PRELIMINARY REPORT OF PROGRESS ON THE STREAM ECOLOGY PHASE OF THE CASPAR CREEK PROJECT[1] JUNE TO DECEMBER, 1965

Introduction

During the summer, orientation surveys were carried out and inital plans for the conduct of the project were completed. Generally, the plans are for the investigation of the short and long-term effects of logging and associated activities on the nature, the ecology, and the productivity of one branch (the south fork) of Caspar Creek. The north fork watershed is not to be logged and the north fork will thus serve as a "control" area for the study. The detection and measurement of any effects resulting from logging activities are to be facilitated by studies of the south fork for about two years before, as well as after, logging is commenced on its watershed, and by simultaneous studies on the north fork.

In this, the stream ecology phase of the overall Caspar Creek watershed project, the resources of ultimate concern are assumed to be the fisheries resources, rather than, say, the domestic, industrial, or agricultural water resources. Accordingly, the ecology research plan based on the salient requirements of fishes for their well-being and productivity. These requirements include those of:

1. living space

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[1]Being conducted by Humboldt State College under authority of Memorandum of Understanding between Humboldt State College and the U. S. Forest Service, dated July 8, 1965.

2. food
3. water temperature
4. dissolved oxygen
5. protection

Since not all stream conditions and all aspects of stream ecology can be emphasized in this study, only those, among the most important ones, expected to be altered to the most significant degree by logging will be studied extensively. Only limited attention, initially at least, is expected to be given to protection, dissolved oxygen, other chemical qualities of the water, and other factors.

The extent of the living space for fishes in a stream is a function of the instantaneous amount of water available in the stream, the depth of the water, its velocity, the surface area of the water, the wetted perimeter of the bottom of the stream, and the nature of the bottom materials. Changes in the volume of flow in a stream can affect all these factors. Since there is reason to expect logging to result in changes in flows, in the evaluation of the effects of logging on fishes, it is deemed necessary to monitor these conditions.

Fish food organisms are produced both in the water and out of the water. The effects of logging on the production of and availability of both aquatic organisms and of important terrestrial organisms must be given adequate consideration. Logging can affect the production of aquatic organisms through its influence on the amount of light reaching the stream, on water temperature, on the amount of living space available to the organisms, and on the abundance and distribution of stream bottom materials, as well as other factors. Thus, possible changes in the composition, distribution, abundance, and production of important aquatic fish food animals and the plants and animals they are dependent upon are to be ascertained and correlated wherever possible, mainly with changes in stream illumination, water temperature, and amount of living space for these organisms. The availability of terrestrial animals as food for fishes is expected to be affected by logging through its alteration of the composition and extent of the floral canopy over the stream and streamside and other nearby vegetation. In this study these aspects of the vegetation are to be measured and correlations between them and the contribution of terrestrial organisms by this vegetation to the supply of food to the stream are to be sought.

Changes in stream width, depth, volume of flow, and velocity, and changes in the amount of light reaching the stream can be expected to occur upon logging near the stream and elsewhere on its watershed. Many combinations of such changes could markedly alter stream temperature conditions. Changes in temperature can affect the production rates of fishes, fish-food organisms, and the plants and animals on which these organisms are dependent for their production. The species of organism and the prevailing temperature level will determine whether changes will be favorable or unfavorable for organism production. Changes in temperature could occur which could be lethal to some organisms. The specific causes of water temperature change associated with logging will be sought as will some of the relationships between degree of change of temperature and degree of change in the causitive factors.

The bulk of the effort on the project will be placed on studies of the south fork during the two years before logging is to be commenced on its watershed. Since completely adequate attention cannot be given to both forks of the creek and since the watershed of the north fork is not to be logged, less effort will be given to this fork during this time.

Summary of work undertaken to date

Both forks in the main study sections were staked at 100-foot intervals for permanent reference.

Detailed maps were made of two sections totalling 2000 feet of the south fork. The maps indicate the location and extent of pools and riffles, stream width, meander, general nature and extent of bottom materials, prominent landmarks, and the location and extent of beds of aquatic vegetation. The mapping was complemented by photographs of sections of the stream, of bottom materials, and of the floral canopy.

