A PROPOSED
RESOURCE EXPLORATION AND ANALYSIS PROGRAM
FOR MINNESOTA

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Prepared by the State Planning Agency in cooperation with

U.S. Geological Survey
National Aeronautics and Space Administration
University of Minnesota
- Soils Department
- Center for Urban and Regional Affairs

Soil Conservation Service, U.S. Department of Agriculture
Minnesota Geological Survey
Department of Natural Resources
U.S. Forest Service, U.S. Department of Agriculture

Introduction

Minnesota's heritage of natural resources is rich and varied. Her rich soils produce food and fiber. Her hidden depths yield iron ore, building stone, sand and gravel and other potential mineral treasures. Her waters support recreation, habitat for fish and game, manufacturing, and human life. With proper management, these resources will continue to serve the needs of present and future generations.

A variety of new programs have focused attention on wise resource utilization. Land use planning, critical areas planning, coastal zone management, power plant siting, environmental assessment and impact statements in addition to many resource management programs all have a need for concise, accurate and readily available information about our resources. It has become apparent that we do not know all that we should about Minnesota's resources. While much information has been collected in the past by a wide variety of agencies, it is not always readily available, or accurate or in a format that is useful to those who need it.

As early as 1963, the Minnesota Resources Commission recognized the need for improving and accelerating the State's data collection activities. In that year, topography mapping was available for only 45% of the state and much of it was obsolete. The Minnesota Resources Commission backed a 10-year program for statewide topographic mapping which will be completed on schedule in 1975. State appropriations of $4.9 million during the 10-year period have been augmented by $5.2 million in Federal funds.

Our progress in topographic mapping is an exception, however, and for a variety of reasons, we do not have good records about some of the other important resources of the state. The scale and accuracy of soil surveys vary widely. Through Minnesota Resources Commission funding of the Soils Atlas Project in 1973, the University of Minnesota is producing the first statewide soil survey utilizing a uniform scale and soil classification system. Detailed soil surveys are available for only 1/3 of the state.

The vast majority of past geologic studies have been concentrated in the Iron Range, despite the fact that geologic data is extremely important in making decisions throughout the state for the construction of buildings, transportation facilities and utilities, underground storage, and recharge of underground acquifers which supply drinking water. The states of Illinois, Iowa, and the Dakotas have spent much more for geologic surveys than Minnesota has. This biennium, the Minnesota Geological Survey is concentrating on the collection of baseline geologic data in the 7-county Metropolitan area. Data are being taken from the logs of well drillers and over 60,000 of these logs have been reviewed. Much work needs to be done, however, in both the metro area and throughout the remainder of the State.

Statewide forest resource information is highly generalized. Public land ownership records are not organized. Despite our image as the land of 10,000 lakes, we do not have adequate records about our lakes, streams, floodplains, or wetlands.

Minnesota desparately needs to embark on a long range program designed to collect and maintain the accuracy of these data. Consequently, the State Planning Agency has consolidated many of the programs which yield resource information into a proposed Resource Exploration and Analysis Program (REAP). The Resource Exploration and Analysis Program incorporates 6 programs at this time, but can be expanded if the need arises. These programs are:

1. Topographic mapping
2. Aerial photography
3. Satellite imagery
4. Soils surveys
5. Geologic surveys
6. Forest surveys

Due to time limitations, the State Planning Agency may have overlooked some programs and will continue to evaluate the scope of REAP.

In the past, the funding requests for these individual programs have been submitted separately. Since many of the programs relate closely to one another, the State Planning Agency felt that it would be helpful to consolidate the requests into an overall package. The description of the purpose, direction and long range costs of each program will facilitate understanding and evaluation.

PROGRAM	ESTIMATED PROGRAM DURATION	ESTIMATED LONG TERM COST	FY 76-77 REQUEST	PROPOSED FUNDING SOURCE	OTHER AVAILABLE FUNDS	RECIPIENT	COMMENTS
Topographic Mapping	ongoing	$314,000 per yr.	$628,000	Gen. Revenue	$628,000 U.S.G.S.	Dept. of Adminis.	To update obsolete maps
Aerial Photography							
1. Small Scale 1:90,000 infra-red	2 yrs.	$400,000	250,000	MRC	150,000 various	SPA	Last flight in 1969. Refly every 5 yrs.
2. Intermediate Scale	ongoing	$ 50,000 per yr.	99,000	Gen. Revenue	0	DNR	For 2nd quarter of 8yr. for. survey prog.
3. Large Scale	as needed	-	60,000	Gen. Revenue	Federal	MHD	For planning specific highways.
4. Aerial Photo Plan	2 yrs.	$ 35,000	35,000	MRC	$149,000 NASA	SPA	To identify & coord. air photo needs-to train users
Satellite Imagery	ongoing	-	0	-	NASA	SPA	Research & training
Soil Mapping							
1. Generalized Soil Atlas 1:250,000	2 yrs.	$112,000	112,000	MRC	0	UM	To publish previously collected data.
2. Intermediate Soil Mapping 1:90,000	-	-	0	-	-	-	-
3. Detailed County Soil Surveys	15 yrs.	$ 7 mil. S. 7 mil. L. 11 mil. F.	280,000	MRC	$280,000 C. $1.4 mil. F.		To accelerate completion of county soil surveys.
Geologic Mapping							
1. Map Publication	2 yrs.	$114,996	78,451	MRC	$ 36,545 GR	MGS	To publish existing data
2. Collect waterwell Data	10 yrs.		109,196	MRC	$ 65,175 GR	MGS	Analyze well drillers records
3. Cu-Ni Monitoring	3-5 yrs.		70,000	MRC	$ 90,000 NSF		Monitoring system research

PROGRAM	ESTIMATED PROGRAM DURATION	ESTIMATED LONG TERM COST	FY 76-77 REQUEST	PROPOSED FUNDING SOURCE	OTHER AVAILABLE FUNDS	RECIPIENT	COMMENTS
Forest Surveys							
1. Forest Inventory	2 yrs.	-	$1,643,236	Gen. Revenue	0	DNR	For inventory of state and county forest resources
2. Forest Maps	2 yrs	-	20,000	MRC	0	SPA	To publish generalized statewide forest map

SUMMARY

Program	MRC	Gen. Rev.	Total
Topographic Mapping	0	$ 628,000	$ 628,000
Aerial Photography	$ 285,000	159,000	444,000
Satellite Imagery	0	0	0
Soils Mapping	392,000	0	392,000
Geologic Surveys	257,647	101,720	359,367
Forest Surveys	20,000	1,643,236	1,663,236
	$ 954,647	$2,531,956	$3,486,603

TOPOGRAPHIC MAPS

1. U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAPS

A. NEED FOR PROGRAM

A topographic map is a graphic representation of selected man-made and natural features of a part of the earth's surface. The distinguishing characteristic of a topographic map is its portrayal of the shape and elevation of the terrain as determined by precise engineering surveys and measurements. They show the location and shape of the hills, valleys, and plains, the network of streams and rivers, location of forests, and the principal works of man.

