sizes of the caddisfly, *Hydropsyche orris*, might change in response to food size or quality. In fact, there were no significant differences in sizes of head capsules and nets of caddisflies from upstream and downstream reaches. The longest dimension of POM decreased significantly and zooplankton populations increased significantly downstream (See table below).

The data in the table were obtained from samples taken in August, 1982, a low flow period with little organic matter input from tributaries. Under these conditions, it appears that the caddisflies could trap the POM available in the upper pool, but the POM in the lower pool was small enough to pass through their nets. Caddisflies in the lower pool presumably were feeding primarily on zooplankton, whose average size was 0.51 mm. We plan to measure the nutritional value (C/N ratio) of POM in the upper and lower reaches of the pool. It may be that H. orris cannot change the size of its net, or that it has no need to adjust net sizes because it can obtain nutritional foods at both ends of the pool, but from different sources.

Size of Caddisflies, Hydropsyche orris, and their nets, and size of available food items, in upstream and downstream reaches of Pool 19. Values in table are means, ±2SD in parentheses.

	Caddisflies (N=10)			Food Items	
	Head Capsule	Nets		Zooplankton	POM
Location	Length (mm)	Length (mm)	Width (mm)	Density no/l	Length (mm)
upstream	1.38 (0.22)	0.16 (0.01)	0.06 (0.01)	8 (2.6)	0.85 (0.27)
mid	1.31 (0.17)	0.16 (0.01)	0.07 (0.02)		
downstream	1.40 (0.21)	0.13 (0.03)	0.07 (0.01)	92 (21.4)	0.06 (0.07)

Aquatic Macrophytes

The goals of these studies are to determine the importance of aquatic macrophytes as primary producers and key structural elements in large river ecosystems and to understand how they control other populations or ecosystem functions. In June, we established plots in emergent beds, beds with floating or submerged plants, and in unvegetated habitats of Pool 19 in order to measure production and decomposition rates of selected species. In general, the emergent vegetation had the greatest production and longest residence time for organic matter. Mapping techniques are being used in Pool 19 to extend the turnover rates measured in plots to the entire pool.

Decomposition rates of Sago Pondweed, *Potamogeton pectinatus*, followed an exponential decay curve with a breakdown rate of 0.073 day^{-1} over a 68-day period. There was no significant difference in decomposition rate with depth.

Eighty plants of duck potato, *Sagittaria latifolia*, were transferred to experimental plots in a sheltered harbor on Pool 26 to measure the growth and decomposition of this abundant emergent. An additional twenty plants were identified, tagged and left in place to act as controls. Approximately a 70% turnover of plant material, as measured by old and new shoot counts, was indicated during the first 2 weeks of the study, even though the total gain in number of shoots was much lower. This indicates that production estimates for this species that have been based only on changes in weight during a period of time may have greatly underestimated actual gross production.

Population densities of lotus, *Nelumbo lutea*, and normally submerged tree stumps were recorded at Piasa Island, Pool 26. A unique opportunity to gather these data resulted from a dramatic water level decline when gates in Dam 26 were lifted in anticipation of high flows. All plants and stumps within approximately 200 5 x 5-m plots were counted. Maximum densities of *N. lutea* reached 18/m^{-1}. These results will be used in future comparisons of standing crop means and variances and to measure future changes in plant densities that result from environmental factors. The stumps will be used to determine rates of wood decomposition.

Fish

Fish communities in as many as five habitats on 7-8 transects in each of three navigation pools were sampled using electroshocking and seining techniques. Retrieval programs are now being written (see data management) to test hypotheses related to longitudinal and latitudinal gradients of fish diversity, abundance and species composition.

Larval fish were collected using plankton nets in Pool 19 to document temporal and spatial patterns and their importance in organic material flow in main channel and main channel border habitats. Larval fish made up very low percentages of the total organic material collected. As a result of this and the fact that many man hours were required to separate eggs and larvae from other organic material, these methods will be used in the future only to document spawning of fish in particular backwaters.

Temporal patterns of fish utilization of main channel border habitats were examined in Pool 26, Illinois River, using hoopnets. A major change in fish community structure occurred when river flows dropped at the onset of an extended drought. Typical riverine species, such as freshwater drum, were replaced in the catch by black crappies and other typical backwater species.

The common carp, *Cyprinus carpio*, was selected as a key fish species for an intensive ecological study for several reasons: (1) carp are a primary component of the commercial and sport fisheries of the rivers, (2) they represent a major pathway of organic material and energy flow through the river ecosystem, and (3) they are potential controllers of river vascular plants and benthic populations.

B. DATA MANAGEMENT

Intersite

The Large River LTER site hosted a workshop for LTER data managers at Champaign-Urbana, Illinois, 22-23 November 1982. Many informal good reviews were received about the workshop and the report. A follow-up workshop is planned for early November 1983 at Corvallis, Oregon. Two reports were prepared as a follow-up to the meeting. One 24-page report recommends procedures for two alternative levels of data management at each site. The minimal level should be achieved by all sites, while the optimal level consists of procedures which are desirable, but not required at all sites. Robert Sinclair and Kenneth Lubinski (both from the Large River LTER site) and Carl Bowser (Wisconsin Lakes site) summarized the findings of two work groups in the final report. The second report, co-authored by Robert Sinclair and Ken Lubinski, describes data management at the Large River LTER site and provides abstracts of 33 data sets.

Main Campus

As outlined in the original proposal, our paper documents are being microfilmed chronologically and by categories of data. Another archiving system has been established to maintain machine readable data on magnetic tape.

Computer software automatically determines the location of sampling sites marked on a topographic map. Sites are digitized along with two reference points. Software then computes the sampling site's location in the following coordinated systems: latitude-longitude, state plane, Lambert conformal, and legal (county, township, range, section, and x,y distance in feet from the southwest section corner). Topographic maps for Pool 19 and 26 on the Mississippi River have been digitized. Base map features (county, township, range, and sections) have been digitized along with the river boundary, backwater lakes, and islands.

Field Stations

Field station data entry protocols were established for Apple microcomputers at Western Illinois University and the the Survey Field Station at Grafton using a commercial data management package called "DataFactory 5.0". Standards were established for formatting, organizing and naming data files.

The first of a series of supplemental data bases, selected last year, was examined and described. Historical Illinois River electrofishing data have been verified and formatted for use during the next 3 years of LTER. This data set contains approximately 60,000 records and will enhance our analysis of recent data and our evaluation of long term trends and the effects of environmental factors. All 1982 electrofishing data were entered and verified in the data management system at Grafton. These data were then transferred over phone lines to the S.I.R. data management system at the University of Illinois CYBER computer for statistical analysis. A retrieval program to organize and summarize these data by collection was completed. Another retrieval to evaluate statistical differences in fish diversity, abundance, species richness and composition along transects and among habitats is being implemented.

