TEACHING/RESEARCH/SERVICE
Forest/Range/Wildlife
Fisheries/Utilization

University of Idaho
College of Forestry,
Wildlife and Range Sciences
Moscow, Idaho 83843

January 5, 1976

Mr. Bill Bruner
Pacific Northwest Regional Commission
1205 Washington Street
Vancouver, Washington 98660

Dear Bill:

Enclosed is a brief progress report on Idaho Primitive Area stream ecology work conducted July - December, 1975. It should bring you up to date on our work under Contract No. DEMO - 1015 (10690005).

Please don't hesitate to contact me for further information.

Sincerely,

C.M. Falter
Associate Professor
Fishery Resources

CMF:cs

Enclosure

cc: Dean John Ehrenreich
Idaho Wilderness Research Center

AQUATIC ECOLOGY OF IPA STREAMS

PROGRESS REPORT

JULY - DECEMBER, 1975

INTRODUCTION

This research program is designed to define the aquatic ecology of selected pristine and impacted streams in the Idaho Primitive Area.

The objectives of this project are two fold:

1. To describe the aquatic ecology of a selected range of Pristine sub-alpine to montane zone streams in the Idaho Primitive Area. Many of the streams in the Idaho Primitive Area have historically received very little use pressure. These areas present unique natural aquatic habitats in Idaho which may serve as "barometer" streams, which can help evaluate more intensively used areas.
2. To determine the impact of surrounding human and animal use activity on the aquatic ecology of selected sub-alpine and mid-elevation streams in the Idaho Primitive Area. We are comparing these impacted sites with pristine sites of similar geologic composition enabling estimates of the degree of aquatic degradation and rates of change. Long-term management plans may then be formulated.

APPROACH

Research sites:

Stream ecology is governed by watershed geometry and geochemistry, primarily through regulation of stream productivity. The Idaho Primitive Area may be viewed

as five geochemically different landforms.

1. Precambian Belt Series, metamorphosed sedimentary rocks;
2. Volcanics-Seven Devils and Casto Volcanics Series;
3. Volcanics-Challis;
4. Batholith Granitics with heavy intrusive activity;
5. Batholith Granitics with negligible intrusive activity.

Stream productivity can be expected to decrease from the Belt Series through the Batholith Granitics with negligible intrusive activity.

During the first year of study we selected a pristine and an impacted stream from three of the above types, Precambian Belt Series, Volcanics-Challis and the Batholith Granitics with negligible intrusive activity. A study site was placed at the headwater and mouth of each stream (10 sites). In addition, two sites have been located on Big Creek, one below the mouth of Crooked Creek, and one above Big Creek Ranger Station. Other streams are being intermittently sampled to broaden the range of habitats studied.

Factors considered in site selection were degree of isolation, present activity in the watershed, and past land use which may impact the aquatic system, i.e. continuing watershed instability due to earlier timber harvesting or persistent drainage of heavy metals into the streams from 19th and early 20th century mining.

Study Parameter

We are measuring the following environmental variables throughout the ice-free season:

Water temperature
Turbidity
Oxygen
pH
Sulfates
Bicarbonates
Heavy Metals - copper, iron, lead
zinc, cobalt, mercury, calcium,

Conductivity

Suspended Solids

Nitrates

Phosphates (total and soluble)

Physical Habitat Survey of each stream site (flow, bedload, sediment size, stream bank stability, cover, pool-riffle ratio, gradient)

magnesium, sodium, and potassium,

Algae (composition and quantity)

Benthic Invertebrates (composition, quantity and species diversity)

Some of the above analyses have been conducted on site while other analyses have been or are being done at a later date in University of Idaho laboratories. Sampling and field analyses has been supported from field kits supplied by pack animals.

Discussion:

June, 1975 was spent preparing for the field season while waiting for the initiation of funding. The first field trip was taken one week after the initiation of funding. The purpose of the first trip in early July was to sample Lodgepole and Beaver Creeks in the Chamberlain Basin, while also developing familiarity with packing procedures and field equipment. The sampling team flew into Taylor Ranch on Big Creek on the 8th of July, then proceeded with six pack animals to Lodgepole and Beaver Creeks for sampling of these streams. The trip was completed with stream sampling around upper Big Creek. Extremely high water conditions of the streams precluded access to the mouth of Lodgepole and Beaver Creeks.

The next trip was put off until the first of August while waiting for arrival of equipment. A trip was initiated on the first of August from Big Creek into the Monumental Creek Basin. On the trail one of the field crew (two men) received a broken leg and head injury from a kicking horse, forcing cancellation of the sampling trip.

On the fourteenth of August another field crew attempted the sampling of the Monumental Creek Drainage. On a seventy mile trip, they sampled Snowslide Creek, West Fork of Monumental Creek and the Main Fork of Monumental Creek.

