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Timber Harvest Levels for National Forests: How Good Are They?
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Increasing concerns have been expressed by the Congress, the timber industry, environmentalists, and timber-dependent communities about the amount of timber being harvested from national forests. Some believe that the Forest Service should increase its level of cutting timber in order to reduce losses, increase supplies, and reduce unemployment. Others believe that timber cutting should be reduced in order to reduce the decline in recreational resources, reduce soil disturbances, and assure future timber supplies.

Findings/Conclusions: While the Forest Service recognized these concerns in developing its new timber management plans, it has not developed the plans with the uniformity and precision needed for assuring sustained timber harvests and coordinating them with other forest resource uses. Statistical reliability criteria were established for estimating national forest timber inventories but not for specific timber classifications used to determine allowable harvest levels. Uncertainties in determining harvest levels resulted from sampling errors, difficulties in determining statistical reliability of estimates, failure to identify areas requiring certain management practices, and questionable management assumptions and procedures used to determine harvest levels. All timber management practices that were being used or could be used to sustain harvest levels and achieve higher levels were not given adequate consideration in timber management planning. Conflicts between timber uses and other forest resource uses occurred in implementing some plans. Basing timber sales and management decisions on harvest levels that are uncertain could lead to overcutting or undercutting which could influence lumber supplies and prices.

Recommendations: The Forest Service should: evaluate timber inventory methods and modify inventory procedures for national

forests to assure that data developed are reasonably reliable for determining harvest levels, managing resources, and identifying areas that need specified measures; establish reliability criteria; establish validity of management assumptions and options; seek congressional guidance on whether future management practices should justify current harvest increases; assure that forest management officials maintain adequate records of progress; assure that all timber management practices are adequately considered; and take actions to minimize conflicts of interest between timber harvests and other forest resource uses. The Congress should provide guidance and direction to help the Forest Service resolve unsettled issues.

(HTW)

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL
OF THE UNITED STATES



Timber Harvest Levels For National Forests-- How Good Are They?

Timber harvest levels, developed by the Department of Agriculture's Forest Service for national forests, are of concern to timber-dependent communities, environmentalists, the timber industry, and the Congress. Some want timber harvest levels increased; some want them reduced.

Forest Service timber management plans GAO reviewed had not been developed with enough uniformity and precision to assure that harvest levels set forth in the plans are reliable goals and constraints to sustain timber cutting in coordination with other forest resource uses. Basing timber sales and management decisions on harvest levels that are too uncertain could lead to overcutting or undercutting. The Forest Service needs congressional guidance and direction on these issues.

In implementing timber management plans there also is a need to reduce conflicts between timber and other resource uses, such as wildlife and scenic beauty.



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-125053

To the President of the Senate and the
Speaker of the House of Representatives

This report discusses problems and shortcomings in the processes used by the Forest Service, Department of Agriculture, to establish timber harvest levels for national forests.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

Copies of this report are being sent to the Acting Director, Office of Management and Budget, and to the Secretary of Agriculture.

A handwritten signature in black ink, reading "Luther B. Starks".

Comptroller General
of the United States

D I G E S T

In recent years, the Congress, the timber industry, environmentalists, and timber-dependent communities have been increasingly concerned about the amount of timber that is being harvested from national forests and whether these harvests are compatible with other forest resource uses.

The Congress should provide guidance and direction to help the Department of Agriculture's Forest Service resolve some unsettled issues discussed in this report on the planning for timber harvests in the national forests, particularly issues related to the

--degree of reliability needed in establishing timber harvest levels,

--extent to which timber management assumptions should be documented and displayed in timber plans, and

--proper way to handle growth increment from future-decade timber management practices in determining harvest levels. (See p. 27.)

There are two conflicting points of view: Some believe that the Forest Service should increase its rate (level) of cutting timber. Others believe that timber cutting should be reduced. The arguments for each are as follows.

Arguments for
increased
timber-cutting levels

- To reduce losses in timber resources due to declining growth rates.
- To increase the lumber supply and reduce lumber costs.
- To reduce unemployment in the timber and related industries.

Arguments for
decreased
timber-cutting levels

- To reduce a decline in outdoor recreation, fish and wildlife, and other forest resources.
- To reduce soil disturbances that cause erosion and add to water pollution.
- To assure future timber supply by not cutting timber in excess of its natural growth and not cutting immature trees.

The Forest Service recognized these concerns in developing its new timber management plans. However, the Service has not developed the plans with the uniformity and precision needed to make sure that harvest levels set forth in the plans are accurate and reliable targets and constraints for sustaining timber harvests and for coordinating timber harvests with other forest resource uses. Harvest levels were determined from a variety of data uses and assumptions that sometimes were questionable or applied inconsistently, which produced results and management options that were not fully reliable.

Easing timber sales and management decisions on harvest levels that are too uncertain could lead to overcutting or undercutting national forest timber. In turn, this could influence lumber supplies and prices.

The Forest Service established a nationwide harvest level target (potential yield) of 16.2 billion board feet for fiscal year 1976 and sold about 10.3 billion board feet of timber that year. The volume sold in the Pacific Northwest (4.8 billion board feet) closely approximated the harvest level targeted for that region, which is by far the largest Federal timber-producing area in the Nation.

GAO's review pointed up a number of problems and shortcomings in the processes used by the Forest Service to determine timber harvest levels. The review covered forests in the Pacific Northwest, Rocky Mountains, and California.

UNCERTAINTIES NEED TO BE REDUCED

Although the Forest Service has established statistical reliability criteria for estimating national forest timber inventories, such criteria has not been established for the specific timber classifications that are used to determine allowable harvest levels. Sampling errors for two forests were high enough to cast considerable doubt on the reliability of the harvest levels established for those forests. Their harvest levels could therefore be too high or too low in relation to what their potential timber yield should be.

The Forest Service could not determine the statistical reliability of the timber volume estimates used to establish harvest levels for three of the other four forests GAO reviewed. (See pp. 5 to 12.)

Harvest levels were based on the assumption that certain management practices designed to promote growth would be carried out. However, all areas needing such treatments were not identified. The Service therefore cannot be sure that harvest levels can be sustained or increased over time without impairing the timber supply and impinging on other forest resource uses. (See pp. 5 to 12.)

Some management assumptions and procedures used to determine harvest levels were questionable and had not been evaluated to determine whether they were reasonable and sound based on past field accomplishments and research studies. For example, Service personnel assumed that some forests would be reforested within 5 years of a timber sale though field experience indicated that it took much longer. Using such assumptions casts doubt on the reliability of the harvest levels. (See pp. 12 to 22.)

Forest Service personnel at one forest were beginning to reclassify some areas that were included in the land base used to determine timber

harvest levels. They now expect less timber than initially anticipated from these and other areas, and may have to lower future decade harvest levels. (See pp. 22 to 24.)

ALL MANAGEMENT PRACTICES NEED TO BE SYSTEMATICALLY CONSIDERED

All timber management practices that were being used or could be used to sustain harvest levels and achieve even higher levels were not given adequate consideration in timber management planning. (See pp. 29 to 35.)

For example,

- Some practices (such as clearcutting timber and reforesting cutover areas) were being carried out at different intensities than planned for some forests. (See p. 29.)
- Some practices (such as planting seedlings with superior growth characteristics and thinning crowded young timber areas) were being carried out at some forests but were not included in timber management plans; their effects on timber growth and harvest levels had not been determined; and their progress had not been adequately recorded. (See p. 31.)
- Some practices that were potentially applicable to forests (such as fertilizing young timber areas and eliminating undesirable trees) were left out of management plans and were not considered as a way to increase harvest levels. (See p. 31.)

CONFLICTS WITH OTHER FOREST RESOURCE USES NEED TO BE REDUCED

Conflicts between timber uses and other forest resource uses (such as maintaining scenic beauty and wildlife habitat) occurred in implementing some timber management plans. The plans did not identify the specific areas to be managed primarily for the various forest resource uses and did not specify the timber harvest constraints to be imposed in each area. In some cases timber sales plans indicated that proposed timber harvests would conflict with scenic beauty and

other resource-use objectives, but the sales were approved without giving sufficient consideration to ways to minimize harvest effects on other forest resource uses. (See pp. 36 to 42.)

RECOMMENDATIONS TO THE
SECRETARY OF AGRICULTURE

GAO recommends that the Forest Service:

- Evaluate timber inventory methods used by public and private timber managers and modify inventory procedures for national forests, as necessary, to assure that the data developed is reasonably reliable and useful for determining appropriate harvest levels, managing timber resources, and identifying areas that need specified treatment measures to sustain or increase harvest levels.
- Establish and enforce reliability criteria for the timber volume estimates used in determining timber harvest levels.
- Require that forest areas that are to receive each type of management treatment be identified and included as part of approved timber management plans.
- Establish the validity and reasonableness of management assumptions and options before using them to calculate timber harvest levels.
- Seek congressional guidance on whether, and to what extent, timber growth from management practices planned in future decades should be used to justify increases in harvest levels and timber sales in the current decade.
- Assure that forest management officials maintain adequate records of the progress made and the accomplishments achieved in carrying out all timber management practices, and that they consider the effects on timber growth and harvest levels when practices are performed differently than planned.
- Assure that all timber management practices that are used or could be used are adequately

considered in planning timber management and establishing harvest levels.

These and other recommendations to help the Forest Service assure that timber harvest levels constitute reliable and sustainable targets are discussed on pages 24 and 34. Recommendations to help minimize conflicts between timber harvests and other forest resource uses are discussed on page 41.

AGENCY COMMENTS

The Forest Service agreed in general with GAO's recommendations. It said that it was concerned about the need to reduce risks and uncertainties in determining timber harvest levels and to have more uniformity in management planning. The Service also cited several actions it is taking to address these concerns. GAO's views on the Service's comments are discussed on pages 25, 35, and 42.

The Service disagreed with GAO's conclusion that large statistical sampling errors associated with the calculations of the timber harvest levels for two forests cast considerable doubt on the reliability of the established levels. GAO's views on this disagreement are discussed on page 10.

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CHAPTER 1

INTRODUCTION

The Multiple Use-Sustained Yield Act of 1960 (16 U.S.C. 528-531) gave the Forest Service responsibility to administer the national forests for outdoor recreation, range, timber, watershed, and fish and wildlife purposes. The act also required the Forest Service to achieve and sustain a perpetual high-level output of the various forest resources, in a harmonious and coordinated manner, without impairing the productivity of the land.