Standard topographic maps of the type prepared by the U.S. Geological Survey (USGS) are needed for economical and efficient land use planning. They are indispensable in planning for drainage projects, flood control projects, water supply and power developments, mining operations, site selection for industries, railways, highways, canals, airports, sewers, disposal plants, transmission lines, recreational areas, and industrial and civic developments. In addition, the maps provide a suitable base for recording geologic, soils, hydrologic and land classification data. In many areas, topographic maps are the only reliable source of information about the physical features of the landscape. At least eight state agencies maintain working files of topographic maps. At the present time, 135 copies of each new map are distributed to various public agencies and institutions throughout the state. Any project concerned with land use can be carried out more effectively and economically if accurate, modern topographic maps are available.

B. INVOLVED AGENCIES

Topographic maps are prepared completely by the USGS. In the last 10 years, Minnesota Resources Commission appropriations to the Minnesota Department of Administration have been contracted directly to USGS. State monies have been matched by federal dollars on a 50-50 basis. Priorities for mapping have been established by the State Planning Agency and its Mapping and Air Photo Advisory Committee. This Committee is composed of staff from 14 state agencies and other interested map users. Through the efforts of the Committee, and funding provided by the Minnesota Resources Commission, map coverage of the entire state is scheduled to be completed in 1976.

C. HISTORY OF FUNDING

Topographic mapping in Minnesota has been in progress for over 60 years. The program can be divided into three major eras: (1) pre-1949, (2) 1949-1963, and (3) 1964-1975.

Pre-1949

During the period prior to 1949, topographic maps were prepared for only a few widespread areas in Minnesota. The mapping was done sporadically and with little consideration for the overall needs of the State. The greater part of the mapping during this period was done entirely with federal funds supplied by the USGS. When Congress passed the Temple Act in 1925, a pattern emerged for a cooperative federal-state program of topographic mapping. However, this legislation did not result immediately in an accelerated program of topographic mapping in Minnesota. By 1949, only 45 15-minute quadrangles, equivalent to about 10.5% of the State, had been mapped. Thus, in 1949, Minnesota ranked last among the states in percentage of area covered by standard quadrangle topographic maps.

1949-1963

Acting upon the recommendation of a special study committee, as well as strong action by the Governor and several key legislators, the 1949 State Legislature created the State Mapping Advisory Board and appropriated $100,000 for the biennium to accelerate topographic mapping. A cooperative agreement on a 50-50 matching basis was entered into with the USGS. In the same year, the Iron Range Resources and Rehabilitation Commission began a similar cooperative mapping program for northeastern Minnesota with the USGS by allocating $70,000. The Iron Range Resources and Rehabilitation Commission terminated its cooperative agreement in 1962, after a total expenditure of approximately $600,000.

Despite the acceleration of mapping efforts during this second era, Minnesota still lagged behind the national average in topographic map coverage. Eighty-three 15-minute quadrangles and 258 7½-minute quadrangles were completed by 1963 covering 34.5% of the State. Including the coverage from the previous era, most of which was already obsolete, only 45.0% of the State had topographic map coverage. This compared poorly with the national average of 62.5% coverage in 1963.

1964-1975

The third topographic mapping era began with the passage of the Omnibus Natural Resources Act of 1963. This Act provided $200,000 for mapping in each year of the 1963-1964 biennium. Of this total amount, $173,000 was scheduled for topographic mapping. Furthermore, the Act provided funds for a study which resulted in a 10-year program to complete topographic mapping of the entire state.

The 10-year program was based on estimates of the total cost and the annual distribution proposed by the Regional Engineer of the USGS. Although some funding delays developed in the middle of the 10-year program, an appropriation of $1,060,000 by the Minnesota

Resources Commission in 1973 will allow the 10-year program to be completed on schedule. Over the 10 years of this third mapping era, approximately $4,900,000 of State monies were spent for topographic mapping. Of this amount, $4,600,000 was appropriated by the Minnesota Resources Commission. Without this support, Minnesota's topographic mapping program would have remained inadequate.

D. LONG RANGE PROGRAM

While statewide coverage has been attained through the 10-year accelerated program, the topographic mapping program must not end. Topographic maps have a finite lifespan. With the passage of time, these maps become obsolete or outdated. To be of maximum value, they must be revised or completely redone periodically. Experience of the USGS has shown that the standard topographic 7½-minute and 15-minute quadrangle maps should be revised on the average of about every 10 years, depending upon the extent of man's activity. In general, revisions are needed at intervals of from 5 to 10 years in urban and potential urban areas, from 10 to 15 years in farming areas, and from 15 to 25 years in grazing areas and other areas which undergo little change. Similarly, active mining areas should be revised at relatively short intervals of time. Because topographic maps are so useful by themselves and because they provide base maps for so many other resources inventory programs, a continual update program is very desirable.

The State Planning Agency has developed a computer program that sets priorities and estimates costs for topographic map revisions. Based on a 20-year revision cycle, the estimated annual cost is approximately $628,000 which would be divided equally between the State and the USGS. This figure does not account for increased costs which might result from inflation and higher wages. Nor does it include decreased cost because of technological advances in the mapping science.

E. PROPOSED FY 1976-1977 PROGRAM

Based on priorities approved by the State Planning Agency's Mapping and Air Photo Advisory Committee, the highest priority areas for mapping in the next biennium are: parts of the Twin Cities suburban fringe; the Little Falls-Swanville area; a strip from Wells to Austin; and the Crookston-Red Lake Falls area. All of these areas have not been mapped since the late 1940's and early 1950's. It is recommended that the Legislature appropriate $628,000 from the general revenue account to the Department of Administration for the 1976-1977 biennium.

