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**OAK RIDGE  
NATIONAL  
LABORATORY**

**MARTIN MARIETTA**

**Resource Management Plan**

for the  
U.S. Department of Energy

**Oak Ridge Reservation**

**Volume 6**

**Appendix F: Forest Management**

**July 1984**

T. W. Oakes

Helen M. Braunstein

J. Thomas Kitchings

Wayne W. Chance

Donna B. Slaughter

Dennis M. Bradburn

E. H. Rosenbalm

OPERATED BY  
MARTIN MARIETTA ENERGY SYSTEMS, INC.  
FOR THE UNITED STATES  
DEPARTMENT OF ENERGY



# **Resource Management Plan**

for the  
U.S. Department of Energy

## **Oak Ridge Reservation**

**Volume 6**

**Appendix F: Forest Management**

**Prepared by**

**Dennis M. Bradburn and E. H. Rosenbalm**

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**Document Coordinated by**

**T. W. Oakes (Chairman) J. Thomas Kitchings**  
**Helen M. Braunstein Wayne W. Chance**  
**Donna B. Slaughter (Secretary)**

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for the  
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Resource Management Plan  
for the  
U.S. Department of Energy  
Oak Ridge Reservation

- Vol 1. Management Plan Overview and Summary
- Vol 2. Aquatic Habitats
- Vol 3. Archeological Considerations
- Vol 4. Endangered and Threatened Plant Species
- Vol 5. Environmental Monitoring
- Vol 6. Forest Management
- Vol 7. Geography, Demography, Topography and Soils
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APPENDIX F

FOREST MANAGEMENT

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APPENDIX F  
FOREST MANAGEMENT

I. ABSTRACT

The Forest Management Plan for the Department of Energy Oak Ridge Reservation is a guide for managing and administering forest resources. A newly revised plan summarizes goals and accomplishments of the previous plan and recommends management practices, improvements, and alternatives for the ensuing management cycle. This plan contains a summary of the Reservation's present (1981) timber volume by stratum in each of the 35 management compartments and recommends management treatments, cutting budgets, and silvicultural activities for the ensuing cycle.

II. INTRODUCTION AND OBJECTIVES

The forest management program on the Department of Energy (DOE) Oak Ridge Reservation (ORR) has completed three 5-year management cycles. This report is the third revision of the original plan written in 1965. This plan is intended to be a guide describing the forest resources of ORR and prescribing management treatments for these resources. Periodic revisions of the management plan are necessary to revise practices and integrate new techniques to meet the overall three-plant objectives (Curlin 1965, Strock 1970, Bradburn 1975).

Objectives of the forest management program on the ORR include multiple use of forest lands and sustained yield of quality timber products. This goal is coupled with the DOE multipurpose programmatic

goals for the Reservation. From a forestry programmatic standpoint, this includes maintenance of both natural and planted stands through silvicultural treatments; protection of these stands from wildfire, insects, and diseases; and overall reservation security.

In 1975, an in-depth analysis was completed of available land resources required to accomplish the programmatic objectives of the then Energy Research and Development Administration (ERDA) at Oak Ridge, Tennessee. This study, the "Oak Ridge Reservation Land-Use Plan" (ORO-748,1975), established a long-range land-use plan for both present and projected program requirements incorporating sound forest management concepts that recognize the multiple-use, sustained-yield approach to forest land utilization. Sound forest management embraces the multiple-use sustained-yield concept of land management, with the application of this guiding principle being a primary objective at the inception of the forestry program in 1964, and continuing as a central guide throughout the program's tenure. The Energy Reorganization Act of 1976 abolished the ERDA and replaced it with the DOE. The goals and objectives of the forestry program remained unchanged through this transition; DOE revised the 1975 land-use plan in 1980 (ORO-748-1980-Rev.1) retaining the same programmatic objectives.

### III. MANAGEMENT PLAN

#### A. Management and Harvest Review on the Reservation Forest

##### 1. Land-use allocation

There are presently four separate plant facilities located within the confines of the DOE Reservation, three of which are operated by a single

contractor. These include the Oak Ridge National Laboratory (ORNL, X-10), the Gaseous Diffusion Plant (ORGDP, K-25), and the Y-12 Plant. The Comparative Animal Research Laboratory (CARL), operated by Oak Ridge Associated Universities (ORAU), is the fourth plant located on the east side of the Reservation. Buffer zones are located around these facilities allowing for special use and future plant expansion. Forested areas in the zones are designated as "alternate compartments" to the main group of forest management compartments defined on the reservation. Forest management activities are sometimes limited and/or defined by plant demands in these buffer areas, since uses by plant facilities have priority. Revisions of the Forest Management Plan reflect regulated use by priorities.

Total management area for the DOE Reservation is 15,508 ha of which approximately 12,306 ha are forested (Table 1), with the remaining 3203 ha (occupied by plant sites, rights-of-way, and inundated areas) classed as inoperable land. Lands assigned to CARL (432 ha) consist primarily of pasture with some enclosed woodlots (81 ha) utilized by CARL as livestock shelter. The ORNL primary plant complex contains a small timberstand within the fenced area (4 ha) excluded from any forest management. The remaining 12,221 forested hectares are to be managed to ensure compatibility with all Reservation land-use requirements.

## 2. Resource Evaluation

Forest management practices during the two previous five-year management cycles coupled with demands from other users have necessitated a more extensive inventory program. An extensive inventory and mapping

Table 1. Administrative units on the Department of Energy  
Oak Ridge Reservation in 1982

Description	Forested area <sup>a</sup> (ha)	Total area <sup>a</sup> (ha)
Resource management	12,221 (30,185)	14,050 (34,705)
ORNL primary plant complex <sup>b</sup>	4 (10)	147 (364)
Y-12 primary plant complex <sup>b</sup>	-	352 (870)
ORGDP primary plant complex <sup>b</sup>	-	405 (1,000)
CARL (ORAU-DOE)	81 (200)	432 (1,067)
Total	12,306 (30,395)	15,508 (38,306)

<sup>a</sup>Figures in parentheses are acres.

<sup>b</sup>Primary plant complexes within fenced areas and facilities outside the fenced area but adjoining.

system was started in 1974 to describe the forest in detail by timber types within each of 35 management compartments. Recently, considerable time has been spent revising the forest compartment system to adjust for incorrect map scales, to correct for unaccounted area, and to utilize physical features in delineating compartmental boundaries. This revision contains 28 management compartments, seven alternate compartments (alternate compartments are so designated due to specific management restrictions noted earlier), and five plant complexes totaling 15,508 ha. Compartment sizes range from 188 to 959 ha, with plant complexes ranging from 15 to 432 ha (Table 2). To maintain an accurate data file, all compartments (Fig. 1) will be reinventoried and type maps will be revised during each management cycle. Therefore, based on a five-year cycle, each annual inventory budget will consist of resources to allow recruising and type map updating of seven compartments. The inventory schedule for this management period are as follows:

1983	Compartments #1, 6, 8, 4, 15, 20, 9
1984	Compartments #5, 7, 16, 17, 19, 28, A7
1985	Compartments #10, 11, 12, 18, A3, A5, A2
1986	Compartments #2, 3, 13, 14, 21, 22, A6
1987	Compartments #23, 24, 25, 26, 27, A1, A4

### 3. Timber Inventory and Stand Mapping

All sawtimber sales volumes on the DOE Oak Ridge Reservation are computed from Girard class volume tables, the International (14-Inch Rule (Girard and Mesauage 1966)). Thus, the inventory system, which provides the basis for deriving sawtimber volumes, must be standardized for each

Table 2. Forest area by compartments on the Oak Ridge Reservation

Compartment No.	Total area (ha) 1975	Inoperable land <sup>a</sup> (ha) 1980	Nonforested area (ha) 1980	Forested area (ha) 1980	Revised total area (ha) 1980	Total area (acres)
1	586	178	17	449	644	1,590
2	319	4	49	268	321	792
3	415	26	44	365	435	1,074
4	622	66	14	542	622	1,535
5	373	46	24	276	346	856
6	327	60	30	246	336	829
7	289	27	4	263	294	727
8	254	18	21	201	240	593
9	255	27	14	193	234	577
10	364	19	9	326	354	875
11	449	46	2	424	472	1,167
12	447	48	19	377	444	1,096
13	492	60	61	365	486 <sup>a</sup>	1,200
14	228	25	2	182	209 <sup>a</sup>	517
15	528	45	36	447	528	1,305
16	290	13	43	236	292	722
17	407	23	32	333	387	957
18	319	39	16	289	344	849
19	418	74	89	260	423	1,045
20	349	14	50	271	335	827
21	330	35	5	286	326	805
22	228	69	5	182	256	633
23	481	139	69	432	640	1,580
24	389	99	8	381	488	1,207
25	699	375	5	355	735	1,815
26	276	108	94	147	349	861
27	328	30	141	120	291	719
28	499	31	13	462	506	1,249
Alt. No. 1	922	38	49	872	959	2,369
Alt. No. 2	664	152	25	471	648	1,600
Alt. No. 3	349	85	5	280	370	915
Alt. No. 4	307	18	20	294	332	820
Alt. No. 5	486	61	239	191	491	1,213
Alt. No. 6	182	41	5	142	188	464
Alt. No. 7	243	164	22	93	279	689
K-25 facilities	386	405	0	0	405	1,000
Y-12 facilities	336	352	0	0	352	870
X-10 facilities	141	143	0	4	147	364
35 compartments	14,977	3,203	1,281	11,025	15,508 <sup>b</sup>	38,306

<sup>a</sup>Land occupied by plant sites, right-of-ways, and inundated areas.

<sup>b</sup>Includes 552 ha in the TVA LMFBR site.

# RESOURCE MANAGEMENT PLAN

For The  
U.S. DEPARTMENT OF ENERGY  
ORK RIDGE RESERVATION

Prepared By  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION

LEGEND

1	COMPARTMENT NUMBER
1	ACRES

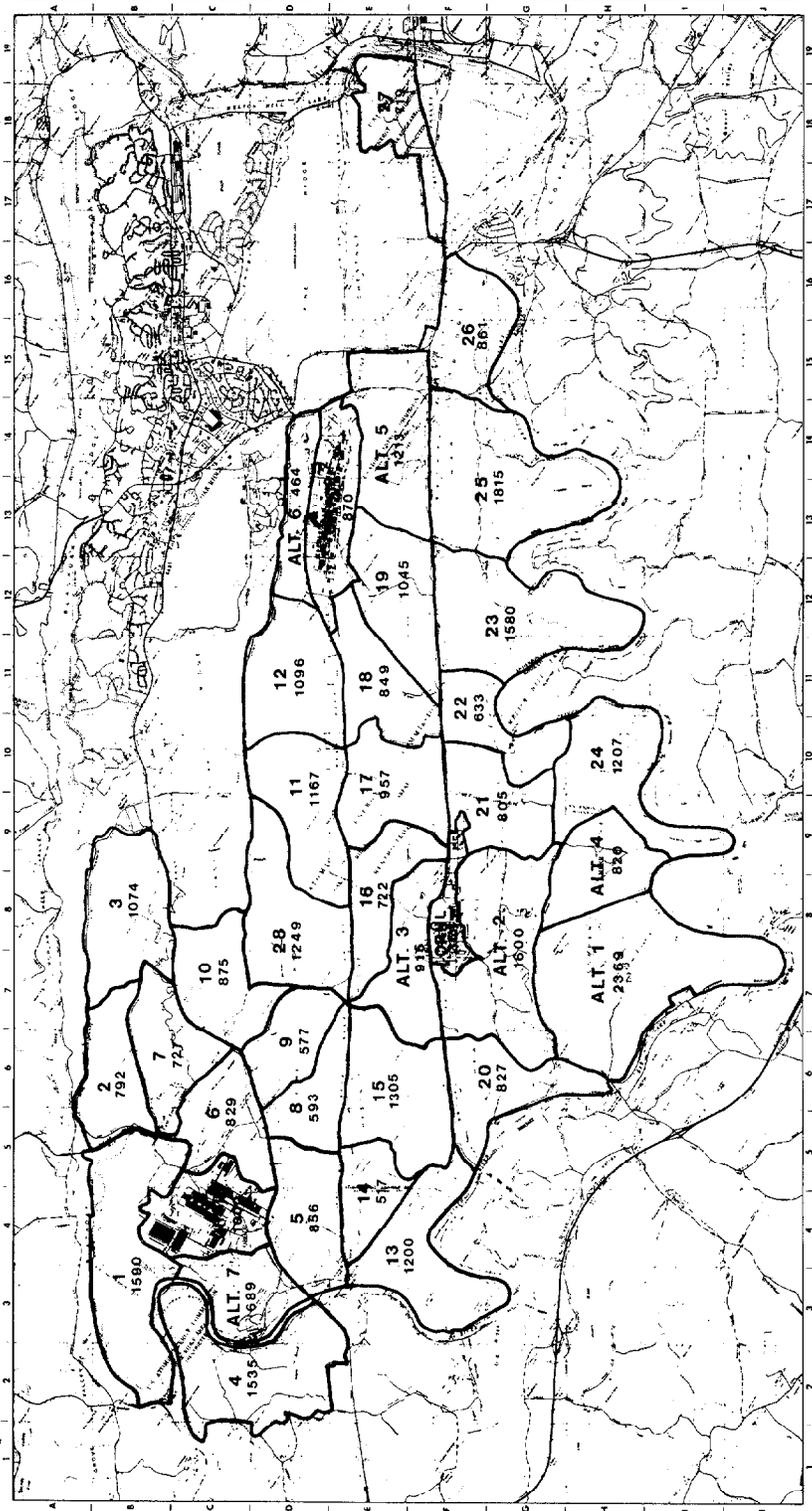


DATE: March 1983

BY: [Signature]

**Fig. 1 Forest Management Compartments.**

APPENDIX E



forest stratum. The new sampling procedure involves type-mapping and cruising each compartment using the Point Sampling [Probability Proportional to Size (PPS)] techniques (Avery 1967). Field tallies are separated on a merchantability basis into three categories:

(1) non-merchantable planted stands (fixed plot tally), (2) merchantable planted stands (variable plot tally), and (3) merchantable natural stands (natural tally). Merchantable stands are also double tallied for both pulpwood and sawtimber (sawtimber tally).

Stand volumes are computed for each species in each stratum with appropriate algorithms using tree diameter taken at breast height (1.4 m) and at merchantable height ( $h$ ) in the equation  $d^2h$ . Regression constants, fitted to Girard volume tables, are used to adjust the final volumes by individual species for their respective form classes. Stand and stocking tables are then developed giving tree volumes, number of trees by diameter, and merchantable height classes for all strata.

Timber volume growth estimates obtained from Continuous Forestry Inventory (CFI) plots in 1961 and 1965 were utilized to determine estimates of allowable cut on the Reservation and to develop silvicultural guidelines incorporated into the original management plan (Curlin 1965). An inventory using temporary plots similar to the CFI system was conducted in 1970 (Strock 1970). To obtain a more comprehensive comparison of data and growth estimates for the 1975 to 1980 revision, 207 of the original 226 TVA CFI plots were relocated and reinventoried in 1975; 16 were lost over the years to construction projects such as the Melton Hill Lake impoundment and powerline rights-of-way installations, and three plots were not located.

Emphasis was placed on completing the compartmental timber type mapping and PPS inventory in 1981 and 1982. Therefore, the CFI inventory will be delayed until 1983 and those data are not included in this revision.

#### 4. Growing Stock

Estimated sawtimber volume on the Reservation in 1961 [ $\geq 6$  in. (15.2 cm) dbh for eastern redcedar trees,  $\geq 10$  in. (25.4 cm) dbh for pine, and  $\geq 12$  in. (30.5 cm) dbh for hardwood species] was 62.9 million b.f. ( $1.5 \times 10^5 \text{ m}^3$ ) according to the TVA inventory. By 1965, when the original management plan was written, estimated volume was 81.0 million b.f. ( $1.9 \times 10^5 \text{ m}^3$ ) (Curlin 1965). In 1970, Strock estimated the forested area to be 10,820 ha with a volume of 93.6 million b.f. ( $2.2 \times 10^5 \text{ m}^3$ ) (Strock 1970). A reinventory of the original CFI plots in 1975 placed the forested area at 10,346 ha with a volume of 127.995 million b.f. ( $3.0 \times 10^5 \text{ m}^3$ ) (Table 3).

Differences between timber volumes estimated in 1970, 1975, and 1981 are explained by the changes in area used in computing volumes, the type of inventory, and various allometric equations used to analyze the data. Differences in area were created by reapportioning compartment size during the past ten years. The 1961 layout of the CFI plots created biases toward timbered areas, causing estimates of the average volume per hectare to be high. This was noted from analysis of the 1975 CFI inventory when it became apparent that recent clearing of forested areas for pasture, roadways, power-line rights-of-way, and construction areas removed plots from lowlands that contained low volume stands. This left a

Table 3. Comparison of PPS (probability proportional to size) inventory with previous inventories (international 1/4-inch rule)

Administrative unit	Total area <sup>a</sup> (ha)	Total forested area <sup>a</sup> (ha)	Sawtimber volume (10 <sup>6</sup> b.f.) <sup>b</sup>				
			1961	1965	1970	1975	1981
Resource Management	14,050 (34,705)	12,221	62.405	80.362	92.864	126.990	122.057
ORNL (X-10)	147	4	0.024	0.031	0.036	0.047	0.048
Y-12	352	-	-	-	-	-	-
ORGDP (K-25)	405	-	-	-	-	-	-
CARL (ORAU-DOE)	432	81	0.471	0.607	0.700	0.958	0.913
<b>TOTAL</b>	<b>15,508</b>	<b>12,306</b>	<b>62.900<sup>c</sup></b>	<b>81.00<sup>c</sup></b>	<b>93.600<sup>d</sup></b>	<b>127.995<sup>e</sup></b>	<b>123.078<sup>f</sup></b>

<sup>a</sup>Area based on 1981 evaluation of PPS inventory.

<sup>b</sup>b.f. = 0.0024 m<sup>3</sup>.

<sup>c</sup>Volume based on a sawtimber forested area of 12,085 ha & CFI.

<sup>d</sup>Volume based on a sawtimber forested area of 11,920 ha & CFI.

<sup>e</sup>Volume based on a sawtimber forested area of 10,820 ha & CFI.

<sup>f</sup>Volume based on a sawtimber forested area of 10,261.5 ha & PPS Inventory.

disproportionate number of plots on heavily timbered slopes and ridges, which thus created the bias.

A summary of figures presently available from the PPS inventory is contained in Table 4. Field data collected over a six-year period from 1976 to 1981 (Column 2) and volumes calculated from this data indicate a total reservation sawtimber volume of  $2.59 \times 10^5 \text{ m}^3$  (110.140 million b.f.) and an estimated total number of trees of 1,306,493. The sample area consisted of 11,504 plots in 735 stata containing sawtimber-size trees and covered an area of 10,248 ha (25,312 acres). Sampling frequency was determined to be one plot per 1.1 ha (1 plot per 2.2 acres). An average hectare contained 127.5 (51.6 per acre) trees with a volume of  $10.2 \text{ m}^3$  (4,334 b.f. per acre).

