

Progress Report Number One B 111
A Methodology Study To Develop Evaluation Criteria
For Wild And Scenic Rivers

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

Progress Report #1

Introduction

On October 2, 1968, Public Law 90-542, which provides for a National Wild and Scenic Rivers System was passed by the 90th Congress. This law spells out Federal policy for creating a system of selected rivers which possess within their immediate environment outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values. The Act insures that these rivers shall be preserved in their free flowing condition and that they shall be protected for the benefit of present and future generations.

The Act provides for conditions under which specific rivers will be included in the Wild and Scenic Rivers System. First, there are those rivers authorized for immediate inclusion (the instant rivers) in the system. Second, are rivers designated for possible inclusion (study rivers) in the system. There are two instant rivers in Idaho and five study rivers. The instant rivers are the Middle Fork of the Salmon and the Middle Fork of the Clearwater, including the Lochsa and the Selway Rivers. The study rivers are the Bruneau, Moyie, Priest, Salmon, and St. Joe Rivers.

The Act specifies three classes of rivers: (1) recreational, (2) scenic, and (3) wild. A recreational river would be one readily accessible by roads and railroads, and which may have some development along its shorelines, and may have undergone impoundment or diversion in the past. A scenic river would be one free of impoundments, with its shorelines or watersheds still largely primitive and undeveloped, but accessible in places by roads. A wild river is one which would be free of impoundments with shorelines essentially primitive and water non-polluted and is accessible only by trails.

The Water Resources Research Institute at the University of Idaho, through a specially organized Scenic Rivers Study Unit, is involved in a study to develop a methodology to evaluate the economics and esthetics of wild rivers. This study has as its goal, establishing criteria which can be used

to identify and estimate all the economic, esthetic, scenic, and other values for wild rivers.

In this study the Salmon River and its basin has been selected to develop a model system to evaluate Wild and Scenic Rivers. The logic of this choice revolves around two considerations, (1) the evaluation model is to be general, and (2) many upstream or offstream activities may be affected by a wild river designation. By this I am referring to the water quality and scenic vistas land withdrawals. In addition, any economic development--impoundment, dredging, logging, etc., would affect the wild segment of the river. A further reason is that any economic analysis of the area should include all the activity in the basin area to be meaningful.

The objectives of this study are to inventory the natural and human resources of the area, and estimate future demands for quantities of these resources. Secondly, to identify, describe, and quantify, where possible, benefits from scenic beauty, personal enrichment, and other esthetic experiences derived from a river. Thirdly, to develop a series of economic models to evaluate and determine resource use patterns consistent with a Wild and Scenic Rivers System, and compare them with resource use patterns under varying levels of development. Finally, to present recommendations for alternative uses of resources for the entire river basins area, restrictions on use if classification is possible, and the economic and social ramifications of each of the alternatives considered.

The procedure followed has been to divide the study into a series of subprojects, each covering an important economic activity related to the river or river basin. There are eleven of these subprojects.

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. Transportation and Access

Three steps will be implemented for each of these subprojects. First, an inventory of the physical, biological, institutional, and human resources will be made for each resource and/or activity. Secondly, the data obtained will be used to make an economic evaluation of the current use of these resources and the potential benefits available. Thirdly, these data will also be used as a basis for projecting future resource use and values under varying restrictions related to a wild or non-wild river classification.

Once the above projects have been completed, the data obtained therefrom will be used to develop economic models. These models will be used to make comparisons of benefits and costs of alternative resource uses. This approach will be extended to make estimates for 1980, 2000, and 2020 consistent with the projections of the Pacific Northwest River Basins Commission Columbia North-Pacific Region Comprehensive Framework Study.

Two types of models will be used to make these evaluations. The first model will be a small area input-output model which will be used to establish bench-mark values for all economic activity in the area. The second model will be a linear-programming or activity analysis model which will be used to estimate the benefits from various levels of development.

General Accomplishments

The following work has been completed. A field survey of recreation uses has been made in all the major recreational areas of the Salmon River. The Institute's survey team had members located at Stanley, Corn Creek, the Mormon Ranch on the Middle Fork, and at Riggins. The individuals stationed at these points interviewed 1302 parties. Three types of questionnaires were used for (1) float trips - 501, (2) fishermen and recreationists - 675, and (3) hunting - 126. The period covered by the survey was from July to November. At the present time all the data obtained have been coded and are in the process of being edited. We have hired a programmer to begin work next month who has developed similar systems of analysis to those needed to analyze these data. In the next few months we will have these data analyzed.

In addition to the work being done on recreation, rapid progress has been made in all the areas except mining, commercial fisheries, and irrigation.

In the first area we have a problem of estimating what quantities of minerals are available, and when the need for these will become great enough to justify development. In the case of commercial fisheries, the subproject researcher was gone most of the summer and fall on a foreign assignment. Work is being done at the present time; we should have some results before July. In the case of the irrigation subproject, Professor Warnick is using this part of the study as a special project for his study in Holland. It should be completed by the time he returns next September.

