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Charles R. Hatch
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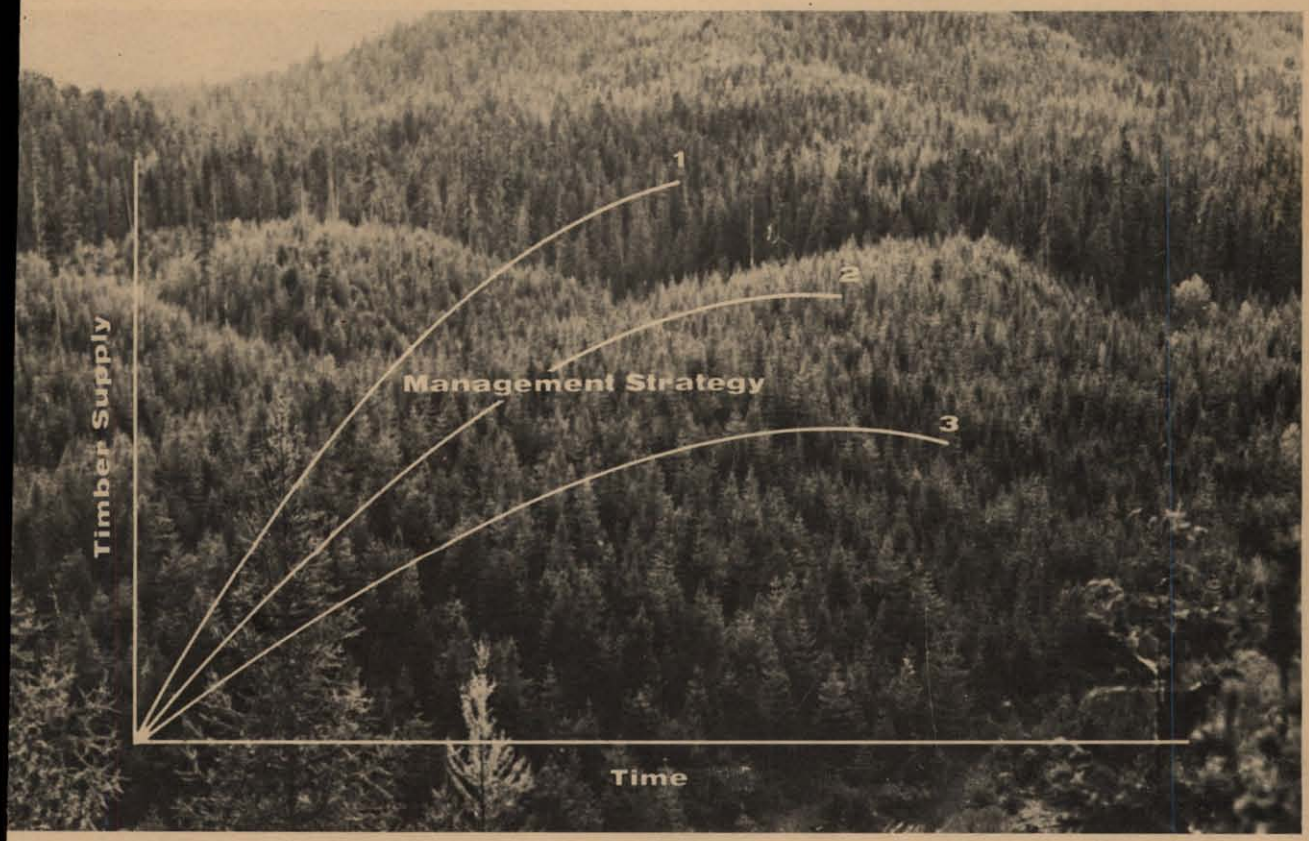

University of Idaho
Moscow, Idaho 83843

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Charles Hatch
College of Forestry, Wildlife and Range Sciences
University of Idaho
Moscow, Idaho

Kenneth Sowles
College of Forestry, Wildlife and Range Sciences
University of Idaho
Moscow, Idaho

Gerald Allen
College of Forestry, Wildlife and Range Sciences
University of Idaho
Moscow, Idaho

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Cover photo: Logged in the early 1930s, the middle portion of this range on Willow Creek, 17 miles south of St. Maries, Idaho, on the St. Joe National Forest, now supports a new forest. Courtesy USDA *Forest Service, Missoula, MT.*

ACKNOWLEDGMENTS

The Idaho Forest Productivity Technical Advisory Committee is acknowledged for the advice and suggestions given the researchers throughout this study. Their input has been very helpful.

The organizations and agencies within the state of Idaho that supplied inventory information are gratefully acknowledged. These organizations are the USDA Forest Service, Region 1; USDA Forest Service, Region 4; USDA Forest Service, Intermountain Forest and Range Experiment Station; Bureau of Land Management; Idaho Department of Lands; Potlatch Corporation; and Boise Cascade Corporation.

This study was accomplished under a contract issued to the Idaho Department of Lands by the Pacific Northwest Regional Commission. The statements, findings, conclusions and recommendations in this study are solely those of the authors and do not necessarily reflect the view of the Idaho Department of Lands or the Pacific Northwest Regional Commission.

Timber Supply Projections for the State of Idaho

Charles R. Hatch, Gerald M. Allen, Geoffrey L. Houck and Kenneth M. Sowles

INTRODUCTION

The forest resources of Idaho are economically rtant to the state. One of the forest resources is timber y on commercial forest land. If individuals are to tively evaluate the impact of timber supplies on the s economy and assess the role of the state's contribu- to the nation's timber supply, Idaho's present and cted future timber supplies must be estimated as rately as possible.

The objective of this study is to determine the nt and expected future timber supplies [1] on commer- forest land within the state of Idaho. Timber supplies projected for a given set of yield assumptions and zation intensities from the present to the year 2045. focal point of the projections is the biological urce; economic constraints are not directly considered. purposes of this analysis the state is divided into two raphic regions, northern Idaho and southern Idaho. Salmon River serves as the north-south dividing line. in each region, timber supply estimates are presented our ownership groups: National Forest, Other Public [2], st Industries, and Other Private [3].

The model employed, the data base used, and the mptions made to estimate future timber supply directly ct the magnitude of the estimates. Therefore, it is most ortant that these factors be considered when ana- ng the results of this study.

THE MODEL

There are several types of projection models available for use when estimating timber supply. The selection of a model should be considered in light of information on forest age-class distribution, forest stand structure, data availability, and the model's data input requirements.

The Timber Resource Analysis System (TRAS) model developed by Larson and Goforth (1970) was selected and used in this study. It is a stand table projection model that has been used by Forest Survey, USDA Forest Service to evaluate the nation's timber supply situation and is well adapted to making aggregate, long term projections for large areas.

Individuals interested in a detailed explanation of the model are referred to publications by Larson and Goforth (1970, 1974). A brief explanation follows.

Because TRAS is a stand table projection model, average number of trees per acre, volumes per tree, annual radial growth rates, annual mortality rates and annual removal rates by 2-inch diameter classes are required as inputs. Gross growth is computed for each year by moving trees from one diameter class to a larger diameter class. Annual radial growth rates by diameter class determine the extent of this tree movement. Annual mortality and removal rates by diameter class reduce number of trees in each diameter class. At the beginning of each year, gross

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Charles R. Hatch and Gerald M. Allen are Associate and stant Professors, respectively, of Forest Resources; Geoffrey Houck is a Research Technician; Kenneth M. Sowles is Associate fessor of Wood Utilization and Marketing, at the University of no.

[1] In economic terminology, the timber supply curves presented in this paper would be defined as timber production functions.