The predominant sawtimber species on the reservation is yellow pine (including loblolly pine, Pinus taeda) with an estimated total number of trees of 453,000 and a volume of  $7.6 \times 10^4 \text{ m}^2$  (32.29 million b.f.) or  $1.7 \times 10^{-1} \text{ m}^3$  per tree (71.28 b.f. per tree). Yellow poplar (Liriodendron tulipifera) follows with 131,000 trees and a volume of  $4.4 \times 10^4 \text{ m}^3$  (18.68 million b.f.) or  $3.4 \times 10^{-1} \text{ m}^3$  per tree (142.60 b.f. per tree). Next is the red oak group (Quercus sp) with 151,000 trees and a volume of  $4.1 \times 10^4 \text{ m}^3$  (17.25 million b.f.) or  $2.7 \times 10^{-1} \text{ m}^3$  per tree (114.24 b.f. per tree). White oak (Quercus alba) is fourth with 99,000 trees and  $2.7 \times 10^4 \text{ m}^3$  (11.32 million b.f.) or  $2.7 \times 10^{-1} \text{ m}^3$  per tree (114.34 b.f. per acre). Other species consisting of black walnut (Juglans nigra), black cherry (Prunus serotina), red cedar (Juniperus virginiana), and miscellaneous oaks (Quercus sp) contain the fifth largest group with 68,000 trees and a volume of  $2.3 \times 10^4 \text{ m}^3$

Table 4. Management compartment summary by area, number of trees, cruise volumes (sawtimber<sup>a</sup>), and error of bound

Compartment	Cruise date	Acre	Hectares	Total trees	Trees per hectare	Trees per acre	Volume per hectare (b.f.) <sup>b</sup>	Volume per acre (b.f.)	1981 volume (b.f.)	Total volume (b.f.)	Error bound for volume (b.f.)
A1	81	2046	828.3	118557	143.126	57.9459	15893.8	6434.74	13165488	13165488	505114
A2	79	1164	471.3	66931	142.027	57.5006	10223.8	4139.19	5473543	4818014	283168
A3	78	617	249.8	40425	161.832	65.5190	9812.9	3972.83	2919468	2451234	191536
A4	81	762	308.5	42295	137.099	55.5056	143826.6	6002.69	4574051	4574051	303617
A5	80	473	191.5	18818	98.265	39.7833	8418.2	3408.19	1708798	1612073	147843
A6	80	351	142.1	13391	94.236	38.1523	9716.7	3933.89	1463642	1380794	147540
A7	78	146	59.1	10322	174.623	70.6975	11854.5	4799.37	829681	700708	76129
O1	77	799	323.5	28126	86.949	35.2020	8176.1	3310.16	3339002	2644817	221927
O2	80	655	265.2	28187	106.294	43.0342	9889.8	4003.95	2779944	2622589	221927
O3	80	859	347.8	40774	117.242	47.4662	9911.7	4012.82	3653933	3447012	239509
O4	77	1133	458.7	48458	105.642	42.7701	7317.1	2962.41	4237364	3356408	198133
O5	78	643	260.3	30349	116.581	47.1987	10139.2	4104.93	3143252	2639471	196044
O6	77	532	215.4	24003	111.442	45.1184	11778.8	4768.73	2931409	2536963	207429
O7	78	369	149.4	21505	143.947	58.2782	8574.9	3471.62	1525730	1281028	140657
O8	76	493	199.6	24281	121.653	49.2523	9934.7	4022.15	2653161	1982921	158081
O9	77	463	187.4	20907	111.536	45.1564	8032.2	3251.89	1837301	1505624	136725
O10	79	698	282.6	31788	112.487	45.5411	11087.3	4488.78	3520432	3133172	228001
O11	79	974	394.3	52470	133.061	53.8709	13778.0	5578.13	6090408	5433091	330398
O12	79	911	368.8	46612	126.380	51.1660	12459.3	5044.27	5163310	4595328	283811
O13	80	835	338.1	51741	153.054	61.9651	9358.7	3788.95	3353603	3163776	231099
O14	80	425	172.1	19636	114.119	46.2022	8147.5	3298.60	1486018	1401904	134685
O15	76	1039	420.6	48160	114.490	46.3524	9568.7	3873.96	5373162	4025048	247252
O16	78	584	236.4	23800	100.663	40.7541	9736.2	3941.79	2741737	2302007	177223
O17	77	803	325.1	37597	115.646	46.8202	8540.5	3457.69	2991139	2776524	217703
O18	79	747	302.4	44141	145.955	59.0909	13744.3	5564.47	4670426	4156662	285827
O19	78	641	259.5	36722	141.503	57.2888	9860.7	3992.18	3044145	2558986	190404
O20	76	543	219.8	31146	141.678	57.3594	10079.2	4080.64	2965230	2215785	170489
O21	80	713	288.7	40041	138.712	56.1588	9045.6	3662.20	2767821	261151	206213
O22	80	450	182.2	21977	120.627	48.8370	8586.9	3476.47	1658274	1564409	150203

Table 4 (Continued)

Compartment	Cruise date	Acre	Hectares	Total trees	Trees per hectare	Trees per acre	Volume per hectare (b.f.) <sup>b</sup>	Volume per acre (b.f.)	1981 volume (b.f.)	Total volume (b.f.)	Error bound for volume (b.f.)
23	80	1066	431.6	73313	169.872	68.7741	13336.3	5399.33	6101023	5755682	312817
24	80	955	386.6	52017	134.536	54.4681	9322.0	3774.07	3820490	3604236	229159
25	80	871	352.6	49213	139.560	56.5019	13296.1	5383.04	4969945	4688627	275483
26	80	363	147.0	17355	118.092	47.8106	8919.9	3611.28	1389547	1310893	139781
27	80	297	120.2	14978	124.562	50.4301	10670.3	4319.94	1360004	1283023	134164
28	78	892	361.1	36455	100.947	40.8692	7848.9	3177.68	3375935	2834491	200119
TOTAL		25312	10247.8	1306493	127.490	51.6156	10747.1	4351.06	123078315	110133996	6047042

<sup>a</sup>Sawtimber = trees >6 in. (15 cm) dbh (red cedar), >10 in. (25.4 cm) dbh (pine, and >12 in. (30.5) dbh (hardwoods).

<sup>b</sup>1 board foot = 0.0024 m<sup>3</sup>.

(9.67 million b.f.) or  $3.4 \times 10^{-1} \text{ m}^3$  per tree (142.21 b.f. per tree). Chestnut oak (Quercus prinus) is sixth with 86,000 trees and  $2.2 \times 10^4 \text{ m}^3$  (9.34 million b.f.) or  $2.6 \times 10^{-1} \text{ m}^3$  per tree (108.60 b.f. per tree). Next is hickory (Carya sp) with 50,000 trees and  $1.4 \times 10^4 \text{ m}^3$  (6.08 million b.f.) or  $2.9 \times 10^{-1} \text{ m}^3$  per tree (121.60 b.f. per tree). Last is a group consisting of the remaining hardwoods such as elm (Ulmus sp), sycamore (Platanus occidentalis), ash (Fraxinus sp), etc. totaling 71,000 trees and a volume of  $1.3 \times 10^4 \text{ m}^3$  (5.67 million b.f.) or  $1.9 \times 10^{-1} \text{ m}^3$  (79.86 b.f. per tree). Figures 2 and 3 contain pie charts illustrating these figures graphically.

A comparison of the species mix in the PPS inventory and the 1975 CFI inventory (Bradburn 1977) shows some reordering of species dominance except for yellow pine which consistently maintains its dominant position in volume on the reservation with 29.3% of the total reservation sawtimber volume. Yellow poplar has moved from sixth to second place with 16.9% of the volume. The red oak group has moved from fifth to third place with 15.6%, followed by white oak, 10.3%; other species with 8.8%, chestnut oak with 8.5%, hickory with 5.5%, and miscellaneous hardwoods with 5.1% (Table 5).

Most of the reordering of species is due to differences in inventory procedures, types of inventories, and sampling intensities. It is interesting to note that the PPS inventory percentages are more comparable to those of the 1970 CFI than the 1975 CFI. Considering individual growth rates of species and the total area occupied by an individual species or species group, the ranking is realistic and acceptable.

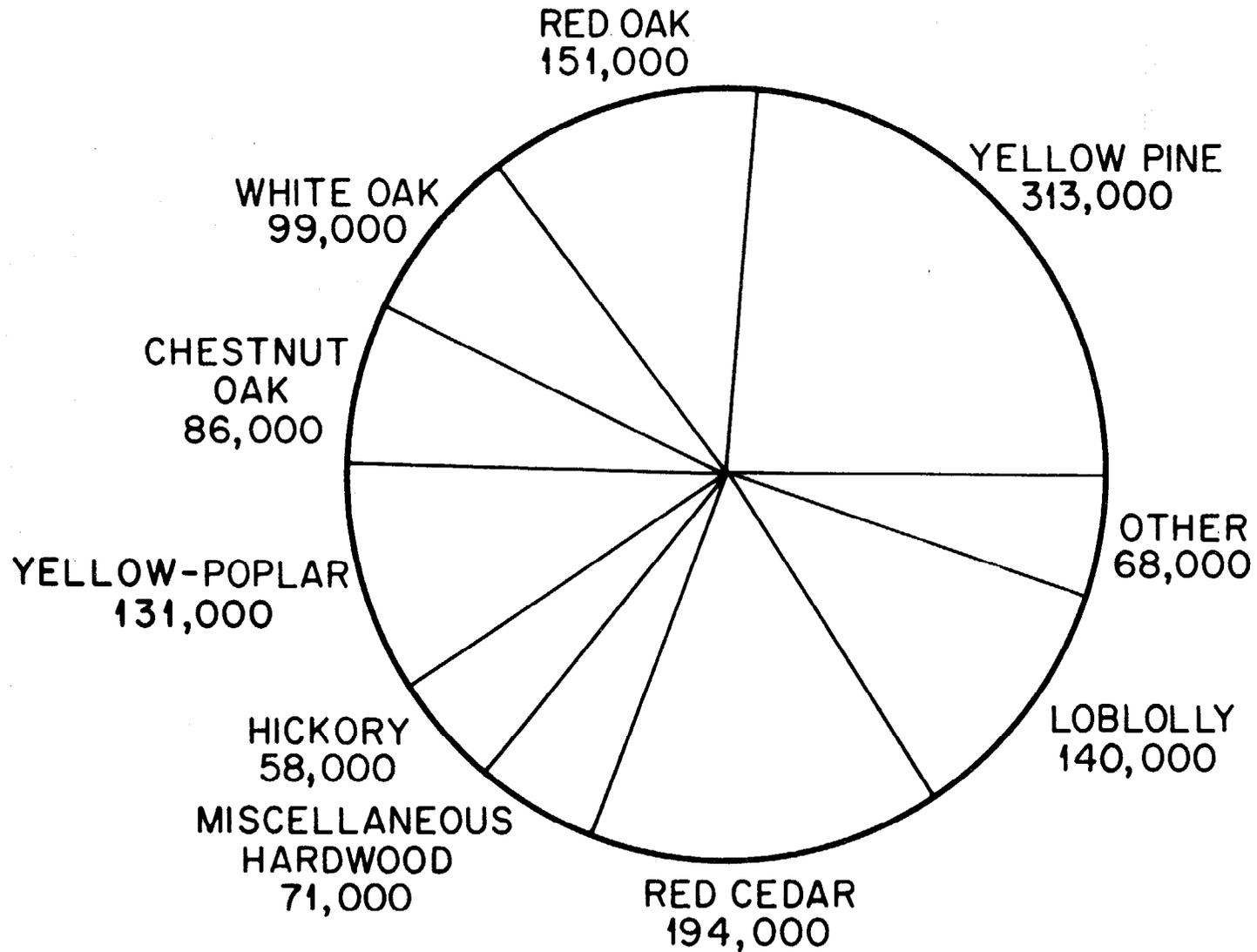


Fig. 2. Total number of sawtimber trees grouped by species as estimated from cruise data obtained between 1976 and 1981.

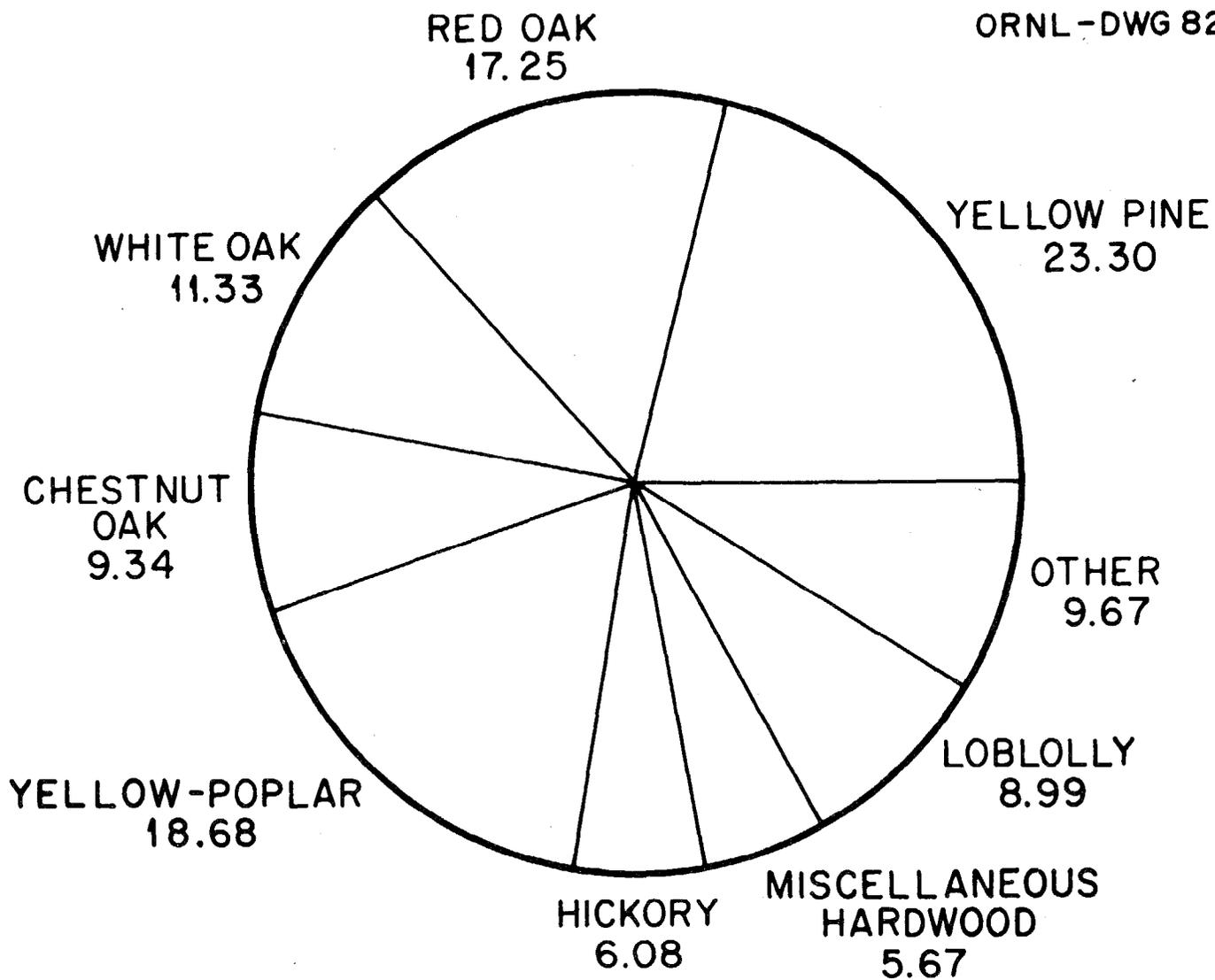


Fig. 3. Total sawtimber volume (million board feet) grouped by species as estimated from cruise data obtained between 1976 and 1981.

Table 5. Sawtimber growing stock by species on the Oak Ridge Reservation from 1970-1981

Species	Trees per acre	Volume per acre (b.f.)	% volume 1970	% volume 1975	% volume 1976-1981	% volume 1981
Southern yellow pine	15.1	1269.9	28.4	30.5	29.3	29.1
White pine	1.8	147.4	3.3	3.0	3.4	4.0
Red oak	8.0	676.1	13.6	9.5	15.6	16.0
White oak	5.3	446.4	13.0	14.1	10.3	10.1
Chestnut oak	4.4	368.4	7.3	10.4	8.5	8.3
Yellow poplar	8.7	732.4	17.7	9.4	16.9	17.0
Hickory	2.9	238.4	7.3	7.6	5.5	6.0
Black cherry	0.1	8.7	0.3	< 0.01	0.2	0.2
Black walnut	0.2	13.0	0.2	0.2	0.3	0.3
Misc. hardwoods	2.6	221.0	6.1	11.5	5.1	5.0
Misc. oaks	2.5	212.8	2.8	3.8	4.9	4.0
TOTAL	51.6	4334.0	100.0	100.0	100.0	100.0

Estimates of current (1981) sawtimber volumes (Table 4) by compartment were determined to provide an up-to-date comparison of inventories and for use in determining cutting schedules and volumes. The 1981 volumes were calculated by growing all 735 strata from their last measurement date through 1981 assuming a 6% annual growth rate (Applegate 1982, Watson 1979, TVA 1975). Volume deductions were made in those stands sustaining a harvest cut between their last measurement date and 1981. The updated total volume accounting for growth is approximately  $2.9 \times 10^5 \text{ m}^3$  (123.1 million b.f.). Volumes per hectares by compartments range from  $37.5 \text{ m}^3$  (6,435 b.f. per acre) in Compartment A1 to  $20.4 \text{ m}^3$  (3,497 b.f. per acre) in Compartment 14. Average volume per hectare for the reservation is  $28.3 \text{ m}^3$  (4,862 b.f. per acre). The updated volume showed no significant change in species ranking. There were some changes in the percent ratios of species and species groups which could be accounted for by harvesting practices since 1976. The species volume expressed as a percent of the total decreased for the southern yellow pine group, white oak, chestnut oak, miscellaneous hardwoods, and miscellaneous oaks, stayed the same for black cherry and black walnut, but increased for white pine, red oaks, yellow poplar, and the hickories (Table 5).

Estimates of the current sawtimber volume by species show yellow pines (including loblolly pine) with  $8.4 \times 10^4 \text{ m}^3$  (35.755 million b.f.), yellow poplar with  $4.9 \times 10^4 \text{ m}^3$  (19.727 million b.f.), white oak with  $2.9 \times 10^4 \text{ m}^3$  (12.329 million b.f.), and chestnut oak with  $2.5 \times 10^4 \text{ m}^3$  [10.23 million b.f (Fig. 4)].

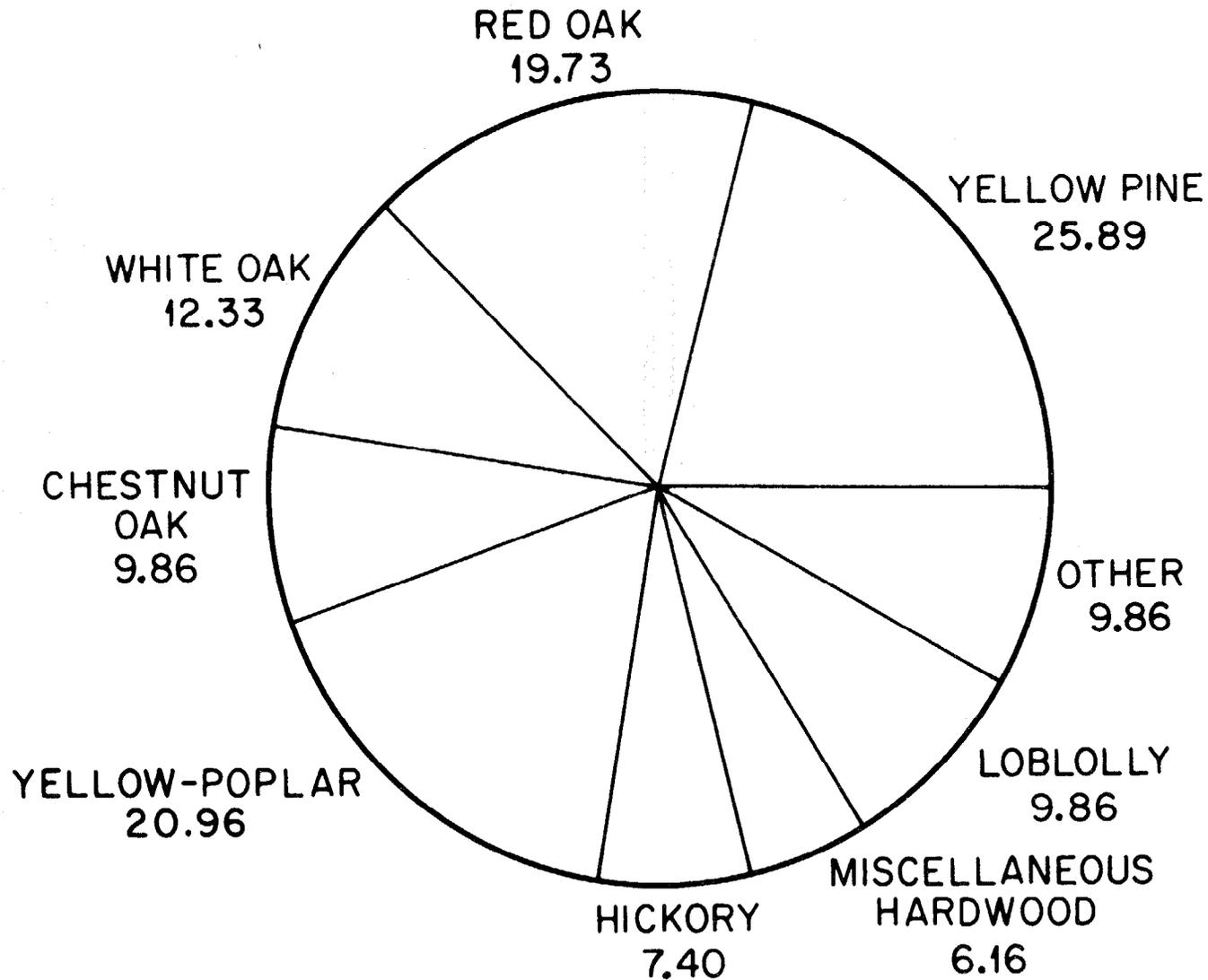


Fig. 4. Total sawtimber volume (million board feet) in 1981 grouped by species, based on growth projections of 1976-1981 cruise estimates presented in Fig. 3 and 4.

