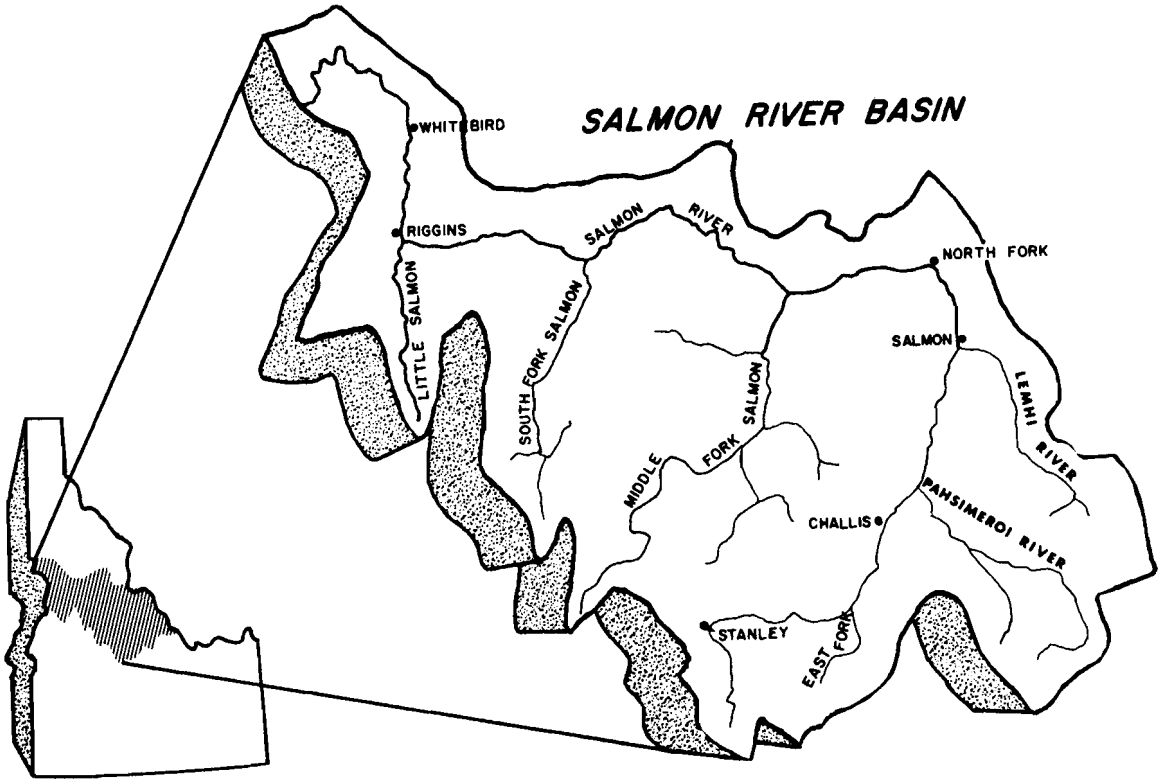
A Methodology Study To Develop Evaluation Criteria For Wild And Scenic Rivers



Report of

Forest Subproject

by

John R. Herbst

Water Resources Research Institute
University of Idaho
Moscow, Idaho
January, 1972

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS

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ABSTRACT

The objective of the Forest subproject was to inventory the timber in the Salmon River drainage, and determine the implications of river classification on timber harvest in the area. A secondary objective was to develop a methodology to relate forestry activities to System river selection, then test this methodology using the Salmon River as an example.

The timber resource in the Salmon River basin was inventoried and evaluated. Based on the information gathered it was concluded that classification of the river would have little effect on the timber industry in the area.

The methodology developed around general steps to take in evaluating the timber resource in relation to the Wild and Scenic Rivers System. It was suggested that once it was decided that the river qualified for the System, the researcher suggest various classification schemes for the river. Then rapid, unrefined estimates be made of the amount and value of the affected timber resource. A market base should be selected and the evaluation done on a sustained yield basis. More refined estimates can be made at a later time if warranted.

Also discussed were factors involving forestry and system rivers such as selection of interest rate and a land value base. It was determined that the main ties between forestry and system rivers related mainly to transportation, water quality, water quantity, and aesthetics. Harvest types and techniques and their relation to system rivers was discussed, and an interpretation of the Act and guidelines in relation to system rivers was presented.

It was concluded that the river basin is not the proper area to consider when relating river classification to the timber industry, as market and not geographic boundaries are relevant.

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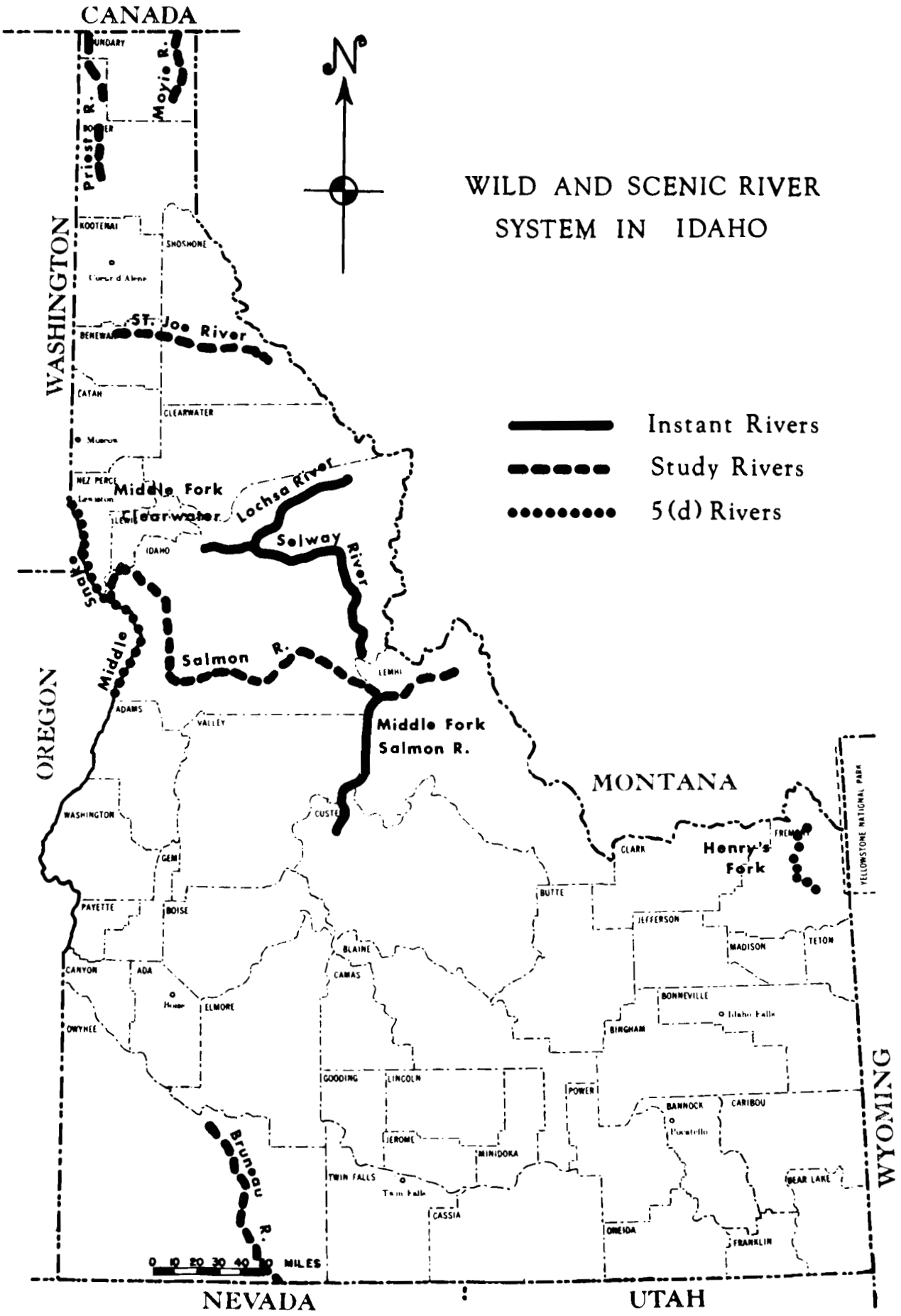
PREFACE

In October, 1968, the Congress of the United States passed Public Law 90-542 (Wild and Scenic Rivers Act) which provides for a National Wild and Scenic Rivers System. The Congress declared that the established national policy of dam and other construction at appropriate sections of rivers in the United States needed to be complemented by a policy to preserve and protect certain other rivers or sections of rivers in their free-flowing condition that they and their immediate environments might be enjoyed by present and future generations of Americans. The boundary of a wild and scenic river "shall include an average of not more than 320 acres per mile on both sides of the river" according to the Act. This is equivalent to approximately one-quarter mile on either side of the river, and is termed the river corridor.

The Act provides for instant and study rivers, instant rivers being those establishing the original Wild and Scenic Rivers System. A system river is defined, for this report, as any wild, scenic, or recreational river area that is included in the National Wild and Scenic Rivers System. In Idaho, the Middle Fork of the Clearwater River, including the Lochsa and Selway Rivers, and the Middle Fork of the Salmon River were named as instant rivers. Rivers in the study category have a moratorium on developmental activities until 1978 so that studies deciding their eligibility and desirability can be made. There are five study rivers in Idaho: the Bruneau, Moyie, Priest, St. Joe and Salmon rivers.

Three management classes of rivers are specified by the Act: wild, scenic, and recreational. The Act defines these as:

> wild river areas - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
>
> scenic rivers areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.


CANADA
WASHINGTON
OREGON
NEVADA
UTAH
WYOMING
MONTANA
WILD AND SCENIC RIVER
SYSTEM IN IDAHO
Instant Rivers
Study Rivers
5(d) Rivers
Moyie R.
Priest R.
St. Joe River
Middle Fork
Clearwater
Lochsa River
Selway River
Salmon R.
Middle Fork
Salmon R.
Henry's
Fork
Bruneau R.
0 10 20 30 40 50 MILES

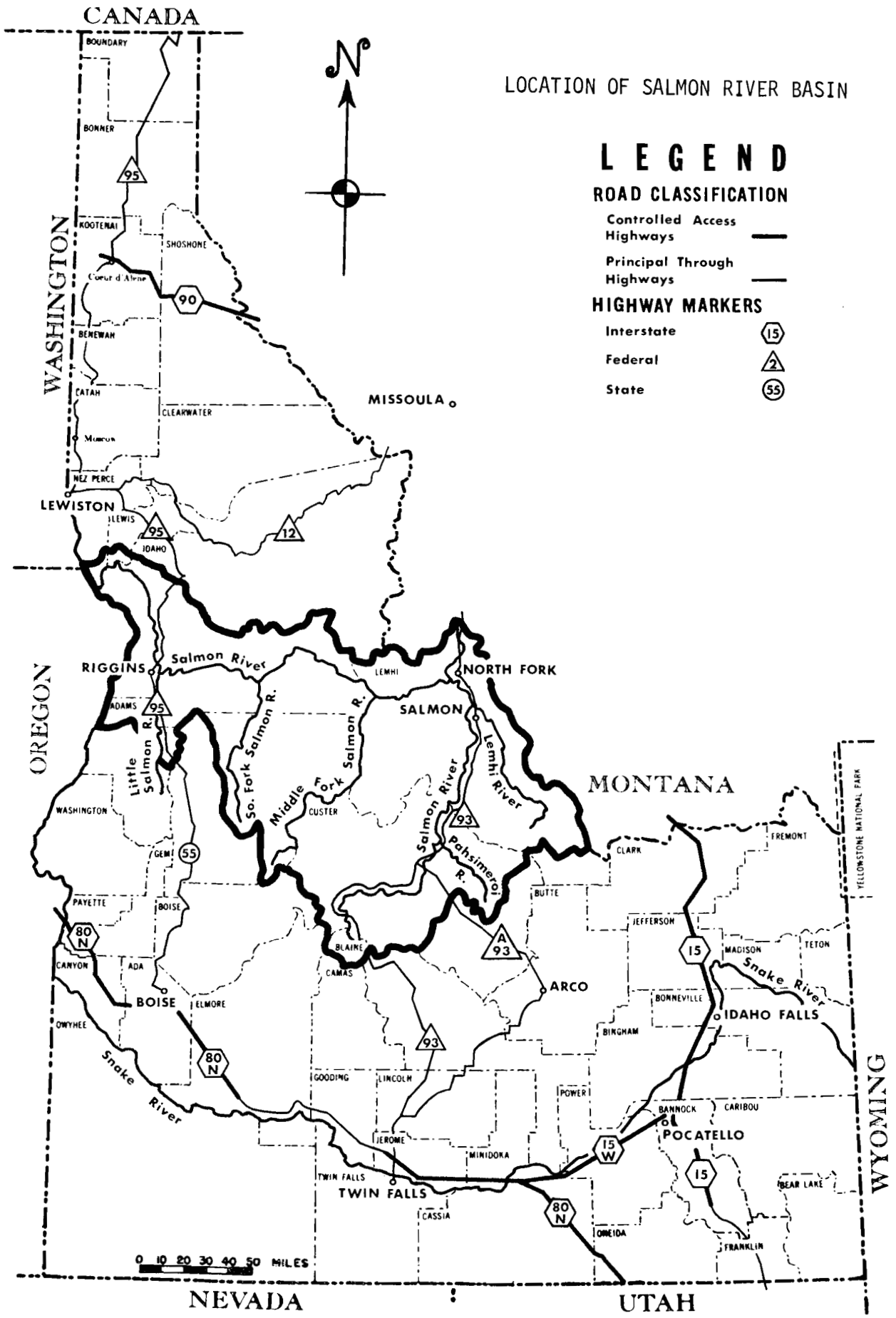
MAP 1.

recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

River plans have been drawn up by either the Bureau of Outdoor Recreation or the Forest Service for all of the instant rivers. Confusion and uncertain interpretations are involved in implementing any new Act. One of the difficulties in instituting a management policy for a system river is that the area is long and narrow, meandering across political boundaries of states, counties, towns, across a heterogeneous ownership pattern including both private and public properties, and across a multiplicity of interests including national forests, national parks, municipal watersheds, farmlands and towns.