Public and congressional concern over use of national forests led to passage of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1601-1610) and the National Forest Management Act of 1976 (Public Law 94-588, 90 Stat. II 2949-2963). The 1976 act sets forth modern standards for managing national forests and builds on the congressional guidance and direction provided in the 1960 and 1974 acts, taking account of the concerns for protecting the environment and national needs for a continuous timber supply. The act also incorporated into law a number of specific directions that had previously been left to the administrative discretion of the Forest Service, such as the policy to manage national forests, to the extent possible, under the nondeclining even-flow sustained-yield concept.

In authorizing this legislation, the Congress expressed its deep concern that proper planning for and management of the nation's forests be of high importance in assuring that a natural resource conservation posture is maintained that will meet the requirements of present and future populations.

Planning for timber management is one of the Forest Service's most complex and sensitive missions. Controversy surrounds technical procedures for determining harvest levels, timber management practices, and future yields, and for implementing congressional policy on managing Forest Service lands. Timber management planning continues to be a changing process.

The Forest Service revised its timber management planning instructions in 1972 and 1973 to better assure that the timber harvest is established at a high level that can be sustained over time and will not interfere with other forest resource uses. As of December 1975 timber harvest levels for 20 of the 155 national forests had been redetermined in new timber management plans prepared under revised instructions and approved by the Forest Service. Revised plans and harvest levels were being developed for 45 more national

forests and were scheduled to be developed for the remaining 90 forests by 1983.

The Forest Service established a nationwide harvest level target (potential yield) of 15.9 billion board feet for fiscal year 1975 and sold 10.8 billion board feet of timber that year. The harvest level target for fiscal year 1976 was set at 16.2 billion board feet; about 10.3 billion board feet of timber was sold that year. These targets represent the maximum sustained-yield cutting levels attainable in those years with intensive forest management. The volume of timber sold in the Pacific Northwest closely approximated the harvest level targeted for that region, but sales volumes in other regions were generally much lower than harvest level targets, as shown below.

<u>Region</u>	<u>Fiscal year 1975</u>		<u>Fiscal year 1976</u>	
	<u>Harvest level target</u>	<u>Volume of timber sold</u>	<u>Harvest level target</u>	<u>Volume of timber sold</u>
	----- (billion board feet) -----			
Pacific Northwest	4.813	4.902	4.767	4.843
California	2.099	1.914	2.249	1.889
Rocky Mountain	1.297	.356	1.108	.351
Other regions combined	<u>7.645</u>	<u>3.652</u>	<u>8.046</u>	<u>3.204</u>
Total	<u>15.854</u>	<u>10.824</u>	<u>16.170</u>	<u>10.287</u>

SCOPE OF REVIEW

This review was made to identify issues and problems the Forest Service has encountered in developing timber harvest levels under the new timber management plans. We focused on how timber harvest levels were derived for the Deschutes and Gifford Pinchot National Forests in the Pacific Northwest region--two of the earliest forests for which management plans and harvest levels were developed using present-day concepts, methodology, and computerized linear programming projection models. We did some spot checking in four other national forests to determine whether some of the problems and concerns at the Deschutes and Gifford Pinchot also applied elsewhere. These forests included the Arapaho and Big Horn National Forests in the Rocky Mountain region and the Stanislaus National Forest in California, which also had new timber management plans, and the Siuslaw National Forest

in the Pacific Northwest region, which had a new plan under development.

The practices followed in preparing and implementing the plans for these forests were discussed with responsible officials at Forest Service headquarters, regional offices, forest supervisor offices, and district offices. We also talked with other Federal and State timber managers and representatives of timber companies, timber industry associations, and environmental organizations.

CHAPTER 2

SUMMARY OF CONCLUSIONS

In recent years, the Congress and the public have been increasingly concerned over how much timber is being harvested from national forests and whether such harvests are compatible with other forest resource uses. In administrative appeals and court litigation, some segments of the public have contended that cutting levels established by the Forest Service should be increased to reduce (1) timber resource losses resulting from declining growth rates, (2) lumber cost, and (3) unemployment in the timber industry and other industries using timber products (such as construction). Other groups have argued that cutting levels should be reduced to minimize (1) cutting immature trees, (2) soil disturbances that contribute to water pollution, (3) a decline of outdoor recreation, fish and wildlife, and other forest resources, and (4) cutting timber above the rate at which it is growing--which could impair future timber supply.

While the Forest Service recognizes these concerns, its new timber management plans have not been developed with the uniformity and precision needed to assure that harvest levels set forth in the plans are accurate and reliable targets and constraints for sustaining timber harvests, and that timber harvests are coordinated with other forest resource uses. Harvest levels were determined from many data uses and assumptions that were sometimes questionable or inconsistently applied, and produced results and management options that were not fully reliable.

Basing timber sales and management decisions on harvest levels with this degree of uncertainty could lead to over-cutting or undercutting national forest timber. In turn, this could influence lumber supplies and prices. The problem areas discussed in the following chapters significantly affect allowable harvest levels and point up the need for the Service to

- reduce uncertainties in determining sustainable timber harvest levels,
- assure that the management activities needed to sustain and increase the timber harvest level are recognized and systematically considered in developing and implementing timber management plans, and
- reduce conflicts between timber harvesting and other forest resource uses.

CHAPTER 3

UNCERTAINTIES IN TIMBER HARVEST LEVEL

DETERMINATIONS NEED TO BE REDUCED

Good timber inventory data is crucial to developing harvest levels that are sufficiently reliable and useful to properly manage national forest timber resources. Because of large statistical sampling errors in estimating timber resources at the Deschutes and Gifford Pinchot, the harvest levels established for those forests for the decade covered by their new timber management plans could be too high or too low in relation to what their potential timber yield should be. Forest Service personnel said that they could not determine the statistical reliability of the timber volume estimates used to establish harvest levels for three of the other four forests reviewed.

The Forest Service based its harvest levels on the assumption that certain management practices designed to promote timber growth would be carried out. However, the Forest Service had not identified all forests locations where these practices should be carried out.

Some management assumptions and procedures used to determine allowable harvest levels were questionable and had not been evaluated to determine whether they were reasonable and sound based on past experience and accomplishments, studies, or other sources. Using such assumptions casts doubt on the reliability of the harvest levels.

Foresters that made on-the-ground examinations of areas of the Stanislaus found that, because of land misclassification, some areas could not be harvested as expected. They said that they expected to harvest less timber than initially anticipated from these and other areas and may have to lower future decade harvest levels.

Because of these problems, there is uncertainty whether established harvest levels can be sustained over time without impairing the timber supply and impinging on other forest resource uses.

HOW HARVEST LEVELS ARE DETERMINED

The Forest Service first determines a base timber harvest level (starting point) by inventorying a forest's existing timber resources using statistical sampling methods, and then estimating future growth that will occur with no additional management efforts to increase the growth rate. This

base level is then increased by the amount of additional harvest which is expected to be gained from applying specific management practices (treatments) to increase growth (such as thinning crowded trees, planting seedlings with superior growth characteristics, and interplanting areas that have insufficient numbers of trees). Applying management practices is largely dependent on future funding.

To inventory the timber resources of the Deschutes and Gifford Pinchot National Forests, foresters examined every tree in systematically selected 1-acre plots. The predominant tree species, the rate of growth, and various other data were recorded in each sample plot. The plots were classified into separate groups based on their indicated treatment needs, including harvesting. Timber quantity and acres of each treatment group within the sample were used to estimate each forest's total existing timber.

Growth expected for harvest within each treatment group was estimated for the next 300 years, and base timber harvest levels for each decade of the 300-year period were computed.

The Forest Service projected the base timber harvest level for the decade ending 1984 for the Deschutes at 1,609 million board feet. The harvest level for the previous decade was set at 1,380 million board feet. The Deschutes 1975-1984 harvest level was increased to 1,914 million board feet because of increased timber growth expected to be realized from thinning crowded trees. The Forest Service estimated that thinning could be performed with existing funding levels.

The base timber harvest level for the 1975-1984 decade for the Gifford Pinchot was projected to be 2,851 million board feet. The harvest level for the previous decade was set at 4,100 million board feet. The Gifford Pinchot 1975-1984 harvest level was increased to 4,042 million board feet because increased growth was expected from performing four management practices. The Forest Service assumed that an additional \$5.3 million over existing funding levels would be needed and provided over the decade for these practices.

The following table summarizes the timber levels established for the Deschutes and Gifford Pinchot forests for the decade ending 1984.

	<u>Acres planned for management</u>	<u>Timber harvest level (million board feet)</u>
Deschutes:		
Base harvest level		
Ponderosa pine areas		1,301
Lodgepole pine areas		280
Mountain hemlock areas		28
Total		<u>1,609</u>
Increase for planned manage- ment practices:		
Thinning crowded young ponderosa pine areas	52,600	305
Timber harvest level		<u>1,914</u>
Gifford Pinchot:		
Base harvest level		2,851
Increase for planned manage- ment practices:		
Thinning crowded young timber areas	35,734	418
Interplanting areas having insufficient trees	29,301	342
Planting areas un- stocked for over 5 years	21,628	335
Planting seedlings with superior growth characteristics	40,000	96
Timber harvest level		<u>4,042</u>

STATISTICAL RELIABILITY OF TIMBER INVENTORY
ESTIMATES USED TO DETERMINE ALLOWABLE
HARVEST LEVELS NOT ESTABLISHED

Although the Forest Service has established statistical reliability criteria for estimating national forest timber inventories, such criteria has not been established for the specific timber classifications that are used to determine allowable harvest levels. We found that the sampling errors for the Gifford Pinchot and Deschutes Forests were high enough to cast considerable doubt on the reliability of their established harvest levels. Such sampling errors represent the extent that a sample estimate could differ from the actual or "true" amount of timber that exists in a national forest.

Timber inventories for the six forests reviewed were estimated on the basis of a statistical sample of commercial forest-land plots, as shown below:

<u>Forest</u>	<u>Number of acres inventoried</u>	<u>Number of plots examined</u>	<u>Size of plots</u>
Gifford Pinchot	1,086,822	570	1 acre
Deschutes	789,385	437	1 acre
Siuslaw	579,730	571	1 acre
Big Horn	540,794	360	1 acre
Arapaho	465,300	185	1 acre
Stanislaus	275,332	132	.4 acre

In estimating the timber inventories of national forests in the West the Forest Service requires that sampling errors be kept to 10 percent or less of the total existing timber volume. This criteria is based on a 67-percent confidence level, which in this case means that there are two chances out of three that the sample estimate would be within 10 percent of the total amount of timber that would be on a national forest if all trees in the forest were measured for volume. While the total volume estimates for existing timber inventories in the six forests reviewed fell within this tolerance, timber harvest levels for the forests were not determined on the basis of these total volume estimates. Instead, the Forest Service classified sample plots into separate groups based on their treatment needs (such as harvesting or thinning). To estimate total acres and volume of timber needing treatment, the Service determined what percent of sample plots required each treatment and applied these percentages to all the acres of commercial forest land.

