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of public review and input, media outreach, development and maintenance of web-based tools, and creation of various other public information tools. Specific activities in the plan include development of a new EMP brochure, an increased emphasis on public information at HREP sites, a renewed commitment to public involvement in project planning as part of the revised HREP planning process, and continuation of many of the activities described above. While implementation of the 2001 public involvement plan has been slowed somewhat by the EMP's fiscal constraints, activities in each of the major task areas are ongoing.

Long Term Resource Monitoring

The Long Term Resource Monitoring Program (LTRMP) combines environmental monitoring, research, and modeling in an effort to provide a solid scientific foundation upon which to base management actions and environmental policy on the Upper Mississippi River System. Data gathering, analysis, and dissemination are all key elements of the LTRMP. The 1997 Report to Congress presented a comprehensive overview of the program's functions and products, and highlighted the results of an LTRMP report on the ecological status and trends of the UMRS. The LTRMP's basic structure remains largely unchanged, and therefore the earlier information will not be repeated here. Instead, this section will describe the LTRMP's accomplishments since the 1997 report, with a focus on particular scientific insights that have been gained, tools that have been developed, and the management applications of those accomplishments. It will also highlight recent trend analysis findings. In addition, evaluations and revisions of the monitoring design to improve LTRMP efficiencies will be discussed.

Long Term Resource Monitoring Program Accomplishments

ADDITIONS TO THE LTRMP DATABASE

Between 1998 and 2002, over 80,000 additions were made to the LTRMP database for the four main field monitoring components—i.e., fish, water quality, macroinvertebrates, and aquatic vegetation (Table 2-3). This is a nearly 60 percent increase in the LTRMP database in only five years of the program's 15 years of data collection. These data have been used in a variety of applications including ecological trend analysis, nutrient loading and hypoxia investigations, exotic species tracking, and many natural resource management and restoration applications. For each of the four LTRMP monitoring components, a 10-year synthesis will be completed in 2004.

Table 2-3. Number of LTRMP data collection records generated over time by each monitoring component.

	Number of Site Collection Records	
Monitoring Component	**1998-2002**	**1987-2002**
Water Quality	26,000	76,000
Fish	14,500	36,000
Macroinvertebrates	3,400	7,500
Aquatic Vegetation	37,500	86,900

To improve the speed and cost effectiveness of data management and reporting, automated data management was recently incorporated into field and laboratory operations. LTRMP staff developed software that allows data to be entered directly into a computer in the field and performs immediate error checking, which greatly reduces data input errors. Field data entry has reduced program costs by eliminating the need for a data entry contractor. Moreover, computerized error checking greatly reduces the staff time needed for quality control on data. In all, it is estimated that these field and laboratory innovations have resulted in a 50 percent reduction in the amount of time required to make new data available to scientists, managers, and the public via the World Wide Web.

Systemic land cover and land use geographic information system (GIS) coverages of the UMRS have been completed for 1975 and 1989, and are about 80 percent complete for aerial photography taken in 2000. Land cover maps from the pre-dam era (1890s) are available for the entire Upper Mississippi River (Figure 2-9), and many locations have presettlement maps (c. 1810s) that help evaluate the natural potential for Upper Mississippi River landscapes. These various geospatial data are being used for long-term trend analyses; detecting change in specific locations; and modeling to assess the effects of droughts, floods, and habitat rehabilitation projects. These maps also form the basis of a variety of GIS-based decision support systems developed for Federal and State resource managers.

Progress has continued in completing a systemic bathymetric (i.e., water depth) database for the UMRS. Recent work has focused on data gaps in the middle and lower river reaches. Presently, the database is complete for about 57 percent of the system. These data on river depths are critical for hydrologic and environmental modeling, designing and planning restoration projects, and predicting and communicating the effects of water level management projects.

Access to LTRMP data is essential and has been a major focus of the program over the last five years. Several new LTRMP web pages have been developed, and systemic bathymetric and land cover data are now available online. In addition to the LTRMP partner agencies, a wide range of other commercial, educational, governmental, and non-governmental organizations also rely on LTRMP data, methods, and reports. People in over 65 countries also access LTRMP data and expertise on large river monitoring and science via the World Wide Web, thereby enabling the program to distribute lessons learned on the UMRS to the world.

MONITORING, RESEARCH, AND MODELING RESULTS

LTRMP monitoring, research, and modeling activities are intended to help answer specific management questions about causal relationships among various factors and threats to UMRS ecological conditions. Monitoring activities are used to detect trends, changes in the system, and unusual occurrences. Applied research is designed to test specific hypotheses about different aspects of the system's functioning. Modeling allows scientists and managers to explore how the system might react to various sorts of changes. All three activities are used in combination to understand the UMRS ecosystem. Examples of program findings in each of these areas are presented below.

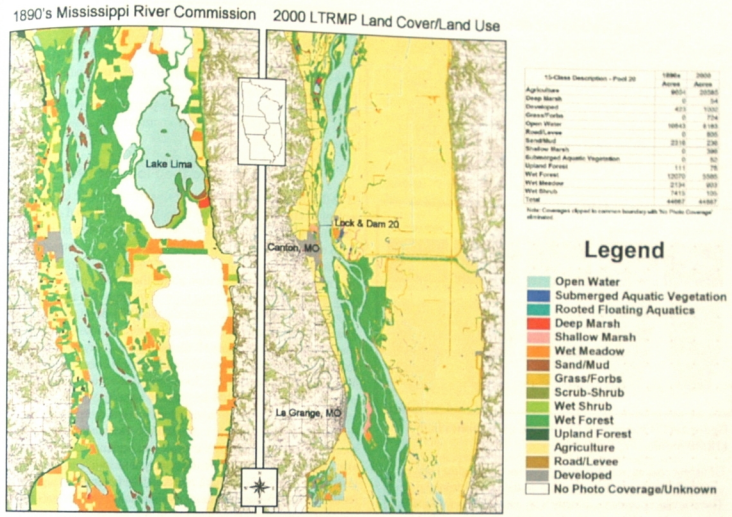

Figure 2-9. Comparison of land cover near Lock and Dam 20 from the 1890s and 2000. The river channel has retained many of its major features, but the floodplain has changed dramatically.

MONITORING

Gulf of Mexico hypoxia

A recent report of the Federal/State Gulf of Mexico Hypoxia Task Force estimated that 35 percent of the nutrient load into the Gulf originates from Midwestern States through the Upper Mississippi River System. The LTRMP continues as an important source of consistent, quality-assured data on nutrients (specifically, nitrogen and phosphorus) for the Upper Mississippi River and many of its tributaries. Both the LTRMP monitoring data and supporting research have been vital to the U.S. Environmental Protection Agency and the States in ongoing efforts to develop nutrient criteria for Midwestern streams and rivers. LTRMP data on tributary inputs also helped the Hypoxia Task Force evaluate spatial patterns of nitrogen yields across the basin, with an aim towards targeting management actions to specific watersheds for greatest effect (Figure 2-10).

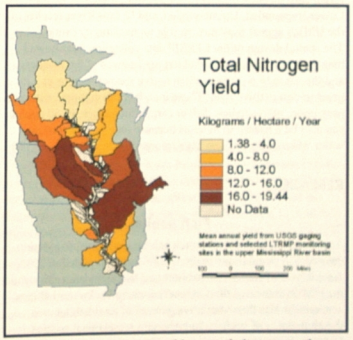

Figure 2-10. Patterns in annual inputs of nitrogen to the Upper Mississippi River from different tributary streams. Yields were estimated from a combination of USGS and LTRMP data from 1977 to 1996.

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