

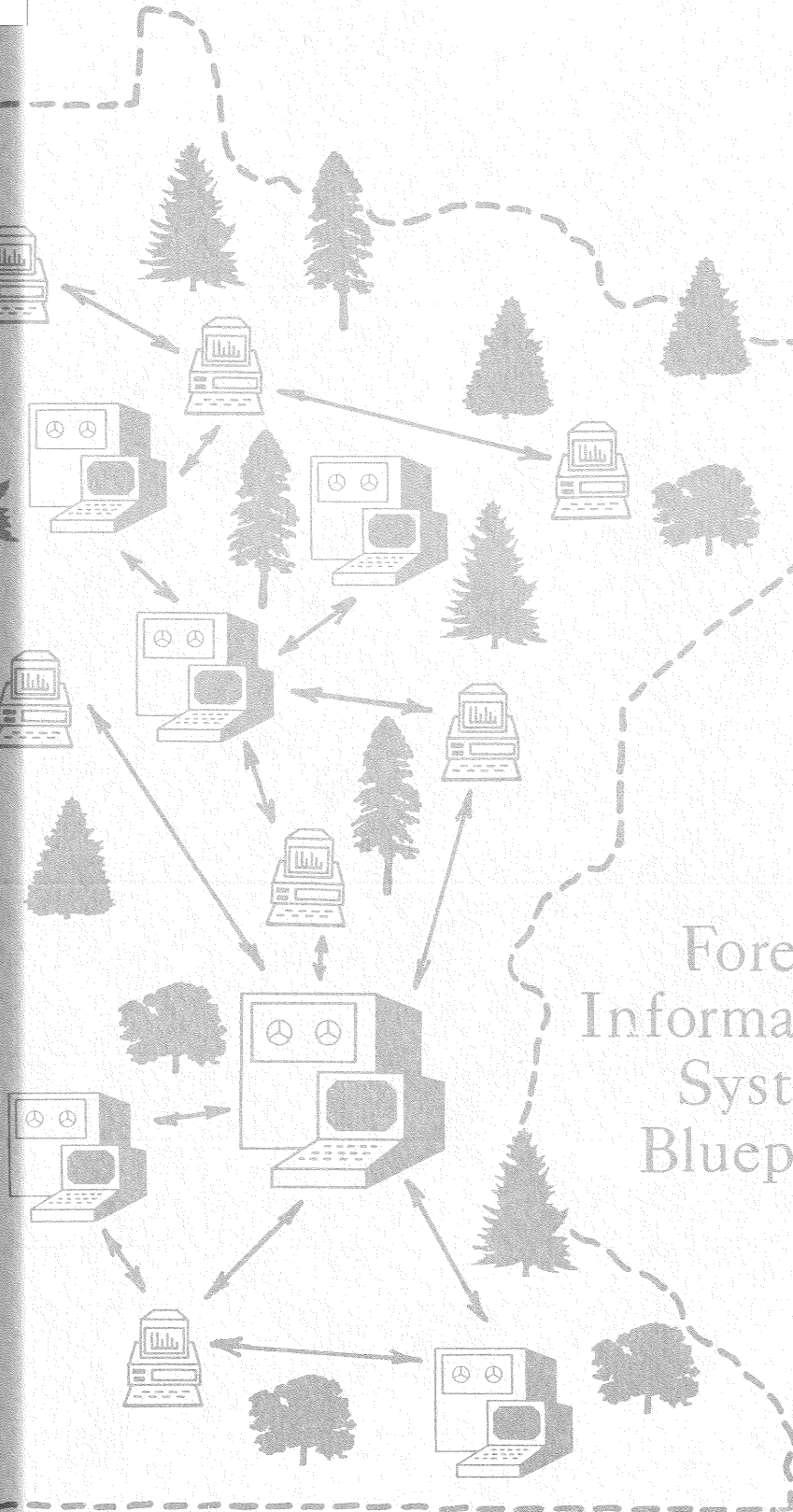
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Forestry Information Systems Blueprint



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Forestry Information Systems Blueprint

October 1989

Minnesota Department of Natural Resources

Division of Forestry

St. Paul, MN

Forestry Information Systems Blueprint

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Introduction

Blueprint Project 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 are currently operated by the Division. 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 of Forestry 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 increase in 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

Blueprint 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.

Who was Involved in Developing the Blueprint

Project Direction

- The Director's Management Team

Project Staff

- Les Maki
- John Olson

Project Committee

- Bruce Abbott
- Tom Eiber
- Doug Ford
- Dave Martodam
- John Mathweg
- Barb Meyer
- Floyd Riester
- Steve Vongroven
- Bruce ZumBahlen
- Glenn Radde (Department Liaison)

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 IPO, DNR MIS, and the Land Management Information Center (LMIC).