[2] Other Public includes Idaho Department of Lands, Bureau of Land Management, Bureau of Indian Affairs, county, municipal and miscellaneous federal ownerships.

[3] Other Private includes farmer and miscellaneous private ownerships.

growth by diameter class is added to the initial stand table and mortality, and removals by diameter class are subtracted to obtain a stand table for the end of the year.

DATA BASE USED

The commercial forest land acreages given by Green and Setzer (1974) were used for all ownerships except National Forest and the State of Idaho. The latter were obtained from the USDA Forest Service Regional Offices and the Department of Lands, respectively. Table 1 lists 1975 acreages used in this study.

Each organization within the state was asked to supply its most recent forest inventory data, consisting of measurements on individual trees located on the inventory plots. Those who contributed are listed in Table 2. Individual tree records were used to generate stand tables (number of trees per acre by diameter class), total volume per tree (cubic feet), and annual radial growth by 2-inch diameter classes for each geographic region by ownership group without regard to species. When two organizations had information on the same owner within an ownership group, the most current inventory information was used (i.e., BLM's inventory information was used in preference to Forest Survey's inventory information for BLM lands).

Mortality rates were obtained by scientists at the USDA Forest Service, Forestry Sciences Laboratory, Moscow, ID from inventories that used a one-time examination of sample plots on the national forests of northern Idaho. Mortality equations constructed from these data predict mortality rate for each species as a function of diameter. The predicted rates, when averaged across all species and applied to stand tables for each ownership group by geographic region, produced the 1975 annual net cubic foot volume/acre mortality shown in Table 3.

Table 1. Commercial forest land acreage within the state of Idaho by geographic region and ownership group.

	Thousands of Acres	
Northern Idaho	7573.6	
National Forest		4208.7
Other Public		778.7
Forest Industries		777.6
Other Private		1808.6
Southern Idaho	7127.8	
National Forest		6125.0
Other Public		568.2
Forest Industries		169.1
Other Private		265.5
Total	14701.4	

Table 2. Organizations contributing forest inventory inform on commercial forest land within the state of Idaho.

Organization	Dates of Inventor
State Department of Lands – Southern Idaho	1966 to 1974
State Department of Lands – Northern Idaho	1968 to 1972
Bureau of Land Management – Southern Idaho	1973
Bureau of Land Management – Northern Idaho	1974
Forest Survey – Southern Idaho	1967
Forest Survey – Northern Idaho	1964
U.S. Forest Service – Southern Idaho	
Boise National Forest	1964
Challis National Forest	1974
Payette National Forest	1965
Salmon National Forest	1973
Sawtooth National Forest	1970
Targhee National Forest	1966
U.S. Forest Service – Northern Idaho	
Clearwater National Forest	1973
Coeur d'Alene National Forest	1972
Kaniksu National Forest	1969
St. Joe National Forest	1972
Potlatch Corporation	1973 to 1974
Boise Cascade Corporation	1975

These equations were compared with mortality fu tions estimated from large scale aerial photography on Colville National Forest and with mortality functi developed from a large collection of permanent sam plots. This comparison indicates that the equati developed from one-time examinations may significan underestimate actual mortality rates. [4]

As mentioned, the stand tables by ownership gr within each region were constructed from forest invent data. These stand tables were updated by projecting stands from the date of inventory to 1975, using previou discussed growth and mortality rates. Annual board f removals from the date of inventory to 1975 were obtai from Hearst (1972, 1975) for state, BLM, BIA, for industries, and miscellaneous private lands. Similar inform tion for National Forests was obtained from the US Forest Service Timber Management Offices of Region Missoula, MT, and Region 4, Ogden, UT. The basic inf mation on removals was converted to cubic feet using

[4] Personal communications with personnel at the Fores Sciences Laboratory, Moscow, Idaho.

3. Actual gross growth, net growth and mortality estimates 75 for each geographic region by ownership group.

	Gross Growth	Net Growth	Mortality
	Cubic Feet/Acre/Year		
hern Idaho			
National Forest	78.03	64.42	13.61
Other Public	93.32	69.14	24.18
Forest Industries	63.34	49.97	13.37
Other Private	53.36	46.89	6.47
hern Idaho			
National Forest	44.44	28.42	16.02
Other Public	95.97	77.19	18.78
Forest Industries	83.80	68.60	15.20
Other Private	75.93	60.53	15.40

rd foot-cubic foot conversion factor of five (5). The verted cubic foot actual past removals given in Table 4 e used in the updating process.

Removal rates by 2-inch diameter class were obtained m Wilson, Green and Choate (1970). The absolute rates e used to provide an initial estimate of removals by meter class. These initial removal estimates were then usted to equal actual annual total removals by owner- p group (Table 4). The relative distribution of removals diameter class was not changed from that given by the ial estimates. The same removal rates were applied to ownership groups in both geographic regions without ard to species.

ASSUMPTIONS

The following assumptions were made when project- timber supplies for the state of Idaho.

d Base

Commercial forest land acreages by geographic region all ownership groups were assumed to remain fixed at 75 levels (Table 1). Data were not available to adequately ecast change in the commercial forest land base. There- e, the 1975 commercial forest land base was used oughout the entire projection period. Timber supply jections for alternative commercial forest land bases can obtained by multiplying the annual net cubic foot ume per acre growth estimates by the desired commer- forest land base. (See Appendix tables.) This provides a ans of evaluating alternative commercial forest land eage assumptions.

nstocked Acreage

Each organization's forest inventory sample plots e located on stocked and nonstocked sites. A non- cked site is defined as commercial forest land less than 7 percent stocked with live, non-cull trees suitable for ustrial wood products (Green and Setzer 1974). Consequently, the present proportion of stocked and nonstocked sites is represented in the stand tables. It is assumed there will be neither an increase nor decrease in percent of stocked sites throughout the entire projection period. Table 5 gives the estimated percent of stocked sites by ownership group within each geographic region. These percentages were obtained from Green and Setzer (1974).

Volume Estimates

Volume estimates used in this study were total tree, net cubic foot volume. When an organization's inventory data did not contain defect information, the average percent defect by diameter class calculated from state Department of Lands data was used. All trees 4 inches and larger in diameter were assumed to have volumes. The use of total tree volume eliminated the need to specify a merchantability standard.

Table 6 gives the estimated 1975 growing stock inventory on commercial forest land in Idaho by ownership group. Timber supply projections are based on this growing stock.

Growth, Mortality and Removal Estimates

Past management actions and economic conditions directly influence present stand structure and indirectly affect radial growth, mortality and removal rates. Therefore, previous forest stand conditions indirectly influence the growth data inputs used in this study (Table 3).

Ingrowth, the number of trees entering the 2-inch diameter class, was assumed to be equal to the number of trees leaving the 2-inch diameter class. Therefore, the number of trees in the smallest diameter class remained constant over the projection period.

The Q method option in the TRAS model (Larson and Goforth 1974) was used to calculate gross growth. This option assumes number of trees per acre can be expressed as an exponential function of diameter.

The same mortality rates by diameter class were used for all ownership groups within a geographic region. This was necessary because accurate mortality rates by diameter class are extremely difficult to obtain.

The distribution of removals by diameter class was expressed as a proportion of the inventory. The distribution of removals by diameter class was used to set total volume of annual removals equal to total volume of annual growth.

Radial growth, mortality and removal rates might well be altered as old-growth forests are converted to younger forests. Presently, there are insufficient data available to adequately express the rate and impact of this potential change. Therefore, 1975 radial growth and mortality rates were used throughout the projection period. It was also assumed that the distribution of removal rates would follow the 1975 pattern throughout the projection period.