Estimates developed from such groupings--each grouping having different characteristics and providing significantly different timber volumes--bore no relationship to the 10-percent sampling error tolerance established for total timber volume. The Forest Service had not established statistical reliability criteria for the volume estimates resulting from the grouping procedures (timber classifications) used in the six forests, and had not determined the estimates' statistical reliability. We calculated the statistical reliability of the estimates for the Gifford Pinchot and Deschutes Forests and discussed our calculations with Service officials who generally agreed with them. Our calculations showed that the sampling errors were rather high.

For example, 51 percent of the Gifford Pinchot inventory plots were included in a treatment group classified as needing harvest, and a harvest of 47,510 board feet of timber an acre was estimated for this group. The Service applied the sample results to the whole forest and estimated that 51 percent of the commercial forest land would produce 26,542 million board feet, of which 2,507 million board feet could be sold during the decade ending in 1984. The timber volume estimates that were used to compute the 2,507-million-board-foot harvest estimate had a 27-percent sampling error at the 67-percent confidence level.

Sampling errors for individual treatment groups (such as in the above example) for the Gifford Pinchot ranged from 27 to 46 percent, and was 28 percent for all groups combined for the entire forest. The following table shows base timber harvest levels and sampling errors for the timber volume estimates that were used to compute these levels for three of the six forests reviewed.

<u>Forest</u>	<u>Base harvest level (million board feet)</u>	<u>Sampling error as per- cent of timber volume for treatment groups</u>	
		<u>Range</u>	<u>Combined</u>
Gifford Pinchot	2,851	27-46	28
Deschutes	1,301	42-57	53
Siuslaw	<u>a/</u>	4-11	6

a/At the time of our review, the timber management plan for the Siuslaw Forest was being developed and the timber harvest level had not been determined.

High sampling errors occurred primarily because of the relatively small number of plots in treatment group classifications and because of the large amount of variability in the characteristics of the plots within different treatment groups. Sampling errors for the Siuslaw were lower than the other two forests because the ratio of the number of plots examined to forest size was much higher, and forest locations represented by each treatment grouping were identified and mapped. This was a Service effort to make the Siuslaw's inventory estimates more reliable.

The Service could not compute the statistical reliability of timber estimates used to determine allowable harvest levels for the Stanislaus, Arapaho, and Big Horn Forests because judgments in using the sample plot data were made to estimate timber growth and volume per acre by treatment group

needs, rather than using only a statistical basis for the estimates.

The magnitude of Service sampling errors by treatment group for the Gifford Pinchot and Deschutes Forests and their potential effect on harvest level computations make the established harvest levels questionable. These levels may be too low and thereby unnecessarily limit available timber supplies and related employment, or they may be too high and thereby impair timber supply and impinge on other forest resource uses.

The Service does not believe that the statistical sampling errors associated with the timber harvest level calculations for the Deschutes and Gifford Pinchot National Forests are high enough to cast considerable doubt on the reliability of the harvest levels established for those forests. The Service emphasized that the sampling error percentages did not necessarily infer that the estimates were off by that much.

We recognize that the sampling errors represent the maximum limits of the estimates' statistical reliability. The large sampling error percentages discussed here are to demonstrate that the Service needs to develop more reliable inventory data for determining timber harvest levels. The errors indicate a strong possibility that the harvest levels established for the Deschutes and Gifford Pinchot National Forests could greatly overstate or understate what the potential yield should be from those forests.

The Service said that checks and balances have been set up to monitor actual against projected performance in carrying out timber management activities. These controls are to provide the Service information it needs to adjust timber harvest levels, if necessary. The Service also emphasized that timber resources in national forests are scheduled to be reinventoried every 10 years, which provides an additional mechanism for recalculating harvest levels when necessary.

We agree that these control safeguards are needed and should be used to recalculate harvest levels and correct timber management problems. Our review showed, however, that forest managers did not always maintain adequate and timely records to compare the progress made in accomplishing all timber management practices. (See p. 32.) Also, errors and uncertainties in current or recently recalculated harvest levels should not be viewed as acceptable or tolerable on the basis that another recalculation will be made in another 10 years, or perhaps sooner. Similar types of errors and uncertainties may still be unresolved in the recalculations.

Considerable time, effort, and resources go into determining new harvest levels in conjunction with developing new timber management plans. Wherever it can reasonably be done, doubts about the reliability of established harvest levels should be eliminated at the very outset. If the reliability of established harvest levels is desired but not that important, perhaps the extensive Service input into recalculating harvest levels should be reconsidered, and harvest operations should be based on less refined estimates.

The Forest Service did not know the location of all the acres needing various specific treatments in most national forests. Some public and private timber managers operating elsewhere in Oregon and Washington said that they knew where the acres making up each of their treatment groups were. They stated that this information had been obtained over the years from aerial land photographs and from on-the-ground examinations while taking inventories and carrying out daily administrative operations. We were told that this information is available in a form that enables them to precisely determine and locate the timber output for each treatment group.

We recognize that private timber managers differ from the Service by farming their land to maximize timber growth that can be harvested without having to be concerned with other land uses. In the Northwest, private managers also generally have less land and better land to work with than the Service. However, we believe that the Service could benefit by evaluating the inventory methods used by private timber managers for possible application to the national forests.

If the Forest Service is going to make projections on the basis of treatment groups, a more statistically valid basis could be obtained by stratifying the universe; that is, by determining and mapping the general locations of those acres needing each treatment (harvesting, thinning, planting, etc.), by selecting samples from those locations (by treatment group), and by making projections from those samples to the total acres needing such treatment.

Pacific Northwest Service officials said that they have begun using this type of approach. They also have recently adopted regional goals that sampling errors should not exceed 10 percent of the timber volume estimates used to compute harvest levels at the 67-percent confidence level, and that the locations of the timber classes should be mapped. The officials said that this was done to increase the reliability of the timber volume estimates used in the calculations. The Siuslaw's new timber management plan, which is still under

development, is the first plan in the Pacific Northwest region to be initiated under these goals.

QUESTIONABLE PROCEDURES AND ASSUMPTIONS
USED TO DETERMINE TIMBER HARVEST LEVELS

The Forest Service used certain procedures and made certain assumptions in determining timber harvest levels that are questionable and cast doubt on the soundness of the determinations. In some cases Service personnel used various combinations and adjustments of forest inventory data that could cause timber volumes for certain species to be overstated or understated. In other cases, Service personnel assumed that

- forest land would be reforested within 5 years of a timber sale although field experience indicated that this took much longer,
- certain additional growth could be obtained from various management practices although available research showed growth rates much different from those assumed,
- additional growth expected from performing certain management practices in future decades could be considered in estimating the increase in growth and harvest levels from performing the same kinds of practices during the current decade, and
- harvest levels should be computed based on the board-foot unit of measure although Forest Service instructions require that the cubic-foot method be used.

In a March 15, 1973, report to the Chief of the Forest Service, we stated that timber management assumptions used in determining timber harvest levels should be compared with field experience. We pointed out that such comparisons would assist field offices in evaluating the assumptions' soundness and provide a better basis for timber harvest level determinations.

The Service issued timber management planning instructions that required comparing timber management assumptions with past accomplishments. Although these instructions provided for comparing forest inventory and treatment group objectives with field accomplishments, they did not require that other assumptions used in determining timber harvest levels be compared with information available from field experience, research studies, and other sources.

Some questionable procedures and assumptions used by the Forest Service in determining timber harvest levels are discussed below.

Using timber inventory data from unregulated forest lands

The Service requires that harvest levels be computed based on regulated commercial forest land--land that can be planned and controlled for sustained yield of timber products. Generally, regulated commercial forest land excludes lands recommended by the Service for possible addition to the National Wilderness System, as well as experimental forests, recreation areas, and other areas.

Some inventory sample plots used to compute the base harvest level on the Gifford Pinchot were located on acreage that was not classified as regulated commercial forest land. Though an adjustment was later made to eliminate the harvest on unregulated lands, the computation produced a different result from what would have been obtained had the harvest level initially been computed based only on sample plots on regulated lands. The timber management plan stated that the adjustment was based on a proration of regulated and unregulated areas. A summary of the base harvest level computation for the Gifford Pinchot is shown below.

	<u>Total acres</u>	<u>Sample plots</u>	<u>Timber harvest level</u> (million board feet)
Basis for harvest level computation	1,086,822	570	3,058
Less: Unregulated lands	<u>94,200</u>	<u>44</u>	207
Regulated commercial land	<u>992,622</u>	<u>526</u>	-----
Adjusted base timber harvest level			<u>2,851</u>

The Service employee who made the computations said he assumed that a reasonable harvest level for the Gifford Pinchot could be determined by including unregulated lands in computing the base harvest level and by subsequently reducing the harvest level in proportion to these lands.

However, our computations showed the reasonableness of this assumption to be questionable.

We computed the base timber harvest level for the Gifford Pinchot based on the 992,622 acres of regulated commercial forest land, and the corresponding 526 sample plots, to eliminate the need for a subsequent reduction to exclude unregulated lands. The base timber harvest level under this computation method would have been 2,736 million board feet, 115 million less than the 2,851 million board feet established by the Service for the decade. The harvest level established by the Service was higher because the inventory plots on the 94,200 acres of unregulated commercial forest lands contained more mature timber and a greater volume per acre than most other forest timber areas.

Effects of combining inventory treatment group data

As previously explained, the inventory data obtained from plots on the Deschutes and Gifford Pinchot Forests was classified and projected according to different treatment groups, and the results were combined to determine overall timber harvest levels.

Service personnel who combined the data said that treatment groups had always been combined in timber harvest level determinations and they had not been instructed to separate each treatment group. They assumed that the combinations of treatment groups would produce reasonable harvest levels. However, our analysis showed that this assumption produced timber harvest levels for certain species that greatly differed from what they would have been had the groups not been combined.

For example, 81 of the 437 plots examined in the ponderosa pine timber areas of the Deschutes were identified to be mostly lodgepole pine, were classified as needing harvest treatment, and were estimated to have 8,623 board feet of timber per acre. The 81 plots were combined for computation with 257 plots of lodgepole pine, ponderosa pine, and other tree species, of which 161 were classified as needing harvest treatment and 96 as needing other treatments before harvest. A Service employee said he combined the plots because he believed they would all yield about the same amount of timber per acre when harvested.