Process Used to Develop the Blueprint

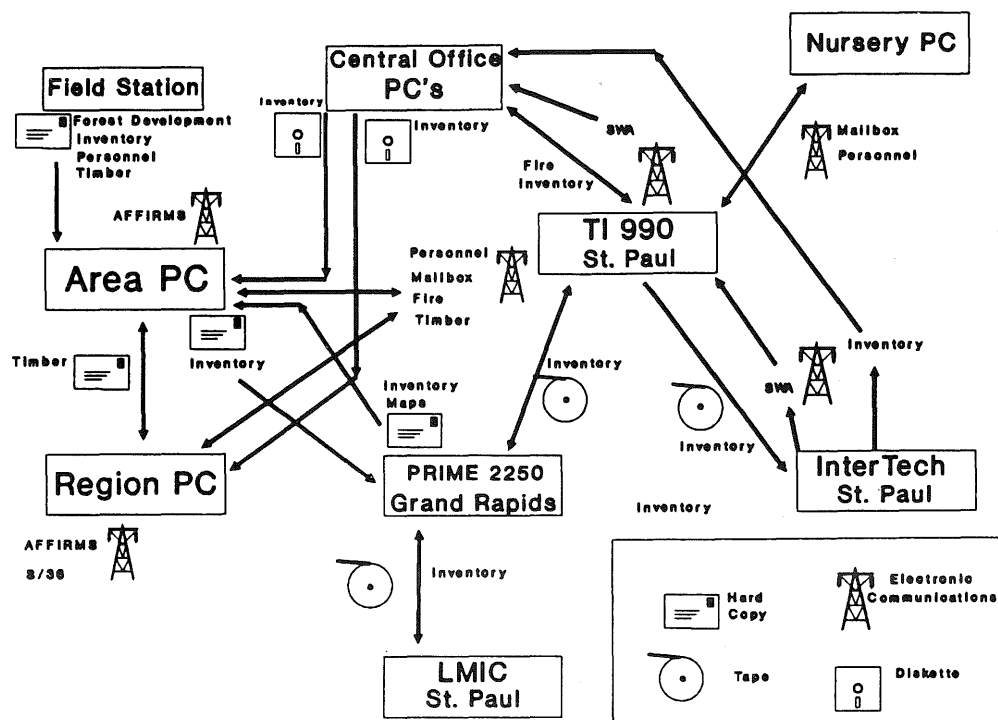
- Introductory Meetings
- Baseline Analysis of Existing Systems
- Needs Assessment Interviews with 43 Division Employees
- Formulation of an Information Systems Vision
- Work Groups Prepared Recommendations on:
 - Systems Modules
 - Data Standards
 - Hardware and Software
 - Staffing
 - User Communication and Training
 - Systems Development Policies and Procedures
- Publish and Present Blueprint

Baseline Analysis and Needs Assessment

Existing Systems

The Division of Forestry currently operates two minicomputer systems: (1) a Texas Instruments 990 located in St. Paul and (2) a PRIME 2250 located in Grand Rapids. In addition the Division operates approximately 125 personal computers and several local area networks. The Division also makes use of computing facilities at LMIC, Intertechnology Group (ITG, formerly IMB), and other locations for some of its information processing needs. The TI 990 was purchased and installed in late 1982. 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 their PC's and then transmitting them via modem to St. Paul. This process of batch processing and the lack of database management software 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. The PRIME 2250 was installed in January 1985. The major software package on the PRIME 2250 is ARC/INFO, a vector based geographic information system and relational database management system. The PRIME 2250 is primarily used to enter and update forest inventory data and maps.

The figure below is a schematic representation of the systems used by the Division.



PC Survey Results

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

ITEM	Region	Area	Station	Nursery	St. Paul	TOTAL	
<u>Personal Computers</u>							
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	
<u>Printers</u>							
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	
<u>Word Processing Software</u>							
WordStar	-	-	-	-	4	4	
DisplayWrite	11	29	2	-	13	55	
WordPerfect	12	7	2	10	39	70	
TOTAL	23	36	4	10	56	129	
<u>Database Management Software</u>							
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	
<u>Spreadsheet Software</u>							
Lotus 1-2-3	7	29	2	9	12	59	
Quattro	9	5	-	-	-	14	
TOTAL	16	34	2	9	12	73	
<u>Graphics Software</u>							
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

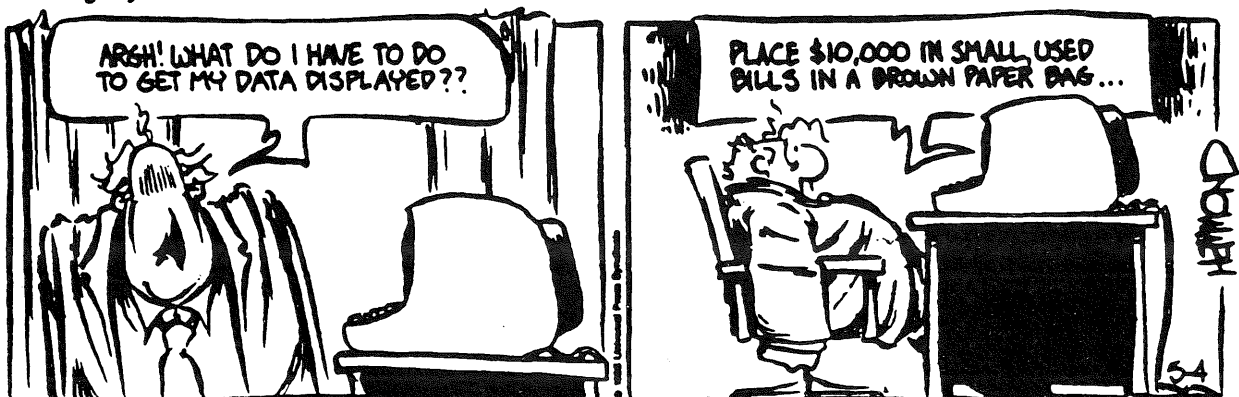
(Note: Forestry uses 9 versions of the MS-DOS operating system, from 2.0 through 4.0. Versions 2.1 and 3.3 predominate).

