

Lake Sedimentation Surveys in Illinois

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## LAKE SEDIMENTATION SURVEYS IN ILLINOIS

### Introduction

Erosion and sedimentation are natural processes that can neither be 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 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 poorly quantified information on the impacts of sediment on stream biota and stream environment; impacts of sediment on water treatment plants; lake sedimentation; locations and causes of sheet, gully, and stream bank erosion; pollutants carried by sediment; and quantity and magnitude of sediment carried by Illinois streams.

Illinois lakes serve as the major sink of the sediment and pollutants carried by 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 change 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. Out of this 32 billion gallons of daily water use, about 68% was used by the hydroelectric facilities, 26% by the thermo-electric power plants, 4% by the 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.

This proclamation states 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.

#### Past Activities of the Water Survey

In the early 1930's, 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 the investigation of 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 for 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 or southern part of the state where ground water is either not available or cannot be exploited economically. 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 silt 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.

The Water Survey's lake sedimentation program was extremely active during the 1950's and early 1960's (figure 2). During this period, several major reservoir watershed studies were conducted in cooperation with other local, state, and federal agencies. However, since the mid-1960's 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 the past several years, some Illinois lakes have been surveyed either because of a need connected to special research projects, such as those involving Blue Creek, Highland Silver Lake, and Horseshoe Lake, or because partial support was made available by local municipalities.

Results of the past studies have shown that the lakes in Illinois are losing their capacities at the rate of 0.2% to 4% per year. Figure 3 is a plot showing capacity losses of Illinois lakes surveyed since 1930. At least

