

# **THE NEED FOR A SYSTEMATIC LAKE SEDIMENTATION SURVEY PROGRAM IN ILLINOIS**

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## **ABSTRACT**

This article summarizes the history of lake sedimentation surveys in Illinois and the present state of surveying. Illinois possesses one of the longest lake sedimentation survey programs in the nation. However, at present no concerted effort is expended in the regular maintenance of a sedimentation survey program. Many Illinois lakes are losing their capacities at an alarming rate and some lakes will be almost useless as either recreational facilities or sources for public water supplies in the very near future. A regular and well-planned lake sedimentation survey program is essential for the better management of this important resource of the state of Illinois.

## **INTRODUCTION**

Erosion and sedimentation are natural processes that can be neither stopped nor eliminated. However, when these processes become excessive they impact many human uses of water. Sedimentation in Illinois lakes and sediment transported by Illinois streams have been recognized as the major water resources problems in Illinois.

Knowledge of the existence and quantities of sediments in Illinois water affects a multitude of agency and business decisions. There are many gaps in our current knowledge of this area. For example, there are major questions with concerning the impact of sediment of stream biota and stream environment; on water treatment plants; lake sedimentation; locations and causes of sheet, gully, and stream bank erosion; and pollutants carried by sediment.

Illinois lakes serve as the major sink of the sediment and pollutants carried by streams. Rate of capacity loss of Illinois lakes must be measured directly and it is not a direct function of the amount of sediment transported by the streams. A quantification of the sedimentation rates in Illinois lakes will not only show the rate of capacity loss of the lakes, but may also indicate the relative changes in the sediment yield from the watersheds because of natural variations and/or human activities.

In 1982 over 33 billion gallons of water per day were used in Illinois. Surface water resources accounted for 97% of this total use, or approximately 32 billion gallons per day. Of this 32 billion gallons of daily water use, about 68% was used by hydroelectric facilities, 26% by thermoelectric power plants, 4% by public water supply utilities, and the remaining 2% by manufacturing, mining, and other users. In Illinois about 5.6 million people rely on surface sources for potable water. Approximately 1.1 million people receive their water from small lakes and reservoirs. Maintenance of the storage capacities of these lakes is thus extremely important for many municipalities, communities, and cities in Illinois.

In recognition of the importance of Illinois' lakes and the impairment of their condition due to sedimentation, Governor James Thompson issued a proclamation declaring April 1985 as Lake and Watershed Cooperation Month (Bhowmik et al., 1985). This proclamation stated in part that "Illinois' 2,900 lakes and 81,000 ponds provide inestimable economic and aesthetic benefits including drinking water, fishing, swimming, boating, cooling water for utilities and industry, and flood control; . . . the Illinois State Water Plan and the Water Quality Management Plan have identified soil erosion as the number one water resource issue facing Illinois and have documented the economic impacts of erosion on Illinois lakes."

This recognition of the close relationship between watershed erosion and sedimentation problems in both lakes and rivers reflects a growing concern about the quality and quantity of the water stored in Illinois lakes. It is essential that the state know the sedimentation rates of Illinois lakes in order to better manage its water resources.

### **History of Lake Sedimentation Surveys**

In the early 1930s, realizing the potential impact of sedimentation on the state's surface water impoundments, the Illinois State Water Survey in cooperation with other interested agencies pioneered the use of lake sedimentation surveys in Illinois for evaluating the conditions of lakes. This program evolved from the Water Survey's long-standing involvement in investigating the quantity and quality of the state's water resources. Illinois may thus possess one of the longest lake sedimentation survey programs in the nation. Over the years, the Water Survey has accumulated records from approximately 180 surveys of more than 130 lakes in Illinois. Figure 1 shows the locations of these surveys. As can be seen, most of these lakes are located in the western and southern parts of the state where ground water either is not available or has not been exploited because of economical reasons. Approximately 15 backwater lakes along the Illinois River have also been surveyed. The original emphasis in the lake sedimentation surveys was on the capacity loss of the lakes due to sediment deposition. However, in recent years the program has been extended to include analyses of water and sediment quality as well as the sources of the sediment. This broadened scope is possible because of the various research activities performed in connection with the lake sedimentation surveys.

