E82-10108

AgRISTARS

RR-L1-04146
JSC-17422
NASA-CR-167448

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

Renewable Resources Inventory

September 1981

SAN JUAN NATIONAL FOREST LAND MANAGEMENT PLANNING SUPPORT SYSTEM (LMPSS) REQUIREMENTS DEFINITION FINAL REPORT

L. F. Werth

(E82-10108) SAN JUAN NATIONAL FOREST LAND MANAGEMENT PLANNING SUPPORT SYSTEM (LMPSS) REQUIREMENTS DEFINITION Final Report (Lockheed Engineering and Management) 41 p HC A03/MF A01 CSCL 02F G3/43

N82-21649

Unclas 00108

Lockheed Engineering and Management Services Company, Inc.
1830 NASA Road 1, Houston, Texas 77058

Lyndon B. Johnson Space Center
Houston, Texas 77058

1. Report No. RR-L1-04146; JSC-17422	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle San Juan National Forest Land Management Planning Support System (LMPSS) Requirements Definition Final Report		5. Report Date September 1981
		6. Performing Organization Code
7. Author(s) Lee F. Werth		8. Performing Organization Report No. LEMSCO-17163
9. Performing Organization Name and Address Lockheed Engineering and Management Services Company, Inc. 1830 NASA Road 1 Houston, Texas 77058		10. Work Unit No.
		11. Contract or Grant No. NAS 9-15800
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, Texas 77058 Technical Monitor: R. E. Joosten		13. Type of Report and Period Covered Final - September 1981
		14. Sponsoring Agency Code

15. Supplementary Notes
The Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing is a joint program of the U.S. Department of Agriculture, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration (U.S. Department of Commerce), the Agency for International Development (U.S. Department of State), and the U.S. Department of the Interior.

16. Abstract
This paper presents the requirements definition for the design of a land management planning support system for the San Juan National Forest, Colorado. The concept uses remote sensing data in a geographic information system, data base management, and planning model. This task is part of the Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing program, Renewable Resources Inventory project.

17. Key Words (Suggested by Author(s)) Data base management; Geographic information system; Land management planning; Natural resources; Remote sensing; San Juan National Forest	18. Distribution Statement

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 41	22. Price*

*For sale by the National Technical Information Service, Springfield, Virginia 22161

JSC Form 1424 (Rev Nov 75)

NASA — JSC

RR-L1-04146
JSC-17422

SAN JUAN NATIONAL FOREST LAND MANAGEMENT PLANNING SUPPORT SYSTEM (LMPSS) REQUIREMENTS DEFINITION

FINAL REPORT

Job Order 72-542

This report describes activities of the Renewable Resources Inventory project of the AgRISTARS program.

PREPARED BY

L. F. Werth

APPROVED BY

A. V. Mazade, Project Manager
Forest and Range Project Office

LOCKHEED ENGINEERING AND MANAGEMENT SERVICES COMPANY, INC.

Under Contract NAS 9-15800

For

Earth Resources Applications Division
Space and Life Sciences Directorate
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

September 1981

LEMSCO-17163

PREFACE

The Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS) is a multiyear program of research, development, evaluation, and application of aerospace remote sensing for agricultural resources, which began in fiscal year 1980. This program is a cooperative effort of the U.S. Department of Agriculture, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration (U.S. Department of Commerce), the Agency for International Development (U.S. Department of State), and the U.S. Department of the Interior.

The U.S. Department of Agriculture Forest Service has been mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974 (later amended by the National Forest Management Act in 1976) to prepare land management plans every 10 years for every forest in the National Forest System.

One of the goals of the Renewable Resource Inventory effort, funded under AgRISTARS is to test and evaluate the use of remote sensing data for multi-resource inventory and land management planning. Remote sensing data can serve as an important tool for inventorying and updating changes for the vast acreage of the National Forest Service. The specific objective of this paper is to describe the land management planning requirements for the San Juan National Forest, Colorado, to support the design of an efficient and effective support system that uses remote sensing data.

The author acknowledges the contributions of personnel of the San Juan National Forest and Nationwide Forestry Applications program, who provided many valuable concepts which form the basis of this report. Support and guidance from Hank Bond and Jimmy Bell were vital throughout this task.

CONTENTS

1. INTRODUCTION

1.1 OBJECTIVE

The goal of this paper is to describe the land management planning requirements for the San Juan National Forest so that an efficient and effective system of resource data management, utilizing remote sensing and other techniques, can be designed and implemented for the next planning cycle, or after 1985. The role of remote sensing data as it relates to a three-component planning system (geographic information, data base management, and planning model) can be clearly understood only when the user requirements are known. In fact, the design of any system for inventory, updating, and monitoring would have very limited application unless the user needs are clarified in the beginning.

It is recognized that requirements documented at this point in time are not absolute and are subject to change when policy changes, when new insight and information are gained through learning processes, when hindsight corrects foresight, and when personnel change. The requirements described in this report refer only to information gathered from intensive informal discussions with San Juan National Forest personnel during March 1981, and in subsequent followup conversations.

1.2 BACKGROUND

The land administered by the U.S. Department of Agriculture (USDA) Forest Service covers 187.6 million acres, or 8 percent of the total land in the United States. Since its inception in 1891, the Forest Service has been charged with managing and protecting this vast acreage. At first, the Forest Service served primarily as protector against fires but later started to inventory the timber and range resources. The objective of the early inventories was to determine how much timber was available for harvest. These inventories, called "timber cruising," were taken from sample strips laid out to determine total available volume. The timber cruising was done either on foot or by horseback. Forest cover type mapping was done only for small project areas using a plane table survey. These early methods required a lot of man-hours and were generally done only on areas subject to timber harvest.

In the 1930's aerial photographs were used to help determine the intensity of sampling and to map forest cover types. By 1939 the Forest Service started to manage the forests based on multiple-use principles. In 1960 the Multiple-Use and Sustained Yield Act was passed by Congress, and it endorsed the Forest Service's policy of multiple-use management and formalized land management planning as a distinct process. As the population expanded and the resource base shrank, the public demanded that the Forest Service carefully plan the allocation of goods and services to meet society's needs. Congress responsed to public pressure by the passage of several bills (discussed later) that mandated long-range planning. The need for more comprehensive inventories, done quickly and with reduced manpower and cost, has set the stage for increased use of remote sensing technology, thus incorporating remote sensing systems as land management tools. Remote sensing includes not only the old black-and-white photographs but also high-altitude color and color-infrared photographs, radar, and satellite data.

1.3 LAND MANAGEMENT PLANNING

The first emphasis was on the timber resource; therefore, the first plans were for timber management. These plans, generated at the district level, included items such as total available volume by species, age classes, existing access, hauling distance to mills, and economic impact on local communities. From this information, which is not meant to be all inclusive, district managers could determine how (1) to put the planning area (working circle) into sustained yield management (even distribution of age classes), (2) to estimate annual allowable cut, and (3) to determine the location of planned new roads and their proposed contribution to the local economy.

However, as society's needs changed from strictly consumptive uses to nonconsumptive uses, such as recreation and sight seeing, and public environmental awareness increased, a need arose to inventory and analyze other resource variables.

After passage of the National Environmental Policy Act in 1969, the requirement for environmental impact statements led to more comprehensive inventories and analyses. The real driving force behind land management planning was the Congressional directive under the Resources Planning Act (RPA) of 1974. The RPA directed the Forest Service to prepare long-range programs for the National Forest System for the next 40 years in 5-year stages. The RPA is a planning and budgetary procedure act and includes administration, roads and trails, research, and cooperative programs. Since 1975, annual progress reports have been prepared which include an assessment of present and anticipated supply-and-demand needs and an inventory of present and potential resource opportunities. In 1976 Congress amended the RPA with the National Forest Management Act (NFMA). Some of the major changes to RPA were new timber management authorities, and the NFMA provided for "a coordinated land management planning process that requires full public participation in the development and revision of land management plans."