The final sampling trip of the season was initiated on September 24th from Cold Meadows. Twelve stations were sampled on this nine day, 135 mile pack trip, repeating early sites, plus Big Creek at the Taylor Ranch and another station on the Middle Fork of the Salmon River at the Flying B Ranch.

Field Data:

The data displayed in the following Tables are a partial listing of field data obtained from 1975 sampling. Algae, benthic invertebrates, and laboratory chemical analyses are now being processed using procedures recommended by the Environmental Protection Agency, 1973, "Method for Chemical Analysis of Water and Wastes". This work will be carried out through the winter months.

Oxygen concentrations all approximated 100% saturation when corrected to altitude. There was no distinguishable variation of % oxygen due to the geochemically different landforms. Temperatures were relatively low as expected, with any one individual reading varying with season, time of day, stream cover, pool-riffle ratio, gradient, and exposure of the drainage.

Bicarbonate, conductivity, and pH fell well within the boundaries expected for undisturbed streams. The range of bicarbonates was between 21 and 70 mg/l HCO_3, the highest reading at the mouth of Snowslide Creek and the lowest in the headwaters of Lodgepole Creek. The range of conductivities fell between 38 and 122 µmho, the high and low also at Snowslide and upper Lodgepole Creeks, respectively. Snowslide Creek is the Precambian Belt Series geochemical landform type. This landform type can be expected to have the most productive streams as indicated by the high

bicarbonates and conductivities. Lodgepole Creek (Batholith Granitic Series with negligible intrusive activity) could have the lowest productivity potential as indicated by bicarbonates and conductivity. Biota analysis will shed further light on this theory. pH was usually close to neutrality at 7.0 and showed little change between geochemical landforms.

Over the winter and early spring months, work will be continued on the samples taken in the field and returned to the University of Idaho labs.

Planned Work in 1976:

Next year, in addition to the present sampling sites, we hope to sample Big Creek in more detail. We feel that data on Big Creek is important because of possibility of future mining activity in its headwater reaches. Any aquatic degradation of Big Creek could severely damage the natural and anadromous fisheries of the entire Big Creek drainage.

We would also like to set up several permanent sampling sites on Chamberlin Creek, one of the largest drainages in the Idaho Primitive Area. Chamberlin Creek transects several different geological landforms, thereby confounding cause-effect conclusions, but it's size calls for regular sampling. We are interested in determining effects on the aquatic habitat of Chamberlin Creek from the concentrated use activity in the vicinity of Chamberlin Air Field and Ranger Station. We did observe very heavy siltation to Chamberlin Creek from streamside trails following thunderstorm activity. We want to determine the degree of aquatic degradation from such trail use.

We are interested in diurnal sampling of the stations next year to determine the change occuring in the streams on a round-the-clock basis. The physical habitat to be determined only once beings most of the parameters do not change over time, i.e. gradient, sediment size, cover, stream bank stability, and pool-riffle ratio do not change considerably on a short-term year to year basis.

Table 1. Summary of field-determinal water quality characteristics of certain Idaho streams, July-September, 1975.

		Site	Temp (°C)	O_2 (mg/l)	% O_2 Saturation	Conductivity (µmhos)	pH	HCO_3 (mg/l)	Flow (cfs)	Elevation in ft.
Precambian Belt Series	Snowslide Creek	* Mouth	7.8	10.4	106.1	121.5	6.9	70	43.98	5200
		Head-waters	8.0	8.8	98.4	59.0		29	5.11	7600
	Beaver Creek	Mouth	7.8	10.4	104.4	98.0		41	51.20	5000
		* Head-waters	7.0	9.5	96.9	87.0	7.0	36	211.87	5800
Challis Volcanics	West Fork Monumental Creek	* Mouth	8.8	9.3	94.8	58.0	7.1	29.5	29.25	5700
		* Head-waters	7.7	9.5	102.4	86.8	7.0	31.5	16.91	7000
	Monumental Creek	* Mouth	11.3	8.9	100.6	61.2	7.1	26	38.26	5800
		* Head-water	6.8	9.5	97.1	57.0	6.9	23	32.85	6000
Batholith Granitic w/o heavy intrusive activity	Lodgepole Creek	Mouth	4.0	11.3	104.8	85.0		53	10.33	5100
		* Head-water	7.9	9.0	96.0	38.5	7.1	21.8	24.86	6600
Large streams	Big Creek	Taylor Ranch	7.5	10.8	104.4	116.3	8.1	56.0	372.8	3900
	Middle Fork Salmon River	Flying B Ranch	11	11.3	117.3	102.5		48.0		3600

Other parameters (Turbidity, Suspended Solids, NO_3, PO_4, SO_4, Heavy Metals, Algae & Benthic invertebrates) have been sampled and will be analysed in the lab.