Needs Interview Highlights

Blueprint Project Committee members conducted in-depth Needs Assessment interviews with 43 Division of Forestry employees. 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. After each interview, Blueprint Project staff prepared a written summary of the interview and returned it to the interviewee for corrections or additions. Thirty-seven written responses to the Needs Assessment questionnaire were submitted by Division employees who were not interviewed. The most frequently offered comments were:

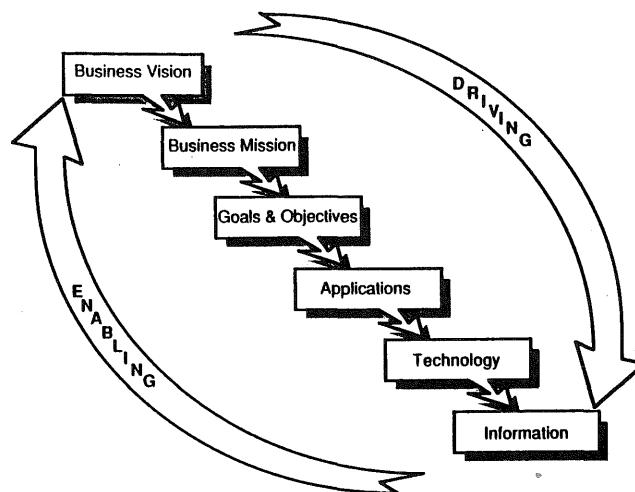
- Need ability to produce maps showing ownership, roads, project locations, and recreation facilities for internal use and public distribution
- Want ability to produce ad hoc reports from data entered into computer systems
- Appraisal data should be entered only once for use throughout the timber sales process
- The forest inventory, timber sales, and forest development record systems should be linked
- Need access to current and historical fire occurrence and weather data
- Should have ability to access fire status reports from other Areas
- Need a good, standardized process for work planning and accomplishment reporting at all levels of the organization
- The Division needs to provide adequate time for computer related training
- Mailbox needs to be improved or replaced
- Fax machines are a very popular addition to the Division's information systems
- There is a desire for additional office automation equipment at Field Stations - copy machines, PCs, fax
- Users should have access to data they have entered

Duffy by Bruce Hammond



Information Systems Vision

The Division's mission must drive the design and operation of its information systems. In other words, 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. The figure below illustrates this dual relationship between the Division's mission and its information systems.



Desirable Systems Characteristics

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
- 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

Information System Components

Information Systems consist of software, data, hardware, and people. The following paragraphs describe the important characteristics of these components in the Division's future information systems.

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. The Division should adopt and adhere to software standards for generic office automation tasks such as word processing and database management. New applications programs should relate to pre-defined databases and be easily transportable between hardware platforms.

Data is becoming an increasingly important component of information systems. The concept of a "corporate database" reflects this change from viewing data as belonging to a single application or organizational unit to viewing it as a resource to be available to meet the entire organization's needs. 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 will dictate that data redundancy be reduced and that databases survive even when the

associated applications are modified or replaced. A data dictionary describing each data entity will have to be developed and used.

The Division's basic hardware architecture will continue to be a central minicomputer with a communications system that supports PC-based workstations at Area and Region offices. Both transaction based applications (e.g., timber sales) and GIS applications will reside on the central minicomputer. A pilot project to evaluate the desirability of Regional GIS workstations is recommended. Stand alone PCs will continue to support office automation tasks and forestry applications that do not need to access central databases on the minicomputer.

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. Information systems staff will have 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. Information Systems Liaisons will be designated for each Area, Region, and St. Paul section to create a communication network and to provide systems users with a source of local help. 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.

Information Systems Modules (Applications Architecture)

This section of the Blueprint provides a conceptual overview of the Division's existing and potential information systems applications. The focus is on major statewide applications. It is not possible to cover small applications or applications used by a limited number of individuals. For convenience, the term module is used to refer to 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. Modules are an arbitrary means of segmenting the Division's information systems. For example, the Resource Inventory, Timber Sales, and Forest Development modules could have been viewed as a single timber management module. The Blueprint recognizes two types of modules. Subject area modules deal with selected Division activities (e.g., fire, timber sales) while functional modules (e.g., office automation, GIS) deal with generic information processing tools used to support a wide range of Division activities.

The Blueprint Technical Document contains detailed descriptions of ten systems modules. Each module description addresses the following topics:

- Current Condition
- Data Requirements and Characteristics
- Input
- Linkages to other Modules
- New Directions and Needs
- Users
- Output
- Hardware and Software Needs

The following summaries focus on the New Directions and Needs aspects of each module.