On the other subprojects I am pleased to report that most of the work has progressed quite well. We are currently finishing the flood control and navigation projects and will have published reports out this spring. In addition, the Water Quality Control, the Water for Municipal and Industrial Use, and the Hydroelectric projects are being developed. These studies will be finished in the spring or early summer. The final projects we are working on are the forest and range resources, and transportation and access. The development of methodology and collection of data will require some additional time. The immediate results are an inventory of forest and range resources and an appraisal of the value of the timber resources. In the transportation and access portion of the study, procedures are being developed to estimate the costs of providing roads into the basin area in order to utilize the resources of the area.

A final comment about progress additional work related to the second and third objectives of the study has been done. In the case of the second objective we have accumulated many pictures and considerable time has been spent in the area. A number of boat trips have been taken and more are contemplated.

Work has been done to develop an economic input-output model for the area. This type of model will identify all of the important sectors and indicate the flow of cash from one sector to another plus the total income generated within the area. We will use this model as a bench mark on which to base all our projections.

Work has also begun on an activity analysis model which will be used to simulate various stages of development. The basic model used is a linear programming model which will include all of the real and potential types of economic activity in the area. The procedure followed will be to use both the input-output model and the activity analysis models conjunctively

and then to compare the results. These models will both generate regional income for the area, and we will compare the results to see whether development generates more income than does a wild river. This is a type of benefits foregone analysis, the major difference is that we are considering all the economic activity, instead of just selected activities. By using this approach it will be possible to estimate future as well as present levels of gross regional income. At present a conceptual linear programming model has been developed. In the next few months we should have a working model and may begin some of the initial programming.

APPENDIX

Subprojects: Objectives, Present Status and Future Goals

The eleven subprojects along with the models and a special land use study are described below in more detail.

Progress in Model Building for the Wild and Scenic Rivers Methodology Study

A linear programming model is being developed to facilitate the resource evaluation process for Wild River areas. This technique was selected because it permits consideration of a multitude of alternatives simultaneously. It also provides resource values for many resources that have no market pricing mechanisms. In other words programming models will estimate the value of an acre-foot of water in terms of the best alternative use of this water. This feature of linear programming, called shadow pricing, will be very useful in developing resource values under simulated conditions of economic development.

The general form of the mathematical model used to evaluate the resources in the Salmon River Basin is:

We want to maximize a function X

$$\text{Max}_{\underline{X}} \quad f(x) = (\underline{C}; \underline{X})^T \quad (1)$$

$$\text{Subject to } X > 0 \quad (2)$$

$$\underline{AX} \leq \underline{b} \quad (3)$$

$$\text{where } \underline{C}^T = (C_1, C_2, \dots, C_n)$$

$$\begin{array}{r} \underline{X} = X_1, \\ \quad X_2, \\ \quad \vdots \\ \quad \vdots \\ X_n \end{array} \quad \begin{array}{r} \underline{b} = b_1, \\ \quad b_2, \\ \quad \vdots \\ \quad \vdots \\ b_n \end{array} \quad \begin{array}{r} \underline{A} = a_{11}, \dots, a_{1n} \\ \quad \vdots \\ \quad \vdots \\ \quad \vdots \\ a_{m1} \quad \quad a_{mn} \end{array}$$

In this model the variable to be maximized will be gross regional income, and the basic structure of the model will revolve around average monthly and annual flows of the Salmon River. All of the economic activity in the area will be related to water, in addition, the model will include variables such as season of the year, capital input, labor, and natural resources.

The output of such a model will permit a value of both the annual flow and the value of impounded water to be estimated. At the present time

structure of this model has not been completed. The first of these models will be completed in the near future and as soon as data from the subprojects are available computer runs will be made.

The structure of a model for the Salmon River Basin will be complex and will require that all of the major natural resource uses be represented. In addition, time is an important variable because it takes time to develop projects and more time to realize their benefits. The first procedure will be to develop a series of linear programming models, one each for the years 1980, 2000, and 2020. These models will estimate the net regional revenue in the area under varying assumed conditions for each of these years. After this is completed these models can be used as a basis to develop recursive linear programming model which will use 1970 as a base and can be programmed year by year to select the alternative developments which have the largest net benefits. The decision to develop this model depends upon the amount of time and money available after the first three models have been developed.

Several models based on this structure will be used in the analysis in order to compare the results of projected levels of development with the present economic activity in the area. The results obtained in this analysis will also be compared to those results obtained from the input-output models being developed by Mr. Larry Kirkland.

Once this package of methodology and models has been developed it will have a broad application to many types of water resources problems. These models can be adopted to other wild rivers and to non-wild rivers with very little additional cost or effort. The results of this research should be useful to the Idaho Water Resource Board on many problems as a basis of resource evaluation.

Basin Input-Output Model

A literature survey of known census and other economic data related to the basin has been completed. Answers to letters of inquiry to several potential sources are still outstanding. The main deficiency in data thus far gathered has been incompleteness and the lack of a uniform year for which it was reported.