Table 4. Idaho timber harvest.

	1969	1970	1971	1972	1973	1974
			(Cubic Feet/Acre)			
USDA Forest Service						
Boise[1]	18.72	16.23	12.61	18.55	17.86	16.04
Caribou	0.86	0.58	0.73	0.71	2.58	5.63
Challis	0.99	1.09	0.80	2.46	2.58	1.38
Payette	18.54	18.86	15.64	17.46	14.88	14.17
Salmon	4.78	4.64	5.60	6.07	5.56	5.98
Sawtooth	6.75	5.99	5.18	5.06	3.76	4.06
Targhee	13.01	14.24	14.13	12.98	16.27	19.94
Clearwater[2]	29.09	27.17	19.51	20.09	23.31	21.46
Coeur d'Alene	42.11	34.01	27.53	23.65	34.82	--
Kaniksu	22.76	19.09	18.98	22.66	22.67	--
Nezperce	20.61	27.57	17.46	17.90	16.72	19.38
St. Joe	35.21	31.95	27.21	26.11	21.99	--
BLM[3]						
Southern	4.71	9.99	2.93	3.38	0.07	1.24
Northern	20.55	12.23	11.23	9.24	5.47	8.76
BIA						
Southern	17.93	0.60	0.16	0.34	0.34	0.34
Northern	23.32	26.49	45.04	55.46	44.64	93.27
State						
Southern	20.48	10.17	11.13	16.04	22.74	17.56
Northern	25.41	39.10	48.64	40.22	44.73	48.38
Forest Industries						
Southern	27.08	35.50	35.90	34.15	70.23	48.00
Northern	86.73	88.01	94.98	103.18	93.49	105.67
Miscellaneous Private						
Southern	8.97	11.76	11.90	11.32	23.28	15.91
Northern	19.40	19.69	21.25	23.08	20.91	23.64

[1] From Region 4, Division of Timber Management, Ogden, UT.

[2] From Region 1, Division of Timber Management, Missoula, MT.

[3] From Hearst, Allen L. 1972, 1975. "Timber Harvest Data for Montana and Idaho." State and Private Forestry, USDA Forest Service, Missoula, MT.

'YPES OF TIMBER SUPPLY PROJECTIONS

Timber supply projections are made for each owner- group within a geographic region. They reflect two ber resource utilization intensities:

1) 100 percent utilization intensity, and
2) 1975 utilization intensity.

ber supply projections based on 100 percent utiliza- n intensity assume all commercial forest land is managed lusively for timber production with complete utilization all trees 4 inches in diameter and larger. Timber supply jections based on 1975 utilization intensity assume nmercial forest land management at a 1975 level of phasis on multiple-use, environmental and economic nagement objectives.

Timber supply projections reflect four alternative wth and mortality rates. Timber supply, the total ume of annual removals, is equated to:

a) 1975 gross volume growth, [5] given in Table 3,
b) 1975 net volume growth, [6] given in Table 3,
c) a modified net volume growth computed with a mortality rate twice the 1975 mortality rate given in Table 3, and
d) a modified net volume growth computed with a growth rate 10 percent greater than the 1975 growth rate given in Table 3 and a mortality rate 10 percent less than the 1975 mortality rate given in Table 3.

ble 5. Percent of stocked sites on commercial forest land by nership group for each geographic region.

	Percent
Northern Idaho	
National Forest	90.99
Other Public	97.25
Forest Industries	97.49
Other Private	91.58
Southern Idaho	
National Forest	98.68
Other Public	97.82
Forest Industries	98.23
Other Private	97.74

Source: Green and Setzer 1974.

[5] Gross volume growth is defined as total volume growth fore deductions for losses due to mortality.

[6] Net volume growth is defined as total volume growth er deductions for losses due to mortality.

Table 6. Estimated 1975 growing stock inventory on commercial forest land in Idaho by ownership group.

	Net Growing Stock Volume (Million Cubic Feet)	
Northern Idaho	19455.27	
National Forest		12011.58
Other Public		2866.09
Forest Industries		2067.50
Other Private		2510.10
Southern Idaho	19441.03	
National Forest		16329.32
Other Public		1990.99
Forest Industries		427.86
Other Private		692.86
Total	38896.30	

RESULTS AND CONSIDERATIONS

Timber supply projections for the state of Idaho are illustrated in Figs. 1 through 12. (Data for these figures appear in the Appendix tables, which correspond to the respective figure numbers.) The right-hand axis in Figs. 1 through 8 is only associated with timber supply projection curves 1a, 1b and 1c. Interesting and important factors portrayed in these graphs are discussed in the following paragraphs.

Sustaining Current Level of Timber Supplies

The solid dot in Figs. 1 through 8 indicates the 1975 level of timber removals for each ownership group. If the solid dot is at or below timber supply curve 2b, that ownership group should be capable of sustaining its current level of timber removals through 2045. The assumption in obtaining timber supply curve 2b is that commercial forest land acreage, utilization intensity, and net volume growth rates remain at 1975 levels. As indicated by the position of the solid dot with respect to timber supply curve 2b, all ownership groups except for Forest Industries in northern Idaho are capable of sustaining their current level of timber removals. Forest Industries in northern Idaho will have to reduce their current level of timber removals before 2045. It should be noted, however, that by allowing timber removals to exceed net growth during a short-term program, an owner can increase the rate at which mature and overmature stands are converted to younger, more rapidly growing stands.

Two factors could cause all ownership groups to reduce their current level of timber removals. These are a reduction in commercial forest land acreage, and less emphasis on timber production and/or more restrictive environmental management conditions.

