RESIS-II: MAKING THE RESERVOIR SURVEY INFORMATION SYSTEM COMPLETE AND USER FRIENDLY

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EXTENDED ABSTRACT

Here we report on work to update the Reservoir Information System (RESIS) database, referred to here as RESIS-II.

Several decades ago, the member agencies forming the Interagency Subcommittee on Sedimentation of the Interagency Advisory Committee on Water Data recognized the importance of maintaining a database of sediment deposition in U.S. reservoirs. The database consisted of data sheets that summarized reservoir sedimentation survey data and occasional summary reports. As such, it became the premiere database in the world for evaluating long-term sedimentation in reservoirs and long-term erosion in watersheds. Dendy et al. (1973) and Dendy and Bolton (1976) summarized the database through 1973. By relating reservoir properties to sedimentation rates, these papers have provided a guide for estimating reservoir sedimentation world wide. Renwick (1996) summarized the database though 1975, focusing on sediment yields as related to the properties of the contributing watersheds.

In 1996, Steffen (1996) introduced RESIS, a computer-based version of the database using INFORMIX software. Currently the database has 5,967 surveys for 1,819 reservoirs across the conterminous U.S.. Although digital, this version of the database was not available for desktop systems. It had not been error checked, and it was not linked to other databases such as the National Inventory of Dams (NID) or to a Geographic Information System (GIS). Linking to a GIS, in particular, would provide a powerful tool for assessing how watershed properties relate to reservoir sedimentation. Finally, RESIS did not have an easy procedure for adding new data, and few data have been added to RESIS since 1975. This is especially significant in light of substantial trends toward use of techniques involving less erosion in agriculture, forestry, and grazing, during the last 30 years. The impact of land-use and conservation-practice changes should be evaluated to fully assess the health of the nation's water supply system.

The Mississippi Basin Carbon Project, MBCP, chose to use the RESIS database as one means for evaluating sediment and carbon storage within the Mississippi River Basin. As part of this effort, RESIS was transferred to a desk-top computer environment using standard database programs (Paradox and Access). In addition to using the original version of RESIS data as the core of the new database, RESIS-II, links are being made to (1) the NID, (2) to scanned versions of the original primary data sheets, and (3) to a GIS polygon coverage of reservoir boundaries. This last feature will, in turn, allow unlimited linkage to all forms of mapped data. To assess quality of the data, a dynamic QA/QC parameter has been added to the database, whereby the accuracy of dam location and reservoir survey data are linked into a quality ranking. Finally, a front end is being designed that matches the format of the field data sheets so that additional data may be added.

A major impediment to completing RESIS-II has been the inaccuracy of the location of every dam in the database. Without an appropriate location, the watershed cannot be delimited in a GIS. Many dams are located in Township/Range/Section coordinates by specifying the nearest post office. Reservoirs were often named after the owners who have long since changed along with the name. After trying several methods for locating dams, we chose an inverse approach. We look for all points in the GIS that are near the location indicated and which have the drainage area and elevation specified in the database and which are on a stream channel. This may not exactly match the dam site because of the effects of the interaction of grid size in the digital elevation model with the algorithm for calculating contributing area. Presently, we have adequate locations for 1,327 reservoirs (Figure 1). Another 472 reservoirs have been located to within 20 km, and 20 reservoirs have no reliable coordinates.

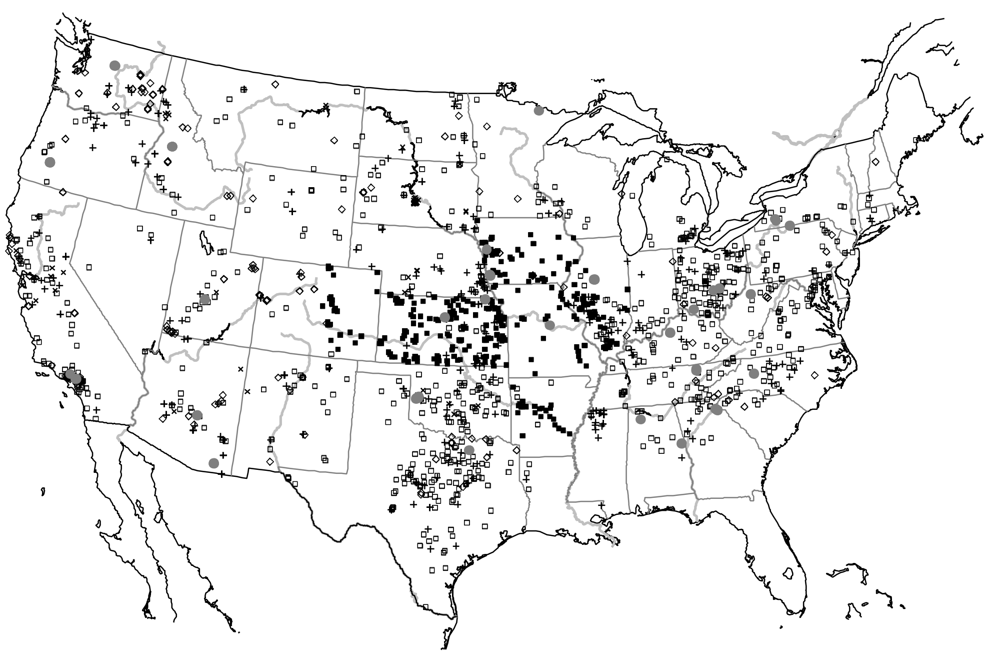

Figure 1. Map of the reservoirs from the RESIS-II database. Black symbols indicate location data quality: solid square - fully geolocated; open square - from the National inventory of Dams; open diamond - from RESIS; cross - township, section, range; plus - nearest post office. The grey circles represent the 50 reservoirs used to test the capabilities of watershed characterization using a GIS.

The MBCP plans to use RESIS-II to model carbon burial in reservoirs (Stallard, 1998, Sundquist, et al. 1998). Accordingly, the efficacy of the use of a GIS to study reservoir sedimentation was examined using a small subset of 50, well located reservoirs. GIS data selected for use in the MBCP (Sundquist, et al. 1998) were related to reservoir sedimentation. For each reservoir, area, relief, mean slope, mean topographic curvature, mean topographic index [ln(Area/tan(β))], mean rainfall, soil-organic-matter-content, fraction of agricultural land, RUSLE R factor [runoff factor], and RUSLE K factor [soil erodibility] were estimated and step-wise regressions were used to identify "controlling" factors influencing sedimentation rates. Of these, the K factor had the dominant influence.

Maintenance of a current and accurate reservoir sedimentation database is essential to many societal and managerial issues. Loss of reservoir storage affects water supplies in times of shortage and excess. Pressure is building to remove many dams. The quantity and quality of stored sediment can affect these decisions. RESIS-II, with its links to GIS, will provide a means of linking land-use history and associated chemical loadings to the sedimentation history of reservoirs. RESIS reservoirs can serve as metaphors for other reservoirs in a region. Reservoirs are also major carbon sinks. Accurate sedimentation models are needed to fully assess the importance of this carbon sink.

Remaining work on the database includes (1) completion of geolocation and watershed delimitation, (2) linkage of original data sheets to electronic records [all sheets have been scanned], and (3) completion of a suitable front end for data entry and data correction.

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