Measurements of the daily amount of light reaching the stream at many stations on the south fork were made with a recording pyroheliometer. Records were kept of water temperature change over stretches of stream on both forks variously exposed to the sun.

Some preliminary work was done on the characterizing of the principal types of stream bottom materials.

Exploratory sampling of bottom. and drift organisms was completed. Regular collections of terrestrial and aquatic organisms dropping to the water surface were made at a number of stations on the south fork. Cursory observations of the organisms being consumed by juvenile salmon and trout were made.

Short sections of the south fork were screened and occasional observations were made on the fishes in each. Data gathered were mainly on species, abundance, weight, and length. Specimens were collected for food habit studies.

Frequent observations were made of general conditions throughout the length of the south fork study area and occasional survey trips were taken to the north fork. Obvious changes in water flow, aquatic plant growths, fish distribution, abundance of invertebrates, and other conditions were noted.

Stream sections to be studied intensively in the future were selected tentatively after much general observation and consideration of the requirements of the project.

The field work described above was carried out from June to September. Since September the work has been mainly in the laboratory and the office on identification and enumeration. of collected specimens, compelation and analysis of data on temperature and light, surveying literature, and the refinement of plans of action.

Representative preliminary results

Thirty-eight simultaneous continuous daily records of water temperatures, two stations at a time, on the south fork were obtained. The minimum recorded temperature change between two stations (600 feet apart) on. a clear day was 0°F. The maximum recorded change between two stations (300 feet apart) was 3°F. In the former case, the stream was well-shaded between the two stations, and in the latter case, it was fairly well exposed. Heating of the water during daylight hours on clear days was, of course, more pronounced at stations not well-shaded that at well-shaded sites.

Only a few water determinations of water temperature were made on the north fork, but one set of observations there shoed the possible extreme effect of stream-bed disturbance accompanying extensive exposure of the stream to sunlight. In this case, the temperature increased from 60°F. to 75°F. over a distance of only 578 feet.

Generally, it is clear that increased exposure of this stream to sunlight, during the summer at least will considerably affect the temperature of it. Spreading and levelling of the stream bed by logging activities in the bed may result in a further increase in the degree of heating of the water.

The degree of stream shading and thus, of course, stream heating, is indicated by the amount of solar radiation being received at the water surface. Pyroheliograph (Taylor no. 5-3850 recordings at numerous stations in the study area on the south fork indicate water surface shading conditions from extreme to moderate. The minimum recorded radiation was 12.6 Langleys. This amounts to only 1.9 per cent of the average maximum, radiation available at that time (684 Langleys). The maximum recorded radiation was 154.8 Langleys, or 20.5 per cent of the average maximum available at that time.

Stream sections well-exposed to the sun contained dense growths of algae, while well-shaded sections did not. Fingerling salmonids appeared to be considerably less abundant in sections where these growths were extensive.

Samples of organisms dropping to the water surface were collected with shallow boxes of 1 square-yard surface area, equipped with plastic liners and filled with a formalin solution. About one-fifth of the 155 samples taken have been analyzed. Seventeen orders of aquatic and terrestrial insects are represented by these samples. Members of both groups were present in numbers sufficient to indicate that both may contribute considerably to the food supply of fishes in the stream. The minimum number of insects collected per (24-hour) box-day was 5. The maximum was 62.

Work plan for the winter period, 1965-66

Regular laboratory and office activities will be continued throughout the winter. Sometime during December and January representative winter conditions of flow, depth, width, water temperature, illumination, and floral canopy will be ascertained. Also, samples of bottom and drift organisms, "drops organisms, and fishes will be collected.

Personnel participating in the work to date

Dr. John W. DeWitt
Dr. Richard h. Ridenhour
Mr. James Andrews

Most of the field work was accomplished by Mr. Andrews, although Dr. DeWitt spent 20 days and Dr. Ridenhour spent 8 days in the field. Dr. Ridenhour has mainly been responsible for the planning of the work with fishes and the analysis of the data on fishes. Dr. DeWitt was mainly responsible for planning the other aspects of the work completed and underway.

Report prepared by John W. DeWitt
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