Basically, land management planning is the process whereby the supply of goods and services is most efficiently allocated according to society's needs. This means that, from a comprehensive multiresource inventory, the various land parcels are allocated to one or more uses according to the land's capability and suitability. The effective allocation of these parcels depends on the proper blending of public issues, management concerns, management prescriptions, and alternatives. These ingredients are processed through the three components of the land management planning process, which are a geographic information system, a data base management system, and a planning model.

1.4 SAN JUAN NATIONAL FOREST

All of the forests of the National Forest System are required to prepare land management planning requirements by 1985 and every 10 years thereafter. This paper will focus on the requirements for the San Juan National Forest located in southwestern Colorado. The San Juan National Forest is 2,101,500 acres in extent, of which 1,867,782 acres are National Forest System lands, and represents a diverse landscape of high mountain peaks, flat mesas, canyons, and valley bottoms. The San Juan National Forest is one of 16 forests in USDA Forest Service Region 2.

2. FUNCTIONAL INVENTORY REQUIREMENTS

The functional resources refer to a specific use of the land such as timber, range, wildlife and fisheries, and recreation. The specialists in these use areas have certain requirements for project planning, administration, and day-to-day activities. The first functional groups to be examined will be vegetation or timber and range.

2.1 TIMBER

The timber specialist is primarily concerned with finding and mapping productive timber that is capable, available, and suitable for harvest. Timber that is capable and available for harvest is known, but timber that is suitable for harvest is an economic and political decision that will be determined through the land management planning process. The major requirements for the timber inventory are listed in table 2-1; other inventory requirements such as fragile soils, key wildlife areas, and sensitive scenic areas would also be useful. What is desired is to encode key existing information into a data base and to be able to retrieve it quickly and display it. Key information will vary depending on what is being accomplished. For example, determining lands capable of producing timber requires different information than determining lands available for harvest.

The inventory of existing vegetation is necessary for planning and management, but it is important also to have the potential native plant community, such as Daubenmire's habitat types, so the timber specialist can see the location of present vegetation on the successional gradient and the production potential for each site. Appendix A presents a current Stage II analysis as an example of available data base information.

2.2 RANGE

Fundamentally, the range specialist needs to know the quantities and locations of vegetation, slope gradients, rock, surface water, and barren areas to determine the amount of usable and unusable range in a given area. The range analysis on the forest shows the amounts and locations of usable and unusable range; however, updates need to be made as range conditions change. Existing vegetation data and potential natural vegetation production data are necessary. Range conditions comprise the current productivity (species and biomass) of a range relative to what that range is naturally capable of producing. The basic requirements for range inventories are listed in table 2-1.

2.3 WILDLIFE AND FISHERIES

Primary requirements for the wildlife biologists are given in table 2-1. Knowledge of existing vegetation is important to determine the habitat diversity index and to rate areas according to low, medium, and high diversity. Vegetation manipulation projects can then be recommended for low diversity areas. A knowledge of potential vegetation and the succession patterns is also necessary, inasmuch as the present plant community changes with time and management. Riparian habitat types need to be identified, and areas lacking adequate water, habitats of specific wildlife species, and the animals actually occupying the habitat need to be inventoried.

The inventory of fisheries should identify fishable streams and streams that need fish habitat improvement.

2.4 WATER

Requirements for the hydrologists are all related to factors affecting the hydrologic cycle. For example, factors such as stream channel characteristics (stability), water yield, sediment yield, and vegetated and nonvegetated areas are needed to make an adequate assessment and recommendation. Other requirements are listed in table 2-1.

2.5 SOILS AND GEOLOGY

Clearly, the most important requirement is to get a soil survey of the San Juan National Forest because, so far, only about one-half of the forest has been surveyed. Primarily, the eastern 40 percent and two areas of the western portion comprise the completed areas. A survey to at least order 3 (family)

TABLE 2-1.- FUNCTIONAL REQUIREMENTS

Functional group	Key elements*	Most important cover types and minimum accuracy acceptable	Minimum mapping unit (acres)	Minimum overall class accuracy allowed at 95-percent confidence level	Geographic position accuracy (feet)
Soils and geology	Soils Survey Bare areas % ground cover Rock types Amount of rock Mass movement Talus slopes		40	Not applicable	360
All groups (baseline)	Slope Aspect Elevation Watersheds Soil productivity			Not applicable	
Timber	Stand size Basal area Stand location Timber type DBH size class	Spruce-fir = 90% Douglas fir - white fir = 90% Ponderosa pine = 90% Nonforest = 75% Mixed conifer = 75% Aspen = 80% Pinyon-juniper = 75% Oakbrush = 80%	3 to 10	75-90%	360
Range	Range type Range condition Noxious weeds Rock and barren Range capacity Range trend	Range types 1 and 2 = 90% Aspen = 80% Oakbrush = 80% Conifer with forage = 75% Pinyon-juniper = 75% Others = 75%	5 to 10	75-90%	360
Wildlife and fisheries	Habitat diversity Road density Riparian Stream width Stream pools Stream riffles	Riparian = 90% Aspen-ponderosa = 90% Mixed shrub = 75% Oakbrush = 75% Aspen = 75% Mixed conifer = 75% Alpine willow = 75%	Riparian = 5 Aspen-ponderosa = 5 Others = 10	75-97%	360
Water	Stream channel characteristics Riparian Vegetation vs. nonvegetation Wetlands Disturbed areas Water quality	Vegetation vs. nonvegetation = 90% Spruce-fir = 90% Mixed conifer = 75% Aspen = 80% Ponderosa pine = 90%	Second order watershed	Not applicable	360

*Key elements listed here should be accessible by functional groups for analysis. This table shows the elements of greatest concern to each functional group.

and preferably to series and phase of a series would be very useful for the functional resources such as timber and range. Soils information should be the foundation for other resource disciplines in their decision-making processes. In addition, the soils scientist would like to be able to distinguish the different rock types (to determine parent material) without extensive field checking and to know the different types of talus slopes for potential uses. The percentages of ground cover, bare areas, and rocks are important to know (table 2-1). It would also be helpful if initial stages of mass movement (e.g., mudslides) and erosion could be detected before occurrence. For soils and geology, as with the other resource areas, existing vegetation data are important as are the potential native or natural vegetation data.

3. REQUIREMENTS FOR LAND MANAGEMENT PLANNING

Generally, there are no rigid and inflexible directions going out to the regions and National Forests regarding land management planning requirements. This is in agreement with the Forest Service tradition of decentralized control. There are, however, some directions to the National Forest regarding land management planning requirements, and they are discussed below.

3.1 NATIONAL

To implement provisions of the Forest and Rangeland Renewable Resources Planning Act and the National Forest Management Act, the USDA issued rules and regulations that were published in the *Federal Register* on September 17, 1979. Rules and regulations were developed primarily from recommendations by a committee of scientists. Other than reaffirming the needs for public participation, an interdisciplinary approach to planning, interagency cooperation, the formulation of alternatives, and other items, the rules and regulations were not very specific, especially regarding planning requirements for the data to collect. USDA rules and regulations emphasized that after 1995 data collection and reporting would be standardized. However, functional requirements in the *Forest Service Manual* and other directive documents vary from nonexistent to very specific. An extract from the Timber Resource Records portion of the *Forest Service Manual* may be examined in appendix B.

The Land Management Planning Office in Washington, D.C., has not issued strict requirements to the regions and forests, except to state that FORPLAN would be used as the planning model for the first planning cycle. The Land Management Planning Unit in Fort Collins, Colorado, has given some direction to the regions in that the basic planning unit would be the capability area and the analysis area would be the input into FORPLAN. The specific geographic information system to be used by the regions is open, but USDA encourages the use of the Resource Information Display System (RIDS). The regions can select the data base management system to use, but funding will be provided only if they use System 2000.

3.2 REGIONAL

Other than the *Forest Service Manual* mentioned in subsection 3.1, as of March 1981 only four memorandums have been sent to personnel in Region 2 of the Forest Service giving additional direction on the process requirements for land management planning. The fact that the process data of all the forests are uniform in format, cover design, etc., is of primary concern. No direction or requirements have been given as to the information which will be collected. The region is leaving that up to the unique situations of each National Forest.