C. ADMINISTRATIVE ACCOMPLISHMENTS

Paul Risser and Richard Sparks participated in a national technical briefing on long term ecological research held in Washington, D.C. 10 May, 1983. Richard Sparks spoke on "Responses to Disturbance", a common theme which cuts across all the LTER sites. Paul Risser concluded the presentations with a talk on present and future perspectives of LTER. The audience included administrators from NSF and from other federal agencies, such as NASA and USGS, which have an interest in long term ecological research. NSF and each LTER site have retained a complete slide set and accompanying text for the entire presentation. Intrasite and intersite activities which required administrative action during the past year are listed in the table below.

Date, Place	Participants	Intra Site	Inter Site	Purpose or Products
4-7 Oct 1982 Montrose, Nauvoo	River LTER PIs & staff	X		48-hr intensive sampling, Montrose Flats, Pool 19.
21-23 Nov 1982 Champaign-Urbana	Data Managers from LTER & non-LTER sites		X	Report of recommendations for data management at LTER sites. Updated site reports.
6 Dec 1982 Champaign-Urbana	River LTER Executive Committee	X		Allot remaining 1982 funds among research components. Consider special funding requests.
19 Jan 1983 Macomb	Lubinski, Sparks, Anderson	X		Data entry at field stations. Common formats.
9-11 Jan 1983 Las Cruces	Sparks, Gorden, Risser, other LTER PIs		X	Plan intersite collaborations, prepare for NSF technical briefing, and plan renewal of coordination grant.
27-28 Jan 1983 Champaign-Urbana	River LTER PIs and Executive Committee	X		PIs present 1982 results.
10 Feb 1983 Champaign-Urbana	River LTER PIs & Executive Committee	X		Plan 1983 sampling, based on 1982 results and recommendations of External Advisory Committee.
7-8 Mar 1983 Denver	LTER Steering Committee, Sparks		X	Practice NSF technical briefing. Approve intersite workshops. Develop coordination proposal.
16-18 Mar 1983 Keokuk	Sparks, Blodgett, Allgire, Adams, USGS	X		Joint sampling with USGS to compare results.
21 Mar 1983 Champaign-Urbana	Natural History Survey Committee on Statistical Needs. Sparks	X		Inform committee of River LTER needs for statistical analyses and computer programming and equipment.

Date, Place	Participants	Intra Site	Inter Site	Purpose or Products
6 April 1983 Champaign-Urbana	Anderson, Gorden, Sparks, Risser	X		Review sampling plan for biological components of River LTER.
19-20 April 1983 Depue, Joliet	Blodgett, Cahill, Gross	X		Joint INHS, IGS sampling of sediments in upper Illinois River.
22 April 1983 Macomb	Lubinski, Sparks, Anderson & staff	X		Plan aquatic plant research & establish a central lab for processing organic matter.
28-30 April 1983 Mountain Research Station, CO	Gross, King, Paleoecologists from LTER sites.		X	Workshop and report on disturbance regimes.
10 May 1983 Washington, D.C.	Risser, Sparks, other LTER PDs		X	National technical briefing on LTER. Slide set.
16-18 May 1983 Champaign-Urbana	River LTER PIs, Wiegert	X		Develop a carbon flow model for river ecosystem.
16-18 May 1983 Corvallis	Brown, LTER invert. ecologists		X	Standardize sampling and promote intersite research on litter-humus invertebrates.
18-20 May 1983 Corvallis	Brown, LTER forest ecologists		X	Discuss methods, exchange data, promote intersite research on wood decomposition.
23-26 May 1983 Montrose, Nauvoo	River LTER PIs, staff	X		48-hr intensive sampling, Montrose Flats, Pool 19.
11-13 July 1983 Manhattan	Adams, Sparks, Lubinski, LTER stream ecologists		X	Compare aquatic research sites & coordinate common measurements.

Date, Place	Participants	Intra Site	Inter Site	Purpose or Products
15 July 1983 Havana	Anderson, Sparks	X		Merging of NHS and WIU data sets on benthos for ESA paper. Map vegetation using SCS, USFWS, LTER data. Equations for model.
26 July 1983 Havana	Anderson, Sparks	X		Merging of WIU, NHS data.
31 July - 3 Aug. 1983 Keokuk	Anderson, Engman, Lubinski, Grubaugh, Henebry, staff	X		Joint sampling of Pool 19. First microbiological sampling.
15-16 Aug 1983 Keokuk	Grubaugh, Engman, Henebry	X		Joint sampling, Pool 19. Second microbiological sampling.
24 Aug 1983 Champaign-Urbana	River LTER Executive Committee	X		Prepare 1983 Progress Report and 1984 Budget.
15-16 Sept 1983 Manhattan	Gorden, LTER Steering Committee		X	Review intersite activities and provisions for network coordination in renewal proposals for sites.
20 Sept 1983 Springfield	PIs, Large River Executive Committee	X		Practice session for external review.
26-28 Sept 1983 Grafton	Large River PIs, External Advisory Committee	X		Present 1982-83 findings and 1984 plans to External Advisory Committee (EAC), which provides a written report.
TOTAL		19	9	

Section 2: SHORTFALLS

1983 seemed to be the year of equipment failure. The Motorola Miniranger III is used to locate sampling sites in virtually every phase of our LTER project. This year there were random part failures in three of the four major pieces of equipment which make up the ranging system. We were able to keep our sampling on schedule by renting units from Motorola, but at a cost of several thousand dollars. A large pontoon boat provided by Western Illinois University began to sink during one of our 48-hour periods of intensive sampling in Montrose Flats on Pool 19. The rivets and joints in the pontoons have worked loose from years of pounding in the waves, and the foam flotation has become water soaked. We will try to remove the old foam this winter, inject new foam, and weld or seal the rivet holes with silicone rubber. The Natural History Survey has a smaller pontoon boat with permanently mounted surface-supply diving equipment, so there is very little deck space available. We maintained our two sampling stations during the intensive sampling by using the Survey boat at one location and making frequent trips to the second sampling site from a shore station -- not an entirely satisfactory solution. We also were forced to cancel a 292-km trip from Pool 19 to Pool 26 for the purpose of sampling a mass of water as it moved downstream and determining whether our hypotheses about upstream/ downstream patterns in community structure and P/R would hold true in the seven pools we planned to sample. We will attempt the trip again next spring.

Merging and analysis of data sets has been impeded by lack of compatibility between equipment and software at the participating institutions. Each field laboratory and institution started the LTER project with whatever computer equipment they had available. This problem could be overcome if our request for a $50,000 equipment increment is granted. The equipment increment also would allow our field stations to take advantage of the Prime Computer and ArcInfo geographical based information system now being installed at the Natural History Survey in Champaign. A substantial portion of our LTER research involves measurement of processes in relatively small experimental areas and extension by area- or volume-weighting to larger reaches. ArcInfo is ideally suited for this sort of task, and our use of this system would save the expense and time required for adapting other software or developing our own programs.

The measurements of organic carbon content of bottom sediment from the rivers proved to be impractical using existing equipment at the Illinois State Geological Survey. That equipment was calibrated and largely dedicated to analyses of high carbon content (80-95%) coals. A new carbon analyzer has been ordered using 50% funding from 1982 LTER funds and 50% funding provided by the Illinois State Geological Survey. We are pleased at the strong continuing support provided to the LTER project by the Geological Survey. Delivery of the new instrument is scheduled for August 1983.