A complete set of compartment summary tables by stratum listing volume, number of trees and volume by area, and total area in acres and hectares is attached at the end of this report. These tables contain figures for the date of cruise and are not updated to 1981.

#### 5. Timber harvest and forest regulation

After initial logging for construction purposes in the early 1940's, no further timber was harvested until 1952. From 1952 to 1956,  $6.48 \times 10^3 \text{ m}^3$  (2.7 million board feet) of sawtimber and  $485 \text{ m}^3$  (134 cords) of pulpwood were sold for \$55,834 (Table 6). No timber was cut from 1956 to 1964 at which time the first in-house forest management program was initiated. Analysis of the inventory data available from the 1964 resurvey of the CFI plots installed during the 1964 TVA prospectus indicated the reservation could sustain an annual harvest of  $3.6 \times 10^3 \text{ m}^3$  (1.5 million board feet) per year from the 11,136 hectare forested portion of the reservation. Such a harvest would stimulate growth, while improving the growing stock quality during the rotation period. Due to the occurrence of widespread SPB epidemic and a sluggish timber market, the allowable cutting goal of  $3.6 \times 10^3 \text{ m}^3$  (1.5 million board feet) of sawtimber per year was not achieved. Sawtimber sales over the first five-year management cycle totaled only  $10.3 \times 10^3 \text{ m}^3$  (4.3 million board feet) or  $2.1 \times 10^3 \text{ m}^3$  (860,000 board feet) per year. Thinnings in the 2,024 hectares of pine plantations progressed as scheduled with 833 hectares yielding  $3.8 \times 10^4 \text{ m}^3$  (10,544 cords) of pulpwood. Revenues from timber sales during this period totaled \$175,928 (Table 6).

Table 6. Timber harvest summary on the DOE Reservation  
1964-1980

Period	Standard cords <sup>a</sup>	Million board feet <sup>b</sup>	Total value (\$)
1942-1947	Unknown	Unknown	Unknown
1947-1952	None	None	None
1952-1956	134	2.7	55,835
1956-1964	None	None	None
1964-1970	26,499 <sup>c</sup>	4.3	175,928
1971-1975	14,145 <sup>c</sup>	6.8	234,216
1976-1982	28,415 <sup>c</sup>	5.3	347,682
<b>TOTAL</b>	<b>69,193</b>	<b>19.1</b>	<b>813,661</b>

<sup>a</sup>128 cubic feet

<sup>b</sup>International 1/4-inch rule

<sup>c</sup>Includes beetle-infested timber

In 1969, the Atomic Energy Corporation (AEC), along with the Tennessee Valley Authority (TVA), the City of Norris, Tennessee, and Emory River Land Company entered into a ten (10) year timber sale contract with Longleaf Industries, Inc., of Lumpkin, Georgia, to entice an integrated wood utilization industry into the Oak Ridge area. A volume of timber equal to the allowable cut was offered by AEC under this contract consisting of  $2.98 \times 10^4 \text{ m}^3$  (12.4 million board feet) of hardwood and  $6.2 \times 10^3 \text{ m}^3$  (2.6 million board feet) of pine sawtimber. Due to erratic mill operation and an unpredictable lumber market, only  $1.85 \times 10^4 \text{ m}^3$  (7.7 million board feet) of pine and hardwood sawtimber was harvested from 1970 through 1975,  $3.1 \times 10^3 \text{ m}^3$  (1.3 million board feet) short of the anticipated volume. Net value of this sawtimber volume was \$183,496. The remaining \$50,720 was received as revenue for the  $5.1 \times 10^4 \text{ m}^3$  (14,145 cords) of pulpwood sold during the same time period. Average annual income for the period 1971 (em1975 was \$61,000 with a total five-year period income of \$234,216 (Table 6).

With the exception of approximately 208 hectares of small diameter shortleaf and loblolly pine, all of the merchantible reservation plantations had been thinned at least once by the end of 1973. Portions of the first thinned areas had been or were in the process of being thinned for the second time. The thinning objective in most cases is the reduction of basal area to 18.35 to  $20.65 \text{ m}^3$  per ha (80 to 90 square feet per acre), thus allowing the stand to maintain maximum growth and vigor while reducing the insect and disease susceptibility of the stand. Pine plantation thinning was halted in the latter portion of 1973 due to

another serious outbreak of southern pine beetles (SPB). Even so, salvage of SPB damaged timber in late 1973, created a sharp increase in the harvested volume of pine pulpwood, and continued through 1977. This epidemic peaked in 1976 when  $3.1 \times 10^4 \text{ m}^3$  (8,538 cords) of damaged pulpwood was removed and began tapering off in 1977 when  $2.3 \times 10^4 \text{ m}^3$  (6,460 cords) were salvaged. By 1978 most salvage cutting had been completed and the thinning program was resumed with only  $1.4 \times 10^4 \text{ m}^3$  (3,915 cords) being removed (Table 7). Through 1980 all remaining pine plantations have been thinned at least once except for approximately 21 hectares of white pine. Most loblolly pine plantations have been thinned twice, and some of these stands on better sites were thinned for a third time.

Sawtimber sales under the 10-year timber contract with Longleaf Industries, Inc. from 1976 through 1980 totaled  $1.0 \times 10^4 \text{ m}^3$  (4.2 million board feet) (Table 7). This contract was transferred in 1976 from Longleaf Industries, Inc. to American Forest Products, a subsidiary of Bendix Corporation. At the same time, the total volume commitment was reduced from  $3.6 \times 10^4 \text{ m}^3$  (15.0 million board feet) to  $3.0 \times 10^4 \text{ m}^3$  (12.3 million board feet) comprised of  $1.8 \times 10^3 \text{ m}^3$  (756,000 b.f.) of pine and  $9.0 \times 10^3 \text{ m}^3$  (3,735,000 b.f.) of hardwood sawtimber. The final timber volume cut under the 10-year contract was  $2.6 \times 10^4 \text{ m}^3$  (11.0 million b.f.),  $3.1 \times 10^3 \text{ m}^3$  (1.3 million b.f.) short of the contract commitment. Neither American Forest Products nor DOE wished to renew the long-term contract for an additional 10-year period;

Table 7. Timber products and market values from 1975-1980

Period	Standard cords <sup>a</sup>	Dollar value	Cedar sawtimber (bd ft) <sup>b</sup>	Dollar value <sup>c</sup>	Longleaf sawtimber (mm bf) <sup>d</sup>	Dollar value	Additional Sawtimber (bd ft) <sup>b</sup>	Dollar value	Total dollar value
1976	8,538	31,714	25,703	771	1.8	62,389	-	-	94,874
1977	6,460	21,891	28,000	847	1.5	65,968	68,450	2,023	90,729
1978	3,915	15,462	18,470	716	0.9	47,618	54,648	2,657	66,453
1979	3,394	21,594	-	-	-	-	243,586	6,800	28,394
1980	2,371	12,944	-	-	-	-	37,744	806	13,750
1981	974	5,899	-	-	-	-	138,141	7,698	13,597
1982	2,763	20,022	62,357	630	-	-	503,757	18,128	39,885
TOTAL	28,415	129,526	134,530	2,964	4.2	175,975	1,046,326	38,112	347,682

<sup>a</sup>128 cubic feet

<sup>b</sup>International 1/4-inch rule

<sup>c</sup>Includes fence post and firewood sales revenues

<sup>d</sup>Million board feet

<sup>e</sup>Includes \$1,105 in hay sales revenue

therefore, it was terminated in December 1978. Additional sawtimber sales for the 1976 (em1982 period consisted of spot bid sales of hardwood, pine, and redcedar sawtimber. Total cut volume for 1981 was low with only \$13,597 in revenues generated through the sale of  $3.5 \times 10^3 \text{ m}^3$  (974 cords) of pulpwood and  $3.3 \times 10^2 \text{ m}^3$  (138,141 b.f.) of sawtimber. Sales increased in 1982 partly due to clearing for the Clinch River Breeder Reactor where  $8.8 \times 10^2 \text{ m}^3$  (365,000 b.f.) of sawtimber and  $3.8 \times 10^3 \text{ m}^3$  (11,051 cords) of pulpwood was harvested. Total revenue for 1982 was \$39,885 and for this management period was \$347,682 (Table 7, also includes \$1,105 in hay sale revenues).

The allowable cut for the first three years of the 1976-1980 management cycle was  $3.8 \times 10^3 \text{ m}^3$  (1.6 million b.f.); the second three years it was cut to  $2.4 \times 10^3 \text{ m}^3$  (1.0 million b.f.), and the last two years no allowable cut was specified (Table 8). Harvesting during 1976 and 1977 satisfied the cut, but declined to a low in 1981 of only  $91.2 \text{ m}^3$  (38,000 b.f.) of sawtimber. Absence of an allowable cut in 1981 and 1982 was due to a re-evaluation of Forest Management programmatic goals by the Environmental Sciences Division at ORNL. Responsibility for the Forest Management program has since been transferred to the Operations Division and through encouragement by DOE Oak Ridge Operations for wise use of reservation resources, an allowable cut has been reinstated in concert with the multiple-use concept as described in the Oak Ridge Reservation Land Use Plan.

Table 8. Timber removals by compartments 1976-1982

Year	Recommended cut <sup>a</sup> Compartments	Actual cut (MMBF) <sup>b</sup>	(MMBF) <sup>b</sup>
1976	A-2,C-1,3,7,13,25,26	1.6	1.798
1977	A-2,3,C-1,2,3,5,6,7,8,9, 10,12,16,17,28	1.6	1.569
1978	A-2,3,C-6,16	1.6	0.972
1979	A-6,C-5,6,9	1.0	0.244
1980	C-8,9,15 1.0	0.038	
1981	C-9,10,11,19,20,28	0.0	0.138
1982	A-3,C-11,12,13,14,15,16, 18,20,28	0.0	0.504
TOTALS		6.8	5.263

<sup>a</sup>The allowable cut was increased in 1976 from 1.5 to 1.6 million board feet to fulfill the long-term timber contract obligation.

<sup>b</sup>Million board feet.

Previous plan revisions have contained an allowable cut for sawtimber only; this plan revision will include cutting budgets for pine and hardwood pulpwood. Pine pulpwood is removed through plantation thinnings, salvage for insect and disease control, and salvage prior to reforestation. Hardwood pulpwood is removed for timber stand improvement (TSI), accomplished through cultural treatments which improve stand health such as diseased tree removal, cull removal, and precommercial thinning of young hardwood plantations. Included in these budgets will be estimated volumes of pulpwood to be removed prior to programmatic clearing for three plant projects. An allowable cut of  $1.3 \times 10^4 \text{ m}^3$  (3500 cords) is estimated for pine pulpwood to meet all programmatic needs. The actual cuts will range from  $1.27 \times 10^4 \text{ m}^3$  (3400 cords) to  $1.34 \times 10^4 \text{ m}^3$  (3700 cords) with annual revenues from \$23,000 to \$30,000. Average annual area to be thinned is 96.36 ha (238 acres). Total revenue to be expected from the removal of  $6.4 \times 10^4 \text{ m}^3$  (17,688 cords) of pine pulpwood is \$132,746 (Table 9).

An allowable cut for hardwood pulpwood is estimated at  $0.7 \times 10^4 \text{ m}^3$  (2000 cords) to accomplish the aforementioned goals. Hardwood pulpwood sales and sale areas will be smaller than those for pine, since there are fewer established hardwood plantations on the reservation. Hardwood pulpwood bid sales will be utilized primarily to fulfill the three-plant needs, cull timber removal, and cleanup after hardwood timber sales.

Table 9. Proposed pine pulpwood budget and removals for 1983-1987

Year	Budgeted cut (cfs) <sup>a</sup>	Compartment No.	Stand No.	Actual cut (cfs) <sup>a</sup>	Revenues
1983	3,500	C-11,12,15,20	1-46,1-24,3-3,4-10,5-37	3,584	\$23,296
1984	3,500	A-1,5,C-17,21	1-10,1-7,1-51,2-78,3-5,1-59,2-78,3-5 2-18,6-11,38-12,6-38,4-6,6-5,7-8,	3,428	23,996
1985	3,500	C-24,25	2-21,2-52,3-4,3-9,3-4	3,456	25,920
1986	3,500	C-4	1-129,2-5,3-200	3,672	29,376
1987	3,500	C-13,18	1-110,2-60,3-32,4-24,5-4,6-13,7-13	3,548	30,158
TOTALS	17,500			17,688	\$132,746

<sup>a</sup>Standard cord = 128 cubic feet

The cutting schedule for the ensuing five-year management period will entail bringing the total growing stock closer to the optimum level by balancing the timber size classes and arial distributions to ensure a future uniform annual yield and species diversity. A theoretical rotation age or adjustment period of 96 years is necessary to fully regulate a hardwood forest of this type. A regulated cutting system will tend to maintain the forest in a healthy rigorous condition by removing mature and overmature timber, diseased and insect-infested trees, and inferior quality (cull) trees.

An allowable cut for sawtimber in previous plans varied from  $2.4 \times 10^3 \text{ m}^3$  (1.0 million b.f.) to  $3.8 \times 10^3 \text{ m}^3$  (1.6 million b.f.). The sustained-yield concepts maintains that the allowable cut should not exceed total net growth. An average annual growth rate of approximately 6 percent has been consistently maintained on the reservation since the first inventory was conducted by TVA in 1961. Therefore, applying this rate to the 1981 sawtimber volume, accrued growth for 1982 would equal approximately  $1.8 \times 10^4 \text{ m}^3$  (7.4 million b.f.). It is not desirable to cut the total growth since this would theoretically maintain the forest in a static condition and not allow maturing of young sawtimber and pole-timber stands. The primary goal of forest regulation is to attain, then maintain, full stocking of all stands in the forest. A fully stocked stand contains the optimum number of trees per acre which take full advantage of the site's potential.

A minimum allowable sawtimber cut of  $2.4 \times 10^3 \text{ m}^3$  (1.0 million b.f.) per year is needed with harvest cuts made in specified stands of at least three compartments annually in order to cover the 35 compartments

within a 12-year cutting cycle. Eight cutting cycles will constitute a rotation of 96 years or the maximum theoretical age a hardwood stand will attain when the forest is perfectly regulated. The 96 year age class will probably never be obtained since many hardwood stands have already surpassed this age class and the allowable cut is too low (13.5 percent of the  $1.8 \times 10^4 \text{ m}^3$  annual increment) to remove the necessary volume.

Disruptions in the harvest schedule from 1978 through 1982 (Table 8) have created an overabundance of mature stands requiring attention. This fact, coupled with a minimal allowable cut and the present shortage of man-power, will increase the time needed to adequately treat the required number of stands and compartments during this management cycle.

Therefore, with the exception of 1986 and 1987, only two compartments per year will be treated initially in operational cutting sequence (Table 10).

The annual allowable cut is defined by compartment and stand number in Table 10. Stands were selected for cutting on the basis of age, volume per hectare, logging chance, and vigor. Average stand volume per hectare ranged from  $8.4 \text{ m}^3$  (3500 b.f. per acre) to  $29.5 \text{ m}^3$  (12,311 b.f. per acre). The average volume per hectare for the total recommended cutover area is:  $20.8 \text{ m}^3$  (8,659 b.f. per acre). All stands were grown at six percent per year from the date of cruise to the year of cut to determine their "present" volume.\* Volume to be removed, "cut volume," by compartment was determined by the ratio of the present compartment volume to the total for that given year times the allowable cut. Expected

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\*Present volume is defined as that volume a timber stand will attain by harvest year. .FE

Table 10. Operational sequence for timber harvest by stand and compartment for 1983-1987

Year	Compartment	Stand no.	Area (ACS)	Present vol. (MBF)	Cut vol. (MBF)	Revenues \$
1983	C-1	11,13,14,18,21,22,24	480	2,371	760	31,920
	C-22	12,19,21,22	149	763	240	10,080
			610	3,134	1,000	42,000
1984	C-23	7,12,13,21,23,24,26,28,32,34	588	4,751	780	34,905
	C-24	4,8,13,22,28,34,35	166	1,319	220	9,845
			754	6,070	1,000	44,750
1985	A-1	3,9,10,11,12,21,23,24,29,37, 38,39,43,44	964	9,507	941	47,521
	A-5	10,17	65	589	59	2,980
			1,029	10,096	1,000	50,501
1986	A-4	4,10,12,13,16,20,22,24,25	320	3,940	680	37,230
	C-19	7,12,14,15	129	1,194	210	11,498
	C-21	16,23,24	77	658	110	6,023
		526	5,792	1,000	54,751	
1987	A-3	2,4,11,15	100	931	110	6,490
	C-4	8,9,18,19	304	2,464	300	17,700
	C-25	2,4,5,6,7,8,9,12,14,15,16, 17,19,23,24	538	4,946	590	34,810
		942	8,341	1,000	59,000	
TOTALS			3,861	33,433	5,000	251,002

revenues were determined by first separating the allowable cut into two species groups (em pine and hardwood). Next a base stumpage rate equal to 1982 prices was assumed for the 1983 cut. This base rate was then increased each year by \$2.50 and \$5.00 per thousand board feet for pine and hardwood, respectively. These rates are very conservative; therefore, with improved market conditions, the actual revenues should run from 15 to 25 percent greater than those projected.

The harvest schedule described in Table 10 is at best a general guide to be utilized in the final selection of the actual stands to be cut. Use-priority will eliminate some stands (research studies, natural area, etc.) plus the present forest management manpower levels negate applying an adequate uniform treatment to such large areas annually. Also, silvicultural, wildlife, and utilization objectives cannot be met by applying a small cut over such a large area. The average volume per hectare of  $3.1 \text{ m}^3$  (1295 b.f. per acre) is an unsatisfactory logging change. Logging chance is the economic profitability of removing stumpage or timber from the forest as viewed both by the seller and purchaser. Therefore, to accomplish multiple objectives, the actual volume per hectare removed will be increased to approximately  $8.4 \text{ m}^3$  (3599 b.f. per acre) and the total cutover area decreased to approximately 116 ha (286 acres) per year. Total revenue from sawtimber sales during the next management period should therefore exceed \$251,000.

Additional figures summarizing the potential cut areas are contained in Table 11. The most significant point in Table 11 is that even with a harvest cut of  $2.4 \times 10^3 \text{ m}^3$  (1.0 million b.f.), the average stand

Table 11. Operational sequential cut summary by compartments and year

Compartment	Total acs (sawtimbered)	Total vol. (MBF)	Ave. vol. acs(b.f.)	Cut acs	Total vol. cut acs (MBF)	Cut vol. (MBF)	Residual vol. (MBF)	Residual vol./ac
<u>1983</u>								
C-1	799	3,732	4,670	480	2,371	760	1,611	3,356
C-22	450	1,863	4,140	149	763	240	523	3,510
	1,249	5,595	4,480	629	3,134	1,000	2,134	3,392
<u>1984</u>								
C-23	1,066	7,266	6,816	588	4,751	780	3,971	6,753
C-24	955	4,823	5,641	166	1,319	220	1,099	6,620
	2,021	12,089	5,982	754	6,070	1,000	5,070	6,724
<u>1985</u>								
A-1	2,046	16,621	8,123	964	9,507	941	8,566	8,886
A-5	473	2,035	4,302	65	589	59	530	8,154
	2,519	18,656	7,406	1,059	10,096	1,000	9,096	8,840
<u>1986</u>								
A-4	762	6,117	8,028	320	3,940	680	3,260	10,188
C-19	641	4,079	6,363	129	1,193	210	983	7,620
C-21	713	3,704	5,195	77	658	110	548	7,117
	2,116	13,900	6,569	526	5,791	1,000	4,791	9,108

Table 11 (Continued)

Compartment	Total acs (sawtimbered)	Total vol. (MBF)	Ave. vol. acs(b.f.)	Cut acs	Total vol. cut acs (MBF)	Cut vol. (MBF)	Residual vol. (MBF)	Residual vol./ac
<u>1987</u>								
A-3	617	4,141	6,712	100	931	110	821	8,210
C-4	1,133	6,010	5,305	304	2,464	300	2,164	7,118
C-25	871	7,050	8,094	538	4,946	590	4,356	8,097
	2,621	17,201	20,111	942	8,341	1,000	7,341	7,793
TOTALS	10,526	67,441	6,407	3,880	33,432	5,000	28,432	7,327

volume will continue to increase from year to year and is well above the reservation average of 11.7 m<sup>3</sup> per hectare (48.62 b.f. per acre). This point holds true whether the allowable cut is taken from 116 ha (286 acres) or 1570 ha (3880 acres), and any decrease in the cut area will also decrease the logging impact. Total sawtimber volume of the selected cut stands will be decreased by 15 percent or 3 percent per year. Given there will be needs for specific areas to be clear-cut during this same time period (3-plant needs, wildlife projects, research studies, or site-species conversion), the cut volume will be concentrated and the total impacted area decreased even further. This is not always desirable from a silvicultural standpoint and may tend to increase the cut volume in a given year since the specified allowable cut may have already been contracted for sale.

