GREAT BASIN REDBAND TROUT (*Oncorhynchus mykiss newberrii*) HABITAT IMPROVEMENT USING FELLED WESTERN JUNIPER (*Juniperus occidentalis*)

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SUMMARY

Efforts to manage stream temperature have focused on maintenance or improvement of streamside vegetation through riparian fencing and vegetation planting projects. This project investigates the use of felled western juniper (*Juniperus occidentalis*) as a fencing alternative for the improvement of streamside vegetation and the amelioration of summer stream water temperature on a Great Basin redband trout (*Oncorhynchus mykiss newberrii*) inhabited stream. Redband trout movement, willow shrub measurements, and hourly water temperatures were collected pre-treatment during the summer of 2002 and post-treatment data will be collected during the summer of 2003. Amount of felled juniper placed over the stream channel was documented by low-level helium blimp aerial photography. Passive Integrated Transponders (PIT tags) and swim-through PIT tag antennae gates tracked the movement of fish between treatment locations in 2002. Data from 2002 indicate that maximum summer daytime stream temperatures exceeded 78°F.

INTRODUCTION

Some streams in southeastern Oregon are water quality limited due to stream temperatures observed during summer months (ODEQ 2002). These stream temperatures reach levels potentially lethal to redband trout (at least 75°F for > 2 hours) (Gamperl and Rodnick 2003). Methods of managing stream temperature have focused on maintenance or improvement of streamside vegetation through riparian fencing and vegetation planting projects. However, these methods are not always feasible. Our study intends to expand the applicability of these methods and to make use of western juniper trees, which are increasing in abundance on Great Basin rangelands (Gedney *et al.* 1999). Our study investigates how placing felled western juniper trees over a stream channel effects summer stream temperatures, willow growth, and fish movement. Objectives of this study are to: (1) determine if felled western juniper cover moderates summer stream temperatures; (2) determine if felled western juniper placed over streamside willow shoots is an effective protective structure for reducing ungulate herbivory; and (3) describe the movement and distribution of native redband trout in relation to placement of felled western juniper over the stream channel. Pre-treatment fieldwork was conducted during the summer of 2002 and post-treatment evaluation will occur during summer 2003.

MATERIALS AND METHODS

Our study site is located on Steens Mountain, 6 miles west of Andrews, OR. The study stream reach is 4,000 ft in length and begins just below the stream's source (springs) at an elevation of 6,800 ft. It is contained within a low gradient alluvial valley. The majority of annual precipitation comes in the form of snow during October to April. Spring rains are common and thundershowers may occur throughout the summer months. Average annual precipitation is estimated to range between 13 to 20 inches. The site receives run-on from snowmelt during the spring and early summer. The soil temperature regime is frigid (USDA 1988). Extreme temperatures range from above 90°F during summer to -32°F in winter. The frost-free period is about 30 to 60 days. Optimum period for plant growth is from mid-May to mid-August (Bowers 2002). Below the study reach, the stream flows westward into several miles of narrow rugged canyon before exiting into the Catlow Valley. Historically, the site has been homesteaded, plowed, and used as irrigated pasture. Homesteaders excavated a new stream course, effectively rerouting the stream. The present day stream shows evidence of channelization. Recently, the area has been under 4 years of rest from grazing and was prescribed burned by the Bureau of Land Management during September of 2001. Willow shrubs (*Salix spp.)* are present, but their growth appears to be severely retarded due to annual herbivory by native ungulates.

EXPERIMENTAL DESIGN

Stream reach was divided into 4 contiguous blocks of 1,000 ft in length. Each block was assigned two (500 ft length) treatments: (1) felled western juniper trees placed over the stream channel, and (2) open. The starting position of the reach (upstream or downstream end) for the layout of contiguous blocks within the stream reach was randomly selected. Treatments of covered or opened were randomly assigned to the first block and alternated thereafter proceeding towards the opposite end of the study reach. Western juniper trees were felled during spring 2002. Trees were placed over the stream and removed of their limbs from one side of their bole during September 2002 (Figure 1 and 2).

