

FINAL REPORT

AUG 13 2001

1999 Project Abstract

For the Period Ending June 30, 2001

TITLE: D15 GIS Utilization of Historic Timberland Survey Records

PROJECT MANAGER: Robert Horton, State Archivist

ORGANIZATION: Minnesota Historical Society

ADDRESS: 345 Kellogg Blvd. W., St. Paul, MN 55102

FUND: Future Resources Fund

LEGAL CITATION: ML 1999, Ch. 231, Sec. 16, Subd. 10(f).

APPROPRIATION AMOUNT: \$120,000

Overall Project Outcome and Results

This project successfully converted historical environmental records into a digital, GIS format. The result was a three-CD set that contains digital images, GIS and tabular data from the 2,900 pages in the "Reports of Estimates and Appraisals of the Timber Commissioners Board, 1895-1905."

Each page contains a map and assessment indicating the extent, value and condition of timber resources on state owned lands in the northern half of Minnesota. The map notes the location of timber relative to water features, wetlands and cultural references. The digitized products can now be integrated with other GIS data sets to analyze the development of critical lands over time; to plan for the most effective replanting of native species of timber; and to assess the human impact on the environment.

This project demonstrated how to realize the potential value of historical paper records by converting them into a digital format. It is the first step in the creation of a digital library of historical data sets that document the development of the landscape in Minnesota.

Project Results Use and Dissemination

The project results were copied onto 1000 three-CD sets. Their distribution is now in progress. The Department of Natural Resources received 200 copies, as did the Land Management Information Center. Additional sets went to advisory board members and to many others. Among those are the Georgia State Archives, which plans to use this as a model, the Map Division of the Library of Congress and the Mille Lacs Band of Ojibwe. The State Archives is developing a web site to document the project and to foster interest in the digitization of historic environmental records. LMIC will submit descriptive metadata to its GeoGateway and the Geographic Clearinghouse.

Date of Report: July 1, 2001
LCMR Final Work Program Report

FINAL REPORT

Date of Work Program Approval: June 18, 1999
Project Completion Date: June 30, 2001

I. PROJECT TITLE: D15 GIS Utilization of Historic Timberland Survey Records

Project Manager: Robert Horton, State Archivist
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Total Biennial Project Budget: \$120,000

\$ LCMR:	\$120,000	\$MATCH	\$	0
- \$ LCMR Amount		- \$ Match Amount		
Spent:	\$114,045	Spent:	\$	0
= \$LCMR Balance:	\$5,955	= \$Match Balance:	\$	0

A. Legal Citation: ML 1999, Chap. 231, Sec. 16, Subd. 10(f).

D15 GIS Utilization of Historic Timberland Survey Records 120,000

Appropriation language:

\$120,000 is from the future resources fund to the Minnesota Historical Society to digitize and distribute historic timberland survey records in a geographic information systems format.

II and III. FINAL PROJECT SUMMARY

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IV. OUTLINE OF PROJECT RESULTS

Result 1: Select members for a project advisory team (likely members will include representatives from DNR, LMIC, MHS, other interested state agencies, counties, private for-profit and non-profit groups).

<i>Budget:</i>	LCMR Budget:	\$	0
	Balance:	\$	0

Completion date: July 1999

At the beginning of the project, Bob Horton contacted a variety of people to become members of the board. This went smoothly, with the agreement of a variety of constituencies, public, governmental and private, to participate. But over the course of the project, not all members participated regularly, with the representatives of private for-profit organizations notably absent. While the majority of the board did attend and did affirm the initial estimate of the value of the records, it would have been useful to have better participation from all constituencies. The board's primary activities were the review of the process and of the potential applications of the products. Members also discussed the

availability of complementary records and resources. As the board represented the primary audience and user base for the final products, its involvement, interest and approval were crucial to insuring the project's use value.