B. Management Policy and Silvicultural Practices

The silvicultural objective of the forest management program is to develop the optimum species type(s) for each site on the reservation consistent with the aims and objectives of the multiple-use principle (wildlife, forestry, NERP, research, etc.) as they relate to the DOE Land-Use Plan. To accomplish this objective, a combination of silvicultural methods is needed, depending on individual site characteristics and species capabilities. More productive sites can support more intensive cultural methods since greater timber values can be derived than on poorer sites. Therefore, the reservation will be characterized by a broad spectrum of silvicultural treatments ranging from protected natural areas to intensively cultured plantations.

1. Low-production sites

Ridges, upper slopes, and south-facing slopes have low production potential. These areas range in oak site index\* from 40 to 50 and loblolly pine site index from 50 to 90. Such sites are generally characterized by dry rocky or cherty ridges, south-facing upper and mid-slopes, (topographic classes 1, 2, and 3), and small amounts of severely eroded soil. Timber stands occupying these sites are low quality oak species (Quercus spp.), Virginia (Pinus virginiana), and shortleaf pine (Pinus taeda). Yellow-poplar production will exceed that of most oak species on the better of these poor sites, but will not maintain pure stands, even though the proportion of yellow-poplar can be increased on some of these sites with proper management. Loblolly pine is best suited for these poor sites and should be planted whenever possible. Site conversion with Virginia pine is marginal.

Narrow bands of Gladesville soil series, a highly erodible soil formed over calcareous siltstone, run east to west across the Reservation and comprise the poorest sites in the forest. During the past five-year management cycle, some of these sites have been artificially regenerated with loblolly pine. Seedling survival has been satisfactory and growth is approximately 75% of that observed on adjacent sites with better soils.

\*Site index is a measure of the capability of land to produce timber. It is the height in feet that dominant trees will attain in 50 years on a specific site (soil).

Sites with low productivity will be managed by either the group-selection method (uneven-age forest) or the clear-cutting method (even-age forest). The system actually used will depend on the species occupying the site, the soil type, and the topographic class. Virginia and shortleaf pine occupied many of these sites until the recent southern pine beetle epidemic, and now many of these areas are either cut-over or left with standing dead. At those sites where reproduction is sufficient and there are desired species, no further action is required. Sites with insufficient new stock will be regenerated artificially with hardwood or other pine species. Where pine predominates and is suited to the site, a 40- to 50-year rotation will be established under an even-aged management system. Hardwoods that eventually can be harvested require a 90- to 120-year rotation period.

No species considered undesirable will be intensively managed or replanted on a low-productive site, except in natural areas or those areas designated to satisfy a wildlife objective.

## 2. High-production sites

Better quality areas on the Oak Ridge Reservation have an oak site index that ranges from 60 to 80 and a yellow-poplar site index from 90 to 120. Coves, bottomlands, north slopes, many lower south slopes (topographic classes 4 through 8), and some ridge tops with relatively deep, well-drained soils derived from limestone parent material develop these site indices.

Many of the high-production sites support pure or mixed stands of yellow-poplar, black walnut, northern and southern red oak (Quercus rubra L. and Q. falcata Michx.), sweetgum (Liquidamber styraciflua), and maples (Acer sp.). White oak, red oak, and yellow-poplar will be favored on north upper and mid-slopes when present. Even-aged silviculture will be used to manage the productive sites. This will favor the more shade-intolerant species such as yellow-poplar, black walnut, black cherry, cottonwood (Populus deltoides), and ash species (Fraxinus sp.). Two cutting phases, the reproduction (harvest) cut and intermediate cuts, comprise one rotation.

The reproduction cut is made the final year of the rotation period, usually in a mature stand. It is recommended that understocked stands composed of less desirable species be cut before biological maturity to facilitate area regeneration with more suitable higher potential (value) growing stock. A reproduction cut removes all mature timber, thus allowing seeds to be evenly germinated, and coppice growth. Any trees not harvested should be killed shortly after the reproduction cut to help assure successful natural regeneration.

Thinnings or improvement cuts should be made at 12-year intervals after the reproduction cut. This will maintain a healthy vigorous stand of high-quality stems. Intermediate cuts will also maintain proper spacing and stocking during the interim between regeneration and the rotation cut. Initial thinnings and improvement cuts will yield pulpwood, but later, as the stand matures, sawtimber may also be removed, leaving the best stems each time for crop trees. Stand reproduction is of no concern during the intermediate cutting stages of the rotation period.

Thinnings and improvement cuts are usually terminated after the first 60 to 70 years at which time theoretical optimum stocking should be achieved.

The best cove and minor bottom sites should yield 24- to 28-in. (61- to 71cm) sawtimber over a 60- to 75-year rotation with most hardwood species. Slope sites of intermediate productivity should produce 20- to 24-in. (51- to 61-cm) sawtimber with a rotation period of 75 to 90 years, given proper thinning and care. These estimates exclude any initial cultural treatment such as fertilization or cultivation during the rotation.

### 3. Plantations

The original reforestation program on the DOE Reservation was contracted through Management Services Incorporated (MSI) in the middle 1940s to reforest the numerous old field sites located primarily in the valleys and lower slopes of the Reservation. Species planted by MSI from 1947 to 1961 in order of predominance were shortleaf pine, loblolly pine, white pine, Virginia pine, yellow-poplar, white ash (Fraxinum americana), sycamore (Platanus occidentalis), black locust (Robinia pseudoacacia), red maple (Acer rubra), and eastern redcedar. The principal goal was reforestation of open areas as quickly as possible, with species-site suitability a secondary consideration. Shortleaf pine, a native species, was heavily favored over most others and was extensively planted over a diversity of sites. This species has since proved least desirable on most of the sites and has been the most susceptible to southern pine beetle attacks during the 1966 and 1976 epidemics. A total of 6,305,000 seedlings were planted through 1961 with spacing of initial plantings

ranging from 0.6 x 1.8 - 1.8 x 1.8 m (2 x 6 - 6 x 6 ft). Seedling survival was generally good, and the oldest plantings (1947) are now 36 years old.

The commercial thinning program begun in 1967 has progressed well over the years with all loblolly stands having been thinned at least once. With the exception of approximately 51 hectares (125 acres) these same stands now have had a second thinning. Third thinnings began in 1976 with just over a third of these plantations being thinned to date. Stands are thinned to a basal area of 18.35 sq meters per hectare (80 sq ft per acre) with first thinnings yielding from 35.9 to 53.8 m<sup>3</sup> of pulpwood per hectare (4 to 6 cords per acre), second thinnings yielding 44.8 to 71.7 m<sup>3</sup> of pulpwood per hectare (5 to 8 cords per acre) and third thinnings yielding 45.9 m<sup>3</sup> of pulpwood and 2.2 m<sup>3</sup> of sawtimber per hectare (5.12 cords and 380 board feet per acre). Some thinnings were accomplished in white pine plantation also with approximately half of these stands now having been thinned once. Volumes per hectare ranged from 71.7 m<sup>3</sup> to 89.7 m<sup>3</sup> (8 to 10 cords per acre) including sawtimber. Annual pulpwood harvest volumes fell in 1977 and 1978 after the SPB epidemic returning to a level consistent with the thinning program. Pulpwood removals totaled  $10.3 \times 10^4$  m<sup>3</sup> (28,415 cords) with a value of \$129,526 for the 1976 (em1982 cycle (Table 7)). Efforts will be made to maintain the thinning program on schedule to assure healthy productive stands.

Planted areas managed for pine will be scheduled on a forty (40) year rotation for loblolly, 50 years for Virginia and shortleaf pine, and 70 years for white pine. It is doubtful that seed tree cuts will

satisfactorily regenerate these species if prescribed fire is eliminated from the management system. This would be due to advance hardwood competition and the absence of a mineral-soil seed bed at harvest. Therefore, to eliminate the possibility of regenerating understocked stand, it will be necessary to mechanically prepare the site and reforest with improved planting stock of a desired species. A shorter rotation period is also realized by artificial regeneration. Acres with satisfactory pine reproduction or desirable "on-site" hardwood species will be managed accordingly by silvicultural methods previously outlined.

The recent southern pine beetle epidemic (1973-1976) has taken a devastating toll on the original shortleaf stands, both natural and planted. Beetle damaged pulpwood and sawtimber has been salvaged on approximately 1122 hectares since 1973. With an expanded reforestation program during this time, most of these areas have been returned to production. During the past management cycle, 719.4 hectares (1777.1 acres) have been replanted with numerous pine and hardwood species. Table 12 summarizes regeneration activities by species, areas, and survival rates. Survival has been high overall with an average stand survival rate of 85.1% and seedling survival of 90.6%. A 4.9-ha area (12 acres) located in Compartment #1 was lost to drought during the summer of 1980 and a 2.4-ha area (6 acres) of black walnut lost in the summer of 1981 due to herbaceous competition. Both areas have been replanted and are doing well with high survival rates. Two areas were planted in 1981 consisting of a mixture of seven species for demonstration purposes and fertilizer growth studies. Species planted within some of these areas

Table 12. Regeneration of forest stands by species on the Oak Ridge Reservation 1976 to 1980

Year	Species	No. of seedlings	Area (ha) <sup>a</sup>	Stand survival (%)	Seedling survival (%)
1976	Loblolly pine	165,000	89.9 (222)	83.1	83.5
	Eastern cottonwood	7,000	4.9 ( 12)	94.3	94.3
	Sweetgum	5,000	4.0 ( 10)	84.0	82.5
	Black walnut	4,000	4.0 ( 10)	75.0	75.0
	Sycamore	12,000	11.7 ( 29)	92.5	92.5
	Green ash	10,000	6.9 ( 17)	93.4	92.0
	River birch	8,000	5.3 ( 13)	95.0	94.1
	Black cherry	400	0.4 ( 1)	80.0	80.1
	Chinese chestnut	1,000	0.8 ( 2)	91.7	91.7
	American chestnut	200	0.2 (0.5)	10.0	10.0
	Longleaf pine	2,000	1.2 ( 3)	17.5	17.5
	Northern red oak	300	0.2 (0.5)	77.5	77.5
	TOTAL	214,900	129.5 (320)	83.0	83.5
1977	Loblolly pine	182,000	96.0 (237)	88.0	92.0
	Yellow-poplar	12,800	4.4 ( 11)	72.0	75.0
	Eastern cottonwood	2,000	1.6 ( 4)	82.0	82.0
	Black walnut	4,000	3.6 ( 9)	87.0	87.0
	Sycamore	8,700	5.7 ( 14)	94.0	95.0
	Green ash	12,800	7.3 ( 18)	81.0	89.0
	River birch	350	2.0 ( 5)	74.0	77.0
	Alder	350	0.4 ( 1)	97.0	97.0
	Butternut	100	0.4 ( 1)	75.0	100.0
	Baldcypress	4,000	0.8 ( 2)	97.0	97.0
	TOTAL	227,100	122.2 (302)	91.0	94.0
1978	Loblolly pine	195,000	116.2 (287)	90.0	95.0
	Yellow-poplar	11,000	8.9 ( 22)	88.0	98.0
	Eastern cottonwood	5,000	8.5 ( 21)	89.0	94.0
	Black walnut	3,000	2.0 ( 5)	75.0	92.0
	Sycamore	1,500	2.0 ( 5)	82.0	94.0
	White ash	10,000	5.3 ( 13)	84.0	89.0
	Chinese chestnut	500	0.4 ( 1)	87.0	94.0
	Baldcypress	200	0.4 ( 1)	85.0	94.0
	White mulberry	500	0.4 ( 1)	65.0	76.0
	TOTAL	226,700	144.1 (356)	90.0	94.0

Table 12 (Continued)

Year	Species	No. of seedlings	Area (ha) <sup>a</sup>	Stand survival (%)	Seedling survival (%)
1979	Loblolly pine	165,000	105.3 (260)	94.0	97.0
	Yellow-poplar	15,000	6.5 ( 16)	93.0	95.0
	Eastern cottonwood	15,000	4.0 ( 10)	91.0	95.0
	Black walnut	4,250	3.2 ( 8)	86.0	91.0
	Sycamore and Cottonwood	7,000	12.2 ( 30)	84.0	89.0
	Cottonwood	331	1.2 ( 3)	98.0	100.0
	White pine	2,000	2.0 ( 5)	92.0	95.0
	TOTAL	208,581	134.4 (332)	93.0	96.0
1980	Loblolly pine	100,000	63.6 (157)	73.0	80.0
	Yellow-poplar	4,000	2.4 ( 6)	80.0	94.0
	Eastern cottonwood	4,000	0.8 ( 2)	22.0	22.0
	Sycamore	7,000	5.7 ( 14)	63.0	76.0
	Cottonwood	6,000	5.3 ( 13)	75.0	81.0
	White pine	5,000	3.6 ( 9)	22.0	26.0
	TOTAL	126,000	81.4 (201)	73.0	79.0
1981	Loblolly pine	116,119	63.6 (157)	89.0	92.9
	Yellow-poplar	10,582	5.0 ( 12)	92.0	100.0
	Black locust	6,864	2.6 ( 6)	ND	ND
	Sweetgum	6,640	2.6 ( 6)	ND	ND
	Eastern cottonwood	2,692	1.0 (2.5)	ND	ND
	Black walnut	1,500	1.2 ( 3)	50	50
	Sycamore and Paulonia	756 ea.	0.17 (0.42)	ND	ND
	TOTAL	145,909	76.2 (188.1)	89	93
1982	Loblolly pine	50,000	27.9 ( 69)	84	89
	Black walnut	3,000	2.4 ( 6)	95	98
	White ash	1,500	1.2 ( 3)	96	100
	TOTAL	54,500	31.6 ( 78)	86	95
OVERALL TOTAL		1,203,690	719.4 (1777.1)	85.1	90.6

occupy less than 0.5 ha, are intensively cultured, and stocking is maintained at or near a 100% level. Therefore, no survival data has been included for these species in order to eliminate bias.

Numerous pine and hardwood species have been test planted since 1973 to determine those most desirable to plant and manage. Table 13 lists all species planted since 1973 by year planted and total planted area. In order of planting preference, the species have been loblolly pine, yellow poplar, sycamore, and eastern cottonwood. Success has been exceptional with these species. The others, many of which are desirable, require intensive culture and will be utilized as time and project objectives dictate. Of the various hardwood species planted, the most desirable are black walnut and eastern cottonwood on the best bottomland sites; yellow poplar, sycamore, and green ash on the middle and lower north slopes and coves; river birch, sweetgum, sycamore, and ash on the extremely wet and/or poorly drained sites. Criteria affecting species to site selection include soil type, drainage, aspect, accessibility, degree of site prep required, seedling supply, and site index. Species not included in Table 13 due to the small area planted (>0.4 ha) are white oak, chestnut oak, and sawtooth oak (*Quercus ocutissima*) planted in Compartment #4 in 1973. These species were planted on a low site along with yellow poplar. Flooding in the latter portion of 1973 eliminated all of these plantings except for the yellow poplar which is now doing well.

Other new species will be test planted during the next cycle besides those listed in Table 13. Some species to be planted for both timber and

Table 13. Planting summary on the Oak Ridge Reservation 1973-1982

Species	Area		Years planted										
	(ha)	(acres)	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Loblolly pine	<u>Pinus taeda</u>	846.0	2,089.5	X	X	X	X	X	X	X	X	X	X
White pine	<u>Pinus strobus</u>	8.9	22.0					X		X	X		
Longleaf pine	<u>Pinus palustris</u>	1.2	3.0				X						
Bald cypress	<u>Taxodium distichum</u>	1.2	3.0					X	X		X		
Yellow-poplar	<u>Liriodendron tulipifera</u>	51.0	125.5	X		X		X	X	X	X	X	
Eastern cottonwood	<u>Populus deltoides</u>	43.9	112.0		X	X	X	X	X	X	X	X	
Sycamore	<u>Platanus occidentalis</u>	44.8	108.92			X	X	X	X	X	X	X	
Green ash	<u>Fraxinus pennsylvanica</u>	15.1	37.25			X	X	X					
White ash	<u>Fraxinus americana</u>	6.5	16.0						X				X
Black walnut	<u>Juglans nigra</u>	21.8	54.0			X	X	X	X	X		X	X
Sweetgum	<u>Liquidambar styraciflua</u>	9.9	24.0			X	X					X	
River birch	<u>Betula nigra</u>	7.7	19.0			X	X	X					
Chinese chestnut	<u>Castanea mollissima</u>	1.4	3.5				X		X				
American chestnut	<u>Castanea dentata</u>	0.2	0.5				X						
European alder	<u>Alnus glutinosa</u>	1.3	3.25				X	X					
White mulberry	<u>Morus alba</u>	0.6	1.5						X				
Black cherry	<u>Prunus serotina</u>	0.4	1.0				X						
Princess tree	<u>Paulonia tomentosa</u>	0.28	0.21				X					X	
Silky dogwood	<u>Cornus amomum</u>	0.2	0.5				X						
Butternut	<u>Juglans cinerea</u>	0.2	0.5					X					
N. red oak	<u>Quercus rubra</u>	0.2	0.5	X			X						
Black locust	<u>Robinia pseudoacacia</u>												X
TOTAL		1,063.98	2,628.63										

wildlife purposes will include pecan (Carya illinoensis), persimmon (Diospyros virginiana), and Atlantic white cedar (Chamaecyparis thyoides). Plantings will also be conducted for wildlife and soil erosion purposes.

a. Reforestation. Reforestation on the DOE Reservation during the past management period has been directed primarily toward reforesting those pine stands destroyed by southern pine beetle infestations. This effort has slowed somewhat over the past two years, but progressed well from 1973 to 1980 with an average of 121.5 ha (300 acres) per year reforested. Other planting conducted during this same time period has included field areas and right-of-ways around K-25 previously maintained in grass, dump areas at Y-12, and replanting areas with unacceptable survival rates.

Preparation of planting sites has consisted of KG-blade shearing of residual saplings and brush, raking of this debris into windrows, and burning. This treatment is followed with disc harrowing to eliminate soil compaction, incorporation of litter and organic matter, and prepare a suitable transplanting site. Lesser treatment (discing only) was required in areas with only a sod cover. Other site preparation methods or variations of the above-described treatment have been tried with less success (lower rates) in both stand and seedling survival plus slower initial seedling growth. All site preparation activities and tree transplanting are conducted on the contour to minimize soil erosion.

Seedlings for transplanting are selected from vendors in areas as geographically similar to the DOE Oak Ridge Reservation as possible. Transplanting is accomplished with mechanical transplanters - hand-planting being utilized only in those areas unsuitable for mechanical equipment. Seedling survival inventories are conducted each fall prior to leaf fall with this data used to evaluate planting and survival success. Stand survival rates less than 75% are considered undesirable denoting a possible need for replanting. A planting budget of 40.5 to 60.7 ha per year will be needed to fulfill all reforestation needs.

b. Timber stand improvement (TSI). Timber stand improvement is needed in some form on nearly all timber stands at some point in time to enhance stand quality and improve tree vigor. Cull trees have little monetary value, but compete with better quality growing stock for light, moisture, and nutrients. Cull tree removal in both young and old stands can be accomplished during thinnings and intermediate cuts. Pre-commercial thinnings are necessary in non-merchantable overstocked stands exhibiting poor growth. Monthly cultivation of newly planted eastern cottonwood and black walnut seedlings during the growing season is necessary to stimulate growth and release them from competing herbaceous vegetation. This treatment is required for at least three years following establishment.