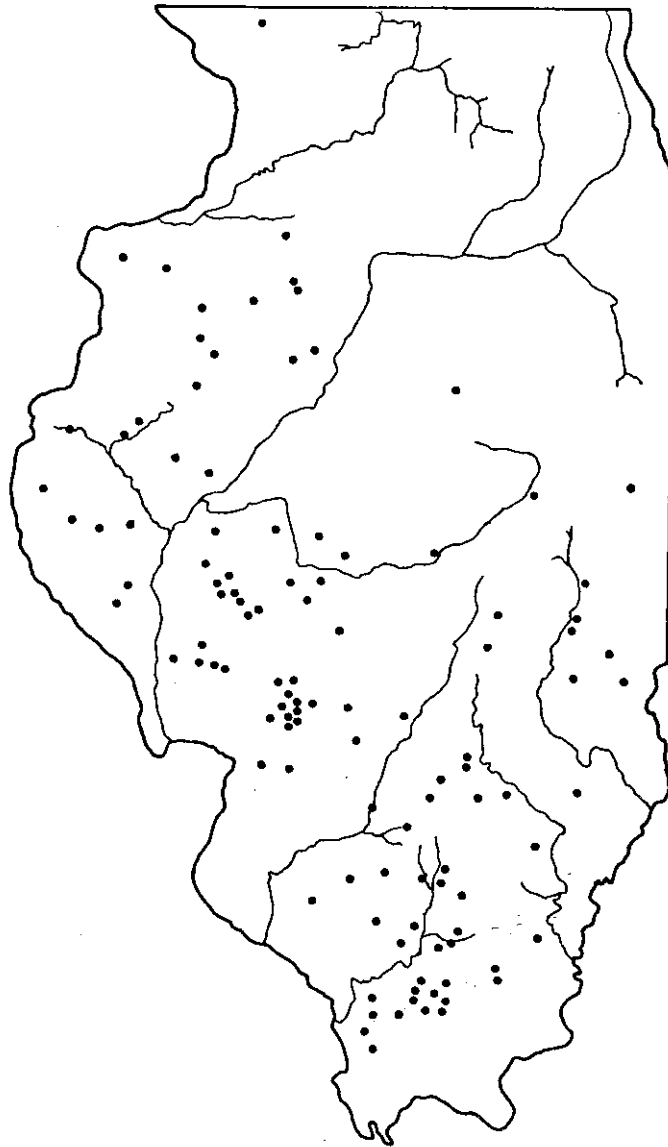


Figure 1. Locations of lake sedimentation surveys in Illinois

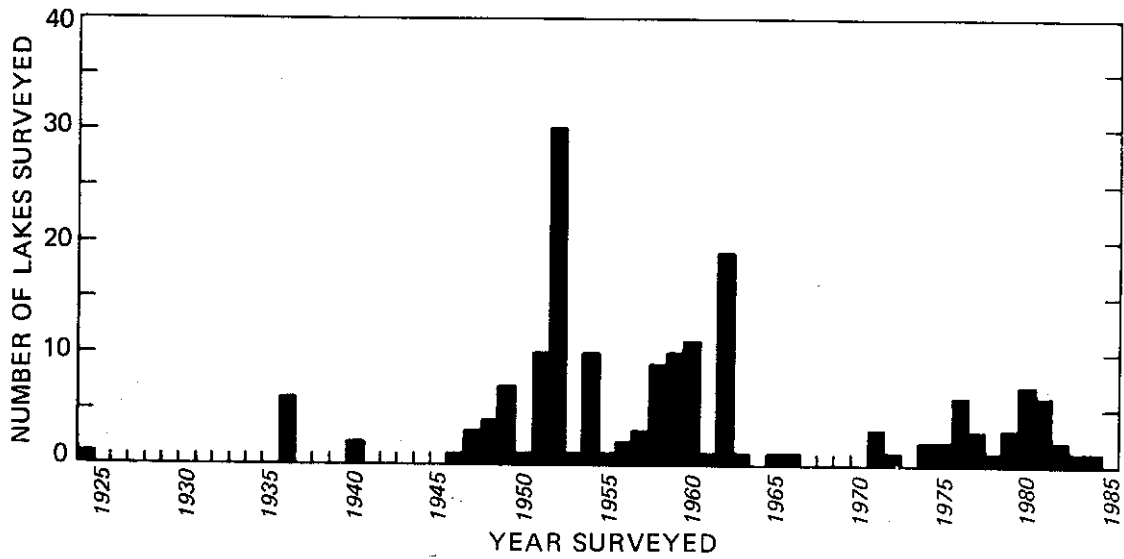


Figure 2. History of lake sedimentation surveys

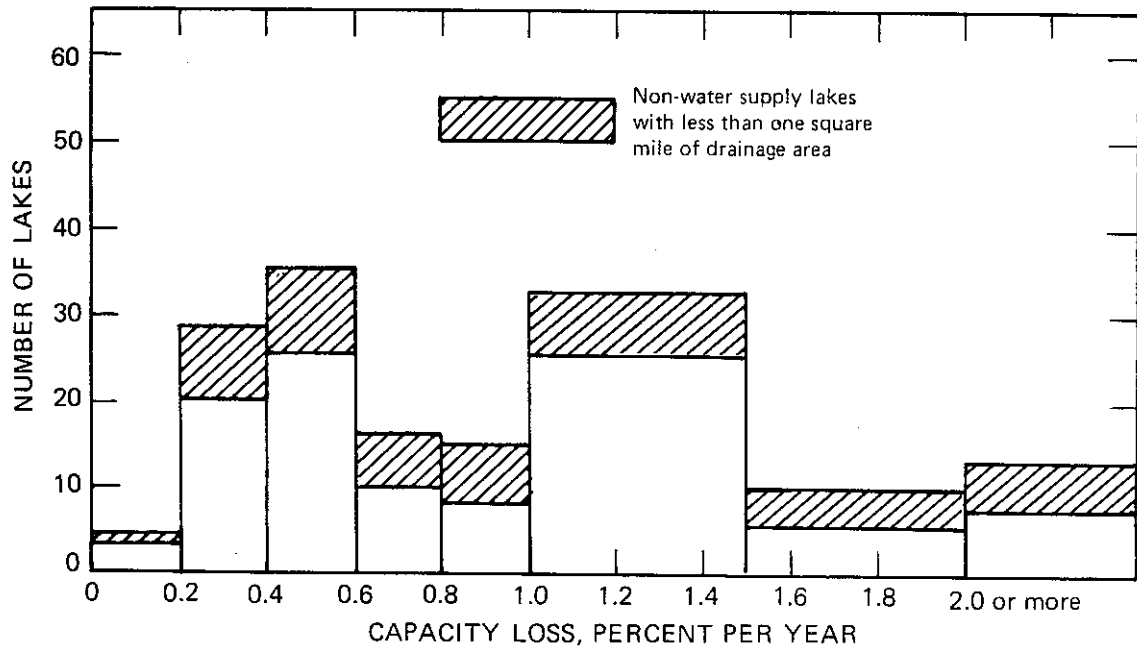


Figure 3. Capacity losses of Illinois lakes

12 of these lakes are losing their capacities by more than 2% per year. If this rate continues, they will lose 50% of their capacities in about 25 years.

#### Present Activities of the Water Survey

In recent years, the Water Survey has been conducting 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, Illinois. 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.

Presently the Water Survey does not have any regular program of conducting lake sedimentation surveys. Most of the staff members are assigned to other projects. If funding is available for a project where a lake sedimentation survey is needed, a survey is generally conducted.

#### Future Outlook

The future of lake sedimentation surveys in Illinois looks extremely bleak unless something is done fairly soon. It is essential that we realize the importance of long-term sedimentation surveys in order to understand and predict the rate of change of capacity loss of Illinois lakes. Moreover, it is quite feasible 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