Forest Resource Inventory Module

The following desired capabilities for an improved Forest Resource Inventory module were suggested during needs interviews:

- There should be copies of Cooperative Stand Assessment (CSA) data available for use with a DBMS at Field Station, Area, Region, and St. Paul offices
- The CSA should be the foundation of an integrated forest resource management system
- Need to link the CSA to the Timber Sales and Forest Development modules, possibly through the CSA stand number
- Need the ability to link CSA data with soils data using a GIS
- Areas should enter CSA data corrections and alterations

- CSA inventory procedures should be used to record inventory data collected through the Private Forest Management program
- Need to merge CSA and Natural Heritage data
- Field data recorders should be used to collect CSA data
- Alterations should trigger changes in wildlife habitat compartment evaluations
- Need ability to share forest resource inventory data among agencies
- The system should identify stands needing updating (re-inventory)

Forest Development Module

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 to permit aggregation, analysis, and summarization of data at Regional and Statewide levels
- The current Development Record System should be converted to a DBMS
- Need better standard report generation capabilities and the ability to generate ad hoc reports
- There should be a goal of "seed to stand" tracking; a link between the Nursery and Forest Development modules
- The basic entity tracked in the Forest Development module should be a stand rather than a project
- Prescribed Burns should be entered in the Forest Development module (i.e., burns should be treated like other site activities)
- The drawing of operational level (i.e., site) maps associated with forest development activities should be automated
- Annual accomplishment reports and annual reports on regeneration by species should be generated by the Forest Development module
- 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

Timber Sales Module

The following desired capabilities for an improved Timber Sales module were suggested during needs interviews:

- Ability to access current year and historical timber sales data
- Need to map sales locations at site specific level and as points on an Area map
- Capability to produce local ad hoc reports
- Ability to access information on available stumpage (appraisals) from other Areas
- System should generate all forms and form letters used for timber sales
- Timber sales billing should utilize an accounts receivable system
- Data should be entered only once and used throughout the timber sales process
- The Timber Sales module should link to the Forest Resource Inventory and Forest Development modules
- The module should be able to generate accomplishment reports
- Loggers should be assigned vendor numbers to facilitate tracking of individual loggers
- Appraisal and scale processing could be done using PCs at Field Stations

Forest Road Module

The following desired capabilities for a Forest Road module were suggested in Blueprint Project needs interviews:

- Need a complete transportation system map in a GIS with associated attribute information for state forest roads
- Need improved means of recording and tracking of road construction, reconstruction, and maintenance projects
- Ability to produce ad hoc reports at the Area, Region, and State levels
- Ability to input and update forest road inventory records at the Area level
- Use 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
- Provision of gravel resource information
- Road design capability including earthwork calculations, drafting, and generation of graphics and specifications for contracts

Private Forest Management Module

The Private Forest Management (PFM) program established a committee to study information needs and suggest changes in information processing in 1987. The following list of desired features of a PFM module is based on that committee's recommendations and the results of the Blueprint Project needs interviews:

- Enter data from the Application for Assistance - capturing name, address, and legal description from the application would provide the cornerstone of a PFM system
- Generate a PFM Programmed Work list showing applicants and the service they desire from the Application for Assistance
- Collect forest inventory data on private land using the CSA inventory system
- The Division writes about 500 comprehensive plans for 45,000 acres each year - a report generator that can access stand data from the inventory and some generalized management guidelines would be useful in preparing these plans
- The Division writes 1,500 brief plans for 25,000 acres each year - 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 Field Station could be used to generate these plans
- Two methods of tracking follow-up needs are the tickler file method and the stand inventory method - both are useful and should be standardized and automated as part of the PFM module
- Capture basic landowner information from cost share referral forms
- Automate tracking of cost share referrals
- The Nursery currently sends each Area hardcopy printouts of private seedling orders sorted by county every 30 to 60 days during the seedling sales season - this report needs to be prepared more frequently and should be sorted by Field Station
- Standardize tracking of reforestation projects
- Integrate Tree Farm Record data with PFM database - basic data on landowners, location, acreage, inspecting forester, and planned activities is the same and should only be entered once
- Enter basic landowner information from Timber Sale Service Application
- Computerize timber appraisal calculations
- Standardize tracking of timber sales and generate standard forms
- Eliminate manual tracking of accomplishment data whenever possible - as the PFM module is developed a number of the items on the accomplishment report could be tallied automatically (e.g., acres planted, number of management plans)

- The PFM module should generate standard lists, forms, letters, and mailing labels required by the PFM program at all administrative levels
- CSA township cover type maps should include available data for private lands
- There should be an automated system to determine acreages and prepare project level maps
- PFM foresters should have read only access to Nursery Tree Order File to be able to check to see if a landowner has ordered trees
- Landowner management plans should be cross indexed with Federal Farm Numbers to better respond to federal agency requests for copies of management plans

Fire Module

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

- Create a historical fire occurrence and fire weather data base which is accessible by Areas, Regions, and St. Paul
- Areas, Regions, and St. Paul need to be able to generate ad hoc reports using current year and historical fire data
- Billing should be automated using data from the completed fire reports
- Automate resource orders 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 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 statewide
- 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 module 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 the Northern Fire Center and Field Stations, 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

Nursery Module

Information needs related to the Nursery module include:

- Need to use strategic planning information rather than historical trend data to prepare nursery seeding plans
- Need to be able to better match available stock to planting needs
- PFM foresters need Tree Order reports sorted by Field Station on a monthly basis from September through March
- Need GIS to prepare maps of nursery layout over time
- Need link between nursery seedlot tracing system and the Forest Development module to provide "seed to stand" tracking to analyze reforestation failures

Administrative Support module

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, with monthly report capabilities, useable at all levels of the organization
- Need an accounts receivable system for the Division that will serve the needs of all programs that generate bills being sent to customers
- Need 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
- 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 declared surplus
- Need access to statewide violation tracking system on the DNR 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 - they should get annual reports for each employee they supervise

GIS Module

The following needs and potential uses of GIS were mentioned during Blueprint Project needs interviews:

- A fully functional GIS should include frequently used spatial entities such as forest cover, road network, recreation areas, hydrology, soils, land ownership, wildlife habitat, forest industry locations, and unique cultural features
- The GIS should generate operational scale (4 or 8 inch per mile) maps for use in timber sales, development projects, forest inventory, prescribed burns, etc.
- Need maps for land management planning - especially maps of Timber Management Planning Information System (TMPIS) prescriptions to illustrate distribution of planned harvests
- Need to provide the public with maps showing ownership, roads, trails, and other features for hunting and other recreational uses
- GIS should be used to maintain forest inventory and forest development records on private lands served by the PFM program
- Should be able to plot traverses on base maps and calculate acreages

- Need to work towards a complete coverage of digitized soils and landform data with related interpretations for forest productivity, operability constraints, and ecological land classification
- Need to link wildfire database with digitized map data for fire protection planning, detection flight routing, dispatching, and prescribed burn planning
- Could use GIS to analyze soils, covertype, past management practices, and climatic factors in an attempt to determine causes of chronic pest outbreaks
- Could use GIS to integrate CSA inventory with Natural Heritage element data, wildlife openings, and other significant wildlife habitat information
- Need ability to produce color maps depicting up to four sections at a scale of 4 inches to the mile at Areas

Office Automation Module

The following needs related to Office Automation were mentioned during needs interviews:

- Need to use standard software throughout the Division
- The acquisition of hardware and software should be centrally coordinated within the Division
- Need a standardized mailing list format
- Installation of fax at Field Stations would improve communication and speed transmittal of information
- Ability to produce graphics for publications and presentations at Areas, Regions, and St. Paul
- Need to replace Mailbox with a more functional electronic mail system
- Field Stations could use fax, copy machines, PCs, modems, and field data recorders
- The Division needs a PC Administrator
- All offices should have tone dial telephones
- There is a need for electronic filing and document retrieval to reduce the number of duplicate paper copies filed throughout the Division
- There is a need for quick and easy access to current versions of statutes, policy documents, and manuals

Data Architecture

Data is becoming an increasingly important component of information systems. In the past, information system development was focused narrowly on single applications resulting in redundant and inconsistent data files that were difficult to link. More recent information systems models view data as a "corporate resource" that exists independent of application programs and must be managed in order to meet the entire organization's needs. A uniform and well defined data structure will facilitate integration among systems.

The development and maintenance of a comprehensive data dictionary for the Division is strongly recommended. A data dictionary defines data in terms of entities, attributes and relationships.

- **Entity** - An object, event, document, person, place or thing about which data is collected (Examples - stand, logger)
- **Attribute** - A characteristic or property of an entity (Examples - stand age, logger name)
- **Relationship** - An association between entities linked by common attributes (Examples - stand and treatments; logger and permits)

Two key steps in building a data dictionary for the Division are:

- Conduct a global data design project to identify important Division-wide entities and their relationships
- Supplement the global architecture with more detailed entity, attribute and relationship definitions prepared during system development projects

Database administration responsibilities must be clearly defined and assigned by the Forestry Information Systems (FIS) Supervisor. These responsibilities should reside with the FIS systems development staff.

Hardware and Software (Technology Architecture)

Minicomputer Needs and Recommendations

The Blueprint Project Committee used the following questions to objectively evaluate the Division's minicomputing needs.

1. Does Forestry have a need for minicomputing?

Yes. The Division of Forestry has a continued need for minicomputing to:

- Conduct complicated analyses that can't conveniently be done on personal computers
- Provide statewide summaries and reports from large databases
- Support applications that need to access up-to-date central files
- Operate as a central server for distributing information and files

To meet the Division's needs, the minicomputer must possess the following characteristics:

- Capability for high speed computation
- Ability to store and retrieve large amounts of data
- 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 (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 of files to remote locations
- Allow transaction processing at remote locations
- Open architecture to facilitate intermachine connection
- Ability to act as server for scientific workstations
- Ability to connect to DNR computer system

2. How many minicomputers does the Division need?

One. Minicomputing should be focused on one system to eliminate the redundancies and inefficiencies caused by the operation of several different systems. The complications of

operating multiple minicomputer systems include:

- Continued difficulties in integrating systems
- Duplicated facilities and staff functions
- Increased cost for purchase and maintenance of computer systems
- Difficult for users to know where to make requests
- Inefficient systems staff communications

3. Should the Division own its minicomputer?

Yes. The minicomputer system should be owned by the Division of Forestry for optimum control of service and costs. Initial inquiries indicated that a vendor would not be found that could effectively and affordably deliver the integrated GIS and data processing services required by the Division. Reasons for the Division to own a minicomputer include:

- Easier for designers and developers to establish and adjust facility and systems as needs are identified
- No computer rate and billing worries
- Potential for cost recovery is created
- Control over use and availability of system
- Avoids continued negotiation with vendor to meet changing needs

4. Where should the minicomputer be located?

St. Paul. The minicomputer should 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 a DNR GIS
- Make use of existing computer facility that will require little additional environmental preparation
- Have better access to computer maintenance services

5. Is joint or cooperative computer operation possible?

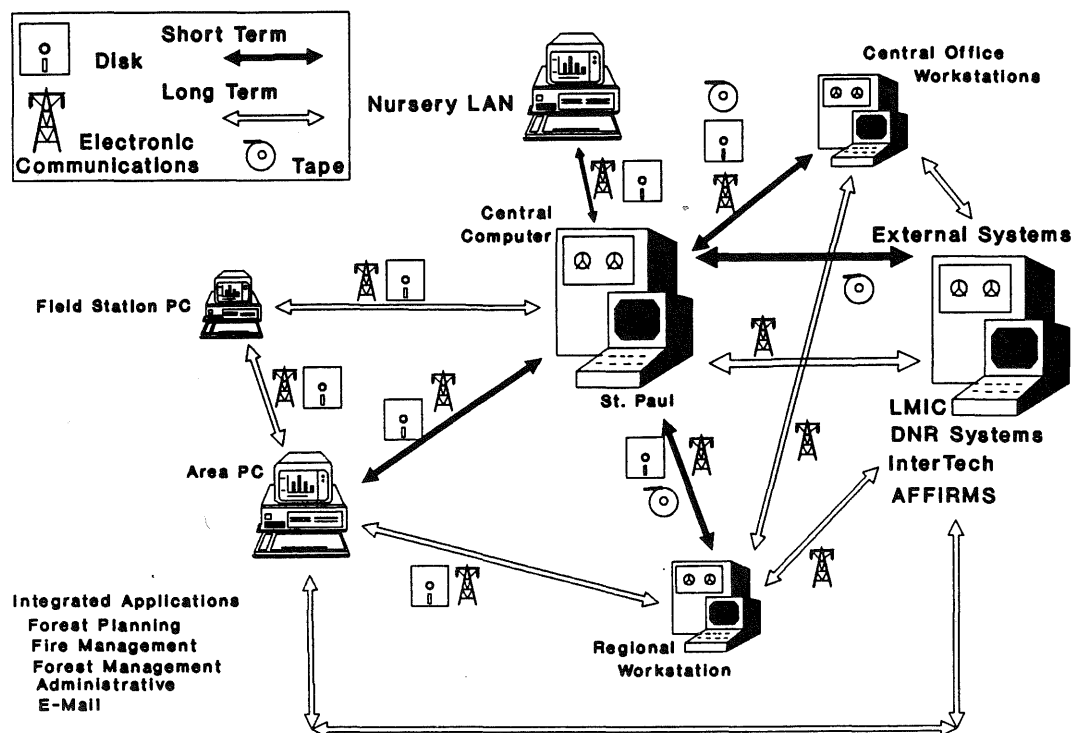
Yes. Alternative minicomputer location and operation arrangements considered included:

- Located at DNR MIS and operated by the Division of Forestry
- Located at State Planning Agency, Land Management Information Center (LMIC) and operated by LMIC staff
- Located at the Division's St. Paul offices and operated by Division of Forestry

The recommended minicomputing alternative is for the Division of Forestry to purchase its own system, initially locate it at LMIC, and purchase system support from LMIC. The reasons for recommending this option include:

- LMIC can operate the computer system, freeing Division staff of this responsibility
- LMIC can provide technical assistance for GIS and data systems
- Mutual training and development for LMIC and Forestry staff
- LMIC provides a better environment for interacting with other governmental units
- LMIC's existing computer facility would need very little upgrading
- Purchase of system using LMIC and Department of Finance financing agreement
- Easy access to LMIC's GIS map layers
- Use of LMIC's communication's equipment
- LMIC and Forestry computers could back each other up
- Could move system to DNR in the future

The figure below is a schematic representation of the recommended computer system architecture for the Division of Forestry.



Hardware and Software Recommendations for Field Stations

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

Hardware and Software Recommendations for Area Offices

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 suppressors 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)

Hardware and Software Recommendations for Region and St. Paul Offices

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)

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 Project 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 following lists summarize the recommended PC hardware and software for use in the Division.