Results of the studies have shown that Illinois lakes are losing their capacities at the rate of 0.2% to 4% per year. Figure 2 is a plot showing capacity losses of Illinois lakes surveyed since 1930. At least 12 of these lakes are losing their capacities at a rate of more than 2% per year. If this rate continues, they will lose 50% of their capacities in about 25 years.

The Water Survey's lake sedimentation program was extremely active during the 1950s and early 1960s (figure 3). During this period, several major reservoir watershed studies were conducted in cooperation with other local, state, and federal agencies. However, since the mid-1960s the Water Survey's effort has been considerably reduced because of limited state support. As a matter of fact, during the period 1967-1970 and in 1973 not a single lake sedimentation survey was conducted in Illinois.

In recent years, the Water Survey has conducted sedimentation surveys either in cooperation with local communities or for specific research projects. Among the surveys in the first category are those for Decatur, Springfield, Mount Olive, Virginia, Vermont, Staunton, Vermilion, Taylorville, and Litchfield. Surveys within the research category include surveys of Lake Pittsfield, Highland Silver Lake, Horseshoe Lake in Alexander County, Mattoon Lake, and Lake Paradise. It should be pointed out that many of the communities that depend on lakes as their sole source of water realize the importance of sedimentation surveys and have cooperated with the Water Survey extremely well.

The future of lake sedimentation surveys in Illinois looks extremely bleak unless something is done fairly soon. Long-term sedimentation surveys must be recognized as essential in predicting the rate of capacity loss of Illinois lakes, and changes in those rates over time. It is quite possible that some lakes may show a trend of decreasing rate of capacity loss with time. Figure 4 shows the changes in capacity loss for two lakes in Illinois and a pool along the Mississippi River. It appears that the rate of sedimentation in Lake Decatur decreased from 140 acre-ft deposited sediment for the 10-year period from 1956 to 1966 to 120 acre-ft from 1966 to 1983, (Fitzpatrick et al., 1987). For the period from 1934 through 1948, Lake Springfield appeared to lose its capacity at a rate of 186 acre-ft per year, but from 1948 through 1977, the rate of loss was about 138 acre-ft per year. Moreover, most of the capacity loss of Lake Springfield occurred near the upstream areas of the lake, especially within the Lick Creek and Sugar Creek arms. The percent capacity loss of Lake Springfield from 1934 through 1984, by segments, is shown in Figure 5, (Fitzpatrick et al., 1985). Similar patterns of sediment deposition have been observed in many other Illinois lakes where the upstream end is gradually changing from a lacustrine environment to a palustrine-terrestrial environment. This type of transformation is taking place in Peoria Lake (Demissie and Bhowmik, 1987).

As is the case for most of the lakes, Pool 19 on the Mississippi River has shown a gradual decrease in capacity loss with time (figure 4). It has been predicted that Pool 19 will attain a dynamic equilibrium by the middle of the next century, when it will have lost about 58% of its original capacity (Bhowmik et al., 1986). This analysis points up the importance of long-term data collections and shows how these can help us to plan and manage our resources judiciously.

We must realize that the state needs to make definite commitments toward maintaining a viable and useful lake sedimentation survey program. The state should not and cannot depend on the cities, municipalities, and others to support a

sporadic program. It is almost certain that very few new lakes will be built in the near future, and thus the people of Illinois will have to depend on existing lakes for potable water. Existing lakes must be technically analyzed to determine their need and suitability for revitalization and rehabilitation.

It is suspected that if Illinois experiences a drought in the near future, many of the public water supply lakes will be dry and will not be suitable for use as sources of water. A regular lake sedimentation survey program can identify the lakes that are losing their capacities at the fastest rates. By predicting future lake capacities, such a program can sound the alarm long before lake capacity becomes a critical problem as a result of natural causes such as droughts.