Approximately 121.5 ha (300+ acres) of the hardwood plantation areas have been released during the first three years following establishment.

The number of treatments per year will vary from one to three repetitions depending upon the treatment: whether it is herbicide, discing, or mowing. Usually after the second or third growing season, the trees are large enough to allow termination of this treatment. Herbaceous vegetation control is imperative in most newly established hardwood plantations if the planting is to be successful. Therefore, these practices are recommended for most future hardwood plantings.

Prescribed fire is one of the most valuable and inexpensive tools available in the management of southern yellow pines. A controlled burn during the winter months reduces the wildfire hazard by removing litter buildup, eliminating much of competing vegetation, and returning nutrients to the soil. Controlled burning of pine plantations usually commences when a stand is between ten and fifteen years old, or average stand height is approximately 26 meters (25 feet). Burns at three- to five-year intervals will maintain a low vegetative understory improving growth, accessibility and browse for wildlife. Prescribed burns from 1972 to 1982 are summarized in Table 14. Fire intensities have varied with weather conditions and fuel moisture content, but overall burns have been considered successful when 80% of the area is burned over with at least 50% litter consumption; 100% litter consumption has been rare. Total area burned was 1,206 ha (2,980 acres) with 250.5 kilometers (155.45 miles) of fire-lines plowed.

Prescribed burns scheduled for the ensuing management cycle are contained in Table 15. All burns will tentatively follow thinning to eliminate slash buildup and insect incidence following the cut. Annual

Table 14. Controlled burning summary

Year	Number of hectares	Number of acres	Kilometers of fire lines plowed	Fire-lines miles	Compartment number	Vegetation type (species)	Forest type
1972	-	-	-	-	-	-	-
1973	236	584	52.1	32.3	C-3,6,7,8,9,15,20	Loblolly, shortleaf pine	Pine
1974	447	1,104	98.9	61.3	C-2,4,7,9,15,20	Loblolly	Pine
1975	-	-	-	-	-	-	-
1976	69	171	15.3	9.5	C-16,17,18,19,22,23	Loblolly	Pine
1977	182	450	40.3	25.0	C-5,8,9,14,15	Loblolly	Pine
1978	81	200	17.9	11.1	C-9,11,12,17,28	Loblolly	Pine
1979*	30	73	-	-	C-1,6,9,13,14,15,16,20,28,A -3,7	-	-
1980*	8	20	-	-	C-1	-	-
1981*	51	125	-	-	C-2	-	-
1982	102	253	26.0	16.25	C-10,11,17	Loblolly	Pine
TOTALS	1,206	2,980	250.5	155.45			

\*Windrow burning for site preparation only.

Table 15. Burning schedule for 1983 through 1987 by compartments

Year	Compartment	Area (ha)	Area (Acs)	Total
1983	C-5,6,7,8,9	11.7,82.6,67.6,23.9,64.8	(29,204,167,59,160)	250.6 (619)
1984	A-1,C-13,14,15,20	4.0,49.8,33.2,51.8,71.7	(10,123,82,128,177)	210.5 (520)
1985	C-1,4,17,21,22	8.9,52.2,92.7,7.3,10.1	(22,129,229,18,25)	171.2 (423)
1986	C-2,3,10,16,A-7	17.0,63.2,49.8,20.2,33.2	(42,156,123,50,82)	183.4 (453)
1987	C-11,12,17,19,28	<u>18.6,9.7,92.8,4.0,21.1</u>	<u>(46,24,229,10,52)</u>	<u>146.2 (361)</u>
Total		961.9	(2376)	961.9 (2376)

burning budget will range from 146.2 ha to 250.6 ha, requiring approximately 0.21 kilometers of fire-line per hectare to be plowed (0.05 miles per acre).

Moderate amounts of chemicals are used periodically in Reservation plantations for control of insects, competing vegetation, and as soil amendments. Insecticides are used in the control of insect pests primarily in hardwood plantings (Malathion for leaf rollers, etc.), herbicides for unwanted vegetation (round-up for Kudzu and other herbaceous species), and chemical fertilizers and lime to stimulate plant growth. Safety precautions are duly exercised to protect both humans and the environment in the application of these chemicals. Preparations for all scheduled burns include notification to the 3-plant shift supervisor, DOE, ORNL fire department, Oak Ridge City fire department, ORNL Environmental Coordinator, and Tennessee Division of Forestry.

#### 4. New programs

A tentative agreement was reached by DOE and the City of Oak Ridge in 1979 for the city to use the Reservation forest as a filtering system for the disposal of their sewage effluent. This program begins in 1983, once the construction of the new sewage treatment plant is completed. Approximately 120 ha are to be allotted annually for effluent application. Responsibilities of ORNL include site locations and supervision of disposal. City of Oak Ridge responsibilities entail effluent supply, transportation, and application. Test plots to determine application rates, run off, nutrient loss through soil water leachate, and growth response in pine and hardwood plantings were installed on the

reservation in 1978 and 1979. General findings from these studies indicate a favorable growth response in both type plantings and an application rate not to exceed 100 kg per hectare on poor to moderately fertile soils. Fertile soils require very light applications with small growth responses. Large areas of fertile soils would be required to dispose of even a moderate effluent volume; therefore, fertile soils in general will be excluded from this program.

Another project implemented in 1981 in association with the Woody Biomass for Energy Program is an energy demonstration plantation located behind building 1503 at ORNL. This project is a demonstration of growth response from intensively cultured hardwoods and pine. Species planted include royal paulownia, eastern cottonwood, black locust, sycamore, sweetgum, yellow poplar, and loblolly pine. Cultural treatments have included intensive site preparation, application of pre-emergence herbicide following site prep, planting and restocking to a 100% level, discing, mowing, and herbicide treatment to control competition, and annual application of chemical fertilizer. Through two growing seasons, tree height is well above average with the tallest trees 5.53 m (18 ft) and a diameter at breast height of 6.7 cm. A preliminary estimate of production from a plantation such as this is 72 metric tons per hectare (6 cords per acre) or 18 metric tons per hectare per year (4 cords per acre per year).

C. Forest Protection

1. Security

The Oak Ridge Reservation is a restricted use area and therefore not accessible to the general public (see appendices L and N). All roads within the Reservation boundaries are for official use only except for two state highways (#58 and #95) transecting the area. Barricades have been erected at all intersections between reservation roads and public use thoroughfares. Overall reservation security is important in the protection of the three-plant areas as well as the public safety and well being in the buffer zones surrounding these areas. The integrity of the forest management field work as well as other projects conducted outside of the central plant security systems has been maintained through the barricade locking system. Two locks are utilized within the forest management department to control access. A security lock is maintained on all reservation barricades outside of the primary plant areas. Keys to this lock are restricted to resource management personnel. A second lock is installed ("contractor's lock") during timber sales to allow access for timber-cutters, etc. Once the sale is complete, the secondary lock is removed. Since these keys are given out in numbers, this lock is changed every five years. The lock-barricade system on the reservation has proved effective in controlling unauthorized access throughout the reservation, thus minimizing timber and wild plant theft and wildlife poaching (see Appendices B, D, M, and Q).

## 2. Insects and diseases

The southern pine beetle epidemic of 1974-1976 was described in the previous plan revision as was other insect pest and diseases of consequences (Bradburn 1977). Activities associated with this epidemic have been detailed in other sections of this report. Control efforts and reforestation efforts in the future would be similar to those of the past. There have been no insect or disease outbreaks of consequence during the latter portion of the last management cycle. Through thinnings, salvage cuts, releases, and proper cultural practices, insect and disease attacks can be minimized.

Heart rot and decay-causing fungi and disease are more subtle in their attack and destruction of hardwood timber than an epidemic of insects such as southern pine beetles. Yet more timber volume is lost annually through wood decay than through southern pine beetle infestations. Control efforts to prevent timber loss from diseases are directed toward cull tree removal through selective cutting utilizing good sanitation and logging practices that minimize damage to the residual stand.

## 3. Fire control

The Reservation has had an excellent history of fire control under the management program. Total area burned by wildfires during the past cycle was less than 41.7 ha (100 acres). Two of these were from controlled burns and were readily extinguished with minimal damage to mixed pine-hardwood and hardwood stands. Incendiary caused wildfires

along roads and highways did little if any apparent damage being confined to the road right-of-ways.

Suppression of most woods fires can be effectively handled by the Forest Management Department. The department operates two 4-wheel drive pickups, one equipped with a  $5.7 \times 10^2$  -L (150-gallon) pump tank and the other with a  $7.6 \times 10^2$  -L (200-gallon) pump tank during fire seasons. Both trucks carry numerous hand tools which can be used to manually construct fire lines in areas where mechanical line construction is impossible and for control of fires in their initial stages. Additional labor crews are also available from the Plant and Equipment Division for fire control assistance. These crews are trained annually in fire line construction. A 350 series John Deere crawler tractor mounted with a fireline plow is maintained on stand-by basis during fire seasons. Primary backup of the Forest Management Department for forest fire control is the Oak Ridge Fire Department with secondary assistance from the three plant fire departments. In a large-scale effort, assistance would also be available from the Tennessee State Division of Forestry, which has suppression crews located at Kingston, Knoxville, and Rockwood.

Each individual plant complex, except for CARL, has its own fire department, responsible first for fire control and prevention of that facility. Therefore, responsibility and supervision of fire control in the s, Reservation forest lies primarily with the Forest Management Department.

#### 4. Roads and access

There are approximately 227.1 kilometers (140.8 miles) of secondary roads throughout the Reservation, plus 38.7 kilometers (24.0 miles) of primary roads maintained by the Rust Engineering Company (a private contractor located at the Y-12 plant), and 19.0 kilometers (11.8 miles) of state highways. Maintenance of most secondary roads is the responsibility of the Plant and Equipment Division (P&E) at ORNL. Some secondary and woods roads (logging roads) are maintained by the Forestry Department. Lists of all secondary roads, their lengths, and maintenance responsibilities are attached (see Appendix O).

There are numerous other woods roads, and trails unnamed throughout the reservation and used only periodically. Most important among these are the roads traversing the power-line right-of-ways used for power-line and right-of-way maintenance. Since the majority of point source soil erosion is roads (U.S. E.P.A 1973); the access roads along the power-line corridors are the prime contributors of soil displacement on the reservation. Power-lines generally follow straight lines, crossing contours as do their access roads. Access roads are only used every two to three years when maintenance crews clear the right-of-ways of encroaching vegetation. Access roads are simply "bladed off" each time maintenance is scheduled with no consideration for erosion control. During the past management cycle, field crews from the Forestry Department have installed water bars, water turn-outs, and seeded some problem areas to grass. This activity will be continued in an effort to decrease soil loss from power line right-of-way access roads.

New access roads planned during the next cycle include an interior road into Compartments #11 and #12 from Midway Turnpike Road. This road will actually only be an upgrading of the existing old road into a former housesite area. Upgrading the road already started into Compartment #23 from Bethel Valley Road to Bull Bluff Road. Relocation and an extension of Park City Road into Compartment #24 for timber salvage and reforestation. Reservation roads are an integral part of all resources management, allowing access for data collection, fire control, timber removals, protection, and silvicultural activities.

5. Reservation soils

Soil types on the reservation will not be covered in this report since a detailed description with maps is contained in other reports (Mann, et al. 1982). Soil protection is covered in other sections of this report along with silvicultural treatments of sites. All logging, timber cutting, road maintenance, and road construction activities will be conducted in a manner conducive to the protection of forest soils and the prevention of soil erosion (U.S. E.P.A. 1973).

D. Timber Sales Policies

Under the previous two plan revisions, timber was sold under the 10-year contract and pulpwood under spot bid sales. Since the 10-year contract has been terminated, all timber will now be sold under spot-bid sales contracts. As before, under this type contract, the management forester will be responsible for: (1) marking and computing timber volumes to be sold; (2) making joint cruises with the prospective buyer

when there is a disagreement concerning volumes, etc.; (3) assisting the cutters in sale area locations, skid trails, log loading areas, and access; (4) maintaining periodic checks during the cutting operation; (5) overseeing cleanup operations at the sales end; and (6) maintaining records of sales areas, volumes, maps, and dates.

#### E. Cost-Benefit Analysis

The annual operating budget necessary to implement the activities as described in this plan over the next five years will average approximately \$250,000 per year. This budget includes personnel salaries and all materials, but does not include capital equipment funding. An optimum level of manpower requirements would include (1) one forester, (2) two to three forest technicians (preferably with B.S. degrees, (1) one laborer, and (2) two power equipment operators. The present personnel level is (1) forester, (1) one forest technician, (3) laborers, and (1) power equipment operator.

Direct benefits of this program are revenues from timber and pulpwood sales (off-setting one-third to one-half of the annual operating budget), continued growth, vigor, and improvement of the timber resources through "good" silvicultural practices; protection and wise use of the timber resources. Many activities of the forest management program indirectly impact other programs positively. The reservation wildlife populations have benefitted by improved and diversified habitats (see Appendix Q) and numerous environmental research projects have been facilitated by efforts of the forestry program in reforestation, mapping, timber inventory, and plantation establishment and maintenance. Numerous

research projects have also benefitted by improved access generated through new road construction, logging roads, and general road maintenance conducted primarily for silviculture activities. The forest management program works in concert with programmatic objectives of the four plants in harvesting timber prior to clearing for new burial grounds, building sites, right-of-ways, etc., and upon abandonment or completion of specific projects returning the area to forest production through reforestation.

1. Line organization

A re-organization of the forest management program in 1982 transferred program responsibilities from the ORNL Environmental Sciences Division to the Operations Division at ORNL. The reservation forester reports directly to the Operations Division Director who reports to the Executive Laboratory Director who in turn reports to DOE Oak Ridge Operations.

2. Work for others

An important responsibility of the forest management program is as a service organization conducting work for other divisions within the X-10 plant area, the Oak Ridge Gaseous Diffusion Plant, Y-12, the Clinch River Breeder Project, and DOE. Many of the specific activities have been described in other sections of this plan. Jobs range from real property appraisal to tree planting in unused areas. Policy governing cost burden of this work is dependent upon the nature of the job and the initiator of the work request. Cost for all timber removals falls on the forest management program. Those jobs analogous to work already budgeted within

the management plan for a given year will have their costs assumed within the forestry program. An example would be if an area needs reforestation in a burial ground, then this area would be included in the reforestation budget for that year at no cost to the requestor.

Requests for work above and beyond that annually budgeted within the program or that which would necessitate additional resources to complete would have the cost born by the requestor. The working budgets and goals detailed in this plan should not be compromised by "work for others." Nevertheless, in past years a significant amount of negative cost has been realized by the forestry program through "work for others" and this practice will be encouraged.

#### F. Control Records

Detailed records and maps of all timber product sales are maintained in the forestry office files. Other records include maps of the Reservation showing timber types; roads; past, present, and potential cutting areas; site preparation; tree planting; controlled burning; and other cultural operations. Aerial photographs taken every five years for activity planning and updating base maps are filed according to photo indices. New computer-based files have been created that contain Reservation forest inventory data. The information is filed in fortran and SAS format and can be used with relative ease by staff and managers familiar with fortran and SAS. Information can be assembled in tabular form, graphs, and maps, and statistical analysis of information derived from the inventory can be developed easily and efficiently.

#### IV. INTERFACE WITH OTHER PLANS

The forest management plan interfaces directly with eight of the other management plans: Endangered and Threatened Plants (Appendix D); Geographical and Topographical (Appendix G); Health and Safety (Appendix I); Interface with ORNL, Y-12, ORGDP Site Development (Appendix K); National Environmental Research Park (NERP) (Appendix M); Utilities (Appendix O); and Wildlife Management (Appendix Q). Three other plans, Aquatic Habitats (Appendix A), Archaeological Considerations (Appendix B), and Law/Regulations/Guidelines (Appendix L), indirectly interface. There would be some interaction between the forest management plan and the remaining five plans (Appendices C, E, F, H, and P).

As depicted in Fig. 5, utilization and protection are the driving functions of the forest management plan, common for most other plans. The actual interfacing of the forest management plan with some of the other plans has been described in previous sections of this report. Cooperation between programs is the key to success in fulfilling the goals and objectives of the resource management plan.

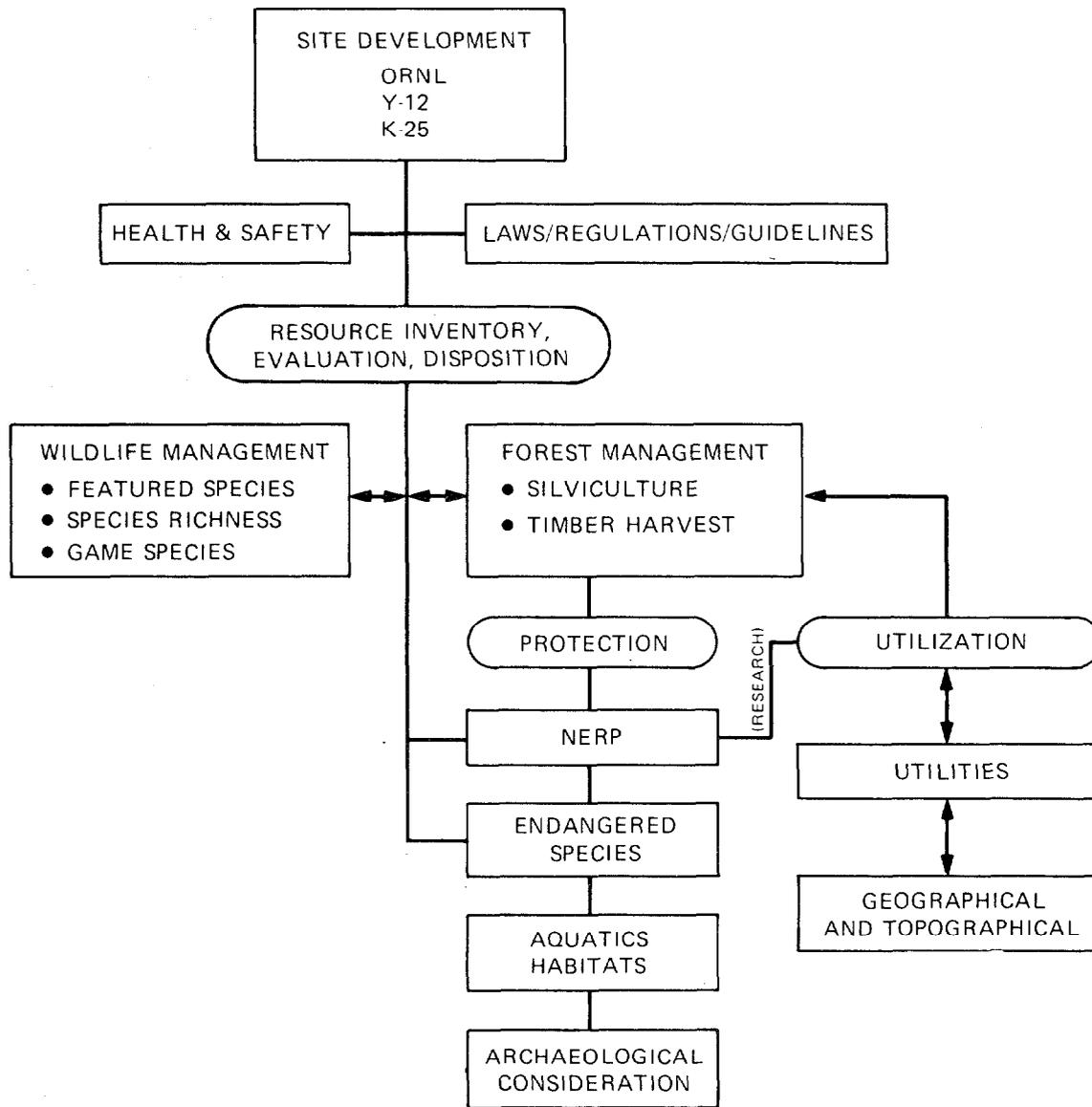


Fig. 5. Interfacing of forest management plan with other resource plans on the DOE Reservation.

## V. LITERATURE CITED

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## VI. ATTACHMENTS

Summaries of the Oak Ridge Reservation forest management compartments by strata giving number of trees and board-feet volume by area and total number of trees and volume.

Summary of DOE Reservation roads with lengths, and maintenance responsibilities.