Our analysis showed that combining the plots almost doubled the estimated timber volume per acre on the 81 lodgepole pine plots--increasing 8,623 board feet to 16,324 board feet. This adjustment increased the lodgepole pine timber

harvest level in these areas by 389 million board feet and decreased the ponderosa pine harvest level by 568 million board feet for the decade ending in 1984. Similar harvest level differences resulted from combining treatment groups on the Gifford Pinchot. The combining procedure had a relatively small net effect on the two forests' overall base harvest levels because of offsetting changes.

Service officials said that combining plots would not cause overcutting or undercutting various timber species because actual cutting would be done only after on-the-ground examinations of timber stands to give full recognition to each acre and stand. They said that harvest levels were broad goals that would be translated into action only after ground examinations were made.

Timber management plans are major planning tools that should provide a reliable basis for managing a forest's timber resources. While inaccuracies in harvest levels and estimating timber resources in different treatment groups can be compensated for through sale-by-sale ground examinations, this would not seem to give the Service the kind of long-range planning basis that better forest management seems to need.

Using a reforestation time factor that was not representative of actual field experiences

In determining timber harvest levels for the Deschutes and Gifford Pinchot, the Service assumed that it would take 5 years from completion of a timber sale to successfully reforest (plant new trees in) harvested areas. This assumption was based on Pacific Northwest Service guidelines that set a goal that no more than 5 years should elapse between completing a timber sale and successfully reforesting the sale area. Service personnel who computed harvest levels said they were instructed by their regional office to use the 5-year goal.

Using a factor of more than 5 years from the time of timber sale to successful reforestation (which is indicated by past experience) would decrease estimated timber growth and harvest levels on the Deschutes, Gifford Pinchot, and Stanislaus Forests.

According to a 1970 Service report on Pacific Northwest reforestation, the Service found that 5 years after completing a timber sale it had successfully reforested 56 percent of the harvested areas in the Deschutes and 92 percent of the Gifford Pinchot. The Service also found that after 20 years neither forest had successfully reforested all

harvested areas. The time periods shown in the report did not include the additional time taken to complete timber sales. It normally takes an additional 2 to 3 years from the time of sale to the time all the timber is harvested and the sale is completed on both forests.

A 5-year reforestation factor from the beginning of a sale was used to compute the timber harvest level for the Stanislaus National Forest, in line with the Service's regional reforestation goal for California forests. Stanislaus Forest personnel said that the 5-year goal was highly optimistic and was not realistic. District foresters and silviculturalists said that it normally takes 6 to 10 years from the beginning of a timber sale to the time harvested areas are successfully reforested. Three of the forest's four districts have had considerable problems in reforesting red fir areas and have taken as long as 20 years to successfully start new timber stands.

A reforestation time factor was not used to compute timber harvest levels for the Arapaho and Big Horn Forests. Using such a factor should decrease harvest levels. Service Rocky Mountain regional officials said that, while they did not have any studies, they believed it usually took 3 to 7 years to reforest spruce-fir and lodgepole pine--the primary species harvested in the two forests. Although they believed that a reforestation time lag of less than 10 years would not affect potential timber growth and yield, they were unable to provide support for this belief.

Service officials said that they are expanding their nursery capabilities in western regions and are carrying out a more aggressive and higher funded national reforestation program to work toward reforestation time goals.

Growth rates from some management practices not supported by research results

Service personnel made certain assumptions about increased growth rates that would result from carrying out various timber management activities. Two examples where available Service research showed rates that differed from those assumed are discussed below.

1. Service personnel estimated that thinning crowded young ponderosa pine timber in the Deschutes would increase the remaining trees growth rate by 64 board feet an acre a year. This estimate was based on the judgment and experience of the Service employee who made the estimate and was reviewed by Service researchers. No documentation of the basis for the estimate or of the results of the researchers' review existed.

We discussed this management practice with a Service researcher who studied the growth of young ponderosa pine in an experimental forest on the Deschutes, and who has published several studies on the results. He provided information indicating that thinning such crowded young timber on the Deschutes would increase the growth rate of the remaining trees by 42 board feet an acre a year. The use of a lower annual growth rate per acre from thinning crowded young ponderosa pine timber, as indicated by the researcher's work, would decrease the harvest level established for the Deschutes ponderosa pine timber areas.

2. Service personnel estimated that planting seedlings with superior growth characteristics on the Gifford Pinchot would increase growth by 26 board feet an acre a year during the first 50 years. The basis for this estimate was not documented and the Service employee who made it was unable to cite support. Service studies covering a 50-year period at the Gifford Pinchot showed that planting seedlings with superior growth rates would increase growth as much as 54 board feet an acre a year during the first 50 years. Using a higher growth rate for planting such seedlings, as indicated in the studies, would increase the harvest level established for the Gifford Pinchot.

Service officials said that their growth predictions are not always totally supported by research data. They pointed out, however, that they consider available research data as a guide when making their timber growth predictions for managed stands. They believe that growth predictions from research data and from monitoring timber management activities will improve as more young stands of timber are intensively managed and their growth response measured.

Effects of future-decade management practices considered in determining current-decade harvest levels

To determine the amount of additional harvest that could be obtained from performing specific timber management practices at the Deschutes, Gifford Pinchot, Big Horn, and Stanislaus Forests, Service officials considered not only the increased growth expected from accomplishing practices during the current decade, but also took some credit in the current decade for increased growth expected from performing practices in future decades. Including the estimated effects of anticipated future-decade accomplishments in harvest level computations overstated the increased growth that should result during the current decade. Two examples are discussed below.

Thinning crowded young trees in
the Deschutes National Forest

Forest Service officials calculated that the base timber harvest level for the Deschutes could be increased by 305 million board feet for the decade ended in 1984 by thinning crowded young ponderosa pine timber on 52,600 acres during the decade. (See table on p. 7.) Thinning was to be done for trees that had not matured to where they had commercial value. In computing the amount of increase, the officials considered forest inventory data that was obtained and projected from sample plots, opinions of Forest Service district personnel, and funding constraints, as shown below.

	<u>Acres that need to be thinned</u>	<u>Computed increase in harvest level</u>
		(million board feet)
Based on forest inventory data	173,967	560
Based on opinions of Service district personnel	96,600	560
Based on funding constraints (planned for accomplishment by 1984)	52,600	305

Projected forest inventory data indicated that 173,967 acres needed to be thinned during the current decade. Forest management officials calculated that thinning that many acres this decade and all acres that needed to be thinned during the next 29 decades would increase the growth and harvest level by 560 million board feet for the current decade.

However, the officials believed that the 173,967-acre estimate was much too high. Consequently, Service district officials were asked to estimate the number of acres that needed thinning in each district. Using district estimates, management officials concluded that only 96,600 acres of crowded young timber were available for thinning during the current decade. They assumed that thinning 96,600 acres would still cause a 560-million-board-foot increase in the growth and harvest level.

However, the officials estimated that the work could only be accomplished on 52,600 acres during the decade because of anticipated funding constraints and anticipated problems in using spraying techniques for brush control.

They assumed that the 560-million-board-foot increase in the harvest level for the current decade (which included the potential effects of thinning in future decades) could be used as a basis for projecting what the increase in harvest level would be from thinning only 52,600 acres. They did not separately determine the increase from thinning 52,600 acres.

With Service personnel assistance, we computed the additional growth that could be expected from thinning 52,600 acres during the current decade. We did not include any factors for estimating the effects of thinning in future decades. Our computation showed that the harvest level could be increased by 86 million board feet, instead of 305 million board feet, as shown in the Deschutes' timber management plan.

Thinning crowded young trees and interplanting areas on the Gifford Pinchot National Forest

Service officials calculated that the base timber harvest level for the Gifford Pinchot could be increased by 1,872 million board feet for the decade ended in 1984 by thinning 89,615 acres of crowded young timber during the decade and interplanting 70,548 acres having insufficient trees. The increase for the current decade included an allocated share of the estimated effects of performing thinning and interplanting on all acres needing such treatment in future decades. Expected funding constraints, however, caused officials to plan thinning on only 35,734 acres and interplanting on only 29,301 acres during the current decade.

Service officials assumed that the 1,872-million-board-foot estimate could be used as a basis for projecting the additional growth and harvest that could be expected from thinning and interplanting the smaller areas. The officials did not separately determine the increase in harvest level from thinning 35,734 acres and interplanting 29,301 acres during the current decade.

With Service personnel assistance, we computed the additional growth to be expected from thinning 35,734 acres and interplanting 29,301 acres in the current decade. We did not include any factors for allocating the estimated effects of future-decade thinning and interplanting to the current decade. A comparison of our analysis results with the harvest level increase in the Gifford Pinchot timber management plan is shown below.

	Acres planned for treatment-- <u>current decade</u>	Computed increase in <u>harvest level</u>
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(million board feet)

Thinning crowded young
timber areas:

Amount included in timber management plan	35,734	418
Our calculated amount	35,734	<u>208</u>
Difference		<u><u>210</u></u>

Interplanting areas having
insufficient trees:

Amount included in timber management plan	29,301	342
Our calculated amount	29,301	<u>170</u>
Difference		<u><u>172</u></u>

In the first year of the Gifford Pinchot's new timber management plan, 419 million board feet of timber was sold from the forest. This volume was 134 million board feet higher than the forest's annual base harvest level and 15 million board feet higher than the annual level was after the current-decade harvest level had been increased to reflect a timber growth increase from performing thinning and interplanting not only during this decade but also in future decades. Service officials are therefore justifying increases in the Gifford Pinchot timber harvest level for the current decade partly on the basis of planned management practices that may or may not be funded and carried out in future decades.

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Forest Service Pacific Northwest regional officials said that the method used to determine the increase in timber harvest levels on the Gifford Pinchot and Deschutes Forests was also being used at other forests in the region. They believed that the method was consistent with Service

headquarters' broad criteria for determining and justifying increases in timber harvest levels. Service national criteria requires forest managers to estimate the growth increase likely to occur from performing specified management practices. However, Service criteria provides that harvest levels are not to be increased until such practices are employed in ongoing programs to assure that timber growth credit is not taken for the practices until the work is accomplished.

The National Forest Management Act of 1976 provides that the Secretary of Agriculture shall promulgate regulations specifying guidelines for land management plans that

"* * * permit increases in harvest levels based on intensified management practices, such as reforestation, thinning, and tree improvement if (i) such practices justify increasing the harvests in accordance with the Multiple-Use Sustained-Yield Act of 1960, and (ii) such harvest levels are decreased at the end of each planning period if such practices cannot be successfully implemented or funds are not received to permit such practices to continue substantially as planned."

It is not clear whether the Congress intended that the expected timber growth increases from performing management practices in future decades should be used as a basis for justifying increases in harvest levels and timber sales in the current decade. We believe the Forest Service should seek clarification of this matter.