AERIAL PHOTOGRAPHS

2. AERIAL PHOTOGRAPHS

A. NEED FOR PROGRAM

Aerial photos are an essential element in the total package of informational tools needed for resource management. Aerial photographs are obtained by many private and public agencies, including the mining, power and paper industries and all levels of government. They are obtained for various purposes, at different times of year, at various scales, and with different film types. Most air photos fall into three categories:

		Scale	One inch equals
Large scale photography	(most detailed)	1:30,000 to 1:12,000	.05 to .19 miles
Medium scale photography		1:15,000 to 1:40,000	.24 to .63 miles
Small scale photography	(least detailed)	1:80,000 to 1:120,000	1.26 to 1.9 miles

Large scale photography

Large scale photography in Minnesota is usually taken by the Department of Highways, to be used in determining the best location for highway construction. The flight lines are linear or strip and each photo covers a relatively small area of land. This detailed photography enables the Highway Department to map changes in elevation ranging from one to five feet and to produce a map at a scale five times larger than the scale of the photography.

Medium scale photography

There are many users of medium scale photography. Until recently, nearly all of this photography in Minnesota came from the Agricultural Stabilization and Conservation Service (ASCS) of the U.S. Department of Agriculture. Agricultural Stabilization and Conservation Service periodically contracts for aerial photography of the State's agricultural counties. In the past, most photos were taken at the scale of 1:20,000 or 1:24,000. In the last few years, photos have been purchased at scales up to 1:40,000. However, no federal funds have been allocated for flights in 1975 or 1976. Therefore, at least one year will be missed in the seven year rotation program of the U.S. Department of Agriculture.

Among many users of medium altitude photography are foresters representing both public and private interests. A substantial forest inventory is to be made in Minnesota in 1975-1976, and the success of this inventory depends upon up-to-date photography. Foresters generally prefer to use scales ranging between 1:15,000 and 1:24,000. However, because of recent improvements in air photos, studies have shown that smaller scale photos can be used for nearly all of the required work. To properly identify tree types, foresters require that the photography be taken when the leaves are on the trees and prefer that infra-red film be used. Infra-red photography is also useful in locating the occurrence of plant diseases and insect infestation. When infra-red photography is not available, however, foresters have used panchromatic photos.

Small scale photography

Small scale photography has recently come into use as a resource management tool because of recent technical improvements. Minnesota was one of the first states to contract for high altitude photos of its entire area. Statewide photos were purchased in 1969 at a scale of 1:90,000. Also purchased were a set of enlargements which are being used to make inexpensive reproductions of air photos with a standard blueprint machine. These bluelines, which are at the same scale as the 1:24,000 topographic maps, have been used by over 25 state agencies. To date, over 62,000 bluelines have been processed and distributed.

The small scale photography purchased in 1969 has proved to be a very useful tool. These photos were required to produce the 1969 state land use map. In fact, they have been used for more purposes and by more people than was originally planned. Small scale photography is an economical method of recording conditions that exist throughout the entire state at a single point in time. Despite all of the new uses, small scale photography will never eliminate the need for larger scale photos. For example, small scale photos cannot be used for much of the engineering work of the Highway Department, nor can they be used for detailed forest inventories. However, engineers, foresters, soil scientists and others have used the small scale photos for some work activities.

B. INVOLVED AGENCIES

Two principal agencies are involved with medium scale photography in Minnesota. As previously mentioned, the U.S. Department of Agriculture, has had a program for photographing the State's agricultural counties on a seven year rotation. In addition, the 1973 Legislature funded the Department of Natural Resources to begin a program to fly the forested counties on an eight year rotation. These photos are vital to the State's proposed program to inventory the State's forest resources to be discussed later.

The purchase of the small scale photos of the State was coordinated by the State Planning Agency in 1968 and 1969. Reproduction services are provided by the Minnesota Highway Department.

C. HISTORY OF FUNDING

State funds have been used to purchase photos in all three scale ranges. Large scale photos, used largely by the State for highway engineering purposes, are purchased largely with State highway funds. Some federal funds are used for work on Interstate freeways. In recent years, approximately $30,000 per year has been spent by the Highway Department for these large scale photos.

In the past, most medium scale photography has been purchased with federal funds. In addition to ASCS photos, the U.S. Forest Service, USGS, and the Bureau of Indian Affairs have all purchased photos for selected parts of the State. In recent years, the U.S. Department of Agriculture has spent over $400,000 per year for their photos; other federal agencies have purchased photos on a project-by-project basis. In 1973, the Department of Natural Resources received $80,000 of State funds for the first two years of an eight-year program to fly the forested counties of northeastern Minnesota. This program is designed to provide the air photo needs for both state and county resource managers, especially foresters. Many medium scale photos are also purchased by private industry, primarily paper, mining and power companies.

The only statewide set of small scale photos purchased in Minnesota was done with a combination of state and federal monies. State monies came from a Minnesota Resources Commission appropriation and state Highway Department funds. Federal funds included part of a Housing and Urban Development grant to the State Planning Agency and a grant to the State Planning Agency from the Upper Great Lakes Regional Commission. The total expenditure for the 1969 photos was approximately $120,000. Since that time, several state agencies have purchased additional air photos from the contractor and many state agencies have purchased the blueline air photos from the Highway Department's reproduction service.

D. LONG RANGE PROGRAM

New air photos in all three scales will be required on a continual basis. Large scale photos, used primarily for engineering works, will continue to be purchased on a project-by-project basis. There is no alternative way of obtaining required data without tremendous increases in costs.

While the purchase of medium scale air photos will require a continual program, this does not mean that the State will have to continue purchasing exactly the same kinds of photos. Because of great improvements in air photo technology, the smaller scale photography of today can be used to perform the same jobs as larger scale photos of 10 to 20 years ago. As has been previously stated, the U.S. Department of Agriculture has already changed to a smaller scale photography for their agricultural lands investigations.

The State will continue to be involved in two major medium scale air photo programs. If the U.S. Department of Agriculture air photo program is re-instated, coverage of the two-thirds of the State will be available to serve the needs of most users. If this program is not continued, the State may have to begin a program to maintain usable coverage. In the northern portion of the State, air photos are vital for proper management of the State's forests. A program is underway to obtain the required coverage and it is recommended that this program be continued on some rotational basis.

It is the recommendation of the State Planning Agency and its Mapping and Air Photo Advisory Committee, that the state be reflown with small scale photography on a 5-year interval. It is desirable that every other flight coincide with the national population census. Investigations by users of the 1969 flight have shown that the useful life of the photos is approximately 5 years.