A business questionnaire, which has been designed and will be sent out shortly, is going to play an important roll in the success of this portion of the study. The questionnaire has two major objectives; (1) to gether economic data on businesses in the basin in 1969--the tentative year chosen for analysis--and to determine the portion attributable to outdoor recreationists visiting the basin.

A rough transactions table has been drawn up. It is divided into tourist derived business (here equated with outdoor recreation derived business) and all other non-tourist business. The number of total sectors is presently 20. This number could and may be lowered to 16 if the final data to be used warrants it.

The input-output model of the basin will make several important contributions. First, it will present purchases and sales data for the various sectors of the basin economy in a common year; second, it will provide a means for comparing the significance of increases in sales and purchases of the various sectors; and third, it will provide a means for evaluating future changes in the basin's economy.

A difficulty in using a small basin model such as this is that many purchases used by both recreationists and indigenous consumers in the basin are purchased outside the basin. At present, no information is available concerning the magnitude of this quantity. From talking with recreationists, especially Idaho recreationists who visit the basin for a short time, much of their food, equipment, and even petroleum products are purchased outside the basin, but still in Idaho. Consequently, it is significant in the evaluation of the basin to the State.

Once the model has been completed, predicted values for recreationists, business demands, household changes, etc., under the various basin management policies, will be programmed into the model. The results should greatly aid decision makers in charting the overall basin policy to be pursued.

The Impact of Land Ownership on Recreational Land Use in the
Lower Salmon River Area

- Objectives:
1. To ascertain the nature, distribution, and cause of conflicts between land owners and recreationists in the study area.
 2. To determine the consequences of changes in land ownership, land management, highway location, accessibility, and the number of recreationist on the land owner-recreation user relationship.
 3. To suggest alternative management policies, legislation, or legal action to alleviate these conflicts and potential future ones.

The narrow corridor of the Little Salmon and Salmon Rivers adjacent to U.S. Highway 95 between Round Valley and White Bird Creek is subject to high concentrations of recreationists during the summer season. This area is unique in the Salmon River basin. It has considerable scenic and fishery resources yet a large percentage of the land is privately owned. Public access to the rivers is limited and there are no camping facilities in the immediate corridor containing the highway and the rivers. U.S. Highway 95 is the direct route connecting north and south Idaho; it is a major route connecting the populations concentrations of southerwester United States with the tourist attractions of northern Idaho, western Montana, and Canada; and it is the only access to the western portion of the Salmon River drainage. The esthetic, scientific, historical, and recreational values of the area attract significant numbers of recreationists in addition to those just passing through. The results is conflict between the land owner and the recreation resource user and over use of existing facilities. As recreationists increase in number, more private land is subdivided for summer or permanent home, and the highway is improved, the problems will increase.

This subproject is also the subject of a Master's degree thesis in Geography. Progress thus far has dealt primarily with defining the problems and the objectives. A study of the land area included in the project is underway. A mail questionnaire directed to the private property owners is being developed. Potential Federal, State, and local government sources of information are being explored. A literature review of similar studies and of present laws and ordinances that may have some bearing on any decision-

making processes concerned with recreational use of the lands and waters in the study area is being carried out.

The results of this study should prove valuable to decision-makers under all management policies proposed for the basin.

Subproject Title: Forest and Range Resources

Subproject No. 1

- Objectives: 1. To determine the present value of forest and range resources of Salmon River and adjacent lands proposed for wild river classification.
2. To estimate the future values of the forest and range resources of the Salmon River interim of a wild river versus varying degrees of non-wild river classification.

The principal subgoal necessary to fulfill the objectives of this subproject is an inventory of the timber, range, and wildlife resources in the Salmon River drainage. Once this inventory has been completed, values will be assigned to these resources and the total present economic value under alternative management and administrative policies will be determined.

Timber Resources

The Forest Service, the Bureau of Land Management, and the State Department of Public Lands are all contributing Salmon River basin timber inventory data. Information on Region 1 of the Forest Service has already been gathered. The inventory has been divided into two parts, that for reserved lands and that for non-reserved lands. Reserved lands are special use lands managed for a specific use and not under a multiple-use concept. Some examples would be: wilderness areas, primitive areas, park lands, ski areas, etc. The main portion of reserved lands on the north side of the river consists of the Salmon River Breaks Primitive Area. Non-reserved lands are all other lands under Forest Service administration.

The inventory covers all lands within the National Forest boundary, whether they be public or private. This means that the inventory is based on a rather extensive statistical sample, and will be valid only over large areas. In fact, the smaller the area under consideration, the less valid the figures in the inventory. This also means that the compartment figures will have a larger standard deviation than will district figures or forest figures. The compartment figures, then, are good for a general estimate of volume within an area and probably shouldn't be leaned on too heavily for management purposes.

An example of the intensiveness of past inventory surveys is the Salmon River Breaks Primitive Areas, which was inventoried separately for the first time this past summer. It covers 217,000 acres. Past records listed it as a part of the total forest inventory rather than a separate unit.