Sampling of particulate organic matter (>2 mm) continues to present problems. At two of our mainstem sampling stations, current velocities are >1 m/sec at the surface. We want to take point samples, because we believe that coarse particulate organic matter is not uniformly distributed vertically or horizontally in the river. Conventional plankton nets with depressors trail so far behind the boat that we have little confidence in calculating their position in the water column using the angle of the line and the length of cable reeled out. We constructed an alternative design, based on one used successfully by a member of our Advisory Committee, Dr. James Eckblad. The net collars are made of heavy steel and have adjustable fins. The first time we used this apparatus, the nets went directly to the bottom as planned, but they also bent the 3.75-cm diameter davit and pulled the transom of the boat under water. We believe this problem can be overcome by scaling down the net collars and using a larger boat. By observation we know that very coarse particulate matter, ranging from sticks up to large trees, also moves in the river during the spring flood. We are trying to estimate the quantity of material by treating power plant intakes and navigation dams as large scale sampling devices and converting man-hours spent by the companies or Corps of Engineers in removing materials from trash racks.

We overcame the problem of sampling sediment and nutrients near the navigation dams. Jet turbulence in the flow under the gates at Lock and Dam 18 had made anchoring and sampling difficult. We moved the sample cross section downstream below the jet flow, but we could no longer determine our sampling locations by visual alignment with the gates and lock guidewall. The Miniranger is now used to locate these stations. Below Lock and Dam 19 we now tie off to a bridge, which also serves as an accurate locater for our cross section.

The classic problem of hydrologic data collection on small streams is the capture of flood events which last only a few hours. We installed a pump sampler on Larry Creek, but the sampler needs to be returned this fall. We expect the problem of timing will be solved in the usual manner by sampling over an extended period. In addition, we are trying to anticipate storm events, based on weather forecasts. Instantaneous flow data is collected at many points on the Mississippi and Illinois Rivers, and flood events last for weeks instead of hours, so this is not a problem on the big rivers.

Section 3: PROJECT PLAN

In keeping with the plan in our original proposal, intensive sampling of plankton, benthos and fish will rotate to the Peoria Pool of the Illinois River in 1984. Pool 19 of the Mississippi was sampled intensively in 1982 and Pool 26, which includes portions of the Mississippi and Illinois Rivers, in 1983. A lower level of sampling (maintenance sampling) will continue on Pools 19 and 26 in 1984. Stations have been added so that each compartment (Figure 1) in the pools will be sampled.

Mapping of sediments and bottom topography in Pools 19 and 26 will be completed this winter and good information is already available for Peoria Pool, so emphasis of the geological component will shift to reconstruction of the history of perturbation through analysis of cores from sediment and old trees on the floodplain.

The research components on water, sediment and nutrient budgets and ecosystem function continued sampling in Pool 19 in 1983, for several reasons. First, it takes more than one year to develop water and sediment budgets, because of the problem of capturing high flows on tributaries. Two years of data on Pool 19 will enable us to determine whether the budget approach is feasible and should be continued. Under the original timetable, the second year of data on Pool 19 would not be available until the end of 1985.

The second reason for staying on Pool 19 is that several new research approaches were developed in response to the advice of our External Advisory Committee, and it seemed best to try them on a familiar site rather than take new approaches to a new site. An example of a new approach is the measurement of photosynthesis and respiration in light and dark bottles in the water column and benthic respiration in situ in chambers every 4 hours for 48 hours. Standing crops of plankton and benthos are also monitored. We decided to do the 48-hr studies in a channel border compartment in Pool 19, Montrose Flats, which we knew was highly productive in terms of benthos. Much less background information was available on Pool 26. The 48-hour intensive sampling is very expensive and requires a crew of 8-12 people to man two stations round the clock, so it is important to pick sites which are ecologically interesting, because of dense populations for example. The need to know something about community structure and substrate and water flow patterns, before committing ourselves to an intensive 48-hour study, is a good argument for purposely having these studies lag the studies on ecosystem structure and sediment. In 1984, 48-hour intensive sampling will be done on Pool 26, in a broad side channel at Piasa Island, at least once during the phytoplankton bloom in the spring and at least once again in the fall.

Two manipulative experiments will be completed in 1984, to provide information needed in our model (Figures 1 and 2). One experiment addresses the following questions: (1) What effect does aquatic vegetation have on the rate of deposition of coarse particulate organic matter? (2) Do mechanical factors play a role in the breakdown and deposition of organic matter? Three 100 m^2 plots have been established, one in each of the following areas: (1) non-vegetated, (2) a bed of submergents, and (3) a bed of emergents. Quadrats 1 m^2 are periodically harvested in each area and all standing living and dead vegetation measured. Regrowth in areas previously harvested will also be measured. Litter bags containing plant material will be placed in the plots, with some litter treated chemically to stop biologically mediated breakdown, in order to assess the role of mechanical breakdown. Sediment traps will measure the effect of vegetation on sedimentation.

The second manipulative experiment uses cages to exclude bottom-feeding fish and diving ducks from areas of the bottom where known populations of fingernail clams or Mayflies have been stocked. By comparing production in exlosures to production in unprotected areas, we will determine the effects of vertebrate predation.

Section 4: MOST SIGNIFICANT ACCOMPLISHMENTS AND FINDINGS

- Aerial photographs and vane-float studies have confirmed the presence of a large (.8 km diameter) back eddy in Pool 19 of the Mississippi River on at least two occasions this past year. The eddy may be driven by shears along the main channel and inflow from a tributary. Since it has a cycle time for water of 3 to 8 days, it acts as a largescale retention device for water, sediment, nutrients and plankton. The presence of the eddy may explain the abundance of filter feeding mayflies and fingernail clams which have been recorded in the same area since the 1960's. We plan to determine what conditions trigger the eddy, how long it persists and whether large eddies are general features of pooled reaches of the Upper Mississippi River.

- The record flood of 1973 on the Mississippi River had no detectable effect on benthic macroinvertebrates or aquatic vegetation in a pooled reach of the River for which we have good historical data. In contrast, the record low flow of 1976-77 pushed succession foreward, i.e., the coverage by submerged or floating aquatics tripled and the mud-bottom benthos was replaced by fauna typically inhabiting shallow plant beds. Wild celery, <u>Vallisneria</u>, appeared in Pool 19 of the Mississippi River for the first time during the low flow.

One short-term effect of reduced flow in 1976 was to improve light penetration because of reduced sediment delivery to the mainstrem Mississippi. Another short-term effect was reduced dilution of pollutants, thereby causing an increase in body burdens of contaminants in some macrobenthos and slowing their growth and reproduction.

The vegetation changes have persisted, despite the return to normal flows and turbidity starting in 1978, because once established, the aquatic plants are able to grow into the euphotic zone by utilizing stored food reserves. Despite reductions in body burdens of contaminants, the typical mud-burrowing benthic organisms are no longer able to thrive in the altered habitat conditions created by the plants.

Section 5: PUBLICATIONS AND PRODUCTS

A. LTER REPORTS

Sinclair, R.A. 1983. Long Term Ecological Research Data Management Workshop Held at Urbana--Champaign, Illinois, November 22-23, 1982, Illinois State Water Survey Misc. Pub. 72, 24pp.