Hardware

- **General Use Desktop PC** - MS-DOS compatible 286 class PC with 5.25" and 3.5" diskette drives, 40MB hard drive, and EGA color monitor
- **GIS and Heavy DBMS Use Desktop PC** - MS-Dos compatible 386 class PC with 5.25" and 3.5" diskette drives, 65MB or larger hard drive, and VGA color monitor.
- **Dot Matrix Printer** - 24 pin printers able to produce 200 dot per inch resolution with tractor and friction paper feed and Epson LQ standard emulation
- **Laser Printer** - Either Postscript or HP Laserjet emulation standards with 300 dot per inch resolution.
- **Modem** - Support Hayes AT command set, Bell 103, Bell 212, X.25 (optional), and V.32 (optional) protocols. At least 2400 baud speed with auto switching to slower speeds
- **Mouse** - Microsoft mouse compatible, serial or bus type
- **Desktop Plotter** - Hewlett Packard Graphics Language (HPGL) command set compatible
- **Scanner** - Capable of exporting standard TIFF or PCX files
- **Surge Protector** - Meets Underwriters Laboratory standard UL1449

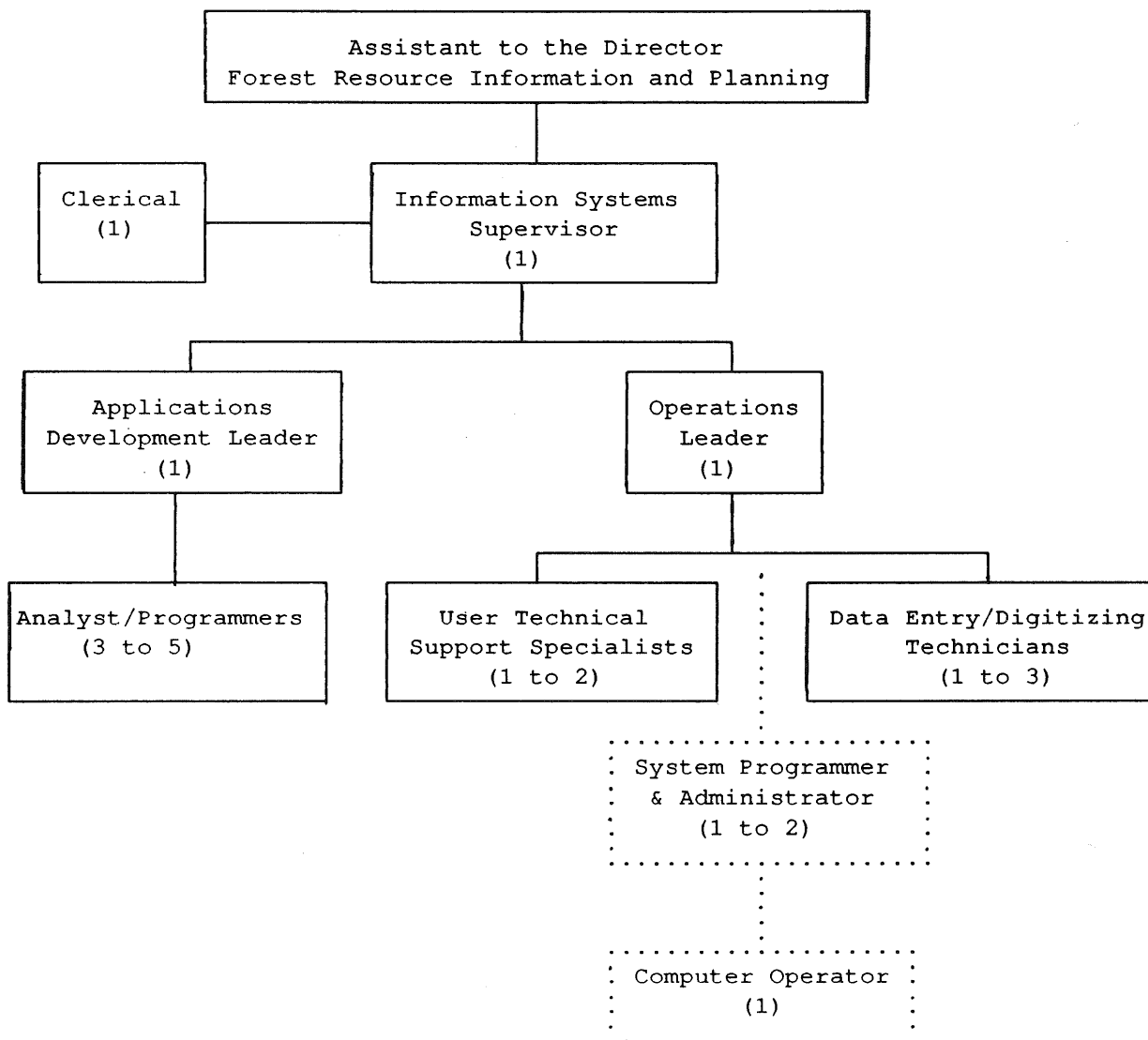
Software

- **Operating System** - MS-DOS 3.3 or PC-DOS 3.3
- **Word Processing** - WordPerfect 5.0
- **Database Management** - Ability to import and export flat ASCII files. R:Base for DOS version 2.0 or higher, PC-File III
- **Spreadsheet** - Ability to read, write, and operate Lotus-style .WK1 and .WKS formats. Lotus 1-2-3, Quattro

- **Business and Presentation Graphics** - Ability to produce VGA resolution screens, import and export TIFF or PCX files, ability to import .WK1 and .WKS data, ability to export graphic image to WordPerfect. Lotus Freelance, Corel Draw, PC Paintbrush, Harvard Graphics 2.1 (does not import TIFF or PCX files)
- **Communications Software** - Ability to operate with Hayes AT command set modems and provide automatic speed switching for 300, 1200, and 2400 baud. Procomm+, Bitcom, Crosstalk, Smartcom
- **Backup Utility** - Fastback Plus 2.0 or higher
- **Desktop GIS** - EPPL 7

FIS Staffing

The diagram below represents the recommended organizational structure for the Forestry Information System (FIS) Unit. The FIS Unit should be part of the Forest Resource Information and Planning section. Duties and responsibilities for the major FIS staff positions are outlined on the next page.