Table 16. DOE reservation secondary roads, lengths, and maintenance responsibility

Name	Primary Compartment Location	(Miles) Total Length	Maintenance Responsibility	
			Forestry	P&E
*Dyllis Orchard Rd.	1	5.1		5.1
West Ridge Rd.	1	3.6		3.6
Raby Rd.	1	1.8	1.8	
*East Ridge Rd.	2,3	5.2		5.2
Hunley Rd.	2	0.9	0.9	
*East Quarry Rd.	3	0.8		0.8
Gallaher Ferry Rd.	4	2.5		2.5
Kennedy Bend Rd.	4	5.5		5.5
Brasher Island Rd.	4	0.8		0.8
Woods Access Rds. (unnamed)	5	4.0	4.0	
*Wheat Rd.	6	1.0		1.0
*Water Storage Tank Access Rd.	6	0.3 (K-25)	-	-
*Poplar Creek Rd.	6,7	1.5		1.5
Herrell Rd.	7	1.0	1.0	
Cooper Rd.	7	0.2	0.2	
*West Quarry Rd.	3,7	0.3		0.3
East Fork Rd.	2,7	2.1		2.1
Weather Tower Rd.	8	0.5	0.5	
*Walnut Orchard Rd.	8,9	1.6		1.6
Sherman Hembree	9	1.1	1.1	
*Hot Yard Rd.	10,28	0.9	0.9	
*Old County Rd.	10,28	1.8		1.8
Watson Rd.	10	0.6	0.6	
*Salvage Yard Rd.	10	0.3		0.3
*Midway Turnpike Rd.	10,11,12	7.3		7.3
*Gum Branch Rd.	11,28	1.9		1.9
Power Line Access Rd.	11	0.3 (K-25)	-	-
*Y-12 Burial Ground Access Rds.	12	1.4	1.4 (Y-12)	-
-				
*Grubb Island Patrol Rd.	13	5.3		5.3
Sam Grubb Rd.	13	1.6		1.6
Lewis Rd.	13,14	1.2	1.2	
Tupper Rd.	13,14	1.1	1.1	
*Rifle Range Access Rd.	14	0.3 (K-25)	-	-
*Walker Rd.	15	0.7	0.7	
*Lou Cagle Rd.	15	2.0		2.0
*Grassy Creek Rd.	15	1.6	1.6	
Connelly Rd.	15	1.7	1.7	
*New Zion Patrol Rd.	15	3.2		3.2

Table 16 (Continued)

Name	Primary Compartment Location	(Miles) Total Length	Maintenance Responsibility	
			Forestry	P&E
*Reeves Rd.	16	1.2 (K-25)	-	-
Nursery Rd.	16	1.3		1.3
Gas Line Rd.	16	1.9		1.9
*Hawk's Next Rd.	17	1.1	1.1	
*Chestnut Ridge Rd.	17	1.6		1.6
*Jim Diggs Rd.	17,18	1.0		1.0
*0907 Access Rd.	17,18	0.8		0.8
Rain Gauge #1 Rd.	18	0.2		0.2
Rain Gauge #3 Rd.	18	0.6		0.6
Rain Gauge #5 Rd.	18	1.0		1.0
Weir Rd.	18	0.5		0.5
*Old Bethel Valley Rd.	17,18,19	4.3		4.3
Foster Rd.	19	0.6	0.6	
Raccoon Creek Patrol Rd.	20	0.5		0.5
*Jones Island Patrol Rd.	20	1.8		1.8
0800 Rd.	20	0.4		0.4
Melton Valley Extension Rd.	21	1.1		1.1
*EGCR Access Rd.	21	0.8		0.8
Bearden Creek Rd.	21	1.0		1.0
Walker Branch Rd.	22	0.9	0.9	
Woods Access Rd.	22	0.5	0.5	
*Gallaher Bend Farm Rd.	23	1.7		1.7
Park City Rd.	24	2.2		2.2
Price Rd.	24	0.9		0.9
*Bull Bluff Rd.	25	2.0		2.0
*Freels Bend Rd.	25	3.0		3.0
*Solway Bend Farm Rd.	26	1.5 (CARL)	-	-
Farm Rd.	26	0.6 (CARL)	-	-
*Chestnut Ridge Farm Rd.	27	1.3	-	1.3
*Waller Farm Rd.	27	0.5		0.5
Farm Rd.	27	0.3		0.3
McNew Hollow Rd.	28	1.5	1.5	
*Hagwood Rd.	28	0.4	0.4	
Currier Rd.	28	0.9	0.9	
TSF Access Rd.	A-1	1.6		1.6
Holland Rd.	A-1	1.7		1.7
Melton Hill Rd.	A-1	0.7		0.7
Gravel Hill Rd.	A-1	1.8		1.8
Johnson Rd.	A-1	1.4		1.4
TSF-HPRR Rd.	A-1	1.1		1.1
*Lagoon Rd.	A-2	1.6		1.6

Table 16 (Continued)

Name	Primary Compartment Location	(Miles) Total Length	Maintenance Responsibility	
			Forestry	P&E
Melton Valley Dr.	A-2	1.4		1.4
*Burial Ground No. 5 Rd.	A-2	1.5		1.5
*Evacuation Rd.	A-2	2.7		2.7
*Burial Ground No. 3 Rd.	A-2	0.6		0.6
*Burial Ground No. 6 Rd.	A-2	1.5		1.5
*Water Tank Rd.	A-2	0.2		0.2
Powerline Access Rd.	A-3	1.7	1.7	
HPRR Rd.	A-4	1.2		1.2
*Cesium Forest Rd.	A-4	0.7		0.7
*Farm Rd.	A-5	1.5 (CARL)	-	-
*Filtration Plant Rd.	A-6	0.7 (Y-12)	-	-
*Water Tank Rd.	A-6	0.2 (Y-12)	-	-
West Perimeter Rd.	A-7	3.0 (K-25)	-	-
*Land Fill Rd.	A-7	1.1 (K-25)	-	-
TOTALS		140.8 (12.1)	26.5	102.2

\*Denotes roads with barricades.

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=01 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	22	8.907	2299.3	258.144	104.512	17494.8	7082.9	155825	.
2	21	8.502	4224.2	49.833	270.216	3123.2	1264.4	265556	.
3	2	3.232	334.9	103.240	41.796	9782.2	3960.4	31683	.
6	42	17.004	93.5	41.240	16.696	2428.1	983.0	41962	.
7	10	4.004	1460.6	85.294	34.775	8319.5	3368.2	14142	.
8	10	4.004	4657.0	113.704	46.046	7616.9	3108.1	31392	.
9	1	0.405	66.3	145.704	18.564	3659.7	1481.5	7719	.
10	20	8.072	66.3	14.668	68.202	19097.2	7719.5	309416	.
11	66	26.724	3640.6	44.105	18.202	3821.3	1547.4	289200	.
12	55	22.207	1134.3	63.105	26.358	7991.8	3098.8	144799	.
13	22	8.907	1202.3	93.846	38.852	1291.8	525.8	157788	.
14	60	27.580	1501.4	134.589	54.652	2200.9	867.2	304527	.
15	37	14.980	1323.4	190.851	35.768	19140.8	7676.2	215220	.
16	3	1.215	214.1	176.262	71.070	19154.0	7676.2	17788	.
17	40	16.119	2140.9	132.572	57.070	13289.8	5380.5	19997	.
18	4	1.615	10.9	28.845	10.041	4907.1	1965.8	7697	.
19	3	1.215	10.9	99.358	40.307	1558.8	587.0	1919	.
20	16	6.492	644.8	99.355	40.307	1558.8	587.0	61023	.
22	19	7.692	275.8	128.116	51.925	28637.0	11593.0	33327	.
23	3	1.215	1894.0	276.649	11.049	8271.1	3348.7	20327	.
24	61	24.596	28126.4	86.949	335.202	8271.1	3348.7	2615025	77
TOTALS	799	323.482							

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=02 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	42	17.004	3406.9	200.359	81.1941	15334.7	6248.88	3209158	.
2	55	20.810	3871.9	173.873	70.9406	14412.5	5834.88	3209158	.
3	10	4.049	1366.4	105.103	74.6416	13440.5	5425.31	260088	.
4	14	5.618	1712.5	107.794	43.1186	9437.6	260088	1484	.
5	7	2.834	258.6	91.239	36.0389	10567.1	4318.58	30231	.
6	21	8.907	1038.0	168.785	38.0935	10567.1	4318.58	30231	.
7	1	0.404	246.4	86.257	34.9755	18334.8	73599	73599	.
8	1	0.834	60.4	74.557	34.9755	18334.8	73599	73599	.
9	2	0.819	167.4	103.690	41.1977	16124.8	62479.6	47284	.
10	2	0.619	107.8	174.590	41.1977	16124.8	62479.6	47284	.
11	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
12	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
13	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
14	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
15	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
16	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
17	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
18	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
19	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
20	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
21	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
22	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
23	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
24	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
25	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
26	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
27	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
28	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
29	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
30	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
31	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
32	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
33	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
34	1	1.146	145.7	127.106	33.4391	8656.1	3507.7	14015	.
TOTALS	655	265.182	28187.4	106.294	45.0312	5977.9	40339.6	264596	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=03 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	156	63.158	10315.0	163.321	66.122	12908.5	5226.12	815274	.
2	8	3.239	172.1	53.147	21.517	2344.1	949.04	7592	.
3	1	0.405	49.6	122.480	49.587	6768.0	2740.08	2740	.
4	1	0.405	74.5	183.951	74.474	13080.4	5295.70	5296	.
5	4	1.619	99.8	61.638	24.955	3195.1	1293.57	5174	.
8	30	12.146	2393.5	197.038	79.782	13703.7	5548.06	166442	.
9	1	0.405	33.4	82.533	33.414	5607.6	2270.28	2270	.
10	4	1.619	259.7	160.385	64.933	7283.3	2948.72	11795	.
11	51	20.648	2627.9	127.274	51.528	11202.2	4535.29	231300	.
12	9	3.644	219.8	60.319	24.421	5463.5	2211.93	19907	.
13	3	1.215	140.7	115.868	46.910	8570.5	3469.83	10409	.
14	37	14.980	2226.9	148.658	60.186	8812.8	3567.92	132013	.
15	8	3.239	476.2	147.017	59.521	21538.5	8720.03	69760	.
15	13	5.263	788.3	149.783	60.641	16471.7	6668.72	86693	.
17	26	10.526	1443.2	137.105	55.508	8178.5	3311.14	86090	.
18	11	4.453	2693.1	604.712	244.823	14012.4	5673.03	62403	.
19	9	3.644	550.9	150.982	61.126	3773.4	1577.71	13749	.
20	2	0.810	118.9	146.783	59.426	2894.2	1171.72	2343	.
21	3	1.215	98.6	81.179	32.866	6264.7	2536.31	7609	.
22	54	21.862	1836.2	83.991	34.004	8917.2	3610.21	194951	.
23	382	154.656	13256.5	85.716	34.703	9128.9	3695.91	1411838	.
24	2	0.810	39.4	48.661	19.701	4235.8	1714.89	3430	.
25	7	2.834	65.7	23.193	9.390	1960.4	793.68	5556	.
26	7	2.834	199.8	70.495	28.540	8118.3	3286.75	23007	.
28	30	12.146	594.7	48.960	19.822	3761.9	1523.02	45691	.
TOTALS	859	347.773	40773.5	117.242	47.466	9843.6	3985.26	3423334	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

11

----- COMPARTMENT=04 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	139	56.275	5619.4	99.855	40.4273	4450.7	1801.9	250463	.
4	278	112.551	13353.5	118.645	48.0343	7987.8	3233.9	899030	.
5	113	45.749	5719.7	125.024	50.6169	5204.5	2107.1	238099	.
6	48	19.433	2621.7	134.911	54.6197	5514.7	2232.7	107168	.
7	59	23.887	1300.5	54.443	22.0419	5144.8	2082.9	122892	.
8	58	3.239	297.1	88.628	35.8819	11502.4	4656.8	37255	.
9	23	9.312	1135.9	121.986	49.3871	13279.4	5376.3	123655	.
10	52	21.053	2116.4	100.529	40.7001	8003.7	3240.4	168500	.
11	48	19.433	714.0	36.742	14.8755	2715.7	1099.5	52776	.
12	19	7.692	690.5	89.762	36.3409	9613.5	3892.1	73950	.
13	16	6.478	751.3	115.980	46.9555	9618.9	3894.3	62309	.
15	8	3.239	734.7	226.824	91.8317	8378.1	3391.9	27136	.
16	10	4.049	502.7	124.167	50.2700	2904.2	1175.8	11758	.
17	11	4.453	347.2	77.972	31.5675	8556.9	3464.3	38107	.
18	266	107.692	11011.5	102.250	41.3968	10210.8	4133.9	1099624	.
19	7	2.834	610.8	215.536	87.2615	32572.2	13187.1	92310	.
20	26	10.526	992.1	84.747	34.3104	6266.0	2536.8	65958	.
21	2	0.810	49.4	61.063	24.7217	5376.0	2176.5	4353	.
TOTALS	1133	458.704	48458.5	105.642	42.7701	7576.4	3067.4	3475342	77

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

12

----- COMPARTMENT=05 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	12	4.858	1468.8	302.326	122.399	19576.0	7925.50	95106	.
2	10	4.049	698.4	172.515	69.844	9316.4	3771.82	37718	.
3	7	2.834	248.0	87.502	35.426	4196.9	1699.15	11894	.
4	54	21.862	2654.6	121.422	49.159	7383.5	2989.25	161420	.
7	36	14.575	2105.5	144.458	58.485	10242.8	4146.88	149288	.
8	24	9.717	1232.7	126.865	51.362	13027.4	5274.26	126582	.
9	43	17.409	2252.5	129.386	52.383	13379.9	5416.95	232929	.
10	132	53.441	5436.5	101.729	41.186	8834.8	3576.86	472145	.
11	59	20.243	3139.8	155.106	62.796	12291.4	4976.26	248813	.
12	28	11.336	1014.8	89.519	36.243	9820.6	3975.97	111327	.
13	87	35.223	3960.0	112.428	45.517	11069.7	4481.66	389905	.
14	60	24.291	1994.5	82.106	33.241	6053.0	2450.89	147053	.
15	16	6.478	216.7	33.461	13.547	1504.0	608.89	9742	.
16	84	34.008	3926.0	115.444	46.739	14121.1	5717.04	480231	.
TOTALS	643	260.324	30348.8	116.581	47.199	10272.4	4156.87	2674154	78

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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----- COMPARTMENT=06 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	157	63.563	9697.8	152.570	61.7694	13260.8	5368.74	842892	.
3	46	18.623	2726.0	146.377	59.2618	13046.4	5281.93	242969	.
7	23	11.741	1285.0	109.444	44.3094	16366.7	6626.19	192159	.
8	20	8.097	1085.3	134.037	54.2658	16448.5	6659.31	133186	.
9	7	2.834	44.0	15.531	6.2890	1323.4	535.78	3750	.
10	9	3.644	559.4	153.536	62.1602	11588.0	4637.48	42223	.
11	3	1.215	169.4	139.442	56.4541	22261.8	9012.86	27039	.
12	95	38.462	3560.0	92.560	37.4737	10866.1	4399.22	417926	.
13	19	7.692	400.9	52.111	21.0974	3634.4	1471.44	27957	.
14	30	12.146	1358.1	111.819	45.2709	8063.1	3264.39	97932	.
15	84	34.008	2556.0	75.130	30.4171	9576.6	3877.18	325683	.
16	14	5.668	152.4	26.887	10.8853	1696.5	686.83	9616	.
17	11	4.453	120.4	27.045	10.9495	1360.4	550.78	6059	.
18	3	1.215	50.7	41.782	16.9156	4730.9	1915.34	5746	.
19	5	2.024	238.4	117.783	47.6853	13109.8	5307.60	26538	.
TOTALS	532	215.305	24003.0	111.442	45.1184	11150.6	4514.43	2401676	77

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=A1

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
2	5	2.429	572	235	95	3988	1663	13980	4	33980	
3	44	17.814	3952	117	76	1421	191	3541	10	2541	
4	67	24.688	5188	117	186	3278	271	4648	7	2564	
5	224	90.688	9192	307	186	1117	114	3203	1	3203	
6	38	15.384	2407	155	143	2786	331	4557	1	4557	
7	44	17.814	3153	174	102	1786	119	2786	1	2786	
8	62	25.312	3976	64	44	1564	119	1786	1	1786	
9	234	94.500	2839	12	44	1155	119	1786	1	1786	
10	209	84.515	1207	5	61	2292	119	1786	1	1786	
11	36	14.665	1207	34	94	2019	119	1786	1	1786	
12	2	0.810	197	1	42	118	119	1786	1	1786	
13	2	0.810	197	1	42	118	119	1786	1	1786	
14	2	0.810	197	1	42	118	119	1786	1	1786	
15	2	0.810	197	1	42	118	119	1786	1	1786	
16	2	0.810	197	1	42	118	119	1786	1	1786	
17	2	0.810	197	1	42	118	119	1786	1	1786	
18	2	0.810	197	1	42	118	119	1786	1	1786	
19	2	0.810	197	1	42	118	119	1786	1	1786	
20	2	0.810	197	1	42	118	119	1786	1	1786	
21	2	0.810	197	1	42	118	119	1786	1	1786	
22	2	0.810	197	1	42	118	119	1786	1	1786	
23	2	0.810	197	1	42	118	119	1786	1	1786	
24	2	0.810	197	1	42	118	119	1786	1	1786	
25	2	0.810	197	1	42	118	119	1786	1	1786	
26	2	0.810	197	1	42	118	119	1786	1	1786	
27	2	0.810	197	1	42	118	119	1786	1	1786	
28	2	0.810	197	1	42	118	119	1786	1	1786	
29	2	0.810	197	1	42	118	119	1786	1	1786	
30	2	0.810	197	1	42	118	119	1786	1	1786	
31	2	0.810	197	1	42	118	119	1786	1	1786	
32	2	0.810	197	1	42	118	119	1786	1	1786	
33	2	0.810	197	1	42	118	119	1786	1	1786	
34	2	0.810	197	1	42	118	119	1786	1	1786	
35	2	0.810	197	1	42	118	119	1786	1	1786	
36	2	0.810	197	1	42	118	119	1786	1	1786	
37	2	0.810	197	1	42	118	119	1786	1	1786	
38	2	0.810	197	1	42	118	119	1786	1	1786	
39	2	0.810	197	1	42	118	119	1786	1	1786	
40	2	0.810	197	1	42	118	119	1786	1	1786	
41	2	0.810	197	1	42	118	119	1786	1	1786	
42	2	0.810	197	1	42	118	119	1786	1	1786	
43	2	0.810	197	1	42	118	119	1786	1	1786	
44	2	0.810	197	1	42	118	119	1786	1	1786	
45	2	0.810	197	1	42	118	119	1786	1	1786	
46	2	0.810	197	1	42	118	119	1786	1	1786	
TOTALS	2046	828.340	11855	143	157	12013	615	126013	81	126013	

FURST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=A2 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	TREES PER ACRE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	30	194	885.5	54.677	22.137	3038.0	1239.98	49199	.....	
2	2346	155147	18442.6	193.022	78.137	10707.5	4334.96	1033050	.....	
3	35	186215	217.7	153.263	622.455	101802.5	10707.5	189597	.....	
4	10	7024	814.0	1147.088	591.598	210526.1	4261.88	215691	.....	
5	2	4042	192.0	207.057	88.957	33921.5	1453.64	4261.88	.....	
6	10	0.810	204.3	252.822	102.740	11233.0	325.76	39076	.....	
7	28	7.2815	71.7	287.186	22.220	92388.0	1520.36	69476	.....	
8	3	1.239	199.2	164.377	62.551	193820.3	7824.68	158661	.....	
9	38	37004	1733.7	126.009	603.1	22844.3	9273.18	13989	.....	
10	12	17421	2441.0	146.090	1301.0	21733.2	8422.44	73989	.....	
11	164	108514	2641.6	137.090	144.232	110345.7	540.98	362797	.....	
12	147	59514	2033.1	122.077	49.160	115846.0	5423.36	382550	.....	
13	165	23624	3139.0	120.438	47.314	115671.5	6342.85	362797	.....	
14	11	374	1013.6	1128.967	2182.3	18461.7	3429.35	120658	.....	
15	22	40828	689.9	1128.967	452.198	15340.3	4216.26	141177	.....	
16	47	19099	2442.1	101.338	258.285	6776.3	233.70	102506	.....	
17	44	11615	119.6	72.594	19.203	6722.0	1743.30	122509	.....	
18	37	149807	3031.8	200.166	83.627	4206.4	1733.31	50925	.....	
19	18	9049	46.8	15.252	4.656	5901.1	331.48	36484	.....	
20	18	3232	50.9	142.021	59.501	10454.9	4224.66	491750	78	
TOTALS	1164	471235	66930.7	142.021	59.501	10454.9	4224.66	491750		



FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=A4

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	3	1.215	109.6	90.172	36.5069	3230.6	1307.9	3927	..
2	3	1.215	527.9	49.999	65.2100	31508.3	1288.3	38634	..
3	3	1.215	568.2	162.640	71.1742	109875.8	4254.7	34034	..
4	10	4.05	1665.8	137.040	52.5265	110367.4	4116.9	64377	..
5	30	1243	2406.9	138.998	56.1243	9522.4	325.7	172598	..
6	85	1.215	899.7	207.821	29.1389	3334.8	127.0	6479	..
7	105	1.458	3672.7	171.333	69.12985	15335.6	572.8	3093055	..
8	105	4.05	1143.9	111.409	71.43767	11553.3	429.1	329055	..
9	4	2.024	1224.9	11.988	43.5617	1303.3	46.8	100674	..
10	4	2.024	155.9	75.2819	30.4933	13081.4	594.0	21078	..
11	23	1.215	245.1	201.693	81.7063	1619.3	59.3	19664	..
12	1	1.215	51.2	31.5202	12.8335	2747.3	104.8	15997	..
13	1	1.215	189.7	120.5303	44.5465	8402.8	312.8	20020	..
14	18	2.024	3593.7	170.702	47.3408	16501.3	601.3	275786	..
15	16	2.024	236.8	119.403	47.3408	17828.9	63.5	172969	..
16	16	2.024	340.0	168.695	68.14501	14884.9	52.6	102447	..
17	17	2.024	1098.0	112.511	61.0403	12332.9	43.1	1853362	..
18	1	0.4085	910.3	117.411	52.757	1031.3	37.2	849834	..
19	16	0.4085	26.0	14.279	26.230	12.2	0.3	34177	..
20	35	0.4085	1747.5	115.611	46.2449	10705.7	39.3	181700	..
21	27	0.4085	1417.9	117.63	67.5199	118673.8	40.7	151700	..
22	35	0.4085	339.5	154.706	62.9159	13714.6	51.7	245822	..
23	35	0.4085	64.3	130.306	52.064	1146.4	4.0	202301	..
24	16	0.4085	842.8	130.306	62.9159	13714.6	51.7	52261	..
TOTALS	762	308.502	42050.8	136.306	55.1848	114293.2	5786.0	4409487	81

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=A5 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	7	2.834	472.3	166.647	67.466	9489.8	3842.02	26894.4	.
2	21	8.502	1187.1	139.537	56.453	7991.5	425.526	6793.4	.
3	15	4.778	207.9	146.546	59.346	1051.5	220.984	1487.57	.
4	12	4.778	231.2	155.582	62.200	721.2	292.033	584.8	.
5	21	8.502	341.7	120.582	48.815	231.0	935.40	547.07	.
6	21	8.502	750.8	189.241	134.627	644.5	260.496	1733.39	.
7	6	2.429	185.7	176.458	55.297	770.5	288.122	520.53	.
8	6	2.429	159.6	144.858	42.977	174.7	67.824	305.33	.
9	5	1.698	159.3	182.283	71.433	718.0	291.391	398.82	.
10	20	8.097	571.1	70.535	27.157	282.1	110.304	398.32	.
11	31	12.551	1221.6	121.317	46.116	2914.7	1703.810	2247.34	.
12	22	8.917	1083.5	121.014	48.116	1641.3	705.226	1856.07	.
13	6	2.429	91.7	121.657	48.803	639.8	252.655	487.34	.
14	9	3.724	188.0	77.517	30.888	398.2	150.661	206.88	.
15	2	0.810	189.7	76.791	27.041	981.5	385.358	221.49	.
16	2	0.810	56.7	40.393	16.253	396.2	160.522	95.12	.
17	2	0.810	98.1	55.265	23.543	396.2	160.522	95.12	.
18	2	0.810	135.5	98.265	39.583	863.2	332.76	963.20	80
TOTALS	473	191.498	18817.5						

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

6

----- COMPARTMENT=A6 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	3	1.215	169.6	139.604	56.5196	10249.1	4149.42	12448	.
2	1	0.405	96.6	238.543	96.5761	20942.3	8478.65	8479	.
4	2	0.810	157.9	195.041	78.9641	13918.8	5635.14	11270	.
5	5	2.024	275.3	135.019	55.0685	12633.2	5114.66	25573	.
6	2	0.810	42.1	51.954	21.0341	7981.8	3231.52	6463	.
7	10	4.049	233.3	57.620	23.3278	4272.0	1729.55	17296	.
8	39	15.789	1426.3	90.335	36.5730	7953.3	3219.96	125578	.
9	2	0.810	25.5	31.448	12.7320	2217.1	897.60	1795	.
10	169	68.421	6279.4	91.776	37.1561	10570.2	4259.20	719804	.
11	66	26.721	2608.9	97.635	39.5283	9527.3	3857.22	254577	.
12	17	6.983	629.6	91.479	37.0361	9670.9	3915.36	66561	.
13	1	0.405	10.9	26.878	10.9819	4718.6	1910.36	1910	.
14	3	1.215	141.8	116.717	47.2538	13018.7	5270.72	15812	.
15	1	0.405	38.2	94.344	38.1959	4905.9	1986.19	1986	.
16	3	1.215	93.3	76.779	31.0847	8242.8	3337.17	10012	.
17	4	1.619	202.0	124.708	50.4889	8514.1	3447.01	13788	.
18	13	5.263	458.6	87.133	35.2766	10756.9	4355.01	56615	.
19	10	4.049	502.4	124.088	50.2379	11716.9	4743.69	47437	.
TOTALS	351	142.105	13391.5	94.236	38.1523	9833.6	3981.21	1397405	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

7

----- COMPARTMENT=A7 -----

STRAT	ACPES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	16	6.4777	1659.8	256.228	103.736	20193.2	8175.40	130806	.
2	34	13.7652	2615.4	190.002	76.924	12924.3	5232.51	177905	.
3	16	6.4777	1107.8	171.014	69.236	8649.2	3501.72	56027	.
6	2	0.8097	212.7	262.650	106.336	18726.0	7581.39	15163	.
7	28	11.3360	1680.5	148.241	60.017	10870.5	4401.02	123229	.
9	13	5.2632	346.1	65.760	26.623	5220.9	2113.74	27479	.
9	17	6.8826	865.8	125.802	50.932	15468.5	6262.54	106463	.
10	5	2.0243	142.3	70.313	28.467	7326.3	2966.11	14831	.
11	15	6.0729	1691.4	278.524	112.763	10873.6	4402.25	66034	.
TOTALS	146	59.1093	10321.8	174.623	70.697	12145.9	4917.37	717937	78

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FUREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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COMPARTMENT=07

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	94	38.057	4751.7	124.859	50.550	8014.4	3244.68	305000	.
2	66	26.721	6173.4	231.035	93.537	14339.8	5805.61	383170	.
3	7	2.834	98.8	34.862	14.114	1792.0	725.50	5079	.
4	12	4.858	138.5	28.500	11.538	2196.1	886.66	10640	.
5	3	1.215	82.5	67.928	27.501	2495.4	990.04	2970	.
20	24	9.717	1787.3	183.939	74.469	13012.3	5268.12	126435	.
21	7	2.834	314.3	119.902	44.899	12756.2	5164.47	36151	.
22	42	17.004	1823.6	107.247	43.420	8545.0	3459.50	145299	.
23	97	39.271	4198.5	106.910	43.283	6287.3	2545.48	246912	.
24	13	5.263	1672.5	317.767	128.651	7427.4	3007.08	39092	.
26	4	1.619	463.7	286.307	115.914	19098.2	7732.05	30928	.
TOTALS	369	149.393	21504.7	143.947	58.278	8913.9	3608.88	1331676	78

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FOREST MANAGEMENT PLAN SIRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=08 -----

SIRATA	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	21	8.502	1936.7	227.795	92.2248	14250.3	5769.37	121157	.
2	34	15.385	3410.2	271.660	89.7411	12419.3	5028.06	191066	.
3	26	10.526	749.9	71.238	32.8411	3692.8	1491.07	138191	.
4	150	60.729	7680.6	126.474	37.3739	5935.8	1491.07	718191	.
5	10	4.026	387.4	126.488	51.7401	12813.7	5187.75	354712	.
6	26	10.473	573.6	54.970	22.0619	5192.6	2104.30	547123	.
7	15	6.019	255.0	100.716	41.4071	5487.6	2271.63	184439	.
8	15	6.019	195.0	130.716	48.8911	6902.8	2711.52	101846	.
9	27	10.931	159.7	131.332	53.1393	854.8	325.53	105120	.
10	82	33.198	4356.7	131.273	65.4791	16990.6	6518.53	393562	.
11	25	10.144	1645.0	122.172	49.4624	16255.6	6252.67	171968	.
12	38	15.385	1445.2	122.961	49.7007	1749.7	708.25	227914	.
13	38	15.385	368.6	49.017	19.8450	1720.7	696.69	26914	.
14	9	3.644	178.6	49.017	19.8450	10063.0	4074.09	6270	76
15	9	3.644	178.6	49.017	19.8450	10063.0	4074.09	6270	.
TOTALS	493	199.595	24231.7	121.404	40.1516	10063.0	4074.09	2008524	

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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----- COMPARTMENT=09 -----

STPAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	47	19.028	1491.7	78.393	31.7379	4646.4	1881.12	88413	.
2	113	45.749	8075.2	176.512	71.4622	11431.3	4628.07	522972	.
3	7	2.834	443.4	158.225	64.0587	11548.7	4675.60	32729	.
7	13	5.263	820.0	155.799	63.0764	9940.7	4024.58	52320	.
8	10	4.049	537.3	132.710	53.7289	9965.2	4034.50	40345	.
9	3	1.215	281.1	231.415	93.6901	16324.6	6609.16	19827	.
10	6	2.429	286.9	118.126	47.8244	18785.1	7605.31	45632	.
11	153	61.943	6403.7	103.380	41.8544	8892.3	3600.11	550817	.
12	57	23.077	1687.7	73.132	29.6083	6173.1	2499.25	142457	.
13	54	21.862	875.4	40.041	16.2109	2840.3	1149.91	62095	.
TOTALS	463	187.449	20907.4	111.536	45.1564	8309.5	3364.16	1557607	77

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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----- COMPARTMENT=10 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	3	1.215	110.0	90.570	36.6680	3713.4	1503.39	4510	.
2	8	3.239	753.7	232.715	91.2166	10837.9	6816.95	54536	.
3	101	40.891	7057.5	172.593	69.8758	12775.2	5172.16	522388	.
12	112	45.344	6854.4	151.164	61.1999	12661.9	5126.28	574143	.
13	20	8.097	777.4	96.004	38.8682	20709.9	8384.56	167691	.
14	66	26.721	2395.0	89.633	36.2886	12486.1	5055.08	333636	.
15	42	17.004	1399.3	82.295	33.3177	9320.6	3773.52	158488	.
16	222	89.879	7708.8	85.770	34.7245	6280.1	3352.45	744199	.
17	71	28.745	2656.0	92.399	37.4094	11092.2	4490.78	318846	.
18	34	13.765	1090.1	79.191	32.0610	8870.9	3591.44	122109	.
19	1	0.405	31.3	77.265	31.2814	8571.5	3470.25	3470	.
20	10	4.049	684.8	169.141	68.4781	8488.7	3436.70	34367	.
21	8	3.239	269.4	83.177	33.6747	4207.2	1703.32	13627	.
TOTALS	698	282.591	31787.7	112.487	45.5411	10800.1	4372.51	3052010	78

FOREST MANAGEMENT PLAN STPATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=11 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	46	18.623	2973.3	159.656	64.6380	12430.6	5032.6	231500	.
2	5	2.024	215.9	106.294	43.0340	5002.7	2025.4	10127	.
5	216	87.449	15743.4	180.034	72.8883	14937.2	6041.4	1306249	.
6	3	1.215	157.2	129.461	52.4132	4171.0	2592.0	15586	.
7	481	194.737	23626.7	121.380	49.0161	11706.5	16832.0	50496	.
8	28	11.336	5296.9	158.719	73.7565	15127.2	8585.6	240398	.
9	258	38.462	1771.4	37.737	30.5413	8028.1	3275.4	581817	.
10	58	23.482	1401.3	27.534	11.8473	23016.5	869.8	190159	.
11	36	14.575	52470.3	133.061	53.8709	13016.5	5269.8	31215	.
12	974	394.332						5132810	79
TOTALS									

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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----- COMPARTMENT=12 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	24	9.717	2229.4	229.441	92.8911	15885.4	6431.3	154352	.
2	65	26.316	3704.8	140.781	56.9964	9337.9	3780.5	245734	.
3	3	1.215	173.2	142.626	57.7435	12843.3	5199.7	15599	.
7	93	37.652	5910.3	156.974	63.5520	14240.7	5765.5	536189	.
8	2	0.810	139.4	172.132	69.6892	27274.6	11042.4	22085	.
9	627	253.846	32308.4	127.276	51.5286	12972.3	5252.0	3292975	.
10	45	18.219	1201.3	65.940	26.6965	7677.2	3108.2	139867	.
11	52	21.053	945.4	44.905	18.1801	1953.2	790.8	41120	.
TOTALS	911	368.826	46612.3	126.380	51.1660	12059.7	4882.5	4447921	79

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=13 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	110	44.534	5264.8	118.220	47.040	9090.1	3680.22	404824	..
2	10	24.291	4142.4	170.528	69.040	13204.6	5295.26	320759	..
3	34	1771.7	1771.7	130.355	55.872	10413.8	4072.09	130386	..
4	13	1960.6	1460.6	120.174	44.477	8041.9	3385.34	142322	..
5	13	1578.9	444.0	104.537	34.456	6637.3	2687.81	349335	..
6	13	545.2	577.6	132.594	52.046	11425.5	4507.49	498400	..
7	32	9.355	647.3	77.694	15.109	7094.9	2881.95	527335	..
8	54	19.462	1342.3	432.895	123.775	7818.6	3170.95	170964	..
9	22	18.907	6770.9	310.357	144.967	6713.4	2605.18	249052	..
10	40	17.211	1134.3	136.477	144.967	13980.0	1611.82	170964	..
11	3	1.155	165.5	113.090	51.760	13880.0	1522.22	165223	..
12	3	1.024	310.5	70.951	14.370	10950.3	2371.35	228536	..
13	6	2.453	248.1	103.389	23.193	12430.3	488.08	229100	..
14	6	19.838	317.4	106.581	23.193	8430.9	342.34	252441	..
15	2	12.495	1524.0	77.507	30.374	16206.1	623.47	169995	..
16	20	7.097	684.0	134.578	113.372	10693.5	42.82	74119	..
17	4	3.919	258.0	73.558	33.252	10633.3	395.77	86629	..
18	4	1.429	132.5	44.441	15.227	7299.8	169.03	27674	..
19	7	12.769	2624.3	85.239	34.435	4248.0	174.14	17044	..
20	7	3.045	164.3	22.943	16.576	2905.3	117.67	28455	..
21	2	1.244	132.2	41.000	14.721	1927.9	79.32	11743	..
22	2	0.810	22.0	11.512	1.461	2475.5	100.07	12007	..
23	12	4.428	474.0	19.153	39.635	7908.4	299.84	35506	..
TOTALS	035	338.057	51740.8	153.154	61.965	79289.4	3161.03	314045	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=14 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	59	23.887	4158.8	174.106	70.4884	10003.8	4050.14	238958	.
2	16	6.478	1005.1	155.161	62.8180	6991.8	2830.69	45291	.
3	7	2.834	393.8	138.944	56.2527	6278.8	2542.03	17794	.
4	52	21.053	3915.5	181.239	73.3759	9693.7	3924.56	204977	.
11	18	7.287	988.5	135.640	54.9151	8602.6	3482.84	62691	.
12	25	10.121	649.8	64.201	25.9923	4435.2	1795.64	44891	.
13	2	0.810	61.2	75.565	30.5932	4665.8	1898.97	3778	.
14	77	31.174	2972.6	92.145	37.3058	8428.8	3412.49	262761	.
15	92	37.247	4869.9	130.747	52.9339	13217.9	5351.37	492326	.
16	33	15.385	793.2	51.557	20.8731	5506.7	2229.45	84719	.
19	39	15.789	27.6	1.747	0.7073	237.6	96.20	3752	.
TOTALS	425	172.065	19635.9	114.119	46.2022	8491.2	3437.74	1461038	80

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=15 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	15	6.073	1465.2	241.274	97.682	14459.3	5853.95	87809	.
2	77	31.174	774.7	12.433	30.931	5251.7	21880.3	53193	.
3	36	14.575	2763.5	189.274	71.871	71103.1	40097.3	222376	.
4	27	10.231	809.2	77.597	28.582	13283.0	53577.5	192596	.
5	3	1.215	227.4	187.029	75.875	4573.4	18344.5	52255	.
6	14	4.538	1164.6	81.438	105.815	15853.3	16416.3	131860	.
7	14	3.538	380.3	107.559	40.570	1200.4	4750.0	376176	.
8	4	1.633	1392.4	101.191	40.552	8741.1	3750.5	127284	.
9	48	19.458	417.6	16.954	34.799	1440.9	2772.8	33274	.
10	12	4.817	3813.8	147.135	59.594	1848.2	6422.4	340156	.
11	14	25.917	1556.8	160.229	64.571	15864.5	30022.0	154137	.
12	24	11.770	1289.6	112.216	45.671	12508.3	30022.0	143066	.
13	28	11.770	53.2	4.535	1.157	958.5	2200.5	33974	.
14	218	88.259	9191.9	143.164	42.717	12015.9	25905.0	569748	76
TOTALS	1039	420.648	47615.9	113.197	45.629	9571.3	3875.02	4026148	

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=16 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME Per HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	7	2.834	524.9	185.201	74.9800	12318.0	4987.03	34909	.
2	43	17.409	823.8	47.322	19.1586	2544.6	1030.20	44298	.
3	22	8.907	1143.7	128.402	51.9845	10362.4	4195.30	92297	.
4	10	7.287	677.5	92.970	37.6398	5197.6	2104.29	37877	.
5	6	2.429	431.4	177.584	71.8963	8916.6	3609.98	21660	.
6	28	11.336	1302.9	114.933	46.5315	7910.2	3202.53	89671	.
7	18	7.287	871.3	119.568	48.4080	6151.7	2490.56	44830	.
8	15	6.073	678.7	111.761	45.2474	15779.9	6368.39	95526	.
9	64	25.911	3048.1	117.639	47.6272	15010.6	6077.15	388938	.
10	363	146.964	14298.1	97.290	39.3886	9894.0	4005.67	1454058	.
TOTALS	584	236.437	23800.4	100.663	40.7541	9744.9	3945.32	2304064	78

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FUREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT-18 -----

STAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	27	10.931	1535.9	140.504	56.884	8171.8	308.13	89328	.
2	78	31.579	6279.6	198.854	80.508	9864.8	3001.64	312128	.
3	31	12.551	1794.0	142.945	57.873	14037.7	5681.72	176133	.
4	24	9.717	1377.6	141.777	57.470	14576.2	5901.23	141027	.
5	264	119.628	16670.1	139.631	56.521	12979.5	2449.34	1839067	.
6	10	4.049	977.4	241.410	97.237	10749.3	4351.14	43519	.
7	30	12.146	1533.7	126.228	51.1769	1757.8	5998.12	179944	.
8	10	4.049	397.7	98.228	39.1769	1757.8	5998.12	179944	.
9	131	53.036	6534.6	123.508	49.883	17482.4	3059.46	30598	.
10	69	23.564	2565.4	100.508	40.578	17208.6	5458.17	309480	.
11	31	12.551	3774.0	316.641	48.1805	7208.6	2652.82	76594	.
12	9	3.644	103.0	28.261	11.482	6503.0	249.34	61617	.
13	747	302.429	4140.9	145.955	59.091	2867.2	1471.34	10290	79
TOTALS								4012388	

FUREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=19 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	10	4.049	762.3	189.286	76.279	9577.9	3877.70	38777	.
2	46	18.623	3384.4	181.726	73.273	16775.3	4162.06	191328	.
3	86	34.818	3589.5	160.292	64.936	10788.4	4362.76	375628	.
4	19	7.738	3892.3	196.234	79.438	8362.7	3382.48	165889	.
5	132	53.441	3504.6	108.368	43.131	9738.7	3942.79	520448	.
6	1	0.418	84.6	199.412	39.825	10105.9	4028.43	360651	.
7	1	0.224	20.6	100.835	40.823	17171.6	6918.15	24220	.
8	5	2.020	206.9	255.535	103.477	5290.7	2141.55	9490	.
9	2	0.810	72.5	11.890	4.711	616.0	241.20	37420	.
10	19	7.658	410.6	84.934	34.508	7719.9	3071.26	80741	.
11	56	22.644	400.2	14.933	44.325	2216.9	871.38	152285	.
12	90	36.672	6122.5	170.033	109.325	6718.4	2607.24	476751	.
13	11	4.453	4637.5	127.485	87.536	13084.2	5207.04	94589	.
14	11	4.453	955.1	141.503	57.289	11238.6	4145.02	265695	78
TOTALS	641	259.514	36722.1						

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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COMPARTMENT=20

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
3	140	56.680	8035.6	141.772	57.3975	7679.2	3109.00	435261	.
4	62	25.101	2600.0	103.579	41.9349	6202.0	2510.91	155677	.
5	36	14.575	2601.5	178.490	72.2632	13077.5	5294.52	190603	.
6	128	51.822	8197.8	158.192	64.0452	11359.3	4598.91	588661	.
7	15	6.073	1169.0	192.333	77.8677	12624.4	5111.09	76666	.
8	22	8.907	1319.5	148.148	59.9791	15091.4	6109.89	134418	.
9	3	1.215	129.5	106.613	43.1632	8913.0	3608.49	10825	.
10	29	11.741	1760.0	149.903	60.6894	15181.1	6146.19	178239	.
11	28	11.336	1742.3	153.693	62.2238	15135.4	6127.71	171576	.
12	25	10.121	1653.8	163.332	66.1263	15546.8	6294.26	157356	.
13	55	22.267	1938.8	87.070	35.2511	8916.1	3609.75	198536	.
TOTALS	543	219.838	31146.1	141.678	57.3594	10452.3	4231.71	2297818	76

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FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=21

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	70	28.340	4258.0	150.247	60.829	10456.8	4233.54	296348	.
2	29	11.336	2015.0	177.454	71.965	11714.9	4742.88	132801	.
4	61	24.696	2990.1	121.074	49.018	7128.3	2885.93	176042	.
5	8	3.239	212.3	65.560	26.542	4342.4	1758.06	14064	.
6	22	8.907	1282.6	144.001	58.300	9274.6	3754.88	82607	.
7	5	2.024	202.9	100.223	40.576	5563.9	2252.61	11263	.
8	3	1.215	270.8	229.543	92.932	13272.4	5373.45	16120	.
9	20	8.097	881.2	108.833	44.062	5631.8	2280.08	45602	.
10	21	8.502	1888.1	222.072	89.908	8774.0	3552.25	74597	.
11	11	4.453	115.4	25.927	10.495	2230.5	903.05	9934	.
12	3	1.215	165.4	136.170	55.129	3122.2	1264.03	3792	.
13	25	10.121	1897.4	187.460	75.895	6990.3	2830.07	70752	.
14	13	5.263	1229.0	233.515	94.540	7032.9	2847.31	37015	.
15	9	3.644	411.3	112.876	45.699	4608.1	1865.65	16791	.
16	17	6.883	1131.6	164.419	66.566	14903.5	6033.80	102575	.
17	6	2.429	431.2	177.495	71.860	11506.2	4658.38	27950	.
18	4	1.619	231.6	143.909	57.895	7861.8	3182.91	12732	.
19	3	1.215	133.3	109.732	44.426	9014.2	3649.48	10948	.
20	12	4.858	402.3	82.810	33.526	5455.0	2208.51	26502	.
21	64	25.911	2223.6	85.819	34.745	9302.2	3766.08	241029	.
22	6	2.429	224.8	92.527	37.460	6125.1	2478.79	14879	.
23	13	5.263	480.6	91.307	36.966	12062.1	4883.45	63485	.
24	47	18.028	2799.4	147.117	59.561	15901.7	6437.93	302583	.
25	11	4.453	259.2	58.212	23.568	9894.2	4005.76	44063	.
26	78	31.579	3113.4	98.599	39.915	10960.9	4437.59	346132	.
27	10	4.049	436.6	107.842	43.661	9811.4	3972.23	39722	.
28	10	4.049	1006.0	248.489	100.603	7884.4	3192.07	31921	.
29	9	3.644	198.8	54.553	22.086	3794.3	1536.15	13825	.
30	8	3.239	288.9	89.189	36.109	7342.0	2972.47	23780	.
31	24	9.717	854.0	87.886	35.581	10609.3	4295.26	103086	.
32	23	11.336	943.2	83.203	33.685	5051.4	2045.10	57263	.
33	23	9.312	821.6	88.233	35.722	5897.0	2387.44	54911	.
34	1	0.405	24.5	60.415	24.459	7382.4	2988.82	2989	.
35	21	8.502	1277.9	150.311	60.855	13035.7	5277.61	110830	.
37	2	0.810	204.8	252.878	102.380	12086.6	4893.35	9787	.
38	17	6.883	4726.5	686.740	278.032	12858.6	5205.90	88500	.
TOTALS	713	288.664	40041.2	138.712	56.159	6413.1	3810.97	2717220	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=22

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	25	10.121	1240.5	122.558	49.619	6457.0	2614.16	65354	
2	3	1.215	167.3	137.742	55.766	6952.5	2814.78	8444	.
3	36	14.575	2456.7	168.559	68.243	11201.8	4535.16	163266	.
4	18	7.287	508.1	69.725	28.229	3383.1	1369.67	24654	.
5	20	8.097	999.5	123.433	49.973	9524.4	3856.02	77120	.
6	1	0.405	78.8	194.689	78.821	6306.9	2553.38	2553	.
7	2	0.810	152.9	188.803	76.439	11962.3	4843.06	9686	.
8	15	6.073	538.2	88.624	35.880	5221.1	2113.83	31707	.
9	18	7.287	803.3	110.225	44.626	7079.1	2845.78	51224	.
10	19	7.692	602.6	78.354	31.714	3173.4	1284.77	24411	.
11	1	0.405	118.2	292.066	118.245	10585.2	4285.52	4286	.
12	2	0.810	286.6	353.927	143.290	15395.1	6232.83	12466	.
13	8	3.239	232.5	71.796	29.067	7384.9	2989.84	23919	.
14	1	0.405	23.7	58.494	23.682	5610.4	2271.41	2271	.
15	16	6.470	422.2	65.179	26.388	4718.4	1910.30	30565	.
16	5	2.024	216.9	107.171	43.389	9534.1	3859.96	19300	.
17	31	12.551	980.8	78.147	31.638	5549.9	2246.92	69655	.
18	8	3.239	174.2	53.773	21.770	6231.7	2522.96	20184	.
19	19	4.019	570.7	140.969	57.072	17788.3	7201.74	72017	.
20	12	4.858	134.9	27.766	11.242	2797.5	1132.59	13591	.
21	21	8.502	911.5	107.213	43.406	14344.5	5807.49	121957	.
22	116	46.964	4567.1	97.247	39.371	10338.6	4185.65	485535	.
23	7	2.834	277.8	98.039	39.692	11727.4	4747.94	33236	.
24	3	1.215	135.5	111.578	45.173	5351.9	2166.77	6500	.
25	8	3.239	814.8	251.584	101.856	3522.7	1425.98	11408	.
26	39	15.789	4183.9	264.983	107.281	12749.1	5161.60	201302	.
27	5	2.024	377.3	186.324	75.462	7115.9	2880.92	14405	.
TOTALS	450	182.186	21976.7	120.627	48.837	8787.8	3557.81	1601016	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=23 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	18	7.287	1067.4	146.474	59.308	8430.7	3413.24	1	3413.24	61438	.
2	175	70.850	14275.4	301.769	81.597	12770695	4946.44	1	4946.44	865610	.
3	18	9.045	340.5	199.074	80.597	1089695	4333.25	1	4333.25	390011	.
4	18	9.045	620.2	191.477	77.821	89647	3262.22	1	3262.22	32666	.
5	166	67.206	8788.0	130.612	49.179	8871.4	3263.99	1	3263.99	29491	.
6	142	57.004	3450.3	202.954	82.150	17851.1	4796.03	1	4796.03	1201567	.
7	48	19.599	686.5	35.054	12.587	9968.8	3283.69	1	3283.69	32490	.
8	6	2.429	580.5	238.967	96.587	15888.3	5833.97	1	5833.97	309388	.
9	79	31.984	5415.9	337.490	136.597	15888.3	7464.93	1	7464.93	305880	.
10	77	31.617	5924.4	190.060	74.474	11483.4	4345.23	1	4345.23	359908	.
11	22	9.045	1447.4	188.574	76.178	11825.1	3728.88	1	3728.88	63743	.
12	46	18.627	620.6	377.053	146.380	10925.9	3728.88	1	3728.88	93177	.
13	28	11.419	932.7	380.053	153.487	19911.0	4315.97	1	4315.97	27720	.
14	28	11.419	1410.6	235.732	93.323	19911.0	4315.97	1	4315.97	16251	.
15	28	11.419	720.1	180.567	71.507	11807.2	3252.67	1	3252.67	638108	.
16	33	13.333	201.1	157.342	60.701	1807.1	230.68	1	230.68	195818	.
17	17	7.683	201.3	157.342	60.701	1807.1	230.68	1	230.68	418017	.
18	17	7.683	1030.7	144.572	56.298	12351.5	3427.95	1	3427.95	1202255	.
19	11	4.444	425.4	114.649	45.593	11414.1	3427.95	1	3427.95	342792	.
20	11	4.444	425.4	114.649	45.593	11414.1	3427.95	1	3427.95	469349	.
21	11	4.444	1000.7	166.822	66.511	11515.6	4088.88	1	4088.88	182550	.
22	11	4.444	1000.7	166.822	66.511	11515.6	4088.88	1	4088.88	182550	.
23	11	4.444	1000.7	166.822	66.511	11515.6	4088.88	1	4088.88	182550	.
24	11	4.444	1000.7	166.822	66.511	11515.6	4088.88	1	4088.88	182550	.
TOTALS	1066	431.579	73313.2	169.872	68.977	123451	85418.15	1	85418.15	5808016	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=24

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	19	0.810	26	323	10.637	1706.5	690.9	13872	
2	2	7.287	195	260	78.448	1467.0	1221.5	23047	
3	0	0.448	78	173	78.205	1467.0	1221.5	48947	
4	0	0.205	176	705	71.519	1023.9	4143.0	29039	
5	227	89.931	174	359	566.7	2652.8	4740.3	23236	
6	17	6.839	325	922	121.207	465.7	1085.5	18257	
7	49	19.834	258	807	359.027	682.7	3353.3	33801	
8	7	2.834	26	350	40.403	110.9	138.0	31017	
9	235	10.108	112	632	587.632	1605.3	1338.4	41297	
10	12	4.688	33	844	45.856	1870.3	143.3	15433	
11	30	11.489	133	623	36.858	1404.8	177.9	21995	
12	14	5.689	65	107	692.1	1254.4	220.1	19109	
13	13	5.163	27	695	682.1	1090.0	336.7	24995	
14	70	27.609	11	957	350.5	1336.7	33.0	24284	
15	4	1.629	113	487	60.950	1977.0	177.0	58974	
16	3	1.154	116	627	83.6	1933.6	171.0	32701	
17	8	3.149	11	336	77.7	1973.6	148.6	58974	
18	17	6.646	362	363	108.94	1163.7	32.4	20272	
19	5	1.933	15	599	119.8	1163.7	18.9	30272	
20	1	0.446	39	142	32.5	1163.7	1.3	14276	
21	67	26.446	239	994	359.0	1339.9	4.6	17368	
22	1	0.446	169	794	293.9	1470.0	180.7	9488	
23	1	0.446	169	794	293.9	1470.0	180.7	9488	
24	1	0.446	169	794	293.9	1470.0	180.7	9488	
25	1	0.446	169	794	293.9	1470.0	180.7	9488	
26	1	0.446	169	794	293.9	1470.0	180.7	9488	
27	1	0.446	169	794	293.9	1470.0	180.7	9488	
28	1	0.446	169	794	293.9	1470.0	180.7	9488	
29	1	0.446	169	794	293.9	1470.0	180.7	9488	
30	1	0.446	169	794	293.9	1470.0	180.7	9488	
31	1	0.446	169	794	293.9	1470.0	180.7	9488	
32	1	0.446	169	794	293.9	1470.0	180.7	9488	
33	1	0.446	169	794	293.9	1470.0	180.7	9488	
34	1	0.446	169	794	293.9	1470.0	180.7	9488	
35	1	0.446	169	794	293.9	1470.0	180.7	9488	
36	1	0.446	169	794	293.9	1470.0	180.7	9488	
37	1	0.446	169	794	293.9	1470.0	180.7	9488	
38	1	0.446	169	794	293.9	1470.0	180.7	9488	
TOTALS	955	386.640	52017	134.536	141.968	1955.1	387.2	371278	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=25 -----

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
2	102	41.296	7896.7	191.228	77.471	1309.7	5829.0	553761	.
3	130	12.116	2990.1	246.131	99.639	1281.4	4874.9	152221	.
4	14	5.668	447.6	149.086	66.537	1257.2	5189.1	11965	.
5	17	6.683	1038.1	159.460	22.452	1168.6	7757.3	113491	.
6	54	0.862	260.8	119.948	24.127	1322.3	6258.2	183109	.
7	101	21.789	5213.2	121.230	51.074	1097.6	4058.4	13565	.
8	33	15.385	1251.4	211.347	85.559	2034.2	8235.1	16470	.
9	22	0.800	334.6	262.430	166.976	1242.7	4901.6	98162	.
10	22	0.800	245.7	119.948	166.976	280.5	1015.3	20032	.
11	40	1.594	2473.7	155.264	114.847	1424.3	5758.0	45130	.
12	120	16.943	5543.7	112.867	45.694	1107.1	4483.9	20092	.
13	106	42.445	2743.7	115.849	23.380	1168.7	4464.4	49301	.
14	153	21.457	927.9	94.096	38.077	1107.8	4071.1	33594	.
15	25	1.150	175.1	125.027	59.077	239.6	864.5	11052	.
16	32	0.205	195.3	220.076	85.092	193.8	700.4	1199	.
17	34	1.634	195.2	160.764	65.094	239.6	864.5	1199	.
18	47	11.634	356.3	125.708	25.794	1027.8	3694.1	30261	.
19	76	30.780	321.3	116.844	48.844	148.0	534.1	39261	.
20	87	0.802	492.3	130.560	8.050	131.6	494.1	465226	80
TOTALS		352.602							

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

----- COMPARTMENT=26 -----

STRA	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	53	21.457	4321.6	201.403	81.5399	14134.4	5722.43	301289	.
2	17	6.819	531.1	77.342	48.3166	7735.7	2731.93	34251	.
3	17	6.819	169.1	24.953	83.0459	21689.4	8781.26	17454	.
4	16	6.429	416.7	64.338	69.2489	17473.4	3027.23	11817	.
5	35	14.075	27.3	67.233	27.2075	5619.1	2270.94	8350	.
6	15	6.033	472.7	77.834	31.0559	3525.2	1331.39	2185	.
7	40	16.226	2606.2	139.944	50.5559	13255.7	5710.48	24658	.
8	88	35.406	3136.0	89.332	37.7866	7474.0	3025.92	3112	.
9	88	35.406	411.0	11.622	60.1926	13229.8	5710.48	24658	.
10	13	5.210	204.6	39.010	21.1092	1116.6	425.05	1327	.
11	13	5.210	1458.2	280.757	33.4192	11646.0	425.05	1327	.
12	42	16.804	1458.2	85.757	33.4192	667.9	253.33	10949	.
13	19	7.692	634.6	82.544	33.3355	2957.9	1043.19	29906	.
14	19	7.692	230.8	29.869	32.3587	7780.8	2933.40	59873	.
15	19	7.692	230.8	29.869	32.3587	6531.0	2445.10	17653	.
16	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
17	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
18	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
19	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
20	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
21	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
22	19	7.692	230.8	29.869	32.3587	5230.0	190.71	1523	.
TOTALS	363	146.564	17355.3	118.092	47.8106	9230.7	3247.12	135674	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

COMPARTMENT=27

SIPAL	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	10	4.05	105.4	265.552	105.082	30092.0	17183.0	12183	.
2	16	4.42	1073.7	255.414	107.345	18689.1	2915.4	17493	.
3	13	4.05	1022.5	231.433	76.612	17201.3	26593.6	17684	.
4	1	2.21	308.5	308.584	102.829	10576.5	9282.0	12344	.
5	13	5.26	406.5	148.941	58.334	4796.2	1566.5	73664	.
6	18	3.64	1124.8	1347.296	145.598	13996.3	3614.6	23253	.
7	9	3.88	470.8	116.892	38.228	8928.0	4874.5	35956	.
8	12	8.87	2998.3	101.866	38.979	11994.0	4855.7	28482	.
9	22	9.07	593.5	112.982	45.373	17837.2	5349.1	96742	.
10	11	4.53	916.9	166.582	45.959	26383.1	24463.9	57456	.
11	14	5.74	382.5	189.178	76.585	27821.4	11243.2	112753	.
12	15	4.05	243.6	170.431	86.761	13287.7	4874.5	16653	.
13	1	2.21	287.5	142.527	43.501	11797.5	7347.1	16093	.
14	1	2.21	237.0	107.961	48.567	11746.5	7347.1	13934	.
15	9	3.64	237.8	163.618	68.258	11211.7	5125.4	13514	.
16	2	0.83	1468.6	166.461	67.158	12646.3	4512.7	31774	.
17	4	1.61	184.6	117.382	47.258	12546.3	5125.4	20511	.
18	2	0.81	154.5	105.826	42.292	13470.2	7347.1	6110	.
19	2	0.81	82.3	109.626	42.292	13470.2	7347.1	10715	.
20	2	0.81	110.4	97.174	38.979	12452.9	7347.1	10715	.
21	2	0.81	476.7	124.562	38.979	12452.9	7347.1	10715	.
22	2	0.81	110.4	97.174	38.979	12452.9	7347.1	10715	.
23	2	0.81	476.7	124.562	38.979	12452.9	7347.1	10715	.
24	2	0.81	110.4	97.174	38.979	12452.9	7347.1	10715	.
25	2	0.81	476.7	124.562	38.979	12452.9	7347.1	10715	.
26	2	0.81	110.4	97.174	38.979	12452.9	7347.1	10715	.
27	2	0.81	476.7	124.562	38.979	12452.9	7347.1	10715	.
28	2	0.81	110.4	97.174	38.979	12452.9	7347.1	10715	.
TOTALS	297	120.243	14977.7	124.562	50.430	10983.1	14446.8	1320698	80

FOREST MANAGEMENT PLAN STRATA SUMMARIES BY COMPARTMENT

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COMPARTMENT=28

STRAT	ACRES	HECTARES	TOTAL TREES	TREES PER HECTARE	TREES PER ACRE	VOLUME PER HECTARE	VOLUME PER ACRE	TOTAL VOLUME	CRUISE DATE
1	16	6.478	484.4	74.785	30.2773	3902.2	1579.85	25278	.
2	297	120.243	13483.2	112.133	45.3979	7808.1	3161.16	938865	.
3	52	21.053	3222.6	153.075	61.9737	11015.0	4459.50	231894	.
23	40	19.433	1703.9	87.680	35.4980	7456.8	3018.93	144909	.
24	11	4.453	598.7	114.229	46.2464	8077.0	3270.02	35970	.
25	3	1.215	244.4	201.233	81.4709	20570.6	8328.19	24985	.
26	390	157.875	15640.8	99.058	40.1046	8274.0	3349.81	1306426	.
27	32	12.955	273.1	21.080	8.5343	1575.1	637.68	20406	.
28	12	4.858	287.7	59.225	23.9779	4056.4	1642.26	19707	.
29	1	0.405	80.6	199.037	80.5816	21467.2	8691.17	8691	.
30	30	12.146	525.8	43.292	17.5271	3205.8	1297.88	38936	.
TOTALS	892	361.134	36455.3	100.947	40.8692	7742.5	3134.60	2796067	78

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## INTERNAL DISTRIBUTION

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