Thus, although the data is available on a compartment basis, the data is more reliable over a larger area. A statistical basis for all of these inventories is being sought. On this basis, the Forest Service has forest inventory data for about 90% of the land in the basin. The BLM will have inventory on most of the remaining land, especially in the upper basin area. The State Department of Public Lands furnished an inventory for all state lands in the basin. These will be particularly valuable in the lower reaches of the river where the land is primarily privately owned, with state owned land interspersed throughout. In order to get data on these private lands, it will probably be necessary to extrapolate data from the state lands.

Evaluation of Timber

Economic evaluation of the timber resource is based on information obtained from two major sources, the Forest Service and the Western Woods Products Association. The information from the Forest Service consists of appraisal and sale data on the National Forests involved from 1966-1969. The three year period is used in order that the fairly stable pricing structure evident in timber products prior to 1968 can be used. In 1968 the prices started to rise sharply, reaching their peak in the late 1968 or early 1969 and have since been falling in a trend that appears to be bringing them back to "normal". If this is true, it will make a big difference in the predicted values of the timber resources.

The appraisal data consists of appraisal prices for timber; actual selling prices; volumes of timber sold; prices paid for reforestation; prices paid to the Forest Service for slash disposal; kinds and amounts of roads built and their costs; costs of depreciation; costs of administration; etc. Data for whole forests are being used because; (1) there has been little timber harvested in the Salmon River drainage itself, and (2) it gives a range of costs for conditions similar to those in the basin using the same markets as those available to the drainage area. New markets will be considered with regard to models of future harvest in the basin.

The price lists from WWPA give prices f.o.b. the mill for various wood products for the whole Pacific Northwest. They also give prices for manufactured materials. Thus, these reports should indicate, although roughly, the gross sales within the area.

Lists of wood products manufacturer's and the capacity of their plants are incomplete for this area. It is simple to get this information for the members of WWPA, but the independent operator's aren't listed in this organization's reports. Fortunately, most of the large operators belong to WWPA and their capacities are known, as well as the types of materials manufactured.

Along with the inventories and evaluations, the location of various timber types, volume concentration, manufacturing facilities, roads, restricted areas, and many other items will be shown on an overlay type of map so that it will be readily apparent what the relationships between various activities are. For instance, one could put the cover type overlay on the ownership base for an indication of who is managing most of a particular cover type. Then you could put an overlay indicating the volume of various timber types to ascertain where the most valuable timber was located in relation to cover type, ownership, and road locations. This will be a very valuable type of map, especially for planning and management of the area.

Range Resource

The agencies with information on range resources are the Bureau of Land Management, the Forest Service, and the Idaho Department of Fish and Game. No contact has yet been made with Bureau of Land Management or the Idaho Department of Fish and Game, but the Forest Service has available, at the Supervisor level, data on allotments, types and numbers of animals on a given area for the lands that they manage. The Forest Service has just begun a survey that will show range productivity, carrying capacity, and the condition of their rangelands; unfortunately, the data will not be available until after the completion of this study. Bureau of Land Management has records not only of numbers of animals produced but also some range productivity data. Range improvement plans such as reseeding sagebrush control, and rest-rotation grazing will be investigated, also.

Wildlife

The wildlife inventory is just beginning. The main sources for this data are the Idaho Department of Fish and Game and the Forest Service. The Bureau of Land Management apparently does not have wildlife data for the Salmon River Basin. A factor of major importance to be considered is the amount, location, and condition of winter range for game. Winter range determines the number of animals available, the health of the herd, and the reproductive rates. This, of course, applies to birds as well as big game.

Subproject Title: Minerals

Subproject No. 2

- Objectives:
1. To determine the known and probable mineral deposits within the entire Salmon River basin.
 2. To determine the impact of mineral exploration and development in those upstream and tributary portions of the basin on the segments of the river designated for wild river perpetuation.
 3. To relate known and probable deposits in the basin to both projected national demands and other areas of domestic production to ascertain the regional and national significance of the deposits.
 4. To determine the extent of the gaps in mineral knowledge for various segments of the basin.

The results so far consist of a listing of the minerals occurring in the 43 mining districts in or touching the Salmon River Drainage and some comments on the four objectives of this subproject. In general, mineral information on the basin must be termed insufficient. Neither the money nor the time is available to this study for a complete coverage of the basin. The goal of this study is to make the best use of the information available.

Some of the immediate objectives of this subproject are a listing of the producing mines in the basin and their present output, the extent of the ore bodies they are working, and some estimate of the changes which might occur if prices for metals being mined should rise or lower a reasonable amount.

The Salmon River Drainage is large and appears to have only been prospected surficially. A history of exploration in the area as related to contact zones, past discoveries, and potential areas for future discovery is also necessary. A large molybdenum deposit was just recently uncovered in the White Clouds Range which is largely in the Salmon River Basin. How long has it been known that there was molybdenum in this area? Are there other areas with similar potential? The price of gold mined in Idaho in 1969 averaged \$42.19 per ounce. What effect will such a change in the price of gold, if sustained, have on mining in the basin? At least qualitatively, these questions are answerable.