The criteria for evaluating rivers for possible inclusion in the System is in the formative stage. Some studies have begun on the study rivers by the agencies responsible for them, i.e., The Forest Service and the Bureau of Outdoor Recreation. Each river is different in nature and has its own problems. Because Idaho has so many rivers already included or being studied for possible inclusion in the System, the Water Resources Research Institute at the University of Idaho has organized a Scenic Rivers Study Unit to develop methodology relevant to decision making and planning in the selection, use, and management of a wild and scenic river system. The methodology study has four broad objectives.

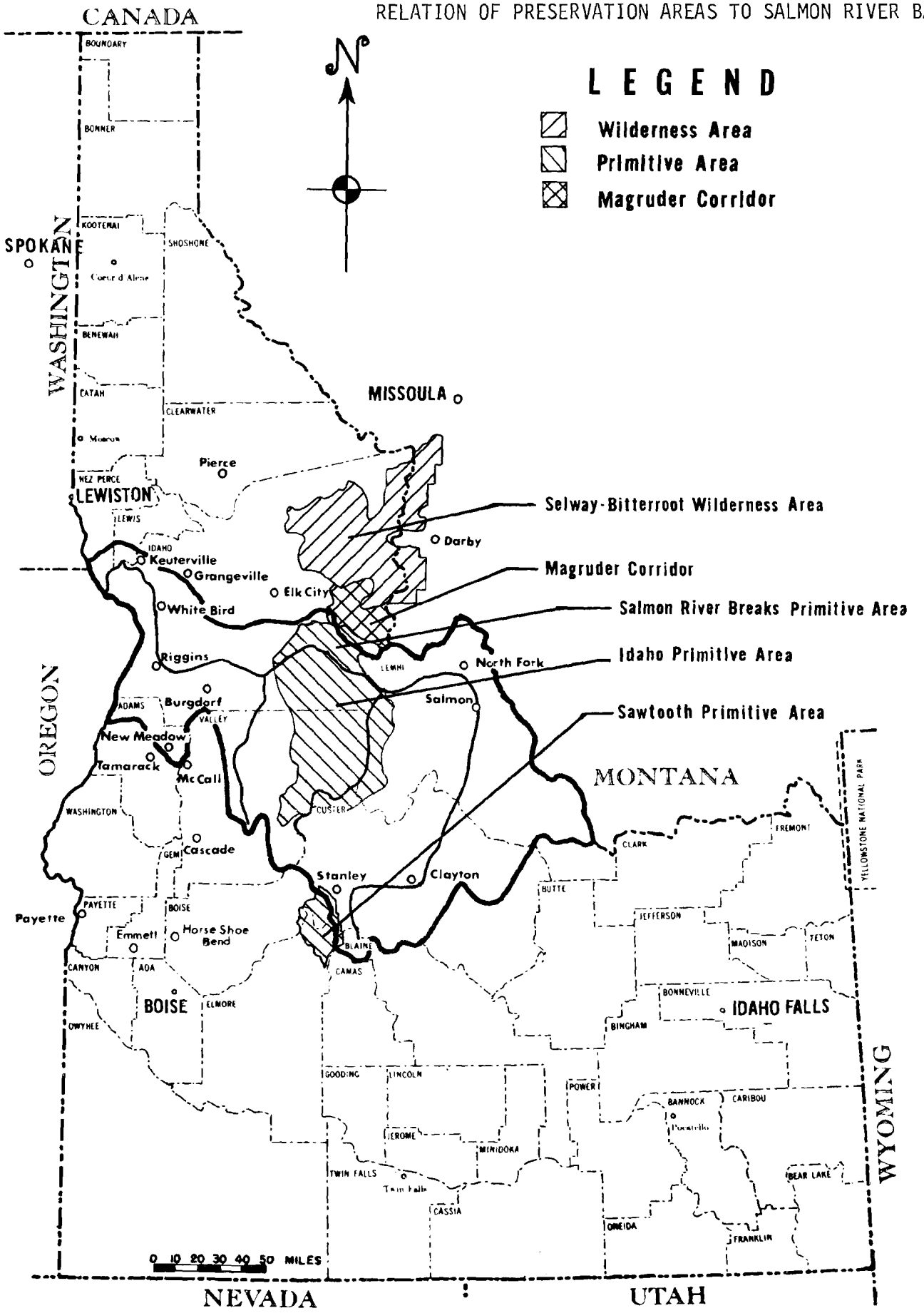
1. Inventory present quantities and qualities of natural resources in the river basin area, and estimate future quantities and qualities of these resources, establishing their values in both situations.
2. Identify, describe, and quantify, where possible, benefits from scenic beauty, personal enrichment, and other aesthetic experiences derived from the river.
3. Develop a series of models to evaluate or determine the resource use pattern consistent with a wild rivers system, and the resource use pattern which would exist under various levels of development in the river basin area.


LOCATION OF SALMON RIVER BASIN
LEGEND
ROAD CLASSIFICATION
Controlled Access Highways
Principal Through Highways
HIGHWAY MARKERS
Interstate
Federal
State
CANADA
BOUNDARY
BONNER
KOOTENAI
SHOSHONE
Coeur d'Alene
BENEWAH
CATAH
CLEARWATER
Moscow
NEZ PERCE
LEWISTON
LEWIS
IDAHO
WASHINGTON
OREGON
MONTANA
WYOMING
NEVADA
UTAH
MISSOULA
RIGGINS
Salmon River
ADAMS
LEMHI
NORTH FORK
SALMON
Little Salmon R.
So. Fork Salmon R.
Middle Fork Salmon R.
Salmon River
Lemhi River
Pahsimeroi R.
CUSTER
WASHINGTON
GEM
PAYETTE
BOISE
CANYON
ADA
ELMORE
OWYHEE
BLAINE
CAMAS
ARCO
BUTTE
CLARK
FREMONT
YELLOWSTONE NATIONAL PARK
JEFFERSON
MADISON
TETON
Snake River
BONNEVILLE
IDAHO FALLS
BINGHAM
GOODING
LINCOLN
JEROME
MINIDOKA
TWIN FALLS
CASSIA
POWER
BANNOCK
CARIBOU
POCATELLO
BEAR LAKE
ONEIDA
FRANKLIN
0 10 20 30 40 50 MILES

MAP 2.

x

RELATION OF PRESERVATION AREAS TO SALMON RIVER BASIN



MAP 3.

4. Present recommendations for alternative uses of resources for the entire river basin area, recommend restrictions if classification is applicable, and describe the economic and social ramifications of each of the alternatives considered.

The Salmon was chosen as the river to test the methodology study. Reasons for this decision are many. It is mentioned as a study river in the Act and contains attributes for all three river classifications: wild, scenic, and recreational. Many of the attributes desirable for a system river are present, as well as potential for many of the developmental activities.

The scope of the study considers the entire hydrologic basin and all of the activities, economic and otherwise, that take place within it. The reasons the whole basin was studied were: To find out the effect of any economic development; impoundments, diversions, logging, mining, etc., on a system river and if, how, or where such activities can take place without adversely affecting a system river. At the same time, the effects of a system river on these economic developments will be identified. The study of the basin area is consistent with the hydrologic units used in the Idaho Economic Base Study for Water Requirements (23).

In our analysis of the Salmon River Basin, fifteen subproject studies were initiated:

1. Forest and range resources
2. Minerals
3. Outdoor recreation
4. Commercial fisheries
5. Irrigation
6. Water for municipal and industrial use
7. Water quality control
8. Hydroelectric power
9. Flood control
10. Navigation
11. Archaeology
12. History
13. Transportation and access
14. Agriculture
15. Hunting

Each subproject is designed to independently study present levels of development and project uses to the years 2000 and 2020. This is consistent with time projections of the Columbia-North Pacific Region Comprehensive Framework Study (PNWRBC) (5). After they have been all

completed, an economic model, or models, will be constructed to provide 1) estimates of costs and benefits of alternate management plans for the river area, and 2) a comparison of various resource uses. Particular emphasis is made throughout the study to identify, and, if possible, quantify the aesthetic and personal enhancement values that Congress expressed a desire to protect and preserve.

INTRODUCTION

There has been increasing interest in preserving portions of our nation in its natural state. This interest was first expressed as a desire for wilderness and primitive areas, and more recently this interest has turned towards preservation of some free flowing rivers, neither harnessed or tamed by man. This interest resulted in passage of the Wild and Scenic Rivers Act.

According to the Act and to the guidelines published jointly by the Departments of Agriculture and Interior (16) restrictions on resource use depend on river classification, whether it be wild, scenic or recreational. The wild classification may have "limited range of agriculture and other resource uses permitted". Scenic classification says "wide range of agriculture and other resource uses may be permitted", and recreational classification reads, "full range of agriculture and other resource uses may be permitted". These restrictions permit resource uses within the corridor, and place no regulations on uses outside of the corridor area. We may stress preservation or enhancement of the river corridor, but not of the surrounding area for the purposes of this Act. This Act states:

> The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.

The stated purposes of the Act is to implement this policy. The Act does not state its purpose as providing recreational facilities for present and future generations, although recreation may be included in "other vital national conservation purposes."

The guidelines state that "despite some obvious similarities, the 'wildness' associated with a wild river area is not synonymous with the 'wildness' involved in wilderness classification". Administrators should concentrate on the management of the river corridor area, and not attempt

management of the outside area unless water quality or quantity is adversely affected. Consequences of either transportation or aesthetics outside the river corridor not affecting water quality or quantity should be of little concern to river management. The intent of the Act appears to be preservation of only the area needed to maintain the values of the river.

The Act allows some resource use (farming, timber harvest, and recreation), to take place within the corridor on certain of the classifications. The Act does not specify recreation as the dominant use of the rivers, but rather preservation in a "free flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes." The main management emphasis is nevertheless on recreation, but various other activities such as limited farming and timber harvest are allowed within the area. The Act allows a boundary with no more than an average of 320 acres per mile of river, and provides for scenic easements on private lands to protect the values for which the rivers were chosen. Within this boundary, any activity having an adverse aesthetic effect may be restricted.

The objective of the forest subproject is to critically examine the forest resource to assess the implications with regard to the selection of a river for the System. The primary objective will be to inventory and evaluate the timber resources of the basin and specifically in the areas that would be affected by classifying the river, using several alternative river classification schemes. Other objectives include identifying parameters linking timber production to system river status and identifying parameters that link timber production to other land management factors which in turn may affect system river selection.

Timber harvest and reproduction may have diverse effects on a system river, and road building and clearcutting may be curtailed on nearby areas. In recent years, some timber harvest activities have come under increased criticisms by concerned citizens. In turn, public land management organizations and private industry, reacting to the criticism, have taken a closer look at their harvest activities and have changed criteria for harvest techniques in some instances and changed land management plans in others. Special use zones have been set aside in which harvest, if conducted at all,

must be done in such a manner as to minimize the effects on aesthetics, water quality, or recreational experiences.

Timber harvest and associated activities that take place outside of the actual river corridor can affect a system river in several ways. For example, siltation of the river through logging or road building activity far removed from the river may take place, or an accidental dumping of diesel oil from streamside storage tanks may kill off the fishery, or nutritional enrichment of the streams may take place because of clear-cutting or burning activities. In most instances there already are laws or at least management policies that govern these actions, but enforcement is not always as stringent as it could be. The Act could be used as an added deterrent.