Sinclair, R.A. and K.S. Lubinski. 1983. Long Term Ecological Research Illinois River and Upper Mississippi River (Large Rivers) Site report. Illinois State Water Survey Misc. Pub. 73, 65pp.

B. PUBLICATIONS

Anderson, R.V. and D. Day. (In preparation). Temporal and habitat variation in benthic macroinvertebrates of a navigation pool, Upper Mississippi River.

Anderson, R.V. and W.S. Vinikour. (With editor). Trichopteran associations with mollusks in shallow channel border areas of Pool 19, Mississippi River.

Lubinski, K.S. and M.J. Wallendorf. (In prepartion). The effects of recent water level regimes on carp and carp catches from the Illinois River.

Pillard, D.A. and R.V. Anderson. (In preparation). Zooplankton populations above and below Lock and Dam 19, Mississippi River.

Pillard, D.A. And R.V. Anderson. (In preparation). Temporal and habitat variation in zooplankton of Pool 19, Mississippi River.

Reese, M.C. and K.S. Lubinski. (In press). A survey and annotated check list of late summer aquatic and floodplain flora, middle and lower Pool 26, Mississippi and Illinois rivers. Castanea.

Swecker, S.J. and K.S. Lubinski. (In preparation). Decomposition rates of Sago Pondweed, *Potamogeton pectinatus*, in Navigation Pool 19, Mississippi River.

C. THESIS

Pillard, David A. 1983. An Examination of the zooplankton of Pool 19, Mississippi River, and the effects of filtering collectors. 136p., Master of Science, Western Illinois University. (Advisor, R.V. Anderson).

Section 6: OTHER SIGNIFICANT ACCOMPLISHMENTS

Several of our PIs presented results of their research on the Large River LTER sites at international and national meetings. The presentations are listed below:

Adams, J.R. and N.G. Bhowmik. Sediment transport in Pool 19. Mississippi American Society of Civil Engineers, Hydraulics Division Conference, Cambridge, Massachusetts, August 9-12, 1983.

Adams, J.R., M. Demissie and N.G. Bhowmik. Long term ecological research, Illinois river sites. American Geophysical Union, Baltimore, Maryland, May 30-June 3, 1983.

Allgire, R.L. and J.R. Adams. Observation of circulation patterns on Montrose Flats. American Geophysical Union Spring Meeting, Baltimore, Maryland, May 30-June 3, 1983.

Anderson, R.V. Response of net-spinning caddisfly larvae (Hydropsychidae) to change in size of potential food items. AIBS/ Ecological Society of America, Grand Forks, North Dakota, August 8-11, 1983.

Anderson, R.V. Nematode associations with aquatic macrophyte beds, Mississippi River. Society of Nematology, Ames, Iowa, June 27 - July 1, 1983.

Anderson, R.V. and D. Day. Longitudinal variation in benthic macro-invertebrate communities of a navigation pool, Upper Mississippi River. 31st Annual Meeting, North American Benthological Society, LaCrosse, Wisconsin, May 27-29, 1983.

Anderson, R.V. and W.S. Vinikour. Mollusk dispersion patterns in shallow channel border areas of Pool 19, Upper Mississippi River. 31st Annual Meeting, North American Benthological Society, LaCrosse, Wisconsin, May 27-29, 1983.

Cahill, R.A. and A.L. Devalle. Application of lead-210 and cesium-137 in dating recent sediments of backwater areas associated with the Illinois and Mississippi rivers. American Chemical Society, 186th National Meeting, Washington, D.C., August 31, 1983.

Gross, D.L. Differentiation of pre- and post-cultural sediments: examples from the lakes and rivers of Illinois. INQUA Commission on Genesis and Lithology of Quaternary Deposits, Barcelona, Spain, September 1, 1983.

Pillard, D.A. and R.V. Anderson. Effects of filtering collectors on zooplankton populations, Mississippi River. 31st Annual Meeting, North American Benthological Society, LaCrosse, Wisconsin, May 27-29, 1983.

Pillard, D.A. and R.V. Anderson. Temporal change in zooplankton populations in Pool 19, Upper Mississippi River. AIBS/Ecological Society of America, Grand Forks, North Dakota, August 8-11, 1983.

Reed, P.C., M.L. Sargent, and D.L. Gross. Use of natural-gamma logging for characterization of bottom sediment in the Mississippi River. Annual Meeting of the Geological Society of America, Indianapolis, Indiana, November 3, 1983.

Sparks, R.E. and R.V. Anderson. Effects of a short-term drought on long-term succession in a pooled reach of the Mississippi River. AIBS/Ecological Society of America, Grand Forks, North Dakota, August 8-11, 1983.

Section 7: LITERATURE CITED

Gilbertson, D.E. and T.J. Kelly. 1981. Summary resource description, Upper Mississippi River System, Volume 4, Biology. Upper Mississippi River Basin Commission. 102 pp.

Serie, J.R., D.L. Trauger, and D.E. Sharp. 1983. Migration and winter distributions of canvasbacks staging on the Upper Mississippi River. Journal of Wildlife Management. 47(3):741-753.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences. 37(1):130-137.

Ward, J.V. and J.A. Stanford, eds. 1979. The ecology of regulated streams. Plenum Press, New York. 385pp.

Appendix A: CHANGES IN PERSONNEL

A post-doc in microbial ecology, Dr. Michael Henebry has been added to the staff.

Appendix B: EXTERNAL ADVISORY COMMITTEE

Our External Advisory Committee met for the first time 28-30 June, 1982, four months after the start-up of our project in March. The purpose of the early meeting was for the EAC to advise us on our research approach, after hearing our plans and observing the site on Pool 19, Mississippi River. The second meeting will be on Pool 26 of the Mississippi River, at Grafton, Illinois, 26-28 September, 1983. The date of the second meeting was moved back so that the EAC could view the waterfowl migration and the standing plants in the marshes and backwaters. Since the EAC meeting occurs after this report has already been submitted, their report and our reponse will appear in our 1984 Progress Report. We propose to schedule the next meeting of our EAC for early spring of 1985, at our main offices on the campus of the University of Illinois in Champaign-Urbana. The postponement will allow our PIs to analyze their 1984 data for presentation to the EAC. Although there is little for the EAC to see at our field sites in February or March, we feel it is important for them to see our main laboratories and a demonstration of the computer system we use for our LTER data.

