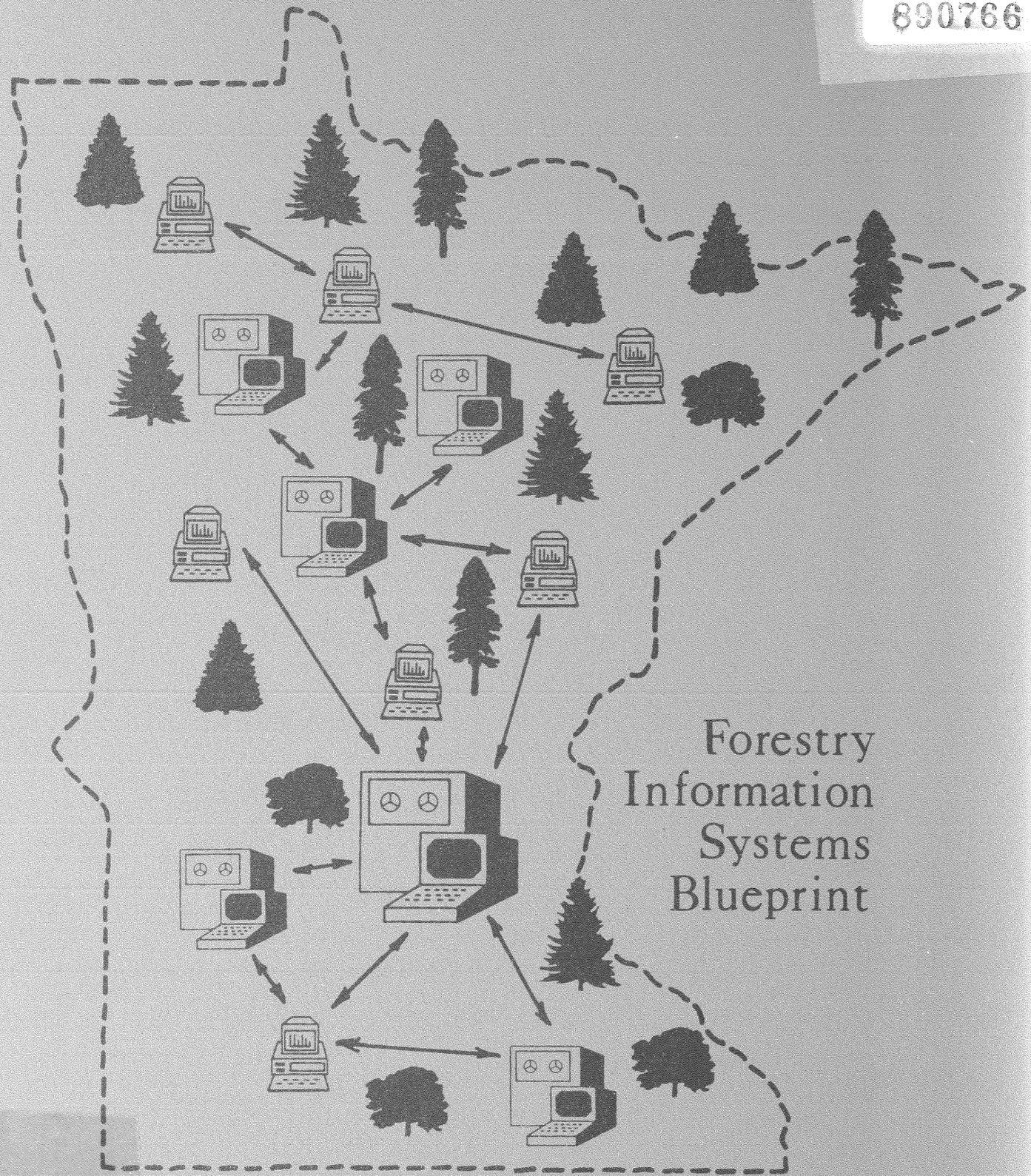

Forestry Information Systems Blueprint

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Technical Document

October 1989

Minnesota Department of Natural Resources

Division of Forestry

St. Paul, MN

Forestry Information Systems Blueprint

Technical Document Outline

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Forestry Information Systems Blueprint

1. Introduction

Background

The Division of Forestry received funding from the Legislative Commission on Minnesota Resources (LCMR) to establish and operate its own computerized management information systems (MIS) in 1981. Prior to that time the Division had relied entirely on other agencies to meet its automated data processing needs. Another LCMR project allowed the Division to install a Geographic Information System (GIS) to automate mapping and data processing for the forest inventory in 1985. The MIS and GIS minicomputers and over 100 personal computers (PCs) are currently operated by the Division. Twelve employees are assigned to the MIS and GIS units. The information systems staff have developed and maintain applications to support the Division's efforts in fire management, timber sales, timber management, forest inventory, personnel management, and other activities.

The Division prepared its first information systems plan in 1982. A review draft of an updated MIS plan was prepared in 1986. However, before the plan was finalized a staff reorganization resulted in the joining of the Inventory, GIS, and MIS units. In early 1988 the Division's managers recognized the need to complete a major update of the MIS plan. Factors pointing to the need for a new plan included:

- Computer capacity problems resulting in delays in accomplishing conversion of hand drawn inventory maps
- The greatly expanded interest in using GIS to support a variety of Division programs
- The increasing age of the Division's minicomputers
- The difficulty in maintaining coordination and standards as result of the increased use of personal computers
- The lack of progress in integrating the Division's databases
- The difficulty in developing new applications in a timely manner
- The desire to design an effective staff structure in the combined MIS/GIS unit
- The creation of the Information Policy Office (IPO) and the associated information systems planning requirements

The Division contacted the State Planning Agency's Land Management Information Center (LMIC) for possible assistance in a systems planning project. LMIC had experience in designing and operating a GIS and had been involved in the development of St. Louis County's Resource Management Information System. The Blueprint Project proposal was developed and presented to the Director's Management Team (DMT) in May 1988. The DMT agreed to sponsor the project.

LMIC provided a staff member to serve as the Blueprint Project Leader through a mobility assignment to the Division. The Division also provided one staff member to work full time on the project. A ten member Blueprint Project Committee (Appendix A) was appointed to assist in setting direction, provide input, review findings and recommendations, and to maintain communication with the rest of the Division.

Project Purpose

The purpose of the Forestry Information Systems Blueprint Project is to provide a plan for the future development of the Division of Forestry's information systems.

Project Process

The Blueprint Project was initiated with a series of meetings to explain the project to Division employees and other groups. Blueprint staff and committee members attended Region and Area meetings to establish two way communication between the project team and Division employees. The project team has worked to maintain communication through regular presentations at DMT meetings, articles in *Roots*, and distribution of committee minutes and working papers.

The committee then worked to refine the project scope and procedures. A project goal was established and consensus was reached on guiding principles and desirable characteristics for future information systems.

A baseline analysis of the existing information systems was completed. This involved documenting existing hardware, software, applications, and databases. MIS and GIS staff provided the necessary information about the minicomputers and their use. An inventory of all PC hardware and software was completed. Flowcharts were developed showing the information flows and forms used in the Division's major activities.

The needs assessment phase of the project was designed to judge the level of satisfaction with existing systems and to identify specific information needs that were not being met. A needs assessment questionnaire was developed. Interviews were conducted with 43 Division employees representing all job classifications, geographic locations, and programs in the Division. The questionnaire was also sent to all employees who were not interviewed so that they could provide input to the needs assessment if they desired to do so. A written summary of each interview was prepared. The committee synthesized the results of the interviews for use in developing the information systems blueprint.

The committee then developed a conceptual framework for the Division's information systems. Five work groups were established to begin developing recommendations for future systems development and use. The work group topics were:

- Systems development policies and procedures
- Communication about information management activities
- Data standards
- Describing applications or system modules
- Hardware, software, and staffing

The work group specifications and recommendations were discussed and modified to form the basis of the Blueprint.

The last step in the Blueprint Project was to develop an implementation plan that recommends steps that should be taken to improve the Division's information systems.

Throughout the process regular reports and recommendations were presented to the DMT for their review and approval. A draft of the Blueprint summary was widely circulated within the Division for review and comment.

The Blueprint project produced a technical document and a summary document. The summary is intended for wide distribution as a vehicle for promoting a shared vision of the Division's information systems. The technical document contains a more complete record of the project team's recommendations and supporting documentation.

While this project ends with the production and distribution of the Blueprint documents, the process of strategic information systems planning is one that must be repeated on a regular basis. The DMT should plan on conducting an abbreviated version of the Blueprint process on a biennial basis. Frequent review and revision of the strategic information systems plan is important given the rapidly evolving nature of information technology.

Forestry Information Systems Blueprint
2. Baseline Analysis and Needs Assessment

Baseline Analysis

The Blueprint Project Committee completed a baseline analysis to develop an understanding of the Division's existing information systems. This involved documenting existing hardware, software, applications, and databases. MIS and GIS staff provided the necessary information about the minicomputers and their use. An inventory of all PC hardware and software was completed. Flowcharts were developed showing the information flows and forms used in the Division's major activities.

Organizational Setting

The Division of Forestry is the operating division of the Department of Natural Resources concerned with the protection, management, and use of forest resources. The Division has over 450 employees, all of whom use information systems in some way in their job. The majority of the Division's information system services are provided by the MIS and GIS units in the Resource Information and Planning Section (see Figure 2.1). Twelve employees (including the Resource Assessment Supervisor) are currently assigned to the MIS and GIS units.

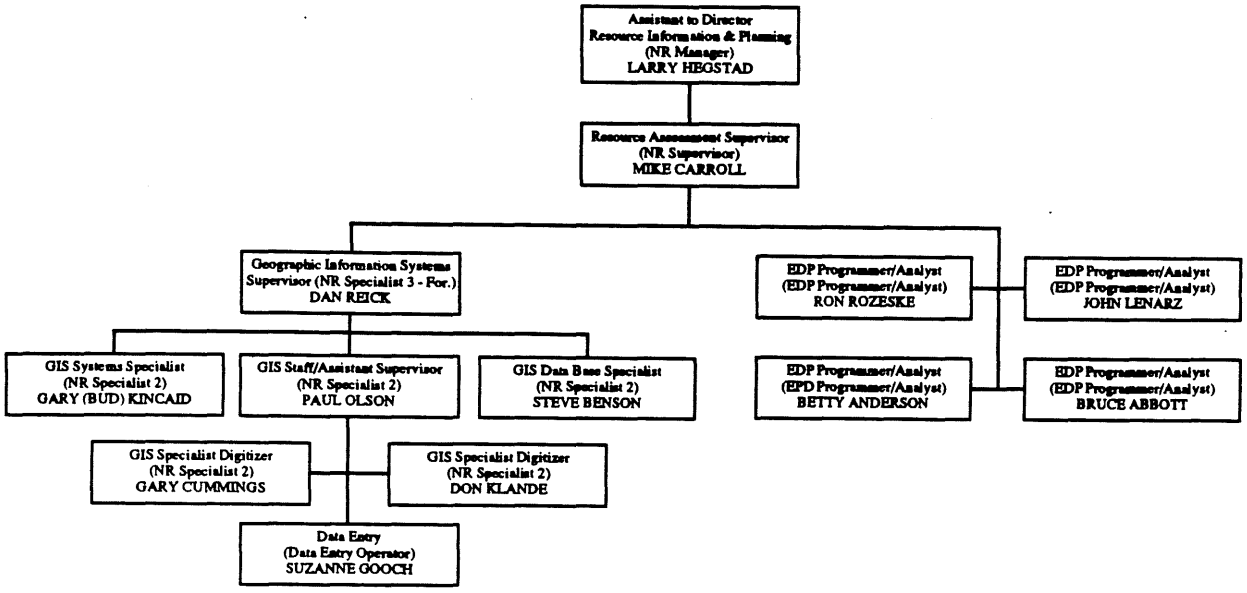


Figure 2.1 Organizational Structure of MIS and GIS Units

Existing Systems

The Division of Forestry currently operates two minicomputer systems: (1) a TI 990 located in St. Paul which is primarily used for transaction processing and (2) a PRIME 2250 located in Grand Rapids which is used for Forest Inventory data management and GIS activities. In addition the Division operates approximately 125 personal computers and several Local Area Networks. The Division also makes use of computing facilities at LMIC, InterTechnologies Group (ITG, formerly IMB), and other locations for some of its information processing needs.

TI 990 Based Systems

The Division operates a Texas Instruments TI 990 Model 12 minicomputer in St. Paul. A staff of four programmer-analysts, with duties ranging from system design to day-to-day operations, perform all system support and management functions. The TI 990 is connected via phone communications to personal computers in each of the Area headquarters. The TI 990 was purchased and installed in late 1982. The TI 990, a low-end minicomputer, has a main memory size of 0.768 Mb and a total of 900 Mb of space available to store data and programs on its three 300 Mb disk drives with removable disk packs.

The TI 990 is hampered by having a small central memory and limited processing speed. In addition, it does not possess today's flexible database management languages in its software repertoire. Some of the key components of the TI 990 are beginning to suffer from the wear and tear of nearly seven years of heavy use. In the last year, for example, the disk drives have failed several times and have had to undergo major reconstruction. If the types of failure that occurred, would have happened during a high fire situation the Division could have been faced with a serious communications problem. Exacerbating the situation, AmeriData, the vendor providing maintenance for the TI 990 announced that the current contract with the State would be allowed to lapse on July 31, 1989. Any new contract will go up by nearly 30% in price and will take 2 or 3 months to negotiate.

Connection to the TI 990 from remote locations is accomplished through two 1200 baud bisynchronous and two 300/1200 baud asynchronous modems. The Babytalk communications board used to link PCs and the TI 990 is no longer manufactured.

A bisynchronous line is also available to connect with the IBM mainframe at InterTech. Connection to the TI 990 by St. Paul based staff is accomplished via TI 990 alphanumeric CRT's. Additional equipment connected to the system includes a 600 line per minute Printronix P600 dot matrix printer, three 150 character per second TI 810 dot-matrix printers, and a 1600 bpi (bit per inch) TI MT1600 streamer tape drive. Backups are done by swapping disk packs, thus the tape drive gets very little use other than for transfer of

files with other computer facilities. The TI 990 has no off-site backup facility. This is a situation that needs to be addressed.

Nearly all of the programs developed for the TI 990 are written in COBOL, although BASIC and FORTRAN are also available. The machine has no vendor supplied data base packages or utilities. All applications have been custom written by MIS staff or consultants.

The major applications supported on the TI 990 are Timber Sales, Fire Reporting, Personnel Training Records, Mailbox, and Forest Inventory. Applications are characterized by creating batches of updates in the Area using COBOL programs on PCs and then transmitting them via modem to St. Paul. This process of batch processing and the lack of DBMS systems on the TI 990 has resulted in a general lack of access by the Areas to the information that they have entered into the system.

Even though the TI 990 has been able to keep up with its workload, it is still an aging machine and is nearing the end of its serviceability to the Division.

PRIME 2250 Based Systems

The Division also operates a PRIME 2250 Rabbit, another low-end minicomputer, installed in January 1985. It is operated by the Division's GIS Unit, with a staff of seven, located at Grand Rapids. The primary use of the PRIME 2250 is for CSA Forest Inventory data management and mapping (GIS) activities. The GIS Unit is the only location in the DNR where the CSA inventory maps can be generated.

The Rabbit has 3 Mb central memory and has two disk drives with non-removable disk packs with a total disk space of 316 Mb for storing software and data. All processing is done at the Grand Rapids office. The system has only one modem available for external access. Backups are done on a multi-density (800/1600/3200 bpi) PRIME streamer tape drive. Copies of backup tapes are sent to LMIC for user access and for off-site storage.

The major software package on the Rabbit is the ARC/INFO Geographic Information System that was purchased from the Environmental Systems Research Institute of Redlands, California. The ARC/INFO system is a vector or arc/node polygon based system used for the entry and analysis of mapped information.

Entry of maps is done by a process known as digitizing. Forest inventory maps are digitized one section at a time into township coverages (files) using maps drawn on acetate film by the field survey staff as the input documents. Map entry is done at three work stations consisting of Calcomp digitizing tables and Visual, Tektronix, and Esprit graphics

monitors. Maps are plotted on a 37 inch wide Calcomp 1073 multiple pen plotter. The GIS Unit has also has purchased a 37 inch Calcomp 1074 pen plotter which is currently installed at LMIC and is being used in digitizing the large set of previously hand drafted inventory maps.

In addition to the mapping and related alterations activities, another major activity conducted on the Rabbit is the upkeep of the CSA Forest Inventory attribute database. This is done using INFO, ARC's companion relational data base management system.

The Rabbit is not able to keep up with the workload it needs to do. It is old and outdated. It is not capable of efficiently performing the many tasks that are being asked of it. Even though the machine has 16 ports, it can only handle a few users at a time. Because the Rabbit can only store about 3% of the forest inventory on-line at any given time, a disproportionate amount of time is spent performing routine tape to disk load and unload operations.

Just considering forest inventory alterations, with the pace work can be done on the current configuration, the GIS Unit takes 1.5 years to process 1 years worth of alterations, thus falling 1/2 year behind with each year that passes. With the Division's goal of updating 10% of its stands per year, as an additional task, the unit falls an addition 1.5 years behind with each year that passes.

Another problem caused by the limited data storage capability, is that the GIS Unit is not able to efficiently import large map coverages (such as hydrology and roads) from other sources such as LMIC or USGS. Currently, these large databases must be imported or exported in many small pieces.

The Rabbit is so small that newest version of the ARC/INFO (Rev. 5) will not even run on the machine. Another big problem is that PRIME, in the last year, announced that it would no longer support the BRMS tape backup system used on the Rabbit. The GIS Unit is having a difficult time keeping the drive functional until a new computer is available.

While the PRIME 2250 and its tape and disk drives need to be replaced very soon, much of its peripheral equipment (such as digitizing tables, plotters and printers) could be used in a new system.

> **There is an urgent need to replace the PRIME. The problems mentioned above are critically threatening the continued functioning of the Division's GIS.**

Personal Computers

The use of personal computers (PC's) has increased dramatically during the past 5 years. Currently, there are about 120 PC's owned and operated within the Division. They exist at all levels of the organization from the Central Office to Field Stations. Approximately a dozen District Foresters have access to PC's owned by other divisions in shared offices. Division owned PC's are available for use at Field Stations located in Area headquarters. In addition, several PC's have been placed at Field Stations with heavy PFM workloads. In total, about 40% of District Foresters have access to PC's at their location. All Regions and Areas have Division owned PC's.

The PC has been instrumental in filling the need for computing that has not been met by the Division's two current minicomputer facilities. As is often the case, the initial use of PC's was as word processors, but their abilities to help manage local budgets, maintain databases, and assist forest management quickly made them indispensable to the Division. Recent applications include desktop publishing with WordPerfect and Ventura Publisher and GIS analysis with EPPL 7.

In addition to commercial software, the Division MIS staff has developed several custom, communication-oriented programs that interface PC's with the TI 990 for functions such as Timber Sales, Fire Reporting, and Mailbox. Various stand alone programs have also been developed by non-MIS staff for activities including Forest Recreation, Development Records, Accomplishment Reporting, and Personnel and Budget Records.

While PC's have been beneficially used at all levels, their usage is creating concern amongst information systems staff and some managers. Concerns center on two issues. One, applications developed at numerous locations by various staff are generally not compatible with each other or with corporate databases. Also, since most of these applications are created by staff untrained in system development or programming, the programs are often inefficient, ill-designed, or flawed. Two, many managers and supervisors worry that this is not a proper use of field personnel time. Time spent developing applications occurs at the expense of field work. While some loss of field time is inevitable, development work done by field personnel can have benefits for the Division. Most of these efforts are undertaken by highly-motivated, enthusiastic individuals. Much of this work has been done on the individual's own time on their own equipment, since many, have purchased computers for use at home.

The use of PCs by field staff has been nowhere more evident than at the Region level. Concerns are often voiced that refer to regional resource specialists as "computer jockeys" and that they "might spend all of their time at their desk rather than getting out into the woods where they need to be." It is true that regional resource management specialists are regularly called upon to provide information systems support needed in their offices and at the Area level. Additional computer support work will be generated when the computer

systems or software need to be changed or upgraded. This will continue to erode specialist's time until central support is upgraded.

Meanwhile, the creation of a consistent corporate database and system architecture remains a concern in the minds of professional staff at all levels. Many fear that a chaotic state of information management is approaching from both data structure and technology standpoints. During the Needs Interviews, the Blueprint Committee has been told that systems have been developed and implemented widely in the Division without proper consideration for user needs, the impact on workloads, or the suitability of the selected software for the task.

> **The MIS Unit, given its current level of staffing and organization cannot provide the needed support for the collection of personal computer equipment and software in use.**

The lack of adequate support has resulted in an uncoordinated, unmanageable, and unsupported collection of hardware and software in use. This only increases the burden on the staff specialists and has drained more time from their traditional technical roles while they solve system problems and provide user assistance.

External Computing Facilities

The main external computer system used by Forestry is operated by the Department of Administration's InterTechnologies Group (ITG). ITG is used primarily for statewide accounting and payroll activities. In addition, some forest resource management analysis is done at ITG by Dr. Chen, primarily for his forest biometrics activities that use databases that are too large to operate on the Division's minicomputers. Dr. Chen uses SAS and graphic capabilities at ITG in his analyses that use copies of the FIA and CSA forest inventory databases.

Another computer facility used by Forestry is the GIS capability at LMIC Service Bureau of the State Planning Agency. Forestry has used LMIC (1) to assist with digitizing activities, (2) as a support, training, and development facility for the Division's GIS, (3) as a location to support user requests for non-standard analysis or map requests of FIA and CSA data, and (4) as an off-site storage location for backup of inventory data.

There is use of U.S. Forest Service computer capabilities at several locations. Forestry accesses AFFIRMS through a service bureau contracting for the Forest Service. The Division, in a cooperative effort with the North Central Forest Experiment Station, builds and maintains the FIA Inventory on the Forest Service's Data General computer system. Copies of the FIA file are given to the Division for analysis on its own equipment and at ITG.

Forestry's use of the System 38 computer system maintained by the DNR MIS Bureau is somewhat limited. Little on-line access is made. Direct access is available in the St. Paul office and through System 36 terminals in Regions 1, 3 and 5. In St. Paul, the Division Director's secretary uses the System 38 to keep the Director's calendar and to access calendars of other top managers in DNR. Intermittent on-line access is by Timber Sales and Land Management staff to make inquiries about land status from the Bureau of Real Estate Management's Land Record System.

Other uses of the System 38 include: (1) periodically getting a copy of the Land Records file to check ownership data in the CSA inventory and Timber Sales programs, (2) the generation of hard copy land ownership, acquisition, and lease reports for distribution to Forestry field locations, and (3) to download files for use with Area and Region planning activities.

No organized community of System 36/38 users has developed in Forestry, either in the Regions or in St Paul. There is question as to who is in charge of use in the Regions and what the long term purposes of the system are beyond word processing, calendaring, enforcement, and land records functions. The DNR System 38/36 has no existing capability to support the integration of MIS and GIS activities.

Personal Computer Hardware and Software Survey

To gain an understanding of the existing PC situation, the Blueprint Committee conducted a survey of PC hardware and software. Surveys (see Figure 2.2) were filled out for all personal computers. The survey results are summarized in Figure 2.3.

Hardware

The survey indicated that the Division currently has 119 personal computers in operation. There are six types of PC's in use in Forestry. The predominant type of personal computer in use, with a count of 84, is the IBM XT and its clones. The second most prevalent machine is the IBM AT class machine.

Attached to the computers are 123 monitors, 101 printers, 43 communications devices, and a scattering of other devices including scanners, mice, Bernoulli boxes, uninterruptable power supplies, and accelerator boards.

Forestry Information Blueprint Project

Personal Computer Survey

Your Name: Phone: Current Date:

Brand of PC: Model of PC:
Year PC was originally installed:
Location of PC:
State Property Number of Central Unit:

PC Administrator: Phone:

Located on Network or LAN? Yes No (circle one)

About how many people use this PC with some frequency?

Job Classifications or Titles for the major users of this PC:

Short Description on Nature of Use:

Description of this PC configuration:
RAM (Kb): Version of DOS:
Amount of Hard Disk Storage (MB):
Floppy Disks (Size, bytes):
Types of Boards/Chips/Processors Included:
Type(s) of Printers:
Type(s) of Plotters:
Brand of Monitor: Color or Monochrome)
Type of Graphics Emulation (CGA, EGA, etc.):
Type of Modem: Baud Rate(s):
Any other Devices connected to PC: (scanners, etc.)

Software in use: Existing Applications:

Describe Type of Backup Procedures Implemented:

List any General Comments about the use of this PC:

Figure 2.2 Information Requested in PC Survey

Number of Units by Location, as of 6/7/89

ITEM		Region	Area	Station	Nursery	St. Paul	TOTAL
Personal Computers							
XT-class		13	26	4	8	33	**84**
AT-class		6	10	-	1	13	**30**
386-class		1	-	-	-	-	**1**
IBM PS/2		-	1	-	2	1	**4**
	TOTAL	20	37	4	11	47	**119**
Printers							
9-pin dot matrix		10	28	4	4	24	**70**
24-pin dot matrix (black)		2	6	-	3	3	**14**
color printers/plotters		1	2	-	-	3	**6**
laser		3	-	-	-	1	**4**
other		-	2	-	-	5	**7**
	TOTAL	16	38	4	7	36	**101**
Word Processing Software							
WordStar		-	-	-	-	4	**4**
DisplayWrite		11	29	2	-	13	**55**
WordPerfect		12	7	2	10	39	**70**
	TOTAL	23	36	4	10	56	**129**
Database Management Software							
PC-File		10	34	4	2	33	**83**
R:Base		10	10	1	9	29	**59**
Other		-	-	-	1	1	**2**
	TOTAL	20	44	5	12	63	**144**
Spreadsheet Software							
Lotus 1-2-3		7	29	2	9	12	**59**
Quattro		9	5	-	-	-	**14**
	TOTAL	16	34	2	9	12	**73**
Graphics Software							
Harvard Graphics		4	-	-	-	2	**6**
PFS:First Graphics		-	-	-	3	-	**3**
Freelance Plus		1	-	-	-	-	**1**
Microsoft Chart		-	-	-	-	1	**1**
Other		4	-	-	-	3	**7**
	TOTAL	9	-	-	3	6	**18**
EPPL 7 (GIS Software)	TOTAL	5	3	-	-	4	**12**

(Note: Forestry uses 9 versions of the MS-DOS operating system, from 2.0 through 4.0. Versions 2.1 and 3.3 predominate).

Figure 2.3 PC Survey Results

The Division has 85 monochrome monitors and 38 color monitors in use. Of the color monitors 26 are of EGA quality or better, making them more suitable for high quality business graphics and GIS activities.

Of the 101 printers that the Division operates, there are 23 different models from seven different classes of printers. The dominant class of printer is the 9-pin dot matrix printer with a count of 70. It is followed by the higher quality 24-pin printers with a total of 14 (predominantly Epson LQ850's).

For communications the Division has 26 Babytalk boards with modems to link PCs to the TI 990, and an additional twelve 1200-baud modems and five 2400-baud modems.

Software

The survey shows that personal computer software currently in Forestry's possession is primarily used for office automation activities, although a growing number of packages and programs are being acquired or developed for the purpose of forest resource analysis and management. Software written for PC's, as part of systems that are based on the TI 990 (such as Timber Sales and Fire Reporting) are not included in this summary.

Excluding the software interacting directly with the TI 990 or on the PRIME 2250 system at Grand Rapids, the survey showed the Division to be using 64 different software packages. At the time of the inventory, there were 670 copies (551 excluding DOS) of these 64 packages in use.

PC-File, a "flat-file" database management program, was the most widely distributed package. It was followed by FASTBACK, a hard disk backup and retrieval utility, and WordPerfect, a word processing program in number of copies.

There are several interesting trends or themes that were evident from the survey. One theme is that there does seem to be a focus on one or two primary packages in most software categories. The exception is business graphics with 11 different packages making up the 18 copies in use. Major trends include (1) WordPerfect becoming the dominant word processing package, (2) FASTBACK, an excellent package for easily doing backups, being in place at most installations and (3) the fast rise of R:BASE which is quickly catching up to PC-File as a database management tool.

With 670 copies of software in use, it is estimated that Forestry has invested somewhere between $50,000 (@ $75 per copy) and $100,000 (@ $150 per copy) on the purchase of PC software alone.

Needs Assessment

The needs assessment was designed to judge the level of satisfaction with existing systems and to identify specific information needs that were not being met. A needs assessment questionnaire was developed. Interviews were conducted with 43 Division employees representing all job classifications, geographic locations, and programs in the Division. The questionnaire was also sent to all employees who were not interviewed so that they could provide input to the needs assessment if they desired to do so.

Procedures

Blueprint Project Committee members conducted in-depth Needs Assessment interviews with 43 Division of Forestry employees between December 1988 and February 1989. The interviews were designed to assess both the general condition of the Division's information systems and specific information needs related to each of the Division's operating programs. The average interview lasted about three hours. After the interview, Blueprint Project staff prepared a written summary of the interview and returned it to the interviewee for corrections or additions. The interview summaries will not be published but are available in the Blueprint Project files. Thirty-seven written responses to the Needs Assessment questionnaire were submitted by Division employees who were not interviewed.

Copies of the interview summaries and written responses to the questionnaire were made available to all Blueprint Project Committee members. A committee member was assigned to represent each of the interviewees during the synthesis process. The Blueprint Project Committee synthesized the interview results at its February 15 - 17, 1989 meeting.

The synthesis process involved categorizing interview comments by program and topic. A flip chart was prepared for each of the MFRP programs (except MIS) and for five additional topics (Communication; Data Standards; Computer and Systems Related Policies and Procedures; Hardware, Software, and Staffing; and Legal, Organizational, and Policy Constraints). The essence of a comment was recorded on the flip chart and the administrative level from which the comment originated was recorded. The number of times similar comments were received from each administrative level were tallied. The next comment was then recorded on the flip chart and similar responses were tallied. This was repeated until all comments for a given MFRP program or topic had been listed. The results of the synthesis process follow. For each MFRP program or topic the comment is listed in the left column. The right columns are the tally of the number of times a comment was expressed at a given administrative level (R = Region, A = Area, D = Field Station, S = St. Paul Staff, N = Nursery).

Land Administration

	R	A	D	S
Need on-line access to land ownership and lease status data.	1	2	3	1
Need on-line access to land ownership records and ability to prepare maps of ownership and RAD boundaries in St. Paul.	R	A	D 1	S 5
Need a System 38 terminal on desk to access land ownership records.	R	A	D	S 1
Should have GIS to map lease locations, state ownership, and other lands data at Area.	R 1	A 1	D	S
Need a mechanism to track deed restrictions on LAWCON and gift lands.	R	A	D	S 1
System should generate automated lease expiration and billing notices.	R	A 1	D 1	S
Need timely access to status of exchanges and acquisitions.	R	A 1	D	S
Need list of lands available for exchange and acquisition.	R	A 1	D	S
Need to link ownership and mineral leasing information.	R	A	D	S 1
Need ability to measure satisfaction of land sellers and lessees.	R	A	D	S 1
Field review of land transactions needs to be done in a more timely manner.	R	A	D	S 2
Should process leases at the Area level.	R	A	D	S 1

Forest Recreation

Need ability to produce maps of trails, accesses, river routes, and ownership using GIS.	R	A 3	D 1	S 6
Need ability to deliver recreation user maps (with ownership layer) to public.	R 1	A 5	D 3	S 1
Need to collect user satisfaction and usage information on recreation facilities.	R 1	A 1	D 2	S 2
Need recreation facility location and state forest descriptions available.	R	A	D	S 1
Need local (district) review of accuracy of recreation and ownership maps.	R	A	D 1	S
Need to link recreation facility information to roads information.	R	A	D	S 1
Need an automated comprehensive recreation facility database (it should be linked to, or be available for I&E's marketing effort).	R	A	D	S 2
Need to map recreation travel patterns with respect to other land uses.	R	A	D	S 1
Need to identify recreation facilities that require sensitive management guidelines (possible GIS overlay).	R	A	D 1	S 1
Need to relate Heritage, Historic, Archaeologic, and Wild & Scenic River locations to recreation facility and other management plans (possibly using GIS).	R	A	D	S 3
Need system to track recreation facility condition information.	R	A	D	S 1
Should use Fiscal's SWA system to record receipts by campground to avoid having to reenter this data in Forestry's database.	R	A	D	S 1
Need ability to provide covertype maps to hunters.	R	A	D	S 1

State Forest Roads

	R	A	D	S
Need roads data digitized from USGS topographic maps for use with GIS.		3	3	1
Road inventory attributes (Blackduck Pilot Project) maybe too complex. Need to determine the proper level of detail for road attributes.		2		1
Need capability to map road network.	1			4
Need to use development record system to track road projects.		1		1
Need to keep road inventory up-to-date.	1			
Need to integrate roads information with TMPIS, Inventory, and Soils data.	1	1		1
Need ability to find out what Regional priority for a road project is.		1		
Need to monitor road use to plan road maintenance and provide maintenance budget based on that information.	1			1
Need to estimate the length of time a road will be used so that development level and maintenance needs can be planned.				1

Timber Sales

	R	A	D	S
Need access to current year and historical timber sales data.	2	1	2	
Need ability to map location of timber sales (both on a site specific basis and as points on an Area map).	2	5	1	
Need capability to produce local ad hoc reports.	2	6	1	1
Need ability to respond to logger requests for information.	1			
Need to be able to track new and reoffered timber.	2			
Do not need to track new vs. reoffered timber.	1			
Need ability to access information on available stumpage (appraisals) from other Areas.	1	1	1	
Need to have computer fill out all forms and form letters needed in timber sales process.		2	1	1
Timber sales forms should be preprinted so manual preparation is possible if computer is down.		1		1
Need a major overhaul of timber sales computer system.	1			2
Need an accounts receivable system or something better than current system.		3		1
F-121 data should be entered only once and used throughout timber sales system.	1	7	2	3
Timber Sales system should link to forest development and inventory systems.	1	5	3	2
Should use data recorders to enter data.	1	2	2	1
Shouldn't use data recorders to enter data.			2	
Need to link to accomplishment reporting system.		2	1	
Need ability to map TMPIS prescriptions.	1			3

	R	A	D	S
Need ability to track drain acres.	1	2	1	
Need ability to track appraiser accuracy.		2		
Need ability to track revenue.		1		
Need ability to keep track of bonding due.		1		
Need ability to track auction results.		1	1	
Need ability to track volume by administrative unit.		1		
Need to link sales information to TMPIS records.	1	2	3	3
Need to use soils information for timber sales planning.	1	1		1
Need to automate the Timber Sales Manual.				2
Need to automate the Timber Sales System Manual.		1		
Need to assign loggers vendor numbers to facilitate tracking of individual loggers.		2		1
Need access to current statewide logger information (delinquents, number of sales).	1	5	3	1
Region should still get a copy of appraisals after switch to Area processing of auctions.	1			
Standard bond forms should be available at the auctions to reduce confusion for loggers.			1	
The system should generate prompts for billings, expirations, and extensions.			1	
Need PCs at Field Stations to process appraisals and scales.		2	1	
Areas should have input on setting prices and prices should be reviewed more frequently.			2	

Need ability to determine the efficiency (cost/benefit ratio) of the timber sales program.	R	A	D	S 1
Need ability to select sales based on season of harvest (or other sale regulation) on the system.	R	A 1	D	S
Would like a better system for tracking load tickets.	R	A 1	D 1	S
Should look for efficiencies in scale reporting.	R	A 1	D	S
All scaling reports should be sent to St. Paul.	R	A 1	D	S
Areas should be allowed to adjust scale reports.	R	A 1	D	S
Need ability to record scaler ID on F-121.	R	A	D 1	S
Allow "remarks" to be entered on scale report.	R	A 1	D	S
Have the computer do more of the appraisal computations.	R	A 1	D	S

Timber Management (Silviculture)

	R	A	D	S
Need a good computerized forest development record system with mapping capabilities.	3	4	3	3
Need to integrate development record system with other programs using CSA inventory as the foundation.	2	5	1	2
Need a better development record system to allow analysis of success and failure factors.	2	2	1	3
Need to computerize the F-80 development records.				1
Areas should have automated TMPIS maps.				1
Need to share (disseminate) the results of silvicultural trials.	1		1	
Need to link development records to accomplishment reporting system.	2			1
Need a uniform spending, work planning and accomplishment reporting system for forest development.				2
Need a system to track development projects from "cradle to grave".	2	2		
Need to record CSA stand number on development records.				1
Need to link development records to previous stand history.				1
Harvest plans should trigger regeneration planning and update inventory.				1
Need ability to track a stand from planned cut list to timber sale to development record ("seed to stand").	1	1	1	
Need an ecological classification system to evaluate cover type relationships.				1
Should use TMPIS maps and record for work planning and tracking.				1
Should use development record system for prescribed burns.		1		
Need ability to aggregate development records at regional and statewide levels.		1		1

Need better linkage of planting needs to tree orders.	R 1	A	D	S
Need a uniform seedling needs determination and tree ordering process.	R	A	D	S 1
Should use timber sales to estimate regeneration needs as a basis for developing nursery seeding plans.	N 1	A 1	D	S 1
Need an annual report on regeneration accomplishment by species.	R	A	D	S 1
Need ability to use site maps prepared for timber sales on development records.	R 1	A	D	S
Need ability to prepare working maps showing plantations needing regeneration checks and stands needing inventory update or other field check.	R	A	D	S 1
Need on-line access to regeneration records to prepare ad hoc reports.	R	A	D	S 1
Need ability to correlate soils information with regeneration needs.	R	A 1	D	S

Fish and Wildlife Habitat Management

	R	A	D	S
Need to organize development projects for Division of Wildlife review.		1	1	
Need to improve Wildlife's access to CSA data.		1		
Need to be able to map Wildlife project location by type of project to analyze impacts on wildlife populations (e.g. wolves) using GIS.	1			
Need to be able to overlay TMPIS maps and Wildlife compartment maps.		1		
Need GIS produced Wildlife compartment maps.			1	
Should use uniform forms in DNR for all types of management activities.				1
Should coordinate RIM accomplishment reports between Forestry and Wildlife to avoid duplicate reporting.				1
Should systematically record wildlife openings on CSA.			1	
Should be able to establish and map buffer zones for Natural Heritage elements.				2
Need ability to access and link to other agency data bases.				1

Nursery and Tree Improvement

Need to improve Regional input to seeding plan.	R 1	A	D	S
Need to use strategic planning rather than historical trend data to prepare seeding plan.	R	A 1	D	S
Need to be able to match available stock to planting needs.	R 1	A	D	S
Need Tree Order status report by District on a monthly basis from September through March.	R	A 1	D	S 1
Need uniform Tree Order reporting process and calendar.	R	A	D	S 1
Need GIS to map Nursery layout over time.	N 1	A	D	S
Need to track where seedlings are going for failure analysis (seed to stand tracking).	N 1	A	D	S

Private Forest Management

Need a good PFM target setting and accomplishment reporting system.	R	A 3	D	S 1
Need Ad Hoc reporting capability using PFM accomplishment reports.	R	A 1	D	S
Should have the ability to share data and reports with ASCS, SCS, etc.	R	A 1	D 1	S
Need CSA type inventory on private lands.	R	A 1	D	S 1
Need inventory of timber available from management plans on file.	R	A 1	D	S
Need monthly Tree Order report by District.	R	A 1	D	S 1
Need on-line access to Tree Order system.	R	A 1	D	S
Need system to track seedling back orders.	R	A 1	D	S
Need tickler file of practices planned by landowner.	R	A 2	D	S 1
Do not need tickler file of practices planned by landowner.	R	A	D 1	S
Need system for tracking of service status by landowner (request, initial visit, plan, cost share, etc.)	R	A 1	D 1	S 1
Need to use historical activity by landowner to prioritize revisits to landowners.	R	A	D 1	S
Need to use similar forms for state and private land management (should add space for landowner ID on state forms).	R	A 2	D 1	S
Need to be able to prepare PFM landowner map by locations.	R	A 1	D	S
Should have the ability to track PFM data by location as well as by owner.	R	A	D	S 1
Need operational level PFM data base in Area and/or Field Station.	R	A 2	D	S
Need seed to stand tracking ability on private lands.	N 1	A	D	S

Need to maintain historical record of private land planting locations.	N 1	A	D	S
Need automation in preparation of PFM plans (word processing, boiler plate sections) at point of origin.	R	A 3	D 1	S
Need system to capture details on PFM contacts (only do dot tally of incidental assists).	R 1	A	D 1	S
Need to investigate possible sharing of data on AFA Tree Farm computer reports.	R	A 1	D	S

Urban Forestry

Need a link to accomplishment reporting system.	R	A	D	S 1
Need form letters for standard requests.	R	A	D	S 1
Need improved access to Metro Council and LMIC data.	R	A	D	S 1
Need Updatable Urban Forestry Directory.	R	A	D	S 1
Should provide leadership to small communities in using PC-based GIS for Urban Forestry.	R	A	D	S 1
Need better information flow of pertinent I&D and U&M information to Urban Forestry provider (i.e., District Forester, City Foresters).	R	A	D 1	S
Should use electronic bulletin board for I&D related information, and allow access by Urban Foresters.	R	A 1	D	S

Need ability to check on status of county grant processing.	R	A	D	S 1
Need to automate tax related files and projections (Tree Growth, Auxiliary Forest).	R	A	D	S 1
Need ability to track Auxiliary Forest contract withdrawals.	R	A	D	S 1
Need to better coordinate central office review of tax-forfeited land sales with field input and timber cruising.	R	A	D	S 1
Areas need more lead time to prepare annual Auxiliary Forest Report.	R	A 1	D	S

Forest Pest Management

	R	A	D	S
Need a pest occurrence layer on a GIS.	2	1		
Need uniform, timely, statewide pest report recording.	1		2	1
Need ability to relate pest occurrences to FIA, CSA, TMPIS, and planned cut list.	1			
Need a system for tracking and accessing technical documents and articles.	1			
Need a system for collecting semi-annual pesticide use reports.	1			
Need electronic file transfer between offices for time sensitive I&D information.	1			
Need to capture pest information from F-80 and F-65.	1			
Need a statewide pest phenology calendar.	1			
Need good access to weather and climatological data.	1			
Need ability to access historical data on herbicide applications.	1			
Need ability to exchange map based information with the USFS.	1			
Need ability to use GIS on detailed (site specific) pest investigations.	1			
Need more information production/distribution like what was done for bark beetles.			1	
Need electronic bulletin board for pest related information.		1		

Forest Soils

Need to have soils data available for use in land management decision making process.	R 1	A 1	D 1	S 1
Should include geology, hydrology, and watersheds as layers in GIS.	R	A	D	S 1
Need digitized soils data in GIS.	R 2	A 2	D	S 2
Need ability to use GIS to produce soils maps and analyses.	R 1	A 1	D	S
Need ability to map and classify soils by timber productivity level to make soil surveys more useful to foresters.	R 3	A	D 1	S 3
Soil related operability constraints information should be available when doing TMPIS.	R 1	A	D	S 1
Need to use soils information in roads program to improve road location and design and to locate gravel sources.	R 1	A	D	S 1
Soils information should be noted on timber sales and development records.	R	A	D	S 1
Need to relate forest management experimental findings with soils data.	R 1	A	D	S 1
Need to use LORAN to locate soils plots.	R	A	D	S 1
Should use data recorders to enter soils data in the field.	R	A	D	S 1

Inventory

	R	A	D	S
Need read only CSA attribute data available on computer at District, Area, Region, and St. Paul.	2	3	4	2
Need GIS form of CSA (automated attribute and map files).	1	2	1	1
CSA is the foundation of integrated Forestry land management systems.	1	4		3
Use GIS to integrate road network with CSA.			1	1
Need to link CSA stand number to Timber Sales system.	1	1		
Use CSA stand number in Timber Sales system to trigger alterations.	1			1
Need to link CSA stand number to forest development records.		1		1
Need the ability to relate CSA data and soils data with a GIS.	3			1
Areas should enter corrections and alterations.		4	1	1
Districts should enter corrections and alterations.			2	
Annual update of CSA is adequate.	1			
Alterations need to be processed quicker (more often than the annual window).		2	1	
CSA needs to be redesigned to better reflect land productivity (collect more data on better sites).				1
Need to model inventory forward to current date.		3		
Need to establish Area and Region Inventory Specialists.		1		
Need to have inventory on private lands.		1		
Need to merge Natural Heritage data into Inventory.				1

	R	A	D	S
CSA should be operational system strong enough to provide initial appraisals for the timber sales process.				1
CSA should not be used for timber sales appraisals.			2	
Prescriptions (e.g. TMPIS and prescribed burns) for a stand should be linked to CSA.		2	1	2
Should have all CSA data on a single computer.				1
Use data recorders for FIA and CSA.				1
Use outside vendors for map production (backlog).				1
Add "Big Tree" inventory to data base.				1
Alterations should trigger change in Wildlife compartment habitat evaluation.		1	1	
Need FIA plots as a standard GIS layer.				1
Need access to county forest inventory data.		1		
U&M Specialists need ability to access FIA, CSA, and TMPIS.	1			
Need access and ability to share inventory data among agencies.		1		1
Computer should identify stands needing updating (re-inventory).	1			

Utilization and Marketing

Need a reference filing system for technical documents.	R	A	D	S 2
Need a network linking Chen, U&M Staff, clerical and graphics (to allow electronic file transfer for document production).	R	A	D	S 1
Need a GIS database with type, size, and density attributes covering all ownerships.	R 1	A	D	S 1
Need current industry location and procurement zones on GIS.	R	A 1	D	S 1
Need ability to generate custom reports from the Forest Products Directory data.	R	A	D	S 2
Need Christmas tree availability data.	R	A 1	D	S
Need access to information on national and international markets.	R	A	D	S 1
Need to provide U&M information (industry plans, etc.) to forest managers.	R	A	D	S 1

Fire

	R	A	D	S
Fire information should be linked to other programs via CSA.		1		
Need to be able to produce maps of fire occurrences on a timely basis (to the 40 acre parcel).		3		1
Need access to current and historical fire occurrence and weather.	6	4	2	
Need to know who has what equipment on standby.		4		
Need the ability to correct Fire Reports on system at the Area.		3		
Need the ability to locally manipulate fire weather data for fire manning decisions.		1		
Wants to be able to use BEHAVE for prescribed burns and for ongoing fires.		3		
Need ability to track fire billings at Area.		5		1
Need cover type, residential development, and roads on fire hazard maps (GIS).	1	5	1	2
Need better process for handling resource orders.	1	2	1	
Need ability to produce status report of fire department agreements, equipment inventory, and out of area availability.		2	1	
Need additional data fields on fire reports for age of arsonist, property loss, and casualties.		2		
Fire report system should have the ability to roll fire reports with pending billings over to next year.		2		
Should have fuel models with respect to AFFIRMS indices available early enough in day to be useful.		1		
Should have an integrated weather report to meet the needs of AFFIRMS, the state climatologist and Trails & Waterways.		1		
Should have Ad Hoc reporting capability on number of fires by size, type and location during the fire season.		2	1	
Need details on fire cost and collections.		1		