PROJECTED AVERAGE ANNUAL TIMBER SUPPLIES – NORTHERN IDAHO

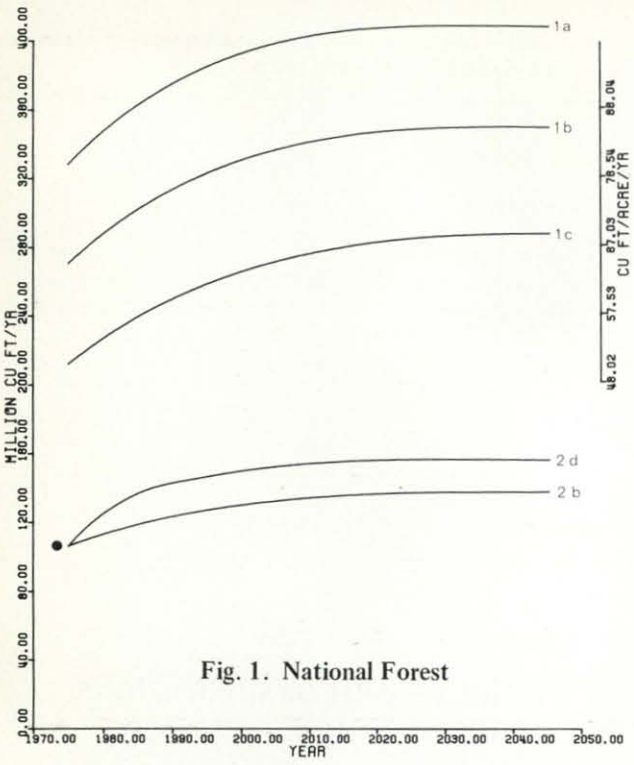


Fig. 1. National Forest

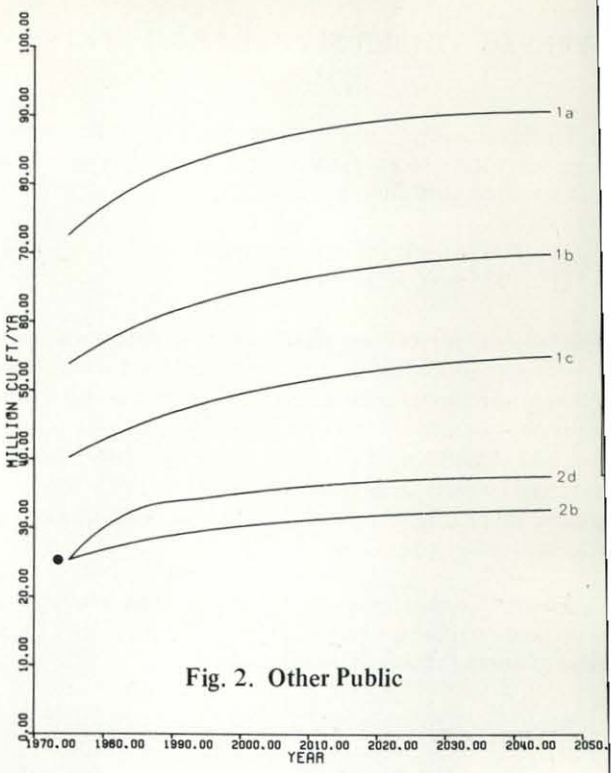


Fig. 2. Other Public

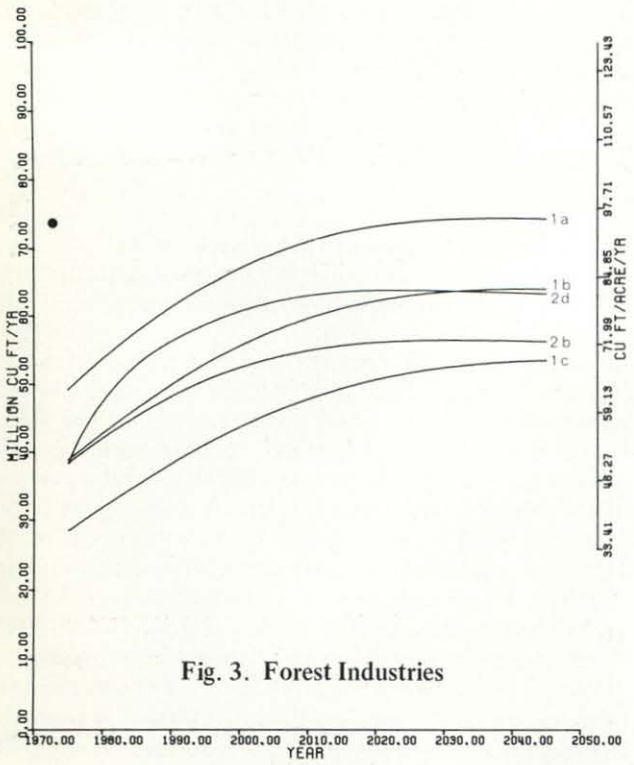


Fig. 3. Forest Industries

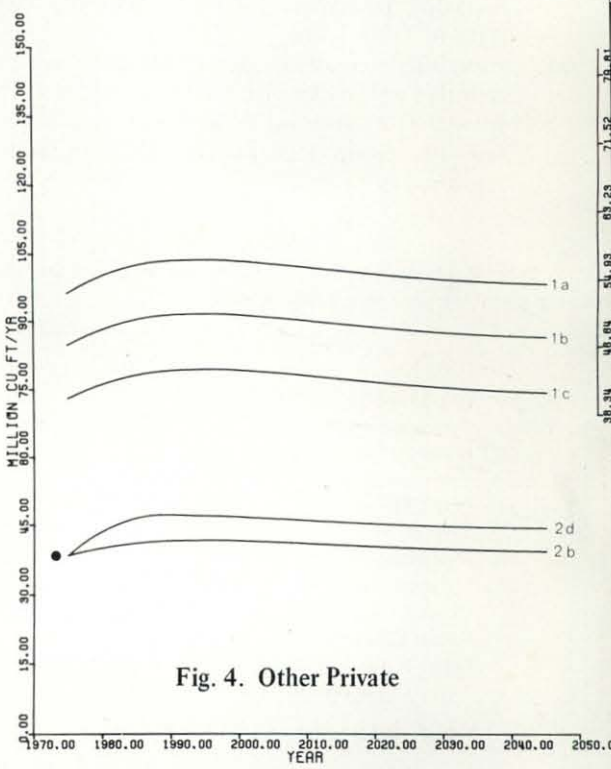


Fig. 4. Other Private

Note: The solid dot (●) denotes 1975 average annual removals. Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth – 100 percent Utilization Intensity.

1b Annual removals equaling 1975 annual net volume growth – 100 percent Utilization Intensity.

1c Annual removals equaling a modified annual net volume growth – 100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.

2d Annual removals equaling a modified annual net volume growth – 1975 Utilization Intensity. Modifi annual net volume growth is computed using growth alternative d.

2b Annual removals equaling 1975 annual net volume growth – 1975 Utilization Intensity.