Using board-foot measure tends to underestimate harvest levels

The Service requires that timber harvest levels be sustained at a high output level over many decades. It also requires that harvest levels be computed based on the cubic-foot unit of measure because the board-foot measure tends to underestimate the quantity of forest products that can be obtained from small trees. California and Pacific Northwest forests complied with this requirement but Rocky Mountain forests did not. As a result, the harvest levels for the Arapaho and Big Horn Forests are probably lower than they would have been had the cubic-foot method been used.

A Rocky Mountain Service official said that the board-foot method was used to determine harvest levels for forests in that region because they sold timber by that measurement. Service officials in the other two regions said that their forests also sold timber by the board foot, but the cubic-foot

method was used to compute harvest levels and the resulting data was converted into board feet for timber sales and management.

Because cubic-foot timber inventory data was not available for the Arapaho and Big Horn Forests, we could not determine how much higher the harvest levels for the two forests would have been had they been computed by the cubic-foot method. To obtain some indication of what the effect might be, however, we determined what the harvest levels for two other forests would have been using the board-foot method and compared the results with the levels that had been established for the forests using the cubic-foot method. Our analysis showed that the cubic-foot method increased harvest levels for the Gifford Pinchot and Deschutes Forests by 196 million board feet and 137 million board feet, respectively, for the decade ended in 1984.

RECLASSIFYING FOREST LANDS COULD AFFECT FUTURE HARVEST LEVELS

Service personnel at the Stanislaus National Forest have reclassified some areas that were included in the land base used to determine timber harvest levels. They now believe that some forest areas will produce less timber than they expected when harvest levels were first computed.

Under Service requirements, regulated commercial forest land used to determine allowable harvest levels is to be classified in the following components:

- Standard. Land areas on which crops of industrial wood can be grown and harvested with adequate protection of the other forest resources.
- Special. Land areas that need special treatment of the timber resource to achieve landscape or other key resource objectives.
- Marginal. Land areas that do not qualify as standard or special components primarily because they would require excessive development costs, have low product values, or are affected by resource protection constraints.

Service personnel initially classified regulated commercial forest land at the Stanislaus on the basis of aerial photographs. The forest has been divided into 132 compartments since 1973, and forest managers have begun to make on-the-ground examinations of each compartment to determine the conditions and treatment needs of the timber stands and soil.

The compartment analyses are to provide the data needed for allocating to each district the timber management goals set forth in the timber management plan.

The Stanislaus National Forest was one of the first California forests to begin making such analyses. As of August 1976, 13 of the forest's 132 compartments had been evaluated for their land classification and capability for growing timber. Stanislaus personnel plan to complete all compartment examinations by 1984.

Based on the results of their analyses of land and timber resources in the 13 compartments, Stanislaus Service personnel reclassified 4,154 acres (12 percent) of the standard component land in these compartments as follows:

<u>Redesignated land classification</u>	<u>Acres</u>
Marginal	3,452
Special	175
Noncommercial forest land	<u>527</u>
Total	<u>4,154</u>

The areas were generally reclassified for the following reasons:

- Some sites were poor quality. Some stands that had never been logged were sparsely stocked. Some areas were rocky and had shallow soil that could not withstand the effects of tractor or cable logging.
- Some areas were isolated.
- Some areas were in sensitive streamside zones along unnamed creeks. Such areas will not be managed intensively for timber production.
- Some areas were near new roads that have become main travel routes for recreationalists.

Service regional and forest personnel said that they expected 15 to 20 percent of the standard component land at the Stanislaus to be reclassified by the time all compartment examinations are completed. Officials at one of the forest's four districts estimated that about 38 percent of the standard component areas in that district might be reclassified.

Stanislaus forest managers believed that only 70 percent of the timber growth could be harvested in areas that have been reclassified into marginal and special components. No harvest was expected from areas reclassified as noncommercial forest land. They said that shrinking the standard component land base will probably require lowering future-decade harvest levels for the forest.

CONCLUSIONS

The management of national forest lands greatly influences present and future timber supplies and is an issue of major concern to timber-dependent communities, environmentalists, the timber industry, and the Congress. Developing timber management plans and determining timber harvest levels involve many complex policies and concepts, as well as technical methodologies, that must be applied to assure that harvest targets are set at achievable levels that can be sustained over time without impairing the timber supply or impinging on other resource uses and environmental objectives.

Large sampling errors in estimating national forest timber resources on the basis of forest treatment needs could produce unreliable harvest levels. Also, forest managers have not identified all forest areas that need specified treatment measures to sustain or increase timber harvest levels. The Service has not determined how reliable and definitive its treatment group inventories need to be, and it has not directed national forests to develop and implement procedures that will produce the quality of data needed for effective timber management.

Some management assumptions and procedures used in determining harvest levels cast doubt on the reliability of established levels. The Service did not have adequate controls to assure that management assumptions and options were being evaluated to determine whether they were reasonable and sound based on past field accomplishments and research studies. There is also some doubt about whether and to what extent management practices planned for future decades should be used to justify increases in harvest levels and timber sales in the current decade.

RECOMMENDATIONS TO THE SECRETARY OF AGRICULTURE

We recommend that the Secretary of Agriculture direct the Forest Service to take the following actions to assure that timber harvest levels are accurate and reliable targets.

- Evaluate timber inventory methods used by public and private timber managers and modify inventory procedures for national forests, as necessary, to assure that the data developed is reasonably reliable and useful for determining appropriate timber harvest levels, managing timber resources, and identifying areas that need specified treatment measures to sustain or increase timber harvest levels.
- Establish and enforce reliability criteria for the timber volume estimates used in determining timber harvest levels.
- Require that forest areas that are to receive each type of management treatment be identified and included as an integral part of approved timber management plans.
- Establish the validity and reasonableness of management assumptions and options before using them to calculate timber harvest levels.
- Require that the results of the evaluation of each management assumption and option and their effects on harvest levels be included in the approved timber management plan.
- Seek congressional guidance on whether, and to what extent, timber growth from management practices planned in future decades should be used to justify increases in harvest levels and timber sales in the current decade.

AGENCY COMMENTS AND OUR EVALUATION

The Service said that it generally agreed with our recommendations and that it shared our concern about reducing risks and uncertainties in determining timber harvest levels.

Regarding our recommendation that timber inventory methods used by public and private timber managers should be evaluated and Service procedures modified as necessary to obtain better inventory data, the Service said that it would continue to adopt and/or develop new methods and techniques for establishing timber inventories on a cost/benefit basis. The Service said that it is requiring all new timber management inventories to use in place or mapped information to locate areas that need specific management treatment. Information identifying specific areas needing reforestation and timber stand improvement--the primary management opportunities in current timber management planning--is scheduled to be

available for all national forests by September 1978. At this time it is difficult to judge whether this target date will be met.

Action to obtain inplace information on all areas requiring specific management measures is needed to obtain better timber inventory data. We note, however, that during Service hearings held in March 1977 before a House Appropriations subcommittee, the Chairman questioned why the Service was reducing the number of acres that would receive silviculture examinations (from about 7.1 million acres in 1977 to about 5.4 million acres in 1978). Since such examinations are to specifically identify areas needing planting, timber stand improvement, and other timber management measures, and to obtain better inventory data on timber stands within such areas, it seems reasonable that the Service should make every effort to complete these silviculture examinations in the shortest time possible, rather than reduce an activity of this importance.

The Service agreed that reliability levels for timber classifications used in models to project current and future harvest levels can be established. It noted, however, that the additional costs of obtaining greater reliability might outweigh the benefits. The Service said that it is studying the development of such criteria and the associated costs and benefits.

How reliable Service timber harvest levels need to be for effective forest management is a matter that needs specific decision by the Service. A major consideration in this regard should be the extent to which the Congress, the public, and the timber industry rely, or should be entitled to rely, on Service harvest levels in carrying out their responsibilities, satisfying their concerns, and conducting their business. We believe that the thoughts and concerns of the Congress on this important matter should be specifically taken into account.

Commenting on our recommendations about timber management assumptions used in harvest level calculations, the Service agreed that the reasonableness of its assumptions should be tested but said that it was not sure how a test of reasonableness could be measured. We believe that management assumptions and options should be based, to the extent possible, on the results of past field accomplishments and research studies. Management assumptions should be uniformly applied, where similar conditions exist, and the basis for the assumptions should be documented in applicable timber management plans.

As to justifying current increases in harvest levels and timber sales partly on the basis of timber growth from future-decade management practices, the Service said that this issue would be considered during the formal rulemaking process involved in developing and issuing regulations (scheduled for October 1978) to implement sections of the National Forest Management Act of 1976. The Service said that it would seek further guidance from the Congress if the issue is still unresolved at that time.

We believe that the Service should obtain timely congressional input and direction as part of its resolution of this issue. We hope that this will be done before the formal rulemaking process is completed and the Service's land use planning regulations are issued--otherwise it may be too late for congressional guidance to affect the new harvest levels included in timber management plans submitted for approval in 1978.

RECOMMENDATIONS TO THE CONGRESS

The volume of timber that should be harvested annually from national forests has been a major issue in congressional deliberations on Federal forest management, and a major point of contention among various segments of the public. Understated levels can lead to undercutting timber which can contribute to timber waste, reduced supply, higher prices, and greater unemployment in timber-dependent communities and businesses. Overstated levels can lead to timber overcutting, which can impair timber supplies for future generations and adversely affect the forest environment and other forest resources. From a legislative standpoint, both undercutting and overcutting could be a violation of the concept of a sustained high-level, nondeclining yield of forest resources, as mandated in the recently enacted National Forest Management Act of 1976.

Although the Service recognizes these concerns, its timber harvest levels have not been developed with the uniformity and precision needed to assure that they are reliable targets and constraints for sustaining timber harvests. We believe congressional direction would help resolve some of the unsettled issues discussed in this report. We therefore recommend that the Congress

- provide the Forest Service with its views on how reliable national forest timber harvest levels need to be for effective congressional oversight of forest management activities and better management and use of forest resources;

- require the Forest Service to base management assumptions and options used in harvest level calculations on the results of past field accomplishments and research studies, wherever possible, and to document such bases in applicable timber management plans; and
- guide the Forest Service about whether, and to what extent, timber growth from planned management practices in future decades should be used to justify increases in harvest levels and timber sales in the current decade.

CHAPTER 4

MORE CONSIDERATION SHOULD BE GIVEN TO TIMBER MANAGEMENT PRACTICES IN DEVELOPING HARVEST LEVELS AND IMPLEMENTING MANAGEMENT PLANS

Some timber management practices at the forests reviewed were being performed at different intensities than specified in timber management plans. Other practices were being carried out but were not included in the plans, and their effects on timber growth and harvest levels had not been determined. Adequate records were not always maintained to show progress in accomplishing some practices, although the Forest Service requires such records. The Service therefore does not know what effect these actions will have on timber harvest levels.