3.3 SAN JUAN NATIONAL FOREST

For planning purposes, resource data for the San Juan National Forest are stored and processed at three hierarchical levels: the geographic area, capability area, and site type. Geographic areas are approximately equivalent to fourth order watersheds. The National Forest identification team mapped the capability areas according to geology (parent material), landform, slope, dissection, vegetation zone (primarily potential native or natural vegetation), and special modifiers or hazard areas such as rock and land slides. The capability areas are relatively homogeneous regions where the response to management prescriptions is believed predictable. The site types are the smallest parcels of land defined by existing vegetation, and they are stored in the data base at the site type level.

Analysis areas are the units that are input into the FORPLAN model to determine outputs and allocations. They do not represent a particular parcel of land but can be scattered randomly within the National Forest. Analysis areas are defined by existing vegetation, size class, slope percentage, and road status. It is a long and arduous process to take output from the planning model and find the parcels on the ground, the reason being that no direct link exists between RIDS (the geographic information system which locates these parcels of land) and System 2000 (the data base system which houses the data used to make decisions).

On the first cycle of planning, R2MAP will be used as the geographic information system, System 2000 as the data base management system, and FORPLAN as the resource allocation model. Appendix C presents System 2000 input codes and coding forms. Appendix D shows a portion of a FORPLAN output. Frustrations and experiences during this first cycle illustrate the need for a better system during the next planning cycle. One that is not so time consuming and requires less manual labor is desired. This may be accomplished by installing a geographic information system with data base management capabilities. Also, future efforts will require more specific and uniform data within and between the resources. See table 2-1 for current data minimums.

For planning at the National Forest level, the planners need the existing vegetation size, class, and basal area, something the presently defined capability area does not give. The existing vegetation classification accuracy of homogeneous timber stands and range types derived from Landsat data is 80 to 90 percent, but heterogeneous timber stands and range types vary from 30 to 75 percent. The accuracy should not be lower than 75 percent. The commercial species should have greater accuracy than noncommercial species. The minimum mapping unit should be 10 acres, and the geographical positional accuracy of the mapping unit should be within 360 feet.

The geographic information system should be able to handle polygons and manipulate the various resource layers (such as aspect, soils, elevation, range, timber, and minerals) and administrative and political boundaries. All the layers should be tied to a ranger district. Planners and resource managers want to be able to retrieve information quickly and display the area where the management prescription is to be applied. They also want a geographic information system in which scale can be changed.

In the next planning cycle, it is anticipated that a new model other than FORPLAN will be used or that FORPLAN will be modified and equipped with better instructions on its use. The present FORPLAN model has the following limitations:

a. It was designed for timber primarily.

b. It uses tabular data and not physical land entities; therefore, it is difficult to handle areas adjacent to analysis areas.

c. There is a limitation on the number of prescriptions that can be applied to an analysis area.

d. It does not really tell the impacts of prescriptions on other resources such as recreation and minerals.

e. It should have timber age class for allocation but loses it in the model.

f. It does not permit the use of capability areas, contrary to the original intention.

The total land management planning system should be developed to cost no more than 5 cents per acre (average) and to require no more than 3 man-years of personnel. The average yearly cost of the system should not exceed $180,000 (1980 dollars). The cost during some years may exceed this amount, but other years would have to be lower to maintain the average value. National Forest personnel want a land management planning system that is easy to use and requires only a short training period.

3.4 DISTRICT

The ranger district, the basic working level, is required to collect and feed information into the National Forest supervisor's office regarding resource inventory and activities. For example, the ranger district provides maps and data showing vegetation manipulation history, plantation records, regeneration success counts, etc. Districts need the capability to produce accurate resource inventories and to monitor and update an interactive data base.

4. COMPATIBILITY OF FUNCTIONAL INVENTORY VERSUS PLANNING

Generally, with some exceptions, the minimum mapping unit requirement of 10 acres is the same for planning and for functional resource management. The geographic positional accuracy is somewhat the same for both, and the overall classification accuracy varies somewhat. The large disparities between functional resource management and planning are (1) the key variables needed and (2) the ability to retain the integrity of a parcel of land. For example, the parameters used to map the capability areas do not provide enough information to determine range capacity. For wildlife purposes, there is no way of relating capability areas to wildlife management indicator species because of species mobility. The capability area units do not provide very much information for timber purposes. However, if information on timber stands (such as volume, number of stems per acre, and basal area stocking) can be related spatially to capability areas, a printout of the stands would be very helpful.

The areal extents of capability areas are generally too great to meet many of the functional group's requirements. Primarily, functional groups prefer mapping units that are more specific (10 acres or greater) and not so generalized. The capability areas are large because they are used to store other resource information. If capability areas were smaller, the volume would be too cumbersome to store in System 2000.

Attempts at entering all the data needs for each functional area into a large data base and using this for planning have been only partially satisfactory. What is needed is a fundamental inventory related to a "physical piece of real estate" that includes basic information on soils, vegetation characteristics, landform and slope, and aquatic areas. The closest thing to this is the National Site Classification System (NSCS) developed at Fort Collins, Colorado. The problem with applying NSCS to the San Juan National Forest is that the vegetation component is potential native or natural vegetation. Linkage from NSCS to current high-commercial-value vegetation has not been fully developed at this time. Presently, potential native or natural vegetation of a Daubenmire-habitat-type level has not been identified or mapped on the San Juan National Forest. Also, a complete soil survey is lacking for a large portion of the forest.

The fundamental inventory should provide the following information and have the capacity to be aggregated and disaggregated from a district level forest to the regional level and to the national level.

a. Information on vegetation: area, extent, location, structure, ecological succession, and stages.

b. Information on substrate: soils and slope.

c. Information on water: quality, amounts, extent, and duration.

d. Information on fauna: species, number, and distribution.

e. Information on landform: geology dissection.

f. Information on minerals: current and potential production.

g. Information on recreation: current and potential activities for recreation.

h. Information on stream inventory: stream and channel characteristics.

This proposed inventory would probably not meet all of the functional resource data needs, but at least the gap between functional management and planning would not be so wide as it is at this date.

5. ROLE OF REMOTE SENSING IN LAND MANAGMENT PLANNING

Although all of the information required for planning cannot be obtained using remote sensing techniques, a good share of it can. For instance, habitat types cannot be mapped with existing remote sensing techniques, but some existing vegetation parameters can be mapped.

The major role of remote sensing in land management planning will be to input information into the geographic information system. Remote sensing should not be constrained to the use of only one type of sensor. A wide range of remote sensors such as small- and large-format cameras, synthetic aperture radar, and Landsat data should be utilized. Because of the detail and accuracy required, high-altitude color infrared photographs should serve as the baseline data base and be supplemented and updated with small-format cameras, synthetic aperture radar, and Landsat data. Small-format, color infrared photography (35- and 70-millimeter) could be used for photographing priority areas and areas that cannot be adequately mapped from high-altitude imagery, and also for monitoring. Synthetic aperture radar data may help separate some land-cover and land-use classes and provide information on soils, dissection, and soil moisture. Because of repetitive coverage, Landsat data may be good for monitoring and updating some of the forest changes, but Landsat spectral data alone would probably not meet planning requirements. Landsat data supplemented with ancillary information (soils, elevation, slope, and aspect) and maybe even synthetic aperture radar would be promising for monitoring and change detection.