APPENDIX C: CURRENT AND PENDING SUPPORT

	A	B	C	D	E	F
	Supporting Agency	Project Title	Amount (x$1000)	Period Covered	Man-Months	Research Location
I. Principal Investigators						
R.V. Anderson						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/82-1/15/87	5	MI and IL Rivers
2. Duck Creek Survey	CILCO*	Biotic Survey of Duck Creek Reservoir	24	2/1/83-12/31/83	1	Duck Creek Res., IL
B. Proposals Pending						
1. Mosquito Habitat	NSF*	The role of larvicidal *Bacillus spaericus* in decomposition and community structure in simulated aquatic systems	82	6/1/84-6/1/86	1	WIU, IL

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
I. Principal Investigators						
R.V. Anderson						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/82- 1/15/87	5	MI and IL Rivers
2. Duck Creek Survey	CILCO*	Biotic Survey of Duck Creek Reservoir	24	2/1/83- 12/31/83	1	Duck Creek Res., IL
B. Proposals Pending						
1. Mosquito Habitat	NSF*	The role of larvicidal *Bacillus spaericus* in decomposition and community structure in simulated aquatic systems	82	6/1/84- 6/1/86	1	WIU, IL

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
N.G. Bhowmik						
A. Current Support						
1. LTER	NSF*	LTER on MI & IL Rivers	259/yr	1/15/82-1/14/87	2 yr	MI and IL Rivers
2. Highland-Silver Lake	USDA*	Watershed Erosion & Sedimentation	70/yr	1/82-10/85	1	Highland-Silverlake
3. Secondary Circulation	WRC*	Secondary Circulation of Natural Rivers	19.8	7/1/83-6/31/84	2	Kankakee and Vermilion River
4. Board Project	ENR*	Conceptual Model of Erosion & Sedimentation in Illinois	21	8/82-8/31/83	1	Champaign
5. Sediment Monitoring	ENR*	Statewide Sediment Monitoring Program	60	10/8/82-8/31/83	1	Streams in Illinois
6. Kankakee	ENR*	Hydraulics & Sediment Transport	14.5	10/4/82-8/31/83	1	Kankakee River
B. Proposals Pending						
1. Horseshoe Lake	IDOC/ USFWS*	Sedimentation Investigation, Horseshoe, Alexander	107	10/1/83-6/30/85	2	Horseshoe Lake-Alexander Co.
2. Sediment Analysis	ENR*	Suspended Sediment Data Analysis	62	9/83-9/84	1	Champaign
3. Sediment Analysis	COE-RID*	Suspended Sediment Transport. Miss. River & Ill. River Basin	34	9/83-12/84	1	Champaign

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
N.G. Bhowmik						
B. Proposals Pending, Continued						
4. Rivers & Infiltration	USBR*	Effects of Hydraulics on Streambed Infiltration Rates	99.3	9/15/83 9/14/85	4	Champaign

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
David L. Gross						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/83-1/14/84	2	Illinois
2. Model	ENR*	A Conceptual Model of Erosion & Sedimentation in Illinois	7	9/1/82-8/31/83	1.8	Illinois
3. LUMP	USOSM*	Lands Unsuitable for Mining Program	56	7/1/83-6/30/84	2.4	Illinois

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Coveredd	E Man-Months	F Research Location
K.S. Lubinski						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/82- 1/14/87	6	MI and IL Rivers
2. Thalweg Disposal	USCOE*	Winter Utilization of Main Channel Habitats by Fish	18/yr	1/12/82- 1/06/84	1	Pool 13, MI River-
B. Pending Support						
1. Carp Age	IDOC*	Age Structure of River Carp Populations	10/yr	1/10/83- 3/31/84	1	MI and IL Rivers

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
R.E. Sparks						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/82-1/14/87	7.4	MI and IL Rivers
2. Fleeting Areas	NMFS*	Effects of Barge Fleeting on Mussel Beds	20	10/1/82-9/30/84	1.0	Illinois River
B. Proposals Pending						
1. Fleeting Areas	USACOE*	Effects of Fleeting on Mussel Beds	25/yr	10/1/84-9/30/87	1.5	Illinois River
2. Facilities Support	NSF*	Expansion of Facilities for Visiting Scientists and New Staff at the River Research Laboratory	100	6/1/84-5/31/87	1.0	Havana, IL

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
II. Co-Investigators						
J.R. Adams						
A. Current Support						
1. LTER	NSF*	LTER on MI & IL Rivers	259/yr	1/15/82-1/14/87	2/yr	MI & IL Rivers
B. Pending Support						
1. Horseshoe Lake	IDOC/USFWS*	Sedimentation Investigation of Horseshoe Lake	107	10/1/83-6/30/85	3	Horseshoe Lake, Alexander Co.
2. Sediment Analysis	COE-RID*	Suspended Sediment Transport: Miss. R. Ill. River Basin	34	9/83-12/84	3	Champaign
3. Kankakee Dam	IDOC*	Field Verification of Discharge Capacity of Kankakee Dam	11.6	10/1/83-9/30/85	3	Champaign/Kankakee

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
M. Demissie						
A. Current Support						
1. LTER	NSF*	LTER on MI & IL Rivers	259/yr	1/15/82- 1/14/87	2.5/yr	MI & IL Rivers
2. Board Project	ENR*	Conceptual Model of Erosion & Sedimentation in Illinois	21	8/82- 8/31/83	3	Champaign
3. Hennepin Canal	IDOC*	Hydraulic & Hydrologic Analysis of the IL and MI Canal	25	6/11/83- 9/15/83	3	Champaign
4. Secondary Circulation	WRC*	Secondary Circulation of Natural Streams	19.8	7/1/83- 6/30/84	2	Kankakee R. & Vermilion R.
5. Kankakee River	ENR*	Hydraulics & Sediment Transport: Kankakee R.	14.5	10/4/82- 8/31/83	1	Kankakee R.
B. Pending						
1. Horseshoe Lake	IDOC/USFWS*	Sedimentation Investigation of Horseshoe Lake	107	9/83- 8/85	3	Horseshoe Lake, Alexander Co.
2. Sediment Analysis	ENR*	Suspended Sediment Data Analysis	62	9/83- 8/31/82	2	Champaign

CURRENT AND PENDING SUPPORT

	A Supporting Agency	B Project Title	C Amount (x$1000)	D Period Covered	E Man-Months	F Research Location
R.W. Gorden						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	1/15/82-1/14/87	1.5	Champaign, IL
2. Hybrid Carp	DOC/USFWS*	The Effects of Hybrid Carp on Aquatic Ecosystems	180/yr	4/1/80-3/31/84	1	Champaign, IL
3. Microcosms	IDENR*	Modeling of Economic & Ecological Systems	49	12/21/81-8/30/83	1	Champaign, IL

CURRENT AND PENDING SUPPORT

	A	B	C	D	E	F
	Supporting Agency	Project Title	Amount (x$1000)	Period Covered	Man-Months	Research Location
Mike Henebry						
A. Current Support						
1. LTER	NSF*	LTER on MI and IL Rivers	259/yr	7/1/83-6/30/84	4.5	IL & MI Rivers
2. Aquaculture-BARD	BARD*	Isotope Tracer Technique	50	7/1/83-6/30/84	4.5	Champaign/Kinmundy
3. Hybrid Carp	DOC/USFWS*	Effects of Hybrid Carp on Aquatic Ecosystems	180	7/1/83-6/30/84	3	Champaign