The long range cost of an air photo program is more difficult to predict than most other programs. This is because most photos are purchased from contractors who are faced with extremely variable production costs and work loads. However, it is possible to estimate costs for the near future. In recent years, the Highway Department has spent about $30,000 for large scale air photos. It is likely that similar costs will continue, barring no major increase in highway programs.

For the 1974-1975 biennium, the Department of Natural Resources spent $80,000 for one-fourth of an eight-year program for medium scale photos in northern Minnesota. If there are no major changes in photo requirements, these costs will continue. If the U.S. Department of Agriculture decided to abandon its air photo program, the State may be faced with flying the entire State with medium scale photography if coverage is to be maintained.

Preliminary costs estimates in 1974 for a reflight of the State with small scale photography is about $400,000. The actual cost will not be known until the bids are in.

E. PROPOSED FY 1976-1977 PROGRAM

The 1976-1977 proposal is in three parts. First, the Highway Department request for large scale photos will be contained in their regular budget and is expected to continue at the present rate of $30,000 per year.

Second, the Department of Natural Resources will request funding for the second quarter of their eight-year program in northern Minnesota from the general revenue account. The request includes $46,000 for FY 1976 and $53,000 for FY 1977.

Third, the State Planning Agency has two requests:

1. $400,000 for statewide small scale photography. This photography will utilize infra-red film and will be taken under leaf-off conditions in spring or fall, depending on weather conditions. If the Minnesota Resources Commission appropriates $250,000, the State Planning Agency will seek supplemental funds from a variety of potential sources to complete the $400,000 funding package. The appropriation will also allow the products of this flight to be made available to all public agencies at reduced costs. This privilege applied only to State agencies under the present (1969) contract.

2. $35,000 for the preparation of a long-range aerial photo plan. This two-year study would include: (a) an inventory of all existing photos in State ownership and privately owned photos accessible to the public; (b) a published report showing the data discovered in the inventory; (c) a determination of the statewide need for medium scale photography; and (d) training sessions for State and local officials for using the increasingly diverse and sophisticated types of new photographic techniques. These training sessions would be held in conjunction with a similar training program in the use of satellite imagery which probably will be funded by the State Planning Agency via a grant from National Aeronautics and Space Administration.

SATELLITE IMAGERY

3. SATELLITE IMAGERY

A. NEED FOR PROGRAM

For several years, the ERTS-1 satellite has been orbiting the earth transmitting images of the U.S. on an eighteen day rotation. The Minnesota portion of the U.S. is covered by the images taken from five consecutive days in the rotation. Thus, ERTS satellite imagery is a source of periodic data which supplements existing data. The National Aeronautics and Space Administration (NASA) granted funds to researchers to investigate the applications of ERTS imagery. The Minnesota State Planning Agency received one of these grants in 1971 and will be awarded a second grant in December 1974.

There are two different needs for ERTS program funding. The first is to determine what can or cannot be detected from the imagery. The second need is to disseminate the information to those persons in the planning and resource management fields in Minnesota, so that the available information will be put to use where it is needed.

The application of ERTS-1 imagery has been demonstrated by several studies in Minnesota. First, ERTS imagery, when coupled with recent topographic maps, has proven to be valuable for the seasonal analysis of water resources, including water level changes. The quality of resultant water maps are excellent. Second, spring images have proven useful for the low-cost analysis of the amount of cover-free land during the winter months to determine wildlife habitat conditions. Third, ERTS-1 has been used for monitoring the progress of open pit mining and mineland reclamation activities over large areas. Finally, some potential for determining land use and water quality has been demonstrated. The major attribute of the ERTS system is the low cost availability of data during all seasons of the year which is not economically feasible with other data sources.

B. INVOLVED AGENCIES

The State Planning Agency, through contract with the University of Minnesota conducted the investigations into what can be seen on the images and for this reason is likely to be involved in future projects that use ERTS images. Since it is charged with coordination of planning programs, State Planning Agency will be involved in monitoring the results of all ERTS related programs.

C. HISTORY OF FUNDING

The Minnesota State Planning Agency received a two-year $108,000 grant (ending December 31, 1974) from NASA to determine, among other things, what types of land uses can be detected by ERTS imagery. The State Planning Agency contracted with the University of Minnesota, Center for Urban and Regional Affairs, to supply technical staff for the research.

To date, all research has been conducted with federal funds. However, employees of several state agencies have spent time reviewing the findings of the research. Inter-agency cooperation is expected to increase with the work of the seconde NASA grant.

D. LONG RANGE PROGRAM

The development of long range goals for using ERTS imagery is dependent on the longevity of the entire ERTS program including the current satellite. National Aeronautics and Space Administration expects to launch a new satellite in 1975. Since it is not known how long the ERTS program will continue, due to federal funding cuts, no long range plans or costs have been drawn up at this time.

E. PROPOSED FY 1976-1977 PROGRAM

A twenty-one month contract (starting January 1, 1975) with the State Planning Agency has been approved by NASA. The grant request for the twenty-one month contract is approximately $149,000 -- all federal funds. The monies from this second contract will be used to present the results from the first contract (what can be seen on ERTS imagery) to state and local officials and planners. They will be shown how ERTS imagery can be used to assist in solving their planning and management problems.

SOILS DATA

4. SOILS DATA

A. NEED FOR PROGRAM

Soil maps are inventories of soil resources. Soils data is needed by farmers and foresters to determine the capability of the soil to produce food or wood crops, to determine necessary soil and water conservation practices, and to determine what fertilizers are needed to maintain the nutrient levels in the soil. Designers and builders must understand soil characteristics to choose housing and commercial development sites free from soil absorption, foundation or settling problems. Avoidance of these building problems will reduce the cost of the construction both in terms of dollars and environmental impact. Ecologists and planners need soils information to plan for wise and orderly land use, resource management and conservation of soil and water resources. Assessors and appraisers use soil characteristics to make more equitable valuations for forest and cropland. Health officials need soils data to determine the limitations of soil for septic tank filter fields and sanitary landfills.

Soils mapping is dependent upon other data sources in the Resource Exploration and Analysis Program (REAP). Soil scientists use air photos as an aid in the delineation and interpretation of soil types; and as base maps for published soil surveys. Any improvements in aerial photography will directly benefit the soil mapping programs. The soil mapping program also benefits from the State's well log data collection program, as it results in soil samples for analysis. Locational information, taken from topographic maps, is used in the creation of the finished soils maps.

Soil mapping occurs at three different levels in Minnesota. Each is undertaken with a different degree of detail and at a different scale.