APPENDIX A

EXAMPLE OF A STAGE II STAND ANALYSIS PRINTOUT

STAGE II STAND ANALYSIS SAN JUAN J92-ANIMAS-CASCADE CK-PINE DIST-UP RFA   DATE 012679   PAGE 22

DL/ID 106601* 5 CASCADE CREEK   INDV RUN   NET_MERCH FACTORS   PAGE TYPE 1

-COMPARTMENT-	-STAND-	-COMPUTED TYPE&STANDSIZE-		-YR OF ORIGIN-
106601	5	SPRUCEFIR	SAWTIMBER	1873

-SUMMARY OF HEADER INFORMATION-

FIELD DATA:

GROUND LAND USE CLASS	20
TYPE OF SURVEY	943
DATE OF SURVEY	1078
SAMPLE KIND	7
NO. OF SAMPLE POINTS	16
BASAL AREA FACTOR	60
FIXED PLOT SIZE	300
GROWTH PERIOD	0
SLOPE PERCENT	50
SLOPE POSITION CLASS	2(WET SIDEHILL)
ASPECT	1(N)
EROSION CONDITION CLASS	1
PLANT COMMUNITY	A GA01
STAND ORIGIN	1
SEED SOURCE	1

PHOTO AND MAP DATA:

PHOTO IDENTIFICATION	F16C008000973111
PI LAND USE CLASS	0
PI TYPE	0
PI STAND SIZE CLASS	0
LEGAL LAND DESCRIPTION	039N009W11
GELO-CELL	0
ELEVATION MIDPOINT	0
SOIL-MAP-UNIT	
RANGE ALLOTMENT NUMBER	311
RECREATION-COMPOSITE	00004223

OFFICE DATA:

STATE	8
COUNTY	111
DISTRICT	1
OWNERSHIP	11
WATERSHED	14080300290
M.U.M. ZONE	1
PLANNING UNIT	0
LAND USE TREND	0
RAM-TIMBER-CLASS	
ECO-LAND-UNIT	0

AREA DATA:

STAND AREA ACRES	153.0
NON-FOREST-NCFL:CODE	0
STANDARD COMPONENT:CODE	0
STANDARD COMPONENT:ACRES	0
SPECIAL COMPONENT:CODE	0
SPECIAL COMPONENT:ACRES	0
MARGINAL COMPONENT CODE	700
MARGINAL COMPONENT ACRES	153
UNREGULATED COMPONENT:CODE	0
UNREGULATED COMPONENT:ACRES	0

Stage II Print out for one stand.
Key portions of this data should be included in the data base.

STAGE II STAND ANALYSIS SAN JUAN JA2-ANIMAS-CASCADE CK-PINE DIST-UP REA DATE 012679 PAGE 23

DL/ID 106601* 5 CASCADE CREEK INDV RUN NET MERCH FACTORS PAGE TYPE 2
SAMPLE POINTS 16 SAMPLE TREES 76

ORIGINAL PAGE IS OF POOR QUALITY

-PER ACRE MEASUREMENTS BY TREE CLASS-

MEASUREMENT	DESIRABLE	ACCEPTABLE	GROWINGSTK	CULL	LIVE	SND DEAD	TOTAL	CVS(TOTAL)	SES(TOTAL)	70%CI(TOTL)
TREES(0IN+)	367.	192.	559.	206.	765.	5.	770.	101.	24.	198.
BASAL(5IN+)	97.	64.	161.	0.	161.	8.	169.	54.	13.	23.
CUBIC(5IN+)	2043.	1278.	3321.	0.	3321.	224.	3545.	53.	12.	474.
SCRIB(9IN+)	6343.	3580.	9924.	0.	9924.	1004.	10928.	81.	19.	2252.
INT (9IN+)	7706.	4357.	12063.	0.	12063.	1182.	13245.	78.	18.	2620.

-PER ACRE DEAD STEM FUEL LOADING IN TOTAL STEM CUNITS-

SOUND DEAD(5IN+)-STANDING-DOWN		NONSOUND DEAD(1IN+)-STANDING-DOWN		TOTAL
2.56	.00	5.58	.00	8.14

-PERCENT OF LODGEPOLE TREES(5IN.+) PER ACRE WITH-

OPEN-CONES	CLOSED-CONES	NO-CONES
0.	0.	0.

-PER ACRE STAND AVERAGES-

STORY	DBH	HEIGHT	AGE	STEMS	BA	CUNITS(5IN+)	MBFSCRIB(9IN+)
UND	1.1	5	27	169	4	.18	.000
CVR	8.0	52	81	390	158	33.03	9.924
TOT	8.5	51	82	353	161	33.21	9.924

-STAND CLASSES-

RISKCLASS	CONDCLASS
4	40

-LIVE MISTLETOE TREES/ACRE-

DBH	LONGPOLE	DOUGFIR	PONDEROSA	OTHERS
0-4.9	0.	0.	0.	0.
5-8.9	0.	0.	0.	0.
9IN+	0.	0.	0.	0.

-RESTRICTED STOCKING PERCENT/ACRE-

DES%	ACC%	GROWINGSTK%	CULL%	ALL%	OVERSTK%
74.	41.	115.	0.	115.	0.

-PERCENT OF NONSTOCKED POINTS PER ACRE DUE TO-

OTHER OTHER	>75%HIGH BRUSH	>75%LOW BRUSH	>75% SOD	>75% DUFF	>75% SLASH	>25%NONSTK NOT-OVRTOP	>25%NONSTK OVERTOPPED
0.	0.	0.	0.	0.	0.	6.	0.

-PERCENT OF NONSTOCKABLE POINTS PER ACRE DUE TO-

OTHER OTHER	RKYMTN JUNIPER	BEDROCK BOULDERS	POOR-SOIL DRAINAGE	SOIL DEPTH	SOIL EROSION	CLAY CONT
0.	0.	0.	0.	0.	0.	0.

-PER ACRE GROWING STOCK GROWTH AND MORTALITY-

ANNUAL PER ACRE GROWTH BASED ON 18 TALLIED GROWTH TREES

MEASURE	INGROWTH	ACCRETION	GROSS	MORT	LOGGING	NET
CUBIC(5IN+)	37.7	73.4	111.1	.0	.0	111.1
SCRIB(9IN+)	.0	200.3	200.3	.0	.0	200.3
STEMS(5IN+)	27.50			.00	.00	

ANNUAL PER ACRE MORTALITY BY CAUSE

MEASURE	INSECT	DISEASE	FIRE	ANIMAL	WEATHER	SUPPRESSED	UNKNOWN
CUBIC(5IN+)	.00	.00	.00	.00	.00	.00	.00
SCRIB(9IN+)	.00	.00	.00	.00	.00	.00	.00
STEMS(5IN+)	.00	.00	.00	.00	.00	.00	.00
STMS(1-4.9)	.00	.00	.00	.00	.00	.00	.00