One function of the forest subproject is to review methods of obtaining a timber resource inventory to be used in the decision making process of selecting rivers for inclusion in the Wild and Scenic Rivers System. Besides the inventory, evaluation procedures will be discussed, and recommendations of methods for inventory and evaluation of rivers for inclusion in the national system will be made. The constraints placed on timber production and harvest by a system river will be identified and discussed.

The Salmon River basin is located in central Idaho and lies entirely within the state. With a drainage area of over 14,000 square miles, it is one of the largest drainage basins that lies entirely within one state. The river is approximately 425 miles long, originating in Idaho's beautiful Sawtooth Valley and emptying into the Snake River about 49 miles south of Lewiston, Idaho. The portion of the river specified for study by the Act is from the town of North Fork downstream to its confluence with the Snake, a distance of 237 miles. The elevation at the origin is about 8,000 feet, diminishing to 905 feet at its mouth. In the stretch of river designated as the "River of No Return" it falls an average of eight feet per mile, with many large rapids along the way. It is sought out and traveled as a "whitewater" river. Average discharge measured at Whitebird, Idaho, is 11,000 cfs with a range from 1,000 cfs - 100,000 cfs. Average annual runoff is 8,000,000 acre feet.

Rainfall within the basin varies from 7 inches at Challis to 50 inches high in the mountains. The basin is influenced by North-Pacific weather patterns, consequently moisture comes mostly in the form of snow during the winter months. In the lower reaches of the canyon, snow rarely stays on the ground more than a couple of days. Because of elevational and rainfall patterns, vegetational types vary from bunchgrass through subalpine types. Unique watershed problems are present in the form of the Idaho batholith with coarse, unstable granitic soils. Other areas in the basin are characterized by relatively stable soils.

Activities taking place in the drainage include agriculture, logging, mining, and an extensive recreational industry. Among the recreational pursuits are hunting, fishing, whitewater sports, hiking, pack trips, back country flying, jetboat trips, sightseeing, etc. The area is also rich in history and archeaologic value.

THE TEST CASE

METHODS

Qualification

In this study it is assumed that the Salmon River qualifies for system river classification. This assumption was based on the definitions as given in the Act, and the guidelines (16) that have been approved by the Secretaries of Agriculture and Interior.

Alternative Classifications

The river can be segmented into logical management areas. These areas need not coincide with their wild, scenic, or recreational qualification status. I segmented the river on the basis of the transportation system and the amounts of economic activity taking place near it as these two factors appear to be the main qualifying criteria.

Inventory

To inventory the timber resource for this study, I collected all available inventories from the various land management agencies, compared them with one another and chose those portions of the inventories that were relevant to the problem. Data were collected from the Forest Service, Bureau of Land Management, and the State Department of Public Lands.

To inventory the timber that would be affected by classification, I first looked at the area to determine where an inventory would be relevant. Extensive areas that did not have commercial stands of timber were immediately excluded from the inventory process. These included the area from Clayton to North Fork, and the area from approximately Berg Creek, mile 91, to the river's mouth. Primitive areas were also excluded because no harvest is permitted. These included the stretch of river from Horse Creek, mile 187, to Painter Mine, mile 140, and the South side of the river just upstream from the mouth of the Middle Fork, mile 199, down to Horse Creek. This includes the heaviest timbered area with the best stands along the Salmon River. The most heavily timbered area starts about at Sabe Creek, mile 169, and goes downstream to the Gaines Bar area, or about mile 142. The area upstream from Clayton was deleted because this area is under consideration for a National Park or National Recreation Area.

I inventoried the timber in an arbitrarily proposed 1/2 mile wide corridor by using Forest Service two inch-to-the-mile forest type maps and estimation of volumes of timber by applying the State Department of Forestry average volume figures for this part of the state to the inventoried areas. The magnitude of timber estimated was relatively small, so I decided a more intensive inventory was not justified.

Evaluation

Having found that the volume of timber that would be affected by including the Salmon in the System was relatively small, I checked the number of people that could be permanently employed in the primary industries of logging and milling by the yield from this amount of timber. This turned out to be no more than two employees or about $20,000 worth of labor value. I decided this amount of timber was insignificant to the industry as a whole, and did not carry out further evaluation. This represents approximately $90,000 to $180,000 gross value of merchandise, f.o.b. the mill, each year.

Resource Map

A resource map consisting of four base maps at a scale of 1:250,000 and Torene overlays was constructed. The base maps are U.S.G.S. maps of the state of Idaho depicting planimetric, topographic, ownership, and geologic features of Idaho. The overlays can be used in various combinations so that rapid visual checks can be made of the effects of various resource uses on each other. Implications of alternate resource management plans can also be rapidly visualized, and effects of compromises between plans can be seen. Overlays of other activities can easily be constructed to compliment this basic scheme.

TEST CASE - THE SALMON RIVER

Qualification

The Salmon River could qualify for a system river all the way from its headwaters to its mouth, a distance exceeding 425 miles! The Wild and Scenic Rivers Act stipulates that a river be free flowing and its adjacent lands have one or more of the following attributes: outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values.

The anadromous fish runs of the Salmon could qualify the entire Salmon River for system river classification for its outstandingly remarkable fisheries values! Besides this qualification, the Salmon River has many of the other named attributes in the Wild and Scenic Rivers Act: Scenery - outstandingly scenic throughout its length; Recreation - outstanding whitewater and wilderness floats, outstanding fishing for salmon and steelhead; Geologic - it flows through several geologic types, the Sawtooth Batholith, the Idaho Batholith, and the Columbia Basin Lava flows, and rare and precious minerals and hot springs are other unusual geologic phenomena; Wildlife - winter range for Bighorn sheep and mountain goats, outstanding chukar habitat; History - Sheepeater Indian war, Chief Joseph traveled through the area on his historic flight, Lewis and Clark termed the river impassable, mining activities have been quite important, especially on some of the tributaries; Archeaologic - traces of Indian culture dating back as far as 8,000 years are prevalent. There is no doubt that the river does have many qualifying attributes!

Alternate Classifications

Different stretches of river could qualify for different classifications. The stretch of river from the headwaters to Corn Creek, river mile 191, downstream from the town of North Fork has roads paralleling the river within 1/4 mile, as well as commercial establishments, towns, etc., and would qualify only for recreational classification. The alternate situation would be no classification.

From Corn Creek to Chittum Rapids, river mile 112, a distance of about 79 miles, the river is essentially without roads with the exception of two pioneer roads which meet the river at two places, Whitewater Ranch at river mile 152 and Mackay Bar at river mile 135. The road to Mackay Bar parallels the river up to the Painter Mine, a distance of about 4 miles. The segment from Corn Creek to Chittum Rapids would seem to qualify for wild river classification under the Act. Alternate classifications for this stretch would be scenic, recreational, and no classification.

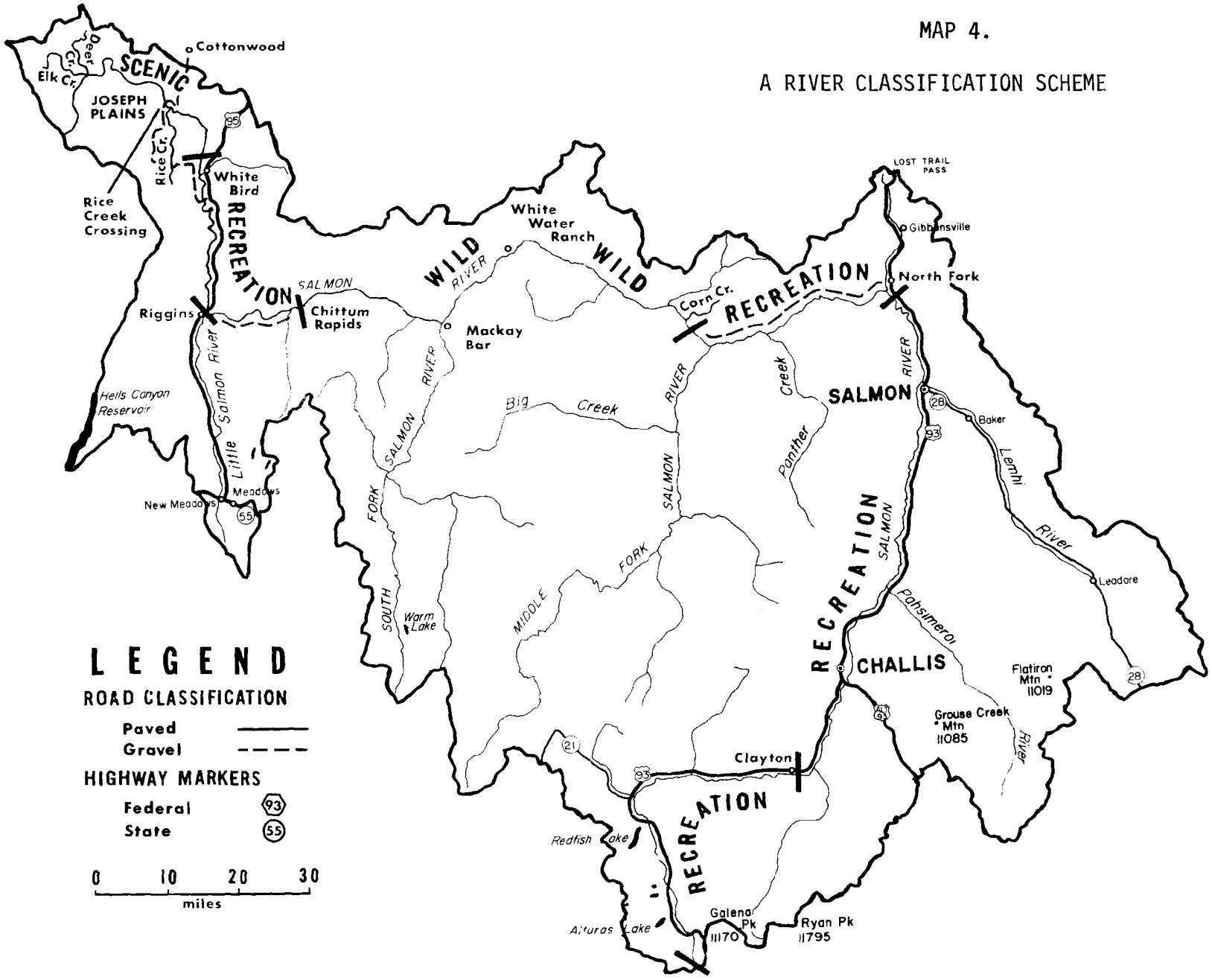
The segment from Chittum Rapids downstream to Riggins and then downstream to a few miles below Whitebird Creek, about river mile 50, has roads paralleling the river. This segment would qualify only for recreational classification. The alternative would be no classification.

The stretch of river from mile 50 to its mouth is a rather remote area again, with very few roads leading to the river. There are only two points of public access, where the road from Cottonwood to Joseph Plains crosses the river at Rice Creek, mile 37.5, and the unimproved road down Eagle Creek at river mile 13.5. This latter road then parallels the river from Deer Creek, about mile 14, down to the Wapshilla Creek area which is about mile 8. The road down Wapshilla Creek has been closed to public travel, and there are a few private roads down to ranches from the Joseph Plains area. In 50 miles of river through wild and rugged canyon land, there is a 12.5 mile stretch of river area without roads from Whitebird to Rice Creek, followed by a 23.5 mile stretch without roads from Rice Creek to Deer Creek. The last 5 to 8 miles of river are also without roads and flows through an extremely rugged canyon. At least 41 of this last 50 miles are without roads and the Eagle Creek road is far from a good road. Because of the outstanding steelhead and bass fishing, excellent chukar populations, and whitewater boating available, besides the outstanding scenic qualities of the sections without roads it may qualify for wild classification. This leaves alternatives of scenic, recreational, and no classification.

One way the Salmon could be segmented is shown by Map 4. Headwaters to Clayton - the river is a prime spawning area for anadromous fish, and the surrounding area is presently under consideration as a National Recreation Area attesting to its outstanding recreational values. Clayton

MAP 4.

A RIVER CLASSIFICATION SCHEME



to North Fork - U.S. 93 follows the river canyon, farms and recreational developments are everywhere in evidence, and the scenery is not as spectacular as the first segment. North Fork to Corn Creek - the river is paralleled by a lower standard road, and economic and recreational development activities are not as prevelant as the previous segment as the river begins to cut its way westward through steep canyons. Corn Creek to Chittum Rapids - this is a stretch of river without roads except for two low standard dirt roads meeting the river at Whitewater Ranch and Mackay Bar. Chittum Rapids to Riggins - the river is paralleled by a gravelled road with evidence of man more prevelant. Riggins to Whitebird Creek - the river is paralleled by U.S. 95 and in places this highway has encroached upon the river. Whitebird Creek to the confluence with the Snake - an area with few roads through sparsely populated lands.