Due to scheduling conflicts, the final board meeting was postponed until 26 April 2001. The members reviewed the final plans for producing and distributing the CDs with the GIS data sets. They also had some suggestions for additional resources that would complement the final products of the project. These included "pre-packaged" county maps with types of vegetation and volume of pine indicated, as well as references to photographs in the MHS's Visual Resources Database that would illustrate the area and the timber industry.

Result 2: Optically scan state timber survey plats currently housed at MHS at a minimum resolution of 800 DPI, black and white. This process includes:

- Index and prepare the documents for scanning.^{1 & 2}
- Prepare, solicit and award bids for the scanning.²
- Contractor will scan documents to project specifications.
- Review and print tiff images produced by contractor. Advise contractor of needed rescanning.²

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 13,200 (expended in MHS contract with LMIC)
Balance: \$ 0

Completion date: January 2000.

This phase of the project was delayed by the length of time it took to work out a controlling legal agreement between MHS and LMIC. The necessary contract for LMIC's services (\$110,000) was successfully negotiated but there was a notable loss of time before a RFP for the scanning could be issued. As the other results were contingent on the completion of the scanning, this had an impact on the schedule for whole project. By the end of FY2001, we felt the loss of time acutely and this complicated the work for Result 6.

On the plus side, once it had started, Perfect Image, of Kirkland, WA, completed the imaging process quickly, by April 2000. In addition, the quality of the work was extremely high. The cost of this result was notably less than projected, probably because there was a national response to the RFP. The budget was adjusted, with the approval of the LCMR staff, to reflect this, with the amount allocated to the task reduced from \$27,500 to \$13,200. In sum, the task was completed as planned and per the amount allocated in the revised budget.

Result 3: Construct geographic linkages between the scanned images and an appropriate digital public land survey base (DNR's and/or LMIC's).² This will allow the scanned images to be placed as a backdrop against other existing GIS data layers.

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 31,500 (expended in MHS contract with LMIC)
Balance: \$ 0

Completion

Date: May 2000.

The programs required to geo-reference the scanned images were designed and written by LMIC. Included in the design, but not in the original LCMR proposal, was a process for extracting the section map found on each geo-referenced page. LMIC staff felt that the map would be less cumbersome to use when viewing the scanned products with other GIS data. Sample products were reviewed and approved by the advisory board in July 2000. The work was done in-house by LMIC. Costs were higher than expected, as this process proved more difficult than originally envisioned requiring more staff time and computing resources. To reflect the changes in the deliverables and resulting work load, the budget for this result was adjusted, with the approval of the LCMR staff, from \$18,500 to \$31,500. The task was completed as planned, but in addition to the work contracted at the allocated \$31,500, LMIC contributed time and resources worth \$172.16.

Result 4: Construct a tabular database consisting of the section summary information found on each page.² Summary data includes timber volume by species. This data can be combined with other GIS data layers for mapping and analysis purposes.

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 15,700 (expended in MHS contract with LMIC)
Balance: \$ 0

Completion

date: June 2000.

LMIC began work on this task concurrent with the work described in Result 3. The advisory board also reviewed and approved the design in July 2000. LMIC started the data entry and explored the possibility of out-sourcing a portion of the work to InterTech, MN Dept. of Administration. After conducting two pilot tests with InterTech, LMIC determined that out-sourcing would be too expensive, primarily due to the additional time required by data entry staff to interpret the

summary information. LMIC completed the data entry using staff already familiar with the nuances of the data. The final costs for this result were less than originally planned and the budget was revised, from \$18,500 to \$15,700 with the approval of the LCMR staff. The task was completed as planned. In addition to the work contracted at the allocated \$15,700, LMIC contributed time and resources worth \$561.39.