The extent of the ore bodies is extremely important as mining economies last only as long as the ores they thrive on. Presently, there are no significant mining economies in the basin. With regard to future mining, the least that can be done is to summarize the information which is now available and indicate the areas which need more study. Mining in general has been criticized because of past pollution of air and water, low productivities in dredged areas, and depressed towns and counties left near depleted orebodies. Are the technical means available to prevent the above? What are the legal codes of the State of Idaho and the Federal Government regarding the above? Would they prevent the occurrence in Idaho of similar situations? These questions will become more and more important to an environmentally oriented public and must be answered.

Nonmetals such as sand and gravel are important in highway and other construction. What are the needs for these materials at present in the basin and what might the need be under the various management policies which might be pursued in the basin?

How does mining fit into the present state economic picture and its present and future policies? Even though the present fund of information on minerals in the basin is scant, what information there is available concerning the above should be helpful in making policy decisions. None of the other study areas have 100% of the information desired either. Progress toward answering the above questions is expected in the near future.

Subproject Title: Outdoor Recreation

Subproject No. 3

- Objectives:
1. To determine the present recreational values of the Salmon River and the adjacent lands proposed for wild river classification.
 2. To estimate the future recreational value of the Salmon River in terms of a wild river versus varying degrees of non-wild river classification.

The outdoor recreation portion of the methodology study got under way immediately after the commencement of the study in June of 1969. Most of June was spent designing and field testing the questionnaires to be used during the summer. Two questionnaires were used during the summer; a float trip questionnaire geared especially for the Middle Fork and the Main Salmon where floated, and a general recreation questionnaire for use on the Main Salmon and its tributaries when interviewing non-floater recreationists.

Much effort was concentrated on the recreation survey early in the study because of the need to immediately begin gathering data from and about the summer peak of recreationists in the area. Four graduate students spent approximately two months apiece in the field interviewing recreationists, making license plate consensus, taking pictures of the area and gathering other pertinent data. During the hunting season one student remained in the field interviewing hunters with a special hunting questionnaire. Each graduate student took a portion of the Salmon River Basin. This plan encouraged efficiency and it permitted the interviewer to become familiar with the territory, to learn what areas were most heavily used, and how best to divide his time over the large area which he had to cover. The results of the survey are 675 general recreation questionnaires, 501 wild river or float questionnaires, and 126 hunting questionnaires.

The questionnaires were designed to get information on three major areas of interest to the methodology study: (1) the recreationist's views concerning the uniqueness of the particular area he was in, (2) his feelings toward various development plans and (3) economic data about his trip or outing. Other helpful information such as the number of previous trips he had made into the Salmon River Basin, the type of outdoor activities he pursued

in the basin, his city and state of residence, the composition of his group, means of travel, education, income, and age were also gathered in the interviews. All the information from the questionnaires has been coded. We are presently waiting for the completion of the computer program to analyze the data gathered.

This is one aspect of the basin recreation study. To supplement the information gathered during the summer, all other known sources of outdoor recreation are being considered. Doug Gordon has just completed a state-wide study of fishing. This study was done on a watershed basis. The Salmon River Basin is one of the study units. The information gathered in Mr. Gordon's study should be directly applicable to the Salmon River sports fishing study as it contains fisherman-day values and economic data concerning fishing.

Hunting is also a major attraction of the basin and contributes significantly to the economy. We are hoping to get 1969 hunter-day estimates and animal kill estimates for the basin from the Idaho Department of Fish and Game. From earlier studies in Idaho and studies done in surrounding states, we should arrive at a good estimate of the values of hunting in the basin.

In 1960, hunting and fishing in Idaho was a \$60 million business. In the past 10 years these outdoor recreation activities have burgeoned considerably. Since the Salmon River drainage comprises about 17% of the total area of Idaho and a much larger percentage of the prime fishing and hunting acreage in Idaho, the returns to the State from these basin activities alone should be considerable. To this must be added the economic returns from river floaters, hikers, campers, sightseers, and others not included in the above. In 1966, tourism, which is closely related to outdoor recreation, was a \$191.2 million industry in Idaho. In addition, there is the recreation equipment industry in Idaho which is partly largely dependent on users of Idaho's attractive outdoors. This would include camper, trailer, boat, tent, etc., construction. The number of Idahoans either wholly or partially employed to serve in-state and out-of-state recreationists should be considered. Also, some consideration should be given to the money which would be spent in Canada, Montana, Washington, and elsewhere, were Idaho unable to satisfy its residents outdoor needs. All this is only the economic value of outdoor recreation in the basin under the present management program.

The personal satisfaction and value derived from such things as clean water and air, untrammelled wilderness, white water, the sighting of wild game, etc., are much harder to evaluate. Information from the questionnaires will indicate orders of preference and some correlation between expenditures and these factors, but much of this evaluation is still inchoate and the best we can do may be qualitative.