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

Duties and Responsibilities of FIS Staff

Information Systems Supervisor

- Leadership and direction
- Planning
- Communication with DMT
- Interact with DNR
- Administer staff and budget
- Negotiate agreements
- Standards
- Training
- Project proposal development
- Project review and progress reports

Applications Development Leader

- System development leader
- Systems maintenance
- Project team member
- Policy, procedures, standards
- Logical database design
- Data dictionary
- Integration of systems
- Project review
- Contracts and RFPs

Analyst/Programmers

- Project team member
- Design and develop systems
- Documentation
- Programming
- Test and implement systems
- System maintenance
- Logical database design
- Data dictionary maintenance
- User application assistance
- Production assistance
- Analysis and special requests

Operations Leader

- Lead and direct
- Technical user support
- Head liaison network
- FIS newsletter
- Technical training
- Hardware/software standards
- Review of purchases
- Hardware/software inventory
- Help desk supervision
- Data entry and digitizing supervision
- Computer services contracts

Technical Support Specialist

- PC technical support
- Work with liaison network
- Assist with installation
- PC training
- Update PC standards
- Distribute PC standards
- Help desk operation
- Assistance and referrals
- Keep "expert" list
- Test new PC software
- Test new PC hardware
- Keep equipment inventory
- Keep software inventory
- Inventory of applications

Computer Operations Staff

- Operate minicomputer
- System administration
- System programming
- Network administration
- System upgrades
- Install new system software
- Install new equipment
- Facility management
- Work with project teams
- Software support
- System backups
- Equipment maintenance
- Production assistance
- Order supplies
- Monitor system performance
- Schedule use of system

User Communication and Training

The need for training and ongoing communication among system users was mentioned in nearly every Blueprint Project needs interview. Providing training and communication to support the users 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 Division should publish an information systems newsletter containing short articles on systems applications, training opportunity announcements, a question and answer section, and a user forum. The newsletter would be printed and distributed as a loose leaf insert in *Roots*.

Improve Computer Related Training

Nearly half of the Division employees interviewed mentioned the need for systems related training. Employees, supervisors, systems staff, and the Human Resources program all have roles to play in improving training. Employees and supervisors are responsible for ensuring that employees have adequate skill training if systems use is a part of the employees job. Systems staff should identify, evaluate, and publicize systems training opportunities. Human Resources program staff should review minimum qualifications for various positions with respect to computer skills and include appropriate training opportunities in the course catalog.

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. Almost everyone supported continuation of the Help Desk and were generally satisfied with the service they received. The primary recommendation related to the Help Desk is that it become a responsibility of a single individual on the systems staff.

Create a Forest Information Systems Liaison Network

FIS Liaisons should be designated for each Area, Region, and St. Paul section. FIS Liaisons will: be local contacts for help with systems use; assist in acquiring and installing systems in their work units; help evaluate new software and hardware; and assist in the preparation and evaluation of systems development proposals.

Policies and Procedures for Systems Development

To develop effective, integrated systems with consistent and compatible databases, the Division should implement a set of system development policies and procedures. These policies and procedures must be followed when developing systems that have Division-wide application and will be used on a recurring basis.

The systems development process must involve managers and users as well as systems staff. Managers are ultimately responsible for seeing that the Division's information systems are helping the Division achieve its mission. Top managers must assume responsibility for the planning, funding, and support of information systems. Users must understand the capabilities of existing systems, clearly communicate their information system needs, and participate in the design, development, testing, and use of new systems.

Division-wide systems should be developed by Project Teams following a six stage development procedure.

- Suggestion for System
- Project Proposal
- Conceptual Design
- Detailed Design
- System Construction
- System Implementation and Use

Project Teams will generally have three to five members (including users and analysts). Project Teams should be directed by Project Leaders who usually will be from the user community and will be able to provide leadership ability and authority. The Teams will:

- Involve management and users, getting their input and approval and providing feedback
- Carry a system development project from the proposal through design, construction, and implementation
- Use standard database and system design procedures to insure consistency and integration
- Maintain standards, technical validity, and integration with other systems

Implementation Plan

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 major tasks that should be undertaken are listed below. 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
- Hire an Information Systems Supervisor
- Adopt and Implement PC Hardware and Software Standards
- Develop TI 990 Conversion Strategy
- Publish IS Newsletter
- Adopt Systems Development Policies and Procedures
- Establish FIS Liaison Network
- Develop Global Data Architecture
- Incorporate Blueprint Goals in DNR and Division Strategic Plans

Stage 2 Implementation Tasks

- Organize and Staff FIS Unit
- Develop Equipment Specifications and Evaluate Proposals
- Prepare Contract with Vendor Providing Computer Services
- Implement TI 990 Conversion Strategy
- Conduct GIS Workstation Pilot
- Update FIS Plan and Prepare Budget for 1991 - 93 Biennium
- Improve IS Training
- Develop Systems Applications
- Install PCs and other Equipment in Field Stations