PROJECTED AVERAGE ANNUAL TIMBER SUPPLIES – SOUTHERN IDAHO

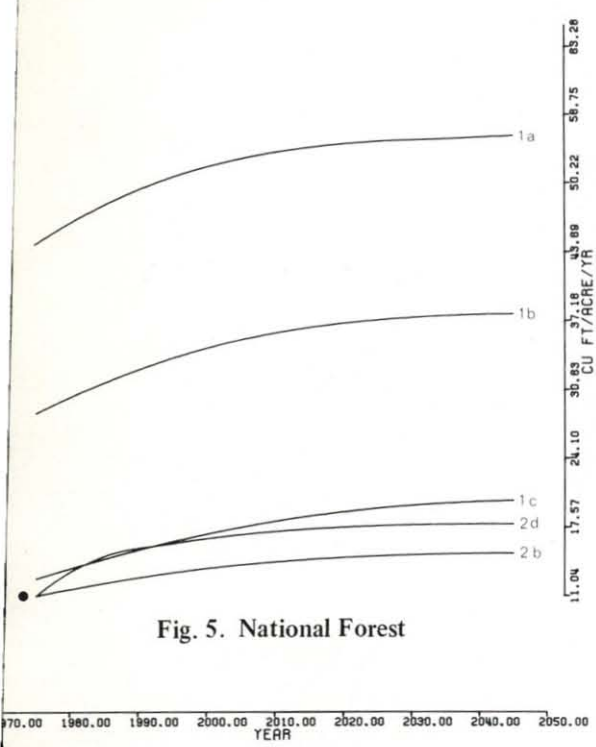


Fig. 5. National Forest

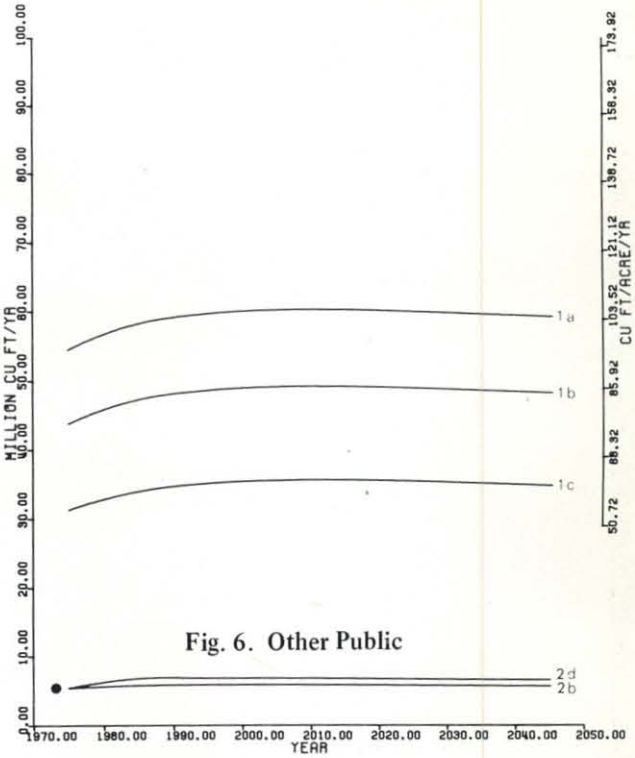


Fig. 6. Other Public

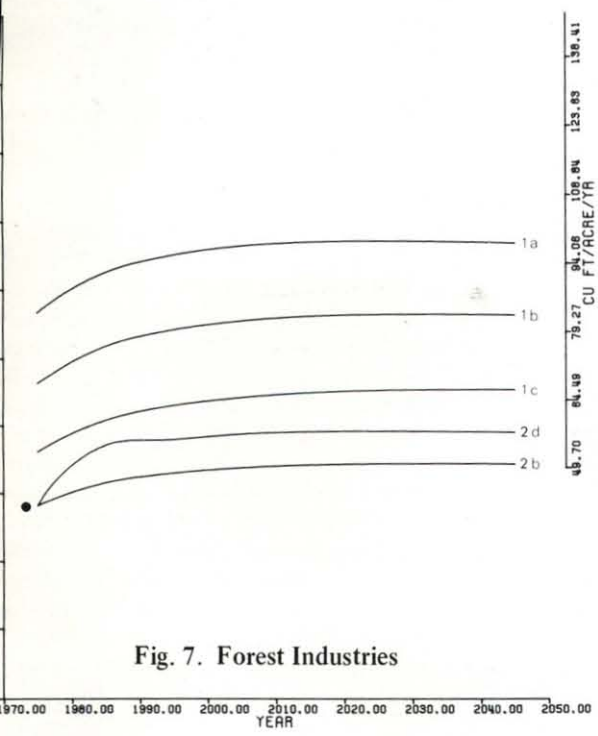


Fig. 7. Forest Industries

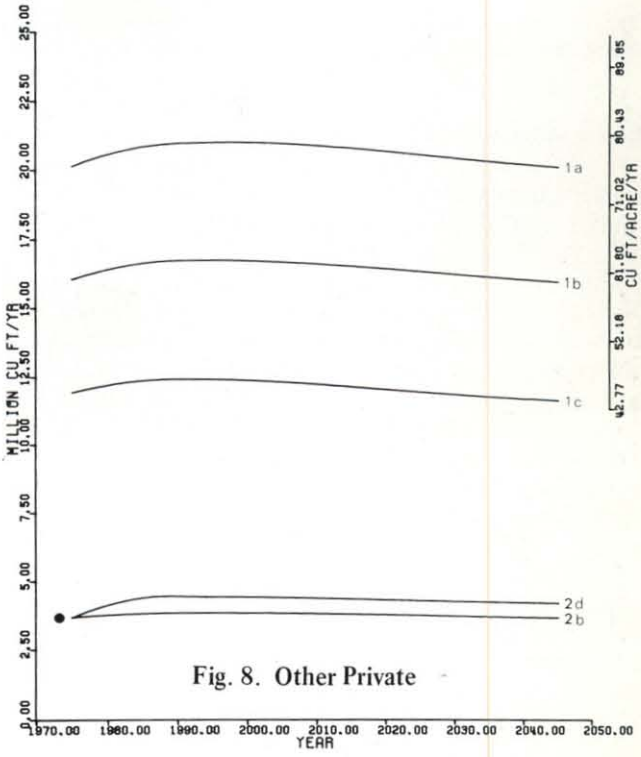


Fig. 8. Other Private

Note: The solid dot (●) denotes 1975 average annual removals. Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth – 100 percent Utilization Intensity.

1b Annual removals equaling 1975 annual net volume growth – 100 percent Utilization Intensity.

1c Annual removals equaling a modified annual net volume growth – 100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.

2d Annual removals equaling a modified annual net volume growth – 1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.

2b Annual removals equaling 1975 annual net volume growth – 1975 Utilization Intensity.

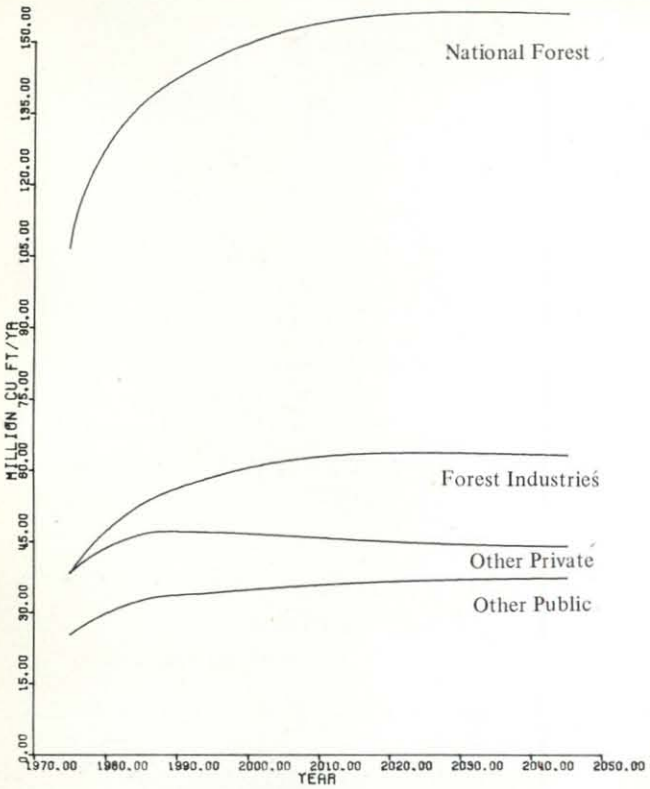


Fig. 9. Projected average annual timber supply by ownership group based on timber supply projection 2b–Northern Idaho.

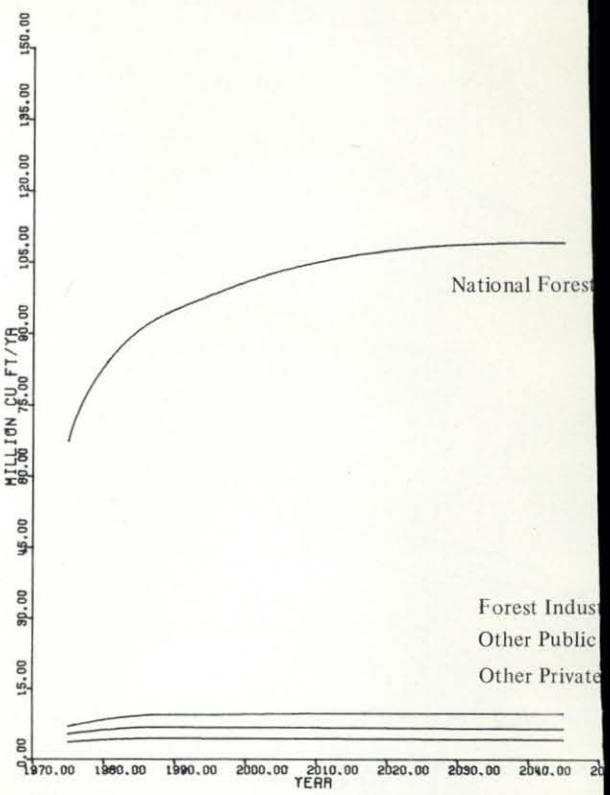


Fig. 10. Projected average annual timber supply by owner group based on timber supply projection 2b–Southern Idaho.