	R	A	D	S
Information on permits issued by Fire Wardens should be available during the fire season.		1	2	
Should have the ability to access fire status reports for other Areas.	6	3		
Need GIS database for TFW and RFD.		1		
No need for fire history data.			1	
Need to capture weather data in Forestry computer so it can be matched to current year fire reports.	1			1
Present planning and approval procedure for prescribed burning is too complex.			1	
Need to computerize prescribed burn plans and post-burn evaluation reports to reduce duplication.	1			
Need meaningful, timely, local fire weather information and indices.	1	2	2	2
Need fax at District for fire related communication.	1	1	3	
Personnel system needs to be modified to meet fire needs (experience & qualifications for permanent and temporary employees).				1
Need more reliable communication link than is provided by the TI 990.		1		1
Need more consistent use of demobilization process statewide.	1			
Need to standardize format of fire databases among Areas (TFW's, equipment lists, etc.).		2		
Need to be able to track funding source for prescribed burns.	1			
Should have on-line system that begins tracking a fire as soon as it is reported.	2			
Need portable PCs for use on large fires.		1		1
Need clearly defined procedure for requesting spot fire weather forecast.	1			

Should link prescribed burn information to development records.	R	A	D	S 1
Need up to date information to respond to public requests.	R	A 1	D	S

	R	A	D	S
Need ability (data) to do cost benefit analyses.				1
Need better planning information flow between Divisions (knowledge of other Division plans and activities).			1	
MFRP, unit plans, and work plans should be part of linked database so changes at one level are reflected at other levels.	1	1	1	
St. Paul should develop uniform format and time line for annual work planning and accomplishment report.	1			
Need integrated planning - Department wide.		1		
Need to share Division planning results with clients and cooperators.				1
Goal setting for work plans should be flexible and responsive to current staffing.		1		
Should use TMPIS as an aid in planning wildlife habitat and road projects.		1		1
Plans should be updated every 3 - 4 years.		1		

Public Affairs

Need access to a computer database of natural resource/forestry related facts that are updated regularly to respond to common questions from the public.	R	A 1	D	S 1
Need to know what other Divisions are doing so that Forestry can respond to questions from the public.	R	A	D 1	S
Need "fall color" GIS layer.	R	A	D	S 1
Need ability to respond to requests for hunting maps.	R	A	D	S 1
Need a calendar with major forestry dates (Arbor Day, Fire Prevention Week) noted.	R	A	D	S 1
Need good fire information (statewide) for release to public and media.	R	A 1	D	S

Human Resources Development

	R	A	D	S
Need to provide training on database concepts.		1	1	
Need to provide training on NFDRS.		1		
Need to provide training on PC-File III.		1		
Need to provide training on Graphics.			1	3
Need to provide training on DOS.	2			1
Regions and Areas should have access to statewide training and experience records.	3	1		1
Need to track position vacancies using GIS.				1
Need a full time computer training specialist in the Division.				1
Should computerize the Personnel Development Manual.				1
Need to add "supplemental course catalog" and "desired qualifications by position" to personnel system.				1
Need a comprehensive human resources database (including training, experience, red card info., seniority dates, birthdate, etc.)	1			1
Need to provide adequate time for computer related training.	4	7	2	5
Should maintain existing training and experience record system.		1		
The experience record portion of existing personnel system is not useful or used.		1		
Need clarification on policies for using "training needed plans" for developing class rosters.		1		
Need to have supervisors approve/revise class rosters generated by the personnel system.	1	1		
Should encourage the use of automated, decentralized training vehicles (e.g. tutorials, audio and video tapes) for computer related training.		2		1

	R	A	D	S
Should allow the supervisor and employee to decide what training is needed (less mandatory training required by the DNR).	2			
Need better information flow to Districts on training opportunities, promotional exams, etc.			1	
Need more detailed course descriptions.		1		

Law Enforcement

	R	A	D	S
Need access to statewide violation tracking system (currently on System 38/36).		4	1	1
Need statewide summaries of violations and ability to sort by type of violation, location, etc.				1
Need better enforcement training.		1		
Need better inter-Area information sharing on trespasses and delinquent accounts.		1		

	R	A	D	S
Need a good, standardized process for work planning and accomplishment reporting useable at all levels of the organization.	6	8	2	9
Need ability to analyze efficiency of resource (staff, budget) use.	R	A 1	D	S
Need ability to track and compare accomplishments at the individual, unit, and statewide levels.	R	A 1	D	S
Need to link time summary with work plan and accomplishment report system (use similar categories).	R	A 1	D	S 2
Should have on-line access to computerized, indexed policy manuals.	R 2	A 5	D 1	S 1
No need to have computer access to policy manuals.	R	A 2	D 1	S
Affirmative Action reporting system should make better use of data already available in personnel systems.	R 1	A 2	D	S
Need to include requirement to use specific software to accomplish given tasks in Position Descriptions.	R	A	D	S 1
Need to provide adequate time for computer training.	R 4	A 7	D 2	S 5
Need to develop an uniform MFRP target and accomplishment system and time line so that information in only requested once.	R 3	A 1	D	S 2
Would like an automated building inventory.	R 1	A	D 1	S 1
Need automated semi-expendable inventory.	R	A 1	D	S
Need read only access to fixed asset inventory.	R 2	A 2	D 1	S
Need ability (authority?) to transmit payroll data electronically (fax).	R 1	A 4	D	S
Would like access to Field Service's Fleet Management database on equipment.	R 1	A 3	D 1	S
Need ability to generate ad hoc reports from fleet management database.	R	A 2	D 1	S 2
Need a quality on-line budget system.	R 1	A 2	D	S 4

	R	A	D	S
All Division of Forestry offices should use the same budget tracking system.	1			1
Need revision of SWA so it is less complicated.		1		1
Need replacement for Lotus budget template.		2		1
Need on-line access to SWA.	1	1		
Need ability to track condition of fixed assets to plan repair and replacement schedule.			1	2
Need on-line access to state procurement contracts information.		2	1	1
Need access to list of equipment being released.		1		
Need a calendar giving deadlines for reports.	1	3	1	
Need more time summary categories to track work being done.		1		1
Current time summary categories are adequate.		1		1
Clerical and managerial staff shouldn't do time summaries. Prorate their time according to overall Division time distribution.				1
Need a system for dissemination of meeting minutes on a timely basis.		1	1	
Need to automate payroll and related documents for smokechasers.	2			
Need to improve filing system and its use.	1	3		3
Need guidelines for electronic media filing system.	1			
Need standards and guidelines for electronic media file naming and storage. Need guidelines for disk space usage.		1		1
Need to reduce number of AIDs used. Problems caused by project based budget tracking.	1			

Need to provide feedback on data that is entered and integration so that data only has to be entered once.	R A D S 2

User Communication

Do not know what is available in terms of information systems.	R	A 1	D	S
Need a "information systems newsletter" for the Division.	R	A 1	D	S 1
MIS help desk staff doesn't have the time or expertise to handle PC related questions.	R	A 3	D	S
Need a "suggestion box" for software ideas with appropriate recognition or reward for the person suggesting the idea.	R	A	D	S 1
It is difficult to know who the experts for a given system are.	R	A 1	D	S 1
Need to recognize and utilize field computer expertise.	R	A 1	D	S 1

Data Standards

	R	A	D	S
Need a standard mailing list format.		1		2
Need data standards to allow system integration.		2		
Need standardized index for policy manuals, reports, and documents.		1		1
Should maintain uniformity of forms between programs.		1		
Division needs a data dictionary.	1	1		

	R	A	D	S
Need to be able to correct errors at Area.		1		
Forest development record system needed testing beyond one Area (should have had wider testing).		1		
Development records system should be implemented uniformly in all Areas and Regions.				1
Should use vendors to enter historical backlogs.				1
Need to use standard software across the Division.	4			4
Division should buy good equipment with an eye to future needs.				1
Field stations should enter the data they collect.		1	1	
Data does not have to be entered at the point of origin (should evaluate on a case by case basis).	1	1		1
The Division needs a clearly defined systems development process.		2		1
The Division should centrally purchase computer hardware and software.	2	1		1
Database design and coding should be done by experts.	1	2		
All programming should be contracted. (MIS/GIS should administer the contracts and keep the standards).	1			3
Foresters should not write programs.				1
Use commercial software when possible.	1			1
Data must be available at the level that must make the decisions.	2	2		1
Managers must be informed enough to make decisions on information systems acquisition and development.				1
PC operation responsibilities should be reflected in Position Descriptions.		2		

Should accept computers as file - no hard copy needed.	R	A 1	D	S
GIS Unit should be viewed as a function, not as part of the Inventory program.	R	A	D	S 1
Forestry should contract for data input.	R	A	D	S 1
Reduce the paper blizzard!	R	A	D 1	S 1
Data entry people must be aware of what data will be used for, especially if they won't use it themselves.	R 1	A	D	S
Forestry needs to use accomplishment reporting system as a management tool.	R	A 2	D	S
Computers should be fleet equipment.	R	A 1	D	S
Computers should not be fleet equipment.	R	A	D	S 1
Assign PCs as personal equipment.	R	A	D	S 1
Use task force concept for software development.	R	A 1	D	S
Division should sell data (e.g., CSA data).	R	A	D	S 1
Division needs to properly allocate resources to accomplish its objectives.	R	A	D	S 1
Division needs to distinguish functions vs. programs.	R	A	D	S 1
Division needs to be resource management oriented rather than program oriented.	R	A	D	S 1
Should use vendors to provide computer training.	R	A	D	S 1

Hardware, Software and Staffing

	R	A	D	S
Need ability to produce GIS color maps at Area.		1		
Need timely update of GIS covers in Area.		1		
Do not need fax.		1	1	
Need fax.	3	8	6	3
Need fax for fire resource orders.	1	1		
Need fax for equipment standby information.		1		
Need fax to move appraisals from District.		1		
Need Voice-mail capability in St. Paul.		1		3
Do not need Voice-mail capability in St. Paul.	1			
Need an Area LAN.		2		
Need a terminal for each Area staff.		1		
Need a PC at every desk.	2	1		3
Need color monitor and printer.	1	2		
Need ability to change scale on maps.		1		
Need to be able to make slides in Area.		1		
Need to be able to prepare business graphics.	1	1		2
Need a reliable central computer.		1		

	R	A	D	S
Need PCs in Field Stations.	1	3	3	3
Do not need PCs in Field Stations.	1	3		
Have some concerns about PCs in Field Stations.		1		1
Mailbox is not reliable.	2	3		1
Mailbox is too crude.	3	4		
Mailbox is a good concept.	1	2		
Need ability to use a scanner.	2		1	3
Need copy machines in Field Stations.	1	1	6	
Need access to field recorders.	1	2	1	3
Do not need field data recorders.			2	
Need field recorders for Inventory.			1	
Need larger Prime computer for GIS.	1			1
Need Thesaurus on word processor.		1		
System 36 is not useful.	3			
Need a PC Administrator in the Division.		3		2
Need a systems supervisor.				1
Need Desktop Publishing.		2		3

	R	A	D	S
Should have Regional computer specialists.	1	1		
Area should have digitizing capability.		1		
Need modems in Districts.			1	
Need laser printer.	1			4
Forestry should consider buying time on outside computers.				2
Should use clerical to do data entry.		2		
Need TV/VCR projection system.				1
Need touch tone phones.			1	
Need good reliable phones.		2	1	
Should have call forwarding capability.	1			
Need full time receptionist in St. Paul.				1
Need electronic file transfer capability.	1	1		1
Need System 38 terminal.				3
Should use floppy disks to transfer files.				1
Need word processors in Districts.		1	1	
Current filing system is effective if properly used (need to assign file numbers).	3			
Concerned about the reliability of the TI 990.	2	6	1	3
Need printer with sheet feeder.		1		

Reliable electrical service in Districts is a concern.	R	A 1	D	S 1
Area needs DBMS.	R	A 1	D	S
All Region staff need word processing, DBMS and spreadsheet capabilities.	R 1	A	D	S

Legal, Organizational, and Policy Constraints

	R	A	D	S
Lease management should be done at the Area level - Areas should be given the tools to do the job.		1		
The Attorney General should delegate lease related approval authority to the DNR.		1		
Areas don't have the time to handle lease administration.				1
It is difficult to get land appraisals on a timely basis.		1		
Need policies on road maintenance schedules.				1
Need agreements with counties not to sell timber to loggers with delinquent state sales and vice versa.			1	
Should be able to add timber that is located in a different forty to a sale.			1	
Should allow auctions to be held in different locations on the same day.			1	
All timber sales should be processed at Area level.			1	
Should use small auction sales in place of informals to insure fairness in timber sales system.			1	
Need to use Price Guide Factors more consistently between Areas.			1	
Permits to cut should be approved by Region in batches - Area Forester could sign the permits.		1		
Field Station Foresters should have the authority to approve extensions, alternate landings, consumer scales, etc.		1	1	
Need more enforcement of contracts and penalties for non-performance or failure to meet deadlines in development contracts.			1	
Need guidelines on carrying out silvicultural activities.				1
Need policy on charging for CSA data provided to Wildlife.				1
Need to clarify Fire Section's role in wildlife prescribed burns.				1

Soil surveys need to be better designed to meet forestry needs.	R	A	D	S 1
Need better policy on use of cut over area vs. anticipated regeneration type designations on CSA inventory.	R	A 2	D	S
Field should be involved in setting guidelines to determine where inventory updates (reinventory) is necessary.	R	A 2	D 1	S 1
Should not do weather reporting during non-fire season.	R	A 1	D 1	S
Prescribed burn initiator and burn boss need to be jointly responsible for monitoring fuel and weather conditions at prescribed burn locations.	R 1	A	D	S
Need a policy to set a deadline for submission of prescribed burn plans to the Region.	R 1	A	D	S
Need a uniform policy for listing DNR phone numbers in phone books.	R	A	D 1	S
Districts should have budgets to cover small purchases or impromptu projects.	R	A	D 1	S
Should change payroll period to end on a Friday to avoid the need to use anticipated hours.	R	A 1	D	S
Need more consistent discipline and promotional rating systems.	R	A 1	D	S

Forestry Information Systems Blueprint

3. Information Systems Vision

Division Mission

The Division of Forestry's mission is to work with public and private entities to promote the conservation, protection, and enjoyment of Minnesota's forest resources through multiple use management, wildfire and pest protection, and technical forestry assistance.

Information systems exist to help the Division accomplish its mission in an effective and efficient manner. The systems must provide the resource manager with the information needed to make effective decisions and serve client needs. Information systems can also improve efficiency by automating repetitive processes and by increasing the speed of data transfer.

The Division's mission must drive the design and operation of its information systems. That is, the information systems must be designed to provide the information needed to manage state lands, to prevent and suppress wildfires, and to provide forest management assistance to private landowners. At the same time, information systems enable the Division to adjust and refine its mission to better serve its clients. For example, forest inventory data can be analyzed to identify new forest industry development opportunities or fire data evaluation may enable the Division to develop a more effective wildfire prevention strategy. Figure 3.1 illustrates this dual relationship between the Division's mission and its information systems.

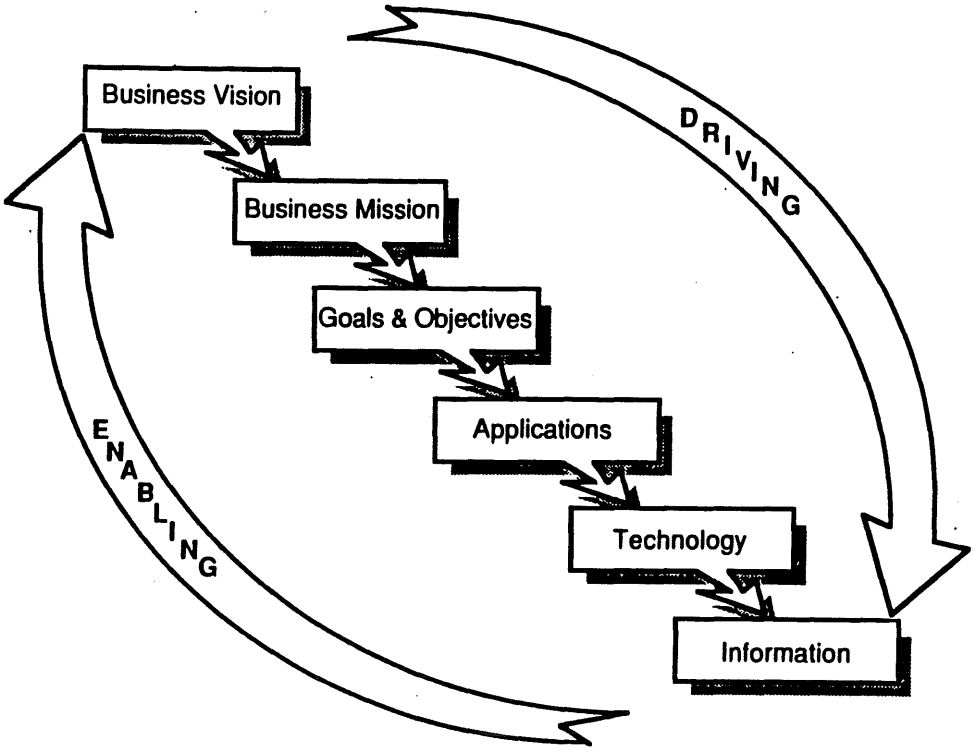


Figure 3.1 Relationship between Business Mission and Information Systems

Desirable Systems Characteristics

Before an architect begins to design a building, she needs to know certain information about her client, the intended use of the building, and the proposed building location. Likewise, when developing an information systems blueprint, information about the organization, potential systems use, and user expectations are needed.

One of the first tasks of the Blueprint Project Team was to describe some of the desirable characteristics of the Division's future information systems. Based on the group's knowledge and understanding of the Division, the following list of desirable characteristics was developed.

The Division of Forestry should have information systems that:

- Are user friendly
- Produce the needed automated reports
- Are capable of being maintained
- Make maximum use of off-the-shelf software and minimize custom programming
- Maximize integration of data
- Are easily upgraded
- Are capable of providing ad hoc inquiries and reports
- Provide an accurate and secure data base
- Can be used to summarize data at the appropriate level
- Provide consistent service to external customers
- Can be linked with external systems
- Minimize duplicate data entry
- Consider economies of scale
- Are responsive and up-to-date
- Contain data that is truly needed and cost-efficient to collect and maintain
- Produce usable information that satisfies needs of user
- Allow data to be entered at the point of transaction
- Permit transfer and sharing of data
- Contain data that is timely, accurate, and can be trusted
- Allow data aggregation and summarization at the appropriate levels
- Link data to the land base

The fact that these characteristics were mentioned several times during the Needs Assessment interviews and in discussions with Division managers reinforced their value as guidelines for system design.

Information System Components

Information systems consist of software (i.e., programs, applications), data, hardware (i.e., computers, communication devices), and people (i.e., users, systems staff, managers). An information system blueprint explains how these components fit together. In the past, most information systems plans focused on hardware and software. Today, most organizations recognize the value of data as a resource and the importance of having well trained staff to use systems. To be complete the blueprint must address all of the information systems components. The remainder of this chapter discusses some of the trends that will influence the character and relationship of the various components of the Division's future information systems.

Software

Software is a collective term including computer programs written for specific applications, programming languages, system development tools, operating systems, and programs for general purpose uses such as database management.

Traditionally, information systems development efforts have focused on automating existing processes. This has been the case in the Division of Forestry where major systems have been developed for timber sales, fire reporting, and forest inventory. This focus on existing processes and programs often results in data redundancy and lack of systems integration. If two separate applications require the same data (e.g., stand number or land parcel ID) redundant data input is often required. Given the focus on a single process, there is little incentive or opportunity to develop generic functional applications (e.g., invoicing or mapping) that could serve a number of programs.

Applications will continue to be a very important component of information systems. Applications (programs) allow the efficient processing of data and provide the reports, summaries, and maps that resource managers need. In the future applications should relate to pre-defined databases, take advantage of programs to support generic functions, and be easily transportable between various computer systems. Applications that will be used statewide must be developed using the process outlined in Chapter 9.

As personal computers are installed at more work locations within the Division it will become increasingly important to develop and enforce PC hardware and software standards. Division employees should be able to use standard PC software for basic office tasks at any location throughout the state.

Data

Data has usually been viewed as part of the program with which it is associated rather than as a resource to be used by the entire organization. For example timber sales data is used to process timber sales but is not readily available for query by managers. Developing new applications which use data from existing applications often requires the addition of attributes or the restructuring of existing data files. This has been very difficult in the past because the existing applications are very dependent on the size and location of data items within the data files. The proliferation of independent and redundant data files has been the result.

The development of database management systems (DBMS) that facilitate the creation and modification of databases will allow a greater independence of data and programs in the future. The cost of collecting and maintaining data dictate that data redundancy be reduced and that databases survive even when the associated applications are modified or replaced. The change in how data is viewed by the organization will be difficult. A successful transition will require careful analysis of what data entities are important and which programs will use the data. A uniform data dictionary describing each of the entities will have to be developed and used. Computers that support DBMS and have adequate on line storage capacity will have to be acquired. Information systems staff and users will have to be trained in database concepts and use.

Hardware

Until recently computer based information systems were highly centralized. The high cost of equipment and need for staff with specialized skills usually resulted in a single computer center serving the entire organization. Users often felt the needed data was unavailable or unreliable. The decreasing price of mini- and microcomputers and the increasing user friendliness of software has resulted in widespread distribution of computers.

The trend toward distributed hardware and end user computing will undoubtedly continue. However, more centralized systems planning, coordination, and control will be necessary to avoid duplication of effort and inefficient use of resources. Increased efforts will be required to maintain compatibility of data and to promote the transfer and sharing of data in an increasingly complex hardware environment.

The basic hardware configuration of the Division's information systems will continue to be a minicomputer communicating via modem with PC based workstations at remote offices. The major change will be that a single minicomputer will support both traditional transaction processing and GIS functions. Stand alone PCs and Regional GIS workstations connected to the central minicomputer will also be used.

People

The roles of various groups of people will change as the Division's information systems evolve. Top management will have to assume more responsibility for the planning, funding, and support of information systems. They must ensure that information systems are actually helping the Division accomplish its mission. They must also be aware of the possible shifts in workload as a result of systems development and be willing to commit adequate resources to information management.

The Information Systems staff will be pressed to keep abreast of changing technology and its application in the Division. Systems personnel will also have to work closely with program managers and systems users to design and implement effective systems. User support will also be an increasingly important function performed by systems staff. There should be less dependence on systems personnel for setting systems development priorities.

A Forestry Information Systems (FIS) Liaison Network, consisting of designated systems users from each Area, Region, and St. Paul staff work unit, should be established to improve communication on information management. FIS Liaisons will provide a link between systems staff and systems users and will be a source of support and assistance for users.

Systems users must become more familiar with the capabilities of existing systems and with general information management concepts. Individual employees and their supervisors must be sure they have adequate training to effectively use the systems required to do their jobs. Users must also be able to clearly communicate their information needs and develop suggestions for systems enhancement.

The next four chapters of the Blueprint provide more detailed descriptions and recommendations for the applications, data, hardware, and people components of the Division's information systems.

Forestry Information Systems Blueprint

4. Information Systems Modules (Applications Architecture)

Introduction

To accomplish its mission, the Division of Forestry conducts a variety of activities. The Division's information systems support these activities by recording and processing data and providing useful information to decision makers. This chapter of the Blueprint describes the Division's major information systems applications.

The intent of this chapter is to provide a conceptual overview of the Division's existing and potential systems applications. The focus is on major applications being used statewide. It is not possible to cover small applications or applications used by a limited number of individuals. The descriptions of existing and desired features is based on information from the baseline assessment and needs analysis. There is no attempt, at this point, to assess the relative importance of the various applications. Division managers and systems users will have to determine which applications will receive priority during the systems development process (see Chapters 9 and 10 for development policy and implementation plan).

For convenience, the term module is used to refer to applications, computer programs, software, and other information processing activities whether they are automated or not. A system module is defined as a logical group of information processing procedures (that may or may not currently be automated) that support a given activity or a related set of activities in an organization. System modules are sets of procedures to:

- collect and record data concerning a related set of events, persons, places, or things on a series of forms or documents.
- enter and store the data in storage files and cabinets and/or in computer files or databases.
- retrieve the files or forms from their manual or automated storage locations for updating, answering questions, generating forms and reports, archiving, or making copies.

The Division has developed and maintains information system modules to support many of its activities (e.g. forest inventory, timber sales, fire reporting). Suggested improvements for these existing modules are included in the following descriptions. New or significantly expanded modules for Private Forest Management and Forest Development are also described. The needs for administrative support modules such as personnel records, payroll, budgeting, accounting, planning, and accomplishment reporting are also described. Finally, the Division's needs for general purpose support applications such as geographic information systems, word processing, electronic mail, and calendaring are discussed.

The following topics will be covered in each system module description:

Current condition - A brief description of the current information collection and information management practices (whether manual or automated) for each system module

being defined. It should identify the major problems and pitfalls, as well as, the advantages and desirable features of the existing practice.

New Directions and Needs - A brief description of the nature of the system desired, outlining changes desired to current practices and procedures. Changes that would be in conflict with current administrative procedure, Division policies or State law will be noted for further evaluation.

Data Requirements and Characteristics - A list of the key entities used in the module. More complete data descriptions to be written during the conceptual design step of module development will include:

- Data Entities - Description of the entities or data elements (events, documents, persons, places or things) about which data needs to be collected. Examples of entities - Stands, sales, auctions, burns, fires, scales, personnel, loggers, bid.
- Important Attributes - A listing of the important attributes or data items that are to be collected for the entities. Examples of attributes - Species, date, RAD, age, density, distance from road, cause, acres, amount of bid.
- Identifying Attributes - The identifying attribute is that piece of information that uniquely identifies single occurrences of an entity. Examples of identifying attributes - type sequence number for a cover type, forest development project number, personnel ID, Permit number, appraisal number, sale number, logger ID, etc.
- Geocodes - That attribute that most precisely locates an occurrence of an entity that has need for spatial reference. Examples of geocodes - Public land survey land descriptions, county codes, State Plane coordinates, latitude/longitude, and UTM coordinates.

Users - A determination of the key system users by geographic location and position classification.

Input - A listing of the forms, documents, maps or other input materials (and their sources) that will be entered into the system. This should identify form numbers, as well as, the geographic location and staff (by position classification) that should enter the information.

Output - A listing of the products to be generated by the system module and who needs them. This should include a listing of the reports, maps, summarizations, permits, forms, licenses, graphs, charts, copies of data bases, etc. that the system needs to be able to produce.

Linkages (Relationships to other modules) - This section will detail the relationship of the system module to other activities in Forestry and outside of Forestry. Linkages of the

type that generate data that should be sent to or accessed by other modules or require data from other modules need to be identified.

Hardware and Software Needs - A delineation of the basic types of hardware and software required for the system module.

Forest Resource Inventory Module

The goal of the Forest Resource Assessment and Analysis Program is to integrate all inventory activities into a comprehensive assessment program that provides accurate information in response to changing user needs and expanded applications. The Division of Forestry cooperates with the US Forest Service in maintaining the statewide, plot-based inventory covering all lands in Minnesota. The Division has also developed a detailed stand-based inventory system used on most DNR and county administered land and some private lands. This Cooperative Stand Assessment (CSA) inventory is the base information for management of state administered timber resources.

The CSA inventory is closely tied to all aspects of the Division's state land management activities. It provides the base information used in the Timber Management Planning Information System (TMPIS). The Timber Sales Module and the Forest Development Module are used to track management activities that result in changes to forest stands which must be reflected in alterations of the CSA data for those stands. Figure 4.1 illustrates the relationships between these components of the Division's information systems.

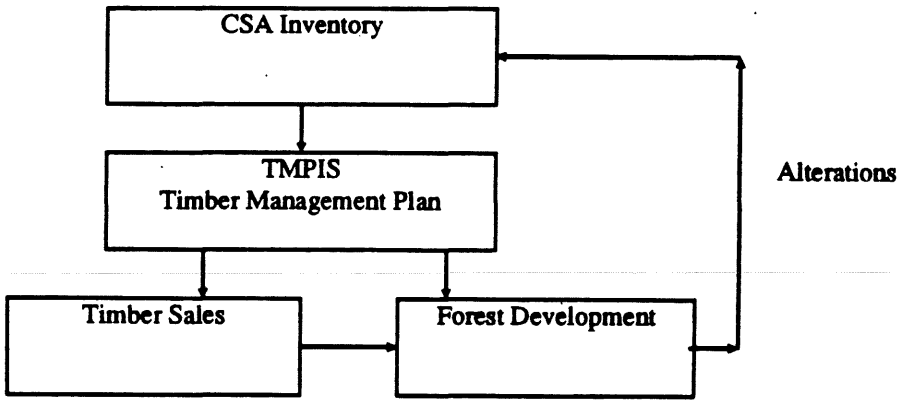


Figure 4.1 Relationship of Timber Management Components of the Forestry Information Systems

Current Condition

The CSA inventory consists of maps of stand boundaries and attribute data associated with those stands. The CSA inventory started in 1976. All DNR administered lands and county administered lands in cooperating counties have had the initial inventory completed. All attribute data is computerized. About 20 percent of the inventory maps have been digitized using a GIS. The remaining hand drawn maps are being converted to digital format.

Maintaining and improving the quality and utility of the CSA data is a constant task given the changing nature of forest stands. Field foresters are responsible for submitting alteration, update, and re-inventory data. The GIS staff in Grand Rapids is responsible for processing the changes to the CSA data. Figure 4.2 illustrates the current procedures for maintaining the CSA inventory.

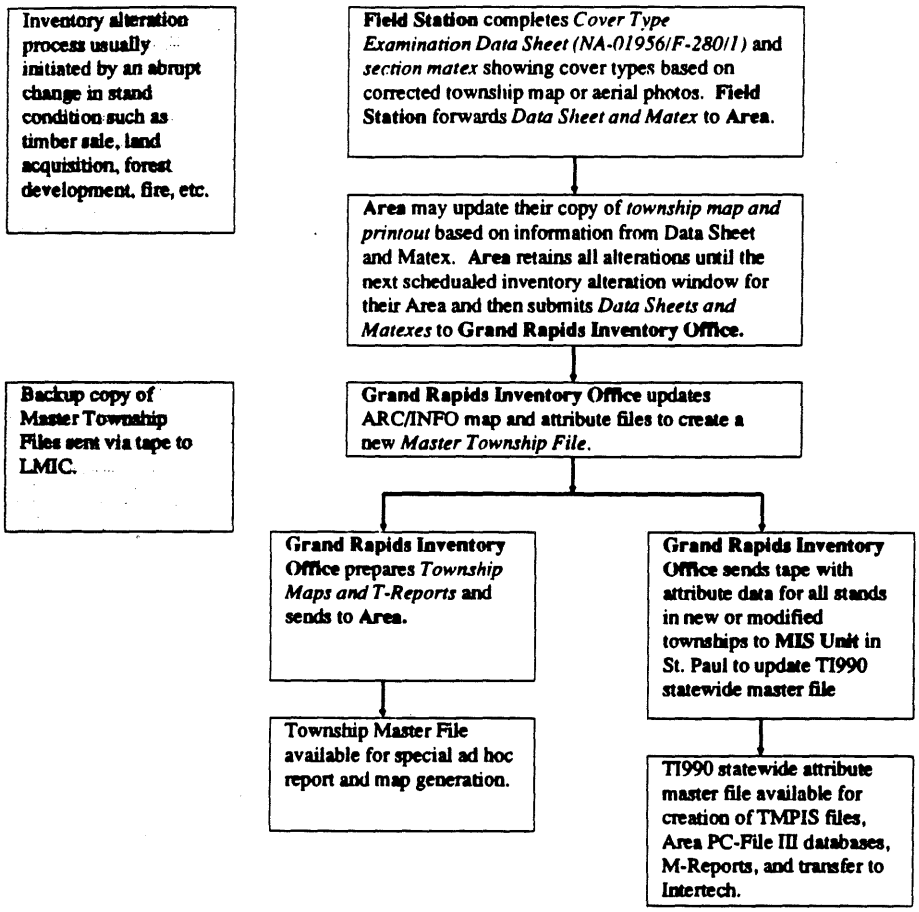


Figure 4.2 CSA Inventory Process and Information Flow

There is currently a pilot project being conducted to evaluate the desirability of having CSA attribute alterations entered at the Area rather than in Grand Rapids. The objectives of the pilot are to avoid the time and delay involved in sending attribute alterations to Grand Rapids for processing and to have an accessible, up-to-date copy of the CSA attribute data available for use in the Areas. INVENT, a microcomputer based application developed using R:Base for DOS, was developed as part of the pilot project. INVENT is currently being tested in selected locations. If INVENT is implemented statewide, attribute updates would be sent to Grand Rapids on floppy diskette so that the township master files can be maintained.

The CSA maps are township base maps with stand boundaries on state and county land. The base information (section corners, water, railroads, major roads) is taken from USGS topographic maps. Stand boundaries are interpreted from 1:15840 scale aerial photos and are field checked when the attribute data is collected. The final maps are drawn at a scale of 1:15840. The Division has contracted with LMIC to convert the remaining hand drawn maps to digital format for use with the GIS. LMIC also maintains a backup copy of all CSA township files. Alterations to stand boundaries are processed in Grand Rapids.

A number of standard reports and maps are prepared from the CSA data. The most common units for data summarization are townships (T reports) and management units (M reports). Copies of the attribute file are provided to each Area to allow them to generate ad hoc using microcomputer database management packages (i.e., PC-File III or R:Base). Copies of the statewide attribute file are also available on the TI 990 and the Intertechnologies Group mainframe in St. Paul.

New Directions and Needs

The CSA data is viewed as a valuable resource, allowing the Division to better manage state forest lands. There is a strong desire to have increased access to the computerized attribute files at all levels of the Division. The most commonly requested means of access is via a commercial database package on a microcomputer. The primary use would be to generate ad hoc reports needed to answer management questions.

A second major concern is the need for improvement in the process for keeping the inventory up-to-date. There is general consensus that the current procedure takes too long for the updated data to get back to the field foresters. As a result alterations generally receive low priority and the inventory gets increasingly out of date. Suggested changes include having the field foresters (Field Station or Area) enter changes to the CSA attribute file locally and send a copy of the changes to update the master file in Grand Rapids. This approach is being piloted using the INVENT program. Speeding up the processing of changes in the map portion of the CSA presents additional challenges. Improvements could be made by completing the conversion of hand drawn maps to digital format and

upgrading the Prime computer to permit faster processing. As GIS technology improves it may be possible to decentralize processing of map alterations. Procedures also need to be developed to identify which stands can have their inventory data modeled forward to the current date and which should be physically re-inventoried. For those stands that need to be physically re-inventoried, the system should generate lists of stands within a selected unit (township, section) and perhaps generate field forms with the data that is not likely to change filled in.

The use of field data recorders for entry of CSA data should be explored.

There is a strong desire to have the CSA inventory more strongly linked to other Division information systems. Most foresters see the CSA inventory as the foundation of an integrated forest land management information system. The CSA provides information about the existing stands. Other parts of the system, such as TMPIS, prescribed burn plans and reports, timber sales system, and forest development records record data about plans for, or activities affecting the stands. The stand ID number is seen as a possible link between these sub-systems.

The CSA inventory is and should continue to be a major component of the Division's GIS database. The Needs Interviews identified the need to overlay CSA data with soils, roads, and Natural Heritage data. Having the CSA available on a GIS will also allow more convenient sharing of inventory data with other agencies. The desirability and feasibility of using stand boundaries and other data (ownership, roads) in the GIS database to automate the preparation of operational scale maps (similar to those currently hand drawn for timber appraisals and development projects) should be investigated.

Data Requirements and Characteristics

A stand is the basic entity involved in the CSA inventory. Each stand has an identifier consisting of a geocode to the section level and a type sequence number. Several attributes are recorded for each stand. The current CSA maps include ownership, public land survey, roads, and water features as well as stand boundaries.

Users

The Forest Inventory module will be used by all Division personnel with timber management or planning responsibilities. Ideally, each person using CSA data would have computer access to fairly up-to-date data for their unit (District or Area) at their own office.

Field Station personnel (foresters and technicians) should either be able to generate ad hoc reports on their own or be able to request needed reports from the Area. Typical uses might include selecting stands for various management practices based on criteria, locating stands capable of providing specialized products, and planning inventory update projects. Field Station personnel will also generate the initial inventory, alterations, and re-inventory data needed to maintain the CSA. Field Station personnel may also request specialized analyses or maps from the GIS.

Area specialists and supervisors will use the Inventory module for planning and operations. Attribute data entry will probably occur at the Area if the INVENT pilot goes as anticipated - although entry could be done at other levels. Areas will also provide simple reports to Field Stations that do not have PCs.

Regional staff specialists may need to use subsets of the inventory data for special projects or to analyze the effectiveness of various management activities. In some cases Regional specialists may need access to or summaries of statewide CSA data.

Inventory specialists on the St. Paul staff will be responsible for maintaining the integrity of statewide data files. St. Paul staff will likely be responsible for completing the larger or more complex analyses of CSA data.

Input

- Cover Type Examination Data Sheet (NA-01956) for attribute data
- Matex overlays from aerial photos showing stand boundaries as basis for CSA township maps

Output

- Township maps and T-, M-, and S-Reports
- TMPIS data sets for management units
- Copies of attribute data for administrative units in format suitable for use with PC database management package
- Ad hoc reports

Linkages

The Forest Inventory module must be linked to the TMPIS, Timber Sales, and Forest Development Record systems. The Stand ID (including a geocode) could be the link between these systems.

If INVENT becomes the attribute entry portion of the CSA inventory, it should also be used to enter private land inventory data.

The Forest Inventory module needs to access DNR land ownership records to check ownership and administrator data.

Hardware and Software Needs

The Forest Inventory module would operate on a PC at Area and/or Field Stations. INVENT (and perhaps R:Base or a similar database package) should meet most needs to enter data and generate reports at the Area or Field Station level. PCs should have adequate mass storage capacity to maintain a complete copy of the administrative unit's CSA attribute file. Current plans are to transmit updates for the master file via diskette, although it could also be done via modem.

There is a potential to use portable data recorders to collect and enter inventory data.

Mini or mainframe computers are needed to store, process, and analyze regional or statewide CSA inventory files. The ability to provide maps and perform geographic analyses is also required.

Forest Development Module

Forest development includes a variety of resource management activities such as reforestation, timber stand improvement, wildlife habitat management, and prescribed burning. These activities can take place on Division administered land or lands of other owners. The Forest Development Module will primarily deal with planning, administering, and keeping historical records on state administered lands. However, portions of the module will be equally useful in the Division's cooperative forest management programs.

Division of Forestry programs conducting forest development activities include Timber Management (Silviculture), Fish and Wildlife Habitat Management, and Fire Management (Prescribed Burning). Closely related programs include Timber Sales, Forest Inventory, Private Forest Management, Pest Management, Soils, and Land Administration.

The goal of the Timber Management program is to efficiently apply sound silvicultural practices to regenerate and improve productivity of state-owned forest lands. Reforestation and timber stand improvement are the major silvicultural activities carried out on state land.

The goal of the Fish and Wildlife Habitat Management program is to provide forest habitats conducive to managing and protecting a variety of fish, wildlife, and native plant resources. To maintain or improve the quality of fish and wildlife habitat the Division modifies timber management practices to mitigate the effects on habitat, creates openings, manages shrub and grass areas, and conducts prescribed burns.

The prescribed burning program seeks to improve the DNR's ability to use controlled fire as a safe and effective vegetative management technique.

Current Condition

The CSA inventory (see Forest Resource Inventory Module) provides basic information about forest resources on state lands. This information is used to develop long term forest management plans. The Timber Management Planning Information System (TMPIS) uses CSA inventory data as input. Figure 4.3 illustrates the steps involved in using TMPIS to develop a timber management plan for a management unit. Based on criteria set by the resource manager, TMPIS selects stands for regeneration without harvest, all-aged management, clear cutting, and thinning. The resource manager can accept or modify the proposed stand treatment or can place the stand in a reserve classification. TMPIS also projects regeneration needs and the future age class distribution of each cover type. TMPIS plans are generally prepared at the Area level (the Area may be subdivided into several management units for timber management purposes). TMPIS was originally designed to provide standard hardcopy reports listing stands selected for various

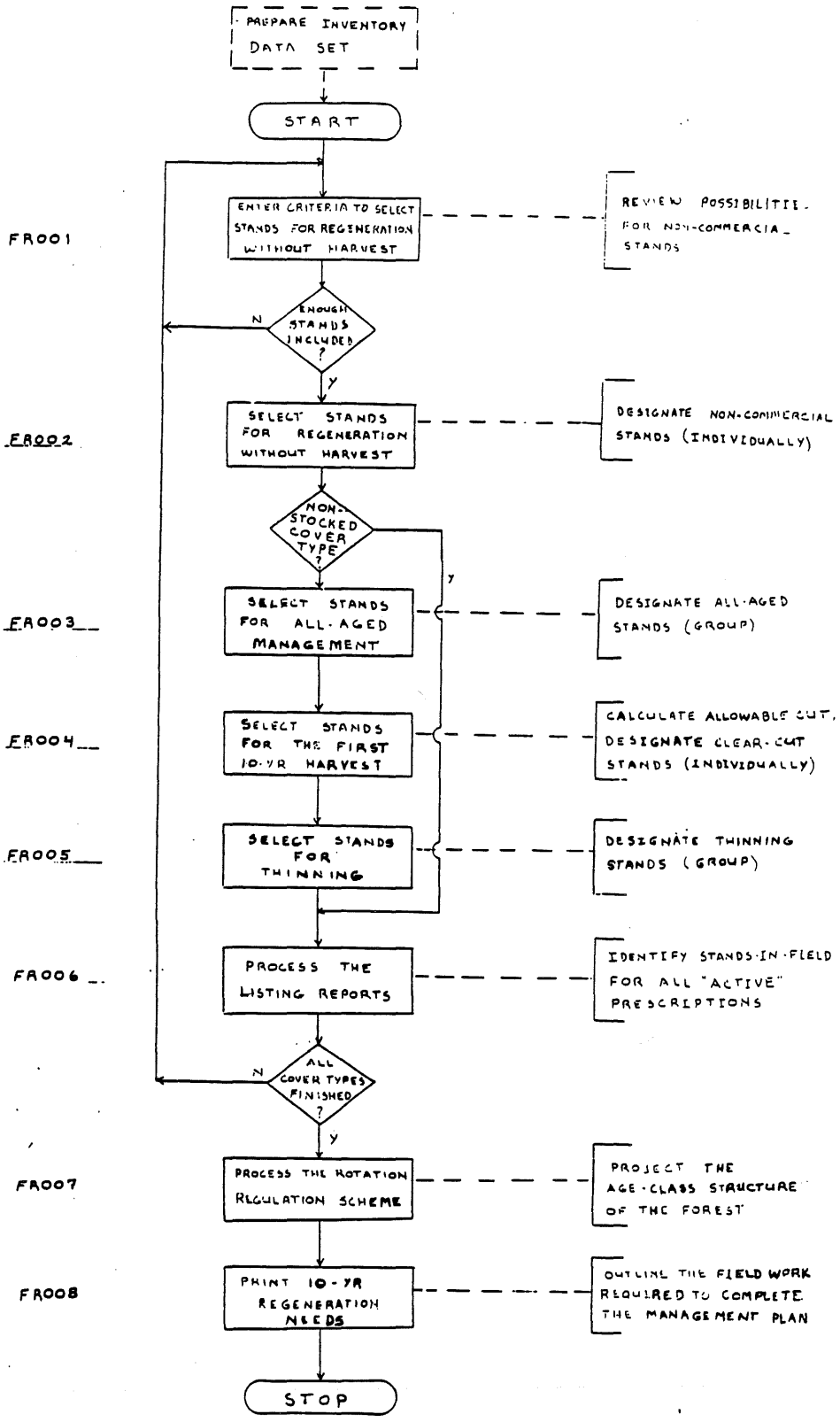


Figure 4.3 Timber Management Planning Information System (TMPIS)

management activities and summary reports for regeneration needs and age class distributions. TMPIS prescriptions are not recorded on the CSA inventory. A procedure has been developed to allow mapping of TMPIS prescriptions on digitized CSA township maps using GIS. TMPIS stand lists have also been imported into database management systems (i.e., PC-File and R:Base) to allow further sorting and to permit tracking of plan implementation.

Forest Development activities are closely tied to Timber Sales activities (see Timber Sales Module) in that most site preparation and reforestation projects are preceded by a timber sale. This relationship is not reflected in the current information systems. The Timber Sales and Forest Development Record systems are not integrated with each other or with the CSA inventory.

Figures 4.4 through 4.7 show the processes and information flows involved in mechanical site preparation, herbicide, natural regeneration, and artificial regeneration projects. Most of these projects are initiated by preparation of a Forest Development Proposal (NA-02170) at the Field Station level. The Forest Development Proposal and associated forms and maps filed at the Field Station are the primary means of maintaining a historical record of management activities for a given stand. Forest Development Proposals prepared at the Field Station are forwarded to the Area for review, approval, and contract processing.

Most Areas are currently entering data from Forest Development Proposals using PLTINDEX/PLTCOST. PLTINDEX/PLTCOST is a Lotus 1-2-3 application that allows retrieval and analysis of development record data. Most Areas have entered data back to the early 1980's. The basic unit for record keeping is a "project" - usually including all activities occurring on a given tract of land. Most of the records deal with regeneration and release of plantations. The feasibility of converting PLTINDEX/PLTCOST to a database management system (DBMS) is currently being evaluated.

A variety of local applications have been developed to track forest development projects through the budgeting, contract administration, and accomplishment reporting. The most advanced applications use Lotus 1-2-3; others use PC-File III or manual methods. No single application is used statewide.

Fish and Wildlife Habitat Management on Division of Forestry administered lands usually does not result in any additional information processing needs. Most habitat management is done as part of other forest development projects. The coordination and review procedures between the Divisions of Forestry and Fish & Wildlife are contained in DNR Policy # 8. Most permanent wildlife openings created in forested areas are too small to be recorded as separate stands on the CSA inventory. Some wildlife habitat management projects involve use of Division of Wildlife funds and have special accomplishment reporting requirements.