*Data is a mean of two samples

Table 2. Summary of field-determinal water quality characteristics of certain Idaho Primitive Areas for each landform type, July-September, 1975.

Mean Average for Geochemical Landform	Temp °C	O_2 (mg/l)	% O_2 Saturation	Conductivity (µmhos)	pH	HCO_3 (mg/l)
Precambian Belt Series	7.6	9.8	101.5	78.1	6.9	42.4
Challis Volcanics	8.6	10.0	98.7	65.8	7.0	28.1
Batholith Granitic w/o heavy intensive activity	6.6	9.7	100.4	54.0	7.1	32.1

Aquatic Ecology

of

Idaho Primitive Area Streams

C. M. Falter, Principal Investigator
College of Forestry, Wildlife and
Range Sciences
University of Idaho
April 15, 1975

The research program described herein will define the aquatic ecology of selected pristine and impacted streams in the Idaho Primitive Area, providing baseline and change-rate data on which to base effective management of these fragile systems.

This investigation has two major objectives:

1) To describe the aquatic ecology of a selected range of pristine sub-alpine to mid-elevation streams in the Idaho Primitive Area. The Idaho Primitive Area contains a very large number of sub-alpine and montane zone streams that have historically received little use pressure. These areas present unique natural aquatic habitats in Idaho which may serve as "barometer" streams ..... comparators to help evaluate more intensively used areas. These aquatic habitats should also be studied as unique systems on their own merits ..... undisturbed, pristine environments.

2) To determine the impact of surrounding human and animal use activity on the aquatic ecology of selected sub-alpine to mid-elevation streams in the Idaho Primitive Area.

We will emphasize use-related impact on selected streams in the Idaho Primitive Area, both historic (mining and logging) and present day (grazing and recreational use). Comparison of these impacted sites with pristine sites of geologically

similar watersheds will enable not only estimation of the degree of aquatic degradation but also estimates of the rate of change. Long-term management plans may then be formulated.

METHODOLOGY

Research Sites

Stream ecology is governed by watershed geochemistry, primarily through regulation of stream productivity. The Idaho Primitive Area may be viewed as five geochemically different landforms:

1) Precambrian Belt Series, metamorphosed sedimentary rocks;
2) Volcanics - Seven Devils and Casto Volcanic Series;
3) Volcanics - Challis;
4) Batholith Granitics with heavy intrusive activity; and
5) Batholith Granitics with negligible intrusive activity.

Stream productivity can be expected to decrease from the Belt Series through the Batholith Granitics.

In the first year of study, we will select a pristine and an impacted stream from each of the above landforms in the Idaho Primitive Area. A study site will be placed in the headwater reach and lower reach of each stream (20 sites). In addition, two sites each will be placed on Big Creek and on the Middle Fork of the Salmon River.

Factors to be considered in site selection will be degree of isolation, present activity in the watershed, and past use which may impact the aquatic system, i.e. continuing watershed instability resulting from earlier timber removal or persistent drainage of heavy metals into stream waters from 19th century spoil piles.

Suggested study streams are:

Landform	Pristine	Disturbed
Belt Series	Snowslide Creek	Beaver Creek
Casto and Seven Devils Volcanics	Rock Creek	-
Challis Volcanics	West Fork, Monumental Creek	Monumental Creek
Batholith Granitics (Intruded)	Little Loon Creek	Yellow Jacket Creek
Batholith Granitics (No intrusive activity)	Lodgepole Creek	Whimstick Creek

Timing

Water chemistry of Idaho streams usually fluctuates from minimum dissolved solids load at or immediately following peak runoff in June to maximum dissolved solids load in late August. We will sample each stream site several times over this time period and through the fall.

Study Parameters

The following environmental variables will describe the aquatic ecology of these Primitive Area streams throughout the ice-free seasons:

Water temperature

Color

Turbidity

Oxygen

pH

Conductivity

Suspended Solids

Nitrate

Phosphorous (total and soluble)

Ammonia

Sulfate

Bicarbonate

Heavy Metals - copper, iron, lead, zinc, cobalt, and mercury

Calcium, magnesium, sodium, and potassium

Algae (composition and quantity)

Benthic invertebrates (composition, quantity and species diversity)

Physical habitat survey of each stream site (flow, bedload, sediment size, stream bank stability, cover, pool-riffle ratio, and gradient)

Fish Populations - native and anadromous fish composition, population size, and status.