Effect of Utilization Intensity

In Figs. 1 through 8 a comparison of projected timber supply curves 1b (100 percent utilization intensity) and 2b (1975 utilization intensity) indicates the tradeoffs in timber supply associated with esthetic, watershed, other multiple-use, and environmental management objectives. Management of commercial forest land exclusively for timber production is limited by these objectives. Merchantability standards [7] are also reflected in the difference between these two curves, but multiple-use and environmental management objectives are the dominating factors. The assumption in obtaining timber supply curves 1b and 2b is that commercial forest land acreage and net volume growth rates remain at 1975 levels.

Because of multiple-use, environmental and economic management objectives, the timber supply associated with curve 1b is not a realistic goal on publicly owned commercial forest land. It only becomes an attainable goal on commercial forest land where the owner exclusively manages his land for timber production.

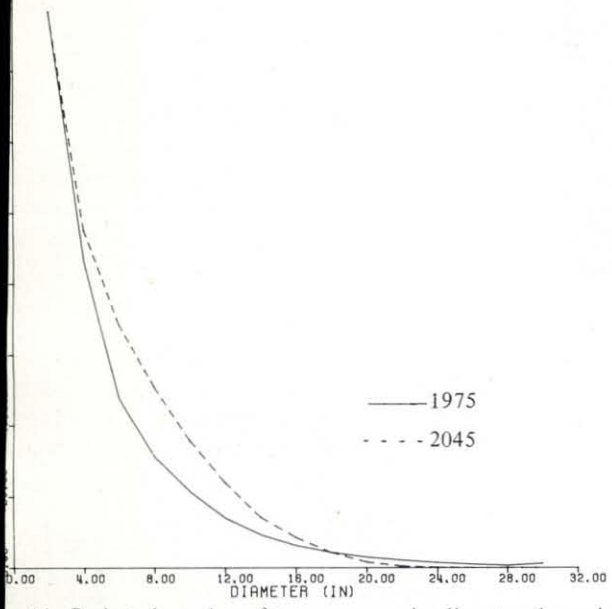
Spatial location and accessibility of forest stands should also be considered when evaluating timber supply projections. Timber supply curve 1b assumes each forest stand in the commercial forest land base in Idaho is rea accessible. For numerous acres this is not the case.

Effect of Increased Growth Rates

Increased net volume growth can be obtained thro forest management practices which simply control density of forest stands. The increase in timber sup that could be attained through regulation of stand densi is shown by the difference between timber supply cu 2d and 2b in Figs. 1 through 8. The assumption in obt ing these curves is that commercial forest land acreage utilization intensity remain at 1975 levels. If increa timber harvest is desired, more intensive forest managem practices would need to be employed. Such managem practices could take the form of genetically impro growing stock, fertilization and regeneration of curr nonstocked acreages. However, it should be recogni that increases in growth rates may often be difficult obtain when a constant or increasing level of emphasis multiple-use and environmental management objecti is maintained.

Increases in timber supply through improved mana ment, in most cases, are slight when compared with ga that might be accomplished through the relaxation multiple-use and environmental management objectiv This is illustrated by the difference between timber sup curves 2d and 2b as compared with the difference betwe timber supply curves 1b and 2b.

[7] Merchantability standards include factors such as minimum stump and top diameter criteria.



g. 11. Projected number of trees per acre by diameter class using nber supply projection 2b–National Forest, Northern Idaho.

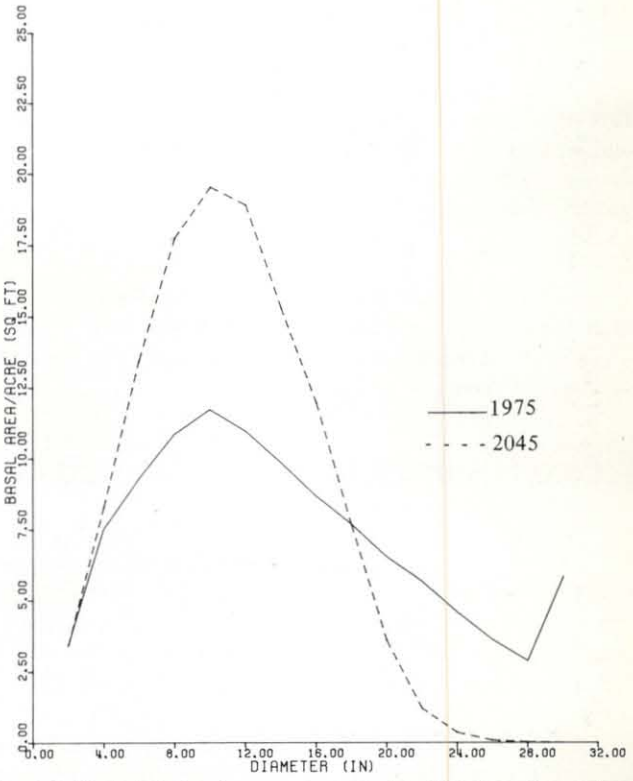


Fig. 12. Projected basal area per acre by diameter class using timber supply projection 2b–National Forest, Northern Idaho.

ffect of Mortality

In Figs. 1 through 8, the comparison of timber supply urves 1a, 1b, and 1c indicates the sensitivity of the timber pply projections to different mortality rate estimates. he assumption in obtaining these curves is that commer- al forest land acreage remains at 1975 levels and is anaged at a 100 percent utilization intensity. Curve 1a flects timber supplies in the absence of mortality. Slight rors in the estimation of mortality can substantially odify the timber supply projections. For example, if ctual mortality rates are in fact twice the mortality rates btained from current forest inventories, timber supplies ould be represented by curve 1c rather than curve 1b. It important that this factor be recognized since mortality te estimates are most subject to error in current forest ventory procedures.

It should also be noted that the difference between 975 utilization intensity and 100 percent utilization inten- ty would not be as great if current estimates of mortality ere half what they should be. This is illustrated by the ifference between timber supply curves 1b and 2b as mpared to the difference between timber supply curves c and 2b.

omparison of Timber Supplies by Ownership

Figs. 9 and 10 illustrate the domination of timber upplies in the state of Idaho by the National Forest wnership group. Over 50 percent of the projected timber supply in northern Idaho and over 80 percent of the projected timber supply in southern Idaho is produced by the National Forest ownership group. The assumption in obtaining these timber supply curves is that commercial forest land acreage, utilization intensity and net volume growth rates remain at 1975 levels.

This domination is a direct result of the fact that in northern Idaho over 55 percent and in southern Idaho over 85 percent of commercial forest land acreage is in the National Forest ownership group.

Changes in Stand Structure

The initial upward slope of timber supply projection curves in Figs. 1 through 8 is caused by a change in stand structure resulting from conversion of mature and overmature forests to younger, more rapid-growing forests. Figures 11 and 12 illustrate stand structure in 1975 and projected stand structure in 2045 in units of trees per acre and basal area, respectively, for the National Forest, northern Idaho ownership group. The assumptions in obtaining these curves are that commercial forest land acreage, utilization intensity and net volume growth rates remain at 1975 levels.