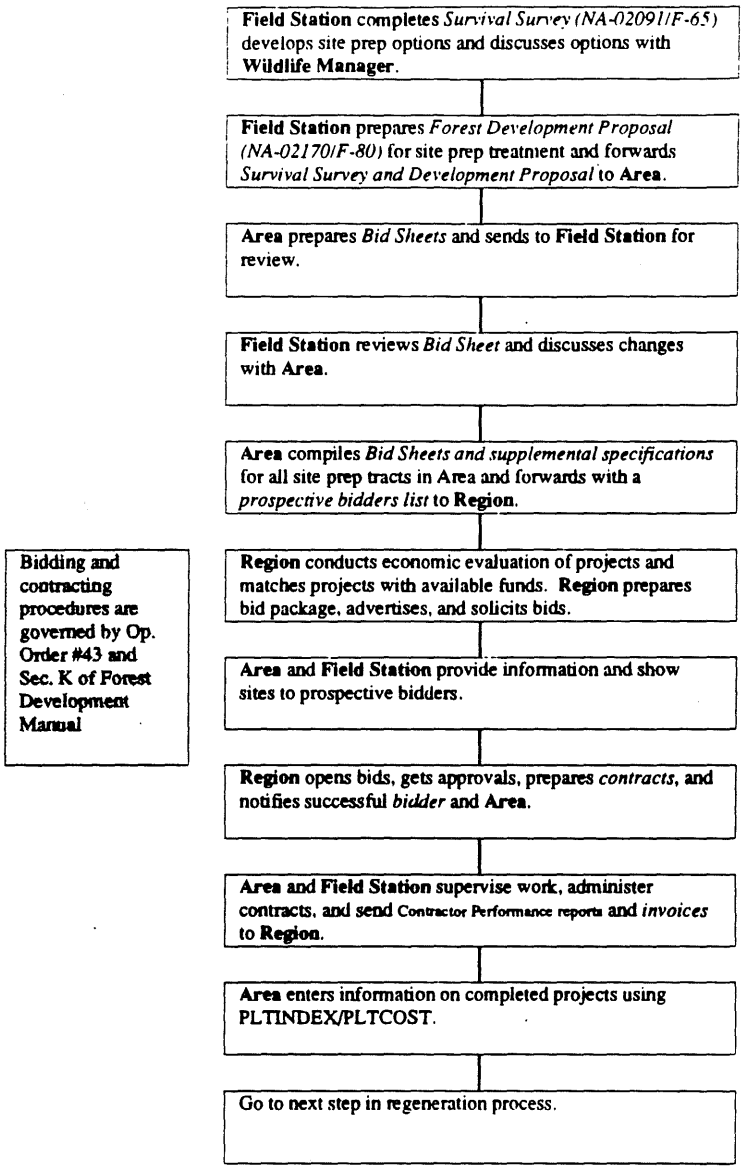


Figure 4.4 Mechanical Site Prep - Process and Information Flow

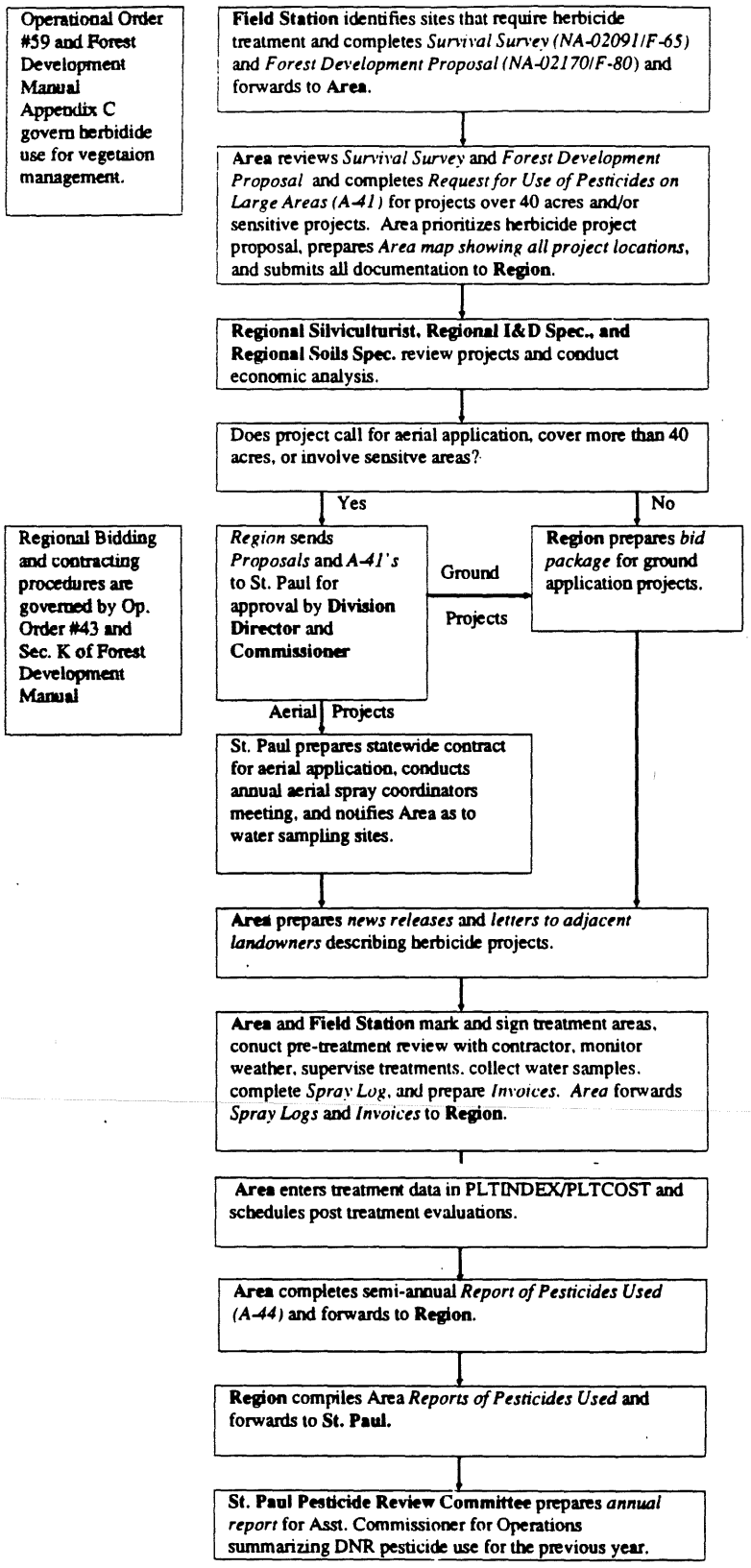


Figure 4.5 Herbicide Projects - Process and Information Flow

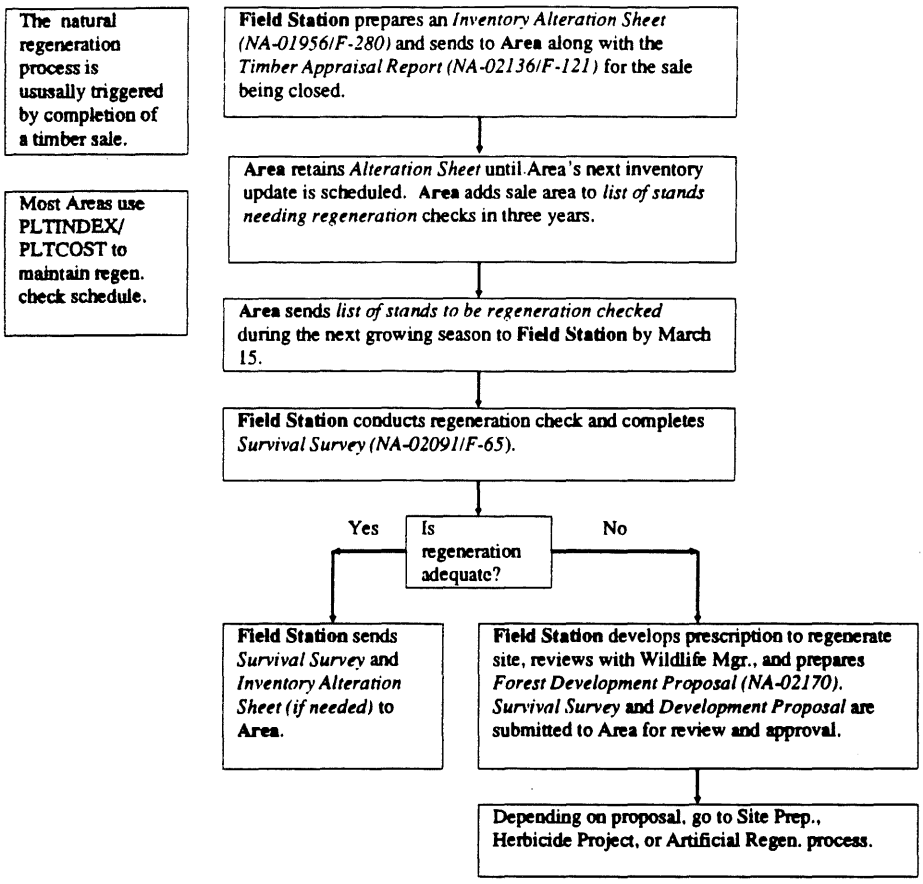


Figure 4.6 Natural Regeneration - Process and Information Flow

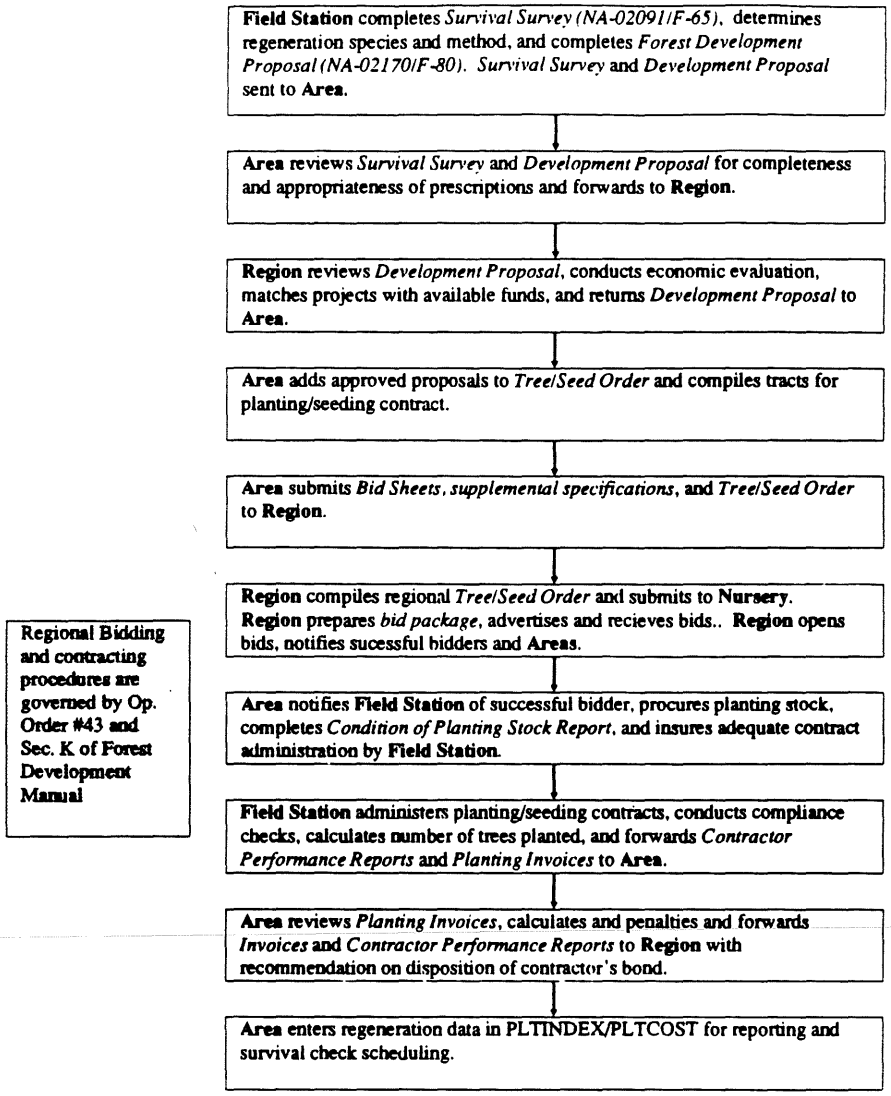


Figure 4.7 Artificial Regeneration - Process and Information Flow

Figure 4.8 depicts the procedures and information flows in the prescribed burning program. All forms and reports are completed manually, photocopied, and mailed to appropriate destinations.

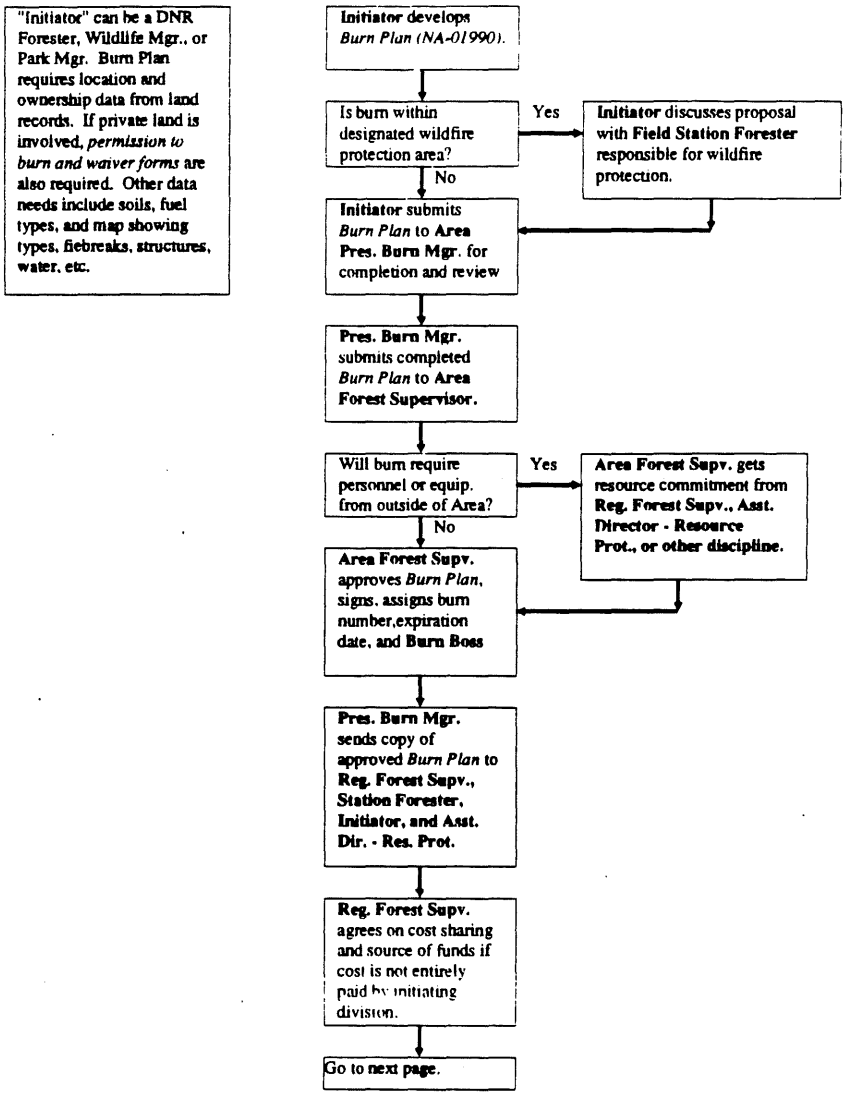
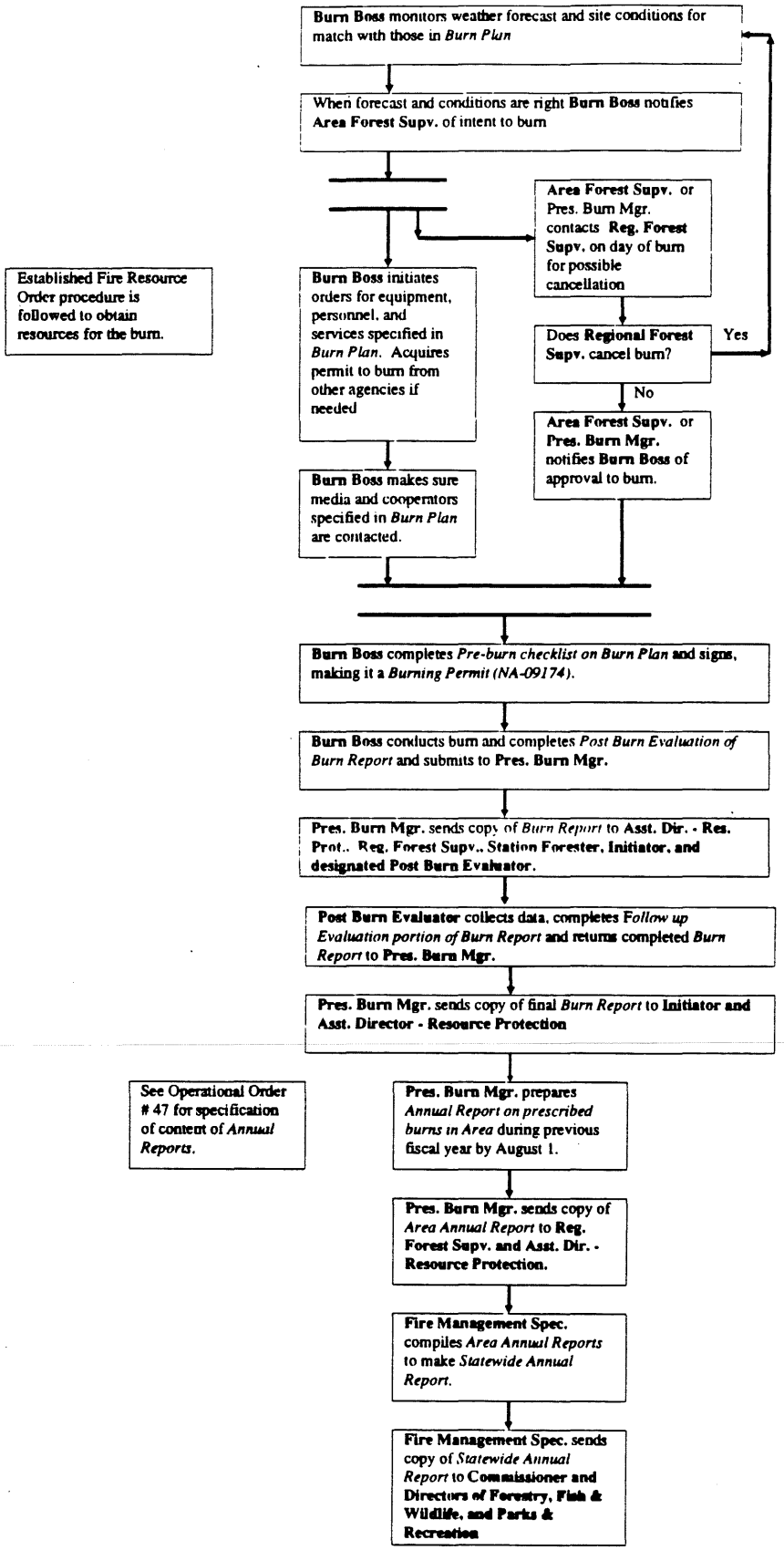


Figure 4.8 Prescribed Burning Process and Information Flow



(Figure 4.8 continued)

New Directions and Needs

The following desired capabilities for an improved Forest Development module were suggested in Blueprint Project needs interviews:

- Need a smooth running Development Record System that is used uniformly in all Areas and Regions. This would allow aggregation, analysis, and summarization of data at Regional and Statewide levels.

- The Development Record System should be converted to a database management system (DBMS). The silvicultural data and the cost data that are currently stored in two separate worksheets should be combined to facilitate data entry and analysis. Along with this there should be an evaluation of the potential size of the database and the hardware and software required.

- Need better report generation capabilities. Need to be able to generate ad hoc reports.

- There should be a goal of "seed to stand" tracking; a link between the nursery and forest development records. The nursery would like to be able to compare regeneration success based on type of stock (bare root or containerized) and other factors. This requires a link with the survival check portion of the Forest Development Record System.

- The basic entity tracked in the Forest Development Record System should be a stand rather than a project. This would allow better linkages with the CSA inventory and timber sales.

- Prescribed Burns should be entered in the Forest Development Record System. Burns should be treated like other site activities.

- The drawing of operational level (site) maps associated with forest development activities should be automated. There is a potential to use maps generated during the timber sales process as the beginning point for forest development maps.

- Annual accomplishment reports and annual reports on regeneration by species should be generated by the Forest Development Record System.

- There should be an effort to make forms used for stand level activities (e.g., silviculture, herbicides, prescribed burns) as uniform as possible. All DNR Divisions should use the same forms and information systems for recording stand level activities.

- Wildlife openings should be systematically recorded on the CSA inventory.

- Prescribed burn plans and post-burn evaluations should be entered in a computer database to eliminate the need to photocopy and distribute forms at so many steps in the process. This would also facilitate preparation of the required annual report.

Data Requirements and Characteristics

Data entities likely to be important to the Forest Development module include:

- Stand (cover type)
- Development Project
- Wildlife Opening
- Prescribed Burn
- Contract
- Contractor

Users

Field Station personnel usually initiate forest development projects by completing a Forest Development Proposal. Field Station personnel also develop contract specifications, certify contract completion, and distribute information to contractors and the public. Survival checks are completed and follow up activities proposed by Field Station personnel. Files are maintained to aid in planning future activities and to provide a reference system for new personnel at the Field Station.

Area personnel are currently responsible for entering data and maintaining the Forest Development Records using PLTINDEX/PLTCOST. Area personnel review, approve, and prioritize Forest Development Proposals and coordinate funding decisions with the Regions. Areas can generate lists of sites needing regeneration or survival checks. Area personnel are also involved in evaluating the success or effectiveness of treatments and in preparing annual work plans and accomplishment reports. Area Forest Supervisors (or designated Area Prescribed Burn Managers) review and approve prescribed burn plans.

Regional personnel coordinate development of Regional work plans and accomplishment reports, allocate funds for approved development projects, and assist in advertising for bids and awarding contracts for selected projects. The Regional Forest Supervisor must approve prescribed burns on the day of the burn. Regional staff keep copies of prescribed burn plans and coordinate inter-Area and inter-Divisional funding, equipment, and staffing to conduct burns.

St. Paul staff directs work planning and accomplishment reporting and allocates development budgets to the Regions. Copies of prescribed burn plans are maintained and the annual prescribed burn report is generated in St. Paul.

Other DNR Divisions are involved in developing TMPIS plans, managing wildlife habitat on state forest land, conducting prescribed burns, and using herbicides for vegetative management.

Input

- Forest Development Proposal (NA-02170/F-80)
- Survival Survey (NA-02091/F-65)
- Inventory Alteration Sheet (NA-01956)
- Prescribed Burn Plan/Report (NA-01990)
- Contract and Contractor data

Output

- Forest Development Accomplishment Reports
- Ad hoc reports and analyses
- Annual summary of prescribed burn acres
- Operational level (site) maps for development projects
- Copies of databases for use by other Divisions and Agencies

Linkages

The Forest Development Module must be closely linked to the CSA inventory and TMPIS. The inventory provides a picture of the existing vegetative cover. TMPIS records planned activities that will affect the vegetation. The Forest Development Record System tracks the status of current projects affecting the vegetation and will provide a history of treatments on a given site. When a project is undertaken the affected stands should be removed from the TMPIS list. When a project is completed it should trigger an alteration of the CSA inventory to reflect the new stand conditions.

The Forest Development Module should be able to reference the DNR land ownership records to determine ownership, administrator, and active leases or land transfers on the parcels involved in a project.

Closure of a timber sale in the Timber Sales Module should prompt creation of a record in the Forest Development Module so that artificial regeneration can be planned or natural regeneration monitored.

The Forest Development Module may be able to help in generating the Nursery Tree Order for state lands. There should also be a link to allow tracing of seedlings planted on a given site back to the nursery seedbed and seedlot.

The Forest Development Module should allow automated generation of accomplishment reports.

Hardware and Software Needs

For the immediate future, the Forest Development Module will not require PC's at the Field Station level. Basic entry of data from the Forest Development Proposals will continue to be done at the Area, though it could be done at Field Stations in the future. Portable data recorders could be used for regeneration surveys.

The Forest Development Module will require a PC with R:Base or a similar DBMS and sufficient mass storage to maintain ten years of development records at the Area level. Modems or diskettes will be needed to export Area level databases to the Region. If operational level maps are to be produced there would be a need for a simple GIS or CAD software and associated input and output devices at the Area level.

Regions should have adequate storage and DBMS to combine and use Area level databases. If a statewide database is to be created there should be mechanisms to export Regional databases to the St. Paul computer.

Timber Sales Module

The timber sales program exists to administer the sale of timber stumpage from state owned lands. A sustained yield of renewable resources from state forests to benefit citizens is the primary objective. Timber sales activities include planning, timber appraisal, sale administration, timber scaling, and processing of timber sale data.

Current Condition

The existing Timber Sales system was developed by the Division of Forestry during the mid 1980's. It is written in COBOL and operates on the Division's TI 990/Area PC network. All hard copy documents prepared during the timber sales process are manually filed after entry into the Timber Sales system.

The major component programs of the Timber Sales system are listed below:

APPRAISAL PROGRAMS
TS101 - Appraisal Entry/Update
TS102 - Print Appraisal
TS114 - Post Auction Sale Results

SCALING/INVOICE PROGRAMS
TS131 - Timber Scaling
TS132 - Invoice Data Entry

MISC. PROGRAMS
TSREP - Run Timber Sales Reports

SUPERVISION PROGRAMS
TS121 - Name/Address Change
TS123 - Cancel/Suspend
TS124 - Added Timber
TS125 - Permit Extension
TS126 - Special Extension

INQUIRY PROGRAMS
TS141 - Permit Inquiry
TS142 - Logger Inquiry
TS143 - List Permits on File

The timber sale process begins with an appraisal of the timber to be sold. Figure 4.9 shows the forms and information flows in the appraisal process. Appraisals are done by Field Station personnel and entered into the computer at the Area. Once an appraisal is completed the timber is sold using the informal sale, intermediate auction, or regular auction procedures.

Figure 4.10 depicts the Informal Timber Sale process. Informal permits are currently typed at the Area and then data is entered into the computer system.

Figure 4.11 depicts the Intermediate Auction Timber Sale process. Appraisals for intermediate auctions are typed at the Area and sent to the Region for approval. After Region approves, they prepare a Notice of Sale. Areas then type the Intermediate Auction Permit to Cut.

Figure 4.12 depicts the Regular Auction Timber Sale process. Regular Auction appraisals are typed at the Area and sent to the Region for approval. After Region approves, they prepare a Notice of Sale. Region then types the Regular Permit to Cut after the tract sells.

Fuelwood and Special Product Permits are prepared at the Field Station and sent to Area for approval. These permits are not entered into the computer system.

Figure 4.13 depicts the Billing and Collection process used for all types of timber sales. The billing process is initiated with the preparation of a scale report. Scale reports are entered into the computer at the Area. The Area triggers the production of Annual and Final billings for Auctions and Invoices for Informal Permits. St. Paul audits, prints, mails, does follow-up on overdue billings, collects, and processes the payment.

The cover type drain portion of the current timber sale system is <u>not</u> compatible with TMPIS.

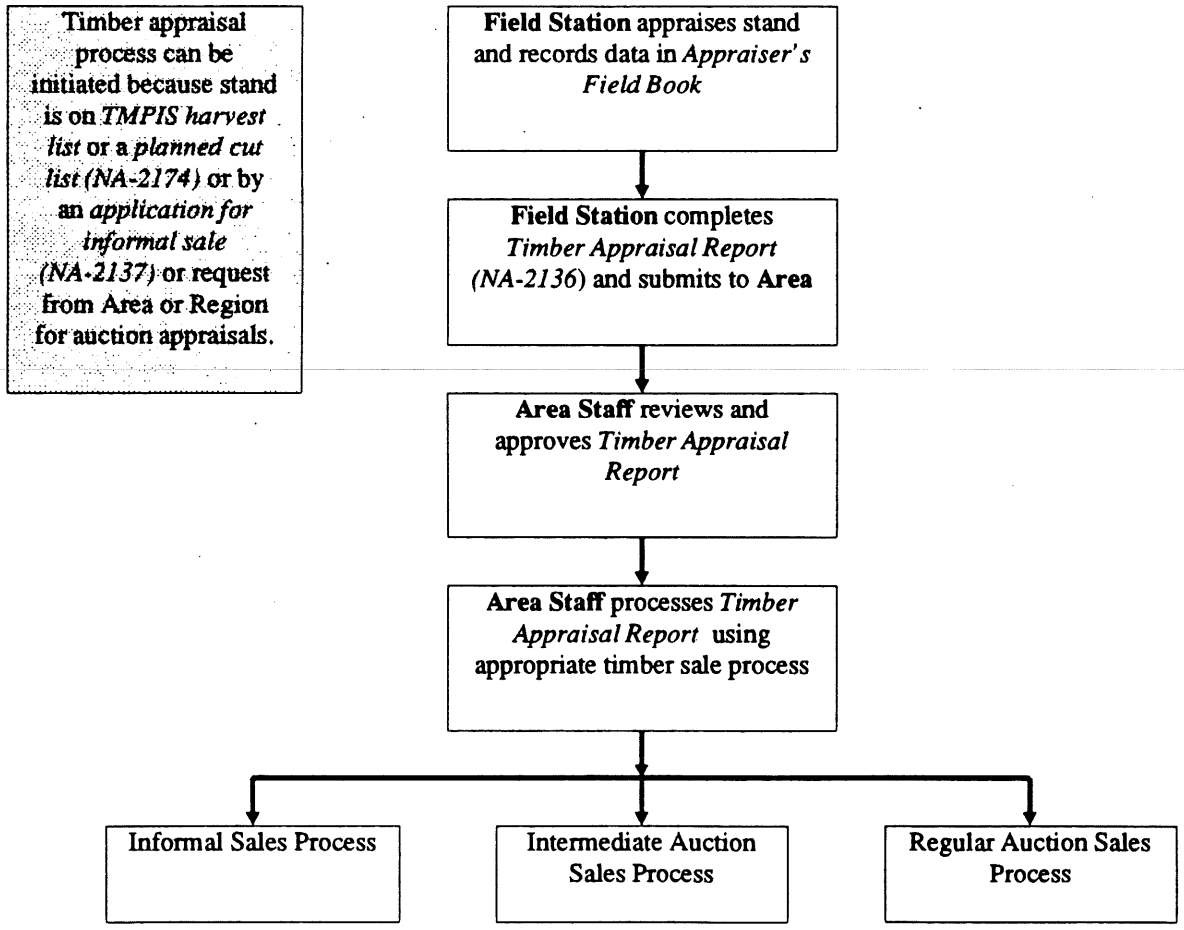


Figure 4.9 Timber Appraisal - Process and Information Flow

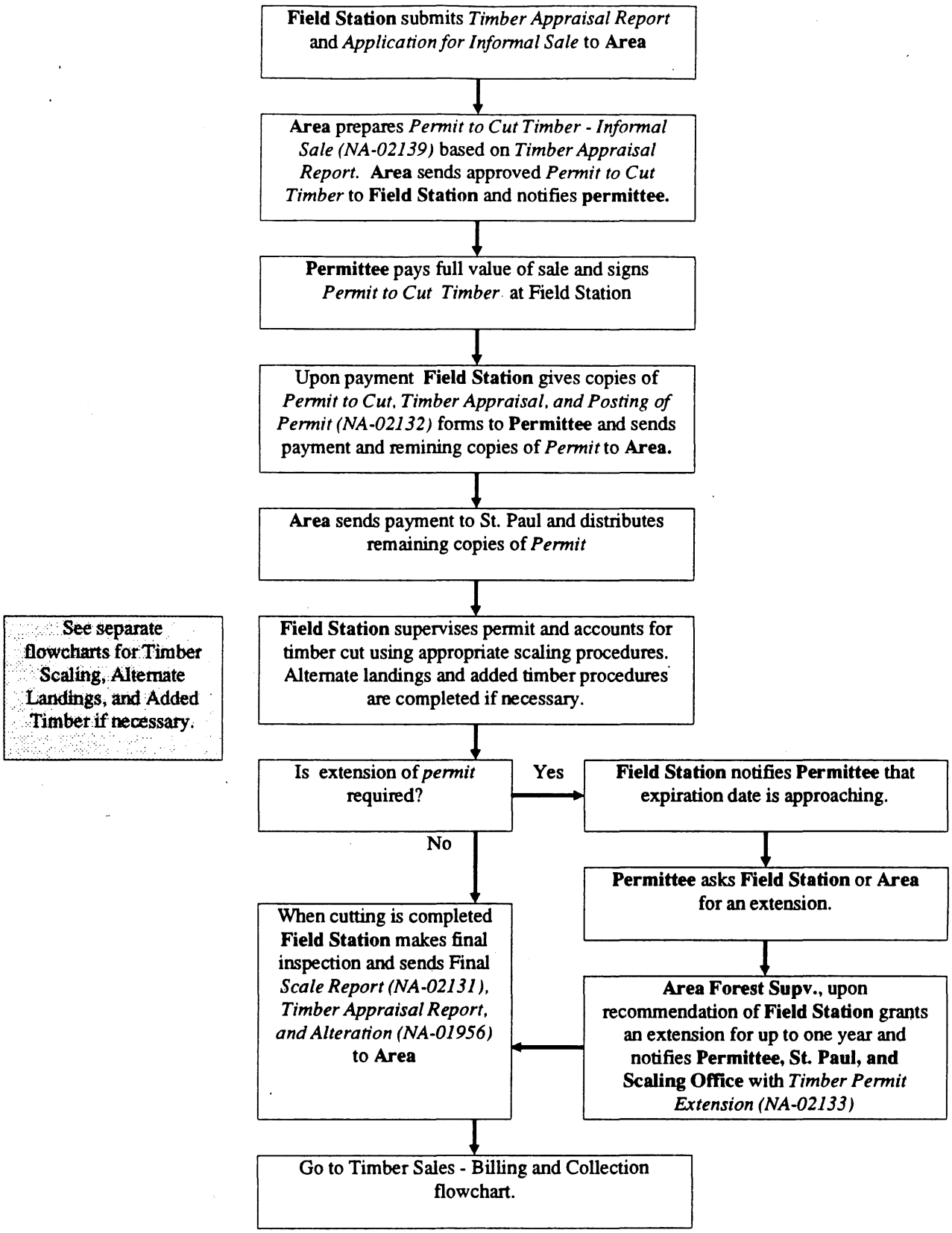


Figure 4.10 Informal Timber Sale - Process and Information Flow

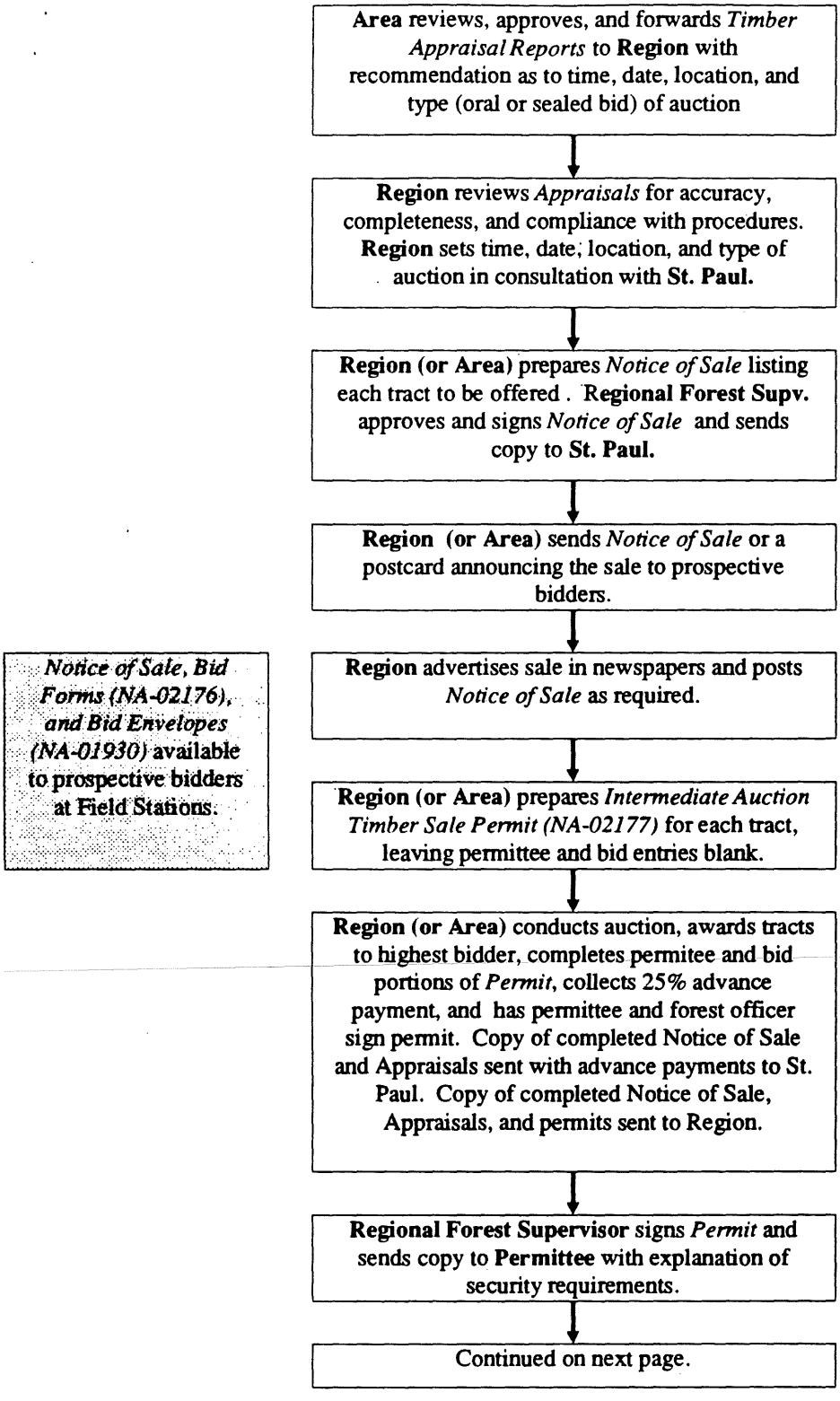
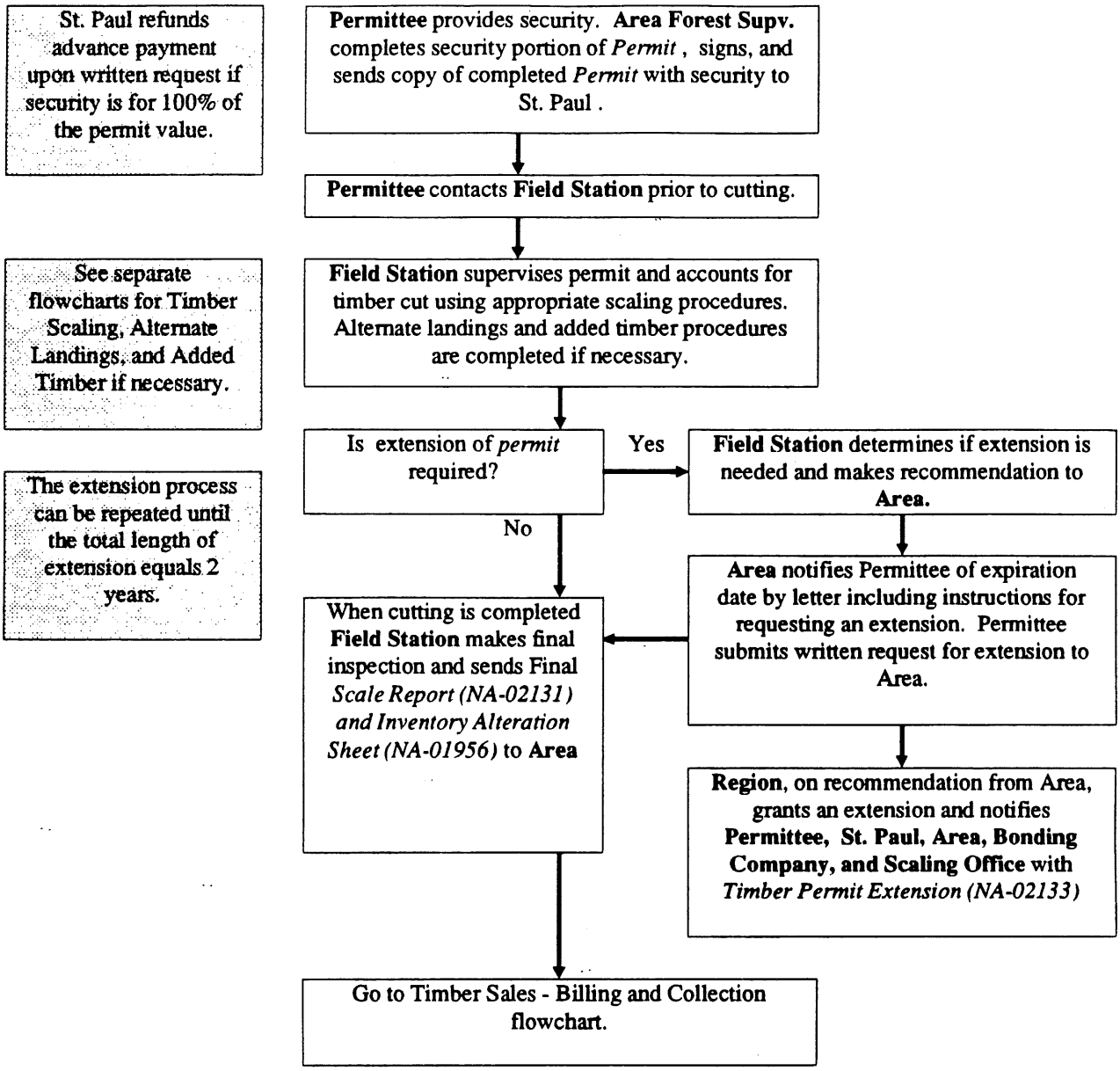


Figure 4.11 Intermediate Auction - Process and Information Flow



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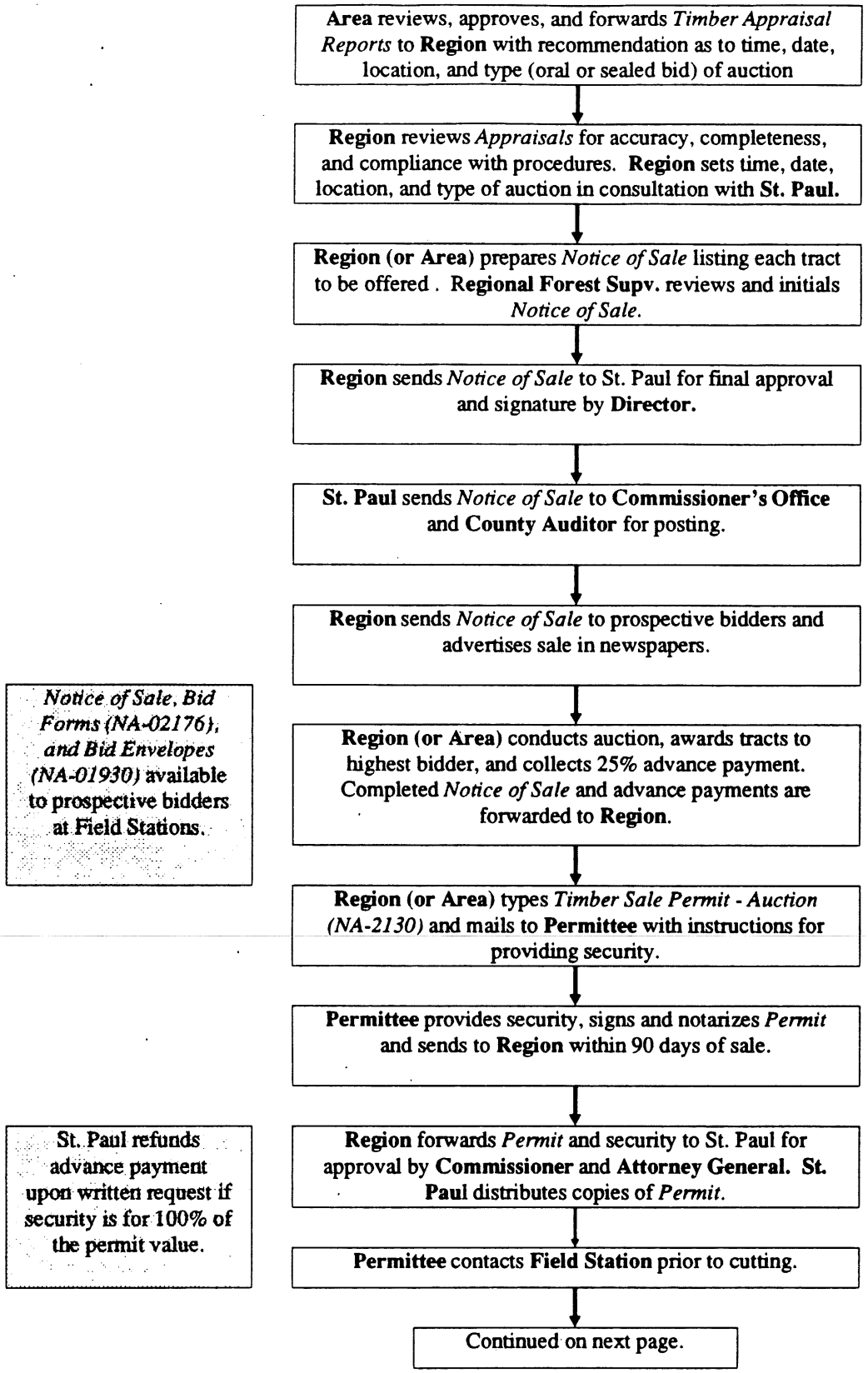
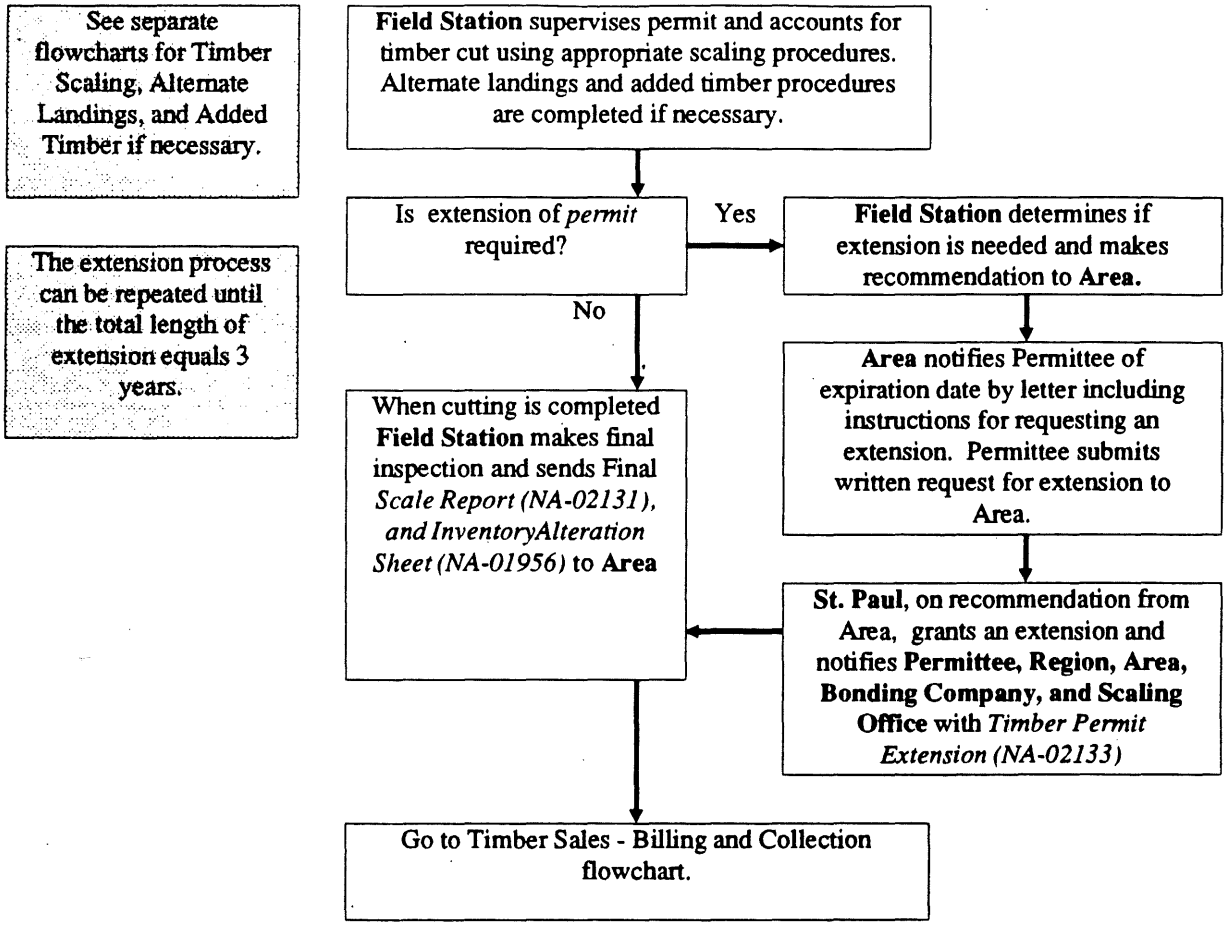


Figure 4.12 Regular Auction - Process and Information Flow



(Figure 4.12 continued)

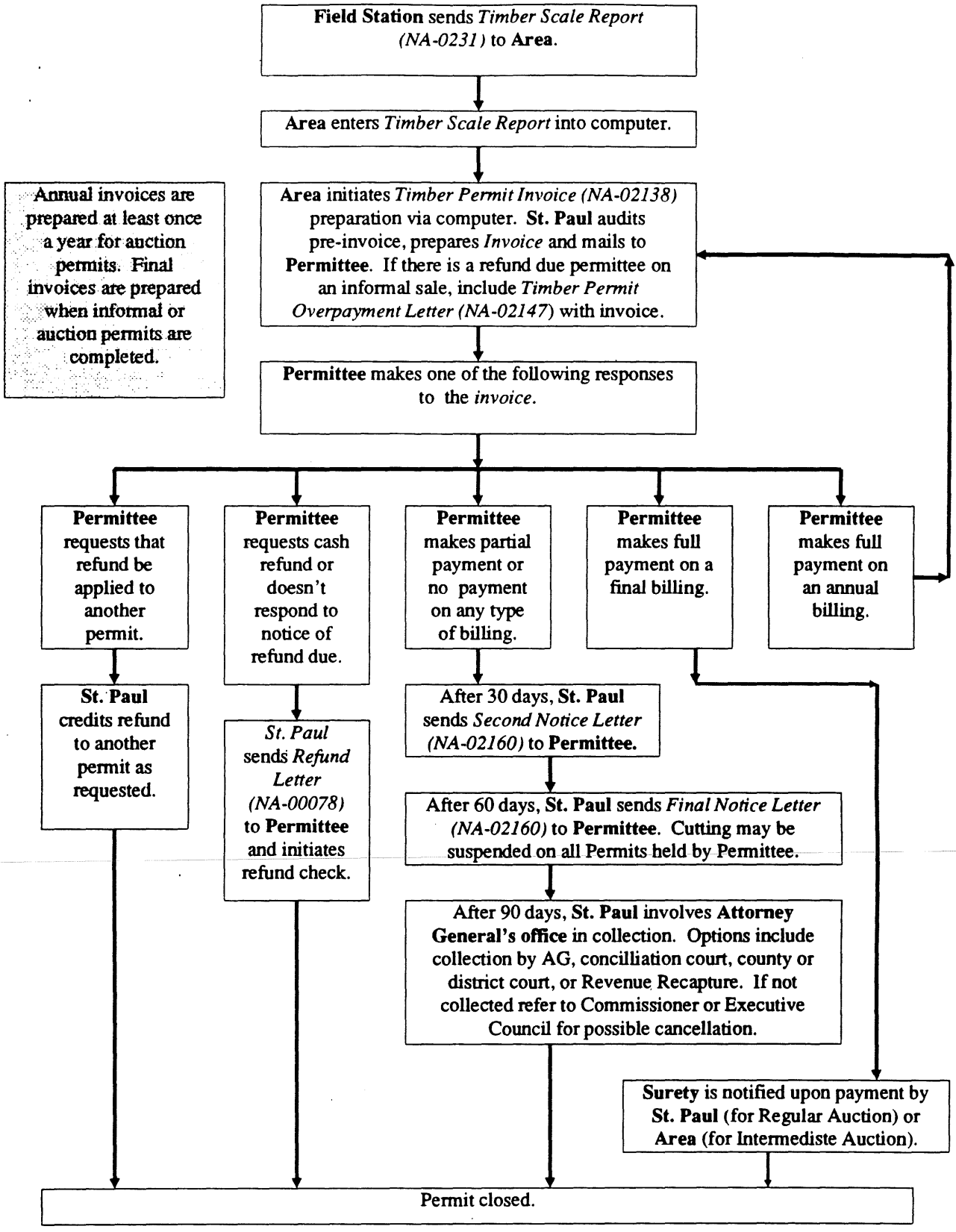


Figure 4.13 Billing and Collection - Process and Information Flow

New Directions and Needs

The following changes to the Timber Sales system have been approved and are being implemented:

- Enter all appraisals at the Area.
- Region will generate the Notice of Sale from the computerized appraisal file created by Area.
- All permits (Informal, Intermediate and Regular Auction) will be printed at the Area.