-NUMBER OF LIVE STEMS PER ACRE DAMAGED BY-

DAMAGE	0-4.9IN	5-8.9IN	9IN+
1-NO DAMAGE	393.7	191.9	83.6
55-MECHANICAL	.0	.0	16.4
79-SWEEP&CROOK	18.8	25.1	.0

DAMAGE	0-4.9IN	5-8.9IN	9IN+
21-RUSTS	.0	.0	3.7
61-SUPPRESSION	.0	19.1	.0

DAMAGE	0-4.9IN	5-8.9IN	9IN+
54-FROST CRACK	.0	.0	10.2
74-DEAD TOP	.0	.0	2.9

DL/ID 106601* 5 CASCADE CREEK INDV RUN NET MERCH FACTORS PAGE TYPE 3

- P E R A C R E S T A N D S U M M A R Y O F L I V E G R O W I N G S T O C K T R E E S -

DIAMETER	TOT STM	HWD STM	AVG DBH	AVG HT	TOT BA	HWD BA	TOT CUR	HD CUR	TOT SCR	HWD SCR	TOT INT	HWD INT	SFT DBH AN.INC	HWD DBH AN.INC	SFT HT AN.INC	HWD HT AN.INC	SFT AGE	HWD AGE
0- .9	150.0	.0	.0	3.2	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.100	.000	22.	0.
1- 1.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
2- 2.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
3- 3.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.05	.00	.000	.000	60.	0.
4- 4.9	56.3	.0	4.6	47.3	6.5	.0	0.	0.	0.	0.	0.	0.	.05	.00	.000	.000	60.	0.
5- 5.9	74.9	.0	5.2	38.7	11.2	.0	161.	0.	0.	0.	0.	0.	.07	.03	.369	.156	55.	76.
6- 6.9	68.4	30.2	6.3	45.0	15.0	7.5	203.	137.	0.	0.	0.	0.	.07	.03	.369	.156	55.	76.
7- 7.9	51.9	14.0	7.3	51.1	15.0	3.8	284.	62.	0.	0.	0.	0.	.12	.00	.764	.000	49.	0.
8- 8.9	40.9	.0	8.2	53.2	15.0	.0	289.	0.	0.	0.	0.	0.	.12	.00	.764	.000	49.	0.
9-10.9	55.7	.0	9.9	53.6	30.0	.0	547.	0.	1822.	0.	2460.	0.	.07	.00	.326	.000	76.	0.
11-12.9	13.3	.0	12.5	55.6	11.2	.0	216.	0.	836.	0.	1049.	0.	.08	.00	.336	.000	60.	0.
13-14.9	28.7	.0	13.8	64.9	30.0	.0	673.	0.	2826.	0.	3416.	0.	.10	.00	.405	.000	116.	0.
15-16.9	8.7	.0	15.4	63.7	11.2	.0	253.	0.	1093.	0.	1306.	0.	.17	.00	.696	.000	58.	0.
17-18.9	4.6	.0	17.3	90.9	7.5	.0	255.	0.	1163.	0.	1366.	0.	.07	.00	.320	.000	168.	0.
19-20.9	3.4	.0	20.2	87.9	7.5	.0	236.	0.	1142.	0.	1305.	0.	.05	.00	.173	.000	212.	0.
21-22.9	1.3	.0	22.6	96.0	3.8	.0	171.	0.	627.	0.	696.	0.	.00	.00	.000	.000	0.	0.
23-24.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
25-26.9	1.1	.0	25.1	64.0	3.8	.0	83.	0.	414.	0.	466.	0.	.00	.00	.000	.000	0.	0.
27-28.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
29-30.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
31-99.9	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	.00	.00	.000	.000	0.	0.
0-99.9	559.1	44.2	.0	.0	167.8	11.2	3321.	198.	9924.	0.	12063.	0.	.00	.00	.000	.000	0.	0.

- P L A N T E D T R E E S P E R A C R E -

GROWING STOCK	CULL
0.	0.

- S I T E T R E E I N F O R M A T I O N -

SPECIES	DAMAGE	TOTAGE	HEIGHT	CLASS	SURVEY YIELD	MAXIMUM GROSS YIELD(MANN)	SITE/BASE USING TOTAL TREE AGE BRICKELL	ALEXANDER	HORNIBROOK	SITE/BASE USING DBH AGE ALEXANDER	MINOR	EDMINSTER
ENGELMANN S.	60.	75.	46.	2.	48.	0.	33./50	0./100	0./100	65./100	0./100	0./100
ENGELMANN S.	54.	69.	57.	1.	66.	0.	44./50	0./100	0./100	83./100	0./100	0./100
ENGELMANN S.	58.	71.	68.	1.	81.	0.	52./50	0./100	0./100	93./100	0./100	0./100
DOUGLAS FIR	52.	67.	42.	1.	50.	0.	34./50	0./100	0./100	0./100	0./100	56./100
DOUGLAS FIR	59.	74.	50.	1.	57.	0.	39./50	0./100	0./100	0./100	0./100	63./100
DOUGLAS FIR	63.	78.	60.	1.	71.	0.	47./50	0./100	0./100	0./100	0./100	73./100
AVERAGE ENGELMANN S.	57.	72.	57.	1.	65.	0.	43./50	0./100	0./100	80./100	0./100	0./100

DL/ID 106601* 5 CASCADE CREEK INDV. RUN NET MERCH FACTORS PAGE TYPE 4

- P E R A C R E S T A N D T A B L E S U M M A R I E S -

SPRUCE(93,94,96)

	STEMS						BASAL AREA				CUBIC VOLUME				SCRIBNER VOLUME			LOWR STM CUBIC		
DIAMETER	DES	ACC	SND CULL	RNT CULL	SALV	MORT	DES	ACC	CULL	SND DEAD	DES	ACC	CULL	SND DEAD	DES	ACC	SND DEAD	DES	ACC	SND DEAD
0- .9	18.8	18.8	37.5	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1- 2.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3- 4.9	18.8	.0	.0	.0	.0	.0	2.5	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5- 6.9	21.9	45.7	.0	.0	.0	.0	3.8	11.2	.0	.0	52.	104.	0.	0.	0.	0.	0.	0.	0.	0.
7- 8.9	42.0	.0	.0	.0	.0	.0	15.0	.0	.0	.0	286.	0.	0.	0.	1000.	0.	0.	0.	0.	0.
9-10.9	.0	6.9	.0	.0	.0	.0	.0	3.8	.0	.0	0.	78.	0.	0.	0.	283.	0.	0.	78.	0.
11-12.9	.0	4.2	.0	.0	.0	.0	.0	3.8	.0	.0	0.	97.	0.	0.	0.	395.	0.	0.	87.	0.
13-14.9	3.8	18.5	.0	.0	.0	.0	3.8	11.2	.0	.0	89.	288.	0.	0.	342.	1280.	0.	80.	258.	0.
15-16.9	2.9	2.9	.0	.0	3.1	.0	3.8	3.8	.0	3.8	95.	87.	0.	100.	409.	368.	476.	85.	78.	0.
17-18.9	2.4	2.2	.0	.0	2.0	.0	3.8	3.8	.0	3.8	142.	113.	0.	124.	653.	510.	578.	127.	101.	0.
19-20.9	1.4	.0	.0	.0	.0	.0	7.5	.0	.0	.0	236.	0.	0.	0.	1142.	0.	0.	211.	0.	0.
21-22.9	1.3	.0	.0	.0	.0	.0	3.8	.0	.0	.0	121.	0.	0.	0.	627.	0.	0.	113.	0.	0.
23-24.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25-26.9	.0	1.1	.0	.0	.0	.0	.0	3.8	.0	.0	0.	83.	0.	0.	0.	414.	0.	0.	78.	0.
27-28.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29-30.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31-99.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0- 4.9	37.5	18.8	37.5	.0	.0	.0	2.5	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-99.9	77.7	93.4	.0	.0	5.1	.0	41.2	41.2	.0	7.5	1022.	850.	0.	224.	4193.	3169.	1004.	616.	672.	0.
0-99.9	115.2	112.1	37.5	.0	5.1	.0	43.7	41.2	.0	7.5	1022.	850.	0.	224.	4193.	3169.	1004.	616.	672.	0.

84.9

FIR(15,18,19)

	STEMS						BASAL AREA				CUBIC VOLUME				SCRIBNER VOLUME			LOWR STM CUBIC		
DIAMETER	DES	ACC	SND CULL	RNT CULL	SALV	MORT	DES	ACC	CULL	SND DEAD	DES	ACC	CULL	SND DEAD	DES	ACC	SND DEAD	DES	ACC	SND DEAD
0- .9	112.5	.0	131.2	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1- 2.9	.0	.0	37.5	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3- 4.9	37.5	.0	.0	.0	.0	.0	4.1	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5- 6.9	.0	25.4	.0	.0	.0	.0	.0	3.8	.0	.0	0.	71.	0.	0.	0.	0.	0.	0.	0.	0.
7- 8.9	14.0	22.8	.0	.0	.0	.0	3.8	7.5	.0	.0	74.	151.	0.	0.	0.	0.	0.	0.	0.	0.
9-10.9	18.6	16.4	.0	.0	.0	.0	11.2	7.5	.0	.0	214.	130.	0.	0.	808.	411.	0.	191.	116.	0.
11-12.9	4.7	.0	.0	.0	.0	.0	3.8	.0	.0	.0	58.	0.	0.	0.	227.	0.	0.	52.	0.	0.
13-14.9	7.2	.0	.0	.0	.0	.0	7.5	.0	.0	.0	140.	0.	0.	0.	609.	0.	0.	125.	0.	0.
15-16.9	2.9	.0	.0	.0	.0	.0	3.8	.0	.0	.0	70.	0.	0.	0.	317.	0.	0.	63.	0.	0.
17-18.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19-20.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21-22.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23-24.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25-26.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27-28.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29-30.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31-99.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0- 4.9	150.0	.0	168.7	.0	.0	.0	4.1	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-99.9	47.5	64.6	.0	.0	.0	.0	30.0	18.8	.0	.0	558.	352.	0.	0.	1960.	411.	0.	431.	116.	0.
0-99.9	197.5	64.6	168.7	.0	.0	.0	34.1	18.8	.0	.0	558.	352.	0.	0.	1960.	411.	0.	431.	116.	0.