There is a very predominant shift in the distribution of number of trees and basal area from the larger to smaller diameter classes during this period. A similar shift occurred in all ownership groups. Graphically, this change is most

apparent when the distribution of basal area per acre by diameter class is viewed (Fig. 12).

This change is in part a ramification of the distribution of removal rates used in the projection model. Mature and overmature timber, represented by trees in the larger diameter classes, was removed at a rate which was relatively greater than removals of trees in the smaller diameter classes.

The 30-inch diameter class represents all trees 30 inches and larger in diameter. This accounts for the sharp increase in trees per acre and especially basal area per acre in diameter classes larger than 28 inches.

CONCLUSIONS AND RECOMMENDATIONS

Using present forest management practices, commercial forest land owners should be able to maintain 1975 levels of timber supply through 2045. If forest management practices were implemented which would regulate forest stand densities, projected timber supplies would exceed 1975 levels.

The projected levels of timber supply can only be expected if the commercial forest land base and emphasis on social, economic and environmental manageme objectives remain at their 1975 levels for the entire proj tion period. A reduction in the commercial forest land b would reduce projected levels of timber supply. M restrictive timber management practices resulting fr changes in the emphasis placed on social, economic a environmental management objectives would also redu projected levels of timber supply.

Estimates of mortality are the component of grow most subject to error using current forest inventory pro dures. Since mortality directly influences projected timb supplies, it is important that forest inventory procedur be implemented which reduce the variability of t estimate.

In some cases, the most recent forest invento information available on some commercial forest lands the state of Idaho is over 10 years old (Table 2). If prese and projected future timber supplies are to be accurate assessed, it is important that all commercial forest acrea be frequently inventoried. Forest inventory procedur should be implemented which are efficient, statistical sound and obtain the information necessary for use modern stand projection and resource decision-maki systems.

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APPENDIX

Appendix Table 1a. Projected average annual timber supplies–National Forest, Northern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	328.42	271.12	212.12	106.57	106.57
1980 - 1990	363.45	302.75	239.90	137.09	119.00
1990 - 2000	385.65	323.77	259.22	146.66	127.32
2000 - 2010	399.25	337.33	272.37	152.44	132.68
2010 - 2020	406.46	345.32	280.82	155.42	135.85
2020 - 2030	409.34	349.24	285.80	156.56	137.42
2030 - 2040	409.68	350.58	288.03	156.65	137.77
2040 - 2050	409.13	350.45	288.71	156.29	137.89

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 1b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–National Forest, Northern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	78.03	64.42	50.40	64.42
1980 - 1990	86.36	71.93	57.00	82.84
1990 - 2000	91.63	76.93	61.59	88.58
2000 - 2010	94.86	80.15	64.72	92.04
2010 - 2020	96.57	82.05	66.72	93.83
2020 - 2030	97.26	82.98	67.91	94.52
2030 - 2040	97.34	83.30	68.44	94.58
2040 - 2050	97.21	83.27	68.60	94.37

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 2a. Projected average annual timber supplies–Other Public, Northern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	72.67	53.84	40.23	25.37	25.37
1980 - 1990	79.88	59.51	44.99	32.70	27.97
1990 - 2000	84.02	63.14	48.33	34.32	29.62
2000 - 2010	86.81	65.61	50.62	35.55	30.71
2010 - 2020	88.72	67.41	52.31	36.42	31.50
2020 - 2030	89.92	68.69	53.57	37.00	32.07
2030 - 2040	90.55	69.52	54.48	37.32	32.45
2040 - 2050	90.77	69.99	55.07	37.52	32.68

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 2b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Other Public, Northern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	93.32	69.14	51.66	69.14
1980 - 1990	102.58	76.42	57.78	89.15
1990 - 2000	107.90	81.08	62.06	93.86
2000 - 2010	111.48	84.26	65.01	97.43
2010 - 2020	113.93	86.57	67.18	99.95
2020 - 2030	115.47	88.21	68.79	101.59
2030 - 2040	116.28	89.28	69.96	102.47
2040 - 2050	116.57	89.88	70.72	102.93

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 3a. Projected average annual timber supplies–Forest Industries, Northern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	49.25	38.86	28.48	38.37	38.37
1980 - 1990	57.70	46.68	35.12	52.84	45.35
1990 - 2000	64.47	52.98	41.17	58.74	50.60
2000 - 2010	69.32	57.83	45.99	62.14	53.90
2010 - 2020	72.43	61.18	49.48	63.68	55.75
2020 - 2030	74.00	63.15	51.79	63.98	56.47
2030 - 2040	74.51	64.04	53.06	63.76	56.54
2040 - 2050	74.42	64.23	53.59	63.46	56.36

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 3b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Forest Industries, Northern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	63.34	49.97	36.63	49.97
1980 - 1990	74.20	59.77	45.16	69.82
1990 - 2000	82.91	68.13	52.94	79.64
2000 - 2010	89.15	74.37	59.14	86.57
2010 - 2020	93.15	78.68	63.63	90.93
2020 - 2030	95.16	81.21	66.60	93.06
2030 - 2040	95.82	82.36	68.24	93.63
2040 - 2050	95.70	82.60	68.92	93.45

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 4a. Projected average annual timber supplies–Other Private, Northern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	96.51	84.81	73.10	38.58	38.58
1980 - 1990	102.64	90.48	78.22	46.56	41.15
1990 - 2000	103.85	91.73	79.45	47.01	41.73
2000 - 2010	102.86	90.86	78.69	46.38	41.33
2010 - 2020	101.34	89.40	77.28	45.56	40.66
2020 - 2030	99.96	88.04	75.92	44.89	40.04
2030 - 2040	98.98	87.03	74.89	44.46	39.58
2040 - 2050	98.42	86.41	74.24	44.26	39.31

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 4b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Other Private, Northern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	53.36	46.89	40.42	46.89
1980 - 1990	56.75	50.03	43.25	56.60
1990 - 2000	57.42	50.72	43.93	57.14
2000 - 2010	56.87	50.24	43.51	56.38
2010 - 2020	56.03	49.43	42.73	55.38
2020 - 2030	55.27	48.68	41.98	54.57
2030 - 2040	54.73	48.12	41.41	54.05
2040 - 2050	54.42	47.78	41.05	53.80

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 5a. Projected average annual timber supplies–National Forest, Southern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	272.18	174.09	77.60	67.53	67.53
1980 - 1990	294.66	191.77	89.12	90.77	74.92
1990 - 2000	310.79	206.00	99.21	98.04	81.00
2000 - 2010	321.37	216.45	107.57	103.25	85.65
2010 - 2020	327.90	223.58	114.00	106.48	88.86
2020 - 2030	331.51	227.94	118.59	108.33	90.85
2030 - 2040	330.00	230.35	121.45	109.15	92.00
2040 - 2050	334.97	231.38	122.98	109.34	92.50

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 5b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–National Forest, Southern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	44.44	28.42	12.67	28.42
1980 - 1990	48.11	31.31	14.55	38.24
1990 - 2000	50.74	33.63	16.20	40.96
2000 - 2010	52.47	35.34	17.56	42.87
2010 - 2020	53.53	36.50	18.61	44.04
2020 - 2030	54.12	37.21	19.36	44.70
2030 - 2040	54.37	37.61	19.83	44.97
2040 - 2050	54.69	37.78	20.08	45.02

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 6a. Projected average annual timber supplies–Other Public, Southern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	54.53	43.86	31.32	5.43	5.43
1980 - 1990	58.35	47.35	34.04	6.78	5.80
1990 - 2000	59.81	48.70	35.19	6.81	5.88
2000 - 2010	60.35	49.21	35.60	6.79	5.88
2010 - 2020	60.35	49.24	35.63	6.74	5.85
2020 - 2030	60.04	48.99	35.42	6.66	5.79
2030 - 2040	59.64	48.61	35.08	6.59	5.72
2040 - 2050	59.25	48.23	34.71	6.53	5.66