The following desired capabilities for an improved Timber Sales module were suggested in Blueprint Project needs interviews:

- All forms and letters used in the timber sale process should be generated by the system (e.g., expirations, extensions, added timber, overdue notices).
- Improved access to information at the Area level (including access to historical and current sales data).
- More standard reports such as Appraisal Accuracy by Appraiser.
- Automated mapping of timber sales related data at site specific and Area-wide scales.
- Timber sales billings should be based on a good accounts receivable system.
- An improved cover type drain record that is compatible with TMPIS and forest development records.
- Areas should have the ability to correct scale data.
- Improved ability to check on the number of permits held by individuals and companies, possibly by use of unique logger identification numbers.
- Need ability to record "remarks" from scale reports in the system.
- Need "on-line HELP" capability for the timber sale system.
- Need ability to determine stumpage availability from other Areas in response to logger requests.

- System should allow for Special Fuelwood Permit entry in order to account for all timber sold.

Data Requirements and Characteristics

The major data entities that need to be used by the Timber Sales module include:

- Appraisal
- Logger
- Permit
- Scale Report
- Invoice
- RAD
- Land Status

Users

Field Station personnel prepare appraisals which are the basic data input into the system. Area personnel (usually the Office Manager) enter the data into the system. Area staff and supervisors rely on reports from the system to administer the timber sales program.

Region staff review and approve appraisals for auctions and oversee program administration. St. Paul staff prepare and audit invoices, take care of billing notices, collect payments and update computer on permit closures.

The system produces output and reports used by the Fiscal Bureau and auditors. Permit holders see each scale report produced by the system as well as the initial permit and various billings.

Timber consumers and Field Station personnel generate scale reports for entry into the system.

Input

- Appraisal reports (NA-02136)
- Application for Informal Permit (NA-02137)
- Scale Report (NA-02131-03)
- Bid Information (no form #)
- Consumer Scale Agreement (NA-02128)
- Added Timber Form (NA-02119-02)
- Authorization for Alternate Landing of Unscaled Timber Products (F-114)
- Permit Extension Letter (F-118)

Output

- All types of permits; informal, intermediate and regular auction and special fuelwood
- Scale reports
- Ad Hoc and standard reports
- Timber drain reports
- Invoices and associated notices
- All required form letters

Linkages

The Timber Sales module must be designed to work in concert with the Forest Inventory, Forest Development Records, and TMPIS to provide an overall timber management support system.

The Timber Sales module should be able to reference the DNR land ownership records to determine ownership, administrator, land status, and active leases on parcels involved in timber sales.

Closure of a timber sale should prompt creation of a record in the Forest Development module so that regeneration can be monitored. The Forest Inventory module should also be updated to reflect the changes resulting from timber sales activities.

The Timber Sales module should allow automated accomplishment report generation.

Linkages to the automated mapping capability of a GIS would permit preparation of operational scale maps used in the timber sales process.

Hardware and Software Needs

- Portable data recorders for cruising and scaling
- AT class machines at the Area
- Communication network linking Areas, Regions, and St. Paul
- Central computer capable of storing statewide files
- High quality dot matrix printers at the Areas
- Database management package for Ad Hoc reports
- Word processing package for form letter production
- GIS or AUTOCAD system for map production at Areas

Forest Road Module

The goal of the State Forest Road program is to identify, develop, and maintain a safe, efficient transportation system that provides access to protect, manage, and use Minnesota's forest resources. The Division currently maintains just over 2,000 miles of state forest roads.

Current Condition

The State Forest Road program currently uses the road inventory and maps completed in 1982 as its primary source of data on the existing forest road system. Selected fields from the 1982 inventory are maintained in a R:Base database by the St. Paul program manager. There are a number of related efforts underway to update and improve the road inventory. The Land Management Information Center (LMIC) is working on converting the 1:100,000 highway network data from USGS topographic maps into a format compatible with the Division's Arc/Info GIS. LMIC is also working to design a computerized attribute file based on a recent state forest road inventory in the Blackduck Area. The GIS map and attribute file may become the new standard for the state forest road inventory.

The Division has recently started collecting road use data using traffic counters. The data is being input into a R:Base database. It is anticipated that some type of road use monitoring process will continue after the initial study.

The Division relies on the Department of Transportation's bridge database for inventory and inspection reports.

A State Forest Road program accomplishment reporting system using Lotus 1-2-3 was recently developed in the Littlefork Area. The system is currently being evaluated in the Warroad and Baudette areas. The eventual result is expected to be an accomplishment reporting system that can be used statewide.

New Directions and Needs

The primary emphasis in developing a Forest Road module should be to use a GIS to maintain a complete transportation network map and associated road inventory database. The State Forest Road program also requires project tracking and road design capabilities. Like other modules, the Forest Road module should generate accomplishment reports.

Additional desired capabilities for the Forest Road module include:

- Recording and tracking of road construction, reconstruction, and maintenance projects. The project tracking system should facilitate project prioritization, budget estimation, work plan development, and monitoring of progress or contract completion.

- Ability to produce Ad Hoc reports at the Area, Region, and State levels. Road inventory data should be easily available for use with a DBMS on personal computers at all administrative levels.

- Ability to input and update forest road inventory records at the Area level.

- Use of field data recorders for road inventory and traffic counting.

- Road project completion should trigger road inventory alterations and additions.

- GIS analysis tools to analyze timber resources tributary to any point on the road system. Ability to analyze transportation costs and road impacts on other resources.

- Provision of gravel resource information including past gravel use records, gravel stockpile quantities, and linkage to soils data.

- Road design capability including earthwork calculations, drafting, and generation of graphics and specifications for contracts.

Data Requirements and Characteristics

The major data entities to be used by the Forest Road module are:

- Road segment
- State Forest Road
- RAD
- Project
- Contract

Users

Field Station and Area personnel will collect and maintain the road inventory data and use maps and reports from the system in carrying out their forest management responsibilities. They will also generate most of the road project proposals that will be tracked by the Forest Road module.

St. Paul and Region staff in charge of the State Forest Roads program will use the system to prioritize projects, develop budgets and work plans, and monitor road program accomplishments. The Forest Road module will also be used when planning timber harvests and other activities that require access to the land.

Personnel from cooperating agencies will use data and maps from the module to coordinate road development and use with the Division.

Input

- Digital files of the road network from USGS maps
- State Forest Road inventory maps and data
- Project proposals
- Engineering designs and survey data

Output

- Maps of the transportation network at a variety of scales
- Standardized and Ad Hoc reports from road inventory data and project tracking
- Accomplishment reports
- Digital files of road network maps and attribute data for transfer to other agencies
- Contracts including graphics and standard text

Linkages

The Forest Road module should be able to access the DNR land records to check ownership, administrator, land status, lease, and easement information on parcels involved in road projects.

Links to the Administrative Support module are needed for budgeting, work planning, cost accounting, and accomplishment reporting.

The Forest Road module should have access to the bridge database maintained by MnDOT.

The transportation layer should be compatible with other data layers in the GIS including CSA inventory, soils, hydrology, and Natural Heritage elements.

Hardware and Software Needs

- Personal computers at Areas with communication to central minicomputer, DBMS, and adequate storage capacity to maintain Area forest road inventory data. Limited GIS capability and a plotter to prepare maps would also be desirable at the Area level.
- GIS workstation at Region offices.
- Central computer capable of storing statewide data files and communications network with Area and Regions.
- Field data recorders for road inventory and traffic data entry.

Nursery Module

The goal of the Nursery and Tree Improvement Program is to economically produce forest regeneration material of the highest genetic and biologic quality in the quantity needed for environmental programs.

Primary activities of the Nursery subprogram include production and distribution of tree seed and bareroot seedlings. The nursery also contracts for production of containerized seedlings. The Tree Improvement subprogram activities include seed source selection, improved seedling distribution, seed production area development, and seed orchard development.

Current Condition

The Forest Resource Management Act of 1982 established a requirement that the Division's nurseries become a self-sustaining operation by 1985. This meant the nursery needed an improved system to document the cost of seedling production so that receipts from sales would be adequate to support the nursery operations. The Price Waterhouse consulting firm prepared a needs assessment for an integrated nursery information system in 1983-84.

The proposed system includes the following components:

- Seedbed Work Order System to maintain records on seedbed, seedlot, and species basis.
- Inventory System to maintain records of seedlings stored in coolers and materials used in seedling production.
- Property System to process inventory, condition, use, and cost data for equipment and fixed assets at the nursery.
- Seed Production Work Order System to maintain records and costs associated with cone purchases, seed extraction, and seed treatment.
- Seedlot Traceability System to allow tracking of a given seedlot from collection through drying, seed extraction, seedling production, packing, shipping, and plantation establishment.
- Personnel System to support personnel management, payroll, and associated activities.

- Order Entry and Invoicing System to enter customer orders, notify customers, generate shipping labels, generate invoices, and maintain sales records.

- Labor Distribution System to record and allocate labor and associated costs to seed and seedling production and other tasks.

The functions, input, and output for each of the components were specified in the consultant's report.

In 1986 the Division attempted to let a contract for nursery systems development but was unsuccessful. The proposed system is currently being developed by Division staff as an R:Base application to operate on a local area network at the nursery.

New Directions and Needs

The information needs to be met by the Nursery module are detailed in the Price Waterhouse study and the work plans for the current systems development project. Needs mentioned during the Blueprint Project needs interviews included:

- Need an improved method of developing the annual nursery seeding plan. The methodology should rely more on strategic planning techniques rather than historical trend analysis. The process should also allow more involvement of Regional Silviculturists.

- Tree Order status reports should be available on a monthly basis from September through March and should be sorted on a District rather than a county basis to improve usefulness to the PFM program.

- A GIS should be used to prepare maps of the nursery seedbeds over time.

Data Requirements and Characteristics

Major data entities that will be used in the Nursery module include:

- Contract
- Customer
- Employee
- Equipment
- Facility
- Order
- RAD
- Seedbed
- Seedlot

Users

The primary users of the Nursery module will be nursery employees and supervisors. Managers will require system reports to oversee the Nursery and Tree Improvement program. Field Station personnel will be involved in ordering seed and seedlings for state and private land reforestation projects and in purchasing seed and cones.

Input

Input requirements for each of the Nursery systems are listed in the Price Waterhouse study report.

Output

Proposed outputs from each of the Nursery systems are described in the Price Waterhouse study.

Linkages

Necessary internal linkages between components of the Nursery module are described in the Price Waterhouse study. The Property, Personnel, Labor Distribution, and Invoicing components of the Nursery module perform many of the same functions as their counterparts at the Division or Department level. These components should be able to transfer data to the larger systems.

Hardware and Software Needs

The Nursery module is intended to operate on a PC LAN at the General Andrews Nursery. The LAN should be a part of the Division-wide communications network.

Private Forest Management (PFM) Module

The goal of the PFM program is to improve the multiple-use management of non-industrial private forest lands. Typical PFM activities include: 1) Promoting forest management through personal contacts with landowners and the use of the media; 2) Providing landowner education through activities such as workshops, adult education classes, tree planting clinics, and forestry field days; 3) Developing multiple-use management plans for individual landowners; 4) Providing technical assistance for specific recommended practices such as tree planting and timber stand improvement; and 5) Providing utilization and marketing assistance associated with timber harvesting.

The PFM system module will provide data processing support for PFM activities.

Current Condition

Figure 4.14 depicts the process and information flows for a typical PFM landowner assist. The majority of the forms are completed manually and stored in file cabinets at the Field Station or Area. The only standardized, automated portion of the process is the accomplishment report. Prior to fiscal year 1989 accomplishment reports were entered into a Lotus spreadsheet program at the Area. Diskettes were sent to St. Paul where Regional and statewide summaries were prepared. Beginning with fiscal year 1989 accomplishment reports are being entered using ACCOMP, a R:Base application. Diskettes containing Area accomplishments are sent to the Region where they are compiled into a Regional diskette for transmission to St. Paul.

Over the years a number of PC based applications were developed to support various PFM activities. Examples include standardized word processing shell documents for management plans and form letters, and database applications to generate mailing labels or to keep records on plantations, equipment use, or calendars of events. These applications were shared among PFM foresters but were not uniformly adopted statewide.

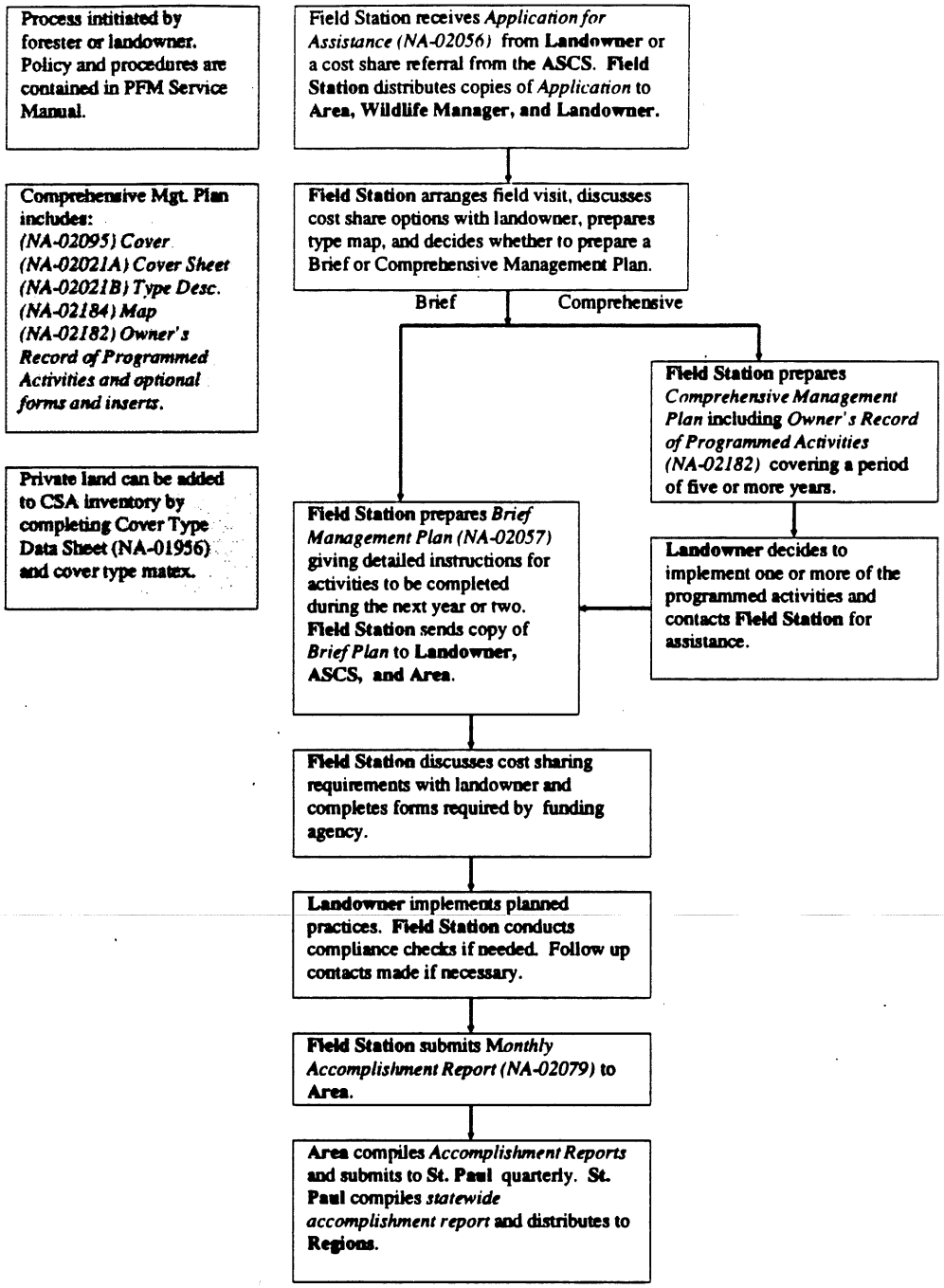


Figure 4.14 PFM Landowner Assistance - Process and Information Flow

New Directions and Needs

PFM/MIS Committee Recommendations

The PFM program established a committee to study information needs and suggest changes in information processing in 1987. Figure 4.15 depicts the committee's proposed information flow for a variety of PFM activities. The handwritten numbers on the flowchart relate to the items in the following list. The committee's priority for implementing each of the suggestions is indicated by a letter in brackets. The four priority levels are:

{A} - Acute need. A bottleneck currently exists or data is often needed but not readily available. Would greatly benefit customers and foresters. Foresters agree on problem and solution.

{B} - Beneficial feature. Would streamline system and make noticeable improvement in workload management. Most foresters agree on problem and on solution.

{C} - Creative solution needed. Most foresters agree on problem but preferred solution not fully defined.

{D} - "Dream world." These ideas are either too costly or too undefined to be realized in the foreseeable future.

1. Computerize Application for Assistance (NA-02056) {A}. The Division receives 8,000 applications annually. Over 80% of all applications result in field accomplishments. The Applications also are used to notify private forestry consultants and DNR Section of Wildlife personnel of potential activities that they may want to be involved in. Capturing name, address, and legal description information from the application would provide the cornerstone of a PFM record keeping system.

- Generate reply letter to applicants {B}. Acknowledgements of applications are good public relations. Must be able to tailor the reply to each situation.

- Have summaries of applications available via computer at any Ag. Extension office in the state {C}. This will allow private forestry consultants access to current data on potential customers desiring various services anywhere in the state from anywhere in the state. Consultants currently have to check with several DNR Forestry offices to get this information.

- Provide computer generated lists of applications to Section of Wildlife personnel {B}. The Division of Forestry currently provides Wildlife Managers with copies of each individual application. Having the information from the application available to wildlife via computer will speed up the process and will allow Wildlife personnel to screen application by legal description or type of service requested.

2. Generate PFM Programmed Work list (NA-02055) {C}. Many kinds of lists are currently used to track applicants and the types of service they desire. A computer

generated work list based on the Application for Assistance would aid in scheduling where workloads are high.

3. Collect and maintain forest inventory data on private land {A}. No forester can operate for long without some kind of forest inventory and inventory tracking system. It is important that all forest inventories in the state be as compatible as possible. The CSA inventory system is appropriate for private land as defined in Section E of the PFM Manual. Inventory data should be collected using the CSA Cover Type Examination Data sheet (NA-01956).

- Provide for storage of PFM inventory data on same computer that is used for State land inventory {C}. Current plans are to store PFM inventory data on Area computers, but this could change. There would be value in being able to aggregate private land inventory at higher levels for use in regional or statewide resource analyses.

- Use same system for entry of public and private land inventory data {A}. Use INVENT or a similar program to enter and store private land inventory.

- Computerize as many of the inventory fieldwork calculations as possible {B}. Converting field tally data into information for entry into the inventory system is time consuming and repetitive (e.g., developing volume per acre statistics from cruise tally).

- Use portable data recorders for field work {D}. This would carry the previous suggestion a step further by eliminating the need to record field observations on a form for latter calculation and entry. Eliminating the paperwork and calculations involved in developing inventory data will increase morale and productivity.

- Recognize and capture data from other private land inventories {C}. A "Phase 1.5" inventory has been completed in some counties. This data should not be lost. SCS and wildlife also may have useful inventory data on private lands.

- Develop GIS or automated mapping for PFM {D}. Need to provide an efficient method of map making.

4. "Canned" Comprehensive Management Plans (NA-02021 a&b) {C}. The Division writes about 500 comprehensive plans covering 45,000 acres each year. Individual stand characteristics and landowner goals are likely to be unique, precluding the use of completely standardized plans. However, a report generator that can access stand data from the inventory and some generalized management guidelines for the type would be useful. There should be a link to the accomplishment portion of the information system to record the fact that a comprehensive plan was completed and the number of acres it

covered. The recommended actions and/or inventory data contained in the plan should also be used to generate work reminders (see item 6 in this list).

5. "Canned" Brief Management Plans (NA-02057) {B}. The Division writes 1,500 brief plans covering 25,000 acres each year. These plans can be more standardized than comprehensive plans. However, each Area or District will probably want to "personalize" the form. The recommended solution is to have a word processor based report generator that accesses client and location (and possibly inventory) data for use with standardized management guidelines created by the Area or District. There should be a link to the accomplishment portion of the information system to record the fact that a brief plan was completed and the number of acres it covered. The recommended actions and/or inventory data contained in the plan should also be used to generate work reminders (see item 6 in this list).

6. Computerize Follow-up Contact {A}. Follow-up is essential for PFM plans. Two methods of tracking follow-up needs were identified by the PFM/MIS committee. Approximately 15 applications using one or the other of these methods currently exist in the Division. The two methods are explained below. Both are useful and should be standardized and further developed.

Tickler File Method {A}. This method is based on the calendar of events contained in PFM management plans. The calendar of events indicates that a given landowner needs to do some management activity in a given year or years (e.g., planting, TSI, harvest). The system should search the management plans by year and/or activity and generate a list of landowners who should be contacted to initiate some activity. No stand inventory data is required for this method.

Stand Inventory Method {A}. Follow-up can be initiated by identifying landowners who have stands with characteristics suited to various management activities (e.g., thin stands with high basal area, harvest stands meeting age and volume criteria). Landowners having stands that meet the selection criteria could be contacted whether or not the practice was included on the calendar of events in their plan.

Regardless of the method used, the follow-up contact system should deal with the problem of reforestation survival checks.

- Survival Checks {A}. A system is needed to track needed survival checks on the 15,000 acres of private land planted each year.
    - Print list of stands needing survival checks {A}.

- Develop a uniform survival check process for public and private lands {D}. If a uniform process were used, many of the required calculations could be automated.

- Print a survival check form for each stand. This would eliminate the need for the forester to copy data from the stand list to the field sheet.

- Use portable data recorders for survival checks {D}. This will eliminate paperwork and increase morale and productivity.

- Print letters to landowners explaining results of the survival check {C}. This is a big undertaking if done manually. Computerization would permit the often lacking follow-up with the landowner. Currently, unless something is wrong, our customers don't know that we have been doing survival checks.

7. Enter basic landowner information from cost share referrals using computerized Application for Assistance (see item 1 above) {A}. For many cost share projects, the first information the Division has about a landowner is from a Conservation Reporting and Evaluation System (CRES) data sheet (ASCS form AD-862). The AD-862 should provide enough information so that completing a separate Application for Assistance (NA-02056) is not necessary. Entering the basic landowner data from the AD-862 using the computerized process would allow notification of Wildlife and consultants.

8. Automate tracking of cost share referrals {D}. Cost share referrals from the ASCS are currently tracked manually using the Cost Sharing Program Referrals form (NA-02020). Referrals follow a fairly set pattern and the process could be easily computerized. In many Areas referrals may be infrequent and could just as easily be kept manually. Other Areas have a larger volume of referrals and could really use an automated system.

9. Improve the usefulness of Nursery Seedling Order printouts {D}. The Nursery currently sends each Area hardcopy printouts of private seedling orders sorted by county. The reports are sent every 30 to 60 days during the seedling sales season. PFM foresters use these reports to see if their landowners have ordered trees as planned. This report needs to be prepared more regularly. In counties with more than one Forestry Area PFM foresters have to look through other Area's data to use the report.

- Transmit reports to Areas electronically {C}. If the information in the current reports were transmitted electronically the Areas could further process the data to provide Area or District specific reports. This would also eliminate the mailing of hard copy reports.

- Use nursery data to update landowner files {D}. Theoretically, nursery tree order data could be used in the follow-up contact, activity tracking, and stand inventory

portions of the PFM module. Problems with making a link to the stand inventory include the fact that nursery data relates to a landowner rather than a stand. The fact that the majority of people who order trees from DNR nurseries order small numbers of trees and are not assisted by foresters limit the value of the data for follow-up contacts.

10. Standardize tracking of reforestation projects {D}. Reforestation projects can be as simple as hand planting a small number of seedlings on a single tract with no site preparation to something as complex as contracting with various vendors for site preparation, shipping, and planting on many acres. This makes it hard to standardize, but perhaps all the more useful.

- Automate tracking of ongoing projects {D}. Perhaps this would be related to item 7 above.

- Generate forms {D}. Standard forms used in the reforestation process (e.g., seedling order form, vendor bid forms, machine planter lease) should be generated by the system.

11. Integrate Tree Farm Record (AFI form AFI-004) data with PFM data base. The American Forest Institute's Tree Farm information system and a variety of Area- and Region-developed applications store data on Tree Farms. Basic data on landowners, location, acreage, inspecting forester, and planned activities is the same for Tree Farm and PFM purposes. This data should only be entered once. The Division annually inspects 450 Tree Farms covering 35,000 acres.

12. Enter basic landowner information from Application for Assistance (NA-02056) or Timber Sale Service Application (NA-02053) using computerized Application for Assistance (see item 1 above) {A}. Requests for assistance with timber sales must be held for thirty days to allow consultants time to contact the landowner. A computerized approach would facilitate distribution of information to consultants and could remind the PFM forester when the thirty days had passed.

13. Computerize timber appraisal calculations {C}. Converting field data to final appraisal information involves numerous calculations. The Division currently does 400 PFM sales on 9,000 acres annually. The procedures for appraisal calculations are quite uniform for both state and private sales in each Area (though there is variability between Areas). At least one computerized appraisal calculation application has been developed.

- Use portable data recorders to collect appraisal data in the field {D}. This would take the automation one step further by eliminating the field form. It should increase morale and productivity.

- Automate printing of the timber sale appraisal form {D}. The PFM appraisal form is similar to the state land form. The PFM program should be able to use or modify any system developed to print appraisal forms on state sales.

14. Standardize tracking of timber sale projects {D}. Timber sales can be as simple as someone selling 1 acre of fuelwood to a neighbor to more complex projects involving bids, contracts, and consumer scaling.

- Automate tracking of ongoing projects {D}. This may be related to item 7 above.

- Generate standard forms {D}. A variety of forms used in the timber sale process (e.g., timber appraisal, bid form, sale contract, consumer scaling agreement, cover letters) should be generated by the system.

15. Eliminate manual tracking of accomplishment data whenever possible {D}. All PFM accomplishments are currently reported monthly using the Monthly Accomplishment Report (NA-02079). The accomplishment data is entered and aggregated using the recently developed ACCOMP program (an R:Base application). As the PFM module is developed a number of the items on the report could be tallied automatically (e.g., acres planted, number of management plans and acreage covered). These categories could then be removed from the accomplishment report form but the information would still be available for use in target setting and monitoring. This will require links between the existing ACCOMP application and the applications described above.

- Transmit accomplishment data electronically {D}. Accomplishment reports are currently sent via diskette from Areas to Regions to St. Paul. This would involve modifications to the ACCOMP application.

16. Lists, letters, labels {A}. The PFM module should generate lists of programmed work and landowners needing contact or follow-up. The system should also be able to generate form letters and mailing labels.

- Lists needed in District offices:
  - Landowners on file {A}.
  - Planting vendor list {C}.
  - Logger list {C}.
  - Landowners waiting for assistance {C}.
  - Landowners doing projects in a given year by project type and project status {B}.
  - Landowner Stands needing future work {A}. Inventory and tickler.
  - Survival Checks {A}.
  - Tree Farms needing reinspection {B}.
  - Landowners eligible for CRP {C}.
  - List of local media.

- Lists needed in Area offices:
  - Possibly all lists needed in Districts.
  - Accomplishment reports.

- Lists needed in Region offices:
  - Tree Farms needing reinspection {A}.
  - Ledger of program funds (i.e. ACP, CRP, Focused Funding) including availability and history of expenditures.
  - Accomplishment reports.

- Lists needed in St. Paul:
  - List of current consultants {C}.
  - Record of payments collected by Area for equipment leases and timber sale services (NA-02059 and NA-02053).
  - Ledger of program funds (i.e. ACP, CRP, Focused Funding) including availability and history of expenditures.
  - Accomplishment reports.

Recommendations Based on Needs Interviews

The following desired features of the PFM systems module were not included in the PFM/MIS committee recommendations but were mentioned in the Blueprint Project needs interviews:

- Need some sort of daily ledger or tally sheet to record PFM activities. Everything is currently stored in people's heads or on individual calendars until the monthly accomplishment report is prepared.

- CSA township cover type maps should include available data for private lands.

- Should have automated system to determine acreages and prepare project level maps.

- Should have read only access to Nursery Tree Order File to be able to check to see if a landowner has ordered trees.

- Need to cross reference landowner management plans with Federal Farm Number to better respond to SCS and FHA requests for copies of management plans.

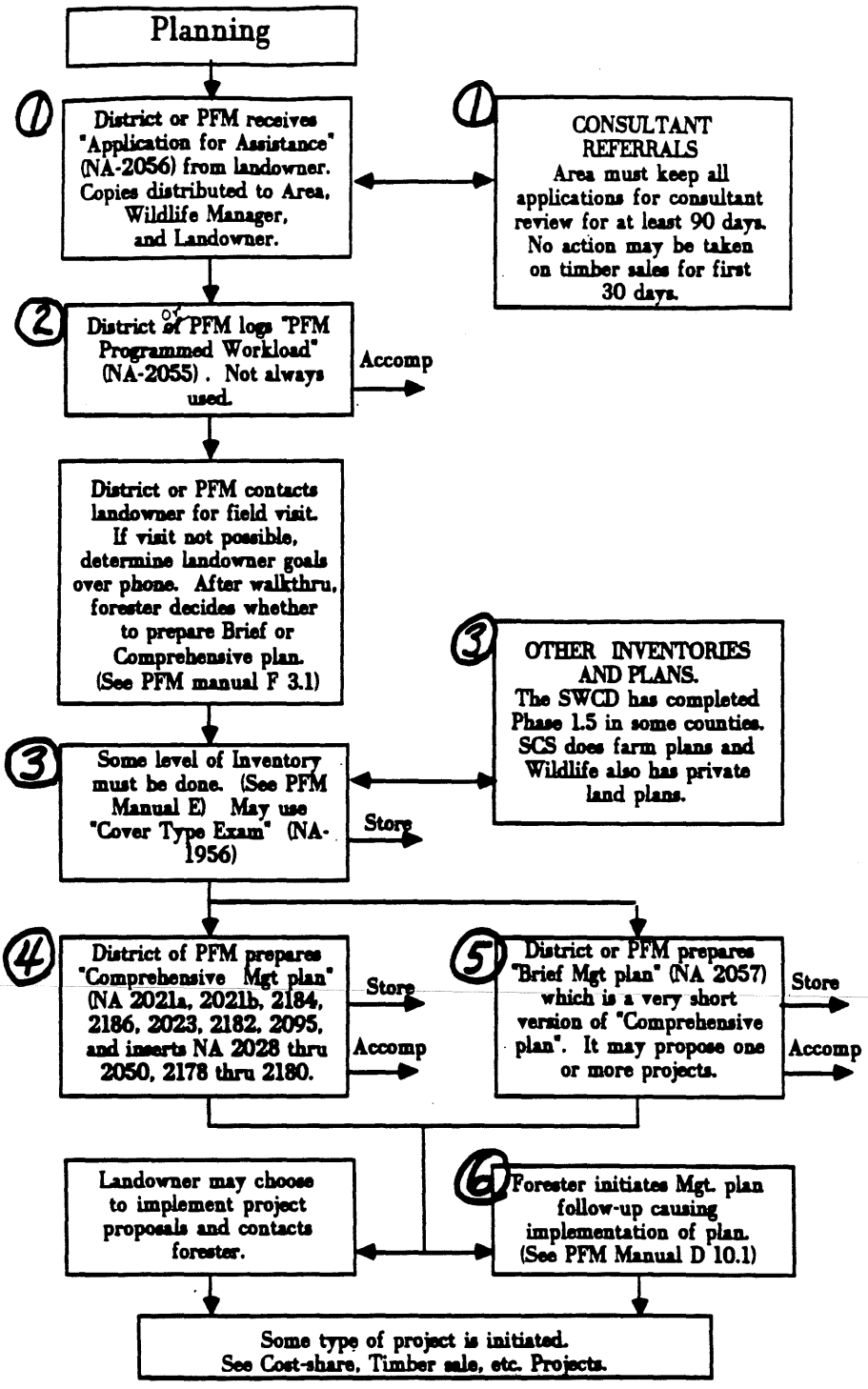
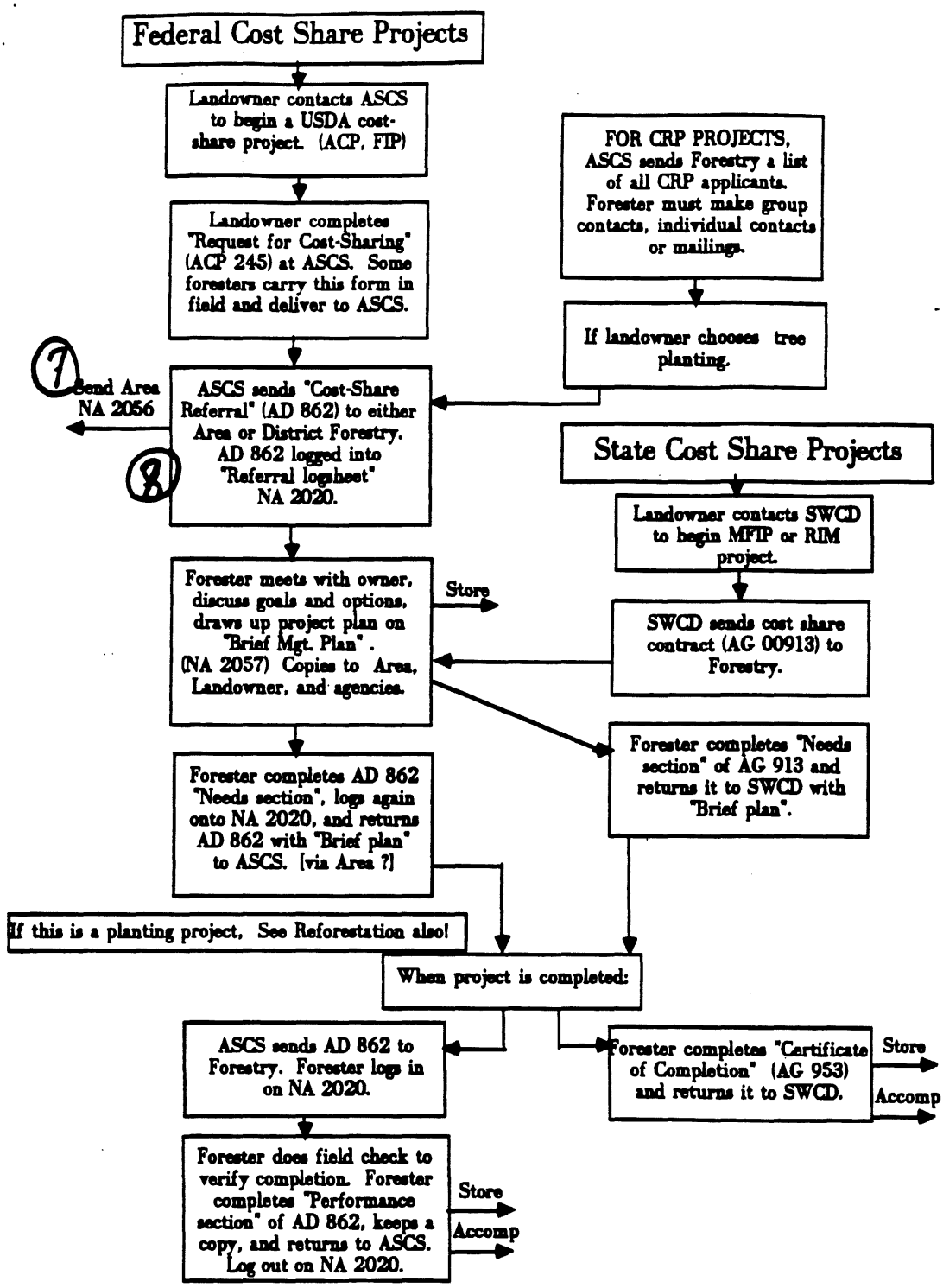


Figure 4.15 Proposed PFM Processes and Information Flows



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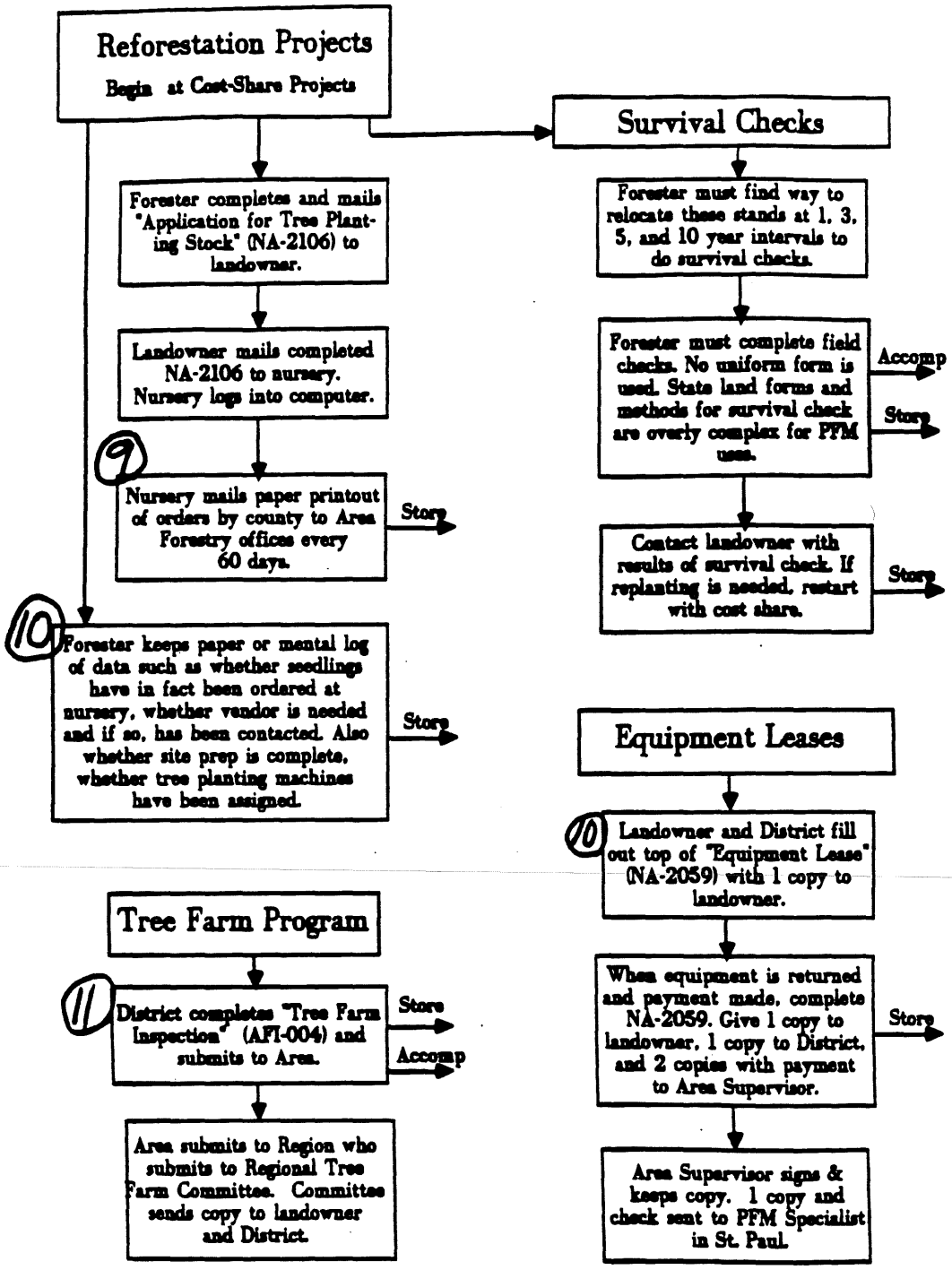

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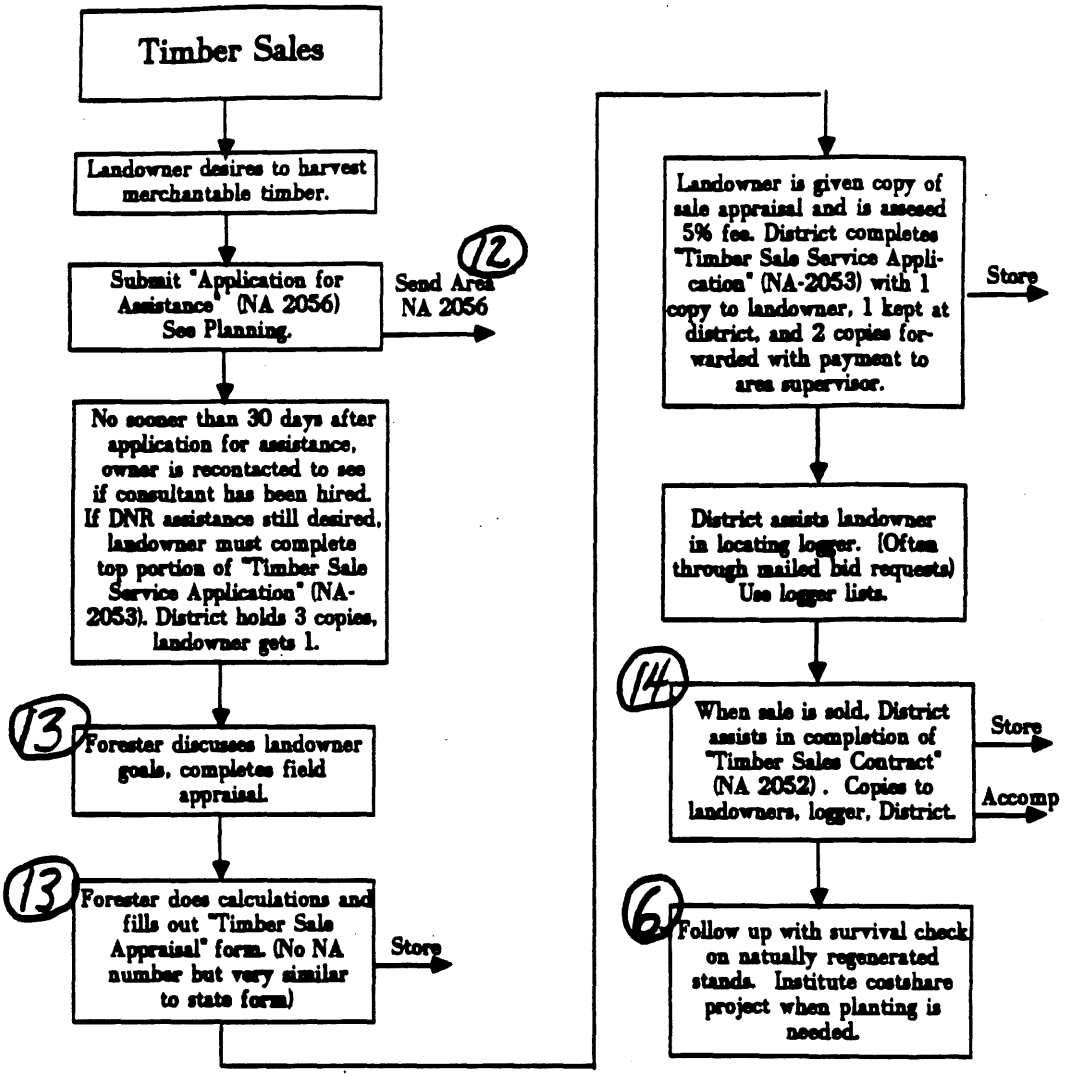

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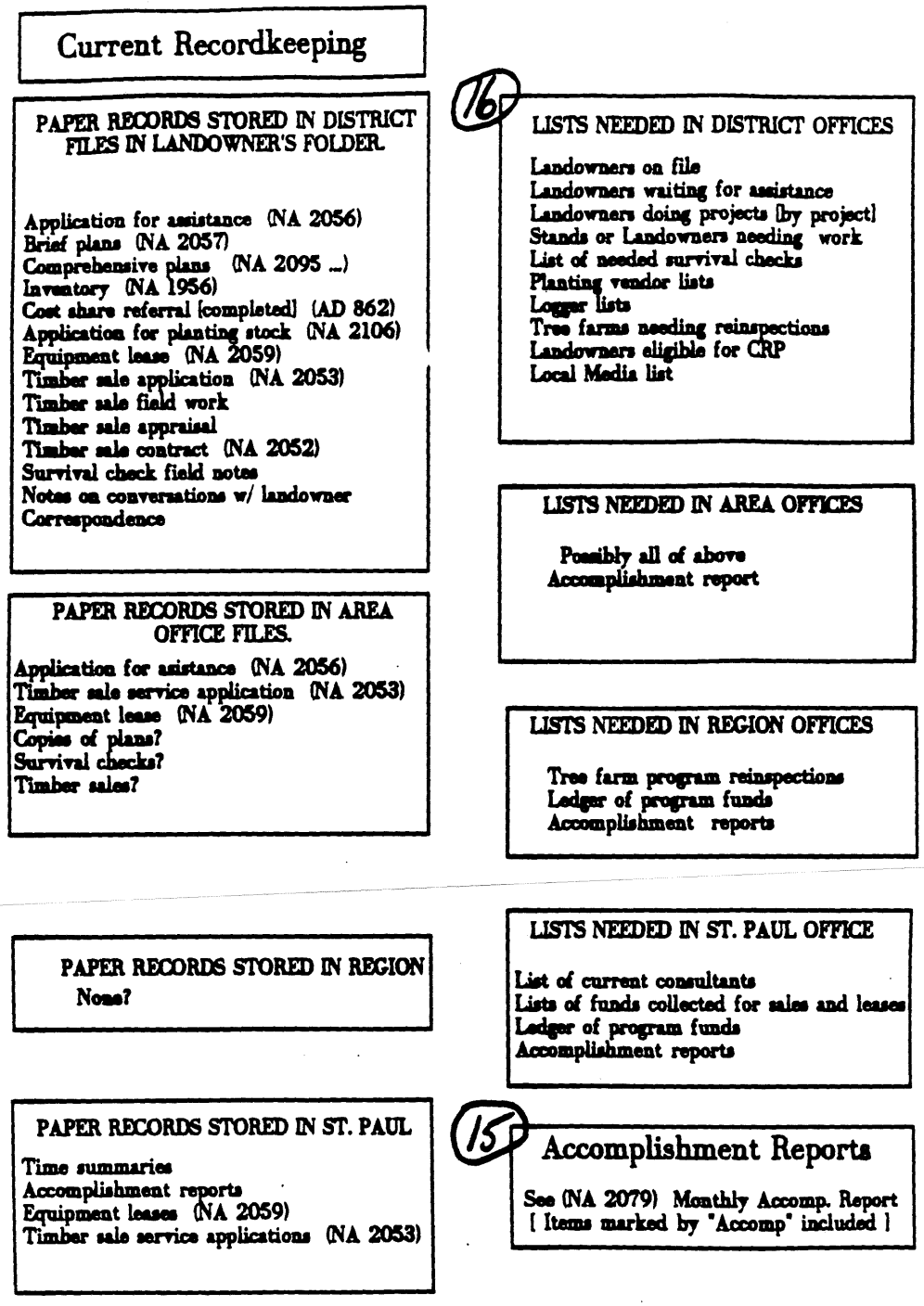

(Figure 4.15 Continued)

Data Requirements and Characteristics

Data entities that will be used by the PFM module include:

- Landowner
- Legal Description of Property
- CSA Data (forest inventory)
- Management Plans
- Forest Development Records (plantations, etc.)