Using these seven river segments and all the classifications for which they qualify, the numbers of possible combinations of river classification alternatives becomes unwieldly. For this report I will use a few of the more restrictive classifications first to see what effect system river classification will have on timber harvest.

Table 1 shows alternate river classification plans considered for this report.

TABLE 1

Alternative River Classification
Used in Forest Subproject

Mgt. Plan	Headwaters-Clayton	Clayton-N. Fork	N. Fork-Corn Cr.	Corn Cr.-Chittum Rapids	Chittum Rapids-Riggins	Riggins-Whitebird Creek	Whitebird Creek - Mouth
1	Rec	Rec	Rec	Wild	Rec	Rec	Scenic
2	No Class	No Class	Rec	Scenic	Rec	No Class	Scenic
3	No Class	No Class	No Class	No Class	No Class	No Class	No Class

Salmon Basin Inventory

The forest inventory of the Salmon River Basin was completed by contacting the various agencies managing lands in the basin. Table 2

TABLE 2

Forest Inventory, MMBF[1], of Salmon River Drainage by Owner and by Species

(Excluding Primitive Areas)

National Forest[2]	Douglas-fir, Larch	Ponderosa Pine	Lodgepole Pine	Spruce	True Firs	Other & Mixed	Total
Boise	1,257.5	318.7	137.2	497.9	537.0	61.7	2,810.0
Challis	3,395.4	295.0	--	1,353.2	518.3	43.6	5,605.5
Nezperce	620.2	109.9	103.3	70.7	97.6	56.2	1,057.9
Payette	1,955.1	1,248.3	397.1	1,501.8	1,616.2	12.4	6,730.9
Salmon	2,922.4	397.4	521.3	293.8	576.7	123.8	4,835.4
Sawtooth	449.7	--	162.6	178.4	80.2	48.5	919.4
	10,600.3	2,369.3	1,321.5	3,895.8	3,426.0	346.2	21,959.1
Bureau of Land Mgt.[2]	168.4	6.6	24.7	7.4	3.3	--	210.4
State of Idaho[3]	271.2[5]	151.8	6.4	--	--	--	429.4
Private[4]	--	--	--	--	--	--	--
TOTAL	11,039.9	2,527.7	1,352.6	3,903.2	3,429.3	346.2	22,598.9

1 - MMBF - million board feet

2 - ± 10% within/ 1 standard deviation

3 - ± 5% within/ 1 standard deviation

4 - no figures, but an insignificant portion of total

5 - mixed species, mostly DF

shows all sawtimber, 9" dbh*, or larger located within the Salmon River drainage on unreserved commercial forest lands.

Commercial forest land is defined differently depending on the agency. The State of Idaho defines commercial forest as land capable of producing usable crops of wood, economically available now or prospectively, and not withdrawn from timber utilization. Their general guide is a site capable of producing five inches of dbh growth in 100 years. Reserved lands are those lands withdrawn from multiple-use management for primitive or wilderness areas, wild rivers, and parks, and the like. All private lands within national forest boundaries are included in the Forest Service survey figures.

I did not collect data on the other forested private lands in the Salmon River drainage. These lands represent an insignificant portion of forested lands within the drainage. The amount of field work required to collect these data would not be justified by the increase in accuracy of the report.

A recent soil and hydrologic reconnaisance survey in the Salmon River Breaks Primitive Area (20) indicates that there are problems with lands along the Salmon River as far as timber harvest and growth are concerned. It is not unreasonable to extrapolate data from this study for another thirty miles downstream as this area also consists of Idaho Batholith, and landform and vegetation types are similar. The study shows that most of the area within 1/4-mile of the river fall into soil-land types 9, 13, 14, and R. Following are tables from this reconnaisance study.

If one were to use just these tables as a guide to timber harvest along the Salmon River, the potential would not be rated high.

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*diameter breast high, approximately 4.5 feet above the ground.

Table 3, Vegetative Potentials

Soil-Land Types (1)	Timber Productivity Potentials (2)	Browse Productivity Potentials (3)	Site Limitations to Reforestation (4)
1	Very Low	Very Low	Severe; cold climate
2	High	Low	Slight; vegetative competition
2G	Moderate	Moderate	Moderate; vegetative competition
3	Moderate & High	High	Moderate; E/T potentials, low moisture holding capacity, vegetative competition, high
3G	Moderate	High	Moderate; vegetative competition
4	Low	High	Severe; low moisture holding capacity, high E/T potentials
5	Moderate	Very High	High; low moisture holding potentials, vegetative competition, high E/T potentials
5G	Low	Very High	High; vegetative competition
6	Low	Low	Slight; cold climate
7	Very Low	Moderate	High; low moisture holding potentials, vegetative competition, high E/T potentals
8	Low	Moderate	High; low moisture holding potentials
9	Low	High	Very severe; low moisture holding potentials, very high E/T potentials
13	Moderate	High	High; very high E/T potentials
15	Very High	Moderate	Slight; vegetative competition
16	High	Low	Slight; vegetative competition
17	High	Low & Moderate	Slight; vegetative competition
Land Types			
14	Very Low	Very High	Very severe; low moisture holding potentials, very high E/T potentials
H	Very Low	Very Low	Severe; cold climate
C	Very Low	Very Low	Severe; cold climate
R	Very Low	High	Same as No. 14

Table 4, Soil Stabilization Guides

Soil-Land Types (1)	Road Cut Slopes (2)	Roadbeds (3)	Timber Harvest (4)
9	Cut ratio near vertical-Do not attempt to vegetate	(1) Inslope, cross drain into natural drainageways, (2) berm fills, wearing necessary, concentrate & remove runoff at slow velocities	Skid upward, very gentle gradients, short reaches, maintain 50% crown canopy & 95% of present low cover per acre
13	Cut ratios near 3/4:1, seed, fetilize & mulch	Same as 9	Skid upward, gentle gradients, water bar & revegetate firebreaks & skid trails
Land Types			
14	Same as 9	Same as 9	Not applicable, generally
R	Same as 9	Same as 9	Not applicable, generally

Table 5, Stability Hazards

Soil-Land Types (1)	Erosion Hazards			Road Cut Mass Failure Hazard (5)	Surface Dry Creep (Unraveling of Natural Surfaces) (6)
	Natural Surfaces (2)	Road Cuts and Fills (3)	Roadbeds and Skid Trails (4)		
9	Very High	Very High	Very High	Moderate	Very High
13	Very High	High	Very High	Moderate	High
Land Types					
14	Very High	Very High	Very High	High	Very High
R	Very High	Very High	Very High	High	Very High

Table 6 shows the estimated amount of timber involved in a corridor extending one quarter of a mile on either side of the river.

TABLE 6

Estimate of Timber Volumes in a Proposed Corridor
Along the Study Portion of the Salmon River
(Primitive Areas Excluded)

Species	Acres	Volumes (MBF)*			Estimated Loggable Volume (MBF)	
		Low Estimate	High Estimate	Probable Est.	Low	High
Douglas-fir	2,040	6,450	46,100	16,350	1,650	6,600
Ponderosa Pine	2,050	10,250	75,950	26,700	2,650	10,600
TOTALS	4,090	16,700	122,050	43,050	4,300	17,200

Acreage - estimate by dot grid count on Forest Service Timber Inventory maps, 2" = 1 mile.

Volumes -

Low - Using Idaho State Department of Public Land estimate for average low volumes in Eastern and Southwestern Idaho, whichever was most appropriate.

High - same as above only high volumes.

Probable - Using personal observations, including some increment borings to indicate site quality along the river.

Loggable Timber - The timber within this corridor is mainly located on steep canyon walls or rocky outcrops with soils and moderately sparse vegetative cover which make logging questionable. I estimated that from 10-40% of the timberland is suitable for logging, with the lower end of the scale being more likely.

*MBF - thousand board feet.

The actual amount of timber in this corridor is probably closer to the lower end of the range than the higher. The sites are, in general, very poor, except on the bars next to the river. I classify the sites as poor from visual observation and by random increment borings made in trees

along the river. I would estimate that 60-90 percent of this timber is not loggable due to steep rocky slopes, potential watershed damage and restrictions of today's logging methods.

To put these volumes in perspective I checked the records of timber sales over the past few years in the national forests in the Salmon River drainage.

TABLE 7

Timber Sale Size in or adjacent to Salmon River Drainage

Years - 1966, 1968, 1969

Volumes in MMBF				Value in Thousands of dollars		
National Forest	Range			Average	Low	High
	Average	Low	High			
Boise	3.75	0.4	6.9	7.4	3.3	12.2
Challis	1.81	0.3	5.0	6.4	2.1	26.8
Nezperce	4.61	0.3	16.4	27.2	3.3	149.8
Payette	6.07	0.2	26.0	73.4	2.1	490.3
Salmon	4.23	0.2	13.5	35.9	2.5	373.0
Sawtooth	1.6	1.4	2.0	9.5	2.7	4.0

The sales varied in size from approximately 200 MBF to 26 MMBF. The volume of loggable timber in the corridor (4.3 MMBF to 17.2 MMBF) could be included within a single timber sale! Even if all sites were capable of producing 200 board feet of growth per year, only about 820 MBF per year would be produced on the corridor area. The average logging production per man year in Idaho is approximately one MMBF. Thus, logging of the annual growth of timber in the corridor would employ less than one man year per year in the logging industry. In this area, timber production is less, on the average, than the figure used in the example. This 820 MBF

is theoretically capable of supporting slightly more than two employees (21) in the logging and milling industry on a sustained yield basis.

This accounts for the magnitude of timber that would be included in a legal boundary, and not necessarily for the timber that would be affected by including the river in the system. Let us review how the harvest of timber might be affected along this particular river, taking into account all physical and administrative constraints. While it is true that without river classification some logging restraints may be overcome sometime in the future, it is doubtful that much of the area described is presently included as a portion of the allowable cut in present management plans, although some of it is included as conditional allowable cut.

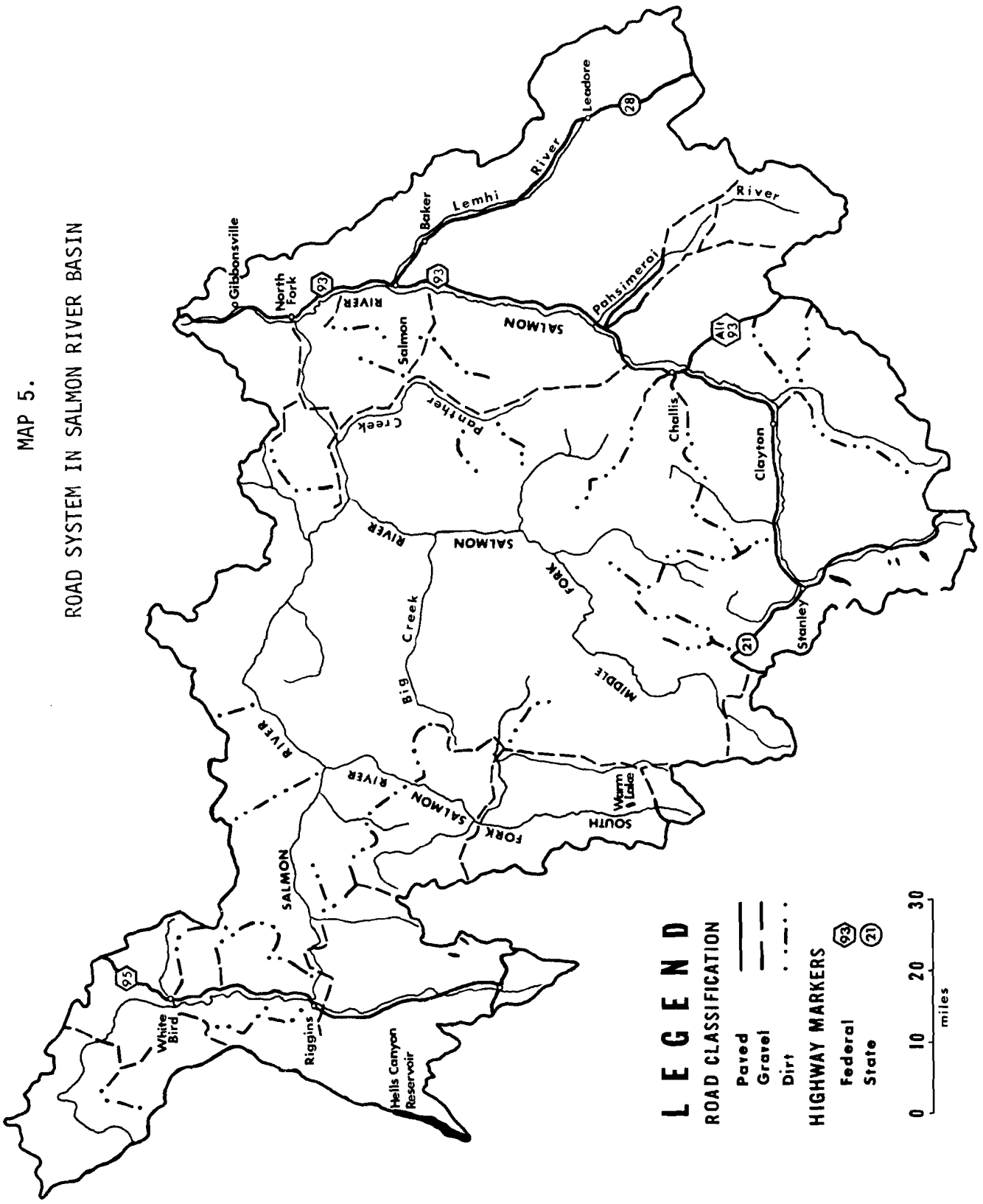
Along the portions of river being considered only for recreational classification, (North Fork-Corn Creek and Chittum Rapids-Riggins) present roads are adequate to transport logs from the forest to the primary manufacturing plants. If existing roads need improvement to make them safer to travel I see nothing in the Act to prevent this, as long as the river is not disturbed. Along the roaded stretches of the river, access to the higher elevations, the productive forest areas, could be obtained by building roads up the larger draws without detracting from the aesthetics along the river. Examples are the Allison Creek, French Creek, Panther Creek and Colson Creek roads.