Level of Soil Survey	Approximate Number of Soil Classifications	Minimum Area Shown	Cost Per Acre	Publication Scale
Detailed County Soil Surveys	500 soil series	2 to 3 acres	60 to 75¢ per acre	1:20,000 for most parts of the state
Intermediate Regional Soil Mapping	200 soil associations	40 acres		1:62,500
Generalized Soil Atlas Projects (11 sheets)	40 soil landscape units	400-640 acres	1¢ acre direct cost	1:250,000

B. INVOLVED AGENCIES

The most detailed soil maps are County Soil Surveys, prepared cooperatively by the Soil Conservation Service, U.S. Department of Agriculture, the University of Minnesota Agricultural Extension Service, and the Minnesota Agricultural Experiment Station.

An intermediate level of detail between the County Soil Survey Maps and the Soil Atlas Project is the regional soils mapping program undertaken by the Arrowhead Regional Development Commission in 1973. These maps were prepared by the Soil Conservation Service at a scale of 1:90,000 (1 inch = 1.4 miles) on a trial basis.

The most generalized program of soils mapping, the Minnesota Soils Atlas Project, is being conducted by the University of Minnesota Soils Science Department in cooperation with the Soil Conservation Service. In this series, Minnesota is divided into 11 geographical areas. Maps of the areas are on a scale of 1:250,000 or ¼ inch to 1 mile.

C. FUNDING HISTORY

Detailed County Soil Surveys have been produced in Minnesota since the early 1900's. In 1974, $896,000 was spent on the County Soil Surveys program. Of this amount, $650,000 was federal, $104,000 was State (University of Minnesota) and $142,000 was local. Despite substantial funding in recent years, only one-third of the counties in Minnesota have adequate detailed Soil Surveys. This represents 19 million acres of Minnesota's 51.2 million acres.

In 1973, the Arrowhead Regional Development Commission (ARDC) contracted with the U.S. Department of Agriculture, Soil Conservation Service to prepare a Regional soil survey. This survey was more detailed than the Atlas series, but less detailed than County Soil Surveys would be. The regional survey cost $17,435 and covered slightly over 11 million acres. The ARDC financed $8,717 of this amount, while the federal government contributed the remainder.

Since FY 1968, the Minnesota Resources Commission has spent $188,000 for the State Soil Atlas series. In addition, the State Planning Agency contributed $65,000 of land use planning money during FY 1973-1974. This money has been used to collect generalized soils data for the entire State and publish three of eleven sheets required to cover the State.

D. LONG RANGE PROGRAM

A program to obtain County Soil Surveys for the remaining two-thirds of the State (32 million acres) has been prepared by State and federal soils agencies. Under this $25 million program, over $10.7 million has been committed by various federal agencies. Thus, over $14 million will be needed from non-federal sources. In the past, this cost has been born by the counties. However, it is the feeling of the State Planning Agency that this data is of interest to the State, as well as the counties. Therefore, several options are available:

1. No acceleration - the present funding ratio of 50% federal, 50% county could be continued. At the present rate of funding, it will be the year 2007 before statewide coverage is attained.

2. State acceleration - State monies would be used to match the county monies on a 50-50 basis. This approach would require $280,000 in the 1976-1977 biennium and $7,045,000 over a 15 year period.

3. Full State funding - State monies would be used to pay the total non-federal cost of $14,090,000. Some economies could be achieved under this system because the State could set priorities to map by large areas of uniform soils rather than by county boundaries.

There is no long range plan for continuing the regional soils survey program. Should the accelerated County Soil Survey be delayed, this program may have to be re-evaluated.

With an appropriation of approximately $112,000, the State Soils Atlas series could be completed. This money would be used to publish the remaining eight sheets of the series. No additional funding would be required to continue this generalized soils inventory because more detailed data will be provided by the County Soil Surveys or a statewide regional soils mapping program.

E. PROPOSED FY 1976-1977 PROGRAM

In the 1976-1977 biennium, it is proposed that the State begin the accelerated County Soil Surveys program to be published at a scale of 1:24,000. Initially, the work would involve organizing and publishing previously collected data, plus some acceleration of new data collection. This first biennium would be used to "gear-up" for larger work efforts in future bienniums.

To begin the accelerated County Soil Survey program, the State should first decide on the method of acceleration. If the State is to match local monies on a 50-50, county-by-county basis, $280,000 should be appropriated for FY 1976-1977. If 100% State monies are made available, then $560,000 should be appropriated for the biennium. During the biennium, a study would be made to determine the costs of a 10 versus a 15-year acceleration program. Priority would be given to counties with major urban development, major lakeshore development, potential soil erosion problems and those counties planning to use soils data for tax assessment purposes.

Also in the 1976-1977 biennium, it is proposed that $111,650 be appropriated by the Minnesota Resources Commission to complete the publication of the State Soil Atlas series data previously collected. At the end of the biennium, modern generalized soil maps would be available for the entire state for the first time in history.

GEOLOGIC SURVEYS

5. GEOLOGIC SURVEYS

There are two primary concerns in a ten-year plan for the Minnesota Geological Survey. One is to identify the jobs that need doing now and develop specific programs to accomplish them. The other is to build a sound professional organization with a basic program to respond effectively and creatively to needs and pressures that will emerge during the coming decade, for it is certain that by 1984 we will be a different kind of organization doing a different kind of geology. The visible present needs for geological information are substantial and specific. The shape of change ahead can be perceived only in broader outlines, but we can foresee with some assurance the directions in which we should move.

The first priority is to publish work that has been completed so that it may be useful to the citizens of the State, and the second is to carry through to completion work that has already been started. Figure 1 shows the status of the 1:250,000 scale geological and geophysical map atlas of the State, started almost a decade ago. Of the 33 maps comprising the atlas, 6 have been published, the geological and geophysical work has been completed on 10, and it is proposed that they be published in the next fiscal year. One additional sheet is scheduled for completion in the next biennium. The pending budget request for the Geological Survey will allow a start to be made on 4 additional sheets if the funds are appropriated. Thus this project will pass its half-way point within the coming biennium.

It is to be hoped that work can be accelerated so that the second half of the atlas will not require another decade, but this highlights an increasingly insistent and critical need with respect to the investigative capabilities of

the Minnesota Geological Survey. Because of the heavy soil cover and the thickness and complexity of glacial deposits over most of the State, a great deal of subsurface information is needed for adequate geologic mapping. This information must be obtained by drilling and its value can be greatly extended by geophysics. The Minnesota Geological Survey has never had this capability, but it has now reached the point where this must be built into the organization of the Survey if further progress is going to be made in most areas of the State. Soils mapping throughout the State routinely uses portable drilling equipment, and it is no less needed by geologists.