## RECOMMENDATIONS

On the basis of this evaluation, it is recommended that a regular lake sedimentation survey program be initiated by the state of Illinois with the following features:

- Surveying will be done by the State Water Survey
- A total of 5 to 10 lakes will be surveyed every year
- Repeat surveying will be done on a 10- to 15-year cycle
- Selection of the lakes for surveying will depend on past and projected sedimentation rates and on the importance of the lakes in terms of the number of people served, recreational facilities, etc.
- Input from state, local, federal, and public officials will be considered in the selection of the lakes to be surveyed.

The proposed program will also encompass the following: (1) impacts of temporal and spatial factors on sedimentation rates, (2) movement of sediment within riverine and lacustrine environments, and (3) impacts of hydrological, hydraulic, and geotechnical factors involved in sedimentation.

This proposed program has already been recommended and approved by the State Water Plan Task Force (Bhowmik et al., 1985). Lakes are one of the major resources of the state and they must be managed properly, especially when it is evident that they not only provide potable water to many communities and serve as outdoor recreational facilities, but that they also accumulate most of the water-borne materials in streams, including many chemicals utilized in agricultural practices. Quantification of lake capacities and determination of sediment quality of major Illinois lakes used for municipal, industrial and recreational water supplies and sources are essential for the development and implementation of proper management practices.

## ACKNOWLEDGMENTS

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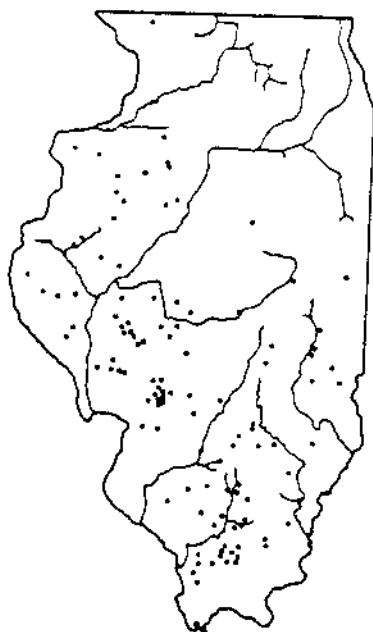