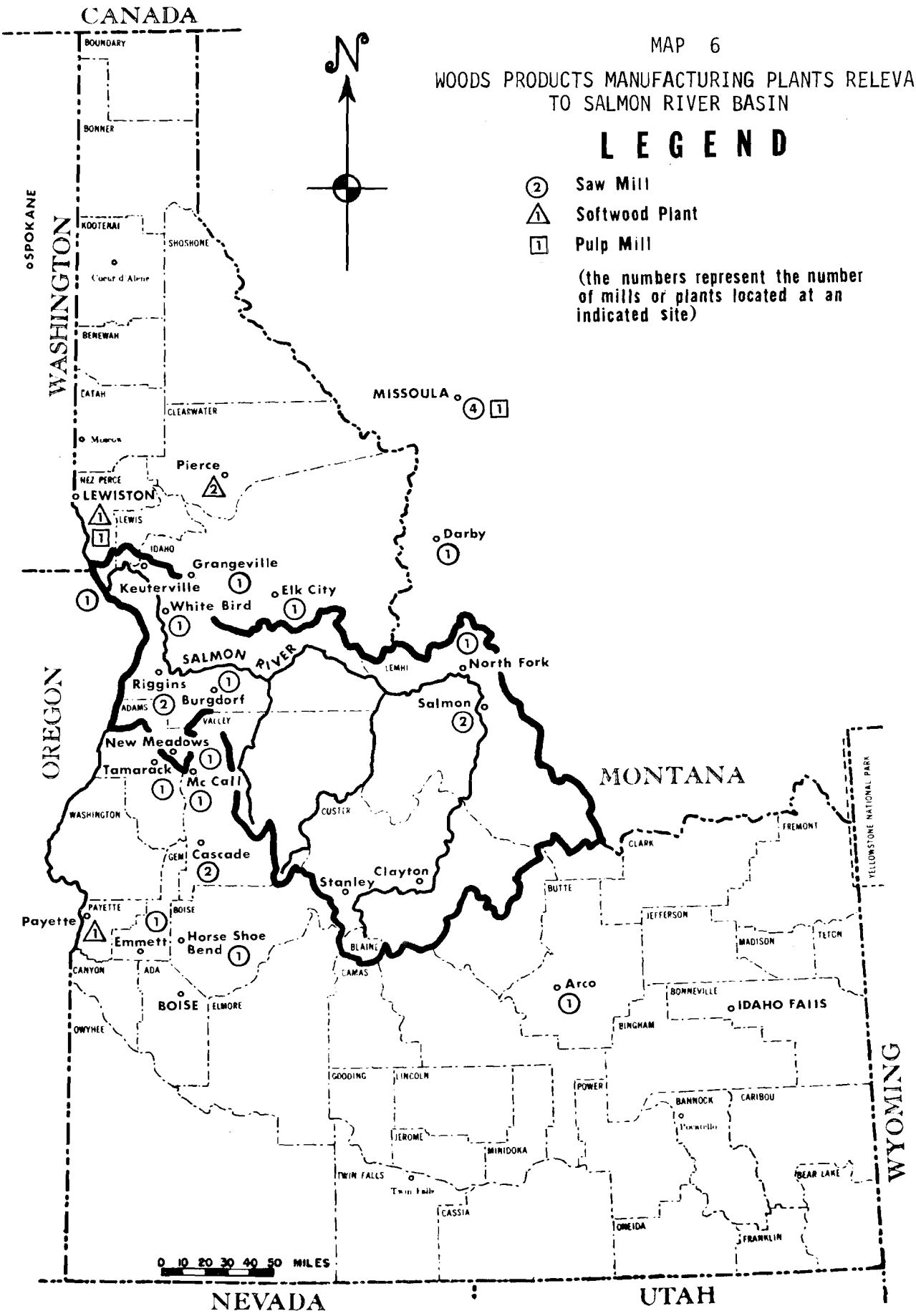
Recreational classification would have little effect on timber harvest activities within the corridor, much less in the river basin. Clearcutting may be prohibited within the corridor, but not outside. Along the Salmon, this type of harvest would not likely be used because of physical restraints, if the land is being properly managed. Therefore, harvest of timber would not be unduly restricted along the recreational classified area of the Salmon River because of type of harvest.

If harvest of timber will not be appreciably affected along the roaded stretches of the river, what will be the effects along unroaded areas which may be classified as wild? This is the stretch of river from Painter Mine to Chittum Rapids, river mile 139 to 112, a distance of 27 miles. There actually is a road going from Mackay Bar up to Elk City so even this area is not without a road, but the road definitely is low standard

MAP 5.

ROAD SYSTEM IN SALMON RIVER BASIN





MAP 6

WOODS PRODUCTS MANUFACTURING PLANTS RELEVANT TO SALMON RIVER BASIN

LEGEND

- (2) Saw Mill
- △1 Softwood Plant
- [1] Pulp Mill

(the numbers represent the number of mills or plants located at an indicated site)

and remote. Another segment without a road is from Corn Creek to Horse Creek, a distance of about 4 miles. There are difficulties with building a road there in that there is primitive area on one side of the river and rock cliffs on the other. The present road already adequately services the entrance to the primitive area, and there is not enough timber available to warrant a road. Therefore, I will consider only the segment from river mile 139 to river mile 112.

There are roads coming in from the upper portions of the drainage to within 10 miles or less of the river. It appears that timber harvest might be better facilitated by utilizing these upper roads leading to the primary manufacturing plants, (Elk City, Grangeville, McCall, and Riggins) regardless of whether or not a river road were to be developed.

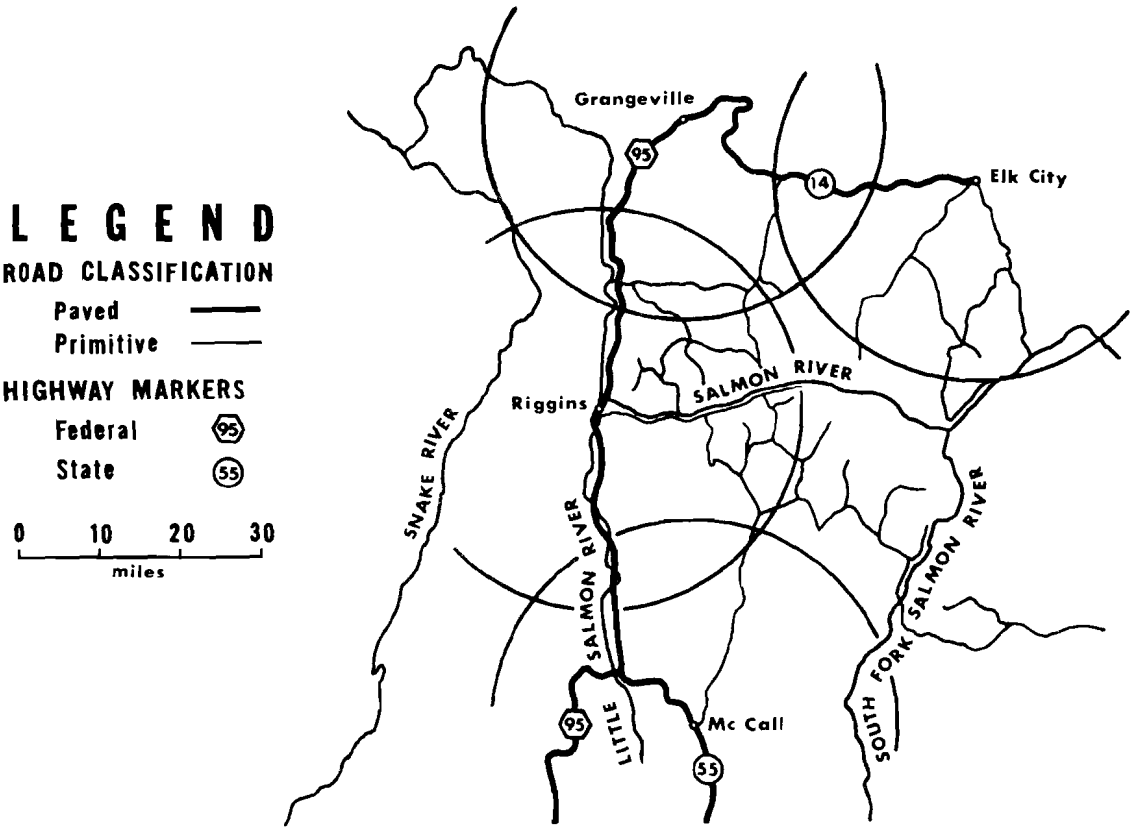


Fig. 1, Distance of River from Manufacturing Plants

Figure 1 shows the location of some of the sawmills utilizing Salmon Basin timber. Also shown are 25 mile radii around these manufacturing plants. If a distance of three miles of log haul for every mile of horizontal distance from the sawmill was assumed, then the longest haul within the radii would be less than 75 miles. This is a common haul distance. Therefore, lack of a road along this portion of river will not restrict harvest of timber, but may affect its destination for manufacture and stumpage value.

The scenic area, from Whitebird to the mouth, does not have enough timber within the corridor area to warrant discussion, and the problems of transportation would be lessened because occasional roads would be allowed to transverse the area, and there would be lesser restrictions on harvest.

Summary

Because of the nature of the Salmon River and its physical and administrative constraints, the amount of timber that would be affected by river classification is negligible. To sum up this section, the better timberlands in the Salmon River basin from volume, harvest, and growth potential viewpoint, are away from the riverbreak area in the higher elevations. Here there are better soils, more moisture, and gentler terrain. The transportation system then would be the limiting criteria to harvest, if any. The maximum impact on the area, as shown in Table 6, is relatively small. The transportation system will not be limiting, but physical and administrative constraints are limiting factors. This discussion was based on management plan number one, the most restrictive of the three plans proposed for this study. The conclusion that could be drawn from the discussion is that classification of the river would have little effect on the timber industry of Idaho, or of Idaho County. The most that it might affect would be employment of two men in the logging and manufacturing industries on a sustained yield basis, and may make some of the timber outside the corridor more expensive to harvest. If this most restrictive of river management plans has little effect on the industry, the less restrictive plans would not have a greater effect, and lesser impacts would be irrelevant to determine. Therefore, it would

be redundant to go through the analysis of the alternate management plans for this particular river.

The timber industry would be affected if logging traffic were prohibited on the roads along a classified river, but there is nothing in the Act which would cause this type of conflict to take place. Therefore, the effects of classification of the Salmon River on the timber industry of Idaho would be negligible.

METHODOLOGY

The methodology section will deal with the succession of steps that should be used in relating timber production potential to river classification. Included will be several steps not used in the test case, but which should be used if river classification would significantly affect timber production in the area.

Qualification

A decision as to whether the river qualifies for classification should be made as indicated in the methods section.