Funds requested for subsurface capability were eliminated in the University administrative review of the Geological Survey budget. Pending restoration of such funds, advantage may be taken of the many thousands of waterwells that have been drilled throughout the State for which usable drillers' logs may be obtained, and a proposal for such a program has been submitted to MRC. It would be well to wait until this information has been collected and compiled before proceeding with 1:250,000 surficial and bedrock geologic maps in the heavily drift covered western half of the State.

Geologic mapping at quadrangle scales has been carried out mainly in the northeastern triangle of the State where many of the critical bedrock relationships are exposed. 24 completed quadrangle maps await publication. It is only by thorough field mapping in well-exposed areas to identify and describe significant rock formations and critical relationships that interpretations can be made of the buried geology underlying most of the rest of the State. Contrary to what seems to be general opinion, mapping in northern Minnesota has had little or nothing to do with the private development of the iron ore resources of the State, but in recent years the renewed interest in the occurrence of copper-nickel sulfides in the basal zone of the Duluth Complex as well as close analogies

between the so-called greenstone belts in northern Minnesota and the geological settings of a number of major Canadian mining districts has made the thorough, detailed bedrock geologic mapping of all well-exposed Precambrian areas in Minnesota important. This is our window through the glacial drift into the Precambrian host rocks and we must exploit it to the fullest extent if we are to make it at all possible to carry mineral resource exploration out into the western and central parts of the State. The rapid deterioration of the mineral resource position of the United States is sure to stimulate interest in subsurface exploration in Minnesota wherever geologic mapping can provide some clue to the potential existence of conditions favorable for mineralization. Again this highlights the critical need for drilling and geophysical capabilities in the Geological Survey--not to search for mineral deposits as such, but to establish the necessary geological basis for exploration.

The impending development of very large, low-grade copper-nickel sulfide bodies in the basal zone of the Duluth Complex presents environmental as well as geological, mineralogical and metallurgical problems. Both the bedrock and the surficial geology must be thoroughly known to adequately investigate and monitor the potential environmental impacts. The Minnesota Geological Survey has already started bedrock and surficial geologic mapping in the Kawishiwi River area. Funds provided in the pending budget request will cover continuation at a very modest level. Matching funds have been requested from MRC for a major proposal in the process of submittal to the National Science Foundation.

The preceeding discussion has dealt with the general State mapping program and with the mineral resource oriented aspects of geology. These obviously concern geological survey programs, but it has led to an aspect of the changing needs and values of society that actually has influenced the Minnesota Geological

Survey program more in the last two years than anything else and will continue to be the major influence on our program development during the coming decade. This is the growing awareness, now becoming embodied in law, of the need to evaluate, monitor, plan and manage man's impacts on the environment. Substantially more than half of our total resources both in our own budget and in grants and contracts during the current biennium has been devoted to studies primarily related to environmental problems and land and water resources. These include compilation of geology related to planning in the Twin Cities area, the development of a computerized waterwell data acquisition system, studies of the geological conditions affecting water supplies and pollution in the Rochester-Olmsted area, studies of sanitary landfill and water pollution problems in cooperation with the State Pollution Control Agency, the Twin Cities Metropolitan Council and out-state local planning organizations.

Growth in these applications of geology to social needs again points to changes in the techniques of geological investigations. Again capability to perform subsurface investigations will become increasingly critical. Geochemical investigations will become important. The most glaring deficiency in the staff of the Minnesota Geological Survey must be filled, hopefully in our request for the next biennium. This is the field of surficial and glacial geology. It should only suffice to point out that Minnesota, which is perhaps the most heavily glaciated state in the United States and is about 90% covered with glacial drift and other surficial deposits, has no up-to-date, reliable state surficial geologic map, even at a scale of 1:1,000,000. Only one of eleven 1:250,000 surficial geology sheets is near completion. Most of the surface and groundwater resources of Minnesota and most of our environmental problems are intimately related to the glacial geology of the State.

The key to an effective, useful geological program for the State is the development of an effective, talented organization. To build such an organization in a scientific and technical field, one must be able to offer stable, professionally rewarding careers to first-rate scientists. The geology of Minnesota is rich enough, both in its scientific interest and the resources to which it relates, to offer such careers to a solid nucleus of professionals. Such an organization cannot be built on a flimsy structure of short-term grants and contracts. Grantsmanship, even if it is successful, is not a basis on which to attract highly qualified personnel or retain them as they are developed, nor does it provide a sound basis for planning and program development. Programs become dependent on the availability of money and not on well thought-out long-range goals. A glance at the present budget of the Minnesota Geological Survey (Figure 3) shows that it is perilously close to typifying this description. Funds appropriated in the University budget left a deficit of $26,872 after basic staff salaries and fringe benefits. This deficit was made up and operating funds were provided by 13 different grants and contracts, accounting for more than half of the total budget. Essentially the entire program of the Minnesota Geological Survey was determined by such ad hoc funding.

Consequently the primary ultimate goal of the Minnesota Geological Survey is to establish the basic staff and operating budget that the State of Minnesota should have for an effective geological survey. On this foundation, other outside-funded programs may be safely built. During the past year the Minnesota Geological Survey presented a very detailed analysis of its organizational needs to the Regents of the University. The budget to establish this organization was accepted in principle, but it called for an increase of 372.7 percent, and in view of heavy pressures on the University budget, a substantially lower request is incorporated in the present University budget. Figure 2 summarizes the structure of

the organization as proposed to the University and shows how present and projected staff relate to it.

At its current level of operations the Minnesota Geological Survey employs a regular staff of 12 people, representing 11.5 full-time equivalents. Nine graduate research assistants are employed, representing 3.98 full-time equivalents. Ten undergraduate assistants are employed on an hourly basis, representing 4.26 F.T.E. Altogether this comprises a payroll of 31 people, representing 19.74 F.T.E. The full-time professional staff, which we believe the Minnesota Geological Survey should build, comprises 25 full-time equivalents with operating funds which would allow for the employment of an additional 8 F.T.E. faculty and graduate research assistants and 6 F.T.E. hourly student help and labor.