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 6b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Other Public, Southern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	95.97	77.19	55.12	77.19
1980 - 1990	102.69	83.33	59.91	98.22
1990 - 2000	105.26	85.71	61.93	98.93
2000 - 2010	106.21	86.61	62.65	99.70
2010 - 2020	106.21	86.66	62.71	99.51
2020 - 2030	105.67	86.22	62.34	98.80
2030 - 2040	104.96	85.55	61.74	97.96
2040 - 2050	104.28	84.88	61.09	97.18

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 7a. Projected average annual timber supplies–Forest Industries, Southern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	14.17	11.60	9.03	7.06	7.06
1980 - 1990	15.64	12.94	10.20	9.27	7.89
1990 - 2000	16.27	13.53	10.75	9.47	8.25
2000 - 2010	16.59	13.85	11.04	9.67	8.44
2010 - 2020	16.72	14.01	11.21	9.75	8.54
2020 - 2030	16.74	14.06	11.29	9.76	8.57
2030 - 2040	16.71	14.06	11.31	9.74	8.57
2040 - 2050	16.65	14.03	11.30	9.71	8.55

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 7b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Forest Industries, Southern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	83.80	68.60	53.40	68.60
1980 - 1990	92.49	76.52	60.32	87.97
1990 - 2000	96.22	80.01	63.57	91.90
2000 - 2010	98.11	81.90	65.29	93.85
2010 - 2020	98.88	82.85	66.29	94.62
2020 - 2030	98.99	83.15	66.77	94.74
2030 - 2040	98.82	83.15	66.88	94.50
2040 - 2050	98.46	82.97	66.82	94.20

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 8a. Projected average annual timber supplies–Other Private, Southern Idaho.

Year	Timber Supply Projection				
	1a	1b	1c	2d	2b
	(Million Net Cubic Feet/Year)				
1975 - 1980	20.16	16.07	11.98	3.68	3.68
1980 - 1990	20.89	16.67	12.41	4.40	3.82
1990 - 2000	21.06	16.79	12.46	4.43	3.84
2000 - 2010	21.03	16.73	12.37	4.41	3.83
2010 - 2020	20.87	16.59	12.21	4.36	3.80
2020 - 2030	20.64	16.41	12.03	4.30	3.76
2030 - 2040	20.41	16.21	11.85	4.25	3.71
2040 - 2050	20.21	16.03	11.70	4.21	3.67

Note: Detailed definitions of the timber supply projections are described under Types of Timber Supply Projections.

1a Annual removals equaling 1975 annual gross volume growth–100 percent Utilization Intensity.
1b Annual removals equaling 1975 annual net volume growth–100 percent Utilization Intensity.
1c Annual removals equaling a modified annual net volume growth–100 percent Utilization Intensity. Modified annual net volume growth is computed using growth alternative c.
2d Annual removals equaling a modified annual net volume growth–1975 Utilization Intensity. Modified annual net volume growth is computed using growth alternative d.
2b Annual removals equaling 1975 annual net volume growth–1975 Utilization Intensity.

Appendix Table 8b. Projected average annual per acre growth rates obtained from alternative growth and mortality assumptions–Other Private, Southern Idaho.

Year	Growth Alternative			
	a	b	c	d
	(Net Cubic Feet/Acre/Year)			
1975 - 1980	75.93	60.53	45.12	60.53
1980 - 1990	78.68	62.81	46.74	72.39
1990 - 2000	79.32	63.24	46.93	72.81
2000 - 2010	79.21	63.01	46.59	72.50
2010 - 2020	78.61	62.49	45.99	71.71
2020 - 2030	77.74	61.81	45.31	70.81
2030 - 2040	76.87	61.05	44.63	69.91
2040 - 2050	76.12	60.38	44.07	69.19

Note: Detailed definitions of projected per acre growth are described under Types of Timber Supply Projections.

a 1975 annual gross volume per acre growth.
b 1975 annual net volume per acre growth.
c A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative c.
d A modified annual net volume per acre growth. Modified annual net volume per acre growth is computed using growth alternative d.

Appendix Table 9. Projected average annual timber supply by ownership group based on timber supply projection 2b–Northern Idaho.

Year	National Forest	Other Public	Forest Industries	Other Private
	(Million Net Cubic Feet/Year)			
1975-1980	106.57	25.37	38.37	38.58
1980-1990	119.00	27.97	45.35	41.15
1990-2000	127.32	29.62	50.60	41.73
2000-2010	132.68	30.71	53.90	41.33
2010-2020	135.85	31.50	55.75	40.66
2020-2030	137.42	32.07	56.47	40.04
2030-2040	137.77	32.45	56.54	39.58
2040-2050	137.89	32.68	56.36	39.31

Appendix Table 10. Projected average annual timber supply by ownership group based on timber supply projection 2b–Southern Idaho.

Year	National Forest	Other Public	Forest Industries	Other Private
	(Million Net Cubic Feet/Year)			
1975-1980	67.53	5.43	7.06	3.68
1980-1990	74.92	5.80	7.89	3.82
1990-2000	81.00	5.88	8.25	3.84
2000-2010	85.65	5.88	8.44	3.83
2010-2020	88.86	5.85	8.54	3.80
2020-2030	90.85	5.79	8.57	3.76
2030-2040	92.00	5.72	8.57	3.71
2040-2050	92.50	5.66	8.55	3.67

Appendix Table 11. Projected number of trees per acre by diameter class using timber supply projection 2b–National Forest, Northern Idaho.

Diameter	Year 1975	Year 2045
2	156.7109	156.7108
4	86.2595	95.1457
6	47.3903	68.6102
8	31.1113	50.8752
10	21.4990	35.8101
12	13.9771	24.0667
14	9.2323	14.3050
16	6.2256	8.5732
18	4.3627	4.3321
20	3.0006	1.6413
22	2.1544	0.4553
24	1.4631	0.1112
26	0.9828	0.0218
28	0.6735	0.0046
30 +	1.1864	0.0000
Total	386.2295	460.6632

Appendix Table 12. Projected basal area per acre by diameter class using timber supply projection 2b–National Forest, Northern Idaho.

Diameter	Year 1975	Year 2045
2	3.4189	3.4189
4	7.5276	8.3034
6	9.3050	13.4715
8	10.8594	17.7570
10	11.7264	19.5313
12	10.9799	18.9045
14	9.8670	15.2976
16	8.6987	11.9660
18	7.7047	7.6517
20	6.5450	3.5779
22	5.6756	1.2011
24	4.5961	0.3493
26	3.6236	0.0804
28	2.8799	0.0197
30+	5.8237	0.0000
Total	109.2315	121.5302

ABSTRACT

Timber Supply Projections for the State of Idaho
Charles R. Hatch, Gerald M. Allen, Geoffrey L. Houck and Kenneth M. Sowles
University of Idaho Forest, Wildlife and Range Experiment Station
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Net cubic foot volume timber supply projections for the state of Idaho are given for the period 1975 to 2045. The timber supplies are projected for a given set of yield assumptions and utilization intensities. These projections are presented separately for northern and southern Idaho by each of four ownership groups: National Forest, Other Public, Forest Industries, and Other Private. Included in the paper is a discussion of the model used, data base used, assumptions, projection development and results and implications.

ABSTRACT

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ABSTRACT

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