Alternative Classification Plans

Examine the entire river system and decide whether the river has the necessary qualifications for the given classifications. If a river qualifies for wild classification, then it automatically qualifies for scenic or recreational classification; and these three alternative plans should all be considered. Another alternative plan to use is no classification. A river may segment into several classifications nicely, a portion wild, the rest recreational (Selway in Idaho), and this presents other alternative plans to study. Out of all the combinations of plans, select a classification or a series of classifications to consider for a particular river.

Relation of Classification to Resource Use

Each plan will place different constraints on the activities that can take place either in the corridor or its near proximity, and may change the volume of timber affected. The alternative classification plans should be compatible with other resource uses of the river. All resource studies should use the same sets of alternative plans so that they can be readily compared in the final phases of the study.

If a proposed river flows through a wilderness area, consideration in a recreational classification would not be a viable alternative. The more restrictive administrative policy of wilderness management would not allow improvements of impoundments of any sort in the area, whether or not the river was included in the system. There would be no roads, no

timber harvest, and the river would logically be classified as wild.

Inventory

Potential system river status presents unique problems for resource inventories. To obtain the data needed for the proposed alternative corridors and associated areas, an original inventory needs to be made. This original inventory must be made because of the nature of the rivers proposed boundary as dictated by chosen alternative river plans.

Forest inventories are usually conducted in the basis of rectangular survey coordinates, and do not follow the wandering course of a river. Consequently, the available inventories will not be suitable for obtaining river corridor inventory data.

The wild and scenic river boundaries can be outlined on aerial photographs for the alternative plans. The next step would be to outline those areas on which timber harvest is not a reasonable activity. These would be areas such as wilderness or primitive areas, recreation sites, travel influence zones, watershed protection zones, noncommercial forests, and areas with administrative restraints. The areas that remain then can be inventoried using photogrammetric procedures. The technique may vary slightly in different parts of the country but photogrammetric guidelines and procedures for each area are available through either the Forest Service or the Bureau of Land Management. Good sources to use to become familiar with these techniques are Avery (2) (3), Spurr (13), and the Manual of Photographic Interpretation (1).

Determine areas outside of the actual corridor that might be affected by these plans, as well as the manner in which the areas are affected. An example would be timber outside of the corridor that could not be harvested because a wild classification precludes road building. Areas requiring scenic easements should also be noted, as well as areas in which cost of harvest may be increased because of river classification. Logging may be allowed only during certain times of the year, when tourist traffic is low, or more indirect transportation systems may be developed to haul the logs to manufacturing points.

Projections

In projecting the values for these timber producing lands, the productivity potential of the land needs to known, as well as the age and size of the growing timber. For this study project activity will be projected to the year 2020 to be consistent with dates used in the PNWRBC study.

Timber is different from some of the other resources, such as minerals, in that its growth and maturing rates are fairly constant over long periods of time, and unless the timber is destroyed through other means such as fire, growth will remain fairly constant despite other activities taking place around it. Timber growth will not increase at exponential rate such as recreational use might, making the projections subject mainly to statistical errors or changes. The economic impact of river classification can readily be assessed from an inventory of the productive capacity of lands and the restrictions of harvest due to river classification.

Value Base

There are several bases that can be used for valuation of timber and timberlands: the cost value, the expectation value, and the market value. The cost value is essentially the replacement value of the resource. It is easy to use and understand because it uses past costs and prices, and because these are tangible values they are sometimes preferred. Cost value does not take into account present market values or future returns.

The expectation value is based on the productivity of the land and takes into account the costs of land, regeneration, and other management costs besides the expected value of the timber at the time of sale. Expectation values are most often used when purchasing land for timber production purposes. Expected values are discounted to present values.

Market value is based on the present worth of timberland. It is the price that would be agreed on by a willing seller and willing buyer, both fully knowledgeable of the situation, acting for their own interests. It could also be defined as the competitively established price which represents the present worth and rights to future benefits, considering the land's highest and best use. Whatever the case, it is difficult

to arrive at a market value without actually selling the piece of ground in question because of all the variations in land and timber. Even comparing it to nearby pieces of real estate that have recently been sold does not necessarily give a good estimate of market value, as no two pieces of ground are identical nor are any two buyers and sellers identical.

To evaluate timber or timberland in conjunction with a candidate river, the expectation value base is the best to use. Present worth and future worth are calculated and used in an analysis of resource use. This procedure makes the evaluator more aware of alternate uses, possible changes in resource use, market value changes and in intensity of use or management.

Economic Base

An economic base will need to be defined to which comparison of the findings of the river inventory can be made. The investigator will have to decide what this comparison base will be, as it will change from river to river. If a 25-mile stretch of river is located entirely within a county, or a single national forest, then either of these units would make a good base. If a river flows between or through two states, and through lands managed by several agencies plus private owners, then the best base may be either the two-state area or even an entire region (southwest, northwest, northeast, etc.). Since economic data follow political boundaries, (state, county, etc.), it is often more convenient to use political units for developing an economic base for making comparisons.

The economic base that I recommend would include areas that will be directly affected by classification of a river. The investigator will need to identify where the timber products would be shipped for manufacturing, and include those counties affected by withdrawal of this timber from harvest as his initial base of comparison. Other areas can also be used as auxiliary bases, such as comparing the gain or loss of economic activity due to river classification to the state's economy. Generally speaking, if the nation were used as a base for comparison, the reduction in the timber economy for any given river would be very small, whereas from a county perspective, it may be very large. If we are looking at the rivers from a national point of view, then any economic values foregone to pre-

serve a river may be insignificant. If we look at it from the viewpoint of the state economy, it may be significant and if from a county base, more significant yet.

Resource Management Map

A map that can quickly and easily show the implications of various management alternatives is very helpful. The use of base maps with specific overlays is an excellent way of showing effects of combined resource activities. For this study the resource management map includes the entire river basin but this has proved to be somewhat inconvenient in that various activities exceeded these boundaries in some cases and was much more restricted in others. The map should include relevant areas for each resource activity, and should not be confined to specific geographic, hydrologic, or political boundaries.

Evaluation of the Resource

Using the classification plan developed for the river area, the amount of timber harvested in each year in the affected area can be calculated. An average yearly sustained yield is calculated, and then the values over the projection period can be discounted to present day values to estimate the impact of the timber industry on the economy. This is using the expectation value method of appraisal.

Value of timber on the land is known as stumpage. Stumpage prices vary considerably but tend to stabilize in the lower values if taken over a long period of time. For instance, in the Nez Perce National Forest, in the period from 1965-1969 the average stumpage price of Douglas-fir (Pseudotsuga menziesii var. glauca) was $13.00/MBF with average values ranging from $2.00/MBF to about $35.00/MBF. This is a price spread of approximately eighteen times! Stumpage rates vary not only with market conditions, but also with location of the timber. One of the most notable variances is presence or absence of roads. Stumpage rates to use for valuation should be long term averages, and it would be most realistic to use a range of values.

Another valuation point is the price of lumber, f.o.b. the mill. This is a measure of the impact of any timber withdrawals on the timber economy of the counties involved, and would provide a direct imput for

an input-output analysis of the regional economy. Present day prices should be used to valuate this point of economic activity.

Another factor to consider is employment. If twelve workers were unemployed because the resource base was removed from production, and they were not employable in a replacement industry or some other location in the same industry, it could be quite significant to a small community. From a regional viewpoint, twelve families unemployed may still be of some concern, but they may be insignificant from a national viewpoint. Gains and losses in employment should be accounted for when considering a river for classification.

Another factor would be the purpose of the valuation, and how far you wished to follow the impact of the resource management decision. This would depend on how far the effect was significant, analagous to the employment situation mentioned above. Removing a source of timber from production for preservation purposes will always have an effect on a local community, and may be substantial enough to alter regional development plans. However, the Act is a federal law and as such the proper perspective for the studies might be a national perspective. If this is the case the study may not have to be very refined, but should be more tuned to producing the "lost" resources in alternate areas in the nation. Development of alternate management plans on a broader scale is an approach to consider.

To estimate benefits foregone in timberland for classification of a river, I devised a simple scheme which gives a rough estimate of the value of timberland based solely on yield per acre per year.

On a yearly basis, assuming 40 MBF feet per acre and a 100 year rotation as shown in Table 8, the net productive rate is in the neighborhood of $0.80 - $8.00 per acre, per year, and this is on highly productive forest soil! Capitalizing this at 6 percent to perpetuity indicates a value of $13.30 to $1330 per acre, based on productive returns to land. This wide disparity in value is due to the extreme percentage change in value of stumpage. Table 8 is an example of how a table can be constructed for any area to give a quick overview of the worth of timberland over a relevant range of figures. A similar table can be quickly constructed for any locale.

I selected these particular values to coincide with the Inland Empire region (parts of Idaho, Montana, and Washington). For high yield Pacific Coast sites the table simply needs to be lengthened to include higher volumes per acre. From this table one can get an estimation of value of land for timber production simply by choosing the most likely volume per acre, stumpage price, and length of rotation, obtaining the net value per year and dividing by the interest rate of your choice. This is simply using the standard capitalization formula to deduce present worth of forest land. Then multiplying by the number of acres in each production classification you can arrive at the "timber" opportunity cost of including the river in the system.

TABLE 8

Value of an acre of timber at various volumes and stumpage prices; and net gain per acre per year at those volumes and stumpages, using varying length rotations.

Volume/Acre (MBF)	Rotation Length (Years)	Stumpage Price							
		$2/MBF		$8/MBF		$14/MBF		$20/MBF	
		Value		Value		Value		Value	
		Per Yr.	Total	Per Yr.	Total	Per Yr.	Total	Per Yr.	Total
10	80	.25	$ 20	1.00	$ 80	1.75	$140	2.50	$200
	100	.20		.80		1.40		2.00	
	120	.17		.67		1.17		1.67	
20	80	.50	$ 40	2.00	$160	3.50	$280	5.00	$400
	100	.40		1.60		2.80		4.00	
	120	.33		1.33		2.33		3.33	
30	80	.75	$ 60	3.00	$240	5.25	$420	7.50	$600
	100	.60		2.40		4.20		6.00	
	120	.50		2.00		3.50		5.00	
40	80	1.00	$ 80	4.00	$320	7.00	$560	10.00	$800
	100	.80		3.20		5.60		8.00	
	120	.67		2.67		4.67		6.67	

DISCUSSION

Landform

Timber harvest will have varying impacts on system rivers depending on type of harvest used and the general physiography of the area. One type of river basin is typified by the Suwannee, a river flowing across relatively flat lands. Lack of relief does not allow you to see any great distance, especially if there is vegetation present that is six feet high or taller. This vegetation also effectively screens out noise. A river meeting this type of description in Idaho might be the upper Salmon River above Obsidian.

Another basic type of river basin is a broad river valley with high mountain ranges paralleling the river, such as the lower Skagit in Washington, the Shenendoah in Virginia, and the Moyie or Priest in Idaho. Even though the hillsides are more than 1/4 mile (distant from the river), any activity on the hillsides is readily seen from the river. The hills provide scenery that is an important part of the river environment. Specialized timber operations or landscape architecture would be needed if any timber harvest were to take place and not despoil the view from the river.

The third basic type is the steep walled canyon or deeply incised canyon typified by the Colorado River through the Grand Canyon, or the Bruneau or Salmon rivers in Idaho. Timber harvest likely could not take place because of erosion problems and difficulty of harvest. Once above the canyon walls and beyond the 1/4 mile distance, activities could be carried on normally without being seen or heard by the river users below.

The Idaho rivers that have been selected for the Wild and Scenic Rivers System and those selected for study rivers fit best into the latter two categories, and most of them actually fit into both categories at some place along their length.

Silvics and Reproduction

The species that are desired for future timber yields or for aesthetic or recreational purposes have some effect on type of timber

harvest that will be chosen. For instance, in western forests, Lodgepole Pine (Pinus contorta) requires a lot of sunlight, as does Ponderosa Pine (Pinus ponderosa). The inland Douglas-fir (P. menziesii var. glauca) will grow under some shade, but will also grow in full sunlight. Hemlock (Tsuga heterophylla), western redcedar (Thuja plicata) and the true Firs (Abies sp.) are the most shade tolerant, and will have difficulty in growing in full sunlight. Clearcuts favor the more light tolerant species, and selective cuts favor the more shade tolerant species.

Site conditions also have an influence on the type of species regenerated. A moist loamy soil on a north or east slope would favor the more shade and moisture tolerant species, whereas a south slope with sandy, well drained soils would favor seral species.