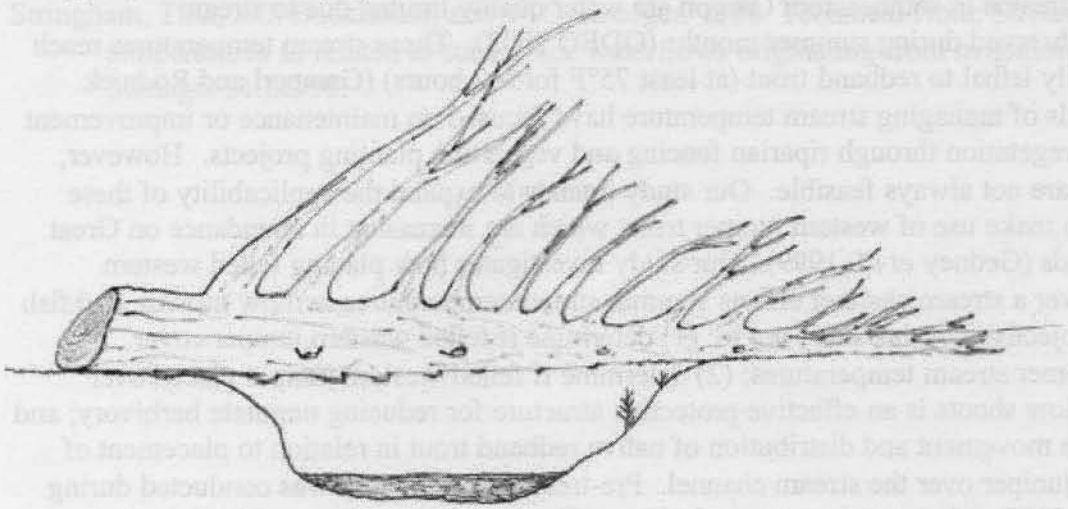

Figure 1. Cross-sectional view of western juniper tree placed over the stream channel.

Figure 2. Aerial view (from helium blimp) at intersection of a covered and open treatment.

WATER QUALITY

Onset stow-a-way thermistors were placed within each treatment area and recorded stream temperatures hourly throughout the summer months of 2002. Thermistors were placed at locations 0.5 miles and 1.0 miles above and below the study reach, as well as at the streams source (springs). Air temperatures were recorded hourly at 5 thermistor locations spaced across the stream study reach. A Rosgen (1996) level II stream classification was completed during 2002. Four permanent stream channel cross-sectional profiles were randomly located in open treatment areas. Cross-sectional profiles are measured once a year at baseflow. Point-in-time discharge and velocity are measured at cross-sections eight times during the summer season using a magnetic head pygmy style Price meter. Preliminary results describe the stream study reach as a Rosgen E channel. Maximum summer daytime stream temperatures exceeded 75°F during 2002.

WILLOWS

Willows within treatment areas were censused, tagged, and measured for volume. Volume measurements included: (1) maximum height; (2) maximum width; and (3) perpendicular width to maximum width (to the nearest cm). Distance of willows to stream's water edge were recorded to the nearest cm. Status of willow plants occurring within or outside of the bankfull width were recorded as well as whether or not they showed evidence of herbivory. Willow measurements were made during the first two weeks of August 2002 and will be repeated in 2003.

REDBAND TROUT

One hundred redband trout were tagged with PIT tags during June of 2002 and there movements were recorded by swim-through PIT tag antennae located at treatment intersections

throughout the summer months of 2002 (Figure 3 and 4). All redband trout captured were marked by an adipose fin clip. Fish were measured for fork length to the nearest mm. Those fish with a fork length longer than 3.94 inches were implanted with a 0.9 long x 0.14 inch wide half-duplex PIT tag. An entry point for the PIT tag was made by making a 0.16 inch-long incision on the midventral line, beginning 0.59-0.79 inches anterior to the pelvic girdle. The incision was made just deep enough to penetrate the peritoneum. The transponder was then implanted by gently pushing it posteriorly within the cavity (Roussel *et al.* 2000). No suture was recommended for fish greater than 3.3 inches (Tranquilli 2002). A handheld Allflex International Standards Organization compatible radio frequency identification portable reader was used to verify functioning of individual tags before and upon release of fish. Fish were anesthetized using clove oil extract diluted 10:1 with ethanol. The clove oil solution was used at a rate of 1 fluid ounce per 7.75 gallons water. Captured fish were allowed to recover from anesthesia for a minimum amount of time, for immediate release back into the stream area from which they were captured. In addition to the fish tagged in 2002, 100 more redband trout will be tagged during June of 2003 and their movements will be recorded throughout the summer months of 2003.