The strictly economic value of future outdoor recreation in the basin is going to depend on the type and number of users. We know that the number of annual users is increasing; unfortunately, the data on past use is quite sparse. Consequently, predictions concerning future use will be based on many sources such as data from highway counts, campground counts, fish and game censuses, actual counts for certain activities such as float trips on the Middle Fork and predictions for surrounding states and the entire country. The basin input-output study will hopefully indicate the returns to the basin from outdoor recreation and what magnitude of returns various increases in users will produce. These figures will then be compared with the user capacities under the various types of management and development being considered. Finally, these outdoor recreation benefits will be compared with the opportunity cost of the developments necessarily foregone in providing for sustained use of portions of the basin by outdoor recreationists. An attempt will be made to predict how tourists and others will look at the attractiveness of the State under these various management policies, to evaluate the importance of having a flow resource to draw upon rather than a stock resource, the fact that the State need not make no significant investment other than recognition of its outdoor recreation resources to get significant returns, what the people of Idaho desire, and other pertinent policy factors.

Subproject Title: Commercial Fisheries

Subproject No. 4

- Objectives:
1. To determine the present contribution of Salmon River salmon and steelhead stocks to commercial fisheries of the Pacific Coast by segments of the river.
 2. To estimate the effects of wild river versus non-wild river classification of the Salmon River on the yield of salmon and steelhead for the commercial fishery.

The person assigned to commercial fisheries has been gone most of this past semester. Presently he is gathering data for the study. The report for this subproject is expected to be completed by late this spring.

In recent years the Salmon River drainage has contributed something over 30% of the total Columbia River salmon and steelhead runs. The relative importance of commercial fishing for salmon and steelhead versus sport fishing for the same has decreased over the years. Dams, chemical and thermal pollutants, destruction of the spawning grounds, and other factors have decreased the total run. Due to the above factors, regulation of the commercial fishing season has been more and more constricting with a resulting decrease in the catch even though the commercial value of the catches has increased.

In recent years, salmon and steelhead hatcheries have been built at several locations in the Salmon and Clearwater drainages. We are just beginning to see the effect of these hatcheries. This year's salmon and steelhead runs were records for recent years. Unfortunately, the number of fish that came up the Columbia but did not spawn due to nitrogen disease and other factors was also a record. The net result was a less than expected number of spawning salmon and steelhead, with the natural spawning fish decreasing in importance relative to the hatchery fish.

To adequately consider the importance of the commercial fishery, some forecasting as to the effect of advanced hatchery management versus the adverse effects of dams and pollutants must be made.

There is also the question of the role of the Salmon River Drainage and the State of Idaho in the commercial fishery, economically speaking. Most of the benefits accrue to the coastal states. If the commercial fishery is able to pay its way, hatcheries on the coast in small undisturbed streams might be better suited for increasing this industry. The Columbia run could then be left for the sport fisherman to enjoy amid the untrammelled

solace and beauty of a wild and/or scenic river. Forecasts of the effects of future development on either the Snake or the Salmon regarding anadromous fish runs has been quite pessimistic. This subproject and that portion of outdoor recreation devoted to sports fishing should clarify the role of development as related to future anadromous fish runs.

Subproject Title: Irrigation

Subproject No. 5

Objectives: 1. To determine possible irrigation present and potential within the Salmon River Basin and the value of this use of water.

2. To determine the impact of such irrigation on the Salmon River as a wild river.

3. To determine possible use of the waters for use in irrigation outside the basin and determine its value and possible impact on the Salmon River as a wild river.

The research on the irrigation potential of the Salmon River is being done by Professor C. C. Warnick as a special problem while he is in Holland. The progress that we know of at this time consists of an inventory of the Class I, II, III, and IV cards for each county south of the Salmon River Basin, and the present irrigated acreage in these counties. Professor Warnick is using this data to determine where potential uses for Salmon River water are, and to indicate where the best division points are.

A full report should be forthcoming after Professor Warnick returns in September of 1970.

Subproject Title: Water for Municipal and Industrial Use

Subproject No. 6

- Objectives:
1. To determine needs for municipal and industrial use in the Salmon River.
 2. To assign a value to the water that might be used for municipal and industrial use in the Salmon River.
 3. To determine the impact of the present and future use of water for municipal and industrial use on the Salmon River as a wild river either in total or in segments.

Prior to quantifying objective three it will be necessary to assess the industrial potential of the Salmon River Basin, i. e. , the mineral and timber product potential will have to be inventoried, then estimates of the quantities of water necessary to process the materials and to satisfy the needs of new communities which would support the industries can then be attempted.

Municipal and industrial demands for Salmon River water are presently minor. Future demands will depend on the management policy of the basin and the economically feasible industries attracted to the area. Since municipal needs do not consume large amounts of water, if present effluent standards are enforced, there should be no water problems in the foreseeable future resulting from these demands. The foreseeable types of industry which might establish in the basin include some large water users but not large water consumers. Again, if adequate effluent treatment standards are enforced, there should be sufficient water to meet the needs. Problems which might arise in the upper basin are those centering around a large agricultural diversion or consumption followed by a large water demand for municipal and industrial users in the Salmon City area. Such a situation could definitely have a detrimental effect on river quality and fish movement as well as creating a water shortage. The low flow plus a large, warm, nutrient rich return flow could cause large enough algae blooms to affect oxygen content of the river while the increased temperature could completely halt anadromous fish migration during critical periods.