CURRENT AND PENDING SUPPORT

	A	B	C	D	E	F
	Supporting Agency	Project Title	Amount (x $1000)	Period Covered	Man-Months	Research Location
P.G. Risser						
A. Current Support						
1.	NSF *	Landscape Ecology Workshop	18.8	2/01/83- 1/31/84	0.5	Champaign, IL
2. LTER	NSF *	LTER on MI & IL Rivers	259/yr	1/15/82- 1/14/87	1.2	Champaign, IL
3.	IDENR *	A Conceptual Model of Erosion & Sedimentation in Illinois	7	7/01/82- 12/31/83	1.8	Illinois
4.	IDENR *	Effects of Conservation Tillage on Agriculture and Wildlife Values	80	5/01/82- 12/31/82	1	Illinois
5.	USOSM *	Lands Unsuitable for Mining Program	910 1.600	7/01/82- 6/30/82- 12/31/83	3	Illinois
B. Proposals Pending						
1.	IDOC*	Presettlement Vegetation	30	10/01/83- 9/30/84	1	Illinois

PGR:aa
9/9/83

*BARD - Binational Agricultural Research and Development. U.S.-Israel.
CILCO - Central Illinois Light Co.
COE-RID - Corps of Engineers-Rock Island District
CWE - Commonwealth Edison
DOE - Department of Energy
ENR - Illinois Department of Energy and Natural Resources
IBM - International Business Machines
IDOC - Illinois Department of Conservation
IDOT - Illinois Department of Transportation
IEPA - Illinois Environmental Protection Agency
INHS - Illinois Natural History Survey
NMFS - National Marine Fisheries Service
NSF - National Science Foundation
USACOE - U.S. Army Corps of Engineers
USBR - U.S. Bureau of Reclamation
USDA - U.S. Department of Agriculture
USFWS - U.S. Fish & Wildife Service
USNRC - U.S. National Research Council
USOSM - U.S. Office of Surface Mining
WRC - Water Resources Center

Appendix D: COLLABORATIVE RESEARCH AND LIASON ACTIVITIES

On 16-18 March, 1983, teams from the USGS, Natural History Survey, and Water Survey conducted a joint sampling exercise downstream from the Keokuk dam. The purpose of the exercise is to determine whether our data are comparable or could be correlated in such a way that we can reduce our sampling of nutrients, sediment and flow below the dam and increase our sampling efforts within the pool, where USGS does not sample.

On 17-18 November, 1982, Dr. J.R. Adams met with the following people to discuss sediment data collection and sediment budgets:

1. Dr. Tatsuaki Nakato of the Iowa Institute for Hydraulic Research at Iowa City, Iowa, who has modelled sediment budgets for the Mississippi River from Lock and Dam 22 to Lock and Dam 10. He will provide us with second-cut model results.

2. Mr. Wilbur Mathes, Jr., Iowa District, U.S. Geological Survey, Iowa City, Iowa, provided data for the Skunk River at Augusta and for the Mississippi River at Keokuk.

3. Mr. William Keelner and Mr. Marvin Martens, Rock Island District, U.S. Army Corps of Engineers, Rock Island, Illinois, will furnish 12 years of daily suspended sediment data on magnetic tape. Data were collected at Keokuk and Burlington, Iowa.

Dr. Sandra Brown, forest ecologist at the University of Illinois, represented the Large River LTER at the intersite meeting on litter/humous invertebrates and wood decomposition. She has submitted a proposal to the U.S. Department of Agriculture to do litter studies on forested floodplains at our sites. She is also collaborating with PIs from the Large River LTER on a proposal to study the fate of refractory material, including wood, in the floodplain and in aquatic areas on our sites.

JUSTIFICATION FOR $50,000 EQUIPMENT INCREMENT FOR THE LARGE RIVER LTER

Five institutions and eleven principal investigators joined the Large River LTER project with the understanding that they would pool their historical data on the Illinois and Mississippi Rivers and share new data they would collect. All of us in the Large River LTER recognize that causes of many phenomena can be traced by making associations between data sets. To take a simple example: the spring phytoplankton bloom in the large rivers is associated with the annual flood and a fresh influx of nutrients from tributaries and the floodplain. The bloom itself produces secondary changes, in the nutrient supply, in zooplankton populations, in survival of larval fish, etc. In just this simple example, we need to merge data sets on temperature, discharge, nutrient concentrations, and populations of algae, zooplankton, and larval fish. Many of our investigators and institutions also work on reaches and tributaries of our large rivers which LTER is not studying intensively. We intend to exchange information on different subsets of our river systems, so that we can make analyses which extend from headwaters to 9-10 order mainstem rivers. Beyond these two levels of exchange (within LTER site, LTER/non LTER), we have a national goal of comparison of data across the network of LTER sites.

While we have been making some progress towards these goals, our efforts have been hampered by differences in computer hardware and software at our three field stations and home institutions. In addition, we would like our LTER project to take advantage of a new Prime computer and a geographically based information system (ArcInfo) now being installed at the

Natural History Survey in Champaign. Our largest single equipment request is $30,000 for a Prime-compatible disk pack which will be dedicated to LTER data. A wide variety of other data sets will be available on the same computer system, including historic and updated locality records for fish, mollusks, aquatic insects and plants. Even more important is the software which will enable us to (1) measure habitat areas and volumes in the floodplain and aquatic areas of our ecosystems, and (2) extend measurements made on experimental plots to entire reaches or pools of the rivers by area- or volume-weighting.

In addition to purchasing the mass storage device, we propose to provide each of our three field stations with an Apple IIe, a letter quality printer, a relatively inexpensive plotter, and a processing board which is compatible with the IBM minicomputer used by our data manager at Champaign. In order to take full advantage of the geographic information system on the Prime, each field station should have an Amdek color terminal and a 1200 baud modem. If this equipment is purchased, LTER will have priority of use, whereas we now must wait to use equipment which is committed (and in some cases overcommitted) to a variety of other uses. The other items in the attached budget will enable our data manager to modify his microcomputer and terminal so that he can enter and manipulate data submitted on Apple disks and move data between Prime, the field stations, and the computer systems at the University of Illinois.

More details on the usefulness of the Prime computer and the ArcInfo system to LTER are given in the attached description prepared by Dr. Warren V. Brigham, who supervises the system.

The Illinois Natural History Survey, in cooperation with other Divisions of the Department of Energy and Natural Resources, has implemented a geographic information system to support its Lands Unsuitable for Mining Program. The heart of this system is ARC/INFO software running on a Prime 750 computer. ARC/INFO is a software system for managing geographic information. It is unique because it represents a cartographic system built around a relational database management system. This facilitates efficient handling of the two generic classes of spatial data: cartographic data describing the location and topology of point, line, and polygon features; and attribute data describing the characteristics of these features. Thus geographic analysis and modelling capability are combined with a complete interactive system for entry, management, and computer display of spatial data. Additional major software acquisitions include statistical (MINITABS), word processing (TEXT), bibliographic (ELS), graphics (IGL), and business graphics packages.

This hardware/software system represents a considerable resource, and, in addition to its support of the Lands Unsuitable for Mining Program, is expected to handle most of the data-processing needs of the Natural History Survey's research program. Beyond mere data processing, the ability to correlate data generated in a specific research project with other data in the system, such as the more than 80 statewide natural resource data sets compiled for the Lands Unsuitable for Mining Program, is expected to enhance greatly our interpretations of interactions which exist within natural systems.