Result 5: Digitize the detailed vegetation maps found on each page of the timber survey. These maps show the boundaries of stands of timber, brush, swamps and water features that existed prior to European settlement. The digitized data can then be combined with other GIS data layers for mapping and analysis purposes. This process includes:

- Prepare the documents for digitizing.^{1 & 2}
- Prepare MnDNR GIS section data (where available) to serve as the background coverage for digitizing.²
- Merge LMIC's 1:100,000 PLS data with the above for those areas of the state where the MnDNR data is not available.²
- Prepare, solicit and award bids for digitizing.²
- Contractor will digitize maps to project specifications.
- Perform quality control on digitized data to ensure they meet contract specifications. Return to contractor as needed.²
- Prepare metadata for the scanned, geo-referenced images and GIS data layers to meet Minnesota Geographic Metadata Guidelines.²

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 26,700 (expended in MHS contract with LMIC)
Balance: \$ 0

Completion
date: February 2001.

Based on its initial work and available staff resources, LMIC made a decision to outsource the digitizing of 600 (out of nearly 2,000) maps to three Minnesota schools with GIS departments: St. Cloud State University, St. Mary's and Alexandria Tech. The schools began their work in December and by January 2001, it appeared as if the result would cost less than first budgeted. The budget was adjusted with the approval of the LCMR staff from \$30,000 to \$26,700. The schools completed their work in mid-February as expected. By early May, LMIC staff finished digitizing the balance of the maps and began its final review of the GIS data. It was during this last phase of Result 5 that LMIC determined additional work would be required to deliver data of the highest quality. Three major problems arose:

1. Unanticipated problems with the GIS software resulted in LMIC staff having to recode features (points, lines, polys) digitized earlier. Approximately 25% of the section maps were affected.
2. Errors in interpreting the features (by the schools and LMIC staff) found on the maps required re-digitizing and labeling. In retrospect these errors were not overly surprising given the nature of the maps, i.e., hand drawn by several different surveyors spanning a ten year period and without a common set of cartographic standards.
3. LMIC staff spent more time than expected carefully reviewing the digitized maps after initially discovering these problems.

However, the task was completed as planned. In addition to the work contracted at the allocated \$26,700, LMIC contributed time and resources worth \$11,232.48 that was not billed.

Result 6: Distribute the completed scanned, geo-referenced imagery and GIS data layer.^{1 & 2}

- Review distribution options with advisory committee. Determine the appropriate number of CD-ROM copies to make based on the recommendations of the committee.^{1 & 2}
- Prepare and solicit and award bids for the CD-ROM production.²
- Describe the project on the State Archives' web site. Make data set available in the Historical Society's Library Reading Room for patron usage. Enhance its use for educational and exhibit purposes.¹
- Consider making the images and data available via LMIC's Spatial Data clearinghouse. This information could then be downloaded via the Internet. Implement if feasible.²

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 16,000 (\$10,000 MHS, \$6,000 LMIC)
 Balance: \$ 5,955 (from MHS budget)

Completion date: May 2001.

After copies of the "raw" TIFF images were made on CDs for and distributed to members of the advisory board and other interested parties, the MHS consulted with interested parties on how best to make the information available. By January 2001, it also prepared, with the help of a graduate student from the

University of Minnesota's Geography Department, a comparative evaluation of other timber and forest related records in the State Archives and elsewhere.

This is critical information. Historical records rarely reflect exactly the concerns of a contemporary audience and so they are often asked questions they were never designed to answer. Because of that, they need to be supplemented to be useful to a variety of groups. The MHS wanted to broaden the appeal of this project's results beyond the primary audience represented in the advisory board; exploring other records and their pertinence led to the concept of a digital library of historic data sets that would complement each other and modern records to present the best available description of the state's historic landscape. The consensus we reached was that the original General Land Office surveys and plats were the optimum resources for a comprehensive analysis of Minnesota. The MHS, LMIC and other interested parties have since been talking to the Secretary of State's Office, custodian of these records, about possible ways to capture this information in a usable, digital format.