52.9

DL/ID 106601* S CASCADE CREEK INDV RUN NET MERCH FACTORS PAGE TYPE 4

- P E R A C R E S T A N D T A B L E S U M M A R I E S -

DOUGLAS FIR(202)

	STEMS						BASAL AREA				CUBIC VOLUME				SCRIBNER VOLUME			LOWR STM CUBIC		
DIAMETER	DES	ACC	SND CULL	RNT CULL	SALV	MORT	DES	ACC	CULL	SND DEAD	DES	ACC	CULL	SND DEAD	DES	ACC	SND DEAD	DES	ACC	SND DEAD
0- .9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1- 2.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3- 4.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5- 6.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7- 8.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9-10.9	13.8	.0	.0	.0	.0	.0	7.5	.0	.0	.0	124.	0.	0.	0.	320.	0.	0.	112.	0.	0.
11-12.9	4.4	.0	.0	.0	.0	.0	3.8	.0	.0	.0	61.	0.	0.	0.	215.	0.	0.	55.	0.	0.
13-14.9	7.3	.0	.0	.0	.0	.0	7.5	.0	.0	.0	156.	0.	0.	0.	656.	0.	0.	141.	0.	0.
15-16.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17-18.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19-20.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21-22.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23-24.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25-26.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27-28.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29-30.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31-99.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0- 4.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-99.9	25.4	.0	.0	.0	.0	.0	18.8	.0	.0	.0	341.	0.	0.	0.	1190.	0.	0.	308.	0.	0.
0-99.9	25.4	.0	.0	.0	.0	.0	18.8	.0	.0	.0	341.	0.	0.	0.	1190.	0.	0.	308.	0.	0.

ASPEN(746)

	STEMS						BASAL AREA				CUBIC VOLUME				SCRIBNER VOLUME			LOWR STM CUBIC		
DIAMETER	DES	ACC	SND CULL	RNT CULL	SALV	MORT	DES	ACC	CULL	SND DEAD	DES	ACC	CULL	SND DEAD	DES	ACC	SND DEAD	DES	ACC	SND DEAD
0- .9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1- 2.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3- 4.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5- 6.9	15.3	14.9	.0	.0	.0	.0	3.8	3.8	.0	.0	61.	76.	0.	0.	0.	0.	0.	0.	0.	0.
7- 8.9	14.0	.0	.0	.0	.0	.0	3.8	.0	.0	.0	67.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9-10.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11-12.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13-14.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15-16.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17-18.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19-20.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21-22.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23-24.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25-26.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27-28.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29-30.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31-99.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0- 4.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-99.9	29.3	14.9	.0	.0	.0	.0	7.5	3.8	.0	.0	123.	76.	0.	0.	0.	0.	0.	0.	0.	0.
0-99.9	29.3	14.9	.0	.0	.0	.0	7.5	3.8	.0	.0	123.	76.	0.	0.	0.	0.	0.	0.	0.	0.

END OF PRINTOUT

113

ORIGINAL PAGE IS
OF POOR QUALITY

APPENDIX B

TIMBER RESOURCE RECORDS EXCERPT FROM THE FOREST SERVICE MANUAL

2414.11 - Timber Resource Records. The entire Forest area will be described in terms of:

1. Stand and Area Map. Stand maps including non-forest areas will be prepared from aerial photos as an integral part of the data base, and will be the basis from which area statistics are derived for planning. A photo scale of 1:24,000 or larger when justified will be used for this purpose. These maps will provide the means for integrating and coordinating the stand data and formulation of analysis areas. The map may be an aerial photo, orthophoto, photo mosaic, planimetric, or a topographic map. These maps are key documents in the planning process and must be retained in the planning records (FSM 1922.11). Stands and other area classes will be delineated on photos by means of stereoscopic study, supplemented by air and/or ground observation to assure proper interpretation.

Large Forms [illegible] [illegible] [illegible] cost effective [illegible]

2. Stand and Area Records. Stands and areas mapped in 1 above will be identified as follows:

a. Forest and non-forest.

b. Productive and nonproductive.

c. Available and not available, by reason, e.g. RARE II, administrative withdrawals, etc.

d. Cover type and local type, as needed.

e. Vegetation series and/or habitat type.

f. Productivity class.

g. Site utilization by the present stand (stocking).

h. Age class of main stand.

i. Stand size classes, including nonstocked and partially stocked areas.

The above area classifications must be capable of being aggregated by planning, analysis, and political units.

ORIGINAL PAGE IS
OF POOR QUALITY

2414.2 - Inventory Standard Output. As a minimum, the following standard tables and maps describing the Forest inventory will be included in the planning records. Regional Foresters, in consultation with Station Directors, may supplement these instructions to include required tables or maps of a Regional or local nature.

2414.21 - Area Tables. For National Forest land.

1. Area by land classes and ownership (gross National Forest area).

2. Area of suitable and available (commercial) forest land by stand size and type (including non-stocked and partially stocked).

3. Area of technologically not suitable and non-productive forest by stand size and forest type.

4. Area of available, capable and tentatively suitable CFL by working group.

5. Area of available, capable and tentatively suitable CFL by working group and area condition classes.

6. Area of available, capable and tentatively suitable CFL by working group and age class.

7. Area of available, capable and tentatively suitable CFL by working group and site productivity class (in terms of potential growth, Cu Ft/Ac/Year).

2414.22 - Volume Tables

1. Net cubic volume on available, capable and tentatively suitable CFL by timber size class by softwoods and hardwoods (growing stock, sawtimber and pole timber; rough, rotten and salvable dead trees).

2. Net cubic volume on (1) productive reserved and (2) deferred forest land by timber size class and by softwoods and hardwoods.

data collection activities, therefore, is essential. These include, but are not limited to, soil and hydrologic surveys, land-use status surveys, range surveys, wildlife habitat surveys, and fuel and/or protection surveys. Since many of the management alternatives and opportunities for enhancement of other resources depend upon manipulation of the forest cover through timber management activities, it is desirable to expand the timber inventory to a total integrated resource inventory when possible. It is also desirable that other surveys and plans be coordinated, to the extent practicable, to the periodic schedule of timber inventories. Examples of cooperation that may reduce costs are: resource photography; planimetric mapping; locating, marking, and posting of property lines; aerial photograph interpretation; field examination; field mapping; work maps; and elimination of duplication in reports and plans. Cooperative financing shall be on the basis of the relative value to the various activities involved. The inventory should be conducted as a Forest project and have project status with personnel assigned to give full attention to the inventory job.

Inventory plans and design are the responsibility of the Regional Forester and are approved by him after coordination with the Forest Resources Evaluation Unit and the Forest Supervisor. The Regional Forester's responsibility includes supplying information needs to meet total Forest Service responsibility. Generally, the plan and technical design are prepared by qualified inventory specialists in the Regional Office after consultation and coordination with Station and Forest personnel. Any or all phases of the inventory may be performed by contracting procedures or by Forest Service personnel.

<u>2414.41</u> - <u>Inventory Design.</u> Inventories must be designed to insure collecting at least the <u>minimum data</u> as discussed in FSM 2414.1, FSH 2409.14 and FSH 4809.11. In design of inventories, objectives of the inventory must first be clearly stated in terms of the type and standards for data collection.