The initial Prime computer configuration was "sized" for the data-processing needs of the Lands Unsuitable for Mining Program, including an allowance for expansion. The system since has been expanded in both number of ports and size of main memory. This expansion was done to encourage and facilitate other uses within the Survey. Data storage capacity has not been expanded as it was felt that the casual user could migrate files between tape and disk storage media. Such a solution, however, is not viable with a multi-user data set such as that being generated by the LTER program. There simply would not be enough disk space available to allow migration of more than a small portion (<5 megabytes) of the data set to disk at a time. In cases such as this, our systems analysists recommend acquisition of a disk drive unit by the research project which would then be installed on the Prime for use by that research project. Approximate prices are $950 for a port on the mainframe, $20,000 for a 300-megabyte drive, and $30,000 for a 675 megabyte drive. Annual maintenance costs typically run 10% of the acquisition cost. No charges for computer use or data storage are made against Survey research projects.

Budget
Large River LTER Equipment Increment

No. of Items	Description	Cost
1	675 megabyte disk pack for Prime computer	30,000
3	Apple IIe with 2 disk drives and CP/M board (or equivalent)	5,752
3	Amdek color terminal (or equivalent)	1,334
3	1200 baud modem	2,235
3	Letter quality printer, 132 column	4,484
3	Plotter (Apple or equivalent)	2,149
1	Plotter (compatible with IBM PC)	1,000
1	SYTEK data communications equipment	981
1	QUADRAM Quadlink CPU board	675
1	IBM color display	580
1	IBM PC disk drive	375
1	DataStar software by MicroPro	275
1	IBM PC 128k bytes of memory	160
	TOTAL	$50,000

CERTIFICATION FOR EQUIPMENT BEING REQUESTED

The University of Illinois and the Illinois Natural History Survey certify that this equipment is (a) essential and not readily available and accessible to the project, and if funded by NSF, will be subject to (b) reasonable inventory controls and maintenance procedures and (c) to organizational policies designed to enhance multiple or shared use on other projects if such other use will not interfere with the work on the project for which the equipment is being acquired.

[illegible]
ASSISTANT DIRECTOR OF
BUSINESS AFFAIRS

9/9/83
Date

Dr. Paul G. Risser
Chief, Illinois Natural
History Survey

9/9/83
Date

(SEE INSTRUCTIONS ON REVERSE BEFORE COMPLETING)

SUMMARY PROPOSAL BUDGET

Large River LTER
Summary Budget, 1984

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (MONTHS) Proposed	Granted
AWARD NO.		

ORGANIZATION: Board of Trustees, University of Illinois

PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR: Richard E. Sparks

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title; A.6. show number in brackets)	NSF FUNDED PERSON-MOS. CAL.	ACAD	SUMR	FUNDS REQUESTED BY PROPOSER	FUNDS GRANTED BY NSF (IF DIFFERENT)
1. R. E. Sparks, P.D.				$ 0	$
2. P. G. Risser				0	
3. R. W. Gorden				0	
4. J. R. Adams	2.0			4,800	
5. (7) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)					
6. (11) TOTAL SENIOR PERSONNEL (1-5)	2.0			4,800	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (1) POST DOCTORAL ASSOCIATES	4.0			6,000	
2. (8) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	69.5			76,523	
3. (1) GRADUATE STUDENTS				4,626	
4. (1) UNDERGRADUATE STUDENTS				1,050	
5. (3) SECRETARIAL-CLERICAL				11,464	
6. (1) OTHER				1,000	
TOTAL SALARIES AND WAGES (A+B)				105,463	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				7,622	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A+B+C)				113,085	
D. PERMANENT EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $1,000; ITEMS OVER $10,000 REQUIRE CERTIFICATION)					
TOTAL PERMANENT EQUIPMENT				500	
E. TRAVEL 1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				13,518	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $					
2. TRAVEL					
3. SUBSISTENCE					
4. OTHER					
TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				10,604	
2. PUBLICATION COSTS/PAGE CHARGES				1,303	
3. CONSULTANT SERVICES				965	
4. COMPUTER (ADPE) SERVICES				1,288	
5. SUBCONTRACTS				23,755	
6. OTHER				31,599	
TOTAL OTHER DIRECT COSTS				69,514	
H. TOTAL DIRECT COSTS (A THROUGH G)				196,617	
I. INDIRECT COSTS (SPECIFY) As specified on individual budgets					
TOTAL INDIRECT COSTS				56,976	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				253,593	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS GPM 252 AND 253)					
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$253,593	$

PI/PD TYPED NAME & SIGNATURE*	DATE	FOR NSF USE ONLY
Richard E. Sparks *Richard E. Sparks*	09/09/83	INDIRECT COST RATE VERIFICATION
INST. REP. TYPED NAME & SIGNATURE*	DATE	Date Checked / Date of Rate Sheet / Initials - DGC
J. J. Kanara *J. J. Kanara*	*9/9/83*	Program

BUDGET EXPLANATION

Long Term Ecological Research (LTER) on the Illinois and Mississippi Rivers

A. Senior personnel, man-mo.

1. R. E. Sparks, PD	7.40	0
2. P. G. Risser	1.20	0
3. R. W. Gorden	1.75	0
4. J. R. Adams	2.00	4,800
5. R. A. Sinclair	1.50	0
6. D. L. Gross	2.00	0
7. R. A. Cahill	3.00	0
8. J. King	2.00	0
9. W. M. Wendland	1.50	0
10. N. G. Bhowmik	2.00	0
11. M. Demissie	2.50	0
12. K. S. Lubinski	6.00	0
(12) Total Senior Personnel	32.85 man-mos.	4,800

B. Other personnel, man-mo.s

1. (1) postdoctoral	4.0	6,000
2. (1) programmer	5.0	8,000
(5) technicians	64.5	68,523
3. (1) graduate student	4.5	4,626
4. (1) undergraduate student	3.0	1,050
5. (3) secretarial	13.0	11,464
6. (1) keypuncher	2.0	1,000
(13) Total Other	96.0 man-mos.	100,663

C. Fringe benefits

0.356% of 28,340		101
3.256% of 20,250		659
12.065% of 56,873		6,862
	Subtotal	7,622

G. Other Direct Costs

5.	Subcontract with Western Illinois University (copy attached)	23,755
6.	Maintenance agreement for Lanier word processor	1,570
	Maintenance agreement and service on computers, lab equipment	5,384
	Analysis of 400 water samples by Natural History Survey Division Water Chemistry Lab @ $33/sample	13,200
	Utilities, Grafton Laboratory	1,820
	Utilities, Havana Laboratory	625
	Servicing of boats and equipment	2,000
	Vehicle operation by Water Survey	4,000
	Sediment analysis by Water Survey Laboratory	3,000
	Subtotal	31,599

I. Indirect Costs

27.2% of 107,654 (field stations)	29,282
42.0% of 63,922 (on campus)	26,847
18.3% of 4,626 (graduate student tuition remission)	847
Subtotal	56,976