Added information on water needs in Idaho is presently being sought. Preliminary study indicates that in 1969 approximately 2×10^9 gallons (approximately 600 AF) of water worth approximately \$500,000 were used for municipal and industrial purposes in the Salmon River Drainage.

Final determination of future demands on Salmon River water will be made after the natural resources of the basin have been inventoried and the economically feasible industrial potential has been determined. The demands by these industries and their supporting communities can then be quantified. Some determination of potential ground water use capacity will be necessary under a full or even partial development plan as increased river use and decreased river quality will increase ground water demands.

Subproject Title: Water Quality Control

Subproject No. 7

- Objectives:
1. To determine the value of water of the Salmon River for water quality control in existing developed state.
 2. To determine the value of waters of the Salmon River for water quality control under a developed state that would include storage of water for release to aid in flow augmentation.
 3. To determine the effect on the wild river nature of the Salmon River of storage of water in the Salmon River basin for flow augmentation to improve water quality at downstream points in the Columbia River system.

The Salmon River is so pure and remote that no systematic gathering of data was undertaken until 1966 when the U.S.G.S. set up a station at White Bird. Even this data does not include BOD and turbidity. The Idaho Department of Health has data on flows in several different years. These appear to be the only sources of water quality data for the Salmon River.

The importance of water quality depends on the use the water is put to. One of the major considerations for the Salmon River has been its purifying effect on warmer, more polluted Snake and Columbia water. During the critical portion of the year--late summer when the flows are low, the Salmon amounts to only about one third of the Snake at their confluence. The effect on the Columbia is questionable now and will be even more so once all the lower Snake dams are filled. To increase the significance of the flow would require large amounts of storage, necessitating big dams, which would doom the anadromous fish runs. Based on present data the results are only speculative as to the benefits of such a scheme.

An equally important consideration is the man caused pollution in the upper reaches of the main Salmon. There are growing concentrations of humans near the river in its most critical period at Redfish Lake, the Stanley Basin area, various campgrounds along the river between there and Clayton, in the vicinity of Salmon City, North Fork, Corn Creek, and between Riggins and Whitebird. In addition to these, there are the cattle and sheep all along the upper reaches and the towns themselves. What effect do these have?

The cost of equipment and manpower to do an intensive study of water quality is beyond this study. The situation can be treated qualitatively. What are the towns doing about their waste? What is the Forest Service

doing about campground waste? Physical observations will also be used. The main Salmon is clear and cold at Stanley. Below North Fork it is 10 degrees warmer and quite turbid from algae. By Corn Creek it has cleared up considerably. Similarly the changes with seasons can be observed. The Salmon ran brown below Riggins this past year. Was this natural or due to logging on the South Fork and elsewhere?

The importance and cost of water quality maintenance will depend on the management policy pursued in the basin. Much development with its roadbuilding, logging, mining, pulp mills, etc., will make maintaining even near present standards costly. On the other hand a wild river policy will largely maintain present water quality at a minimal annual cost. The final write up on water quality will be subsequent to the specifications of the various management alternatives and the degree and type of development included in each.

Subproject Title: Hydroelectric Power

Subproject No. 8

- Objectives:
1. To determine the magnitude of hydroelectric resources in the Salmon River Basin by segments of the river.
 2. To determine the effect of possible hydroelectric developments on segments of the Salmon River as a wild and scenic river.
 3. To determine an optimum combination of peak load and base load development of the hydroelectric resources compatible with the regional power system as a means of determining the value of the power resources.
 4. To investigate alternate limited potential for power such as offstream and special purpose developments which recover portions of the resource.

Introduction

Power values commonly are computed for hydroelectric plants on the basis of cost for the most economical alternate supply. When this cost is then compared to the annual cost of a hydroelectric facility, a benefit-to-cost ratio is secured which measures the relative standing between hydroelectric projects, and all those plants which have costs less than alternative costs are identified.

For purposes of individual plant evaluation the procedure is quite clear cut and comparisons are on a common basis. However, as we look toward more resource-oriented systems additional factors may (should) be introduced. These new factors are necessary to:

- a. Acknowledge that there is available a functional and productive hydroelectric plant at the end of the payout period for operation and maintenance costs only.
- b. Account for the alternative plants utilization of a non-recurring resource. As we find little further use for the term "unlimited", the conservation of such a resource (its existence at the end of an evaluation period) may have considerable value.

Traditional Values

On the basis of present values and preliminary design proposals the main stem of the Salmon River from the Snake River to North Fork, Idaho has a potential installation of 3,311,000 kilowatts, operating at an average yearly plant factor of 35% (individual plants vary from 26 to 89%). If we

apply Federal Power Commission power values to this development, annual gross income value is approximately \$60,000,000.

Non-Traditional Values

The further development of the region in some alternative manner to the conventional method would depend (for power) probably upon seasonal pumped storage or diversion to other basins of that water above fishery and recreational needs.

In a preliminary survey of diversions, lift requirements for pumping exceed greatly any recovery of power potential in the receiving basin.