We also found examples of practices that were potentially applicable to the forests but were not in their plans, although the Service requires that such practices be considered. The Service therefore has no assurance that all the management practices needed to sustain and increase timber harvest levels are recognized and systematically considered in developing and implementing timber management plans.

EFFECTS OF PERFORMING MANAGEMENT PRACTICES DIFFERENTLY THAN PLANNED NOT DETERMINED

The timber harvest levels for the forests reviewed were established on the basis that specified timber management practices would be performed during the 10-year plan period. Deviating from the timber management plan in carrying out such practices could affect timber growth and therefore the harvest level that can be sustained over time.

We compared the progress made in performing certain timber management practices with the goals that had been established for the first year of the new management plans. The following table shows some deviations.

<u>Management practice</u>	<u>Acres planned for accomplishment</u>		<u>Acres accomplished first year</u>
	<u>Decade</u>	<u>First year</u>	
Deschutes:			
Thinning crowded timber with commercial value	11,955	900	535
Removing all or nearly all timber in ponderosa pine areas	60,831	6,083	5,778
Gifford Pinchot:			
Thinning crowded timber with commercial value	25,800	2,600	2,941
Stanislaus:			
Reforesting cutover areas	36,078	3,608	2,009
Big Horn:			
Clearcutting timber	5,000	401	219
Shelterwood cutting (note a)	67,580	3,066	1,306
Arapaho:			
Clearcutting timber	16,200	400	490
Shelterwood cutting (note a)	20,800	1,350	577

a/Harvest method that leaves designated trees to provide seed, shelter, and shade for the new crop. The rest of the mature stand is removed.

Some of these deviations are likely to continue beyond the first year and thereby compound the potential effect on growth. For example, the Deschutes timber harvest level was based partly on the assumption that 11,955 acres of crowded timber having a commercial value would be thinned during the decade ended in 1984. To meet this target, an average of 1,195 acres would have to be thinned each year of the decade. Forest personnel established 900 acres as a goal for the first year. However, the first year's timber sales included such thinning on only 535 acres. Since thinning is to reduce the tree density to the level needed to increase the remaining trees' growth rate, thinning a smaller number of acres than planned during the decade would reduce the growth expected to be realized from this management practice.

The Deschutes timber staff officer did not believe the acreage goal for thinning timber with a commercial value could be attained. He said it would depend on market conditions for smaller timber material.

The effect of deviations on timber growth and harvest levels had not been determined for either the Deschutes or the other forests reviewed. The importance of monitoring the performance of planned activities carefully and determining the effect on harvest levels of doing more or less than planned is illustrated by statements in the new timber management plans for the Arapaho and Big Horn Forests to the effect that a large part of the management practices expected to be accomplished under the previous 10-year management plans had not been done.

Determining effects in the forests reviewed is complicated by the fact that other management practices were being applied but were not in timber management plans and their effects on timber growth were not estimated, as discussed below.

EFFECTS OF ALL APPLICABLE MANAGEMENT PRACTICES NOT INCLUDED IN PLANS

The Service requires that each timber management practice's effect on the timber harvest level be determined to assure that the actions needed to sustain the base harvest level and achieve higher levels of timber harvest are recognized and considered. The effects of all developed and proved systems and concepts of timber management and improved use are to be estimated regardless of whether they are currently economical, likely to be funded, or locally in use.

We found that many timber management practices were being carried out, and others were potentially applicable to the forests reviewed, however, the effects of these practices on harvest levels were not estimated and included in the timber management plans. The Service also did not maintain records of some of the practices being performed.

Some practices being performed, whose effects were not estimated, included:

- Harvesting smaller trees, which improved timber use on the Deschutes and Gifford Pinchot.
- Thinning crowded young timber areas on the Stanislaus and crowded young lodgepole pine areas on the Deschutes.

- Planting seedlings with superior growth characteristics on the Deschutes and Stanislaus.
- Reducing brush that competes with trees for moisture and nutrients on the Gifford Pinchot and Stanislaus.
- Planting areas unstocked for over 5 years on the Deschutes.

The Forest Service also requires that records be maintained on progress in accomplishing timber management goals. Records were available to show the progress in carrying out some management practices, but not in others. Generally, records were kept for practices that were included in management plans but not for practices that were being performed but were not in the plans. The Service needs to ensure that the required determinations and records are made of all applicable management practices. Service personnel have revised the reporting systems and control records for the Gifford Pinchot Forest to keep better track of management accomplishments.

We also observed that some potentially applicable practices were not planned for forests and were not being done, or were in some forest plans but not others. For example, two practices that were not performed and whose effects were not projected at the forests reviewed were fertilizing young timber areas and eliminating undesirable trees. These timber management practices are performed elsewhere by public and private timber managers.

Two practices that were performed at the Gifford Pinchot that were not performed and whose effects were not projected at the Deschutes were reducing brush (which competes with growing trees for moisture and nutrients) and interplanting areas that have too few trees. These forests are in adjacent States in the Pacific Northwest. Service officials who developed the Deschutes timber management plan said they did not include or estimate the potential effects of management practices that were not expected to be performed during the decade.

In another case, we noted that some forests were planting seedlings with superior growth characteristics--but the Arapaho and Big Horn were not applying this practice or projecting its potential effects on harvest levels. Rocky Mountain Service personnel said that using such seedlings had been considered but had not been applied or planned in the two forests because the region's tree improvement program had not progressed enough.

Service personnel also said that the Arapaho and Big Horn Forests were not interplanting in areas with insufficient trees or planting in areas that have been unstocked for over 5 years, and that the two forests had not included such activities or their potential effects in the timber management plans. However, they expect to inventory the forests to determine where such practices should be performed.

Gifford Pinchot officials said that some applied or potentially applicable management practices were not estimated and included in the management plan because of the time constraints for completing the plan.

Without determining the effects of all applied and potentially applicable management practices on harvest levels, the Service does not have enough information to know what practices may be available to sustain or increase harvest levels. Some of these practices could have a large effect on harvest levels.

For example, the base harvest level for the Deschutes and Gifford Pinchot were based on the assumption that the minimum diameter of logs that would be sold during the decade would be 9 inches and 11 inches, respectively. These standards are diameters at breast height and were based on timber sale contract provisions at the time of the forest inventories.

According to a representative of an association of Pacific Northwest forest product manufacturers, the smallest diameter log used to produce forest products has changed from 15 inches to 9 inches in the last 20 years and could drop to 4 inches in the future. In a 1975 study of future timber supplies in the Pacific Coast States, Service researchers estimated that 88 percent of all logs from 5 to 11 inches in diameter would be used by timber purchasers after 1990. Other public and private timber managers in Oregon and Washington used minimum-log diameters ranging from 6 to 12 inches in determining their harvest levels; the greatest number used a 7-inch diameter.

During the first year of the decade some timber was sold from the Deschutes and Gifford Pinchot under contract provisions requiring the purchaser to use logs with a smaller diameter than the minimums the Service used to determine the base timber harvest levels. Using smaller diameter logs should increase harvest levels because more trees and a greater portion of treetops would be included in the forest inventory estimates.

The effect on harvest levels of reducing the minimum log diameter had not been estimated when management plans for

the two forests were prepared. Therefore, the Service has no measure of the benefits already obtained or those obtainable in future years, and it does not know what emphasis should be given to log diameter standards as compared to other management practices in these forests.

The Service discussed the potential effect of using smaller logs in a February 1976 report to the Congress on its plans to implement the Forest and Rangeland Renewable Resources Planning Act of 1974. The report stated that the western regions could increase board-foot yields by 10 to 15 percent through improved use (such as harvesting smaller trees). Service headquarters officials said that the log utilization standard has been lowered to a 7-inch diameter at breast height in some recent Service plans where market conditions justify it.

CONCLUSIONS

The Service has not established procedures to assure that forest personnel comply with its instructions to determine the effect of each applied or potential management activity on harvest levels and to record activity accomplishments. The Service therefore cannot determine whether all the timber management activities that are used or could be used to sustain or increase harvest levels are adequately considered in timber management planning.

Some management activities were being carried out differently than planned but the effects of such deviations on timber growth and harvest goals had not been determined. In other instances, potential and some applied management activities were not considered in determining harvest levels. Better records are needed to give forest managers timely information on the progress in carrying out all timber management activities.

RECOMMENDATIONS TO THE SECRETARY OF AGRICULTURE

We recommend that the Secretary of Agriculture direct the Forest Service to:

- Assure that forest management officials maintain adequate records of the progress made and the accomplishments achieved in carrying out timber management practices, and that they consider the effects on timber growth and harvest levels when practices are performed differently than planned.

- Assure that all potential or applied timber management practices are adequately considered in planning timber management and establishing harvest levels.
- Require that timber management plans discuss how each potential or applied management practice could affect harvest levels.
- Require that forest officials compare management goals with treatment accomplishments yearly and revise timber management plans, as necessary, to emphasize the management practices needed to sustain or increase timber harvest levels.

AGENCY COMMENTS AND OUR EVALUATION

The Service agreed with the intent of these recommendations. It said that a tracking system of planned-versus-achieved management accomplishments is now operational as part of the timber management information system for forests with newly approved timber management plans. It also said that monitoring the management information system at the regional and national levels will help assure that forest managers maintain and follow up with the record and control system, as required.

The Service also agreed that all current feasible timber management practices should be considered in establishing harvest levels. However, it said that it did not want to require forests to include the effects of fertilization and other remote or speculative management opportunities in the harvest level calculations until the benefits of such practices are proved in specific areas or until more knowledge is available on timber growth responses. While it may be sensible to not take credit for the results of management practices that have not been tried or tested in areas with similar growth characteristics, we believe recognition of such practices and their potential effects on timber growth and harvest levels should be included in timber management plans.

CHAPTER 5

NEED TO MINIMIZE CONFLICTS BETWEEN TIMBER AND OTHER RESOURCE USES WHEN IMPLEMENTING TIMBER MANAGEMENT PLANS

Conflicts have occurred between timber production and other forest resource uses as the timber management plans for the Gifford Pinchot and Deschutes National Forests were being implemented, though land use constraints were considered in determining allowable harvest levels. These conflicts occurred because management plans did not identify the locations of areas to be managed primarily for the various forest resource uses and did not specify the timber harvest constraints to be imposed in each area. In some of these cases, the Forest Service approved timber sales without adequately considering ways to minimize the effect of timber harvest on other forest resource uses. Also, in establishing timber harvest levels for the Gifford Pinchot, not enough attention was paid to preserving forest areas for potentially threatened wildlife species.