Users

The primary PFM module users will be the individuals (technicians, foresters, PFM specialists) assigned to work with individual landowners. Ideally, the users would have access to the system at each Field Station. In some parts of the state there may be insufficient PFM workload to justify installation at all Field Stations. Full development of this module would result in a change in how and where some tasks are performed. PFM foresters would spend less time manually preparing forms and performing calculations, but would spend more time entering data and using the system. Some of the typing of management plans and accomplishment data entry that is often done by Area clerical staff would be done by the PFM forester or be generated by the system.

Area and Regional Forest Supervisors will use the system to set program targets and monitor accomplishments. Area, Regional, and St. Paul PFM specialists will also make use of the system.

Input

- Application for Assistance (NA-02056)
- Cover Type Data Sheet (NA-01956)
- Owner's Record (Calendar of Events) (NA-02023)
- Conservation Reporting and Evaluation System (CRES) data sheet (USDA form AD-862)
- Cost Share Program Referrals (NA-02020)
- PFM Programmed Work Load (NA-02055)
- Timber Sale Service Application (NA-02053)
- Tree Farm Inspection Record (AFI form AFI-004)

Output

Most of the desired outputs are described in the "New Directions and Needs" section above. Currently used forms that could be generated by the system include:

- Management Plan Cover Sheet (NA-02021A)
- Management Plan Type Descriptions (NA-02021B)
- Owner's Record (Calendar of Events) (NA-02023)
- Brief Management Plan (NA-02057)

Linkages

As a general principle forms and information systems designed for use on state lands should also be used for PFM activities.

The basic landowner data (name, address, phone number, etc.) used in the PFM module should follow Division data standards.

Private land inventory should be compatible with CSA standards. INVENT should be used to enter and store the inventory data. Inventory data should be accessible for use in management plans and in generating lists for follow-up based on stand characteristics.

Private land plantation records should be compatible state land development records.

Data from the PFM ACCOMP program should feed into the Division's work planning and accomplishment reporting system.

Invoices for planting machine rental and timber marking or scaling should link to a Division accounts receivable package.

There are potential linkages between the PFM module and the Nursery Tree Order module for checking to see if landowners have ordered seedlings, to link seed source records with plantation locations, and to identify landowners who may be candidates for PFM assistance.

There may be a need to be able to transfer data between the PFM module and the AFI's Tree Farm record system.

Certain incidental assists involving pest management questions should be recorded as I&D occurrence reports.

Hardware and Software Needs

The PFM module will most likely operate on PCs at Areas and/or Field Stations. The applications will likely be developed using a commercial database package for data entry and storage. Report generation will likely involve both a database package and word processing. Diskettes and/or modems will be needed for data transfer (e.g. sending ACCOMP reports to the Region). A high quality dot matrix printer will be required to print reports, plans, and correspondence with landowners.

There is a potential to use portable data recorders to collect inventory, timber appraisal, and survival data.

A GIS or automated mapping system could be used to generate operational level maps for use in the PFM program.

Fire Management Module

The goal of the Fire Management Program is to provide wildfire protection for public and private lands in the forested regions of the state and to provide leadership in using fire as a natural resource management tool. The three principle activities within the Fire Management Program are: 1) fire prevention, 2) fire presuppression, and 3) fire suppression. The prescribed burning activity is described within the Forest Development module.

Current Condition

There are twelve components of the current Fire Management module. These information systems are:

1. Wildfire Status Reporting
2. Fire Weather Reporting
3. Historical Fire Information Database
4. Fire Billing and Collection
5. Resource Ordering
6. Fire Qualification Database
7. Rural Fire Departments and Excess Property
8. Fire Warden Database
9. Burning Permit System
10. Enforcement
11. Equipment Availability
12. Aircraft Summary Statistics

The first component of the system, Wildfire Status Reporting is illustrated in Figure 4.16. Field Stations complete Daily Fire worksheets and Individual Fire Reports manually and maintain a hardcopy in their files. Remote Field Stations call the worksheet and fire report information to their Area office by 9:00 a.m. The Areas consolidate the Field Station information on a Daily Fire Worksheet and input worksheet and Individual Fire Report information into their PC's for transmission to the TI 990 in St.Paul via a bisynchronous modem. St. Paul does not maintain a hard copy of the Individual Fire Reports. The Northern Fire Center is responsible for compiling the information from Area reports plus resource availability from the Regions to form the Wildfire Situation Update. Areas and Regions are automatically sent a copy of the Wildfire Situation Update to their electronic mailboxes. The Fire Center combines the information from the Areas with information received via fax from the six other MNICS (Minnesota Incident Command System) agencies to form the Minnesota Interagency Fire Coordination Center (MIFCC) Daily Situation Report. MNICS agencies and the U.S. Forest Service Regional Office in Milwaukee are then faxed a copy of the MIFCC Situation report.

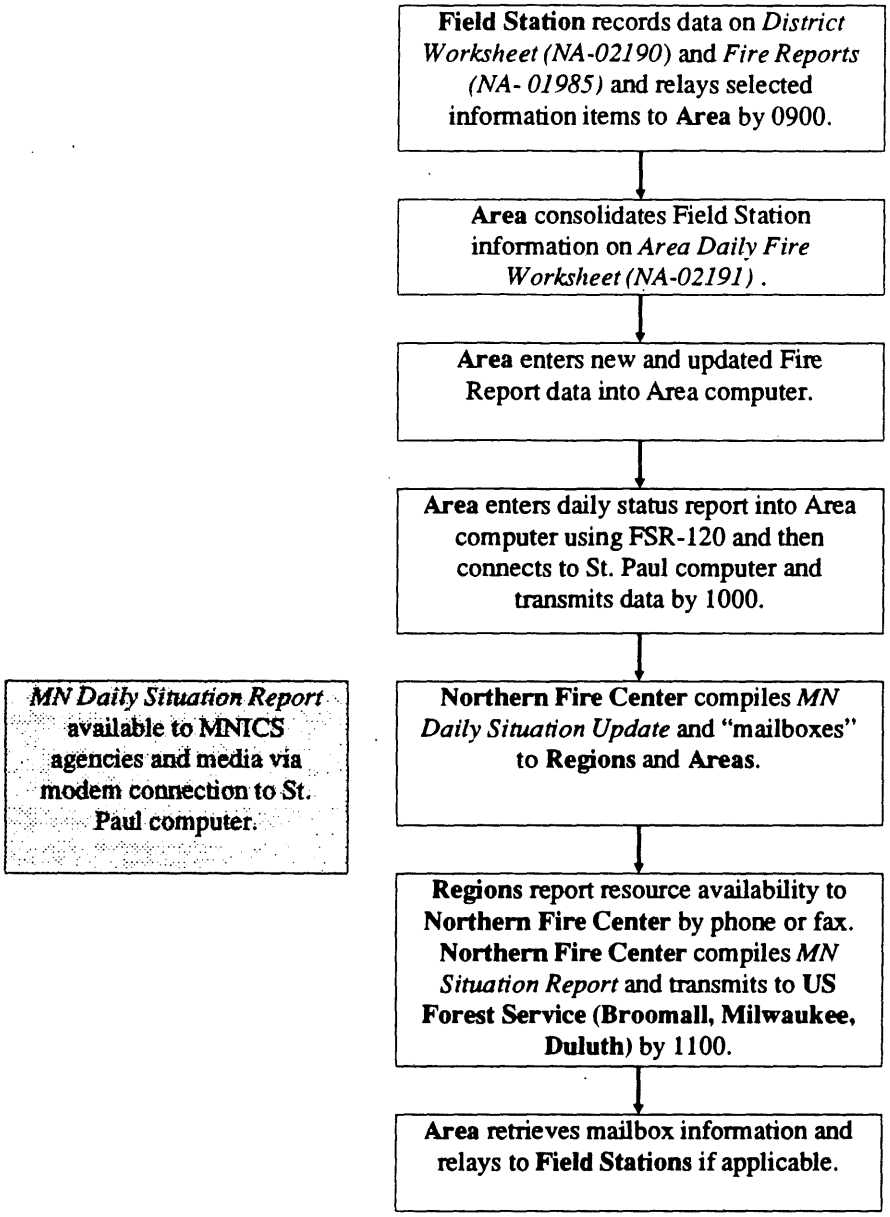

Figure 4.16 Fire Information Reporting - Process and Information Flow

The second component of the system is the Fire Weather System illustrated in Figure 4.17. Selected weather recording stations record weather observations on a District Weather Record Form. The Field Station transmits the weather data via radio or phone to the Area office. The Area records the data on the Daily Fire Weather Record. The information is transmitted to a U.S. Forest Service contract computer using the Area PC and an asynchronous modem. Areas, Regions, and St.Paul can then retrieve fire weather forecasts for Minnesota, as well as National Fire Danger Rating Indices for specified locations and the National Fire Situation Report from the Boise Interagency Fire Center using this same Forest Service system.

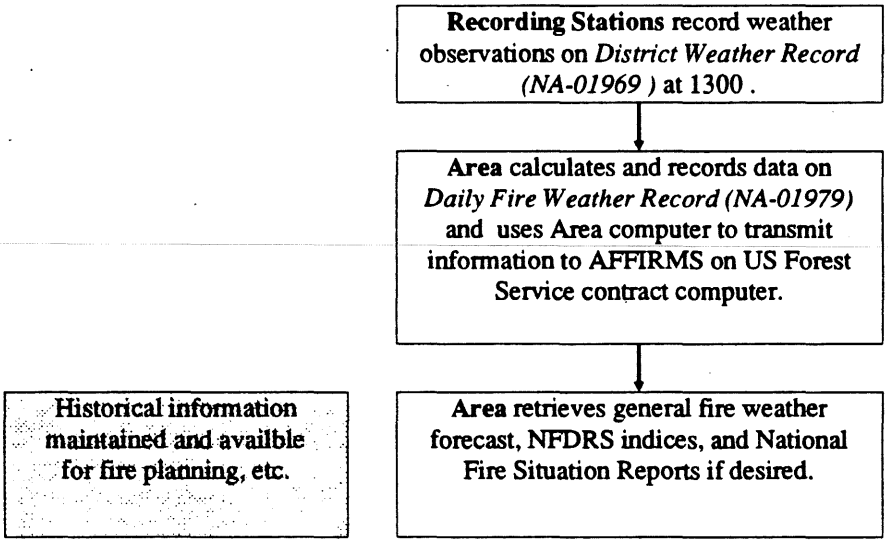

Figure 4.17 Fire Weather Reporting - Process and Information Flow

The third component of the Fire Management Module is the Wildfire Information Database. Currently, a nine year fire occurrence database exits on the Division's TI 990 in St.Paul. A complete fire weather database exists on a contract U.S. Forest Service computer. The Fire Section is midway through a project which would merge the fire occurrence database with the fire weather database to form the Wildfire Information Database. The information would be available in database form at the Area, Region, and St.Paul levels. Areas and Regions would be able to access the information using PC-File or R:Base software and standardized report formats provided by the Fire Section.

The fourth component of the system is billing and collection. Fire suppression costs are billed by each Area for all fires except those that are railroad caused. Areas use a manual billing system, however, the cost of each fire is included on the fire report so that St.Paul can track the amount of funds expended from the fire fund. St.Paul bills railroads for all railroad caused fires based on information provided by the Areas. Fire suppression provided by the DNR on federally protected lands both in-state and out-state is billed back to the federal government by the Northern Fire Center. This process is semi-automated with payrolls and bills being charged to a specified account so a computer generated listing can be retrieved. These bills must be manually separated by resource order number before the bill is submitted to the U.S. Forest Service.

Another component of the fire module is resource ordering. The resource order process is mostly manual at this time. Orders are read over the phone or faxed to the office which will fill the order. An R:Base application was written in 1988 which attempted to track the number of different types of resources ordered and their costs. The program had limited use and requires some modification in order to be fully functional. Currently, a PC-File database is maintained on every person assigned to a federal incident. This database is used to track the location, duration, and costs associated with a fire assignment.

The Fire Qualification Database is the sixth component of the Fire Management Module. All personnel assigned to federal fires must have the training and experience required for their assigned position. The U.S. Forest Service issues an incident qualification card directly to personnel who are qualified for overhead positions such as dispatcher, helibase manager, and crew boss. Each DNR employee who is qualified and has an interest in out-of-state fire assignments fills out a federal qualification form listing their training, experience and the overhead positions they are qualified to perform. These forms are submitted to the U.S. Forest Service for entry into their qualifications system. The DNR maintains this same database on R:Base, plus the training and experience records for all personnel qualified as firefighters.

Rural Fire Departments and Excess Property is the seventh component of the Fire Management Module. Currently, three separate databases exist on PC-File for this component. One database contains names and addresses of all rural fire departments. Another database contains an inventory of excess property assigned to fire departments. The third database

contains an inventory of items purchased by fire departments using federal matching funds. These databases are used only within the Northern Fire Center.

The eighth component of the Fire Management Module is the fire warden database. Areas communicate changes in burning restrictions to fire wardens on post cards. Names and addresses of fire wardens are kept at the Area level. Standard fields must be designated by all Areas so that the Area databases can be merged to a statewide database.

Burning permits make up another component of the Fire Management Module. Currently, burning permits are handwritten. The number of permits written is unknown except in townships which pay fire wardens for the number of permits written. No summary statistics are collected.

The tenth component of the Fire Management Module is enforcement. Areas issue a majority of the citations for illegal burning. The Area offices are responsible for tracking the citation to completion. The Area sends the final results to St.Paul for entry into the Division of Enforcement's system on the System 38 computer.

The next component of the Fire Management Module is equipment and personnel availability. Currently, Areas, Regions, and St.Paul complete equipment agreement forms with vendors which outline standby and operating costs of suppression equipment the vendor has available. Grand Rapids Region keeps a database of all private suppression equipment under equipment agreement in that region. On a daily basis, Regions keep lists of both DNR and private equipment and personnel available within the Region for reassignment to ongoing fires. A central list is maintained by the Northern Fire Center. Lists are exchanged by facsimile machine.

The final component of the Fire Management Module is Aircraft Summary Statistics. The DNR contracts airtankers, helicopters, and fixed wing aircraft during its fire season. Summary statistics are maintained by hand for each type of aircraft.

New Directions and Needs

The following desired capabilities for an improved Fire Management Module were suggested in Blueprint Project needs interviews:

- Wildfire Information System - Create a historical fire occurrence and fire weather database which is accessible by Areas, Regions, and St. Paul. (Project in process)

- Areas, Regions, and St. Paul need to be able to generate ad hoc reports off the fire information system during the current fire season.

- Billing and Collection - Automate this process so suppression bills can be produced from data on completed fire reports.

- Automate resource order process so that resources and their incurred costs can be tracked. The system should be able to determine the number, type, and costs of resources ordered.

- Create a single database which contains Rural Fire Department addresses, excess property inventory, and Federal Matching Funds inventory.

- Create a database of all suppression equipment under equipment agreement state-wide.

- Need to develop a system where Areas can let other Areas know what suppression equipment they have on standby on a given day.

- Need to be able to link the GIS with the fire information system to produce maps of: fire occurrence, fuels, roads, developments (improvements), and hazards.

- The fire reporting system needs to have the flexibility to make changes or additions to fire reports (at the Area level) from previous years due to a resolution of legal cases.

- Need meaningful, timely, local weather forecasts and NFDRS indices.

- Areas need training in the use of the BEHAVE model to use for prescribed burns and ongoing fires.

- Improve communication on ongoing fire matters between NFC and Districts, Areas, and Regions by using facsimile machines and better electronic mail capabilities.

- The Fire Center needs an automated system for summarizing airtanker, helicopter, and detection aircraft use.

Data Requirements and Characteristics

Data entities of importance to the Fire Management Module include:

- Fires
- Weather
- Fire Department
- Contractors (vendors)
- Resource Order
- Employee name

Additional information on entities and attributes related to fire management is available from:

- COBOL program listings
- PC-File database headers
- R:Base file definitions
- Enforcement System Variables
- Resource Order Form Fields
- Equipment Agreement Forms
- Federal excess property forms
- Covertype and facility information from GIS to prepare fire hazard maps.

Users

Users of the Fire Management Module come from all levels within the DNR as well as from groups and individuals outside of the Department.

At the District level, users would need facsimile machines for receiving weather forecasts, wildfire situation updates, and resource orders in a timely manner. Personal computers would not be a requirement at this level.

At the Area level, users have access to the system through Area personal computers and facsimile machines. Areas users include Office Managers, Area Staff, and Area Foresters. Office Managers are responsible for inputting Area Status Reports and Individual Fire Reports into Area PC's for transmission to St. Paul. The Area Staff person collects and inputs weather information into a U.S. Forest Service computer using the PC as a remote terminal. In addition, the Area Staff uses historical fire occurrence and NFDRS indices for long term fire planning as well as for short term staffing needs. The Area Forester uses the fire module for determining staffing needs and identifying resource shortages.

At the Regional level, Region Staff use personal computers and facsimile machines to retrieve weather forecasts, NFDRS indices, Area Status reports and lists of available equipment to determine staffing levels, resource shortages, resource surpluses and fire potential.

At the St. Paul level, all staff use personal computers and facsimile machines to create situation and status reports which are sent to all stations within the DNR and also to all cooperators outside of the DNR. Internal and external communications are very important at this level. Electronic communications are maintained with all DNR Regions and Areas, Chippewa National Forest, Superior National Forest, Bureau of Indian Affairs, Voyageurs National Park, St. Croix Wild and Scenic Riverway, U.S. Fish and Wildlife, news media, railroads, U.S. Forest Service Northeast Area, and U.S. Forest Service Eastern Regional

Headquarters. In addition, PC's are used extensively for developing databases for billing, inventory and resource ordering.

Input

- Prescribed Burn Plan (NA-01190)
- Burning Permit (NA-01974)
- District Worksheet (NA-2190)
- District Weather Record (NA-01969)
- Individual Fire Report (NA-01985)
- Area Daily Fire Worksheet (NA-02191)
- Citation (NA-01996)
- Burning Regulations to Fire Wardens (NA-01984)
- Fire Warden Commission Certification Card (NA-01976)
- Fire Warden Acceptance (NA-01992)
- Fire Weather Forecasts (NA-01967)
- Railroad Billing Report (NA-02175)
- Record of Aircraft Use (NA-02168)
- Excess Property Agreement (NA-01959)
- Equipment Service Agreement (NA-01975)
- Cooperative Fire Protection Agreement (NA-01966)
- Aircraft Accident/Incident Report (NA-02172)
- Resource Order
- Qualifications System Form 320

Output

- Wildfire information updates are sent to Areas, Regions, St.Paul, MNICS agencies, U.S.Forest Service, and media
- Invoices for fire billing sent to responsible landowner or to the U.S. Forest Service
- Citations given to responsible party
- Incident Qualification (Red) Cards given to qualified personnel at all levels
- Fire Planning information from the Wildfire Information System retrieved by Area, Region, and St.Paul personnel
- Accomplishment Reports completed by Area, Region, and St.Paul personnel
- Ad hoc reports from the current fire reports retrieved by Area, Region, and St.Paul personnel
- List of equipment under agreements statewide used by Region and St.Paul staff
- Inventory of excess property used by St.Paul
- Inventory of equipment purchased by fire departments with Federal matching funds used by St.Paul

- Fire Hazard maps used by Field Stations, Areas, Regions, and St.Paul
- Fire occurrence maps used by Field Stations, Areas, Regions, and St.Paul
- Resource orders for equipment, personnel, or supplies sent or received by the Minnesota DNR are maintained by St.Paul, Regions, and Areas
- Aircraft summary statistics used by St.Paul staff and by the Division of Enforcement

Linkages

Forest Service regulations require that overhead positions assigned to a fire must have both formal course work and on the job training to be fully qualified. To achieve this, the Fire Management Module must be closely linked to the personnel system's training records to determine Division of Forestry personnel training needs and fire qualifications.

The Fire Management Module must also be linked to the administrative module to secure personnel roster information used for the incident qualification cards, resource orders, and mobilization lists.

Another linkage should exist with the accounts receivable/accounts payable portion of the Administrative module. This linkage could help to expedite fire billings and fire payments.

This module must be linked to the Geographic Information System to develop maps to be used for fire planning.

Finally, a strong linkage exists between the Fire Module and outside fire-related agencies for the purpose of exchanging information on resources available for mobilization to wildfires.

Hardware & Software Needs

Communications is an extremely important part of fire protection. It is accomplished through the use of telephones, radios, fax machines, and modems. Fax machines are a requirement at all levels within the organization (St.Paul, Regions, Areas, and Field Stations) so that information can be exchanged quickly.

Personal Computers with asynchronous modems are a requirement at the St.Paul, Region, and Area levels. These computers should have enough disk capacity to store 10 years of fire history for the administrative unit.

Fire section personnel should have access to GIS hardware capable of producing both small and large scale maps for fire planning.

A minicomputer or a personal computer which operates as a communications platform needs to be centrally located to receive incoming fire reports and store the information. This same "platform" needs to be able to support an electronic messaging system which is capable of sending messages or documents created in a word processor.

Communications software, relational database software, and accounts receivable/accounts payable software should be resident in the PC's located in St.Paul, Regions, and Areas.

Administrative Support Module

As with any sizeable organization, the Division of Forestry requires basic administrative support services to accomplish its natural resource management objectives. The Division's Management Information Systems, Forest Resource Planning, Public Affairs, Human Resources Development, Law Enforcement, and Maintenance and Administration programs exist to provide technical and administrative support. The collective purpose of these programs is to provide the basic maintenance and administrative support services required to achieve the goals of other Division programs.

The goal of the Management Information Systems program is to coordinate, provide direction, and bear responsibility for processing of the Division of Forestry's information. MIS activities include development of systems applications, computer related support and training, providing recommendations for office automation, and maintaining communications with users and external computing centers (e.g., DNR MIS, ITG, LMIC).

The goal of the Forest Resource Planning program is to provide strategic and land management planning assistance for the Division of Forestry and the Department of Natural Resources. Major planning activities include development of the statewide Minnesota Forest Resource Plan, development of regional land management plans for the Division, preparation of annual work plans and accomplishment reports, coordination of environmental review, and representing the Division in Department level planning efforts.

The goal of the Public Affairs program is to achieve increased public awareness and understanding of Division programs, products, and services. The Public Affairs program cultivates public appreciation for natural resource management, protection, and development while serving as a mechanism for the Division to receive input from the public. Program activities include planning and promoting forestry related events, sponsoring Project Learning Tree, coordinating activities with the Bureau of Information and Education, and encouraging public affairs efforts throughout the Division.

The goal of the Human Resources Development program is to obtain the best possible productivity from the Division's staff through recruitment, selection, training, and continuing education. The Human Resources Development program is responsible for maintaining personnel training and experience records, working with the Training Board, promoting use of mobility assignments, and overseeing the trainee program.

The goal of the Law Enforcement program is to provide compliance with state statutes to prevent wildfires, to protect the public's interest in state land and its assets, and to ensure that the public can safely enjoy the Division's recreational facilities. Program activities include strengthening cooperation with the Division of Enforcement, providing forest officers with the necessary training and tools to carry out their enforcement responsibilities, and maintaining enforcement records and policy manuals.

The goal of the Maintenance and Administration program is to administer fiscal and personnel matters to achieve the goals of the Division's programs; to maintain property and equipment; to ensure employees' safety; and to ensure that Division stations present a pleasing appearance. Program activities include budget development and expenditure tracking, personnel services, building and equipment maintenance, union contract administration, and monitoring of legislation.

Current Condition

The Division of Forestry currently uses a variety of systems to meet its administrative information needs. The most important and widely used systems are briefly described below.

Payroll

The Division uses the state payroll system operated by the Department of Finance which runs on the state mainframe computer at Intertechnologies Group (ITG). Division employees are required to record cost codes on their Biweekly Time Report (NA-00043). This data is used by the Labor Distribution and Cost Distribution systems described below. The major problem encountered with the payroll system is the difficulty in getting the forms from outlying stations to the Area for signature and to the Region for data entry within the allotted timeframe. The use of "anticipated hours" also causes some problems, especially during fire season when it is difficult to know how many hours will be worked.

Labor Distribution

The Labor Distribution system is used to keep track of the amount time spent by employees on various tasks and programs. Basic data is recorded on the Biweekly Time Report and is processed on the ITG mainframe computer. Information from the system provides labor costs for trust fund land management and federal programs. The Labor Distribution information is also used by supervisors and managers to plan staffing levels for various programs and to monitor time spent by individuals or groups of employees on various tasks.

Standard output from the system is distributed semi-annually to all Regions and Areas on microfiche. Specialized reports for an individual employee or work group can be requested from the Forest Economist.

Statewide Accounting System (SWA)

Nearly all Division expenditures are processed through the SWA system which operates on the ITG mainframe computer. Division employees submit invoices and expense reports for processing and payment. Clerical employees code invoices and other documents to indicate which accounts are to be used. The Cost Code 3 and Cost Code 5 fields are used to track

expenditures by RAD and program task, respectively. Most Division offices also use the Lotus Budget Template, the Forestry Administrative Management System (FAMS), or manual records to keep a running balance for their budget accounts.

Cost Distribution

The Cost Distribution system is designed to track expenditures by task or program. Data input consists of the cost code data from expenditures processed through SWA. The system uses COBOL programs and IBM system utilities on the ITG mainframe. Data is downloaded to a Division PC on a monthly basis for additional processing and report generation using SPSS/PC+. Year-to-date reports are generated by the Forest Economist on a monthly basis for distribution to the Regions. Customized reports are also available.

Forestry Administrative Management System (FAMS)

FAMS is a menu driven application developed using R:Base. It operates on PCs and provides useful administrative support functions for Division offices. FAMS has five main functions:

- budget and expenditure bookkeeping.
- personnel records and directories.
- physical asset inventory.
- mailing list and label generation.
- R:Base utility functions for database maintenance.

FAMS' Financial Records Subsystem uses the same accounting structure as the Statewide Accounting System (i.e., APIDs, AIDs, Object Codes, Sequence Numbers). FAMS allows budgeting and expenditure tracking for each RAD or central office section. FAMS automatically does double entry bookkeeping at the Sequence Number and RAD levels of detail. Budget data can be entered at the beginning of the fiscal year. Expenditure records are entered as they are received. FAMS mimics SWA but is not connected to SWA in any manner. Invoices must still be processed through SWA. FAMS is intended to replace the Lotus 1-2-3 Budget Template and/or manual records being used to track expenditures.

The Personnel Records Subsystem contains an electronic version of the Division's Personnel Directory. This subsystem contains information on forestry offices (e.g.. RAD number, office name, address, phone number), positions (e.g., RAD, working title, classification, bargaining unit, radio call number), and employees (e.g., name, birthdate, length of service, home address, phone). This subsystem is capable of producing a variety of reports including directories, bargaining unit lists, affirmative action reports, and age and length of service lists.

The Physical Asset Inventory Subsystem is designed to keep records on both fixed and semi-expendable assets. FAMS maintains a subset of the data normally contained in the state property inventory system. While FAMS requires duplicate entry of some data, its ease of use, ability to track asset assignment, and ability to deal with semi-expendable

items make it a valuable inventory system for use within the Division. This subsystem allows searches for assets based on five different fields and is capable of producing five standard reports.

FAMS' Mailing Applications Subsystem allows development of mailing lists, generation of several standard label formats, and printing postcard size messages. The mailing list format includes a "member" field which allows several types of lists to be combined in a single database, eliminating the need for duplicate entries and making mailing list maintenance easier. The subsystem has features to allow tracking of the location and length of service for Fire Wardens and generation of notice of sale information for loggers. The postcard message feature allows storage and printing of up to 99 different messages (e.g., changes in burning regulations, notice of sales).

The General Database Utilities Subsystem allows use of selected R:Base commands to maintain databases. Available functions include compressing files, loading and unloading data from tables, browsing data, and computing statistics. More advanced R:Base utilities have been password protected to keep inexperienced users from accidentally damaging their databases.

Personnel System

The Personnel System is a Division-developed COBOL program that operates in the TI 990/PC environment. The Personnel System maintains experience and training records for all Division employees. The experience portion of the system maintains a chronological list of all positions an employee has held. The training portion includes a list of all training received by an employee and a list of training needed based on the employee's annual training plan. Each employee and his/her supervisor are supposed to develop a training plan covering the next two fiscal years when the annual performance review is conducted. The first year plan should be based on the list of courses to be offered in the coming year. The second year plan is a list of courses desired. The first year plan is used to develop potential attendance lists for scheduled classes. The second year list is used by the Training Board to help in deciding which courses should be offered in a given year. Data entry is done locally (e.g., at Areas for Station and Area personnel, at Regions for Regional personnel, and in St. Paul for St. Paul staff). The training plan portion of the records are deleted in May of each year to allow new plans to be entered. The system also maintains a list of courses. A course cannot be entered in the training records or on training plans until it has been assigned a number and entered in the course list. There is some duplication of data between the Personnel System and FAMS' Personnel Records Subsystem.

Law Enforcement

The Division of Enforcement maintains records of warnings and citations issued on the DNR's IBM System 38. Regional offices can access the database through their System 36

computers. Forest Officers currently have to phone in for records checks to determine if an individual has had past warnings or citations for forestry related violations.

New Directions and Needs

The following desired capabilities for future Administrative Support Systems were suggested in needs interviews:

- Need a good, standardized process for work planning and accomplishment reporting useable at all levels of the organization. It should have monthly reporting capabilities. Much of the accomplishment report should be generated from other operating systems.

- Need an accounts receivable system for the Division that will serve the needs of all programs that generate bills being sent to customers (e.g., timber sales, fire cost collection, PFM services).

- Would like an automated building inventory.

- Need read only access to state fixed asset inventory systems.

- Need ability to transmit payroll data via fax.

- Would like access to Field Services' Fleet Management database to generate ad hoc reports.

- Need a quality on-line budget system.

- All Division of Forestry offices should use the same budget tracking system.

- Need ability to track condition of fixed assets to plan repair and replacement schedule.

- Need on-line access to state procurement contracts information.

- Need access to list of equipment being released.

- Need access to statewide violation tracking system on the System 38.

- Need statewide summaries of violations and ability to generate ad hoc reports.

- Regions and Areas should have access to training and experience records of all Division employees, not just those in their work unit.

- Need a comprehensive human resources database (including training, experience, red card information, seniority dates, birthdate, etc).

- Need a system to track fire-related skills and experience for Division employees, temporary employees, and fire department personnel.

- Need better information flow to Field Stations on training opportunities, vacancy postings, promotional exams, etc.

- Need access to a computerized database of natural resource/forestry related facts that are updated regularly to respond to common questions from the public.

- Need to make time summary (labor distribution) reports more available to supervisors. Hard copy would be preferred over microfiche. Supervisors should get annual reports for each employee they supervise.

- Categories available on time summary need to be reviewed periodically. It is difficult to measure time spent on Tree Improvement or Forest Soils for example. Time summary categories should be closely related to work plan and accomplishment report units of measure.

Data Requirements and Characteristics

The data requirements for administrative support systems are quite broad. Major entities include:

- Budget
- Citation/warning
- Employees
- Equipment
- Facilities
- Invoices
- Positions
- Purchase orders
- Schedules
- Time Reports
- Vendors

Users

Payroll

All Division employees use the payroll system. For most employees their involvement is limited to filling out their Biweekly Time Report with time and cost code data. Supervisors review the Time Reports and can use them to monitor employee's hours worked by

program on a biweekly basis. Clerical employees usually collect Time Reports, check for missing data, and forward them for data entry and processing. The Time Reports provide data for the Labor and Cost Distribution systems.

Labor Distribution

The primary users of information from the Labor Distribution System are supervisors, managers, planners, and the Forest Economist.

Statewide Accounting System (SWA)

Clerical employees at Area, Region, and St. Paul levels are responsible for coding, editing, and forwarding invoices and other documents for processing and payment through the SWA system. Supervisors and managers receive reports from SWA that allow monitoring of expenditures and remaining balances.

Cost Distribution

The Cost Distribution system uses data from the SWA system to track costs by location (RAD) and program. Primary users of the system are managers, supervisors, and the Forest Economist.

Forestry Administrative Management System (FAMS)

FAMS will be used by a variety of Division employees. Clerical employees will be responsible for entering data and preparing reports using the Financial Records Subsystem. Supervisors will use the reports to monitor and adjust spending patterns. The Administration Section in St. Paul will be a major user of the Personnel Records Subsystem. All Division offices will be able to make use of the Physical Assets Inventory Subsystem. Area offices would probably be the heaviest users of the inventory subsystem and clerical or technical employees are likely to be responsible for data entry and report generation. Nearly every employee should be able to find uses for the Mailing Applications Subsystem. Again it will likely be clerical employees who are responsible for data entry, data updates, and label generation.

Personnel System

Clerical employees at the Area, Region, and St. Paul level are responsible for personnel system data entry. Employees and supervisors provide the data and develop annual training plans. The Personnel Development Supervisor and Training Board use information from the system to develop the training calendar. Course administrators and supervisors use the system to identify potential course participants.

Law Enforcement

Forest Officers will be the primary Division of Forestry users of the law enforcement system.

Input

See "Current Condition" and "Users" for description of input documents.

Output

See "Current Condition" and "Users" for description of reports from existing systems. If an accounts receivable system is developed it should generate invoices, late payment notices, receipt summaries, etc. The work planning and accomplishment reporting system should generate monthly, quarterly, and annual reports of accomplishment by individual or administrative unit.

Linkages

There is a desire for access to the state fixed asset, building inventory, fleet management, SWA, and law enforcement databases maintained by other agencies. An accounts receivable system should serve the Timber Sales, Nursery, Fire, and Private Forest Management (PFM) modules. An accomplishment reporting system would likely require linkages to the Timber Sales, Forest Roads, Forest Development, PFM, and Fire modules. A number of the Administrative Support systems mimic or supplement larger systems operating outside of the Division (i.e., FAMS Financial Records and Physical Assets subsystems). Ideally these outside systems should link with their internal counterparts to eliminate duplicate data entry and inconsistent databases.

Hardware and Software Needs

The payroll, labor distribution, SWA, and cost distribution systems all make use of the mainframe computer operated by ITG. The Division requires terminal access to and ability to download data from the mainframe to continue using these systems. FAMS will operate on most Division owned PCs. It is available in a Runtime version for use on machines with either the complete R:Base software or R:Base Runtime. A compiled version is available for use on machines without R:Base (requires DOS version 3.1 or higher). The personnel system operates in the Division's TI990/PC environment. The personnel system uses internally developed COBOL programs. The law enforcement system operates on the Department System 38/36 environment. Area and Field Station offices do not have access to this system.

All of the anticipated needs for Administrative Support systems should be able to be met using one or more of the above computer systems.

Office Automation Module

The Information Systems Blueprint Project studied both the Division's need for program specific information systems (e.g., timber sales system) and generic information systems that are not related to a single program (e.g. word processing, facsimile, electronic mail). For convenience the generic information processing systems are addressed as a group under the heading of Office Automation. The office automation module includes both computer based systems such as word processing, database management, and electronic mail and non-computer systems such as telephones, facsimile, photocopy, and filing.

Geographic Information System (GIS), a generic system for processing information about spatial attributes, is treated as a separate module.

Current Condition

The current condition of the most widely used office automation systems are described below.

Word Processing

Stand alone IBM Displaywriters were installed in the Division's St. Paul and Regional offices in the early 1980's. PC based word processing became available at Area offices with the installation of PCs in 1983. The phase out of stand alone word processors is nearly complete. Division employees at the St. Paul, Region, and Area levels currently have access to PC based word processing. Field Stations located in Area offices and those sharing office space with other Divisions often have access to word processors. Remote Field Stations without access to PCs either use typewriters or rely on their Area office for word processing.

IBM Displaywrite was the Division standard word processing software until recently. WordPerfect is now the recommended standard, although Displaywrite is still supported. The PC survey conducted as part of the Blueprint Project baseline analysis identified eight different word processing packages in the Division.

The conversion of documents from one software package to another, lack of word processing capability at Field Stations, and lack of standard formats were mentioned as problems related to word processing.

Database Management System (DBMS)

DBMSs are among the most popular software in the Division. The PC survey found 142 copies of DBMS software on the Division's 119 PCs. PC-File, a flat file DBMS, is the most widely available software package in the Division. R:Base, a relational DBMS, is also widely used.

Typical DBMS uses include maintenance of inventory records and mailing lists. A number of program specific applications have been developed using PC-File or R:Base. Examples include Township Fire Warden database, PFM Accomplishment Reporting, INVENT for CSA inventory maintenance, and the Forestry Administrative Management System (FAMS).

Users cited the following DBMS problems: inadequate training on DBMS concepts and applications; difficulty in downloading data from other systems for use with PC based DBMS; and lack of standard database definitions.

Spreadsheets

Lotus 1-2-3 and Quattro are the two PC based spreadsheets used in the Division. There are currently 59 copies of Lotus and 14 copies of Quattro in use.

Program specific applications developed using spreadsheets include a budget template and PLTCOST/PLTINDEX forest development record system.

Business Graphics

The Division has not had a recommended graphic software package. The graphics utilities included in other packages meet the needs of many users. There is also a wide range of stand alone graphics packages in use. The PC survey identified 11 different packages among the 18 copies in use.

Graphics related needs mentioned during the interviews included the ability to make slides at Areas and the ability to prepare business graphics for presentations and reports. Six interviewees wanted access to a scanner for capturing graphic images or text.

Communications

The Division's St. Paul, Region, Area, and Nursery offices are served by a PC to TI 990 communications network. The communication network uses Babytalk boards in the PCs. These boards permit asynchronous and bisynchronous communication over phone lines to remote offices. These boards are no longer manufactured and only operate in XT computers operating at 4.77 MHz. Several Division developed programs (e.g. Timber Sales, Fire Reports, Personnel, and Mailbox) are dependent on this communication environment.

Mailbox is the Division's current electronic message system. There is a strong desire among Division personnel to have an improved electronic mail system. Desired characteristics include improved ability to edit messages before sending, ability to send messages generated on word processors, and ability to transfer files.

PCs with modems are also used to access other systems. Fire weather forecasts and AFFIRMS data are transmitted via modem. The Division also has access to the US Forest Service's Telemail message network.

PCs in St. Paul and Regional offices can access the DNR System 38/36 network using optional 5250 terminal emulation hardware and software.

Telephone

All Division offices have basic phone service and access to the state WATS service. The majority of Division offices are also served by the state North Star Network. Voice mail service is available in St. Paul but is not being used by the Division. The installation of modems and fax machines has required additional phone lines in most offices. Some locations do not have tone dialing which makes it impossible to use some long distance services, voice mail, and automatic call routing systems without the purchase of an auxiliary tone pad.

Fax

St. Paul, Region, and Area offices installed fax machines in 1987. Fax is currently used for many messages that were previously sent via Mailbox.

Filing System

All Division offices maintain manual files of memos, letters, directives, and other material. Material is filed by subject using codes contained in the *Filing System Manual*. Problems with the filing system include difficulty in coding correspondence from outside the Division that deals with a variety of subjects and failure of employees to put file numbers on correspondence they prepare. In larger Division offices, there are often several small filing systems maintained by individuals or small work groups rather than a central file. The filing system is not adequate to deal with reference material needed by staff specialists. The manual files are no longer a complete set of all material on a subject since many memos, letters, and messages are created, sent, and stored electronically.

New Directions and Needs

The following office automation related needs were expressed during Blueprint Project needs interviews:

- There is a need for all Division offices to have fax machines.
- Field Stations need fax, photocopier, and personal computer.
- Mailbox needs to be substantially improved or replaced with another electronic mail system.

- There is a need to use field data recorders for a variety of data collection efforts.
- All Division personnel should have access to word processing, DBMS, and spreadsheet capabilities.
- There is a need to produce slides and other business graphics at Area offices.

Linkages

The ability to transfer data and documents from one location to another is becoming increasingly important. This transfer can be facilitated by adoption and use of standard hardware, software, and formats within the Division. The ability to import and export data in a variety of formats should be a consideration in selecting office automation software. PC based systems should also be able to easily download data from Division developed systems operating on the minicomputer.