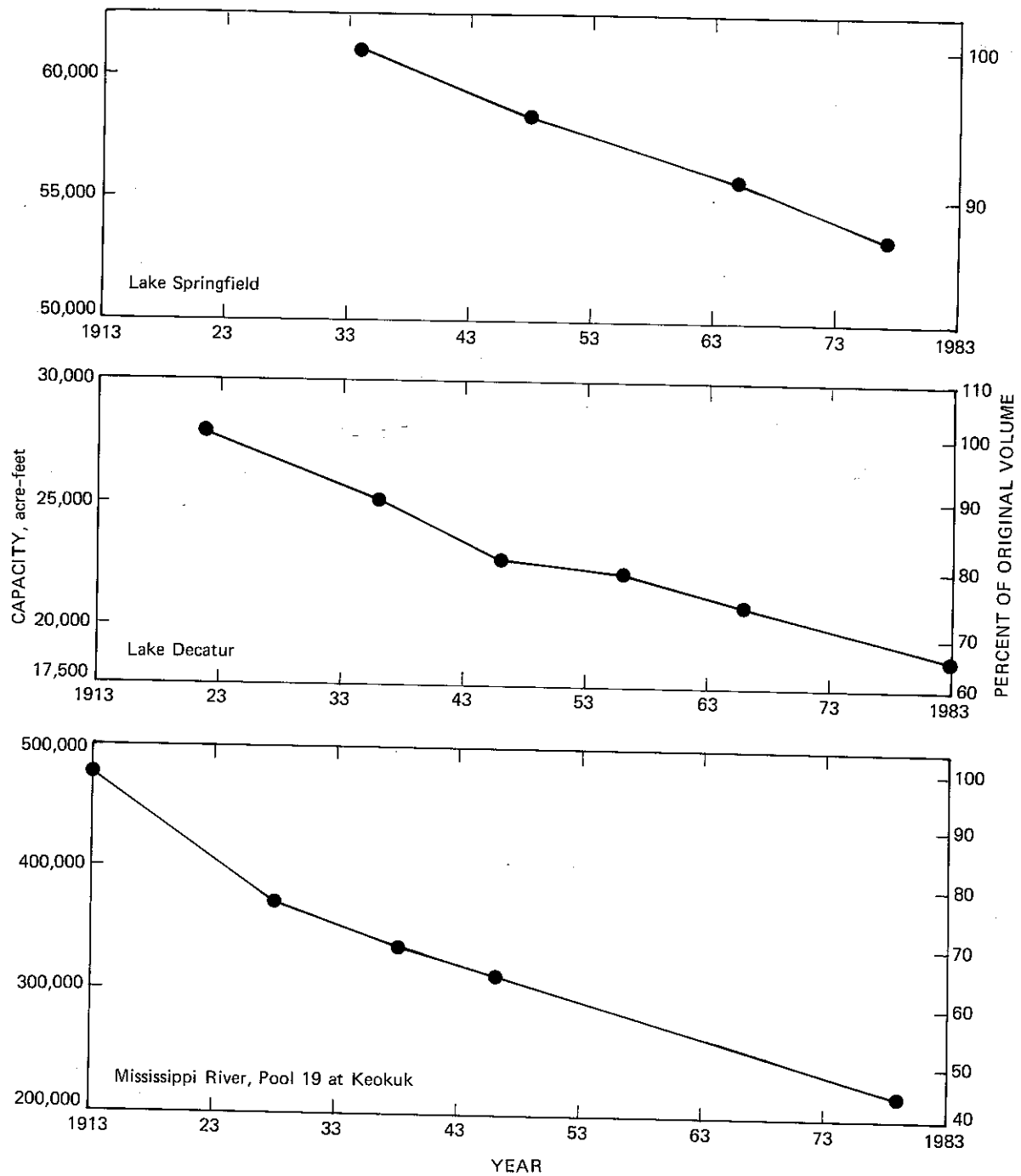


Figure 4. Capacity losses with time, Lake Springfield, Lake Decatur, and Pool 19

the rate of sedimentation in Lake Decatur has decreased from 140 acre-ft deposited sediment for the 10-year period from 1956 to 1966 to 120 acre-ft from 1966 to 1983. With regard to Lake Springfield, it appears that for the period from 1935 through 1977, the lake lost its capacity at a rate of 182 acre-ft per year, but that from 1948 through 1977, the rate of loss was about 172 acre-ft per year. If we consider the Mississippi River Pool 19 at Keokuk, we observe that the rate of capacity loss also has decreased in recent years. We are predicting that the pool will lose about 60% of its capacity before attaining a dynamic equilibrium in the early to middle part of the next century. This analysis vividly points out the importance of long-term data collections and how these can help us to plan and manage our resources judiciously.

It is essential that we realize that the state must 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 the State of Illinois will have to depend on existing lakes for potable water sources. 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 a source 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

We recommend that the state initiate a regular lake sedimentation survey program with the following features:

- ⊙ Surveying to be done by the State Water Survey with state employees
- ⊙ A total of 5 to 10 lakes to be surveyed every year
- ⊙ Repeat surveying to 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
- ⊙ Inputs from state, local, federal, and public officials are to be considered in the selection of the lakes to be surveyed

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

The support needed for such a program will be as follows:

- ⊙ One supervisor
- ⊙ Three field personnel
- ⊙ Facilities such as an automobile, boats, equipment, etc.
- ⊙ Travel funds
- ⊙ Laboratory facilities

The total yearly cost for such a program will be \$150,000, with an additional \$55,000 needed for the first year's operation of the program. This additional funding will be used to purchase essential lake sedimentation survey equipment.