The Service requires timber harvest level determinations to be coordinated with other forest resource uses, such as recreation, range, watershed, and fish and wildlife habitat. It also requires that the annual timber harvest level be reduced when forest lands intended for harvest are declared unavailable due to economic factors or other resource-use constraints. Plans for coordinating the various uses are developed after considering public comments on environmental statements, and are included in timber management plans.

CONFLICTS BETWEEN TIMBER AND SCENIC USES

Because detailed studies are to be made before harvesting timber in roadless national forest areas, the Service adjusted its harvest plans in some other areas of the Gifford Pinchot and Deschutes Forests so that it could achieve harvest levels established for the first 2 years of the forests' 10-year management plans. This action conflicted with plans for maintaining the scenic beauty and quality of the Gifford Pinchot and is beginning to cause similar problems on the Deschutes.

An August 1972 court order precludes the Service from harvesting timber in all roadless national forest areas of 5,000 or more acres until detailed studies are made to determine whether such areas should be classified as wilderness areas or managed for other purposes. About 224,400 and 313,300 acres of roadless areas in the Deschutes and Gifford Pinchot, respectively, are affected by this ruling. A limited Service study of these areas determined that 36,090

acres in the Deschutes and 68,500 acres in the Gifford Pinchot should be studied in greater depth for their potential to be wilderness areas. These areas were eliminated from the land base used to determine allowable timber harvest levels.

The remaining roadless areas, which the study found did not appear to have any wilderness potential, were included in the land base used to compute timber harvest levels for the decade and for the first 2 years of the new management plans. However, timber was not to be harvested in these areas until the detailed land use studies were completed in 1977 for the Deschutes and 1978 for the Gifford Pinchot.

The Service's Pacific Northwest region requires that timber harvesting in some forest areas should remain subordinate to the landscape's visual quality. Timber harvesting can have a devastating effect on scenic beauty. According to the environmental statement for the Gifford Pinchot timber management plan:

"The amount and location of timber removal will determine the extent of change in appearance of the landscape. Regardless of the technique used in timber harvesting, there is at least a short period when the project area is freshly disturbed and man's activities are clearly evident. Lines and forms imposed by patch clearcuts and road construction upon the landform tend to dominate over the natural scene."

According to the environmental statement for the Deschutes timber management plan:

"The closeup view of a clearcut soon after cutting or slash disposal is not pretty. Fresh cut stumps, piles of slash, and charred logs, detract from scenic beauty."

One technique used to preserve the forest lands' scenery is to retain leave strips (standing timber that screen cleared areas from view). In one district of the Gifford Pinchot, however, leave strips were being sold for clearcutting before the screened areas had been returned to a scenic appearance. The Service decided to harvest leave strips without evaluating other available management alternatives.

For example, timber sale plans for two 1975 sales in this district recognized that clearcutting leave strips as proposed would conflict with scenic objectives and make timber harvesting operations dominant over, rather than subordinate to, the landscape's visual quality. The sales plans indicated that

the alternatives to clearcutting would be either not to harvest any timber in the leave strips or to use harvest methods that would remove only part of the timber. The plans stated that there would be no economic return if the timber was not harvested because of the trees' old age and poor condition. One plan indicated that harvest methods other than clearcutting would meet scenic objectives but would not be economical and practical because of topography and the timber's composition. The other plan indicated that harvest methods other than clearcutting would greatly increase the timber's cost and still not fully meet management's scenic objectives.

The Forest Supervisor approved the timber sales as planned, without determining the estimated costs of (1) alternative methods to clearcutting or (2) the economic loss that would result from not clearcutting the leave strip areas. Also, no consideration was given to alternatives, such as harvesting timber from other areas where there would be little or no conflict with other uses.

The Forest Supervisor acknowledged that scenic objectives were compromised in these timber sales but said that sufficient natural topographic and vegetative screening is available in one area so that the effects of clearcutting will be only subtly evident if seen from a distance. Forest Service personnel stated that clearcutting leave strips would not have been authorized if the roadless areas had been available for timber harvest. Those areas represented about 37 percent of the commercial forest land in this district and about 23 percent of commercial land in the whole forest.

We believe that Service managers should have considered other alternatives, such as harvesting timber from district or forest areas where other forest use objectives would not be impaired, or reducing the planned annual harvest level until detailed studies of roadless areas are complete. The Service also should have evaluated the economic loss that would result from delaying timber sales in leave strip areas until growth on the clearcut areas behind them becomes aesthetically satisfactory. Such considerations would have provided a better basis for selecting the best alternative to minimize conflicts between land uses.

The unavailability of roadless areas for timber harvest on the Deschutes Forest is also beginning to cause problems. In May 1975 the Deschutes timber staff officer advised the district rangers that at least one forest district was having difficulty meeting its timber harvest level because of this reason. The district's plan for a 1975 timber sale stated that 29 percent of the timber acreage was in roadless areas,

but that the district had not reduced its harvest level to take this into account; therefore, timber from other forest areas would have to be sold at a faster rate than planned.

Timber use conflicted with scenic use on the Deschutes when the Service approved cutting trees in a designated foreground landscape management zone on which harvesting constraints had been imposed by the timber management plan. Such zones are generally adjacent to roads, streams, lakes, and campgrounds, where timber and landscapes are to provide a visually pleasing environment that maintains the forest's aesthetic appearance.

About 43,000 acres of the Deschutes, containing mostly ponderosa pine, are in such designated landscape zones. Management guidelines for these zones allow timber activity results to be slightly evident, but not conspicuous. The management plan provided for some timber to be harvested on 1,435 of these acres during the decade but did not specify where.

The Service approved a 1975 timber sale in a foreground landscape zone along part of a loop road used by the public for access to wilderness and recreational areas. The timber sale provided for clearcutting in seven areas in the zone, ranging in size from 5 to 27 acres.

The timber sale plan stated that the landscape zone would be reclassified and a 5-mile segment of the road loop would be closed to the public by locked gates for 10 to 15 years, until the aesthetic appearance of clearcut areas was improved by new timber stands. The sale plan warned, however, that problems would likely occur in establishing new timber stands and that extreme care would be needed in logging the timber and preparing fragile soil areas for planting. The plan did not provide any alternatives to clearcutting fragile soil areas and closing the road.

The Forest Supervisor approved the timber sale, as planned, without requiring documentation and analysis of other alternatives, such as changing the sale boundary, harvesting only dead and dying timber, or cutting timber in another forest area where conflicts with other forest resource uses would not occur.

The district timber management assistant who planned the sale said it should be beneficial because timber that is decaying and declining in value will be replaced with vigorous young trees. He said that the part of the road that is to remain open will still provide access to recreation areas.

The clearcuts and closed road will deprive the public of several hundred acres of scenic beauty for 10 to 15 years, or even longer if the anticipated problems in establishing new timber stands should materialize.

CONFLICT BETWEEN TIMBER AND WILDLIFE RESOURCE USES

The Service wildlife management objective is to maintain and develop suitable wildlife habitat compatible with other forest resource uses. Threatened and endangered wildlife species are to receive the highest priority. The Deschutes National Forest considered wildlife habitat in establishing timber harvest levels but the Gifford Pinchot did not.

The timber harvest level of the Deschutes was reduced by 6.84 million board feet so that suitable wildlife habitat could be maintained and developed. Part of the reduction was to maintain the nesting areas of threatened and endangered, decreasing, or unique bird species. The nesting areas were mapped and timber harvesting within a radius of 330 to 1,980 feet (depending on the species) of these areas was prohibited.

The spotted owl is one of the unique species whose nesting areas are being preserved in the Deschutes. A Department of Interior Fish and Wildlife Service official said that the spotted owl is being studied for possible classification and legal protection as a threatened or endangered species.

The environmental impact statement for the Gifford Pinchot timber management plan stated that special attention would be given to the environmental needs of threatened, endangered, unique, and rare wildlife and fish. It also stated that sufficient suitable habitat for the spotted owl would be maintained. However, the forest's timber harvest level was not reduced to maintain and develop suitable wildlife habitat, and the nesting areas of threatened and endangered, decreasing, or unique species of birds were not located and mapped.

A plan for a 1975 clearcut timber sale in the Gifford Pinchot stated that spotted owls had been observed in the sale area but that no special arrangements were made to protect the birds because Service officials believed that owls and other species could live in adjacent timber stands. The Forest Supervisor said that three Service employees saw the spotted owls before the timber sale plan was completed but did not find any nests in the sales area and assumed that the owls nested elsewhere. They did not, however, locate the nests to assure that the timber sale would not interfere with the owls'

habitat. The timber sale plan was approved without evaluating alternatives, such as changing the sale boundaries to minimize or eliminate the conflict between timber use and wildlife resource uses.

With almost a million acres of regulated commercial forest land available for harvesting timber in the Gifford Pinchot, the Service should make every effort to not schedule timber sales in areas where potentially threatened or endangered wildlife species are likely to nest.

CONCLUSIONS

The Service did not always adequately consider other forest resource objectives when determining allowable timber harvest levels and scheduling and approving timber sales. Conflicts between timber uses and other forest resource uses sometimes occurred when implementing timber management plans because the plans did not identify the areas to be managed for multiple uses and specify the harvesting constraints to be imposed.

Though timber sales plans indicated that proposed timber harvests would conflict with other resource-use objectives, Forest Supervisors sometimes approved the sales without adequately considering alternatives to minimize the timber harvest's effect on the other forest resource uses.

RECOMMENDATIONS TO THE SECRETARY OF AGRICULTURE

We recommend that the Secretary of Agriculture direct the Forest Service to take the following actions to minimize conflicts between timber harvests and other forest resource uses:

- Require forests to closely coordinate timber harvest objectives with other forest resource-use objectives when determining harvest levels and scheduling and approving timber sales. Timber management plans should identify areas to be managed for multiple uses and specify the harvesting constraints to be imposed in each area. When conflicts occur, they should be resolved to minimize the timber harvest's effect on other forest resource uses.
- Require forests to consider areas where threatened or endangered wildlife species are likely to nest, when determining harvest levels and scheduling and approving timber sales.

AGENCY COMMENTS AND OUR EVALUATION

The Forest Service agreed with these recommendations but intends to use its new forest land management plans, rather than its timber management plans, as the document for coordinating the uses of the various national forest resources. It said that timber and other specific resource plans will be prepared within the framework provided in the forest land management plans that are being developed under the guidance of the National Forest Management Act of 1976.