Figure 1. Locations of lake sedimentation surveys in Illinois

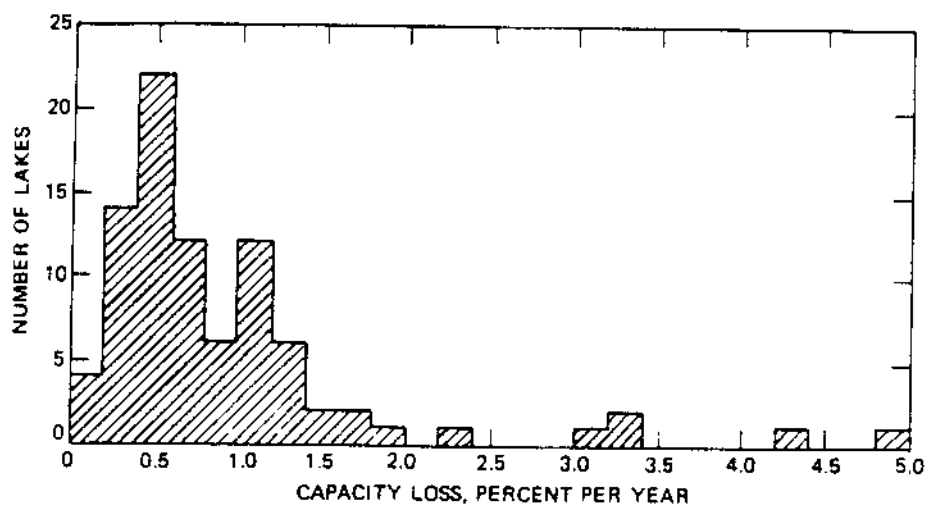


Figure 2. Capacity loss of Illinois lakes

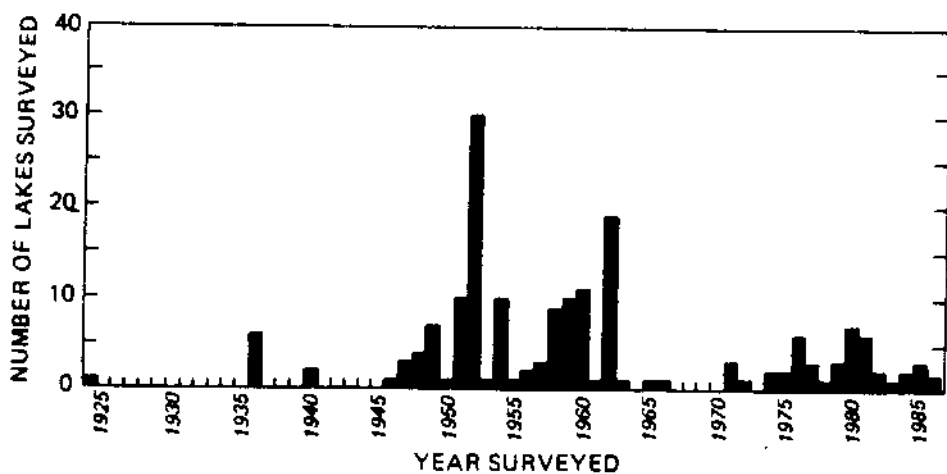


Figure 3. History of lake sedimentation surveys

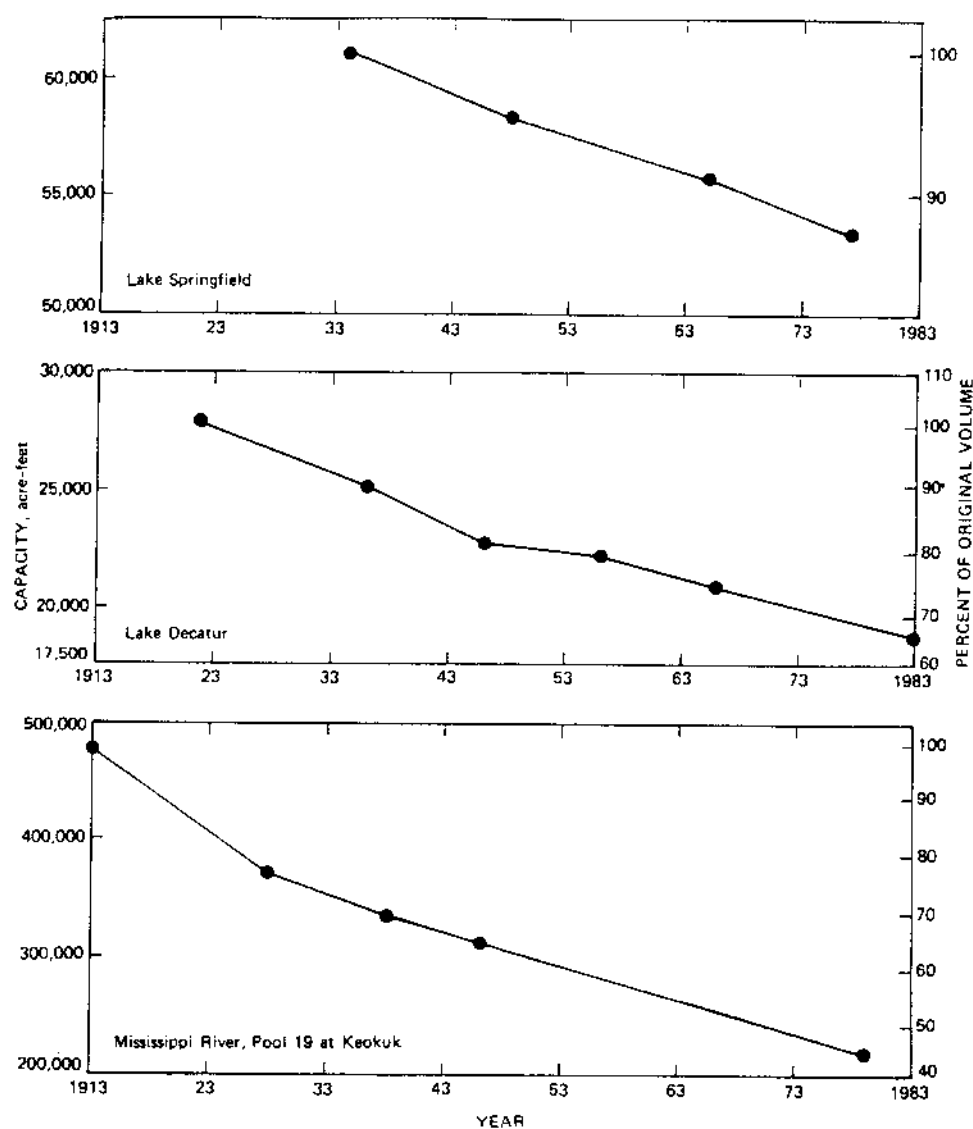