2414.33 - Cost schedules. Analysis of costs for possible silvicultural programs shall be developed on a Regional or zone basis. These costs will include project and overhead costs, including WO overhead. Costs should be estimated in terms of what will be needed in the year during which the work will be done. Regions will determine appropriate inflation rates for their areas (in agreement with GAO recommendations). The analysis should be structured so that predictions of cost under varying conditions of stand density, size of treatment unit, landform, access, and other variables can be considered when building prescriptions. See FSM 2417, FSM 1970, and Economic Analysis Procedures Handbook (Draft).

2414.34 - Records for Updating the Data Base. Records of all completed activities and followup stand and regeneration examinations necessary for certification will be maintained to guide scheduling of subsequent activities, to permit updating of the resource records, and for reporting and control. Records of losses to fire and pests should be available for updating the stand data. Forest Supervisors will be responsible for maintaining the data base in edited and usable form. Regional Foresters shall supplement these instructions providing for inspection, editing, and semiannual updating of the data base. As a minimum, records should be updated following procedures in FSH 2409.14 and standards in FSM 2490.

2414.4 - Resource Inventory Procedures. The resource data for land and resource management planning comes from inventories that may vary widely in recency, objectivity, and precision. Inventories employing aerial photo interpretation, ground examination of stands, and past inventory information can all be used to provide information concerning forest conditions. Periodically, a stage I or extensive phase of sampling covering the entire Forest must be used to introduce strict objectivity and uniformity of definitions, to update elements that make up the data base, and to provide additional detail about the total population. Timber inventories must describe the resource in relation to the land, land use, and other factors affecting opportunities to use the land. Close coordination of resource inventories with Forest Resources Evaluation Units (Forest Survey) and other

Sampling units may be points, fixed area plots, stands, or groups of stands which must have clearly defined boundaries that can be identified on the ground. Management area boundaries may be useful in identifying sampling units. Sufficient information about the surrounding forest should be available so that it can be determined if proposed prescriptions meet management direction for the area. Characteristics that describe management prescriptions should apply to areas large enough to represent real opportunities.

In designing inventories, it is important that the following be considered:

1. Efficiency. Assure that objectives of inventory are met both in terms of minimizing costs of data collection and analysis, as well as in reliability and accuracy of data collected. It will generally be advantageous to use prior inventory information in the estimation procedures.

2. Validity. The sample design for the extensive phase (stage 1) must ensure that the required inventory estimates provide a valid basis for inference concerning the entire planning unit. The estimation formulas should be documented in the inventory plan.

3. Accuracy Standards. National standards for forest survey are included in FSH 4809.11, Forest Survey Handbook. The accuracy standards in exhibit 1 will be regarded as a minimum for a National Forest timber resource inventory, and could be upgraded as needed to address planning problems in land and resource management planning.

Exhibit 1

SPECIFIED SAMPLING ERROR IN PERCENT
(in terms of one standard error)

	PERCENT VOLUME (CUBIC FEET)			AREA (ACRES)	
SECTION	All Live Trees	Timber Cut[2]	Net Annual Growth	CFL[3]	Other Forest Prod. Reserved Prof. Deferred
West	10	10	10	3	10
East[1]	5	5	5	3	10

1 Regions 8 and 9.

2 Although this is the minimum necessary for Forest Survey, it is normally derived from actual cut records for a forest, and will generally be much less than 10%.

3 CFL = Available, capable and tentatively suitable.

In new inventories, area statistics will be determined from the stand map, thus eliminating area sample errors. See FSM 2414.1.

Regional Foresters should supplement this section establishing reliability levels desired for major inventory components such as forest type, working group, condition class, or large special management areas. Sampling error can usually be controlled on only a few items. These items should be selected for their relevance to the decisions to be made; however, this may not be possible in all cases because of associated costs.

Inventories should be conducted in a manner that allows sampling errors to be calculated for most estimates. These errors should be calculated so that the reliability of the estimates will be apparent.

Experience in working with estimates having varying degrees of reliability will provide the basis for specifying future levels of precision for key estimates. Inventories should also be conducted so that technique errors can be quantified, or at least a qualitative statement can be made that these are being held within acceptable limits.

4. Prior Inventories. Permanent plot or point locations established for inventory, growth and mortality estimation will be integrated into re-surveys. As a minimum, 50% of the permanent locations will be remeasured to support trend level estimates and projections required for preparing and/or checking current growth and mortality estimates.

5. Upgrading. When possible, procedures for upgrading prior estimates of stand attributes will be included in new inventory procedures. By correlating successive inventory estimates, unreasonable differences arising from sampling variation should be reduced and efficiency increased. It is often appropriate to collect additional data for special studies or information needed for Forest land and resource management planning. Where this is done, the added work should be financed by the benefiting activity, unless the added work can be absorbed in the regular work without significant increase in time spent for data collection.

APPENDIX C

SYSTEM 2000 INPUT CODES AND CODING FORM

ORIGINAL PAGE IS
OF POOR QUALITY

SAN JUAN DATA BASE SCHEMA

S2K RG	COMPONENT NO.	COMPONENT NAME	CARD CODE	CARD COLUMNS
0	1	GEO ID	01	4-7
0	2	GEO NAME	01	8-20
0	12	FOREST	01	21,22
0	14	RGR DIST	01	27,28
0	17	COUNTY	01	32-34
0	19	HRU	01	36,37
0	36	DIST TO MILL	01	59,60
0	38	†DIVERSE INDEX	01	62-64
0	39	ACCESS COST CL	01	65,66
0	1	GEO ID	21	4-7
1000	1001	CA TYPE	21	8-12
1000	1004	GEOLOGY	21	8
1000	1005	LANDFORM/SLOPE	21	9
1000	1006	DISSECTION	21	10
1000	1007	VEGETATION	21	11
1000	1008	SPECIAL MOD	21	12
1000	1009	GEOL & LANDFORM	21	8,9
1000	1110	DISSECTION & VEG	21	10,11
1000	1002	CA NO.	21	13-15
1000	1051	*ELEV CL	21	17-19
1000	1052	*SLOPE CL	21	20,21
1000	1053	*ASPECT CL	21	22,23
1000	1056	†PRECIP	21	26,27
1000	1059	RGE IMP NEEDS	21	32
1000	1060	RGE ALLOT	21	33-35
1000	1070	PRES ROS	21	37
1000	1071	CULT SENS CL	21	38
1000	1072	LEG/ADM STATUS	21	39
1000	1073	AVE VQO	21	40,41
1000	1074	PRES VIS COND	21	42
1000	1075	AVE VAR CL	21	43
1000	1076	†PRED VAC	21	44
1000	1081	% BIG GAME RGE	21	48
1000	1082	BIG GAME RGE	21	49
1000	1083	E & T HAB	21	50
1000	1084	WILD HAB USE	21	51
1000	1085	STR FISH IMP POT	21	52,53
1000	1086	PRES FISH PROD	21	54
1000	1087	STREAM RIP AC	21	55-57
1000	1088	*OTHER RIP (AC)	21	58-60
1000	1101	MIN LVL 1	21	66

*Not loaded as of May 1981.

†To be derived within System 2000.

SAN JUAN DATA BASE SCHEMA (Concluded)

S2K RG	COMPONENT NO.	COMPONENT NAME	CARD CODE	CARD COLUMNS
1000	1102	MIN LVL 2	21	67
1000	1103	MIN LVL 3	21	68
1000	1104	MIN LVL 4	21	69
1000	1105	MIN LVL 5	21	70
1000	1106	MIN LVL 6	21	71
1000	1110	ROAD DEN CL	21	72
1000	1112	DIST PRES ACCESS	21	74,75
1000	1114	ROAD ACCESS TYPE	21	78
0	1	GEO ID	40	4-7
1000	1001	CA TYPE	40	8-12
1000	1002	CA NO.	40	13-15
2000	2001	SITE TYPE	40	16,17
2000	2002	SITE NO.	40	18,19
2000	2003	TIMBER TYPE	40	20,21
2000	2004	SIZE CLASS	40	22,23
2000	2005	BASAL AREA	40	24
2000	2006	RANGE TYPE	40	25
2000	2007	**PLT COMM	40	26-39
2000	2008	ECO COND	40	40
2000	2009	**USE FACT	40	41,42
2000	2010	†FOR PROD	40	43,44
2000	2011	REC/ADM SITE	40	45
2000	2018	EST. ACRE%	40	48-50
2000	2021	*TOTAL AC	40	51-55
2000	2022	*NON FS AC	NA	NA
2000	2023	WATER AC	40	61-65
2000	2024	WETLAND AC	40	66-70
2000	2028(2022)	††NET FS AC	40	56-60
2000	2029	†ANAL AREA	NA	NA

*Not loaded as of May 1981.