Methods of regeneration vary from site to site, but there are three basic types: Natural regeneration, seeding, and planting seedlings. Site preparation consists of treatment to make favorable conditions for regeneration. It includes such as: The disturbance caused by logging exposing adequate mineral soil for reproduction, burning to reduce competition (grasses, herbaceous vegetation, shrubs and duff), scarifying by machinery to reduce competition and expose mineral soil, terracing to provide an open seedbed and water catchment basins for seedlings, and removal of competition and duff by hand in the localized area to be planted. Which site preparation technique and method of regeneration to use depends on desired management of the area.

Cultural practices could be used to enhance the recreational and aesthetic experiences along a wild and scenic river. Practices such as thinning to reduce the numbers of stems per acre and to reduce competition for the more vigorous trees, and pruning to remove dead branches to improve the remaining stand aesthetically and make if safer for recreation may be desirable. Removal of dead or dying trees would help from both an aesthetic and a safety standpoint, and removal of insect infested or dead trees would help to maintain the health of the rest of the forest. Use of these types of cultural practices should be considered in making management plans for system river areas.

Harvest Methods

Clearcutting:

There are several methods of timber harvest that can be used in the Intermountain West. Probably the best known is the clearcut method. In a clearcut, all trees of merchantable size are removed from the area to be harvested. When applied in the proper situation it is a very desirable method of harvest and reproduction. A stand can be removed and a new one established with the desired species in a comparatively short period of time. At the same time, risk of infection of insect and disease from the residual stand is reduced. The new stand then should be able to attain a healthy, vigorous state rapidly, which in turn helps make it resistant to insect and disease damage.

Selective Cutting:

On the other end of the scale of timber harvest types is the selective cut method. Under some conditions, only a few of the trees on a given area are selected to be cut at any time. Instead of being cut every 80 to 115 years, a given piece of ground could have a few trees cut from it every 5 to 10 years. The trees to be cut are selected by various criteria, the foremost being size, but also taken into account are: form, disease or insect incidence, breakage due to natural factors, position in the canopy, and spacing of the trees. Selective harvest may also mean cutting to a given diameter limit, for instance, cutting everything above fifteen inches dbh. This could leave only a few trees per acre and still be called a selective cut.

Other Harvest Methods:

In between clearcutting and selective cutting are many different variations of harvest that are distinct enough to warrant their own names, but that intergrade enough to make it difficult to identify which type of harvest is being used at any particular site. This intergradation of harvest methods is desirable, because situations on the ground are not uniform, each one calling for a specialized harvest. One method is the shelterwood system in which enough of the overstory is left to provide a seed source and wind and sun protection. The timber left for

shelter, which will consist of a substantial portion of the stand, is then cut after the understory is established and well on its way. Another type of harvest is seed tree cutting, in which 6 to 20 trees per acre are left to provide a uniform seed source. The trees left are selected because they are genetically superior, they have good form and are fast growing. After the new stand is established the seed trees are removed. Group selection is another type in which groups of trees are removed, essentially creating mini-clearcuts. Each one of the types of timber harvest have their advantages and disadvantages, and each is best suited for different situations.

Logging Techniques

Techniques:

The predominant logging techniques are: tractor skidding, jammer skidding; cable logging, including high-lead, skyline, and balloon logging; and feller-buncher operations. The forestry profession, and critics of the profession, often look to logging techniques to solve management problems, where in actuality the problems may arise because of harvest method.

In recent years great advances in logging techniques have taken place, among them being balloon logging operations, radio-operated carriages on skylines, and practical feller-buncher types of machines. Meanwhile the older techniques continue to be applied in varying circumstances.

Tractor skidding is applicable in many situations, especially on flat, stable ground. The addition of the speed of the rubber-tired skidder helps to make this the least expensive of the skidding techniques. An advantage is low investment in machinery.

Jammer skidding has the same advantages as tractor skidding except it has its advantages on steep ground. Although it may no longer be desirable to plan to log an area entirely by jammer skidding, there are still applications in which it is both practical and economical to use. A disadvantage of jammer skidding is that it can not cover long distances, and many roads are required on steep slopes in order to log with this technique.

Cable logging has the advantage of covering long distances, thereby cutting down on the number of roads needed, and is applicable to very rough terrain. Generally speaking there are very high investments involved in this technique. In recent years experiments with skyline and balloon logging show promise for selective cut application. Given proper terrain, these techniques can logistically be used in a selective cut operation. It then becomes a matter of whether it can be done economically.

Feller-buncher machines are a recent advancement in harvest techniques. One man, operating one machine, selects the tree to be cut, cuts it, and guides it to the ground. Some machines even limb the trees, cut off the tops, and stack the logs in piles where they are easily picked up and loaded. Most of these machines require relatively flat ground.

Summarizing, there are various methods of harvest that are available to the forester, along with many different techniques of harvest. Each situation in the forest is different, and harvest method and technique should be fitted to each situation. As management objectives change, such as a desire to maintain aesthetic qualities near a system river, or overlooking a scenic valley, the method and technique of cutting can be manipulated to fulfill this objective.

Operational Costs:

A brief word on costs is appropriate. In general, skidding costs increase as more sophisticated methods of skidding are used because of increases in capital investment. The most inexpensive method is tractor skidding, where it is applicable, and expense progressively increases as we go to jammer skidding, skyline skidding, and balloon skidding. The Forest Service, Region 4, lists logging costs in its timber appraisal handbook for Boise, Payette, Sawtooth, Challis, and Salmon National Forests based on 1968 cost data as follows:

TABLE 9

Average Logging Costs/MBF

Activity	Tractor-Jammer Logging	Skyline Logging	% Increase with skyline
Felling-Bucking	$ 4.25	$ 4.66	10
Skidding	7.28	15.02	106
Loading	2.22	2.23	0
Logging Depreciation	1.99	2.90	46
General Logging Overhead	4.56	5.13	12
TOTAL	$20.30	$29.94	48%

Although the more sophisticated technique, skyline logging, is more expensive all around, the greatest increases take place in skidding, depreciation, and overhead. The overall consequence of using skyline over jammer logging is an increase in logging costs of about 50 percent. I would expect a similar increase in going from skyline logging to balloon logging.

Generally speaking, the higher hazards of land management, i.e., erodability, limitations to reforestation, etc., are found on sites of low productive potential, and these often are the sites that require the more refined, and therefore more expensive, logging techniques. A case in point is the area in Idaho covered by the Idaho Batholith where site productivity is low and erosion hazards are high. In this area the technique being specified by contract is balloon logging, or helicopter logging if this becomes feasible.

In central Idaho, these low productive sites produce low quality timber. This low quality, low volume timber is being removed from the ground using the most expensive techniques! Perhaps there is a need to take a harder look at our overall management objectives. There may be better alternatives in the management scheme in which to invest this money, such as more intensive management of more productive sites, rehabilitating areas that already have severe watershed damage, or reforestation of sites that have been idle for many years after fire or harvest.

Soils and Hydrologic Surveys

The Forest Service is in the process of making soils and hydrologic surveys of its lands. These surveys are being completed one ranger district at a time, and are concentrating on critical areas first. Among other other things, these surveys classify lands as to suitability for logging and even specify logging techniques. When completed these will be an invaluable tool in delineating areas to consider for elimination when making the inventory.

Relationship of Timber Management to System Rivers

There appear to be four significant parameters linking the proposed river 'corridor' to the rest of the drainage basin areas as far as forest practices are concerned: (a) transportation, (b) water quality, (c) water quantity, and (d) aesthetics. There are interactions with most of the other subprojects and other activities as well, but these are the most important parameters.

Transportation:

Transportation systems are needed to move the logs from the forest to the primary manufacturing point. If the decidedly best alternative for road location for this purpose is adjacent to the river there will be conflicts with a river 'corridor' being managed for recreational purposes.

An example of possible transportation conflicts is given in the following diagram.

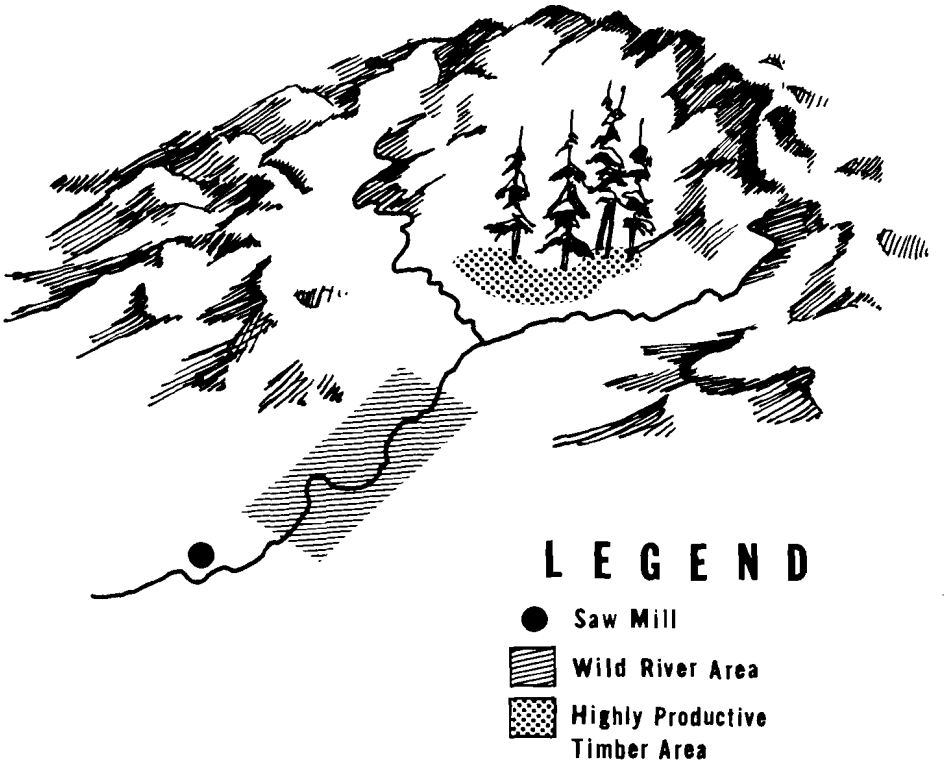


Figure 2. A Hypothetical River Basin

Let the outlined area be the river basin boundary, a primary manufacturing plant (sawmill), the shaded area a highly productive stand of timber of considerable area, and the cross-hatched area inbetween a proposed system river boundary. Suppose the topography is extremely rugged with fragile soils in the lower reaches similar to the Salmon River in the batholith region, but fairly gentle with stable soils in the headwater area. Due to a precipitous range of mountains encircling the drainage, entrance from outside the drainage is prohibited except up the river. The most practical way of reaching the timber would be up the valley bottom. This of course is in direct conflict with a system river of wild or scenic classification. However, if it were feasible, physically and economically, to build a road outside of the proposed corridor area there would be no direct conflict between transportation and the system river, neglecting aesthetics and water quality for the moment. If this road was built to a standard that would preclude erosion, and if it could be designed so that either it could not be seen or was not offensive to view, then it would not be in conflict with the

purposes of the Act. Circumstances would dictate whether in a river reach classified as wild such a road would, in fact, be acceptable.

Although log drives are almost a thing of the past, this would be another way in which the logs could be transported to the mill. This system of transportation may be incompatible with a wild classification, but might be acceptable with scenic and recreational classifications.

Water Quality:

Water quality and quantity might be affected in this stretch of proposed river if logging were allowed in the headwaters. Past experience has shown that water quality can decrease after logging has been done. Turbidity caused by erosion from roads, skid trails, and burned over areas is the most noticeable factor. Studies in the Hubbard Brook Experimental Forest in New Hampshire (6) have shown significant changes in the chemical composition of streams through manipulation of watersheds. Logging does not need to cause erosion . . . the two terms are not necessarily synonymous. Proper layout and construction of roads and skid trails and careful use of proper logging techniques should result in very little or no erosion. If logging can be done without the detrimental effects, the system classification would not affect logging as far as water quality is concerned.

Water Quantity:

Water quantity and relative timing of runoff can be manipulated through cutting practices. Quantity is affected by vegetation density. If all vegetation is removed from an area the water yield will be increased, and the water will leave the area more rapidly. The reasons for this are many, but some of the more important are: Reduction of interception of moisture by the crowns . . . this intercepted quantity is highly susceptible to evaporation; decreased transpiration by vegetation; mechanical properties of the vegetation make the soil more porous allowing increased percolation and less runoff; and vegetative cover mechanically impedes overland flow. Without the benefit of vegetation, the soils compact readily and overland flow takes place readily. Overland flow also starts gullies, and washes, further eroding the lands, thereby increasing water quality problems.

Aesthetics:

Scenic beauty may be affected by any activity in the basin, and is probably one of the most sensitive of the recreational parameters. Because of its subjective nature, it is probably the most difficult of all parameters to evaluate. An eyesore to one individual can be a source of enjoyment to another.