Figure 4. Capacity losses with time, Lake Springfield, Lake Decatur, and Pool 19, Mississippi River

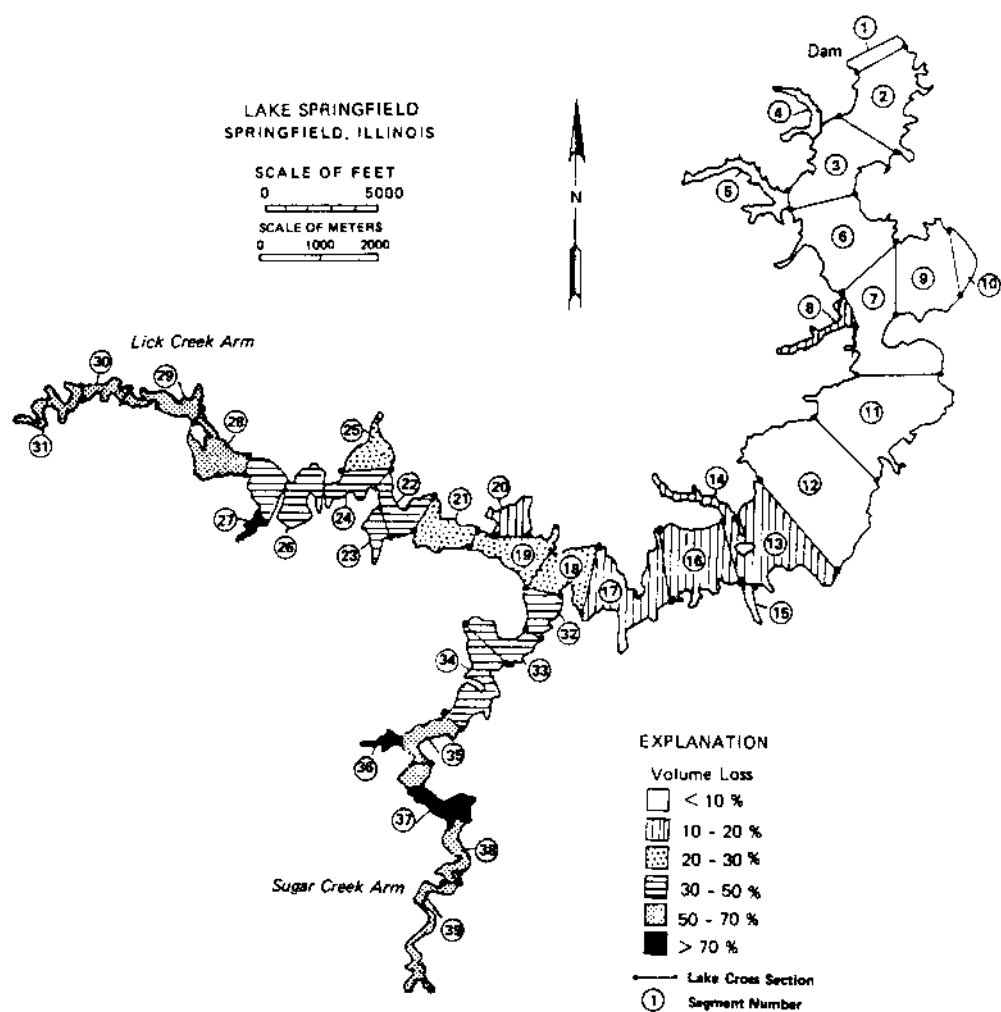


Figure 5. Percent loss of original volume in Lake Springfield due to sediment accumulation from 1931 through 1984, by segments