Hardware and Software Needs

All Field Stations should have the following information systems related equipment and software within five years:

Equipment
- Fax
- Telephone - minimum of 2 lines, tone dialing
- Copy machine
- Surge suppressors for all electronic equipment
- Personal computer
- 9 or 24 pin dot matrix printer
- Modem
- Field data recorder

Software
- Word processing
- Database Management System
- Backup utility
- Communications
- Program specific applications
- Calendar/scheduling
- Electronic filing of documents, policies, and correspondence

Area offices should have the following information systems related equipment and software within five years:

Equipment
- Fax
- Telephone - minimum of 2 lines, tone dialing
- Copy machine
- Surge supressors for all electronic equipment
- 1 PC with high speed modem to access central minicomputer
- 24 pin dot matrix printer with sheet feeder
- 1 or more stand alone PCs
- Peripheral sharing device
- Color printer or plotter (11"x17")

Software
- Word processing
- Relational DBMS
- Spreadsheet
- Communications
- Backup utility
- Calendar/scheduling
- Electronic filing and retrieval of documents, policies, and correspondence
- Program specific applications
- GIS (EPPL 7)

Region and St. Paul offices should have the following information systems related equipment and software within five years:

Equipment
- Fax
- Telephone - multi-line system, tone dialing
- Copy machine
- Surge suppressors for all electronic equipment
- 1 or more PCs with high speed async modem for use with programs requiring access to central minicomputer
- 24 pin dot matrix printer(s) with sheet feeder
- Additional stand alone 286 class PCs as needed
- 1 or more 386 class PCs for GIS and heavy DBMS use
- Full page, flat-bed scanner with graphic and text capabilities
- Laser printer(s)
- Peripheral sharing devices with multiple input and output ports
- Connection(s) to DNR Regional/St. Paul minicomputer network
- Color printer or plotter (11"x17") for maps and graphics
- GIS workstation with digitizer and 36" wide plotter networked with central minicomputer

Software
- Word Processing
- Relational DBMS

- Spreadsheet
- Graphics
- Communications; flexible software with electronic messaging and file transfer capabilities
- Backup utility
- Calendar/scheduling
- Electronic filing and retrieval of documents, policies, and correspondence
- Desktop publishing
- Statistical analysis
- Program specific applications
- GIS (EPPL 7 and vector based workstation software)

GIS Module

A Geographic Information System (GIS) is an automated system through which geographically-referenced databases and maps can be input, stored, linked, manipulated, analyzed, and displayed.

A GIS is where separate layers of geographic data become truly useful, integrated information. The real advantage of a GIS is that it allows integration of data from a wide variety of sources and geographic scales to perform natural resource analyses and explore the effects of alternative management practices.

There are two basic types of GIS - raster and vector. Raster based systems use a grid to store and process data. Landsat is an example of a medium resolution raster database. A vector based system stores geographic data in the form of point, lines, and polygons. Standard file interchange formats are being established to facilitate the exchange of data within and between vector and raster systems. Raster systems usually store and process data more efficiently than vector systems.

Current Condition

The Division of Forestry uses both raster and vector based GIS. The Division's primary GIS consists of ARC/INFO software which runs on the PRIME 2250 Rabbit minicomputer in Grand Rapids. This machine is operated by the Division's GIS Unit, with a staff of seven GIS analysts and data entry specialists. The primary use of the PRIME 2250 is for CSA Forest Inventory data management and mapping. The PRIME, its associated hardware and software, and its uses are described more fully in the Baseline Analysis (Chapter 2).

The Division of Forestry also uses the GIS capability at the Land Management Information Center (LMIC). Forestry has used LMIC: (1) to assist with digitizing activities, (2) as a support, training, and development facility for its GIS software, (3) as a location to support user requests for non-standard analysis or map requests of FIA and CSA data, and (4) as an off-site storage location for backup of inventory data.

LMIC has done much of the DNR's GIS research, development, and production work either on a contract basis or by using DNR staff that have been trained at LMIC. LMIC also has been a primary administrator and maintainer of geographic databases of statewide significance and use.

The raster based GIS used by the Division is EPPL, a system developed by LMIC. EPPL7 is the microcomputer version of the Environmental Planning and Programming Language. With the recent addition of digitizing and relational database capabilities, EPPL7 has emerged as a complete raster GIS for microcomputers. The Division has 12 of EPPL7

installations. Available data for use with EPPL7 includes all of LMIC's MLMIS40 (65 available themes) and MLM100 data (48 available themes) sets for the state and 87 counties.

New Directions and Needs

A GIS should have the capability to relate various combinations of information (maps or layers) such as:

- Forest cover
- Inventory plots
- Transportation systems
- Mineral deposits
- Recreation areas
- Wildlife habitat (game, nongame, endangered species)
- Demographics
- Industry (location and procurement zones)
- Trails, Wild & Scenic Rivers
- Watersheds
- Administrative Areas
- Soils
- Historical, Cultural & Archaeologic sites
- Forest development projects
- Land ownership
- Harvest Plans
- Fire occurrences
- Fire hazard & risk areas

Specific GIS uses and products identified during the Blueprint Project needs interviews included:

- A map similar to the inset map on many Division forms (e.g., F80, F121) showing covertype, roads, water bodies, etc. A map for a given site could be used from timber appraisal through harvest and regeneration.

- Maps of plantations, pest occurrences, lease sites, recreation facilities, and land ownership. These maps should be at a scale suitable for site management activities. The GIS should also be able to display these features as point on Area maps.

- A complete map of the transportation system with associated attribute data for state forest roads.

- A vegetation map covering all ownerships for use in recreation, wildlife habitat, and timber management planning.

- Maps of TMPIS results showing planned timber management locations.

- Maps showing location of stands needing regeneration checks.

- Ability to locate traverses on map and determine acreage.

- Complete detailed soil coverage with interpretations for forest productivity, equipment operability, and suitability for soil active herbicides.

- Track geographic patterns of fire occurrences on a seasonal and yearly basis to locate high incidence areas and plan prevention and enforcement actions at the township level.

- Fire Hazard/Covertype Map for fire planning to identify fuels, high value property, and population centers. Maps showing roads, trails, structures, general cover types, topography, lakes, streams, ditches, railroads, and utility right of ways would greatly assist field people and dispatchers in determining where to go. Maps could be scaled to show a 4 square mile area and could be displayed on the screen or a hard copy printed for field mapping of actual fire.

Data Requirements and Characteristics

A GIS is characterized by its ability to relate geographic (spatial) entities with attribute data stored in a database. The linkage between the map files and the associated data is made possible by having a common identifier (geocode) on both the map and DBMS files. A geocoded database can be compared with other databases with compatible geographic referencing systems. Scale and resolution are important concepts to keep in mind while using geographic data. Changing the scale of a map, which can be easily done with a GIS does not improve the accuracy of the data.

Some of the more important spatial entities that a forestry GIS will track include covertype, soils, transportation network, hydrology, ownership, recreation facilities, and locations of rare or unique natural or cultural features.

Acquisition, entry, and maintenance of geographic data is very costly. It is unlikely that any single organization could afford to develop all the GIS coverages it would like to use. Cooperative data acquisition and entry is very important to the success of a GIS. The Minnesota Natural Resource GIS Consortium (MN-NRGIS) is a group of interested GIS

users, data providers, and data users working towards building the "second generation" (i.e., a 1:24,000 USGS quad based) GIS for Minnesota.

There is a need for data standards to allow transfer data between systems. *Recommended GIS Data Standards, Guidelines and Procedures: Building a Minnesota GIS Map Library*, written by Paul Tessar (LMIC) and published by the MN-NRGIS Consortium is a significant step towards this end.

The MN-NRGIS has produced an inventory of spatial data available within Minnesota. Copies of this document can be obtained from LMIC. It contains brief descriptions of 135 spatial layers of 28 themes collected by 18 agencies.

Users

While GIS have become more user friendly, they still require considerable training to operate effectively. As a result there will be only a limited number of actual hands-on users in the Division. Field Station personnel will primarily use products requested from GIS operators.

Areas will need 1 or 2 trained users of PC based EPPL7. These users should have the ability to use EPPL in limited command level; most use would be in pre-generated applications. These users also will need database training.

Regions will need at least one person expert in the use of EPPL7. This staff should have the expertise to translate EPPL7 into ARC coverages, and vice versa. This person would assist other staff in using GIS in their jobs. Regions will be where vector based GIS workstations are piloted. These workstations will require one or two full time GIS staff (may be DNR rather than Forestry staff).

St. Paul must have at least one person (most likely on FIS staff) with high level expertise in the use of EPPL7. This person should have the expertise to translate EPPL7 into ARC coverages, and vice versa. The FIS Unit should have one or two analyst/programmers who specialize in ARC. All FIS analyst/programmers will need some ability in ARC and related GIS database use.

Input

Ideally, map digitizing and data entry should be closely coordinated to maintain consistency and reliability of the data. On the other hand, there is a desire to have transactional data (e.g., timber sales, fire reports) entered at the source (usually Field Station or Area). Since transactional data processing and GIS will be closely integrated it may be necessary to

have attribute files updated at the Area while map files are updated at the Regions or in St. Paul.

There needs to be a standard set of documents for processing updates to map files. Furthermore, the Division needs to review all forms with maps on them for the possibility of using them as source documents for base map generation and correction.

Output

See New Directions and Needs discussion above for some of the proposed GIS output.

Linkages

The GIS must be linked with the Division's corporate database (e.g., timber sales, inventory, development, fire) so that it can provide mapping and geographic analysis support to all Division programs.

There must exist clear and understandable data standards if the Division is to obtain data and share its own data with others.

Hardware and Software

The following premises must be kept in mind when selecting GIS hardware and software for the Division:

- MIS and GIS will be integrated to form a forest information system to support the Division's mission.
- The system should be based on stand and land related geographic data. This is a step toward operational GIS that provides automated maps for day-to-day applications.
- Areas will likely do the alterations of attribute files (updating central files).
- Regional GIS workstations will update the map bases, and should act as facilities to get other disciplines involved.

GIS and transaction processing should be done on the same computer system. The DBMS used for GIS applications on the minicomputer should also be used for other key applications. A careful examination should be made of the available minicomputer DBMS

packages for GIS (ARC-based) and for transactional processing (DB2, INFO, INGRES, ORACLE all need study). The minicomputer must have at least 6-12 gigabytes of on-line disk storage (CSA maps & attributes alone account for about 6 gigabytes). The Regions and St. Paul must have plotters & digitizers large enough to handle township maps at a scale of 4 inches to the mile without reorientation. Areas should have a PC capable of running EPPL7 and a 11"x17" plotter.

Forestry Information Systems Blueprint

5. Data Architecture

Introduction

Data is becoming an increasingly important component of information systems. Traditional information system development efforts focused on applications. Data existed in relation to applications. Data files were viewed as places to store input and output for applications. If two applications needed the same data, redundant files were often created. More recent information system models view data as a resource that exists independent of application programs. As a resource, data has value to the organization and must be managed. The term "corporate database" reflects the change from viewing data as belonging to a single application or organizational unit to viewing it as something of value to be available to meet the entire organization's needs.

The development of database management systems (DBMSs) is fostering the separation between application programs and data. DBMSs perform a number of generic data management functions that formerly had to be programmed into applications. These functions include database definition, data update, retrieval, data restructuring, and data integrity control. A DBMS removes many of the application program and computer hardware restrictions on data structure and data relationships. Thus with a DBMS the database can be a more realistic representation of real world entities and relationships.

The sharing of data between applications by multiple users brings with it the need to clearly define and document the content and structure of databases.

Information Policy Office Data Architecture Guidelines

The Department of Administration's Information Policy Office (IPO) has proposed a conceptual data architecture for use by state agencies. The IPO has defined the following key terms related to data:

- **Data Group** - a set of data entities that possess similar properties and characteristics. Six data groups (people, service, finance, natural resource, organization, and property) have been established for use by all agencies.
- **Data Entity** - an object, event, document, person, place, or thing about which an organization wishes to collect or store data. An example is "client".
- **Data Attribute** - a named characteristic or property of a data entity containing a single piece of information. Example "client name".
- **Data Occurrence** - a single instance of a data entity. Example "John Doe".
- **Data Relationship** - a logical connection of data to enhance description or differentiation based on common attributes. An association between two data entities.

Division of Forestry Data Architecture Guidelines

The Blueprint Project Committee identified entities of interest to the Division (Figure 5.1). The list of entities is not exhaustive. While the Division currently collects and stores data about each of the entities listed, that data is not necessarily stored in a computer system. Many of the entities are not clearly defined at this time. Formal definition of entities in existing and proposed systems will be critical if the Division is to achieve its goal of integrating systems.

Agencies	Observation, weather
Announcement	Order, tree
Appraisal	Order, resource
Bill (payable)	Order, purchase
Bill (receivable)	Outbreak, (I&D)
Budget	Parcel, land
Citation/warning	Permit
Client	Position
Contract	Project
Cooperator	RAD
Correspondence	Range/Habitat
Cover Type	Road, state forest
Customer	Road, other
Document, information	Sale, timber
Document, policy	Sample (plot, transect)
Employee	Scale, timber
Equipment	Schedule
Facility	Seedbed
Fire, prescribed	Seedlot
Fire, wild	Soils
Geology	Stand (type)
Hydrology	Time Report
Land Use	Tract
Landforms (topography)	Training
Lease	Tree
Management plan	Vendor
Market	

Figure 5.1 Examples of Data Entities Used by the Division of Forestry

The development and maintenance of a comprehensive data dictionary for the Division is strongly recommended. A data dictionary includes data structure diagrams, entity descriptions, attribute descriptions, and an explanation of how the data is used in the organization. Figure 5.2 depicts the hierarchical relationship of data dictionary components. Figure 5.3 illustrates the items required to describe an attribute.

Data Structure Diagram

Entities (Identification and Description)

Attributes (Description of Use, Definitions)

Types of attributes:

- Keys (Unique identifiers)

- Linking identifiers (used to facilitate aggregation and to relate to other data.

- Commonly used attributes (date, name, address, species, etc.)

- Program specific attributes (date of sale, cause of fire, type of PFM Plan, etc.)

Figure 5.2 Data Dictionary Components

An initial task in developing a data dictionary is to inventory and describe existing data within the Division. The inventory process will reveal existing data flows (sources and destinations), redundant data, and inconsistent descriptions of data. A very cursory analysis of data flows was completed as part of the Blueprint Project baseline analysis. The data dictionary prepared during the initial inventory will have to be refined and expanded as new systems are developed.

Attribute Name: RAD

Attribute Type: common, linking, geocode

Description of Attribute: Forestry administrative unit number

Data Type: Integer

Length: 3

Unit of Measurement: class code

Format and subfields: a/b/c
a = Region reference code
b = Area reference code within Region
c = Field Station reference code within Area

Entity associations: land parcel, forestry office, position, etc.

Domain/values: 100 - Bemidji Region
110 - Bemidji Area
111 - Bemidji Field Station
112 - Cass Lake Field Station
.
.
.
990 - Out of State

Figure 5.3 Example of an Attribute Description

The existence of a data dictionary and a "corporate database" create the need for database administration. As sharing of data among users and applications becomes more common the need for coordination and conflict resolution increases. For example there may be disagreement among users as to the appropriate content and structure of databases. A database administrator will have to mediate to identify the optimal solution for the organization rather than allowing each user to develop redundant or inconsistent databases.

Everest[1] lists the following as database administration functions:

- Defining, creating, redefining, and retiring data.
- Making the database available to the using environment.
- Informing and assisting users.
- Maintaining database integrity.
- Monitoring operations and performance.

These functions will require increased attention as data becomes a common organizational resource.

The database administrator concept is new to the Division of Forestry. In the past the database administration functions were either not done or were diffused through several groups. Defining and creating databases was done by systems programmers and users. Users were primarily responsible for database integrity. Only limited efforts were made to document and describe data or make it easily available to others beside the primary user. While the development of systems will continue to be a joint effort between users and systems staff, the responsibility for corporate database planning and control should be centralized within the information systems unit.

In organizing its information systems staff, the Division will have to assign database administration responsibility to one or more people. Everest summarizes the need for, and possible location of the database administration function as follows[2]:

> Acquiring a DBMS is not sufficient for successful data management. The role of database administrator provides the human focus of responsibility to make it all happen. The DBA role may be filled by one person or several persons.
>
> Whenever people share the use of a common resource such as data, the potential for conflict exits. The database administrator role is fundamentally a people-oriented function - to mediate the conflicts and seek compromise for the global good of the organization.
>
> Within an organization, database administration generally begins as a support function within the systems development unit. Sometimes it is in a technical support unit associated with operations. Eventually, it should be separate from both development and operations, residing in a collection of support functions reporting directly to the director of information systems. Such a position has some stature, some independence, and can work directly with users to capture

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[1] Everest, Gordon C., Database Management: Objectives, System Functions, and Administration. (New York: McGraw-Hill, 1986), pp. 576-615.

[2] Ibid., pp. 614-615.

their data requirements. Database administration works with development, operations, and users to coordinate the response to data needs. The database administrator is the key link in establishing and maintaining management and user confidence in the database and in the system facilities which make it available and control is integrity.

Data Definition in the Systems Development Process

Part of the information systems development process (see Chapter 9) involves defining and describing the system's data requirements in terms that are understandable by users and the computer. Data definition begins during the Conceptual Design stage of systems development and should be done by users and systems staff.

The Conceptual Design should provide a description of the data that will be collected, stored, analyzed, and reported on by the system. A logical data description will result in consistent and will structured databases. A well defined data structure will also make it easier to transport data between software packages and computer systems. The Conceptual Design should identify the entities to be included in the system along with the important attributes for each entity. Relationships among entities and linkages to external systems should also be described. The estimated volume of data to be stored in each database must also be estimated. A description of how the database might change in size over time is important, especially if the system will store historical information.

A structured data definition process, such as the Logical Database Design process described by Dr. Gordon Everest[3] of the University of Minnesota, should be used to establish a sound data structure. The data definition process should result in modifications or additions to the Division's data dictionary.

The Conceptual Design describes the data in a format understandable by users and systems programmers. The data description is translated to a format useable by the hardware and software during the Detailed Design and System Construction stages of systems development.

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[3] Ibid., pp. 198-256.

Forestry Information Systems Blueprint

6. Hardware and Software

Introduction

This chapter of the Blueprint deals with the hardware and commercial software components of the Division of Forestry's future information systems. The Information Policy Office refers to this part of a systems plan as the technology architecture.

The Division's existing systems were described in the Baseline Analysis (Chapter 2). The Needs Assessment (Chapter 2) and the Module descriptions (Chapter 4) discussed the Division's information needs by program. This chapter begins with an analysis of information processing needs by location (administrative level). Next is a review of some of the guiding principles the Blueprint Committee used in selecting a recommended technology architecture for the Division. This is followed by an evaluation of alternative approaches to meeting the Division's centralized minicomputing and communications needs. The next section deals with GIS workstations. The final portion of this chapter contains the recommended PC hardware and software standards.

Information Processing Needs by Administrative Level

Each of the Division's four administrative levels (St. Paul Central Office, Regions, Areas, and Field Stations) have unique functions and thus, different needs for information processing. While data access and information processing needs vary by administrative location, there are some needs that are common to all levels. These common needs include:

- Access. Need recent copies (days to weeks old) of portions of central files for local use. In general, no locations have overriding needs for real-time up to the minute access to most databases. Field Stations actually need the most current information for forest management activities. St. Paul and Regions can, for the most part, get by with summary information.
- **The ability to update key files through defined standard procedures on a timely basis.** The responsibility for updating data should reside as close as possible to the point of the transaction that results in the need to update the file.
- **Ability to produce or easily get copies of current maps.**
- **A need for well organized office automation capabilities.** There is a desire at all locations in the organization to have access to personal computers and many of their office automation and productivity tools. These include word processing, electronic mail, database management packages, business graphics, calendaring, and spreadsheets.

St. Paul Central Office

St. Paul provides statewide policy, planning, and budgeting as well as overall program coordination. The primary information needs are for summary level reports to monitor accomplishments and to set future objectives. Some staff also have needs to conduct statistical analyses on statewide databases. Most of the needs for computing in St. Paul can be met by stand alone or networked personal computers. Needs of the St. Paul staff include:

- **Connection to central minicomputer systems.** For staff that are users of systems such as timber sales and fire reporting there is a need to connect their personal computers to the central computer systems. Like other levels of the organization, there is a need for more timely access to information stored in central databases.
- **Access to GIS system and products.** There is a growing desire for St. Paul staff to get better access to GIS capabilities and products. Both Planning and Forest Resource Management need better access to GIS capabilities.
- **Office automation.** St. Paul staff needs to have access to the full range of office automation tools and capabilities. Word processing, electronic mail, business graphics, DBMS, statistical analysis, desktop publishing, calendaring, and desktop helpers are among the needs.

St. Paul staff housed at field locations should have personal computers with communications to central systems and should be able to make use of capabilities available at their particular location.

Regions

Regions provide administrative support to Areas and provide specialist services (e.g., soils, I&D, U&M). Regions have been leaders in the Division in the use of personal computing capabilities. While personal computers solve many of the office automation and productivity needs in the Region there is also a need to connect into Division, Department and Statewide systems. Some of the major needs of the Region include:

- **Office automation.** Regions require a full range of office automation capabilities.
- **Access to information.** Needs include access to systems and files that are maintained on the Division minicomputer, DNR System 38/36, and ITG mainframe. To access this data there needs to be good connections and possibly multiple ports to systems which can act as servers for uploading or downloading files.
- **GIS.** There is a desire by Regions to get much more involved in the use of the GIS. Given the current state of technology, the Regions may be the best location to give Areas and Field Stations more access to GIS capabilities and products. A possible scenario would be to have the Areas update the database (attributes) while the Region updates the master geographic map coverages. Heavy duty processing of GIS data with a vector based GIS would require a GIS workstation.

If the Region is to meet all of the needs described above it will need more computing power than it currently has. High powered personal computers and a GIS workstation that can be connected to central systems should meet most of the needs.

Areas

Areas provide administrative support for Field Stations. Areas are also actively involved in on the ground implementation of the Division's programs. Areas are currently the data entry point for most of the Division's operational level information systems (e.g., timber sales, fire reporting, personnel, forest development records). Area information processing needs can probably continue to be met with personal computer workstations linked to the central minicomputer and stand alone PCs. Area computing needs include:

- **Transaction processing.** Areas will continue to be a primary data entry point for operational systems for the near term future. Areas also need the capability to update important databases in an orderly and timely manner.
- **Better access to information.** Areas need access to information they have entered in statewide databases for local inquiry and analysis. Effective use of DBMS packages will be required to provide this access.
- **Office automation.** A wide range of office automation capabilities are needed at Area offices.
- **GIS.** There is an increasing interest in the use of GIS capabilities at the Area. Areas would like to have full GIS capabilities, but it is still questionable if the technology is affordable and easy enough to use. Tests are needed to examine the possible use of GIS software such as EPPL 7 in Areas. While there is a need to be able to easily make maps or have good access to map-making capabilities, there is not a burning desire to do the actual map entry or digitizing at Area offices. At a minimum Areas should be able to do its own updates of attributes on centrally located attribute files, with the Regions updating map bases. Special requests for maps or analysis could be conducted in the Region on request by Areas. It is felt that the Regional location for GIS activities will be conducive to getting other DNR divisions involved. Use of a GIS such as EPPL 7 in an Area would require an AT or higher level computer with a least 100mb disk storage, VGA monitor, high speed communications, and a plotter or color printer.

Field Stations

Field Stations are the operational administrative level in the Division of Forestry. The need for information processing and data access at Field Stations is real. Field Stations are the level in the organization that has the greatest need for correct, up-to-date forest resource data. The Field Stations computing needs include:

- **Word processing.** Field Stations need word processing capabilities for normal memo and letter writing, and for the preparation of PFM plans and other reports. Today, Field Stations have to either type their letters and reports with old typewriters (often retyping several times and still coming out a mess) or hand draft their materials and send them to the Area...and often wait several weeks for turnarounds on drafts.
- **Use of database packages for accessing forest resource and land related information.** Field Stations often need quick access to current information from the forest inventory when getting inquiries on timber availability. They also need access to correct and up-to-date land ownership information to proceed with their work and to be able to answer questions from the public.
- **Communications.** Field Stations are at the end of the line for communications. Quite often they do not receive important communications and announcements until it is too late to respond. At other times they are the point of origin for information (such as appraisals or fire reports) needed elsewhere in the organization. Providing a computer and modem would open up many new possibilities for better communications for Field Stations. A fax might even go further.

At the present time, the computer would be an office automation, communications, and productivity tool. Eventually, Field Stations could play a much larger role in data entry for operational systems, perhaps using field data recorders.

Several Field Stations already have or are sharing personal computers with other divisions or agencies. The first use of personal computers in Field Stations has been as stand alone equipment not connected to any other computers.

Placing computers in Field Stations must take place in an orderly fashion. The Division can not just place the personal computers there and expect that they will be used effectively. Field Station personnel will first have to be given proper training and insight on when and for what the computer should be used. Some believe that a computer will require assistance from a clerk or placement of a clerk at the Field Station. On the other hand, professional and technical staff at other administrative levels are increasing productivity through use of personal computers while requiring less clerical assistance.

Guiding Principles for Selecting a Technology Architecture

The Blueprint Committee evaluated several alternative architectures that could realistically meet all or most of the Division's anticipated information needs. To select a preferred alternative the Committee used the following principles as guidelines:

- The expressed desire of Division employees to have integrated Forest Information Systems ... a logical integration of MIS and GIS

- The desire to establish a corporate database for Forestry that meets the needs of the Division and is accessible to those who need information to make decisions
- The desire of the Division to establish systems that are consistent with Department needs and capable of being integrated into a larger DNR system
- The degree to which an alternative met the Desirable System Characteristics listed in Chapter 3

In the process of evaluating alternative architectures, the Blueprint Committee had to ask some basic questions about the type, number, ownership, location, and operation of computer systems. The answers to these questions weighed heavily in selecting a preferred alternative. The answers also point to some needed changes from the status quo. Therefore, committee members felt it important to include their deliberations on these questions in the following section of this chapter.

Examining Minicomputer Alternatives

Does Forestry Have a Need for Minicomputing?

The first question the committee asked was, "Does the Division of Forestry need access to a large minicomputer (or mainframe) computer system?"

The answer was yes. There were several needs identified for access to a large computer facility. It was felt that personal computers could not do all the tasks that need to be done. The primary needs identified for the use of minicomputers are:

- **For large or complicated processes that can't conveniently be done on personal computers.** Processes that have to be done on very large files that take too much time or too much storage are concerns. Activities that come under this class include processes such as statewide analyses and modelling of forest inventory data; GIS in general, and large area GIS analysis or mapping in particular; the analysis of large historical, or statewide databases on topics such as development or fire records.
- **For processes that need frequent central access to common reference or master files.** A master file at one location facilitates updates and creates order. Personal computers can not handle the job if heavy concurrent access to files is required or the files are too large.
- **To Perform as a statewide server for some of the Division's major databases.** This would be to perform as a builder and downloader of files to those in the Division that need copies for their local use and analysis. Having a single master file at one location will again facilitate the process and help keep order.

In addition to the general needs described above, to be most effective for Forestry, a minicomputer should also possess most of the additional characteristics listed below:

- Capability for high speed computation (10 to 20 MIPS)
- Ability to store and retrieve large amounts of data (10 to 20 Gigabytes)
- Efficient backup and retrieval mechanisms
- Accounting system to record and monitor system use
- Support GIS functions including mapping and spatial analysis with integrated DBMS
- Support a full featured relational DBMS having SQL compatibility (e.g., Oracle, Ingres)
- Support high level languages (e.g., Pascal, FORTRAN, COBOL)
- Support a selection of off-the shelf software
- Provide software tools for programmers to write "user-friendly" programs
- Electronic mail capabilities for networking with PC's
- On-line documentation for access by system users
- Ability to transfer files to remote locations
- Allow transaction processing at remote locations
- Open architecture to facilitate intermachine connection
- Ability to act as server for scientific workstations using UNIX operating system
- Ability to connect to DNR System 38 computer network

Most major manufacturers of minicomputers, including Prime, Vax, Data General, IBM, and HP, could meet these needs. However, the ARC/INFO system used by Forestry for its GIS activities does not currently run on IBM or HP minicomputers.

How Many Minicomputers Does the Division Need?

Up to this point the committee evaluated the need for access to a minicomputer and outlined some of the desired characteristics of a minicomputer system. If the Division needs minicomputing capabilities, the next big question is, "Does Forestry need to continue to operate two computer facilities, or can one system support all of the desired MIS and GIS functions?" This was a question raised by key members of the Forestry management staff during Blueprint needs interviews.

To complete this evaluation the committee examined some of the advantages and disadvantages related to the operation two separate systems.

Advantages of Operating Two Computer Facilities

There were several advantages the committee could see to the status quo of operating two separate computer facilities. These included:

- **Having a longer useful life for each facility and thereby spreading purchase costs over a longer period of time.** The merger of the services provided by the two centers would tend to put more demands on one facility and would probably require more frequent upgrades.
- **Better control for individual applications and activities.** This would reduce competition between GIS and MIS activities for system resources. Scheduling would be easier. Major changes in architecture of one activity would not directly impact the other. Also, when one computer went down, it would only impact a part of the applications in the Division, and not all of them, as would be the case if all users were on the same computer system.
- **Ability to better match the machine to the function that it must perform.** The architecture of some machines is much better suited for GIS tasks while that of others is more suited for more the more typical transaction oriented IS tasks.
- **Staffing and personnel issues.** Potential personal and political problems related to relocation of staff would be eliminated. Also, it might be possible to develop stronger individual staffs to concentrate on their more specific types of duties.

Disadvantages of Operating Two Computer Facilities

The disadvantages of operating separate systems, for the most part, have to do with the inefficiencies created by having to manage and maintain duplicated facilities and functions. There was also a concern that separation would create problems in the coordination and linking of systems. The disadvantages of operating two systems include:

- **The additional costs of operating two separate facilities.** The extra cost created by duplicating those features of a facility that easily could be shared. There would be an extra cost to operate two very similar physical plants, particularly if both facilities required the same types of environmental and security systems.
- **Redundant staff functions.** A redundancy of staff and their functions was a concern, particularly in the areas of operations and system hardware and software support. With a single facility efficiencies would be gained for operational activities such as system backups, hardware care and maintenance, and system software support.
- **Increased costs related to the purchase and maintenance of hardware and software for two computers.** It is an additional expense to purchase equipment, software and maintenance for separate machines. In fact, it may be impossible right now to buy two systems. Duplication of equipment, such as, tape drives, air and power conditioning, printers and communication systems could be reduced with a shared facility. Much of the hardware and software would only have to be purchased once, if one minicomputer system was used. In addition, there are redundancies in staff for normal system maintenance activities.
- **Creating effective communications between machines having potentially different technologies.** Until the computer industry solves the problem of inter-machine

operability, there will continue to be some problems related to the transfer of data and software. Establishing a sound data structure for the Division will reduce the problem. Just having to transfer files is a time consuming effort today. It may be more convenient to be able to have all users access the same files.

- **Difficulties in coordinating user requests between two facilities.** There will be requests for data and/or analysis that will require close communications between the separate staffs and computer facilities. Both staffs must understand what the other is doing and users will need to know who to contact for what service.
- **Reduced integration of systems and databases.** Having logically related functions operating on two different machines will make it more difficult to have closely integrated operations. The desire to integrate forest resource management activities such as timber sales and forest development with the forest inventory and GIS activities will be complicated. Different operating systems and data structures between the systems will increase the difficulties in integration and transfer of information. Staff will have to understand some of the intricacies of each system.
- **Staff Communications.** While there will be a need for increased communications among staff if two facilities exist, in all likelihood the result will be much less communication than would occur if all staff were in one location. Good communication among staff will be required to develop systems that make use of both MIS and GIS capabilities.

To help the Division achieve it goals of establishing integrated information systems and creating corporate databases the Blueprint Committee recommends that the Division focus its minicomputing activities on one computer system.

Should the Division Own its Minicomputer?

Given the need for minicomputing and the recommendation that minicomputing be focused on one computer, the next question posed was, "Does Forestry need to own a minicomputer or can it purchase computer time and services to meet its needs?"

The committee was able to identify several reasons for Forestry to own its own minicomputer. The desire for Forestry to own its minicomputer basically had to do with the element of control it would have over access, use, service, and costs. The disadvantages identified centered around the burdens resulting from owning equipment and managing a computer center.

Advantages of Ownership

The advantages that the committee saw for Forestry owning its own minicomputer equipment included:

- **More control of its own data.** The ability to store the data you need without having to worry about the costs of storing and retrieving it. Backups and retrievals would be totally be the responsibility of the Division.
- **Better control of services and the computer facility.** This includes concerns about topics such as control over scheduling down time, being able to better manage data storage, control system responsiveness including scheduling traffic on the system, the unpredictability of rates and the potential for the lack of good service at an external computer center. Scheduling and insuring access are very important to activities such as fire reporting.
- **Ability to control and shape own destiny.** The concerns here have to do with not being able to control the direction of another agency or computer center whether they be public or private. One fear was not being able to control the computer center's selection of hardware and software. Major costs for rewriting systems can occur if the computer center unilaterally decides to change computers or software packages. Another problem is not being able to control the direction or emphasis of an external center. What if the center folds or decides or is asked to do something else?
- **Ability to more easily integrate systems.** With the purchase of computer time, and the possibility of the purchase involving more than one machine or provider, it will be more difficult to bring information together as the Needs Assessment has shown is wanted. The chance of finding a service facility that meets or would be willing to add capabilities to meet the needs of the Division is unlikely.

The issues of controlling data, service, and destiny and the ability to more easily integrate systems are key reasons that suggest ownership by Forestry.

Disadvantages of Ownership

The problems or disadvantages for Forestry in owning and operating a minicomputer of its own were also quite obvious and numerous. Major problems identified by the committee included:

- **The need for computer operation staff.** This includes the technicians and specialists that are required to operate the computer center and keep the system hardware and software functional and current. Included in the cadre of staff needed to keep things running for a medium scale minicomputer system are an information system supervisor, system administrator, system's programmer or two and an operator/tape librarian. **From 3 to 5 staff are necessary to keep a multi-faceted computer center organized and in operation.** They perform functions ranging from backups and archiving, to hardware and software trouble shooting, scheduling, monitoring system performance, managing disk space, to the more mundane tasks like making sure all of the necessary supplies such as tapes, ribbons, paper, and plotting supplies are in stock. It is also necessary to consider staff administration

itself. You must be able to find the staff and hire them. Then you have to provide sufficient and on-going training for them. Finally, you have to contend with all of the normal advancement issues and interpersonal disagreements.

- **Creating a facility and keeping it running.** A computer facility needs space and utilities to be functional. As the computer gets larger it requires a more costly environment in which to run. Rental of space, insuring clean and reliable power supply and shutoff systems, sufficient air conditioning, raised floors and security systems are some of the major concerns.
- **Purchase and upgrade of hardware and software.** There are two phases in the purchase of hardware and software, the first being the initial purchase. The purchase is normally a very large investment in terms of funds required to make the purchase and staff time needed to orchestrate it. Much time and thought has to go into defining the details of the computer equipment, software, and the required peripheral and communications equipment. The second phase of hardware and software purchase is upgrades. When new systems are installed a plan should already be identified to fund the eventual upgrade of the new systems. If an organization can get 5 to 7 years out of a hardware purchase, it is doing very well. Over that period equipment value depreciates to nearly zero.
- **Hardware and software maintenance contracts.** Once hardware and software is purchased, a new set of costs is encountered. These are the continuing payments to maintain the equipment and the software. All major equipment items and most of the key system and user software packages need to be under maintenance contract. As a rough rule of thumb, maintenance contracts cost about 1% of the initial purchase cost per month. Thus you could expect to pay approximately $48,000 annually to cover maintenance costs on a $400,000 purchase. Hardware maintenance costs will vary depending on the reliability of the equipment and the distance from the vendor's office. In addition to securing the funds to make the payments, there are additional costs of time to negotiate the contracts and pay bills. And when multiple vendors are involved, costs and frustrations occur when the vendors begin pointing fingers of blame as to the nature of the problem and whose responsibility it is to solve the problem.

Further Evaluation of Ownership vs. Purchasing Computer Time

A review of the advantages and disadvantages of ownership show the cost of operating a computer facility to be high while the desires and needs for control are strong. To make a decision, the cost of buying computer time from a vendor must be weighed against the costs of operating a computer center and the risks involved in relinquishing absolute control of the computer and related services.

LMIC and the DNR MIS Bureau were contacted to get estimates on costs involved in keeping a medium size computer installation running. The following table gives examples of baseline operational costs that these types of centers must be able to cover.

Comparative Annual Costs of Operation

LMIC	DNR MIS	Category
$ 10,000	$ 35,000	Space rental
63,000	46,000	Hardware/software maintenance and repair
15,000	(Included in rent)	Electricity/air
100,000	130,000	Operational staff support
15,000	10,000	Supplies
85,000	100,000	Annual depreciation of computing equipment
$ 288,000	$ 321,000	Total

It takes 3 to 4 FTE's to provide the operational staff support to keep each of these computer centers running. Functions performed by the support staff at LMIC included supplies ordering and monitoring, training, contract administration, staff administration, billings, software maintenance, purchasing, planning for upgrades, scheduling use, answering user questions, disk space management, backups and retrievals, archiving, system monitoring, and problem solving.

In the above table it can be seen that both of these centers, need in the vicinity of $200,000 to cover their operational costs and roughly another $100,000 for staff support.

DNR MIS attempts to keep its maintenance costs down by carefully trying to solve the problem before contacting IBM. Also, it has no software maintenance charges. This is offset though by initial software purchase costs being quite high. Software for their next central processor upgrade will be about $116,000. In addition, each System 36 in the field has about $30,000 worth of software.

When compared with the investment that the Division has in its information base, these costs are very small. For example, the Division has invested nearly $3.00 per acre in conducting and building the CSA inventory. The cost of running a computer facility (@ $300,000 per year), if the total cost was assigned to the inventory, would only be an additional 6 cents per acre per year.

The costs of buying computer time are more difficult to predict and may not be known until jobs actually start to run and the accounting system begins to record use. A problem in buying computer time is the end-of-the-month bill. Careful monitoring of spending and budgets are required. Unexpectedly high or low bills can make for budgeting and planning difficulties. It might be possible to limit the variability of the monthly bill if a computer center or service bureau is willing to negotiate a mutually agreed upon fee for a specified level of services that could include computer time, backups, restoring data, and disk storage.

Potential sources from which the Division might be able to obtain computer service include the private sector, Intertech, the University of Minnesota, DNR MIS, or LMIC.

A partial remedy for fears and risks related to purchasing time from another entity was for Forestry to get directly involved with the decision making of that body, such as through a board of directors that sets policy for the computer center.

The Blueprint Committee developed the following list of conditions to be met if the Division were to purchase computer time from a private vendor:

- The Division would buy time and services only. The vendor would have to provide for all central computer equipment and software.
- Hardware and software architecture would have to be capable of integrating GIS and MIS applications.
- The vendor would have to provide the communications network that would link St. Paul and the field locations.
- Block or set computer billings should be negotiable.
- Vendor must provide all services from one location to facilitate Forestry's communications with the vendor.
- Forestry would own all data and software specifically developed to meet its needs.
- The system would have to meet the desired minicomputer characteristics listed on page 6-6.

Optional services could include the purchase data entry and staff time for software development, maintenance, and problem solving. It should be remembered that these services could be obtained from the vendor even if computer time was not being purchased.

The committee contacted the IPO to see if they knew of any state agencies purchasing computer time and services from private vendors. The IPO recommended talking to the Department of Human Services (DHS). DHS has contracted with a vendor to develop one of its applications that involves distributed operation through the counties and need for access to a central database. DHS is also looking for a vendor to operate this system.

DHS indicated that dealing with vendors can be frustrating. Vendors often fall behind on delivery. Good documentation is often difficult to get. DHS felt it was very important for them to maintain a strong in-house systems unit to deal properly with the vendors. Members of the systems staff need to be identified as contract administrators. Iron clad contracts are a must. They should be developed by the systems staff with assistance of an attorney familiar with computer contracts.

The Division would have to prepare a Request for Proposals (RFP) to further evaluate what vendors could provide. Preparing a sound RFP and then reviewing the responses will be a very time consuming task.

> **The investigation and discussions to date indicate that although there are private vendors that sell computer services, the Division is unlikely to find a private vendor that can provide an integrated MIS/GIS system.**

The Blueprint committee also contacted LMIC and the DNR MIS Bureau to see if they would be willing and capable of providing the Division with the desired computer time and service. Neither agency currently has the computer capacity to meet the Division's needs. However, both agencies indicated that they had sufficient physical space in their computer centers to accommodate expansion. This opened the possibility of having the Division purchase a computer, locating it at an existing center, and jointly operating the center. The option of joint or cooperative operation is explored later in this chapter.

> **The Blueprint Committee recommends that the Division purchase a mini-computer system rather than try to purchase computer time and services from a vendor.**

Where Should the Minicomputer be Located?

The next question to be dealt with was, "Where should the Division's minicomputer be located?" A closely related issue is the location of the Division's systems development, support, and operations staff.

Theoretically, only the computer operations staff would have to be located in close proximity to the computer. Systems development and support staff could work at any location that has access to the computer system. However, systems administration, staff

supervision, and work group communication would all be enhanced if the entire systems unit staff were located in close proximity to the computer.

> **The Blueprint Committee recommends that the minicomputer and the entire systems staff be located in close proximity so that the staff can begin to work together and with the remainder of DNR to better integrate MIS and GIS activities to build more effective systems.**

The following were seen to be the major issues having to do with location of the computer facility:

- **Ability to integrate with other DNR information systems.**
- **Human resource considerations and staff availability.** A major concern is whether or not the advantages of having key systems development staff working together at one location outweigh the cost and disruption involved in relocating existing staff.
- **Political considerations.** Issues such as jobs in Greater Minnesota and decentralization of DNR were identified as concerns.
- **Access to timely computer maintenance services.** There will be higher costs when the computer is farther from maintenance providers.
- **Communications costs to access system.**
- **Availability of space.**
- **Preparation costs for an proper environment for computer equipment.**

Of the location issues, the ability to integrate with other DNR systems and the desirability of staff working in the same location were seen as the most important factors. The political aspects of location are important, but were not deemed to be Blueprint Committee matters and are referred to Forestry management. Availability of space, site preparation and access to maintenance did not seem to be insurmountable problems at either of the Division's two current minicomputer locations.

Even with the centralization of the computer and development staff, it will be important to place staff that can assist with applications and the use of GIS at key locations throughout the state. It is reasonable to suspect that these locations would be the Regions. Staff at these locations should eventually have GIS workstations connected to the central system via high speed lines.

The Blueprint Committee recommends that the Division's computer facility and systems staff be located in St. Paul to:

- Have the entire systems development staff together to facilitate systems integration.
- Assist with and be part of the development of DNR systems.
- Make use of a computer facility that will require little additional environmental preparation.
- Have better access to computer maintenance services.

Is Joint or Cooperative Computer Operation Possible?

The two major minicomputing options initially reviewed by the Blueprint Committee were purchase of computer time and services from a vendor and a Division owned and operated computer center. As explained above, initial discussions with the DNR MIS Bureau and LMIC raised the possibility of joint or cooperative computer center operation. This approach would allow the Division to achieve many of the benefits of computer ownership without having to assume the full burden of computer center operations. Thus the committee felt that it was necessary to examine the possibilities for establishing joint operations with either the DNR MIS Bureau or LMIC.

The LMIC Alternative

Discussions with LMIC indicated that they do not now have the computer power to support Forestry's needs. LMIC, however, offered to discuss the alternative of Forestry purchasing a new computer, compatible with LMIC's hardware and software and placing it in LMIC's existing computer center. LMIC would provide system and operations support for Forestry.

LMIC sees the following as some of the possible elements of an agreement:

- The new computer could be located at LMIC and networked to its Prime 9955 system. LMIC has an existing site that does not have to be expanded or need extensive refinements to add a computer. For this arrangement to be effective, the computer purchased by Forestry would likely have to be of the same manufacture as LMIC's.
- Terminals, PC's and workstations linked to LMIC would be at Forestry offices. Outstate users could dial in through LMIC's existing communications system.
- LMIC would provide operations and system support for a negotiated fee. Forestry could provide some of the support if it desired.
- Forestry would pay for the computer, its software and its maintenance. LMIC would get a loan, up front for the equipment from the Department of Finance, and Forestry would repay LMIC through interest free quarterly installments.
- Forestry would not be charged for computer time or disk storage.
- Forestry would continue to design, build, and provide programming support for its own application systems. Any support from LMIC service bureau staff would be billed through normal procedures.
- LMIC would be a source of technical support for advanced software and hardware issues. The cumulative expertise of both staffs would be increased. Mutual training and staff development would be enhanced.

- Forestry could with proper advance notice move the computer to its own location at any time it so desired. This is consistent with LMIC's desire to be an incubator for new systems.
- Operations schedules, requirements, and procedures would be negotiated.
- Forestry would have access to all of LMIC's public resource map layers and databases.
- The two computers, operated in parallel, could be used to backup each others operations for critical user applications.

By placing its computer at LMIC, the Division eliminates the need to establish a computer facility center for a period of time and the need to dedicate 3 staff to support the computer system.

Details of an agreement that would be acceptable to both parties would have to be negotiated.

A quick evaluation shows that LMIC, Forestry, and the state as a whole may have much to gain from this type of an agreement. A mutual effort of this sort would be advantageous because:

- It would focus environmental and natural resource GIS database activities and expertise.
- Communications between staff and the potential for interchanging staff would be enhanced.
- It creates a potential for sharing software or equipment and the potential to jointly obtain hardware or software (such as color electrostatic plotters) useful to both LMIC and Forestry but affordable to neither.
- Excess computing capacity might be shared or sold to other users with proceeds collected and shared through LMIC's billing system.
- Better use of the existing computer rooms and facility would be achieved.

The DNR MIS Alternative

The Blueprint Committee also evaluated the potential for a possible joint agreement within DNR. Discussions were conducted to determine if there is a potential for joint operation of a computer center with the DNR MIS Bureau. Initial discussions indicate that the DNR MIS Bureau has both an interest and a computer facility that could be easily upgraded to house a computer purchased by Forestry. The discussions are continuing.

The Blueprint Committee saw the following to be some of the advantages and disadvantages of locating its computer equipment at DNR MIS.

Advantages

- Forestry staff would be closer to the computer.
- Forestry could provide leadership in developing integrated DNR systems.
- Increased integration with other Divisions. The interest is there in GIS, but there is still no plan.
- Communication system to Regions exists.
- Not restricted to Prime hardware.
- Possibility for operations support exists.
- There may be some potential for the AS400 to act as a GIS server, as ESRI and IBM get their joint development going.

Disadvantages

- Limited potential for parallel machines, at least initially, since the IBM AS400 does not currently support GIS.
- Limited GIS experience within DNR MIS Bureau. Systems integration will require GIS. Ability of GIS to advance would not be as great as at LMIC.
- DNR MIS Bureau resources will be taxed with its own AS400 conversion and implementation efforts.
- DNR MIS would not be likely to provide system support staff other than an operator.
- It would be more difficult to establish compatible systems and data formats with counties and other governmental units within a DNR center than it would be at LMIC.