Much of the above analyses can be conducted on site; some samples will be preserved and shipped back to the University of Idaho for detailed chemical or biological analysis. Chemical analysis will follow procedures recommended by Environmental Protection Agency, 1973, "Methods for Chemical Analysis of Waters and Wastes". All site work will be conducted from field kits supported by pack animals and occasional air-resupply.

This program will describe the salient components of representative streams in the Idaho Primitive Area, especially with regard to aspects of vital concern to recreation, fisheries and wilderness management needs. Comparison of impacted stream sites to pristine sites of similar watersheds now (and especially in later years) will allow estimation not only of the degree of degradation but also estimates of the rate of change. Long-term management plans may then be formulated.

ANNUAL BUDGET

Idaho Primitive Area Streams Investigations

Principal Investigator, C. Michael Falter	$ 2,100
Two Graduate Assistants @ 4,200	8,400
Secretarial Time	600
Staff Benefits	1,000
Packing Costs:	
2 horses, gear and trailer	950
Pack animal maintenance	1,600
Field Living Expenses:	
160 man days @ 5.00	800
Travel:	
7,000 miles @ .15	1,050
Supplies:	
Back pack shocker, inflatable boat, subsistence gear, water analysis chemicals and glassware and office supplies*	3,200
Annual Total Project Costs:	$19,700

*Limnological sampling equipment will be furnished by the College of Forestry.

ANNUAL BUDGET

Idaho Primitive Area High Lakes and Streams Investigations

February 7, 1975

Principal Investigator, C. Michael Falter	$ 2,100
Two Graduate Assistants @ 4,200	8,400
Secretarial Time	600
Staff Benefits	1,000
Packing Costs:	
2 horses, gear and trailer	950
Pack animal maintenance	1,600
Field living expenses:	
160 man days @ 5.00	800
Travel:	
7,000 miles @ .15	1,050
Supplies:	
Back pack shocker, inflatable boat, subsistence gear, water analysis chemicals and glassware and office supplies*	3,200
Annual Total Project Costs:	$19,700

*Limnological sampling equipment will be furnished by the College of Forestry.

Aquatic Ecology

of

Idaho Primitive Area High Lakes and Streams

C. Michael Falter, Principal Investigator
February 4, 1975

The research program described herein will define the aquatic ecology of selected pristine and impacted high lakes and streams of the Idaho Primitive Area, providing baseline and change-rate data on which to base effective management of these fragile systems.

This proposed five-year investigation has 2 objectives:

1) To describe the aquatic ecology of a selected range of pristine alpine to sub-alpine lakes and streams in the Idaho Primitive Area; and,

2) To determine the impact of surrounding human and animal use activity on the aquatic ecology of selected alpine to sub-alpine lakes and streams in the Idaho Primitive Area.

Objective 1:

The Idaho Primitive Area contains a very large number of alpine to sub-alpine lakes and streams that have historically received little use pressure. These areas present unique natural aquatic habitats in Idaho which may serve as "barometer" lakes and streams ..... comparators to help evaluate more intensively used areas. These aquatic habitats should also be studied as unique systems on their own merits ..... undisturbed, pristine environments.

We will survey potential study sites in the Chamberlain Basin, Big Creek Lakes area, Big Horn Crags, and the Sleeping Deer Lakes area, finally selecting three lake and three stream sites for in-depth study.

A lake and a stream site will be selected from each of the three basic geological landforms in the Idaho Primitive Area:

a) The Precambrian Belt Series, metamorphosed sedimentary rocks;

b) The Permian-Triassic Seven Devils Series and Casto Volcanics; and,

c) The Batholith Granitics.

Segregation by watershed geochemistry is important because different geochemistry will govern productivity of surface waters in these watersheds. These six sites will also be selected for isolation, low use, and balanced aquatic communities. The water chemistry, algae, zooplankton, benthos, and fish populations of these sites will be evaluated with minimum disturbance of the natural systems. Study of these pristine aquatic systems will emphasize summer and fall conditions, but some effort will be expended to define under-ice winter lake and stream dynamics. Work towards this phase of the study will be most intensive in the first three project years.

Objective 2:

This study phase will emphasize user impact on the more accessible high lake and streams in the Primitive Area. In project years 3, 4, and 5, we will select several sites rejected in the first phase because of easy accessibility and altered environmental conditions. We will then analyse use-related impacts, including eroded stream and lake banks; silted-in shoreline, littoral, or riffle areas; decreased benthic invertebrate and fish habitat; high water turbidity; shoreline weed beds; and accelerated lake aging through increased nutrient inputs. The principal investigator has described the sensitive nature of these high lake and stream systems in past work on lakes of the Beartooth Primitive Area in Montana. Comparison of these impacted sites with pristine sites of similar watersheds will enable not only estimation of the degree of degradation but also estimates of the rate of change. Long-term management plans may then be accordingly formulated.