Summary
PROPOSAL BUDGET

LONG TERM ECOLOGICAL RESEARCH (LTER) ON THE ILLINOIS AND MISSISSIPPI RIVERS

	Administration	Data Management	Component 1	Component 2	Component 3	Component 4	Line Totals
A. Senior personnel, (man-mo.)							
1. R. E. Sparks, PD	(4.00) 0				(0.40) 0	(3.00) 0	0
2. P. G. Risser	(0.20) 0				(0.50) 0	(0.50) 0	0
3. R. W. Gorden	(0.25) 0				(1.00) 0	(0.50) 0	0
4. J. R. Adams				(2.00) 4,800			4,800
5. R. A. Sinclair		(1.50) 0					0
6. D. L. Gross			(2.00) 0				0
7. R. A. Cahill			(3.00) 0				0
8. J. King			(2.00) 0				0
9. W. M. Wendland			(1.50) 0				0
10. N. G. Bhowmik				(2.00) 0			0
11. M. Demissie				(2.50) 0			0
12. K. S. Lubinski					(6.00) 0		0
13.							
14.							
15.							
Total Senior Personnel	0	0	0	4,800	0	0	4,800
B. Other personnel, (man-mo.)							
1. (1) Post doctoral	0	0	0	0	0	(4.00) 6,000	6,000 (4.00)
2. (7) Other prof.		(5.00) 8,000	(4.5) 6,250	(12.0) 14,000	(24) 22,153	(24) 26,120	76,523 (69.50)
3. (1) Graduate students			(4.5) 4,626				4,626 (4.50)
4. (1) Undergrad. students					(3.0) 1,050		1,050 (3.00)
5. (3) Secretarial	(12.0) 10,464		(1.0) 1,000				11,464 (13.00)
6. (1) Other		(2.00) 1,000					1,000 (2.00)
Total Salaries & Wages	10,464	9,000	11,786	14,000	23,203	32,120	100,663

	Administration	Management	Component 1	Component 2	Component 3	Component 4	Line Totals
A.+ B. Personnel	10,464	9,000	11,876	18,800	23,203	32,120	105,463
C. Fringe Benefits	37	1,086	341	1,035	2,677	2,446	7,622
D. Permanent equipment	0	0	0	500	0	0	500
E. Travel - domestic	5,918	1,100	1,500	2,000	1,000	2,000	13,518
- foreign	0	0	0	0	0	0	0
F. Participant support costs	0	0	0	0	0	0	0
G. Other direct costs							
1. Materials & supplies	3,347	500	1,673	1,327	1,050	2,707	10,604
2. Publication, pg. charge	0	300	0	500	303	200	1,303
3. Consultant services	965	0	0	0	0	0	965
4. Computer services	0	588	0	500	0	200	1,288
5. Subcontracts	0	0	0	0	23,755	0	23,755
6. Other	2,195	1,100	4,284	7,000	2,820	14,200	31,599
Total other direct costs	6,507	2,488	5,957	9,327	27,928	17,307	69,514
H. Total direct costs (A - G)	22,926	13,674	19,674	31,662	54,808	53,873	196,617
I. Indirect costs	6,236	5,496	9,110	13,088	8,447	14,599	56,976
J. Total direct & indirect costs	29,162	19,170	28,784	44,750	63,255	68,472	253,593
K. Residual funds	0	0	0	0	0	0	0
L. Amount of this request	29,162	19,170	28,784	44,750	63,255	68,472	253,593

NSF - LTER - Subcontract WIU, P.I. R. V. Anderson 1984

(SEE INSTRUCTIONS ON REVERSE BEFORE COMPLETING) Component #3

SUMMARY PROPOSAL BUDGET

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (MONTHS) Proposed	Granted
AWARD NO.		

ORGANIZATION Illinois Natural History Survey - U. of Ill. Subcontract to Western Illinois University

PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR P.D. Richard E. Sparks
Co-P.I. Component #3 - Richard V. Anderson

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title; A.6. show number in brackets)	NSF FUNDED PERSON-MOS. CAL.	ACAD	SUMR	FUNDS REQUESTED BY PROPOSER	FUNDS GRANTED BY NSF (IF DIFFERENT)
1. Richard V. Anderson $2,215/month			2	$ 4,430	$
2.					
3.					
4.					
5. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)					
6. (1) TOTAL SENIOR PERSONNEL (1-5)				4,430	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( ) POST DOCTORAL ASSOCIATES					
2. (1) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.) $750/month	12			9,000	
3. ( ) GRADUATE STUDENTS					
4. ( ) UNDERGRADUATE STUDENTS					
5. ( ) SECRETARIAL-CLERICAL					
6. ( ) OTHER					
TOTAL SALARIES AND WAGES (A+B)				13,430	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				1,366	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A+B+C)				14,796	
D. PERMANENT EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $1,000; ITEMS OVER $10,000 REQUIRE CERTIFICATION)					
TOTAL PERMANENT EQUIPMENT					
E. TRAVEL 1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				1,800	
2. FOREIGN					
F. PARTICIPANT SUPPORT COSTS 1. STIPENDS $ 2. TRAVEL 3. SUBSISTENCE 4. OTHER					
TOTAL PARTICIPANT COSTS					
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				600	
2. PUBLICATION COSTS/PAGE CHARGES				140	
3. CONSULTANT SERVICES					
4. COMPUTER (ADPE) SERVICES					
5. SUBCONTRACTS					
6. OTHER					
TOTAL OTHER DIRECT COSTS				740	
H. TOTAL DIRECT COSTS (A THROUGH G)				17,336	
I. INDIRECT COSTS (SPECIFY) 47.8% X Salaries & Wages ($13,430) DHHS Negotiated Rate, Eff. July 1, 1983					
TOTAL INDIRECT COSTS				6,420	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				23,756	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS GPM 252 AND 253)					
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 23,756	$

PI/PD TYPED NAME & SIGNATURE	DATE	FOR NSF USE ONLY		
Richard V. Anderson, P.I. *Richard V. Anderson*	8/29/83	INDIRECT COST RATE VERIFICATION		
INST. REP. TYPED NAME & SIGNATURE	DATE	Date Checked	Date of Rate Sheet	Initials - DGC
Myron P. Mustaine, Director of Research *M Mustaine*	8/29/83			Program

Western Illinois University, (subcontractor) Component 3 -- 1984

BUDGET JUSTIFICATION 1984

A.	Senior Personnel	
	Richard V. Anderson Budget year 1984-85, 2 months (summer) X $2215 X 100%	$ 4430
B.	Other Personnel	
	Technician $750/month X 12 months	9000
	Total Salaeies and Wages	13430
C.	Fringe Benefits	
	Richard V. Anderson, Retirement - 8.615% X $4430	382
	Technician, Insurance - $82/month X 12	984
	Total Salaries, Wages, and Fringe Benefits	14796
D.	Permanent Equipment	______
E.	Travel	1800
F.	Participant Support Costs	______
G.	Other Direct Costs	
	Material and Supplies	600
	Publication Costs / Page Charges	140
H.	Total Direct Costs	17336
I.	Indirect Cost	
	WIU - 47.8% of salaries and wages only X $13430	6420
J.	Total Direct and Indirect Costs	23756
K.	Residual Funds	______
L.	Amount of Request	$ 23756

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