The Recommended Minicomputer Alternative

After much discussion, evaluation, and re-examination of the alternatives, the Blueprint Committee recommends that the following actions should be taken:

- The Division of Forestry should pursue purchasing its own minicomputer equipment and place it at LMIC.
- The Division should evaluate the possibility of converting its existing TI 990 systems to the new minicomputer platform. It needs to be determined if the existing COBOL systems should be converted to run on the new platform, as they stand, in COBOL. The alternative is to continue to operate these systems on the TI 990 until they can be totally overhauled and become part of the new integrated systems. This overhaul could easily take three or more years.

The Blueprint Committee feels that the Division could get off to a much faster start with the incubation approach at LMIC. And if desired, after a period of operation, development, and learning at LMIC, could transfer operations to a DNR based location.

The following are the reasons for recommending the LMIC option:

- Availability of an existing GIS facility at LMIC needing very little upgrading.
- Can purchase system through LMIC's agreement with Department of Finance.
- Use of LMIC's communication equipment.
- LMIC can operate computer system.
- LMIC has computer operations and systems staff experienced with GIS and relational DBMS systems and will be able to provide technical support.
- Availability of LMIC Service Bureau and staff.
- No charges for computer time.
- Mutual training and staff development.
- Easy access to LMIC's existing GIS layers.
- Ability of computers to back each other up.
- Availability of LMIC's billing system to charge for use of computer.
- Can better interact with other agencies and levels of government at LMIC.
- Could move system to DNR when DNR is ready to operate system on its own.

The Committee feels that this approach is timely considering that the DNR is just beginning to conduct department-wide GIS and LIS (Land Information System) planning studies. Forestry could merge with DNR operations when it is ready to implement a GIS/LIS system of its own.

Wherever Forestry decides to do its computing, the Blueprint Committee recommends that a strong relationship be developed with LMIC. It is felt that by working with LMIC, there is a much better opportunity to get involved and integrated with other important actors in the Minnesota GIS community. The Committee believes that at a minimum, there should be a Memorandum of Understanding between the Division and LMIC.

GIS Workstations

A new direction in computing that may open up options for Forestry is the rapid evolution of the Unix based scientific workstation. A scientific workstation, such as those developed by Sun, Apollo and IBM, provides high powered local computing with the capability of linking into a larger computer network.

Workstations can be linked together, and are flexible enough to be linked to both mini and personal computers. Today's workstations can be configured to provide and distribute much more computing power than is available on the PRIME 2250 that the Division is currently operating for its ARC/INFO GIS activities.

Even though workstations show much promise, the Blueprint Committee feels that the Division should proceed cautiously taking time to conduct pilot projects for experimentation, testing, and evaluation of workstations. More time is needed to get a good measure

of their usefulness and more importantly the amount and types of staff that it will take to make good use of them.

Scientific Workstations

Workstations provide high resolution graphics and have multi-tasking capability. Even though these workstations may be quite useful for the ARC/INFO related GIS activities, because of the way they are designed, they wouldn't work well in a distributed transaction processing mode (as needed for Timber Sales and Fire Reporting). A scientific workstation could quite easily link into a central minicomputer at Forestry or another site. The central computer could act as a repository and server for GIS files and as base for local transaction processing. The ARC/INFO GIS system used for the CSA Inventory is supported on the high powered workstations developed by companies such as Sun, Apollo, and IBM. With this sort of setup a user has high speed processing capabilities and the potential to link to a network as a path to a shared geographic database. For Forestry, the scientific workstation could provide GIS capabilities at the St. Paul or Region levels.

Fully equipped scientific workstations that could be used for digitizing, map production and analysis cost in the range of $70,000 to $100,000. Several persons (digitizer and user/analyst/technician) could operate one effectively. Possible workstation configurations are outlined in Appendix B.

The major advantages of the scientific workstation are that they provide a predictable high level of local computing, they can be connected to a larger system and they reduce the drain on computing power of the central facility.

They, however, are more costly than a central computer based GIS because of the additional computer equipment costs, and the need for more staffing and technical support at remote locations.

Interactive Satellite Workstations

In addition to the scientific workstation, there are several other possible types of workstation configurations that could serve Forestry's GIS needs. One is the "interactive satellite workstation" which uses the central minicomputer to do its computing. This type of workstation consists of a digitizing tablet, graphic CRT, plotter, and printer and is connected to a central facility through a statistical multiplexor (at 9600 baud or higher) over a leased phone line. A workstation of this type could be configured for $20,000 to $30,000.

All computing for the satellite workstation is done on the central computer. The State of Washington is using this type of workstation setup to connect to its regions for forest inventory and management GIS activities. A variation on this approach would be to replace the graphic CRT with a personal computer. An advantage of the remote interactive workstation approach is that management of system hardware, software, and databases takes place at the central minicomputer location with its staff. Remote station staff are therefore relieved of these duties. The major disadvantage of this approach over the scientific workstation is that it creates a very large demand for processing on the central computer, requiring more frequent upgrades to the central facility.

PC GIS Workstations

A final option for GIS activities makes use of personal computers that could process files in a stand alone nature and then send results to a central system. The major problem with this approach is that PC's are still quite slow in terms of the power needed for GIS activities. In addition, every user will have a greater need to be able to obtain system and software maintenance. An investment of $10,000 to $40,000 is required for the hardware and software for each stand-alone PC GIS workstation. See Appendix B for descriptions of possible PC workstation configurations.

The Recommended GIS Workstation Approach

The Blueprint Committee recommends the following approach for future GIS operations:

- The Division should begin to perform its existing GIS activities on workstations and phaseout Prime 2250 operations. The GIS workstations can initially be linked to LMIC's Prime 9955 system and then to Forestry's new minicomputer. This approach helps address existing needs and begins testing workstations for an expanded role in the future.
- Place a scientific workstation in Region 2. This could be used to conduct alterations and produce GIS products for users within the Region, and could act as a pilot for Regional workstations.
- A satellite workstation should be installed at the Central office in St. Paul. This could be used as a site to perform alterations for other Regions and could act as a pilot for satellite workstations.
- LMIC or other vendors should be considered to complete the digitizing of the hand drawn CSA maps that still need to be converted to digital form.
- A site should be designated to test pcARC for alterations and other GIS uses.
- The use of EPPL 7 in Areas should be carefully evaluated. The Blueprint Committee recommends that the Littlefork Area pilot project be pursued.

PC Hardware and Software Standards

PC hardware and software are extremely dynamic. The need to have Division standards for hardware and software became clearly evident during the Blueprint needs interviews. It must be recognized that standards will change over time as PC technology advances. The goal is to adopt industry standards that meet the Division's needs, use the standard as long as it continues to meet our needs, and then provide for an orderly transition to a newer standard. The FIS staff will be responsible for maintaining and updating the PC hardware and software standards.

The standards for various categories of hardware and software consist of a general standard and related specifications followed by a list of those products by brand with which we have had a positive experience. These product listings are not intended as a listing of specific system requirements, but rather as a guide as to what has been successful in the past. At the same time, however, we must assure that unlisted brands of products truly meet the standard set for each class.

This section lists the microcomputer hardware and software recommended for use in the Division of Forestry both now and in the near future. As a result of recent action by the DMT, purchase of hardware and software requires review and approval by the Assistant to the Director for Resource Information and Planning or his designate. If you have special applications or needs, please contact the MIS Help Desk for additional assistance in selecting appropriate hardware and/or software for your needs.

These guidelines are based on the following assumptions:

1. MS-DOS, IBM-style computers will continue to be the standard for stand alone PC operations. Alternative computing environments, such as Apple Macintosh, will only be approved on an individual basis as a specific, stand alone application which is unique to that hardware environment. There may not be central support for these alternate environments.

2. Shared resource computing will continue to become increasingly important at all levels. This trend is desirable for several reasons. The main advantage is in peripheral device sharing. The most common example of this is sharing printers, such as laser printers, where a single high-value, high-potential unit can be shared by many users. Since some of these systems support more than one device, the potential for sharing plotters, modems, and Fax machines makes them very cost effective.

3. Graphics based applications and graphics implementations of current text based programs will become the norm, making high resolution, color monitors a requirement. This includes word processing, spreadsheets, and database management software as well as GIS and graphics applications.

4. Data backup will become increasingly important, since the cost of data acquisition is commonly more expensive than the computer system itself. The Division will investigate backup technologies as an alternative to the current floppy-based FastBack Plus such as Bernoulli's and tape backups. It is recognized that the size and value of data files will make such a migration necessary.

5. The Division's goal is to take advantage of new technologies within proven frameworks in order to manage forest resources effectively and efficiently.

6. The Division will not limit its hardware and software universe to that offered by existing state contracts, nor will the presence of an item on a state contract imply approval for use by the Division.

7. Communications between remote stand alone or networked systems (PC, mini, and mainframe) will become increasingly important.

8. Portable and laptop computers will increase in importance. In order to facilitate exchange of files, laptops should only be located where a dual drive desktop (5.25" 360kb/1.2mb and 3.5" 720kb/1.44mb) is available in that office. Disk drives on laptops are normally 3.5" and of either 720kb or 1.44mb type. Compatibility with existing hardware can be gained if one full function PC is available. An alternative to this is to acquire a laptop-to-PC Hardware/Software System such as LapLink. Laptop computers will be considered on an individual basis based on need, proposed use, and associated supporting systems. Laptop and portable computers are considered special use equipment and are not required to meet the monitor and disk drive (hard and floppy) standards specified for desktop PC's.

9. Hardware and software environments are sufficiently dynamic to require regular review. These guidelines are intended to cover the next year and must be reviewed on an annual basis. Annual reviews should be prepared and published each year by April 1 to facilitate the expenditure of any year end funds and new year monies.

10. The Division will establish a procedure for updating these guidelines by evaluating new hardware and software which will include MIS/GIS professionals and resource professionals. This group should consist of at least 6 staff comprised of at least 2 Systems Professionals and 4 resource professionals with established interest and abilities with PC's. Field staff (Region, Area, and Districts) shall comprise at least 50% of the resource professionals. This step is considered critical in order to facilitate updating these guidelines. Technical leadership for this effort will be provided by the User Technical Support Group.

Hardware Standards

Note: The following recommendations do not apply to replacements for existing BabyTalk-equipped IBM-XT's that become unrepairable and that are required for communications with the TI 990 for applications such as Mailbox, Timber Sales, Personnel, and Fire Data. Should one of these machines fail and need replacement, the Division will endeavor to "swap" computers to solve the short term problem and replace the failed XT with a serviceable used computer. If needed, a new computer meeting the following specifications will be furnished for the office supplying the XT. In this way, the Division will be able to meet short term needs and enhance overall capacity at the same time. This exemption continues in force until the communications environment is modified in such a manner as to eliminate the specific requirement for PC-XT's running at 4.77 mHz.

Desktop Personal Computers (General Use for all uses other than GIS or heavy DBMS)

General Standard: MS-DOS compatible, commonly referred to as IBM-PC compatible.

Specifications:

- 80286 or compatible CPU operating at 10mHz or greater
- slot for 80287 coprocessor
- 640kb RAM installed on the motherboard
- 1mb RAM capacity on the motherboard
- 40mb hard disk drive
- 5.25" diskette drive able to read, write, and format in both 360kb and 1.2mb formats
- 3.5" diskette drive able to read, write, and format in both 720kb and 1.44mb formats
- one parallel port for printers (Centronics with DB-25 connector)
- two serial ports (RS-232 type with DB-25 or DB-9 connectors)
- ability to run MS-DOS 3.3 and OS-2
- system clock with battery backup
- autoswitch EGA video interface with 256kb video RAM
- multisync-type EGA color monitor

Heavy Usage Desktop PC (GIS and heavy DBMS usage)

General Standards: MS-DOS compatible, commonly referred to as IBM-PC compatible.

Specifications:

- 80286 CPU at 20mHz or higher or 80386 CPU at 16mHz or higher
- math coprocessor installed

- 4mb capacity motherboard with 1mb installed
- 65mb or larger hard disk drive
- 5.25" diskette drive able to read, write, and format in both 360kb and 1.2mb formats
- 3.5" diskette drive able to read, write, and format in both 720kb and 1.44mb formats
- one parallel port for printers (Centronics with DB-25 connector)
- two serial ports (RS-232 type with DB-25 or DB-9 connectors)
- ability to run MS-DOS 3.3 and OS-2
- system clock with battery backup
- VGA monitor interface with Autoswitch capacity and 256kb or greater RAM
- VGA or multisync-type monitor

Replacement Monitors

General Standards: All new monitors should be color EGA or higher resolution. If a monochrome monitor or interface card needs to be replaced with another monochrome unit, a "swap" should be arranged to replace one of the many existing monochrome systems currently in existence.

Recommended Models:
- NEC Multisync-type models
- Zenith FTM 1490 (excellent for making 35mm slides directly from the screen)

Portable and Laptop PCs

Special use environment. Must be approved on an individual basis. Must be compatible with MS-DOS environment.

General Use Printers (draft and near letter quality (NLQ) correspondence, mailing labels, general usage)

General Standard: 24 pin dot matrix printers able to produce 200 DPI resolution and 75 CPS in high resolution mode, tractor and friction feed, Epson LQ Standard emulation

Recommended models:
- Okidata 393
- Epson LQ500, LQ800, LQ850, LQ1000, LQ1050, LQ2550

Laser Printers (Letter Quality and Desktop Publishing)

General standard: Laser printers meeting either Postscript or HP LaserJet emulation standards, 300 DPI or better resolution

Recommended models:

- Apple LaserWriter Plus (Postscript)
- Texas Instruments Omnilaser 2108 or QMS 800 (Postscript)
- Hewlett-Packard LaserJet II and IID (HP)

Modems

General standard: Hayes AT command set, Bell 103, Bell 212, X.25 (optional), and V.32 (optional) protocols, 2400 baud minimum recommended speed, auto switching to 300 and 1200 baud on systems not supporting higher speeds

Recommended models:

- Hayes Smartmodems (internal and external)
- Multitech Multimodems (external and internal)
- Everex Evercom (internal)

System 38/36/AS400 connection requires connection via twin-ax cable and a 5250-style emulation board. If you have need for access to departmental computers contact the Department MIS Bureau directly or consult your DNR Regional Technical Coordinator for the S/36.

Mouse

Many software programs work best with a mouse. This trend will continue as graphic applications become more widespread.

General Standard: Microsoft Mouse, serial or bus versions

Recommended models:

- Microsoft Mouse
- Logitech Mouse

Plotters (Desktop models for GIS and business graphics)

General standard: HPGL command set

Recommended models:

- Hewlett-Packard 7475A

Scanners

Scanners are a new technology that have tremendous potential. New models arrive in the market every few weeks and our experience is limited. Two types exist. Large, full sheet, flat-bed scanners can be used for graphics and text (optical character recognition - OCR). Small, hand-held units are good for graphics. OCR applications are still primitive, but developing rapidly.

General standard: Graphics must be written as a standard TIFF or PCX file.

Recommended models:

- Hewlett-Packard ScanJet+ (full size, flat-bed)
- Logitech ScanMan

Surge Protectors

All hardware must be protected from electrical surges and noise common on electrical power lines at ALL locations. All devices including modems, printers, plotters, scanners, etc. that are connected to the computer via cables must also be on the protected supply. Systems with modems must also have a special surge protector for the phone line. Users should realize that surge protectors are designed to protect equipment against normal power line surges. They will not protect against nearby lightning or direct hits by lightning. Users are urged to unplug equipment during electrical storms as well as overnight and weekends during thunderstorm season. The ultimate surge protection is disconnection.

General Standard: UL 1449

Recommended models:

- EFI Corporation DPI 153
- Curtis (several models)

Software Standards

Operating Systems

General Standard: MS-DOS 3.3 or PC-DOS 3.3

Recommended products:

- IBM-PC DOS 3.3
- MS-DOS 3.3

Word processing

General standard: WordPerfect

Recommended products:

- WordPerfect 5.0

Database Management

General Standard: Ability to import and export flat ASCII file

Recommended products:

- R:Base for DOS Version 2.0 or higher
- PC File III

Spreadsheet

General Standard: Ability to read, write, and operate Lotus-style .WK1 and .WKS formats

Recommended Products:

- Lotus 1-2-3
- Quattro

Business and Presentation Graphics

General Standard: Ability to produce VGA screens, import and export TIFF or PCX files, ability to import .WK1 and .WKS data, ability to export graphic image to WordPerfect

Recommended products:

- Lotus Freelance +
- CorelDraw
- PC PaintBrush
- Harvard Graphics 2.1 (does not import TIFF or PCX)

Communications Software

General Standard: Operate with Hayes AT command set modems

Recommended Products:

- Procomm+
- Bitcom
- Crosstalk
- Smartcom

Backup Utility

General Standard: Fastback Plus, in addition to backing up files, Fastback is used for file transfer.

Recommended Products:

- Fastback Plus 2.0 or higher

Desktop GIS

Recommended Products:

- EPPL 7

Forestry Information Systems Blueprint

7. FIS Staffing

Introduction

This chapter of the Blueprint describes the staff required to develop, operate, and maintain the Division's Forestry Information Systems (FIS). The discussion focuses on the functions to be performed by the FIS Unit and the job responsibilities of various positions within the unit. The Blueprint does not recommend classification levels for various positions nor does it provide a detailed analysis of the roles of existing MIS and GIS staff in the future FIS Unit. Determination of classifications and providing for the transition to the recommended staff structure will be critical elements of implementing the Blueprint.

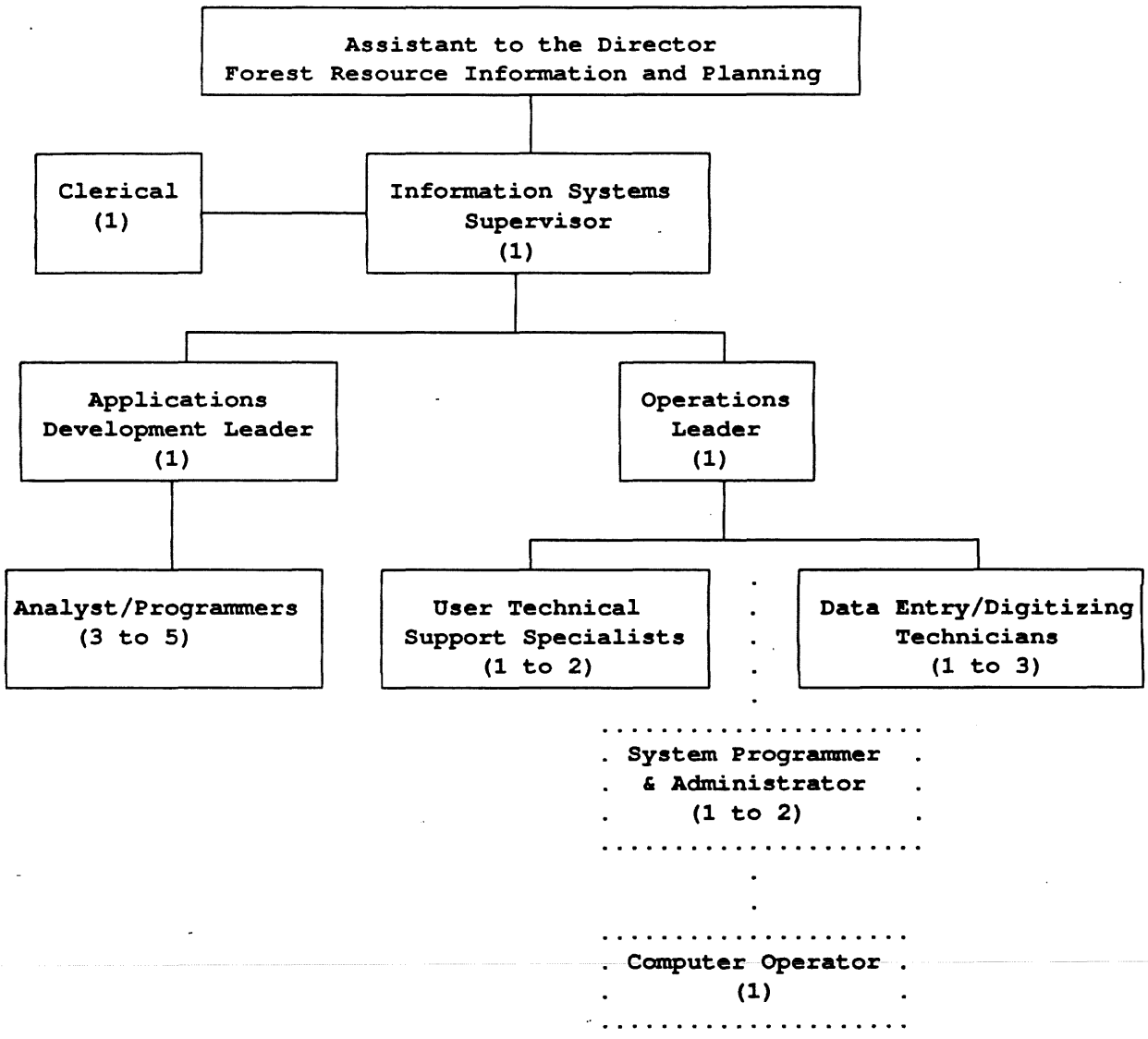
The Blueprint Committee first identified the systems staff that would be required for FIS Unit activities if the Division did not operate a minicomputer system. Next the Committee determined what additional staff would be needed if the Division owned and operated its own minicomputer system. The committee also discussed the staffing requirements for remote GIS workstations. Finally, the need for FIS Liaisons at various locations throughout the Division was addressed.

FIS Staff Organization and Responsibilities

There are basic information systems functions that the FIS Unit must accomplish regardless of how the Division chooses to meet its centralized computing needs (see Chapter 6). These core FIS functions include:

- Manage, develop, maintain, upgrade, and operate Forestry system applications
- Assist Forestry staff in their use of the application systems
- Provide technical support and standards for the use of personal computer hardware and software
- Support the operation of the FIS Liaison Network

Figure 7.1 represents the recommended staff organization for the FIS Unit. The recommended number of FTEs for each position is also included in Figure 7.1. In some cases a range of FTEs is given to indicate flexibility in staffing levels. There are several factors involved in determining the exact staffing requirements for various positions. If digitizing and data entry of the CSA hand drawn maps and some or all alterations were done through outside contracting, fewer digitizers and data entry staff would be needed. If development of new systems and revamping of existing systems were done at a slower pace or if outside vendors were used for programming and other activities fewer Analyst/Programmers would be needed. The Systems Administrator, Systems Programmer, and Computer Operator would be required if the Division operates one or more minicomputers.



Note: The numbers in parentheses represent the range in number of staff required for each classification. Dotted boxes and lines represent the systems operation staff that would be required if the Division elects to operate a minicomputer system.

Figure 7.1 Recommended FIS Unit Organizational Structure

The FIS Unit should be housed in the Forest Resource Information and Planning Section. The FIS Supervisor should report directly to the Assistant to the Director for Resource Information and Planning.

Figure 7.1 gives a range of 9 to 14 FTEs that will be required to conduct system activities if the Division does not operate its own minicomputer system. If the Division operates a minicomputer system the recommended staffing range would be from 12 to 17 FTEs. The

table below summarizes the number of each type of staff that would be required under the various minicomputer alternatives discussed in Chapter 6.

Staffing Requirements for Minicomputer Alternatives

Forestry Computer	Two Forestry Computers	DNR MIS Location	LMIC Location	Buy Time	
1	1	1	1	1	Systems Supervisor
1	1	1	1	1	Applications Leader
1	1	1	1	1	Operations Leader
2	2	2	1-2	1-2	User Support Spec.
3-5	4-5	3-5	3-5	3-5	Analyst/Programmers
1-3	2-3	1-3	1-3	1-3	Data Entry/Digitizers
1	1-2	1	1	1	Clerical
1	2	1	0	0	Computer Operator
1-2	2-4	1-2	0	0	System Admin/Prog.
12-17	16-21	12-17	9-14	9-14	Total Ranges

The recommended staffing levels are reasonable for an organization of the Division's size (approximately 450 employees). The existing complement in the MIS and GIS units is 12 employees (including the Resource Assessment Supervisor). A FIS Unit with 9 FTEs would represent 2% of the Division's workforce while a 17 FTE unit would represent 3.8% of the workforce. An Information Policy Office report estimates that 3.15% of the state employees are involved in EDP or EDP-related jobs. By comparison, the IPO report showed that major service sector companies (e.g., insurance, finance, telecommunications) had information systems staff that comprised from 4.4% to 11.9% of company employees.

The Blueprint Committee recommends that the FIS Unit staff have a blend of information management and natural resource management backgrounds. This range of expertise on the FIS staff will more likely result in systems that are well designed and meet user needs than would be the case if the FIS staff were completely either EDP or natural resource oriented.

The primary responsibilities for each of the FIS staff positions are described below.

Forestry Information Systems Supervisor

The Forestry Information Systems Supervisor is responsible for all information management activities for the Division of Forestry. The FIS Supervisor should be a high level position that has visibility and input to the Division level decision making process. The Blueprint Committee recommends that the FIS Supervisor be a full time position reporting to the Assistant to the Director for Resource Information and Planning. In the future, this position could report directly to the Division Director. Information system unit supervisors in many organizations are placed at such a level.

The FIS Supervisor should not have program management responsibilities in any area other than Forest Information Systems. The FIS Supervisor should be a person having expertise and experience in natural resources, personnel, and project management, and in systems design and development. Having strength in these areas will be essential for this person to communicate with Division managers, information systems staff, and information systems users.

The primary responsibilities of the FIS Supervisor are:

- Providing leadership and direction for the FIS Unit and for the information processing function within the Division.
- Leading information system related planning activities. The FIS Supervisor will work with the FIS Liaison Network to advise the DMT on the use of computers and the development of new systems.
- Communicating and interacting with top Division management. The FIS Supervisor keep the DMT informed on system development activities.
- Providing leadership for the entire Division on all aspects of information management.
- Interacting with the Department and other agencies on information system matters.
- Conducting administrative and supervisory duties such as budgeting, scheduling, and personnel management.
- Negotiating contracts and agreements, and maintaining contacts with vendors providing computing and system development services.
- Ensuring that proper training is available to all staff who develop, maintain, or use systems.

The FIS Supervisor will provide direct supervision for all of the FIS staff. It will be this person's responsibility to supervise the creation of properly integrated systems for forest resource management and administration. The FIS Supervisor must lead and direct systems staff to:

- Establish integrated information systems.
- Create structured and compatible databases.
- Maintain and make use of systems development policy and procedures.
- Work with the FIS Liaison Network.

- Establish proper linkages of GIS to forest resource management systems.
- Maintain a structured environment (hardware, software, and support) for the use of personal computers for office automation activities.

The Blueprint Committee recommends that the FIS Supervisor position be filled as quickly as is possible. Successful implementation of the Blueprint will require the attention of a full time FIS Supervisor.

Applications Development Leader

The Applications Development Leader is the person responsible for the development of new systems or the modification of existing systems. The responsibilities of the Applications Development Leader include:

- Providing direction and leadership for system development and maintenance activities.
- Being a member of major Project Teams that are designing and developing systems.
- Reviewing development activities for adherence to policies, procedures, and standards and making sure that management and users are properly involved in the development process.
- Directing Logical Database Design and Data Dictionary activities.
- Leading the effort to bring traditional MIS and GIS together, creating integrated systems.
- Monitoring status of projects and scheduling staff for involvement in projects.
- Developing specifications and contracts for vendor supported development efforts.

The Applications Development Leader is not necessarily on all Project Teams, but in order to maintain the integrity of systems it is his or her responsibility to carefully review systems as they are being developed. It will be important for the Applications Development Leader to see that MIS and GIS procedures are brought together as needed to develop systems. The Application Development Leader must make sure system developers are following prescribed system development procedures, are properly involving users and are establishing systems that are properly integrated and meet user needs. Analyst/Programmers will report to the Applications Development Leader. The Applications Development Leader could be either a lead worker or a supervisor.

Analyst/Programmers

Analyst/Programmers, using their combined MIS and GIS skills, design, develop, and implement systems; provide support to the users of operational application systems, and perform analyses for special requests with the GIS.

Analyst/Programmers will be members of system development Project Teams. Project Teams prepare designs and lead the development of systems. When a project gets to the construction stage, the Analyst/Programmers will constitute the entire programming team or will work with consultants who do the programming.

Some Division managers have expressed a desire to have the Division's Analyst/-Programmers spend a greater share their time with system design and support and less time on large scale programming tasks. This change would allow the Analyst/Programmers to concentrate on system maintenance and design tasks while leaving the larger programming jobs to consultants.

The primary responsibilities of the Analyst/Programmers will include:

- Working with Project Teams to design and develop systems.
- Performing small development programming tasks along with upgrade, modification, conversion, and maintenance programming.
- Keeping the Data Dictionary current and conducting logical database design assignments. One of the Analyst/Programmers should be assigned as a lead for Logical Database Design and Data Dictionary activities.
- Assisting in the solution of problems with the use of current application systems.
- Assisting or performing special production requests with the GIS and other systems.

Analyst/Programmers and Lead Users will jointly provide assistance to users of existing applications systems. Lead Users will be designated for every operational user system. Lead Users must have extensive training and thorough knowledge of the application of the system, and should be able to answer most of the questions having to do with the normal use of a system. Questions that cannot be answered by the Lead User should be directed to the Analyst/Programmer who developed the system, or has been assigned to provide technical assistance for the system in question.

The number of Programmer/Analysts that the Division will require will be a function of:

- The number of operational system applications that the Division has at any one time and the level of technical support they require for problem solving, maintenance, and upgrades.
- The level of new system development activity.

The Blueprint Committee, based on the current level of activity in the Division, feels that three Analyst/Programmers are a "bare-bones" minimum for maintenance level technical support and programming. With the addition of new applications to develop and then maintain this number will need to increase. Even if development is done by outside vendors, systems staff must be maintained. Based on the experiences of other State agencies that are purchasing system development and programming from vendors, a very strong and capable system staff is still required to develop the proposals and contracts and

then to deal competently with the vendors to insure that the vendors are delivering what is needed.

Operations Leader

The Operations Leader is responsible for improving communication with, and training for users; supervising data entry and help desk operations; and maintaining PC hardware and software standards. If the Division operates a minicomputer, the systems operation staff will also report to the Operations Leader. It will be important that this person communicate with both systems staff and typical system users. Major responsibilities of the Operations Leader will include:

- Directing and leading the technical user support and data entry staffs.
- Heading and providing support for the FIS Liaison Network.
- Producing a FIS newsletter supplement to *Roots*.
- Organizing training for the FIS Liaison Network and other users.
- Maintaining and ensuring the use of hardware and software standards.
- Reviewing purchases of PC hardware and software.
- Keeping inventories of the Division's PC hardware, software, and applications.
- Directing staff in the proper delivery of technical support to users.
- Insuring that the Help Desk is properly manned, that lists of "experts" on various applications are developed, questions are answered or properly referred, and that assistance is being delivered in a prompt and courteous manner.
- Organizing, scheduling, or contracting for data entry and digitizing.

All user technical support and data entry staff will report to the Operations Leader. The Operations Leader could be either a lead worker or a supervisor.

User Technical Support Specialists

There is a need in the Division for User Technical Support Specialists to provide additional assistance to users. The User Technical Support Specialist(s) will report to the Operations Leader. The Blueprint Committee sees the need for one or two User Technical Support Specialists. The Division may get by with one initially, but as more people get involved with computers at more places for more applications, a second person will probably have to be added.

The Technical Support staff will have to be quite versatile. They will have to possess the technical skills, but just as important they will have to be good communicators and listeners. They will need to possess a great deal of patience and understanding to deal with employees who are having problems and do not comprehend the language or the

technology that the systems specialist knows so well. The Technical Support staff must remember, most of all, that they are providing a service to the Forestry operations.

The responsibilities of the Technical User Support staff will include:

- Provision of technical assistance and training with the use of the Division's personal computer hardware and software.
- Provision of technical assistance and training on the use of the hardware and communications network on which the Division's distributed transaction processing systems operate.
- Help Desk operations and referrals. Maintaining a list of "experts" for particular types of problems. Programming and applications questions will be referred to the Applications Development staff.
- Field visits for providing technical assistance and reviewing needs.
- Updating and distributing the PC hardware and software standards.
- Keeping current and conducting and reviewing tests of new PC hardware and software.
- Maintaining inventories of the Division's computer hardware, software, and applications.
- Assisting with the installation of hardware and software.

These specialists will staff the Help Desk, being the first contact for those needing assistance or direction. It is hoped that having permanent Help Desk staff trained to provide technical assistance will reduce the pressure currently being placed on Regional and Program Specialists to perform this function. Requests coming to the Help Desk having to do with Forestry applications systems problems should be referred, if necessary, to the Lead User or Analyst/Programmer having the support responsibilities for the particular application.

The Needs Assessment showed there was a strong desire to have a staff who will frequently visit the field to review hardware and software needs and to provide technical assistance.

The Technical Support Specialists will have the task of periodically updating and then distributing Forestry's PC Hardware and Software Standards. To stay current they will have to review literature and conduct and evaluate tests of new hardware and software. To stay current with the Division's computer environment the Technical Support Specialists will need to maintain an on-going inventory of the hardware and software in use. It is recommended that a database be developed to keep the inventory.

FIS Support Staff Positions

Support staff are required in the FIS Unit to perform data entry, digitizing, and clerical functions. The clerical staff will report directly to the FIS Supervisor while the Data Entry and Digitizing staff will report to the Operations Leader.

These additional staff are needed to perform:

- Production assistance tasks related to application systems.
- Data entry.
- Map digitizing and processing.
- Clerical and administrative assistance.
- Technical writing and documentation.

The number of people in these positions is a function of the need for production assistance and data and map entry. The number could be reduced by contracting for large data entry and digitizing jobs.

Computer Operations Staff

If the Division of Forestry operates its own minicomputer system it will need several staff to support the use and operation of the equipment. These positions will be required to operate, administer, and provide technical support for the minicomputer hardware and software, communications network, and the physical plant that houses them. Computer Operations Staff functions include:

- Operating and administrating the computer system.
- Providing systems level programming support.
- Scheduling the use of the system.
- Installing new hardware, software, and software revisions.
- Maintaining the communications network.
- Working with FIS Development staff and Project Teams to properly design and develop new systems.
- Providing technical assistance with major software packages that are supported on the minicomputer system.

Other minicomputer facilities, such as LMIC and the DNR MIS Computer Center, have 3 to 4 staff assigned to basic computer facility operations and system management activities. To operate effectively, a Division minicomputer will most likely require two to three staff. The positions required are Computer Operator, System Administrator, and System Programmer. It may be possible to combine the duties of the System Administrator and Programmer into one position until operational activities begin to increase. The Computer Operations Staff would be a third group reporting to the Operations Leader.

Computer Operator responsibilities include:

- Routine care and maintenance of equipment.
- Performing disk to tape backups and retrievals.
- Running standard production jobs.
- Monitoring and ordering supplies.
- Decollating and distributing output.
- Watching over jobs on special equipment such as plotters (changing pens/paper).
- Monitoring system performance and disk space.
- Monitoring environmental conditions.
- Scheduling use of equipment.

Activity levels for those in charge of the care and administration of minicomputer facilities are characterized by peaks and valleys. Some of the peaks are scheduled, while others are controlled by gremlins, cannot be predicted in advance, and come about in very unexpected ways at most inopportune times.

System programming support is required when new software is being added, when revisions to key systems are being tested and implemented, when hardware and software are being interfaced, or when any hardware or software is failing for any reason. A well staffed center will have specialists that can work on both hardware and software problems.

The Systems Administrator and Programmer are the ultimate problem solvers for hardware and software questions. If all else fails, it rests on their shoulders. Responsibilities of the Systems Administrator and Systems Programmer include:

- Network configuration and maintenance.
- Operating system support.
- Installation, checkout, and revision of major software packages.
- Installation, maintenance, and upgrade of hardware, including communications gear.
- Disk and directory partitioning, naming, security setting, and passwording.
- Linkage of software packages to hardware.
- Technical assistance to applications programmers and analysts.
- Developing standard user procedures (procs).
- Reviewing system performance, identifying problems, and suggesting remedies or upgrades.

Staffing Requirements at Remote GIS Workstations

GIS workstations located away from a central computer will need many of the same functions to be performed that are done at a computer center, but to a lesser degree. Staff required for remote GIS workstations would be in addition to that which is required for the FIS Unit described above.

There are two quite different types of individuals that are essential to the operation of either scientific or satellite GIS workstations. However, depending on the level of activity and the workload at the location, neither position may need to be full time. Both of these people will have to be highly skilled in the use of GIS, but one will have to be a more skilled analyst who can understand user requests and then work towards their delivery.

Workstation Map Production Technician

A map production technician will be needed to do map production, digitizing, and processing. He or she also will be responsible for other tasks related to keeping databases current on both the central computer system and the workstation.

Workstation User Application Technical Specialist

The User Application Specialist assists resource managers with GIS applications. The specialist will conduct analyses based on user requests for maps or special products. This person's job will vary depending on whether a satellite or scientific workstation is being used. There is a much greater need for technical system support for the more complicated scientific workstation, which is really a type of minicomputer. Technical support activities on a scientific work station include installing software revisions, performing backups, and doing disk maintenance. Technical duties for the satellite workstation (which depends on the minicomputer for its computing) will consist of minor equipment maintenance and requesting and cataloguing backups and retrievals of files on the central minicomputer.

FIS Liaison Network

The need for improved communication among users and between users and information systems staff was clearly evident as a result of the Needs Interviews. An improved technical support delivery mechanism is also needed. As a supplement to the Help Desk, many users call upon self-starting "computer experts" to assist with new systems or when problems are occurring. These experts are meeting a real need to have easily accessible help available. However, the quality of the advice varies considerably depending on the training and experience of the expert. The amount of time spent providing informal technical assistance is difficult to determine.

The Blueprint Committee feels that the need for local assistance is real and that it will probably increase. It is important that this need is recognized and that better and more organized service be provided in the future. The Blueprint Committee recommends that a FIS Liaison Network be established to improve user communication and training and to provide an improved technical support delivery mechanism.

A FIS Liaison should be officially designated for each Area, Region, and St. Paul staff work unit. The FIS Liaison must be a good communicator who can share information about existing systems with co-workers and express needs for further information systems development. The FIS Liaison will also become the first contact for problem solving at any particular geographic location.

By establishing the FIS Liaison Network, the Division will institutionalize the existing informal process and will properly recognize this use of time. The FIS Liaison will also be given the appropriate training and information to properly do the job.
The FIS Liaison must have their liaison duties properly reflected in their position descriptions and must be given the training to do the job. It is estimated that the liaison function will usually take from 2% to 5% of the person's time, and in rare cases take up to 10%. It will be important for this person not to get pulled too deeply into systems activities. A unique cost code should be established to record time spent on liaison activities. It will be important to record time spent (at least initially) to measure the actual impact of the liaison activities. It is likely that the FIS Liaisons will be from a cross section of job classes. The FIS Liaison must be properly trained, must stay informed, and must be connected into a Division-wide network for information dissemination.

The primary responsibilities and tasks of the FIS Liaison will include:

- Communications within their work unit on computer related matters. Keeping current on what is going on in the work unit and in the Division with respect to systems development and use.
- Assist in acquiring and installing PC hardware and software in their work unit.
- Review or lead development of Project Proposals originating in their unit. Assist supervisor in making decision on local versus statewide projects. (See Chapter 9 for details on system development policies and procedures.)
- Local mentoring. Helping and "hand-holding", identify individual training needs, monitoring of activities (such as backup procedures) and providing basic technical support.
- Responsible for knowledge of current systems policies and procedures.

The FIS Liaison must keep in communication. It will be very important for the FIS Liaison in the Area to keep good communications with his or her counterpart at the Region. The FIS Liaison should review Project Proposals at his or her particular location. To promote communications, a FIS Liaison report could be a standard agenda item at Area meetings. The FIS Liaison staff member will also need to establish good communications with Field Stations in the Area as they get more involved with the use of computers. In addition to the normal contact, it is recommended that the FIS Liaisons get together as a group once a year. The Operations Leader on the FIS staff will be responsible for organizing and supporting the FIS Liaison Network.

Forestry Information Systems Blueprint

8. User Communication and Training

Introduction

An information system consists of four basic components; machines, programs, data, and people. The people - users, programmers, and managers - need to have a basic understanding of the information system and adequate training to use it effectively.

The need for training and ongoing communication among system users was mentioned in nearly every Blueprint Project Needs Interview. One interviewee felt the Division was forcing employees to learn systems by trial and error rather than through structured training. The development of "computer experts" at each office is a natural response to the users' needs for help in learning how to use the computer. The downside of relying on local "computer experts" for user support is that it keeps the expert from accomplishing their assigned duties and the quality of the advice is highly variable.

The following excerpts from a recent article[1] about user support describe the challenges and opportunities in providing adequate user training and support:

> Distance is perhaps the biggest obstacle to successfully implementing PCs in geographically-dispersed organizations. The trend of placing more responsibility on the end user makes it especially important to communicate plans and objectives to all end users regardless of where they're located... The unique characteristics of being physically detached from the PC support staff are often overlooked in day-to-day operations. But the reality is that these users are often out of sight and out of mind. The telephone acts as a buffer, allowing support staff to set priorities or, as is often the case, react to crises in their immediate environment instead... The natural tendency is to bump the remote user and help the person in the local offices... It's easier to help someone in person than it is over the phone, a fact that delays helping distant users even further...
>
> There are several steps that can be taken to help reduce the out-of-sight-out-of-mind phenomenon... The first step is getting support staff and local users to recognize some of the disadvantages that remote users are faced with. An awareness campaign that stresses equality reduces the tendency for support staff to feel pressured into serving users in their own office first. Second, it pays to communicate with the users. One of the best ways to keep both remote and local users informed is through a department news bulletin. In my organization, we decided that the best format would be to keep it simple and timely. We publish a bulletin each month that covers current PC issues and offers technical tips. Third, and most important, consider the special needs of remote users and include them in making plans.

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[1] Thomas Grubb, "Beam Down Some Help, Scotty!", *Information Center*, January 1989, page 11.

Providing training and communication to support the people component of the Division's information systems is as important as maintaining databases or servicing hardware. The following actions are recommended to improve training and communication about information systems in the Division.

Publish an Information Systems Newsletter

The Blueprint Needs Interviews confirmed two shortcomings related to information system communications in the Division. First, there is a very uneven knowledge among users of systems capabilities. The lack of information, outdated information, and misinformation as to existing systems and their applications became readily apparent during the interviews. Secondly, there is only limited sharing of tips, techniques, and ideas among users. Both of these shortcomings could be alleviated by publication of a widely distributed information systems newsletter.

As envisioned, the newsletter would contain short articles on system applications, training opportunity announcements, a question and answer section, and a forum for sharing of tips, macros, and short programs among systems users. The FIS staff would have responsibility for collecting and editing newsletter items. The estimated staffing requirement for this function is two to three days per month.

The newsletter would be printed and distributed as a loose leaf insert in *Roots*. This would ensure wide distribution within the Division. The loose leaf format would allow users to remove the insert and keep it for later reference. Also, the insert could be left out of those copies of *Roots* distributed outside of the Division.

Several state agencies currently publish information systems newsletters that could be used as models (e.g. Department of Human Service's *End User Computing*, and DOT's *Unite*).

The establishment of a Division operated computer bulletin board was considered as an alternative or additional means of sharing systems related information. A bulletin board is not recommended at this time. A bulletin board would not reach as broad an audience as the newsletter due to a lack of equipment to access it in many offices and the limited number of users with the time or inclination to use it. The staffing and equipment demands of a bulletin board are also substantially greater than those of a newsletter.

Improve Computer Related Training

Nearly half of the Division employees interviewed during the Blueprint Project mentioned the need for training when asked what concerns they had about the Division's information

systems. Given that the widespread use of computers in the Division is a fairly recent occurrence, this level of concern is understandable. The effective use of any new tool requires adequate training. More troubling is the perception, expressed by some interviewees, that some supervisors and managers view time spent on computer training as unproductive.

Most employees interviewed expressed a preference for classroom based training presented by a professional instructor. The tailoring of the training to include Division specific examples or applications is also desirable. Some employees prefer to use manuals, computer based tutorials, or audio- or videotape based training. The Division should strive to make a variety of training opportunities available to meet individual preferences. As a general rule the Division should use external training sources rather than having Division employees provide the training. This is especially true for training in the use of commercial software packages. The Division may have to develop and present training for its internally developed systems. Training needs must be expressly addressed in any proposal to purchase or develop new software or systems for use in the Division.

As more Division employees begin to use computer based information systems it will become more important to ensure that all employees have a basic understanding of systems capabilities and that those actually required to use the systems have adequate training. Employees, supervisors, FIS staff, and the Human Resources program all have roles to play in improving computer related training in the Division.

Employees' position descriptions should clearly state if they are expected to use computers in their jobs. If so, it is the joint responsibility of employees and supervisors to develop a training plan that will provide the employee with the skills required. Supervisors are responsible for determining whether various training opportunities are appropriate to meet an employee's needs. Supervisors must encourage employees who are reluctant to use computers when it has been demonstrated that use of a computer allows a task to be done more effectively. Likewise, supervisors are responsible for limiting unproductive computer use. Computer related training has a limited "shelf life" - if employees do not make use of the training on a regular basis, the value of the training declines rapidly.

The FIS staff role in training should be to identify, evaluate, and publicize training opportunities. The FIS staff should maintain a list of recommended sources of training for each of the widely used commercial software packages and for other important topics such as project management and database concepts. The list should include courses offered at a variety of locations throughout the state as well as computer based tutorials or training tapes. The FIS staff should recommend training material to be purchased and made available to Division personnel through the Human Resources program. FIS staff may be involved in developing and presenting training on internally developed programs.

Human Resources staff should review the recommended minimum qualifications for various positions with respect to required computer knowledge and skills. If it is determined that computer skills are required for various positions, training opportunities must be made available. Computer training classes, tutorials, and training tapes should be included in the course catalog. Appropriate courses should be put on the training calendar, especially when software is acquired or upgraded on a Division wide basis. The Human Resources program should maintain a lending library of computer training tutorials and tapes.

Improve Help Desk

The MIS staff has operated a Help Desk to answer questions and provide support to systems users for the past three years. Initially, Help Desk duty rotated among the EDP Programmer Analysts on a weekly basis. More recently the duty has rotated on a daily basis.

Interviewees indicated that they often sought answers to their computer related questions from co-workers in their own office before calling the Help Desk. Almost everyone supported continuation of the Help Desk and were generally satisfied with the service they received. One interviewee noted that the MIS staff on the Help Desk were better at answering questions about the TI 990 and internally developed programs than they were at questions involving commercial software packages on PCs.