Seasonal pumped storage opportunities appear more promising, but are not liable to be usable for at least a decade or more in our order of development.

Future Work

1. General data is largely collected on the available alternatives, but needs review and consolidation.
2. Evaluation methods for a plant available at end of the payout period are needed. How do we introduce this into long term? High Hell's Canyon study does model this on Basin Account basis.
3. Present value of unused resources is not known, nor is the value of lack of CO₂, ash, and heat pollution easily expressed.
4. The actual annual value of power stated above represents the regional value. The plant operation represents a considerably smaller specific annual employment dollar localized to this area. The regional gain from the total power value will with some difficulty be identified more provincially to just Idaho.

Subproject Title: Flood Control

Subproject No. 9

- Objectives:
1. To determine flood control needs within the Salmon River.
 2. To determine the potential for flood control storage in the Salmon River Basin based on the needs of the entire Columbia River System.
 3. To determine the impact of flood control storage and channel control on the Salmon River as a wild river in total or in segments.

Several contacts have been made with the Corps of Engineers to obtain information on potential flood control benefits for the Salmon River. Some benefits may accrue to the Salmon River Basin, but most flood control benefits from structures on the Salmon River would be realized on the lower Snake and the Columbia Rivers.

At present, most of the illustrations for the report have been prepared, and the composition of the text material should be completed in late January. The full text of the Flood Control report should be prepared by February 1, 1970.

Subproject Title: Navigation

Subproject No. 10

- Objectives:
1. To determine the navigation potential within the Salmon River area.
 2. To determine the value and need for regulation of the Salmon River to enhance downstream navigation on the Snake and Columbia River.
 3. To determine the impact of navigation or regulation of water on the Salmon River as a wild river either in total or in segments.

Most of the data needed for the navigation study were obtained from the Corps of Engineers along with the Flood Control information. In this case, the majority of the benefits for navigation will also tend to accrue downstream in the lower Snake and the Columbia Rivers. It will be necessary to separate recreational and commercial aspects of navigation on the Salmon River.

The navigation report should be out in April of 1970.

Subproject Title: Transportation and Access

Subproject No. 11

- Objectives:
1. To obtain information on cost of developing a transportation system into the Salmon River Basin for the purpose of gaining access to the natural resources of the basin.
 2. To estimate the effects of possible road systems on segments of the Salmon River under degrees of Wild and Scenic river designation.
 3. To allocate the cost of a transportation system in the Salmon River Basin to the various uses of the natural resources as part of either partial or total development.

Preliminary analysis of the construction cost data thus far obtained indicates that the planned topography and soils approach do not adequately define the cost relationships for various road standards at different locations in the basin. Past road building costs will not necessarily reflect the cost of building stable roads in batholith soils. From study of research on road building problems it is hoped that the deficiencies in present road construction, the remedies for the deficiencies, and their associated costs can be determined.

Objective number one is to relate road cost to resource uses. This implies a standard road adequate to handle a given volume of traffic at some satisfactory level of service. A brief look at traffic data obtained from the Forest Service shows that the majority of roads do not presently handle sufficient volumes of traffic to warrant consideration of capacity characteristics of road standards. Rather, criteria needs to be developed which will promote a harmonious blend of traffic characteristics and protection of environmental values.

The batholithic soils in portions of the basin are so unstable, that standards requiring stable roads may dictate the extent of resource development. In developing road standards it will be assumed that land management practices will recognize watershed, sustained yield, and esthetic values.

Road standards are related to the rate of resource use. More intensive resource use generates more traffic and requires higher road standards to maintain a given level of service. Contrary to this, however, are the esthetic and environmental factors which sometimes dictate reduced road standards. A weighting system needs to be found which will balance the desired level of service goal with the minimization of esthetic and environmental damage goal.

Any future road network and the standards for its various parts will depend upon the management policy of the basin, what resources are economically developable, and the planned rate of consumption of these resources. Different combinations of resources and different rates of consumption will dictate different transportation systems. Therefore, it is recommended that the third objective of this subproject be changed to allow more flexibility. This can be done by relating transportation costs to each resource use rather than trying to lay out a road system which would handle any foreseeable combination of resource uses. Then as the resources are studied, their transportation costs are easily determined and maximum flexibility to study alternative development plans is maintained.

It was previously mentioned that development of resources might not be economically feasible because of access constraints resulting from the need to protect esthetic and environmental values. Additional study will be made to determine if this constraint on development can be taken care of by including in the transportation costs for the various subsections of the basin a realistic estimate of increased construction and intangible costs.

A convenient format for presenting transportation cost data is needed to facilitate calculation of costs when multipurpose use of a transportation facility is planned. If several resources are transported over the same road, it would be unrealistic to apply the total unit transportation cost to each resource use. It is also unfair to expect the first resource use to finance initial construction while subsequent users would incur operating and maintenance expenses only. Perhaps analysis of the cost allocation procedures will contribute to a solution of this problem.

A proposed addition to the subproject is to summarize available traffic data in a form suitable for use as an independent check on growth patterns determined by other subprojects.