However, the Forest Service has much work to do before new forest land management plans will be developed and used for all areas of all national forests. We therefore believe that timber management plans, which are a major guiding force in managing most national forests, should fill the need in the interim.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
P. O. Box 2417
Washington, D. C. 20013

1420

October 12, 1977



Mr. Henry Eschwege, Director
Community and Economic Development Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Eschwege:

In response to your letter of July 29, here are our comments on the draft of your proposed report to the Congress, Timber Harvest Levels-- How Good Are They?

The matter of timber harvest scheduling is a highly technical and complex subject as the review indicates. We appreciate the effort which went into this review and the dialogue with your people during the period of the review.

We recognize and appreciate the concern expressed in the report regarding the need to reduce risk and uncertainties in determining timber harvest levels. Much has been done with improved inventory designs, yield functions, models and the planning process since the audit was initiated. The process is dynamic, and improvements will continue to be made to the point where additional costs are no longer justified.

We are in general agreement with the report recommendations and share the GAO concerns for reduction of risks and need for uniformity in planning. However, we substantially disagree with one major comment of the draft report which concerns sampling design and statistical reliability.

The draft report implies that sampling errors, determined from post stratification of timber management classes on the Gifford Pinchot and Deschutes Forests, are so high as to cast considerable doubt on the harvest level established. We disagree with the GAO's use of sample error for the Gifford Pinchot and Deschutes National Forests and feel that this use draws the reader to false conclusions.

The report cites that 51 percent of the plots on the Gifford Pinchot included in the harvest treatment group had a sampling error of 27 percent, and other classes have sampling errors up to 46 percent. From this, the conclusion is drawn that the harvest levels established are questionable.

The existing inventory and associated sampling error is but one element in determining the harvest level. All plots, whether with harvestable volume now or in the future, enter into the calculations for the current decade. The overall sampling error for the forest as a whole is estimated to be less than ± 10 percent. At the time the inventories sampled in the audit were made, statistical reliability criteria were not established for individual timber classes. Development of such criteria and associated costs/benefits is being studied.

Despite error terms calculated for each component one cannot validly infer that the estimates of harvest levels are questionable.

Standard errors--either a specific number or a percent--are used to establish a confidence interval or confidence limits, i.e., the limits to the interval both maximum and minimum. The confidence interval or limits must be accompanied by a probability level, or the limits are meaningless. For example, the fiducial probability is .68 that the interval covers the true population parameter. In other words, the established limit for a given probability level cannot be used as an amount over or under the estimate but merely as limits of an interval. These limits cannot be used to infer error, since there is nothing that indicates the existing estimate is not the true population parameter or that the existing estimate is wrong in any way. Another way to look at this interval would be as follows: given a probability level of .68 (2 out of 3), samples from the same population will be within this interval. No additional inferences are warranted.

The Forest Service is aware that the post-stratification of the original inventory base into model components--and then, the subsequent projection of these model components through scheduling process produce a greater chance for error than would occur with in-place acreage data. In recognition of this, "checks and balances" have been set up to monitor actual performance against projected performance. These control activities provide for current adjustment of harvest levels whenever planned levels vary significantly from performed levels.

In addition to the control record procedures, the timber management plan provides for on-going review of the plan premises and performance during the plan period with provision for adjustment as needed. Finally, although projections are made up to a 30-decade period (300 years), the projection effective span will not exceed the 10-year period when a reinventory of the forest will be made and a recalculation made. If performance under the plans reveals serious error in the plan projections or assumptions prior to that time, we would make interim adjustments and reinventory and replan sooner than the 10-year period.

Our specific comments on the Chapter 3 recommendations follow:

Recommendation: Evaluate timber inventory methods used by public and private timber managers.

Comments: This is a continuing challenge. We recognize the dynamic nature of change in inventory techniques and planning procedures. We will continue to adopt and/or develop new methods on a cost/benefit basis.

In June 1975, the Forest Service Manual Section of Management Planning Inventories, FSM 2413, was completely revised to incorporate "In-place or Mapped Information" as a basis for inventory and to incorporate the data base concept into timber management planning. All new timber management inventories are being made following these instructions. These instructions specifically provide for "In-place information on the location of treatment opportunities so that management action can be executed." On older inventories this information is being provided through the Stage II or silvicultural examination and prescription inventory. The "in-place inventory" for areas in need of reforestation and timber stand improvement, the primary management opportunities in current timber management plans, is scheduled for completion for the entire National Forest System by September 30, 1978.

Recommendation: Establish and enforce reliability criteria for timber volume estimates used in determining timber harvest levels.

Comments: Minimum timber inventory reliability or accuracy standards have been established in Forest Service directives FSM 2413.21 and FSM 4813. Regional Foresters are authorized to establish additional levels of reliability. The draft report discussion recognizes that inventory estimates were within the required standards on the six

forests reviewed. Reliability levels have not been established for timber classes used in models used to project current and future harvest levels. This can be done. However, to bring volume estimates, for example, to ± 10 percent (1SE) for the major classes would considerably increase costs perhaps as much as four times under present standards. We soon reach a point of excessive costs for refinements that may not be warranted at this time in consideration of the way the data is used and other safeguards in the planning system. As pointed out earlier, the report fails to fully recognize the recurrent nature of Timber Management Inventory and Planning which is a "safeguard" to the uncertainties and risks inherent in the process. Every 10 years a new inventory is made, new plots and stands are sampled, permanent plots are remeasured for growth and mortality. Changes that have occurred since the last inventory are measured and weighed against progress toward the regulated forest. This information, plus continually improving yield information and scheduling models, provide the basis for preparing a new or revised timber management plan. Estimated yields are also stated by area, which is an additional safeguard to reduce uncertainties of volume estimates. It is interesting to note that two of the plans reviewed by the audit team, the Bighorn and Arapaho, are controlled by area rather than volume, with the allowable harvest expressed in both area and volume.

Recommendation: Require that locations of forest areas which are to receive each type of management treatment be identified and included as part of timber management plan.

Comments: This is the objective of Stage II inventories and planning. (See comments on the first recommendation.)

Recommendation: Establish the validity and reasonableness of management assumptions and options before using them to calculate timber harvest levels.

Comments: Timber harvest levels, although based on several calculations, are administratively set by the responsible Forest Supervisor and approved by the Regional Forester. Many different assumptions are tested throughout the planning process and further scrutinized in the review of alternatives required by the NEPA process. The area of risk is recognized in the planning and decision-making process. Although we agree a "test of reasonableness" should be made, we are not sure how this can be measured. Recognizing that new knowledge may become available or unforeseen changes may occur, the Forest

Service directive FSM 2415.45 requires updating Potential Yield Statements as needed. This provision is included in the timber management plans that were reviewed by the audit team.

Recommendation: Seek guidance from the Congress as to whether, and to what extent, the timber growth from planned management practices in future decades should be used to justify increases in harvest levels and timber sales in the current decade.

Comments: The Forest Service, with the advice and counsel of the Committee of Scientists, is currently developing regulations to implement Section 6(g)(3)(D) of the National Forest Management Act of 1976. This issue will receive considerable review and comment during the formal rulemaking process. If further guidance from Congress is necessary, we will follow your suggestion.

Specific comments on Chapter 4 recommendations are as follows:

Recommendation: Ensure that Forest Management officials maintain adequate records of the progress made and the accomplishments achieved and that they consider the effects on timber growth and harvest levels when practices are performed differently than planned.

Comments: Provision is made in FSM 2413, Inventory and Data Base for Timber Management Planning, to maintain and provide this type of information. A tracking system of planned versus achieved silvicultural accomplishment is now operational as part of the timber management information system on Forests with newly approved timber management plans. In addition, more detailed information is maintained in the "Control" section of each plan.

We concur there is need in some areas to "ensure" that forest managers follow up with the record and control system, as required. Monitoring of the system at the regional and national level will help to resolve this problem.

Recommendation: Ensure that all timber management practices that are used or could be used are adequately considered in planning timber management and establishing harvest levels.

Comments: We agree that all currently feasible timber management practices should be considered in establishing harvest levels. However, we believe that the effects of more remote or speculative opportunities, such as fertilization or genetic improvement, should

not be included on a general or nationally required basis until these practices have been proven in specific areas. As these practices are proven or in areas where we now have knowledge concerning growth responses to these practices, they will be considered in planning harvest levels.

Specific comments on Chapter 5 recommendations are as follows:

Recommendation: Require forests to closely coordinate timber harvesting objectives with other resource use objectives when determining harvest levels and scheduling approved timber sales. Timber management plans should identify areas to be managed for multiple uses and specify harvesting constraints to be imposed in each area.

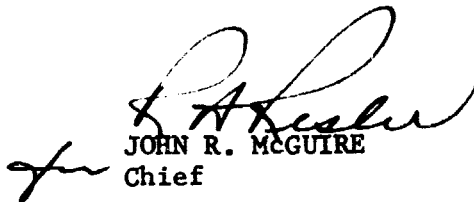
Comments: We agree there is need for close coordination in scheduling timber harvest, land management and resource management planning. We do not agree, however, that the timber management plan is the coordinating document. In the past, the timber management plan has been the key forest planning document, and coordinating requirements were an important part of the plan. In recent years, the multiple use plan and now the new forest land management plans as provided in the National Forest Management Act of 1976 take on this coordinating role. Specific resource plans should be prepared within the framework provided in the forest land management plan.

Recommendation: Require forests to consider areas where threatened or endangered wildlife species are likely to nest when determining harvest levels and scheduling and approving timber sales.

Comments: We agree. Provision and direction requiring such consideration are already located in Forest Service Manual 2405.14, 2602, and 2606.13.

Thank you for the opportunity to review and comment on the draft report.

Sincerely,


JOHN R. MCGUIRE
Chief

PRINCIPAL OFFICIALS OF
THE DEPARTMENT OF AGRICULTURE
RESPONSIBLE FOR ADMINISTRATION OF
ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
SECRETARY OF AGRICULTURE:		
Bob Bergland	Jan. 1977	Present
John A. Knebel	Oct. 1976	Jan. 1977
Earl L. Butz	Dec. 1971	Oct. 1976
Clifford M. Hardin	Jan. 1969	Dec. 1971
 ASSISTANT SECRETARY, CONSERVATION, RESEARCH, AND EDUCATION (note a):		
M. Rupert Cutler	Apr. 1977	Present
Paul A. Vander Myde (acting)	Jan. 1977	Apr. 1977
Robert W. Long	Mar. 1973	Jan. 1977
Thomas K. Cowden	May 1969	Mar. 1973
 CHIEF, FOREST SERVICE:		
John R. McGuire	Apr. 1972	Present
Edward P. Cliff	Mar. 1962	Apr. 1972

a/Title changed from Assistant Secretary, Rural Development and Conservation, in January 1973.