Figure 4 shows a projected budget based on the current University budget request for the next biennium and funds requested in the proposals made to MRC. The budget is shown for one fiscal year and would be essentially doubled for the biennium. The projects proposed to MRC are essentially non-recurring and the temporary staff required for them will be mainly faculty and student researchers from universities and colleges within the State--a mode of operation which the Survey uses wherever possible.

Figure 5 shows a projected budget for full staffing of the organization portrayed in Figure 2. Significant non-recurring investment costs are involved to provide the equipment needed for subsurface investigations. The operating budget is a substantial but not overwhelming increase over present levels. Projected budgets in relation to present funding are summarized in Figure 6.

Figure 1

GEOLOGICAL AND GEOPHYSICAL MAP ATLAS OF MINNESOTA

1:250,000 Scale (11 Sheets)

STATUS

Type of Map	Not Started	In Progress	Publication Proposed	Published
Gravity (Simple Bouguer) 2-mile grid	International Falls St. Cloud St. Paul		Bemidji Brainerd Duluth Stillwater New Ulm	Roseau Hibbing Two Harbors
Number	3	0	5	3
Bedrock Geology	Bemidji Brainerd *St. Cloud	*Stillwater	Roseau International Falls Two Harbors Duluth	Hibbing New Ulm St. Paul
Number	3	1	4	3
Surficial Geology	Roseau International Falls *Two Harbors *Bemidji Hibbing Brainerd Duluth St. Cloud *Stillwater St. Paul		New Ulm	
Number	10	0	1	0
Summary of 33 Sheets	16	1	10	6

*Start budgeted for next biennium (4)

*Completion budgeted, next biennium (1)

Figure 2

PROJECTED TABLE OF ORGANIZATION

	1973-75 Permanent Staff as Now Funded	Rank	Present Unfunded Permanent Staff	1975-77 Staff Additions funded in Biennial Budget Request	1977-79 Future Staff Additio
Director					
Planning, Administration, Supervision, Review	Matt Walton, PhD	Professor			
Professional Geologists & other Technical Personnel					
Precambrian Geology, Principal Geologist					
Bedrock mapping, metallic mineral resources	G.B. Morey, PhD	Assoc. Prof.			
Stratigraphic geology, Principal Geologist					
Bedrock mapping, industrial mineral resources	J. Mossler, PhD	Research Assoc.			
Quaternary geology, Principal Geologist					
Surficial mapping, soils coordination	----------				
Hydrogeology				Senior Scientist	
Subsurface geology, groundwater, pollution					
Principal Geologist					
Geologist	----------				
Assistant Geologist	----------	Scientist	B. Olsen	B. Olsen	Sen.Scie
Assistant Geologist	----------	Asst Sci.	B. Bloomgren	B. Bloomgren	
Environmental Geology	----------				
Urban & industrial problems, landuse, planning					Asst. Sci
Principal Environmental Geologist					
Principal Engineering Geologist	W. Parham, PhD	Assoc.Prof.			
Geophysics & Subsurface Investigation	R. Hogberg, M.S.	Res.Assoc.			
Investigations in support of above programs					
Principal Geophysicist					
Master technician-driller	----------				
Geochemistry	----------				Senior Sc
Investigations in support of above programs					Master tec
Principal Geochemist					
Master Technician--chemistry, mineralogy	P. Weiblen, PhD	1/2FTE,Assoc.Prof.			1/2FTE Sen
Computer systems	----------				Master tech
Data processing, modeling					
Principal Systems Scientist	----------				Senior Sci

(continued)

Figure 2 (continued)

	1973-75 Permanent Staff as Now Funded	Rank	Present Unfunded Permanent Staff	1975-77 Staff Additions Funded in Biennial Budget Request	1977-79 Future Staff Additions
Professional Geologists & other Technical Personnel (continued)					
Publication & Education					
Technical editing, educational materials, graphics					
Editor	----------			Technical Editor	
Assistant Editor	----------				Asst Editor
Cartographer	----------				Cartographer
Draftsman	----------		R. Darling	R. Darling	
Total Professional & Technical, F.T.E. (19)	5.5		3	2 additional	8.5
Administrative, Secretarial, Clerical					
Administrative Assistant	----------				Admin Asst
Principal Secretary	N. Balaban				
Secretary	----------		S. Brown	Secretary	
Secretary	----------			Secretary	
Clerk-typist	----------				Clerk-typist
Publication Sales & Distribution	S. Brostrom				
Total Administrative, F.T.E. (6)	2		1	1 additional	2
TOTAL FULL-TIME STAFF, 25	7.5		4	3 additional	10.5

Figure 3

BUDGET SUMMARY, F.Y. 1974-5

A. University Budget Funds:		
1. State Special	124,647	
2. Geology Dept. "0100"	25,375	
B. Total Appropriation		150,022
C. Salaries & Fringe Benefits		
1. Funded permanent staff	133,735	
2. Unfunded permanent staff	43,179	
D. Total Salaries & Fringes		176,914
E. Funding for Operations (B-D (Deficit)		(26,872)
F. Net Funds from Grants & Contracts*		160,342
G. Available Operating Funds (E + F)		133,450
H. Total Budget (B + F)		310,364

*Summary of Grants, Contracts & Committed Funds

U.S. Bureau of Mines G0244005	24,968
U.S. Bureau of Mines G0144126	15,778
U.S. Geological Survey G-128	22,964
U.S. Geological Survey, Ely Area	4,481
U.S. Geological Survey, Twin Cities (committed)	20,000
U.S.D.A., Soil Conservation Service G-27SCS-00121	6,500
U.S. NASA	6,000
State Planning Agency	30,606
Dept. of Natural Resources (Cu-Ni) (committed)	16,000
Dept. of Natural Resources (IRRRC) (committed)	10,000
Rochester-Olmsted Council of Governments	24,458
Southeastern Minnesota Area Planning Organization	500
Twin Cities Metropolitan Council (Washington Co.)	1,000
TOTAL	183,255
U of M Indirect Costs	33,913
NET	160,342

Figure 4

PROJECTED BUDGET SUMMARY, F.Y. 1975-6

A.	University Budget Request	299,647	299,647
B.	Salaries & Fringes, Permanent Staff	226,154	
C.	Funding for Operations (A - B)	73,493	
D.	Estimated Minimum Operating Expense	57,000	
E.	Operating Reserve & Contingency (C - D)	16,493	
F.	MRC Project Requests (1/2 biennium)		
	Publication of Maps	39,226	
	Waterwell Data	54,598	
	Cu-Ni Monitoring Research	35,000	
G.	Total Request (1/2 biennium)		128,824
H.	Total Projected 1-year Budget Appropriation (A + G)		428,471