As planned, the goal was to distribute the products of the project in CDs. LMIC created the artwork for the CDs, prepared the master CDs, wrote the specifications and obtained the necessary bids for the production of CDs. Based on the bids, MHS hired InSync, a New Jersey firm, to duplicate the data sets. InSync produced 1000, three-CD sets. Each set included: the scanned images of the reports, in high resolution TIFF files; the scanned images geo-referenced to DNR's control point generated Public Land Survey layer; points, lines and polygons appearing on the survey maps in the form of Arc/Info 8.1 export files and ArcView shapefiles; and the assessments of timber resources in Access and .csv formats.

The production of the CDs was successful and the distribution is underway. But almost \$6,000 MHS budgeted for this result was not spent. There are several reasons for this. Overall, the number of tasks necessary to completing the primary products proved to be doable, but complex. This project was notable for the array of activities involved - imaging, geo-referencing, data entry, etc. These challenges were complicated by the necessary reliance on historical sources. Unlike in contemporary GIS projects, the source data was not created for this purpose and the creators were not available for consultation. This data set had to be converted from a paper form that was not designed with any of these applications in mind.

Estimating the precise scope of particular activities was difficult; some took less time and cost less than projected; other took more time and cost more. In sum, we were not able to follow the original schedule and the work on the final products was not complete until June 2001. As a result, there was not enough time available to study the products and determine which enhancements were of interest and feasible to produce. The pre-packaged county maps are an example. Based on the work done by April, the board recommended them, but

they could not be planned or created until the basic data was available. Similarly, the final development and implementation of the web site and the metadata had to wait on the completion of the final work products; we had to understand their look and feel before we could describe them.

LMIC and the State Archives are continuing to collaborate on publicizing and distributing this data set, though. LMIC and MHS staff members will make the CDs available at the upcoming fall GIS/LIS conference in Duluth (attended by 500+ people). The State Archives will move forward with the development of a web site to document the project and to foster interest in the digitization of historic environmental records, basing its efforts on the comments, suggestions and questions it receives as the products are tested. LMIC will submit descriptive metadata to its GeoGateway and the Geographic Clearinghouse. The web site will be completed and published before the GIS/LIS conference. The metadata will be submitted well before then.

Result 7: Ongoing project administration. This includes detailed project design, meetings, report writing, accounting and project archival efforts.^{1 & 2}

¹ Performed by MHS. ² Performed by LMIC.

Budget: LCMR Budget: \$ 16,900 (expended in MHS contract with LMIC)
Balance: \$ 0

Completion date: June 2001.

As originally proposed, LMIC acted as the general contractor for the project. With the various difficulties and differences noted above in the report, the costs of administration proved to be higher than expected. The budget for this result, accordingly, was revised upwards, from \$9,500 to \$16,900 with the approval of the LCMR staff. The task was completed as planned and at the cost allocated in the revised budget.

V. DISSEMINATION

Copies of the geo referenced images, digitized maps and related attribute data will be made available using several media:

- A limited production (1000 copies) of the data in CD-ROM format for free distribution to interested users.
- The LMIC will consider making portions of the dataset available for downloading over the Internet by way of FTP site.

- Descriptions of the dataset and suggestions on how to apply it will be available on the State Archives' web site through the Minnesota Historical Society.
- Metadata will be supplied to the nationwide GIS clearinghouse to enable wider usage.

The project advisory board recommended the most appropriate options for dissemination of the products.

As noted, the distribution of the CDs is underway. The board members, as representatives of the primary user audiences, are themselves serving as distributors. In addition, as news of the project reaches other researchers, both LMIC and the MHS receive requests from individuals for copies of the CDs. All these requests are met.

We decided not to make the data available over the Internet at this time because the CDs are reaching all of the anticipated users. The MHS is proceeding with the development of a web site that will have a number of functions. It will give the necessary background on the project and the data, to allow users to evaluate them. It will describe the historical context for the original records and other, complementary historical records. It will provide an index map that indicates the geographic coverage of the data. It will link to the metadata LMIC is preparing for its GIS Clearinghouse. It will describe and give examples of how the data sets are being used. Finally, if necessary, it will provide access to any corrections to the data that are identified.