†To be derived within System 2000.

**To be modified.

††To be adjusted.

SAN JUAN NATIONAL FOREST - DATA BASE CODE FORMS

LEGEND

WATER ACRES → component heading

C2023 NUMERIC → component number (in S2K) and value type

01-06 → column numbers

- column(s) or component(s) to be hand coded
- column(s) or component(s) will be entered by computer
- column(s) or component(s) not used by the San Juan NF

CODING CONVENTIONS

Ø-zero O-'oh' I-'eye' 1-one Z-'zee' 2-two

numeric data : right justify over last column

ORIGINAL PAGE IS OF POOR QUALITY

GEOGRAPHIC AREA DATA

LAND MANAGEMENT PLANNING - S2K DATA BASE INPUT - REGION 02 -

CARD TYPE: 01 in columns 1 - 2

GEOG AREA ID: (component 1) 4 5 6 7

FOREST: 13 - SAN JUAN

DATE:

BATCH (FILE NAME):

Component heading	Component number and value type	Columns	Entry
GEO AREA NAME	C2 ALPHA/NUMERIC		
FOREST CODE	C12 NUMERIC	21-22	13
RANGER DISTRICT	C14 ALPHA/NUMERIC		
COUNTY	C17 NUMERIC		
HRU	C19 NUMERIC		
DIST TO MILL	C30 NUMERIC		
DIVERSE INDEX	C20 NUMERIC		
ACCESS COST CL	C39 NUMERIC		
		67+	

ORIGINAL PAGE IS OF POOR QUALITY

C-4

SAN JUAN NATIONAL FOREST - DATA BASE CODE FORMS (Concluded)

CAPABILITY AREA DATA

LAND MANAGEMENT PLANNING - S2K DATA BASE INPUT - REGION 02

CARD TYPE: 21 in column 1 - 2
GEOG AREA ID: (component 1) 4 5 6 7

FOREST: 13 - SAN JUAN
DATE:
BATCH (FILE NAME):

- C.A TYPE C1001 ALPHA/NUMERIC — C1004 thru 1010
- C.A NUMBER C1002 NUMERIC
- ELEVATION CLASS C1061 NUMERIC
- SLOPE CLASS C1062 NUMERIC
- ASPECT CLASS C1063 ALPHA/NUMERIC
- PRECIPIATION C1066 NUMERIC
- ROE IMPROVE NEEDS C1050 ALPHA/NUMERIC
- RANGE ALLOTMENT C1068 ALPHA/NUMERIC
- ROS CLASS C1070 ALPHA/NUMERIC
- CULT SENS CLASS C1071 ALPHA/NUMERIC
- LEGAL/ADMIN STAT C1072 ALPHA/NUMERIC
- AVG VISUAL QUAL C1073 ALPHA/NUMERIC
- PRESENT VIS COND C1074 NUMERIC
- AVG VARITY CLASS C1075 ALPHA
- VISUAL ABSORB CAP C1076
- EXIST VISUAL QUAL C1077 ALPHA/NUMERIC
- % BIG GAME RANGE C1081 NUMERIC
- BIG GAME RANGE C1082 ALPHA/NUMERIC
- E & T HABITAT C1083 ALPHA/NUMERIC
- WILDLIFE HAB USE C1084 ALPHA/NUMERIC
- STR FISH IMP POT C1085 NUMERIC
- PRES FISH PROD C1086 ALPHA/NUMERIC
- STREAM RIPARIAN AC C1087 NUMERIC
- % OTHER RIPARIAN C1088 (acres)
- MINERAL LEVEL 1 C1101 ALPHA/NUMERIC
- MINERAL LEVEL 2 C1102 ALPHA/NUMERIC
- MINERAL LEVEL 3 C1103 ALPHA/NUMERIC
- MINERAL LEVEL 4 C1104 ALPHA/NUMERIC
- MINERAL LEVEL 5 C1105 ALPHA/NUMERIC
- MINERAL LEVEL 6 C1106 ALPHA/NUMERIC
- ROAD DENSITY CLASS C1110 NUMERIC
- ROAD DEV COST C1111 ALPHA/NUMERIC
- DIST TO ACCESS C1112 NUMERIC
- ROAD MILES C1113 NUMERIC

SITE DATA

LAND MANAGEMENT PLANNING - S2K DATA BASE INPUT - REGION 02

CARD TYPE: 40 in column 1 - 2
GEOG AREA ID: (component 1)
CAT AREA TYPE: (component 1001)
CAP AREA NUMB: (component 1002)

FOREST: 13 - SAN JUAN
DATE:
BATCH (FILE NAME):

- 16-17 SITE TYPE C2001 ALPHA/NUMERIC (LANDSAT CODE)
- 18-19 SITE NUMBER C2002 NUMERIC
- 20-21 TIMBER TYPE C2003 ALPHA/NUMERIC
- 22-23 SIZE CLASS C2004 ALPHA/NUMERIC
- 24 BASAL AREA C2005 NUMERIC
- 25 RANGE TYPE C2006 ALPHA/NUMERIC
- 26-39 PLANT COMMUNITY C2007 ALPHA/NUMERIC
- 40 ECOL COND C2008 ALPHA/NUMERIC
- 41-42 USE FACT C2009 NUMERIC
- 43-44 FORAGE PROD C2010 NUMERIC
- 45 REC/ADM SITE C2011 ALPHA/NUMERIC
- 46-47
- 48-50 EST. ACRE % C2018 NUMERIC
- 51-55 ~~DIGITIZED ACRES~~ ~~C2020~~ NUMERIC (TOTAL ACRES) C2021
- 56-60 ~~NON FS AREAS~~ C2022 NUMERIC (NET FS ACRES) C2028
- 61-65 WATER ACRES C2023 NUMERIC
- 66-70 WETLAND ACRES C2024 NUMERIC
- 73-78

APPENDIX D

PORTION OF A FORPLAN TEST OUTPUT

1.1 PROBLEM TITLE

SAN JUAN NATIONAL FOREST
RAMPART HILLS--WATERSHED 4100 TEST RUN

1.2 TYPE OF RUN

PRINT OUT DATA AND GENERATE MATRIX

1.3 PROGRAM PARAMETERS

MODEL TYPE 2
TOTAL TIME SPANNED IN PERIODS 20
PERIOD LENGTH 10 YEARS

1.4 REPORT PARAMETERS

INVENTORY REPORT EVERY PERIOD UNTIL	5*
PERIODS BETWEEN INVENTORY REPORT	5*
INVENTORY REPORT DETAIL	NO *
MAXIMUM AREA FOR SCALING	250.00*
MAXIMUM VOLUME FOR SCALING	250.00*
MAXIMUM INVENTORY FOR SCALING	2000.00*
TIMBER HARVEST BY PERIOD REPORT FOR 20 PERIODS	

* DEFAULT VALUES FOR THE REPORT PARAMETERS

NUMBER OF PERIODS PER INTERVAL

INTERVAL NUMBER

1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	5	5	5		

2.1 OBJECTIVE FUNCTION

MAXIMIZE TIMBER FOR 20

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE OF CONTENTS PAGE

TABLE OF CONTENTS (CONTINUED)

* * GRAPHS * *

U.S. GOVERNMENT PRINTING OFFICE: 1981—569-011/2342