Figure 5

PROJECTED BUDGET FOR FULLY STAFFED SURVEY, ONE YEAR

A.	Total Salaries & Fringes for Permanent Staff	$364,484
B.	Student and Faculty Research Assistants and Hourly Help	109,728
C.	Supplies, Expenses and Minor Equipment	117,272
D.	Total Operating Budget	591,484
E.	Non-recurring Major Equipment Costs:	
	Drilling, Geophysics and Geochemical	100,000

Figure 6

ANNUAL BUDGETS

Fiscal Year	Direct Funding	Grants & Contracts	Operating Budget	Major Non-recurring Capital Cost
Present 1974-75	150,022	160,342	310,364	----------
Requested 1975-76	299,647	128,824 (1)	428,471	----------
Requested 1976-77	(essentially the same for second year of biennium)			
Projected 1977-78	591,484	(2)	591,484	100,000 (3)

(1) It is anticipated that additional grants may be obtained. At present substantial grants are under discussion with NSF and the U.S. Geological Survey, but formal submittals have not yet been made.

(2) Grants to accelerate key projects will continue to be sought, especially where the research capabilities of students and faculties at State educational institutions can be brought to bear through Survey management and direction.

(3) If the staff and operating budget to use the equipment covered by this item can be regularly funded, a future request to MRC for this capital cost may be appropriate.

FOREST SURVEYS

6. FOREST SURVEYS

A. NEED FOR PROGRAM

There has been a steady increase in the uses and demands placed on the State's forested lands. These increased pressures have resulted in the need for more intensive management of forested areas, especially publicly owned forests. Foresters must conduct periodic inventories of existing forest cover to determine the type of species that are growing, the size of the trees and the density of the stand. By correlating various factors, foresters are able to determine the species of trees that will grow most successfully under certain conditions.

A variety of survey techniques are required for determining type size and density. For type, the foresters most important tool is adequate air photos. With photos, untold hours of field work have been eliminated. Size and density are determined by field surveys.

Good base maps are required for plotting field data and the USGS topographic maps are often used. Soils surveys are an aid in determining the rate of tree growth. Unfortunately, good soils data are not always available.

B. INVOLVED AGENCIES

Data on Minnesota's forests are gathered by the public and the private sectors. The federal government collects generalized data on a statewide basis at the North Central Forest Experiment Station in St. Paul every 10 years. The Station also collects detailed data for the Superior and Chippewa National Forests and the Bureau of Indian Affairs. The Department of Natural Resources collects data for timber production in state forests and timber management in state recreational and wildlife areas. County and municipal governments collect forestry data for the lands they manage. In the private sector, the pulp and paper, mining, power and railroad industries collect forestry data on the lands they manage.

While many people are collecting forestry data, it is difficult to obtain a statewide picture of forest cover. Data are collected at different scales, using different classification systems, and stored in non-compatible formats.

C. FUNDING HISTORY

Statewide inventories of Minnesota's forest resources were made in 1896, 1936, 1946 and 1960.

During the 1972-1973 biennium, the Department of Natural Resources received $323,000 for inventorying forest resources on state and county tax forfeited lands. In 1974-1975, the Department received $734,000.

D. LONG RANGE PROGRAM

Between 1974 and 1977, the North Central Forest Experiment Station, U.S. Forest Service will collect generalized forest data for the entire State. This type of inventory will be repeated on a ten-year basis. The Department of Natural Resources and the State Planning Agency are assisting in this effort which will result in the most detailed statewide survey ever done in Minnesota and possibly in the nation. Generalized forest cover data will be collected statewide and over 10,460 permanent test plots will be examined in detail. From this study, the State will obtain a clearer picture of its forest resources, forest growth, desirable cut, and projections of growth versus cut.

The Department of Natural Resources will continue to need more detailed information at specific locations to aid in managing the State forests. Therefore, the Department of Natural Resources is beginning an accelerated program to collect detailed forest data. This program includes: detailed species and volume inventories, projections of cutting needs, plans for forest management, and a capitol development plan.

The Department of Natural Resources has estimated that present forest inventory activities will have to be doubled just to keep pace with data needs. In recent years, about $400,000 per year has been spent on forest inventories. Thus, the State may have to spend upwards of $1 million per year for forest inventories and management planning.

E. PROPOSED 1976-1977 PROGRAM

The Department of Natural Resources is requesting $1,643,236 for forest inventories and $99,000 to continue an 8-year aerial photography program for forested counties of the State. This program was started in 1973.

Of the $1,643,236, the Department of Natural Resources will use $820,000 to improve the accuracy of the generalized forest survey of the U.S. Forest Service. State funds will be used in 4,660 permanent test plots that are located on 6.6 million acres of state-owned and county tax forfeited land. $823,236 will be used to accelerate the collection of detailed forestry data on state and county managed lands.

The State Planning Agency requests $20,000 to publish a generalized forest cover map of the State at the same scale as the map of 1969 land use patterns. The State Planning Agency would utilize the data of the North Central Forest Experiment Station, U.S. Forest Service.

OTHER RESOURCE INFORMATION NEEDS

7. OTHER RESOURCE INFORMATION NEEDS

In the previous six sections we have reviewed those resource information programs in which the State Planning Agency has had involvement. There are many other resource data areas, however, which should have increased inter-agency coordination.

As time and budget allow investigations are being conducted by the State Planning Agency on the following topics:

Water Resource Information -- Organize data for quality and quantity of ground and surface water and to identify and define the state's watersheds. The Department of Natural Resources is requesting $250,000 of general revenue funds to begin the design of a state-wide water resources information system as they were directed to do by the past Legislature.

Historic and Archeological Sites -- Prepare a statewide inventory. This work has been initiated by the State Historical Society.

Public Land Ownership -- Prepare a continually updated inventory. The Department of Natural Resources will expand their files to include all public lands in the state.

Land Management Plans -- Prepare and coordinate the plans for land management such as state parks, forests, wildlife management areas, highway lands, and other large blocks of state land.

Climatic Data -- Systematize information on climatic data that is collected in several programs under the State Climatologist. The Department of Natural Resources is requesting funds to begin this program.

All of these programs are dependent upon the adoption of standard classification and recording systems such as geocoding, management area codes, and any other classification schemes that may make information usable to a larger group of users.