VI. CONTEXT

A. Significance:

The state, through such programs as the White Pines Initiative, the Minnesota County Biological Survey and the ecological classification program, has committed significant resources to the study of the landscape and to re-vegetation projects. The most effective investment of those funds will follow the best assessment of the proper and natural habitats of native species; this project would provide efficient access to a significant data component to achieve that, especially when layered with other GIS datasets, such as the bearing tree database. These records would as well have a wider impact:

- The cultural data included in the inventories will be useful in the management of cultural resources in the forested regions of Minnesota.
- Inclusion of this information in a GIS will facilitate identification of land areas that have high potential to contain cultural resources reflecting 19th-century settlement and resource utilization patterns. This will allow for consideration of these resources during project planning, which will increase the probability

that they will be adequately protected from damage during forest management activities.

- As a pilot project, they provide a base for a more extensive catalog of digitized historical data; there are numerous supplementary records available in the State Archives and from other sources, both public and private, that could be developed and integrated in a GIS format in the future.

B. Time:

The target and actual date of completion was June 2001.

C. Budget Context:

This project is not related to any previous work done by the Historical Society.

VII. COOPERATION

1. Division of Forestry, Department of Natural Resources.
2. Land Management Information Center, Minnesota Planning.
3. Other interested organizations (e.g., Institute for Agriculture and Trade Policy, Audubon Society, Sierra Club, U. of Minnesota).

VIII. LOCATION

Oversight of the scanning and digitization of timber records took place in St. Paul. Some work was sub-contracted to vendors at St. Cloud State University, St. Mary's and Alexandria Tech.

As to the records, the Timber Commissioners Board surveyed state owned lands throughout Minnesota. However, given the time period when these records were created, their focus is on the northern half of the state. Please see the attached map (survey locations have been generalized by township).

IX. REPORTING REQUIREMENTS

Periodic work program progress reports were submitted on January 2000, July 2000 and January 2001. A final work program report and associated products were submitted as required.

X. RESEARCH PROJECTS:

Not applicable.

ATTACHMENTS:

See page 11 for budget spreadsheet.

**Attachment A: Deliverable
Products and Related Budget**

LCMR Project Biennial Budget		Objective / Result						
Budget Item	Result 1	Result 2	Result 3	Result 4	Result 5	Result 6	Result 7	ROW TOTAL:
	Establish an advisory team to review project design, bid specifications and projects	Scan timber survey plat at 800 DPI, print and review.	Construct geographic links between scanned images and PLS base	Construct tabular database consisting of section summary info	Digitize detailed vegetation maps and link to tabular data.	Distribute completed images and GIS via CD-ROM and other media.	Project administration including design and meetings.	
Wages, salaries & benefits:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Space rental, maintenance and utilities:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Printing & Advertising:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -
Communications, telephone, mail, etc.	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Contracts:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Professional / technical	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -
Professional / technical: LMIC**	\$ -	\$ 8,200.00	\$ 31,500.00	\$ 15,700.00	\$ 5,000.00	\$ 6,000.00	\$ 16,900.00	\$ 83,300.00
Other contracts (scanning, digitizing):	\$ -	\$ 5,000.00	\$ -	\$ -	\$ 21,700.00	\$ 3,775.00	\$ -	\$ 30,475.00
Local automobile mileage paid:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other travel expenses in Minnesota:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Travel outside Minnesota:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Office Supplies:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 270.00	\$ -	\$ 270.00
Other Supplies:	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -
Tools and equipment:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Office equipment & computers:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other capital equipment:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Other direct operating costs:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Land acquisition:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Land rights acquisition:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Building or other land improvement:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Legal fees:	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
COLUMN TOTAL:	\$ -	\$ 13,200.00	\$ 31,500.00	\$ 15,700.00	\$ 26,700.00	\$ 10,045.00	\$ 16,900.00	\$ 114,045.00

** LMIC's rates include all direct and indirect costs. Rates are reviewed and approved by the Dept. of Finance.