In dealing with aesthetics the land manager must use good judgement to make decisions pertaining to land use. His professional skills and know-how should guide his decisions, but his decisions may be tempered by the public's attitudes and special interest groups ranging all the way from the Sierra Club to mining associations. He must heed a very diverse spectrum of opinions, some offered louder than others, but all must be considered in making the final management decision. A miner's insignificant mine dump is an ugly scar on an otherwise pristine mountainside to a member of the Sierra Club.

There are many aesthetic judgements that are agreeable to most parties. Most would agree that a badly polluted river or a badly eroded hillside are displeasing aesthetically. Still, the enjoyment depends on the aspect from which the activity is viewed. A road, if built to a minimum standard, without big cuts and fills, may be regarded in a pioneering spirit, as not really disturbing to the landscape. A road across a hillside high above the valley used as a viewing platform to look over the whole valley may be acceptable. The panorama takes your attention away from the ugliness close at hand. When the road itself is viewed from a distance and becomes a part of the panorama, then it may not be aesthetically pleasing. Litton (7) mentions that distance softens the impact of aesthetically displeasing items. A fresh clearcut may not look good close up, but if it is situated three miles from the observer and is designed to blend into the landscape, it may not be too offending. Many people would not even recognize it as a clearcut.

Administrative Restraints

In the case of Forest Service administered public lands there are many administrative constraints that preclude clearcutting, and in some instances, any form of logging from taking place near given rivers.

Rivers within wilderness and primitive area boundaries are protected from any cutting taking place on their banks or near vicinity. Even where roads parallel a river, there are restraints to cutting in travel influence and water influence zones. There are restrictions placed on cutting in riverbreak areas where new techniques will have to be developed if any cutting is to be done, and then only partial cuts will be allowed. If administrative constraints do not allow timber harvest without a river being classified, then timber harvest should not be considered as an activity foregone because of river classification. It is not a feasible alternative activity.

Recreation and Timber

Timber production and recreation are not mutually exclusive activities on a given area. Timber production and wilderness experience are not compatible land uses, but timber harvest opens up new areas for other types of recreation by providing roads.

The time it takes to grow a stand of timber to harvest age varies from 30 to 150 years, depending on species, climate, site, and end product desired. In the Intermountain West, the time period, or rotation length, is from 70 to 150 years. The regeneration period, which is the time from harvest until the new trees are tall enough to shield the landscape or make the area aesthetically pleasing takes from 10 to 20 years. This is not very long in relation to the life of the stand, but in relation to an individual's sense of timing it is a long time.

During this regeneration period the forest provides food and cover for many types of wildlife, and in many places blackberries or huckleberries provide a form of recreation and good eating. Young, vigorous stands of timber are resistant to many forms of insects and disease. This, in combination with the heterogeneous mixture of species and age classes formed by timber harvest, can reduce the effects of fires, windstorms, and epidemics. Young vigorous stands of timber take in more carbon dioxide and produce more oxygen than do old stands.

During all ages, a stand of timber provides recreational opportunities for man, but these recreation opportunities may change over time. It is mainly during the regeneration stage that forest land is aesthetically

displeasing, and even then it is dependent on your viewpoint and knowledge of the situation.

Risk and Uncertainty

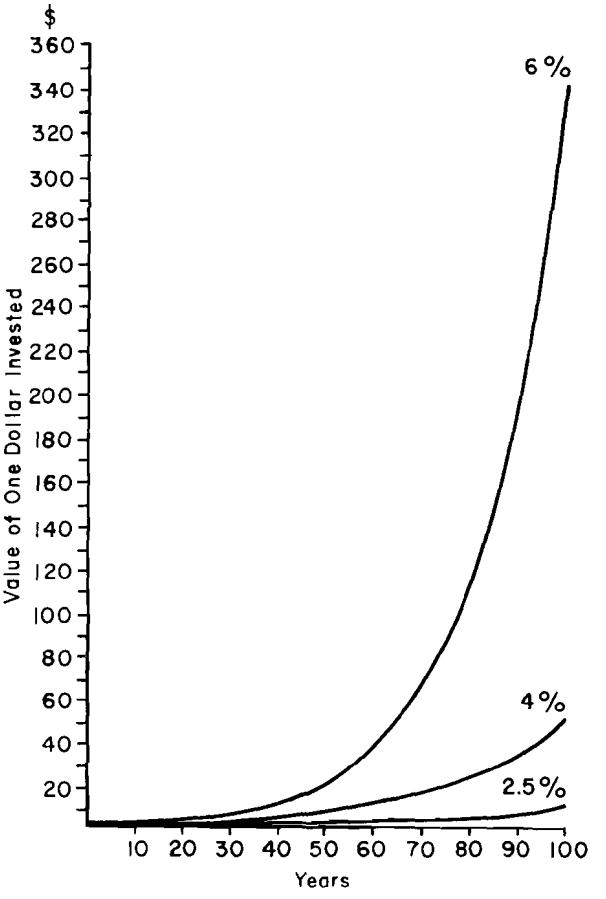
There is a great deal of risk and uncertainty involved when considering growth of a stand of timber that may take from 30 to 120 years to mature. Risks include regeneration, insects, disease, fire, etc., and may vary depending upon the age of the stand. Risk is especially high during the first years of establishing the stand, and towards the end of the rotation when the stand is not as vigorous as during its highly productive years. During the highly productive phase the risks are relatively low, as healthy vigorous trees are not likely to be attacked by insects or disease, and the crowns are usually high enough, bark thick enough, and litter scarce enough that fire danger is low.

Uncertainties facing the timber producer are many and I will mention just a few of them. It is hard to say what species will be desired in 100 years, or what the market structure will be like. Will there be a demand for lumber, for fibre, or for poles? Is this demand controlled solely by supply? What prices will be offered for forest products? Will depression, recession, inflation, or a build and boom period be taking place? Because of these factors the intensity of management or management plan is difficult to decide. The amount of investment that should be allowed at the outset and the rate of interest to use is uncertain. Whether we will be interested in timber as a resource at all in not known.

The point here is that to project values, or to try to discount values from a hundred years hence is a difficult proposition. However, to use just present day values and not take into account the production potential of the land is also misleading.

Interest Rate

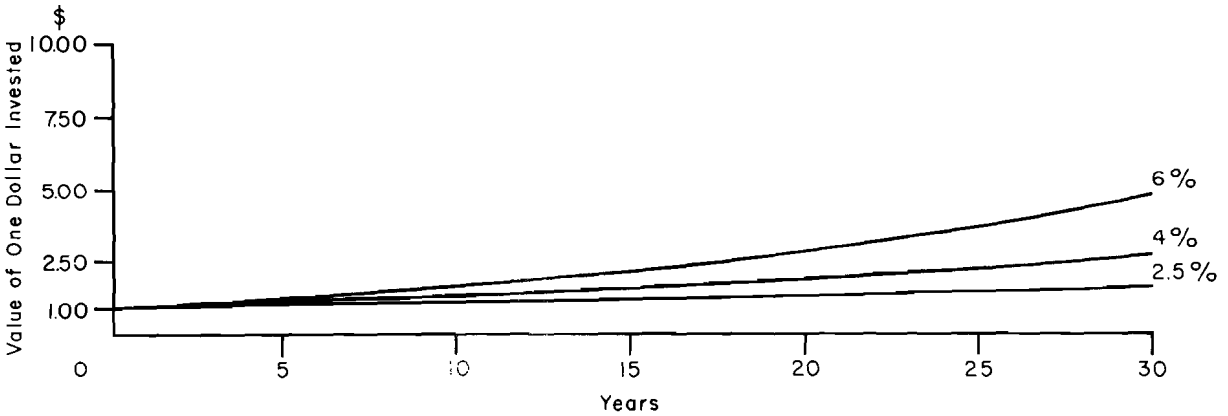
One of the most difficult tasks is to pick a proper interest rate to evaluate the resource over these long time spans, as compound interest rates are misleading when used over long periods of time. When you change from a pure rate of interest to a going rate for investment return (2.5 - 8 percent) you may be doubling or tripling the rate and when



Graph I, Effects of Interest Rate Choices on Long Term Investments

this is compounded over an extended time the values rise astronomically. This can readily be seen by the following graph.

Graph 1 shows that it would be unrealistic to plan on an investment return of 6 percent over a long period of time, such as in growing of timber. The going rate of interest is a fair rate of return over relatively short periods of time, but according to Davis (4), wars, depressions, political upheavals, technological changes and other social and economic phenomena profoundly affect the return on investment over long time periods. A pure rate of interest is that rate paid by a stable government on it's securities. The average cost of carrying the United States' national debt is in the range of 4 percent, so an interest rate somewhat in excess of this should be chosen for forest investments. Because of the risk and uncertainty involved, the investment should return more than a low risk, relatively secure investment in government. Remember that an increase from 3 to 4 percent interest represents a 33 1/3 percent increase in rate. Obviously, one should choose his interest rate with care.



Graph 2, Effects of Interest Rate Choices on Long Term Investments

Graph 2 shows that for shorter periods of time the interest rate chosen is not as critical as for longer periods, but over a period of 30 years there still is a marked difference in return. Most investments that are made at 6 to 8 percent rates of return are short-term relatively

high risk investments. Money is relatively liquid in these types o investments, as opposed to the non-liquid state of money in a forest investment.

CONCLUSIONS

The main conclusion drawn from this study is that including the main stem of the Salmon in the National Wild and Scenic Rivers System would not significantly affect the timber industry in Idaho. Some of the reasons for this conclusion are as follows: 1) Growth potential in the canyon is not very high, except on the bars next to the river where the soils are deep and porous, and moisture is readily available. These areas are not extensive and have little effect on the total timber potential of the river corridor area; 2) The timber that would be affected by river classification is, in general, of low quality and in sparse stands on adverse terrain; 3) The maximum number of people that would be affected in the areas logging and sawmilling industries would be two, according to my estimates; 4) Proper timber management would require light selective cuts.

The largest effect on the timber industry may not come from withdrawal of timber from harvest because of river classification. The larger effect may be an increase in harvest cost because different transportation systems have to be planned, or the haul distance to the mills may be increased. Also, different harvest types or specialized logging techniques may be required thereby increasing costs. The timber may not be withdrawn from harvest, but it may become more expensive to harvest.

When considering timber harvest in relation to system river classification, the river basin is not necessarily the relevant area of concern. If the Act is to be used as a deterrent to poor forest management practices, then the basin is the area to monitor for water quality and quantity manipulation. A lesser area than the basin, the river corridor and immediate vicinity, is the area to consider for aesthetic qualities. To look further than this is probably going outside of the purposes of the Act. When concerned about the impact of river classification on the timber industry, the market area affected is the proper area to consider. The market area may encompass all or portions of several drainage basins, national forests, counties, or states.

The forest inventories available usually will not be adequate to inventory the timber along a river being studied for inclusion in the System. This is because management boundaries for System rivers will be different than any existing management boundaries, so if necessary a timber survey should be developed to conform to river corridor boundaries.

RECOMMENDATIONS

In the early stages of the study, decide on the best segmentation of the river for timber harvest planning. The researcher should determine alternate plans for segmentation as soon as possible to aid in developing alternate classification plans for the river. This would aid in coordinating the timber harvest study with other parts of the methodology study.

Unfortunately, most of the available inventories will not be pertinent to evaluate the timber resources of a study river. Confinement of the study to the proposed corridor except for those specific areas outside the corridor that could be adversely affected by admitting the river into the System would most likely require a separate inventory. Timber production potential of the lands involved should also be included in the inventory report. Finally, a soil-land classification scheme such as that used in the Salmon River Breaks Reclassification Study (19) would also be highly desirable.

The use of unrefined and rapid estimation techniques to estimate the magnitude of timber in the corridor is recommended. Then an estimate of the effects on the wood products industry of including the river in the system should be made. These estimates will provide the guide to the degree of refinement needed for the final estimates.

The economic base to use should be that part of the industry affected by timber withdrawal in the event the river is classified. This area would not be standard for all rivers. It will tend to be a market boundary rather than a geologic or political boundary.

It should not be assumed that administrative restraints are permanent, and these should not be relied upon for total protection of the river environment. When planning the inventory, those areas in which timber harvest is not a reasonable activity should be deleted. Examples are wilderness and primitive areas, or unique wildlife habitats. Included in this should be those areas that have administrative restraints on timber harvest.

The sustained yield principle should be used when evaluating timber resources, and all values should be estimated on an annual basis because timber should be considered a flow resource. An advantage of annual values is that the figures are usually small enough to comprehend and understand, and they are useful in making comparisons. Projected values can easily be computed from annual values. Benefits foregone from the timber resource if the river is included in the System should be computed using various classification schemes where applicable.

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