The primary recommendation related to the Help Desk is that it become a primary responsibility of a single individual on the FIS staff. There are advantages to the current system of rotating Help Desk duty among FIS staff. It ensures contact between FIS staff and users on a regular basis, provides variety in staff duty, and requires all FIS staff to have at least a rudimentary knowledge of all aspects of the Division's systems. However, the disadvantages probably outweigh the advantages. By its nature, Help Desk duty is disruptive to the FIS staff's normal activities. They must interrupt their projects to respond to calls. Having a single individual on Help Desk also provides stability and continuity for users and vendors. This is especially important when a problem extends over a long period of time and when repair services are needed. As the complexity of systems increases and the number of software packages in use increases, it will be more difficult for all members of the FIS staff to maintain adequate knowledge to be effective on Help Desk. The primary Help Desk staffer may not be able to answer all questions either, but would be able to consult with the person most knowledgeable on the question and get back to the user. A single Help Desk staffer would also be able to do a better job of tracking common questions and developing answers that could then be published in the newsletter to benefit other users with the same problem.

The Division should evaluate the usefulness of various remote control software programs for improving Help Desk service to PC users at field offices. Remote control software and

modems would allow the Help Desk staff to see and evaluate the problem exactly as it appears on the remote user's PC. Remote control software also permits file transfer and equipment sharing capabilities among dispersed sites.

Users should also be encouraged to use toll free help lines maintained by suppliers of hardware and software. The availability and quality of such help lines should become a factor in selecting equipment and software for use in the Division.

Establish FIS Liaison Network

The Computer User Group was established in 1984. It consists of about 10 individuals from throughout the Division. Originally the group met quarterly, but meetings have been infrequent in the past year. Computer User Group functions include:

- Advising the MIS Steering Committee (now the DMT) on various aspects related to Division information systems.
- Providing a forum for sharing of user tips and applications and a vehicle for communicating systems related information throughout the organization.
- Being a conduit for forwarding information system proposals from field staff to management and MIS.
- Evaluating hardware and software for possible use in the Division.

The Division's Computer User Group is quite different from typical user groups in several respects. Most user groups are voluntary organizations of users from a local area with a common interest in a certain type of hardware, software, or profession. The Division's user group consisted of employees from across the state representing a variety of job classifications and specialties.

The Computer User Group has not had high visibility in the organization. No one individual is responsible for its operation. As a result the group has been only partially successful in fulfilling it functions. The existing Computer Group should be discontinued and its functions reassigned to the FIS Liaison Network and FIS staff (see Chapter 7). While the existing Computer User Group is no longer needed, employees should be encouraged to develop and/or participate in more traditional user groups. Local user groups are often a source of new ideas and applications. Interest groups or specialists within the Division (e.g., silviculturists, PFM foresters, clerical staff) should also be encouraged to devote time at their meetings to discuss information system applications or topics of particular interest.

Promote Department Level Communication

The Division of Forestry's information systems can not exist in isolation from those in the rest of the DNR. The Division's systems will need to interact with the System 36/38 network. Efforts to expand the use of GIS in natural resource management must be coordinated at the department and interagency levels. There are significant opportunities to improve the effectiveness of information systems by sharing equipment and databases among divisions. All of this requires communication across division lines. A department wide IS communication structure should be established.

The idea of holding a computer fair or "RAM JAM" on an annual or biennial basis has been discussed in the past. Such an event would allow systems users to share ideas and present examples of their current activities. Hardware and software vendors could also be encouraged to exhibit products at the fair. This would probably be most effective if it were coordinated at the department rather than the division level.

Forestry Information Systems Blueprint

9. Policies and Procedures for Systems Development

Introduction

This chapter of the Blueprint contains recommended policies and procedures for systems development within the Division of Forestry. The need for uniform, consistently applied policies and procedures within a large, geographically dispersed organization such as the Division is widely recognized. Guidelines for the development and use of information systems are necessary if the Division is to provide consistent service to its customers and accomplish its mission in an effective and efficient manner.

In the past, when systems development projects were carried out by a limited number of people on the systems staff, there was less need for explicit systems development policies and procedures. With the advent of distributed processing and microcomputers, the need for centralized planning and control of systems development has increased. As the use of information systems in general, and computers in particular, affects how employees do their jobs, it is imperative that changes in systems be carefully planned and implemented. Systems development must involve Division mangers and supervisors who can prioritize development efforts and deal with the shifting workloads that often accompany use of new systems. The development process must also involve users and information systems professionals. Users must articulate their information needs and be involved in the systems design and testing procedures. Systems professionals must work with management and users to design and construct efficient, integrated systems.

The next section of this chapter describes the need to create a positive environment for systems development that matches the rigor of the development standards to the complexity of the system. Systems that will be used statewide for major activities on a regular basis require more stringent development procedures than do systems intended for local use for a limited time. The development policies and procedures must allow for innovation and creativity. The roles and responsibilities of those involved in systems development and use are then discussed. Finally, the recommended systems development procedures are explained.

Creating a Positive Environment for Systems Development

The Division of Forestry has consistently adapted new technologies to meet its resource management responsibilities. This has been the case with radios, aircraft, and other equipment. It is continuing today with computers, fax, and other information processing equipment. The application of new technologies is often the result of innovative, independent trials by a small number of individuals. The rest of the organization then adopts ideas that prove useful. This process has been particularly evident in the application of microcomputers. The challenge is to maintain this spirit of progress and innovation while providing a focus and structure for systems development efforts.

A Balance Between Control and Innovation

To achieve its vision of effective systems with consistent and compatible databases, the Division of Forestry must implement a set of policies and procedures to direct and monitor system development activities.

The policies and procedures must guide the development of systems and make known their potential impact. The procedures must not stifle the development of systems; but result in better systems.

The policies and procedures must not result in a central group that is out of touch with the reality of local operations, needs, and problems exercising excessive control over the actions of others. In order for the Division to advance, a balance must be reached with innovation and exploration taking place within a framework that provides review and approval.

The Blueprint Committee thinks that innovation and exploration can constructively take place within the system development policies and procedures described in this chapter. The policies and procedures are meant to be followed for the development of systems that will be routinely used at multiple Forestry locations. The recommended procedures would be overwhelming if they were followed by someone developing a simple worksheet macro for local use. Nonetheless, a simplified version of the process could be used to ensure logical thought processes and work flow on local systems development projects.

Few, if any, of us can work in isolation as we develop and use our systems. In effect, these guidelines are meant to foster communications; for it is communications that will allow us to make systems work for us.

Characteristics of a Desirable Systems Development Process

Common sense and experience indicate that successful systems development procedures must involve managers, users, and systems personnel. Systems development is also facilitated by adequate equipment; trained staff; good communications; and rigorous standards for data, software, and hardware.

Management Involvement

One of the premises on which the Blueprint is based is that management is responsible for ensuring that information systems meet the organization's needs and support the accomplishment of its mission. Systems development procedures must provide managers the

information they need to understand why the new system is needed, how it will work, and what its impacts will be.

Responsibility for information management cannot be delegated to systems personnel alone. Managers and supervisors must be informed. They need to fully understand the impact of systems they approve.

User Involvement

The development process must involve potential users. Users from the field to the central office must have meaningful input and should be allowed to review the system at key stages during its development. Systems designed without user input often do not meet expectations, creating dissatisfied users and a good chance for failure.

Sound Technical Procedures

Development policies must ensure use of sound technical development and review mechanisms to ensure that systems are effective and fit the Division's framework for systems and data. The responsibility for use of sound technical procedures rests with the FIS Applications Development staff.

Appropriate Training

It will be essential that all staff be given training appropriate to their role and level of involvement in system development and use.

Managers and supervisors will play a key role in making the system development procedures work. They must understand the importance and nature of the development policies and procedures. They must possess the knowledge and skills that will allow them to make informed decisions on proposed systems. Managers and supervisors must understand the need, impact, objectives, and value to the organization of proposed systems so that they can with approve with wisdom and then give their full backing. Managers and supervisors will not have to understand all the technical aspects of systems, but must be given the information to allow them to understand the nature and impact of proposed systems. Managers must be given details on manpower and other resources required, for both the short term development cycle, and the long term use of the system.

FIS Liaisons must be given adequate training and be kept abreast of new developments. Day-to-day users must be given documentation and training on the proper use of the systems.

The Blueprint Committee recommends that all managers, supervisors, and FIS Liaisons be given thorough training on the concepts and contents of the Blueprint. It also recommends on-going training in systems development policy and procedures, possibly in the form of annual workshops that could have changing themes and could include outside speakers.

FIS staff will also have significant training needs if they are to use the recommended systems development procedures. The Blueprint envisions a major change in the systems design and programming environment. There will be much less COBOL programming done in the future. FIS staff will have to be trained in database design, DBMS applications programming, GIS, and project leadership. The migration to a new minicomputer platform will also require training.

Hardware, Software, and Data Standards

Relatively stable hardware, software, and data environments will make systems development much easier. The recommended technology architecture (Chapter 6) includes a central minicomputer with the capability to communicate with distributed PCs and GIS workstations. It will be important to maintain uniformity among the hardware and software in use in the Division. Orderly procedures for the upgrading and installation of hardware and software will be necessary.

A sound foundation for data is important in providing a positive environment for systems development. All staff involved in the development of systems need to understand the Division's logical data structure. The Blueprint Committee recommends that Forestry implement a logical data base design process beginning with a global analysis of Forestry's data and continuing with the employment of the process for all system applications that are developed (Chapter 5). FIS staff will be responsible for keeping a data dictionary. The dictionary must be accessible and current. It must include descriptions, attribute lists, characteristics, use conventions, and relationships for all entities included in the Division's systems.

Systems Development Roles and Responsibilities

Development of major systems is a complex undertaking. The roles and responsibilities of the FIS Supervisor, the Director's Management Team (DMT), and Project Teams in systems development are discussed below.

Role of the FIS Supervisor

The FIS Supervisor receives and processes systems development proposals, coordinates the activities of project teams, and provides the DMT with the information it needs to understand and evaluate the impacts of systems being proposed and developed.

The FIS Supervisor:

- **Reviews systems proposals and designs.** The FIS Supervisor, with input from the FIS Liaison Network will review Project Proposals, Conceptual and Detailed Designs, and Implementation Plans for their completeness, and will schedule projects for DMT review. The FIS Supervisor has a duty to provide feedback to the Project Teams following the reviews.
- **Advises the DMT.** The FIS Supervisor can give advice to the DMT, but should not make decisions for the DMT on the relative priority of systems or the commitment of resources for systems development. The Supervisor will assist with the determination of whether or not projects are local in nature or should come under statewide development procedures.
- **Prepares status reports.** The FIS Supervisor must prepare periodic status reports to the DMT and the Division on project proposals and system development activities.
- **Manages the FIS Unit.** The FIS Supervisor must ensure the FIS Unit resources are effectively applied to approved systems development projects.

Role of the DMT

The DMT is ultimately responsible for ensuring that the Division's information systems are helping the Division achieve its mission in an effective and efficient manner. The DMT's role in the systems development process is to review Project Proposals, Conceptual Designs, and Implementation Plans and commit the resources needed to design, develop, or implement a system.

Role of Project Teams

Project Teams are responsible for the technical aspects of systems development including Conceptual Design, Detailed Design, System Construction, and Implementation Planning. The size of a Project Team can range from three members for smaller projects, to six or seven members for larger projects. A Project Team includes:

- Project Leader
- Systems Analyst/Programmer(s)
- Key User(s)
- Support Staff

For smaller projects a single individual may perform multiple roles. Project Teams are not permanent standing bodies. New Project Teams will be created for each new system development project, and will be disbanded when the project they are working on is finished. Project Teams may be assisted by consultants hired to perform specific tasks as the needs arise (e.g., programming or preparing Detailed Designs). Depending on the nature of the development project, departmental membership on Project Teams should be considered.

Project Teams are guided by a Project Leader. The Project Leader is identified in the Project Proposal and their involvement in the project must be approved by the DMT. In many instances, the person who develops the Project Proposal will become the Project Leader. The Leader will usually come from the user community. The Project Leader needs to be someone with authority, typically a program manager, supervisor, or specialist from the user community. The Leader must take charge and manage the Project. He or she directs, communicates, leads, makes decisions, motivates, schedules, mediates, and facilitates.

A Project Team should include at least one Key User whose primary duty is to insure that user needs are being met. Larger more complicated systems should probably have several Key Users on the Project Team. These user representatives must have a very good knowledge of the application for which the system is being developed. This person must understand the nature of the data being collected, the processes that are to be automated, and the types of output that the users will require. In short, this person must make sure the system will do what the users want it to do.

Depending on the size of the project, there may be several analyst/programmers on the Project Team. The analyst/programmers on a Project Team are responsible for the technical systems aspects of the project.

Project Teams also require support in the areas of technical writing, word processing, preparation of documentation, and project scheduling. Project Team members will have to be assigned these duties or outside assistance will need to be acquired.

Project Teams are very active working groups. Major activities of the Team will range from the preparation of a project plan through testing and implementation of the system. The major duties and responsibilities of a Project Team include:

- **Preparing the system development project plan.** Using the Project Proposal as a guide, the first task of a newly formed Project Team will be to prepare a detailed project plan. This should identify timelines, resources required, funding requirements and who needs to do what.
- **Obtaining user input.** An important part of designing and building a good system is determining the needs of all important system users.

- **Providing feedback to users and management.** Project Teams must provide periodic feedback to users, the DMT, and the FIS Supervisor on project direction, status, and needs.
- **Preparing Conceptual and Detailed Designs.** Project Teams will develop Conceptual and Detailed Designs to outline the nature and requirements of the system. Preparing these will require a joint effort of all of the Project Team members. Consultants may be hired to complete parts or all of these designs.
- **Directing System Construction.** The Project Team will direct the programming and other system construction tasks. Either FIS analyst/programmers or hired consultants will perform the programming tasks.
- **Conducting and reviewing system tests.** The Project Team will be responsible for conducting and reviewing tests on new systems as they are being constructed.
- **Preparing the Implementation Plan.** The Project Team must prepare an Implementation Plan for the system prior to putting the system into operation. Implementation Plans must be reviewed and approved by the FIS Supervisor and the DMT.
- **Insuring technical validity and standards.** It will be a responsibility of the Project Team to follow the system development guidelines and to insure that the system is properly integrated with related systems and that data standards are met.

Recommended Systems Development Procedures

The proposed system development process consists of six principal steps that include parallel review and development paths. While the development process may seem complicated, it is meant to be used in the full blown form, only for developing and upgrading Division-wide systems and for conducting pilot projects that have the potential for major impact on the Division's systems. However, a less rigorous version of the process would be useful for evaluating and conducting local system and database development projects.

The six steps in the recommended systems development process are:

- Suggestion or Idea for a System
- Development of Project Proposal
- Preparation of Conceptual Design
- Completion of Detailed Design
- System Construction or Programming
- Implementation and Use

The proposed system development procedure consists of two parallel paths; technical development and review/approval.

- **Technical Development Path.** The technical path consists of the tasks related to obtaining user input, designing, programming, maintaining standards, and implementing systems.
- **Review/Approval Path.** The purpose of the review/approval path is to get management involved and to acquire its endorsement and support at the key stages of development.

The chart below depicts the six steps and two parallel paths that make up the systems development procedure. It exhibits the tasks and responsibilities that are required in the technical path and it identifies the nature of review and approval at the various stages of development.

Systems Development Procedures

Technical Development	Review and Approval
1. Suggestion	
A. Forestry employee develops an idea or suggestion for systems development and presents to supervisor.	Supervisor reviews suggestion for need and with FIS Liaison determines whether local or statewide development procedures should be followed. If system is local in nature and supervisor approves, development can proceed locally. Worksheet should be prepared when development is complete. Worksheet is sent through FIS Liaison Network to inform others about the local system. If system suggestion is multi-jurisdictional in nature proceed to Project Proposal step.
2. Project Proposal	
A. The Project Proposer, working with the FIS Supervisor (or assigned FIS staff) and selected FIS Liaisons prepare Project Proposal for submission to the DMT.	Project Proposer must get Supervisor's permission to develop Project Proposal. FIS Supervisor, with input from the FIS Liaison Network, reviews the Project Proposal and determines if it is ready for presentation to the DMT or recommends that more research or a Pilot Project may be necessary.

B. Project Proposer and FIS Supervisor present Project Proposal (or proposal for Pilot Project) to the DMT.

DMT must approve and commit resources and funding for the Conceptual Design (or Pilot Project). The Project Proposal must nominate a Project Leader, who needs to be approved by the DMT.

C. Conduct Pilot Project if applicable.

Pilot projects may be necessary when it was impossible to sufficiently work out numbers and details in the Project Proposal. Results of pilot projects must be reported to DMT. DMT may then approve full scale project development.

3. Conceptual Design

A. Project Leader establishes Project Team.

Project Team member's involvement approved by their supervisors.

B. Project Team prepares Conceptual Design which includes a technical report, an executive summary, budget estimate for system completion, and statement on availability of off-the-shelf software.

C. Project Leader submits Conceptual Design to FIS Supervisor.

FIS Supervisor reviews Conceptual Design and prepares recommendations to DMT.

D. Project Leader presents Executive Summary and Budget Statement to DMT.

To proceed, DMT must approve Conceptual Design, budget, and schedule for Detailed Design.

4. Detailed Design

A. Project Team, with possible assistance from a consultant, prepares Detailed Design which includes further information on resource needs (equipment, software, and staffing).

B. Project Leader submits Detailed Design to FIS Supervisor for comparison with Conceptual Design.

FIS Supervisor compares Conceptual and Detailed Designs, especially the original budget and the detailed statement of resource needs. If there are major differences, report to the DMT with recommendations.

5. System Construction

A. FIS staff, with possible assistance from consultant, program and document system.

B. Concurrent with programming, Project Team acquires equipment necessary for system development and testing.

C. Project Team seeks participants to test system.	
D. System developers, test site users, and Project Team conduct system tests.	Project Team accepts system.
E. Concurrently, Project Team completes Implementation Plan which includes schedule for installation, training, and identification of Lead User.	
F. Project Leader submits Implementation Plan to FIS Supervisor and DMT.	FIS Supervisor reviews for completeness and makes recommendations to DMT. DMT approves and schedules implementation.
6. Implementation and Use	
A. System developers, Project Team and users complete training, implementation, and shakedown	
B. Lead User, operators, and users operate system.	
C. System maintained and updated by FIS staff, Lead User, and users.	Any major upgrades or improvements to system must follow system development procedures.

Systems Suggestions

When an employee wants to take an idea or suggestion for a new system or database and develop it (or have someone else develop it), permission to proceed must first be sought from the employee's supervisor. In addition to giving his or her permission to proceed, the supervisor, with input and advice from the local FIS Liaison (and the FIS Supervisor, if necessary) must make the important decision on jurisdiction.

> **It will be the local supervisor's responsibility to decide if the effort is a local project or if it is of a nature to be developed under the Division's statewide system development guidelines.**

There are several questions that the local supervisor with assistance from the FIS Liaison must get answered to determine if a system should come under statewide development guidelines. A yes answer to any of them will require that they get statewide review. The questions that need answering are:

- **Is this system being proposed for routine use at more than one Forestry location?** Routine use is defined as use on a recurrent or cyclical basis (such as daily, weekly, monthly, annually or biennially). Systems being developed for routine use at more than one Forestry location come under the statewide development guidelines. Systems originally developed for use at one location, but now

being considered for routine use at other Forestry locations also come under statewide development guidelines.

- **Are there any significant external linkages or impacts?** Systems that require information from, or modify the content of information used by others or will cause a change in workload at other locations will come under statewide development guidelines.
- **Does this system make use of an innovative new technology that is likely to have Division-wide impact?** Pilots that use innovative technologies will be required to follow statewide development procedures.

If the answers to any of these is yes, the effort should be considered to be of statewide significance and a Project Proposal should be prepared for review by the FIS Supervisor.

If the answers are all no, the local supervisor should still be aware of the following and consider them before giving the OK to proceed locally:

- Will there be an increase in workload? On whom?
- What are the training and on-going maintenance requirements?
- What are the timelines for development?

If there is any doubt, it is recommended that a Project Proposal be completed, if only for local review.

It will be the responsibility of the supervisor to make this very important part of the system development process work. Common sense must be used in making this decision. There will be no need to go through the complete systems development process for each small system related task that is a normal part of an employee's duties.

Publicizing Results of Local Efforts and Pilots

Even if a system is developed for use in only one workplace, it will be important to get the message out to the Division. If something is developed that is useful, it will be of a very positive nature to let others in the Division know about it.

For this reason, a System Worksheet (Items I & II of a Project Proposal) should be prepared describing the new capability and submitted to the local FIS Liaison to be distributed through the FIS Liaison Network.

It would be both stifling and terribly inefficient if Project Proposals and the multi-stage development process were required for everything. Almost anything, developed for computers anywhere in the Division probably could be construed to be useful by staff at another location. Experimentation and piloting must be allowed to continue but should be approved by supervisors. Experiments need to be properly supervised and managed. Results of pilots and experiments must be conveyed through the FIS Liaison Network.

Project Proposal

The process of transforming ideas or suggestions into systems is initiated with the preparation of a Project Proposal and its submission for review by the DMT. Project Proposals must provide enough information to give management a good understanding of the nature, use, and impact of the proposed system. Proposals must also provide an estimate of the effort and resources required to develop the system.

The outline on the next page should be used for Project Proposals. Project Proposals should be concise two to three page documents providing a clear system description and estimate of resource requirements for system development.

The information to be presented under some of the headings in the outline is further described below. To portray the nature of a proposed system the Project Proposal must address the system's:

- **Function.** It must describe what the system will do.
- **Need.** The Project Proposal must identify the need for the system and the advantages that it will provide over current practices. It needs to describe how badly the system is needed and should review the implications of not proceeding.
- **Users.** All potential groups of Forestry staff that can make use of the system should be identified in the Project Proposal.
- **Impact on Workload.** A description of the impact the system will have on the workload of users once it is operational. The Project Proposal should identify who will be entering and accessing the data; who will be managing and monitoring the system, and what level of effort will be required for these tasks.

In examining the scope of resources required to complete the system development effort, the Project Proposal should:

- **Determine costs for completion of Conceptual Design.** Project Proposals should give accurate estimates of the staff and budget requirements and expected timelines for completing the Conceptual Design.
- **Identify the Project Team members and their involvement.** The Project Proposal will need to determine the initial size and membership of the Project Team. Project Team makeup is determined by the person writing the Project Proposal with input and advice from the FIS Supervisor and members of the FIS Liaison Network.
- **Identify need for Consultant for Conceptual Design.** The Project Proposal should specify if the use of an outside consultant will be necessary for the completion of the Conceptual Design.
- **Overall development costs.** A "ballpark" estimate should be made of the budgets, staff, and timelines needed to complete the development of the system. A preliminary estimate of hardware and software required to develop and implement the system should be included.

After being reviewed for completeness by the FIS Supervisor, Project Proposals will be presented to the DMT for their consideration and approval. If the Project Proposal is approved, a Project Team is assembled and begins to work on completing the system.

I. Project Leader: _____ Date:_____
System Name: _____

II. System Description

A. System Function

B. Reason or Need for System

1. Benefits or advantages over current practice
2. Urgency
3. Expected system life

C. Identification of All of the Potential Users

D. Workload Impact of Implemented System

E. Preliminary Statement on Linkages to Other Activities and Systems

III. Resource Requirements for System Development

A. Suggestions for Project Team

1. Size
2. Membership
3. Identify who the Project Leader will report to for the duration of the system development project.

B. Accurate Estimates for Conceptual Design Costs

1. Timeframe and Manhours
2. Statement on Use of Consultants
3. Miscellaneous Costs (Travel, supplies, etc.)

C. Ballpark Estimates of Additional Costs to Complete System from Detailed Design to Implementation

1. Timeframes and Manhours
2. Use of Consultants
3. Hardware and Software Acquisition
4. Other known costs

D. Identification of Funding Sources

Conceptual Design

After the Project Proposal has been accepted and approved by the DMT, the next task in the development of a statewide system is preparation of the Conceptual Design for the system. The Conceptual Design should provide details on the nature of the proposed system and should identify the resources required to complete its development. The Conceptual Design should outline the:

- Types and volume of data to be collected.
- Flow of information and the key processes and procedures that the system must support.
- Reports that the system must generate and the nature of the queries that the users may want to make of the databases.
- The timelines and resource requirements to complete system development.

As part of the Conceptual Design, the Project Team should prepare a Technical Report for use by the staff that will complete the design and programming of the system. The Project Team should also prepare an Executive Summary of the Conceptual Design findings for review by the FIS Supervisor and the DMT.

Data Description

The Conceptual Design should provide a description of the data that will be collected, stored, analyzed, and reported upon by the information system under design. It should provide a logical description of data that will result in consistent and well structured databases. A well defined data structure will make it easier to convert between different software packages and computer systems. In is likely that, over time, systems will tend to be perishable but the data they collect and store will be lasting.

The Conceptual Design should identify those things, the **entities**, for which information needs to be collected and recorded. It should also begin to delineate the important items or **attributes** that will be recorded for each entity. Another important facet in describing and understanding the structure of data is to identify the **relationships** or linkages that exist among those entities about which the system under design is recording information. In addition, the Conceptual Design should identify key external relationships.

The Blueprint Committee recommends that a structured process such as the Logical Database Design procedure, promoted by Professor Gordon Everest of the University of Minnesota, be used at the Conceptual Design stage to help establish a sound data structure. It also recommends that the entities and their attributes be recorded in a Data Dictionary that is accessible to all system users. The dictionary must be both accessible to, and upgraded by the developers of any new Division-wide systems or databases.

In addition to providing a logical definition of the data to be collected, it will also be necessary at this stage of system design to get an **estimate of the volume of data** that will be stored in each of the databases that will be created. It will be important to understand how the databases may change in size over time, especially if the system will be required to store historical information.

Information Flow and Key Business Processes

The Conceptual Design must describe the business procedures or activities that the system must be able to support. It should describe the procedures that will be automated to generate the data that will be used to populate and update the systems's databases.

The Project Team, working with the eventual users and operators, must describe the key business processes and the locations at which they will take place. This should be done in order to help system developers make decisions on the nature of the computer programs or macros to be implemented and to assist in the determination of the computer hardware required to build and operate the system.

Descriptions should be made and schematic flowcharts prepared to depict the business procedures, the employees involved, and the locations where the key activities and actions take place.

System Output and Users

The Project Team, with the knowledgeable input of the user community, should identify the key users and the types of output, reports, and access to files that will be required. The Conceptual Design should identify the users who will require real-time access to the system and who will want downloaded copies of (all or portions of) files for use with personal computers.

System Resource Requirements and Timelines

The Conceptual Design should include details on the hardware, software, manpower, and associated costs that will be required to complete the system design and programming. A determination should be made to see if any "Off-the-shelf" software packages exist that may meet some or all of the needs of the system.

Estimates of manpower requirements and the timelines to complete the design and programming of the system must be included as part of the Conceptual Design. Manpower requirements should be developed with care in order to determine if Forestry has any of its

own staff available to complete the job of building the system. If staff is not available, the manpower estimates are needed to determine funding required to hire a consultant to complete the system.

The Project Team will have to develop a Request for Proposals (RFP) that describes Forestry's needs if it is decided to seek outside support. To formulate the RFP the Project Team will need to draw on information included in the technical Conceptual Design document.

If the Division does not have available staff nor does it have funding available to contract for the system, the Project Team may have to be asked if there are any lower cost system alternatives. Otherwise the Division may have to wait to proceed with the development of the system.

As a final product at this stage, the Project Team should prepare an Executive Summary of the Conceptual Design for review by the FIS Supervisor and the DMT.

Detailed Design

The final three stages in the system development cycle are Detailed Design, Construction, and Implementation. Some overlap exists among all three of these stages, particularly if systems are developed using heuristic design techniques made possible by today's powerful database management packages.

The Detailed Design must provide the detailed specifications for completing the system. It takes the information system needs identified in the Conceptual Design and details them in full. It must give precise enough information so that those involved in completing the system understand what is needed and what they have to do.

No specific standard procedure is recommended for the Detailed Design. It is better if the designers have the freedom to use procedures that they are familiar with and that they find useful. While there is no rigid system to follow, the Detailed Design still must fully specify:

- **Staff requirements for programming.** The detailed design should identify the size of the programming and other system construction tasks.
- **Equipment needs for system building.** Equipment needed for system building and testing must be identified and ordered. Equipment needed for Implementation is ordered during the Construction stage.
- **Computer language(s) to be used.** The computer software to be used must be specified.

- **Functional program specifications.** The Detailed Design must provide the following information for the system builders:
  - Program functions.
  - File structures.
  - Input documents.
  - Input screens.
  - Report and other output formats.
  - User interfaces including menus, read/write privileges and backup requirements.
- **System overview description and flowchart.** It should include an overview that shows the flow of information among files, reports, programs, and input/output procedures.
- **Schedule for completion.** Detail the schedules for system construction and testing activities.
- **Testing requirements.** Identify the users to be involved in testing the system and the effort that it will take. Any equipment that will be required for testing also should be identified.
- **Documentation.** Many of the above materials that are developed in the Detailed Design become part of the system documentation. Additional documentation to be completed during System Construction and Implementation should be identified.

System Construction

System Construction is made up of all of the programming and other technical system tasks (communications, equipment configuration and testing, etc.) that are required to complete the development of a system. Depending on the size and nature of the job and the availability of staff, these tasks will be done, in part, or fully, by either FIS Staff or by consultants.

The Implementation Plan should be prepared as the system construction is completed.

Implementation and Use

The primary purpose of an Implementation Plan is to insure that all of the important resources and materials are identified and ready for delivery or assignment. The Implementation Plan must certify completion of, or schedule the following:

- **Completion of Documentation.** The following need to be included:
  - System management procedures.
  - User documentation.
  - Systems documentation.
  - Training materials.

- **Equipment.** It must check that all required equipment is available or has been ordered. Installation procedures and installers must be identified.
- **Programs/software.** Preparation of any materials that need to be delivered to user locations. Installation procedures and installers must again be identified.
- **Staffing.** Several staffing needs must be checked off including:
  - Designation of Lead User.
  - Identification of responsibilities for system maintenance and provision of user support.
  - Designation of trainers.
  - Identification of users and operators.
- **Training.** Trainers and schedules must be identified to provide training for Lead User and all system users and operators.
- **Schedule and Budgets.** Finalize schedule for beginning use of system. Identify any ongoing operational costs and budgets that will cover them.

The final step in the system cycle is to begin the use of the system. The concluding tasks are to complete the system shakedown, and put the system into full scale operation.

Forestry Information Systems Blueprint

10. Implementation Plan

Introduction

The *Forestry Information Systems Blueprint* is a description of the Division's information systems vision. The transformation of existing systems into the desired systems will require concerted effort by the entire Division. The following implementation plan describes the major tasks that should be undertaken.

The implementation plan represents the Blueprint Committee's recommendations on "who should do what, when." The intent is to provide a bridge from the current situation to where the Division should be in the future. Developing integrated information systems is a complex undertaking. The committee recognizes that implementation of the Blueprint may not proceed in a straight forward manner. Unforseen conditions may block progress on some of the tasks. Some tasks will take longer than anticipated, others may become unnecessary. Each task should be judged on whether or not it moves toward the desired systems.

Timing is an important factor in systems development. Some tasks must clearly be completed before others can begin. Other tasks can be done simultaneously. A few tasks (e.g., developing budget requests) must be completed by certain dates that are not related to specific milestones in the systems development process. To indicate some of these time dependencies and the relative priority of tasks, the Blueprint Committee established two implementation stages. Stage 1 begins with adoption of the Blueprint by the Division and lasts for six months (roughly September 1989 through February 1990). Stage 2 covers the remainder of the current biennium (March 1990 through June 1991).

Stage 1 Implementation Tasks

Provide Blueprint Orientation

Task Description: The Information Systems vision contained in the Blueprint has to be explained to Division of Forestry managers and employees, DNR managers, DNR MIS personnel, and other interested agencies and organizations. The first orientation sessions will be for the DMT and Division Supervisors. Additional presentations will be made as requested at staff meetings or training sessions. Articles will be written for publication in *Roots*.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Blueprint Project Staff and Blueprint Committee Members. Information Systems Supervisor after that position is filled.

Timing: Begin in August 1989. The majority of the orientation sessions should be completed by October 1989.

Hire an Information Systems Supervisor

Task Description: The Information Systems Supervisor will play a key role in implementing the Blueprint and managing systems development. It is imperative that this position be filled as soon as possible. The Information Systems Supervisor's responsibilities and relationships are described in Chapter 7 of the Blueprint. Steps involved in filling the position include preparing a Position Description, establishing the position classification, advertising the vacancy, obtaining a list of qualified applicants, interviewing candidates, and appointing the selected candidate.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: DNR Bureau of Human Resources, DOER, Director, and Assistant Director.

Timing: The hiring process should begin immediately with a goal of having the Information Systems Supervisor on board by January 1990.

Adopt and Implement PC Hardware and Software Standards

Task Description: The Blueprint establishes Division standards for PC hardware and software (Chapter 6). These standards need to be officially adopted and widely distributed within the Division. The standards will be used in guiding PC hardware and software acquisition under the direction of the Assistant to the Director for Resource Information and Planning. The new standards will replace those which were distributed as an attachment to the Director's memo to Division of Forestry Supervisors dated April 13, 1989. Policies and procedures related to the acquisition of PC hardware and software under the new centralized funding decision should be distributed at the same time. Existing MIS staff should be designated to develop the policy and procedures, and to assist users in acquiring PC hardware and software. These tasks will eventually become the responsibility of the FIS User Technical Support unit.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Purchasers of PC hardware and software, designated MIS staff.

Timing: Policies and procedures should be developed and standards distributed by October 1989.

Study TI 990 Conversion Options

Task Description: The Division should evaluate the options for conversion of existing TI 990 systems (e.g., mailbox, timber sales, fire reporting, personnel) to the new minicomputer platform. It needs to be determined if the existing COBOL systems should be converted to run on the new platform, as they stand, in COBOL. An alternative is to continue to operate these systems on the TI 990 until they can be totally overhauled and become part of the new integrated systems. This overhaul could easily take three or more years. The following steps should be taken in making the determination:

- Identify all costs and manpower required to convert the TI 990 COBOL based systems to the new minicomputer system. This will involve discussions with LMIC to see if conversion could begin on LMIC's equipment before Forestry's new equipment is in place. LMIC does not presently have a COBOL compiler.
- Identify costs of continued operation on the TI 990.
- If conversion is the appropriate path to take, develop a recommended sequence for conversion of systems. Timber sales, fire reporting, personnel, mailbox, and forest inventory are the major systems on the TI 990.
- Identify who will do the conversion. It needs to be determined if Forestry staff can do the conversion alone, or if outside vendors should be sought to assist with the job.
- Prepare report on conversion recommendations for the DMT.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Designated MIS/GIS staff, systems users, LMIC.

Timing: Report to the DMT concerning TI 990 conversion should be complete by December 1, 1989.

Publish IS Newsletter

Task Description: The Blueprint recommends publication of an information systems newsletter to be inserted into Roots (Chapter 8). An existing staff member should be assigned responsibility for initiating the newsletter pending organization of the FIS User Technical Support unit.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Designated staff, *Roots* editor, contributing writers.

Timing: The newsletter should begin publication with the January 1990 issue of *Roots*.

Adopt Systems Development Policies and Procedures

Task Description: Chapter 9 of the Blueprint contains recommended information systems development policies and procedures. Following approval of the Blueprint, these policies and procedures should be formally adopted by the Division. A Circular Letter should be developed to institute the policies and procedures. These guidelines would replace the interim guidelines contained in the Director's memo to Division of Forestry Supervisors dated April 13, 1989.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: FIS staff and DMT.

Timing: Complete by January 1990.

Establish FIS Liaison Network

Task Description: FIS liaisons are individuals in each Area and Region office and each St. Paul work unit who have specific duties related to information systems (see chapters 7 and 8). FIS liaisons and the FIS User Technical Support Specialists form a network to improve communication with and support for end users. FIS liaisons have to be appointed and their position descriptions modified to reflect their information systems related responsibilities. An existing staff member of the MIS group should be assigned responsibility to work with the liaison network pending organization and staffing of the FIS User Support unit.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Designated MIS staff; Area, Regional, and St. Paul work unit supervisors; FIS liaisons.

Timing: FIS liaison network should be in place by February 1990.

Develop Global Data Architecture

Task Description: The information systems vision (Chapter 3) calls for an increased emphasis on the data component of the Division's systems. The development of integrated, easily accessible, and useable corporate databases is a high priority for the Division. The

need to develop a broad scale data structure diagram for the Division is outlined in Chapter 5. Without this global data architecture it will be difficult or impossible to design integrated databases. Since the Division lacks expertise in this area, it should enter into a contract to develop a global data architecture. The vendor should provide training on the need for and techniques of database design as well as facilitating the global level design process. The global level architecture must be completed before detailed, application level database design projects are undertaken. Eventually, database design and database administration will be functions of the FIS Systems Development unit.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: Vendor, DMT, selected information systems users, FIS staff.

Timing: The global data architecture should be completed by February 1990 so that systems development projects can proceed.

Incorporate Blueprint Goals in DNR and Division Strategic Plans

Task Description: The DNR's *Directions* and the Division's *MFRP* strategic plans are updated at regular intervals. These planning processes provide opportunities to surface information systems related issues. They also provide an additional forum for promoting the Division's information systems vision. These documents are used in setting organizational priorities and in developing public support for agency activities.

Responsibility: Assistant to the Director for Resource Information and Planning.

Others Involved: FIS and planning units, DNR Office of Planning, CMT, DMT.

Timing: The *MFRP* is scheduled for updating beginning in late 1989. *Directions* will be updated in 1990 for use in developing the DNR's legislative and budgetary initiatives for the 1991 - 93 biennium.

Stage 2 Implementation Tasks

Organize and Staff FIS Unit

Task Description: The recommended FIS staff structure is described in Chapter 7. The new Information Systems Supervisor should begin to reorganize the existing MIS and GIS staffs as soon as possible. This will involve rewriting position descriptions, establishing classifications, matching existing staff qualifications with proposed positions, reassigning staff, and/or hiring new staff.

Responsibility: FIS Supervisor.

Others Involved: Assistant to the Director for Resource Information and Planning, MIS and GIS staff, DNR Bureau of Human Resources.

Timing: The FIS staff reorganization should begin as soon as possible after the Information Systems Supervisor is on board. The timeline for completion of the reorganization is impossible to predict. It will depend on the schedule for switching from the existing minicomputers to the new minicomputer, on the willingness and ability of existing staff to relocate, on the FIS unit workload, and other factors.

Implement the TI 990 Conversion Strategy

Task Description: Depending on the results of the TI 990 conversion study, either begin conversion of existing TI 990 based to the new minicomputer platform or maintain operation of the TI 990 and begin efforts to develop new systems to replace those operating on the TI 990.

Responsibility: FIS Supervisor.

Others Involved: FIS staff, systems users, LMIC, DMT.

Timing: If conversion to the new minicomputer is the selected option, efforts could begin using existing LMIC equipment by January 1990. The goal should be to complete conversion as soon as possible to avoid the costs associated with operation and maintenance of the TI 990.

Develop Equipment Specifications and Evaluate Proposals

Task Description: The basic hardware configuration for the Division's information systems consists of a single central minicomputer that supports a network of PC based workstations at Area, Regional, and St. Paul offices. The minicomputer should also be capable of supporting Regional GIS workstations (Chapter 6). The basic hardware guidelines contained in the Blueprint must be expanded into equipment specifications that can be the basis for an equipment RFP. The RFP should cover the Division's minicomputer, communications network, and GIS workstation needs. The RFP should be circulated and the responses evaluated to see which best meets the Division's needs.

Responsibility: FIS Supervisor.

Others Involved: FIS staff, DMT, Department of Administration.

Timing: The RFP should be ready for distribution by April 1990.

Prepare Contract with Vendor Providing Computer Services

Task Description: The Blueprint recommends that the Division not operate its own computer center (Chapter 6). As a result the Division will have to negotiate a contract or memorandum of understanding with the agency or vendor that provides computer and communications system operation services. This task must be closely coordinated with the development of equipment specifications. The contract must cover such items as services and staffing to be provided, hours of operations, disaster recovery, software to be supported, billing rates and methods, and ownership of hardware, software, and data.

Responsibility: FIS Supervisor.

Others Involved: FIS staff, DMT, Attorney General's Office, Department of Administration.

Timing: Negotiations should begin by March 1990. Final contract will likely be developed after results of equipment RFP are available.

Conduct GIS Workstation Pilot

Task Description: The Blueprint calls for a pilot study to evaluate the feasibility of Regional GIS workstations (Chapter 6). Two separate types of workstations should be evaluated. A scientific workstation with its own processing capability is proposed for evaluation in the Grand Rapids Region. A satellite workstation relying on the central minicomputer for processing is proposed for St. Paul. The equipment specifications and computer services contract discussed above should be developed with the GIS workstation pilot in mind.

Responsibility: FIS Supervisor.

Others Involved: FIS staff, DMT, LMIC.

Timing: The scientific workstation could be installed and begin processing before the minicomputer is installed. The satellite workstation could possibly be installed to work off the existing LMIC computer with eventual transfer to the Division minicomputer. A project proposal for the pilot should be available by April 1990.

Update FIS Plan and Prepare Budget for 1991 - 93 Biennium

Task Description: The Division's FIS plan should be reviewed and updated on a biennial basis, prior to development of the biennial budget request. By mid-1990 it should be possible to predict whether there will have to be major changes in the Blueprint. The Information Systems Supervisor and the DMT should then set priorities for the 1991 - 93 biennium and determine if there is a need to develop budget change level requests.

Responsibility: FIS Supervisor.

Others Involved: DMT, cooperating agencies.

Timing: The plan review could take place in conjunction with the Division's annual work planning and budgeting process in May 1990. The Department of Finance determines biennial budget preparation deadlines. Budget preparation will likely begin in the summer of 1990 and continue through the 1991 legislative session.

Improve IS Training

Task Description: There is a need for continuing training for systems users and FIS staff. End user training is discussed in Chapter 8 of the Blueprint. The proposed systems development process (Chapter 9) will require training for FIS staff and project team members. FIS staff must begin identifying appropriate training and work with the Personnel Development Supervisor and the Division Training Board to make the training available to Division employees.

Responsibility: FIS Supervisor.

Others Involved: FIS User Technical Support unit, Personnel Development Supervisor, Training Board, Division employees and supervisors.

Timing: This will be an ongoing effort. It could begin as soon as the responsibility for training is assigned to a FIS staff member.

Develop Systems Applications

Task Description: Chapter 9 establishes the procedures to be followed in developing systems applications. Systems users will be primarily responsible for proposing applications. The DMT will review and prioritize development projects.

Responsibility: FIS Supervisor.

Others Involved: Systems users, project teams, FIS staff, DMT.

Timing: New applications development should not begin before the global data architecture has been established (February 1990). Project proposals and conceptual design work could begin by March 1990, but systems construction will have to wait until the new minicomputer and associated systems development tools are available.

Install PCs and other Equipment in Field Stations

Task Description: Chapter 4 lists the recommended Office Automation equipment for Field Stations. Providing fax, photocopiers, and PCs should allow Field Stations to use Office Automation to improve the effectiveness and efficiency of resource management and public service. The successful use of this equipment will require substantial investment in training for field station personnel. Training, equipment acquisition, installation, and use must be well planned. Equipment should not just be delivered to the Field Station. The need for various types of equipment varies from Station to Station. Some of the PCs and other equipment is likely to be "hand-me-downs" from Areas or other locations. Thus timing of the installation is likely to be related to upgrades of the existing TI-990 / PC network.

Responsibility: Area Forest Supervisors

Others Involved: Field Station Personnel, FIS Liaisons, FIS User Technical Support Staff.

Timing: Ongoing process that has already begun. The goal should be to have "standard" equipment available in all Field Stations within five years.

Forestry Information Systems Blueprint

A. Blueprint Project Contributors

Blueprint Project Direction

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Division and Other Agency Involvement

Division employees provided input to the Blueprint through interviews, surveys, and conversations. Division employees were informed about Blueprint progress at staff meetings and through articles in the Division's monthly newsletter. Other agencies consulted during the project include the Information Policy Office, DNR Management Information Systems Bureau, and the Land Management Information Center (LMIC).

Forestry Information Systems Blueprint
B. GIS Workstation Configurations

The following are sample configurations that show various types of workstations that could be used for processing the Division's ARC/INFO based GIS databases. (Equipment from different manufacturers can be substituted for those shown. Prices are estimated.)

Scientific workstation

Sun SPARC 2 Workstation (with 1200 MB disk and color monitor)	$35,000
Workstation ARC/INFO software (second copy cost)	13,000
Digitizer - 3' x 4 (Calcomp 9136 or Altek 3648)	5,500
Pen Plotter - 36", 8 Pen (Calcomp 1044 or Zeta 836)	10,500
Laser printer	
(HP - LA2)	1,800
(HP - LA2 - 2MB)	800

	$66,600

(Additional seats could be added for $15,000 to $25,000.)

Interactive Satellite Workstation

Graphic CRT (Tektronix 4209)	$ 7,000
Digitizer - 3' x 4' (Calcomp 9136 or Altek 3648)	5,500
Pen Plotter - 36", 8 Pen (Calcomp 1044 or Zeta 836)	10,500
Laser printer - (HP - LA2)	1,800
	$24,800

(Replacing Graphic CRT with AT level personal computer could reduce cost by approximately $4,000)

Minimum pcARC configuration (For analysis only, no digitizing or overlaying capabilities, limited hardcopy)

PS/2 Model 50Z - 60MB disk (IBM - PS2 - 5061)	$3,000
Monitor - Model IBM 8512 (with swivel stand)	450
Plotter - 6 pen (HP - 7475A/1)	1,400
Printer - 9 pin, 80 col (Epson FX850)	400
Mouse (IBM - PS2 - MOUS)	70
pcARC/INFO Starter kit	2,500
ARCPLOT Module	2,000
	$9,820

Fully configured pcARC system (for digitizing and analysis)

PS/2 Model 80Z - 115MB disk (IBM - PS2 - 8111)	$ 6,000
Monitor - Model IBM 8514	1,100
High resolution graphics card 1024x768 resolution, 256 colors (IBM - PS2 - DAHI) (IBM - PS2 - DAHM)	1,150
Digitizer - 3' x 4 (Calcomp 9136 or Altek 3648)	5,500
Pen Plotter - 36", 8 Pen (Calcomp 1044 or Zeta 836)	10,500
Laser printer - (HP - LA2) (HP - LA2 - 2MB)	 1,800 800
Mouse (IBM - PS2 - MOUS)	70
pcARC/INFO Starter kit	2,500
ARCPLOT Module	2,000
ARCEDIT Module	1,000
OVERLAY Module	2,000
PC INFO 9.31 DBMS software	1,200
	$35,620

(This amount could be reduced by about $5,000 to $7,000 by selecting a smaller plotter.)