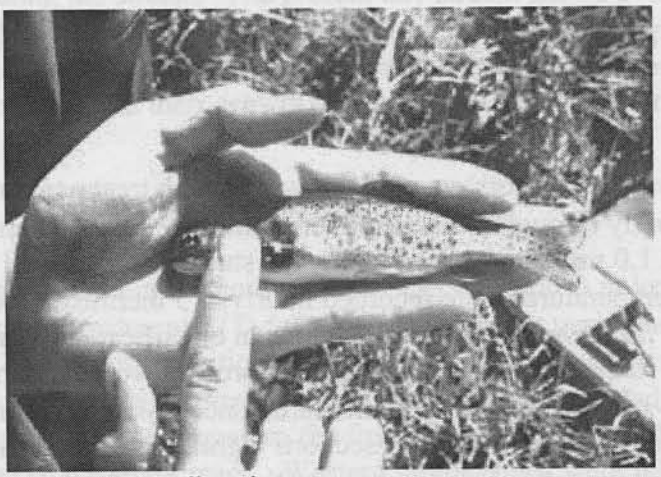

Figure 3. Implanting PIT tag into redband trout.

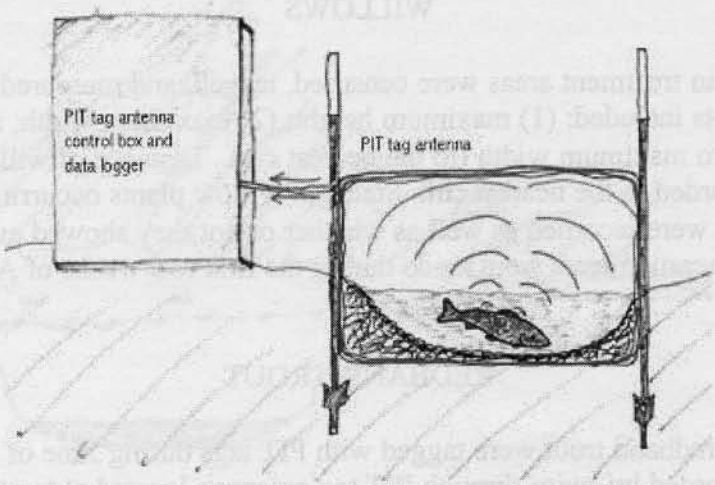

Figure 4. Cross-sectional view of swim-through PIT tag antenna setup.

AERIAL PHOTOGRAPHY

Western juniper cover will be quantified using blimp photography and image analysis software. Approximately 300 white shingle (1 x 1 ft) ground control targets were placed at evenly spaced intervals along both sides of the stream, within the study reach. These targets were associated with Universal Transverse Mercator coordinates using global positioning system ground mapping. A small helium blimp (Figure 5) was elevated to a height approximately 150 ft above the ground surface at locations along the stream channel length until the whole length had been photographed, and photos were taken using Kodak Royal Gold 200 speed color film before and after treatment during 2002. Photographs were developed, scanned at a resolution of 600 dots per inch, and saved in digital image format on compact disk for analysis using image analysis software to determine % cover of juniper placed over the stream.

Figure 5. Using helium blimp for aerial photography.

PRELIMINARY RESULTS

A total of 109 willow shrubs were tagged and measured in August of 2002. Less than 2% of the willows tagged were found outside of the stream's bankfull width, and less than 10% showed evidence of ungulate herbivory of current year's growth prior to adding juniper treatment. Average willow height was approximately 18 inches.

Stream temperature above the study reach (2-3 miles), at its ground water source, remained between 43-47°F all summer. However, summer daytime maximum stream temperatures exceeded 75°F within the study reach (Figure 6). Beginning mid-September, study reach maximum daytime stream temperatures no longer exceeded 70°F and by mid-October maximum daytime stream temperatures did not exceed 55°F.

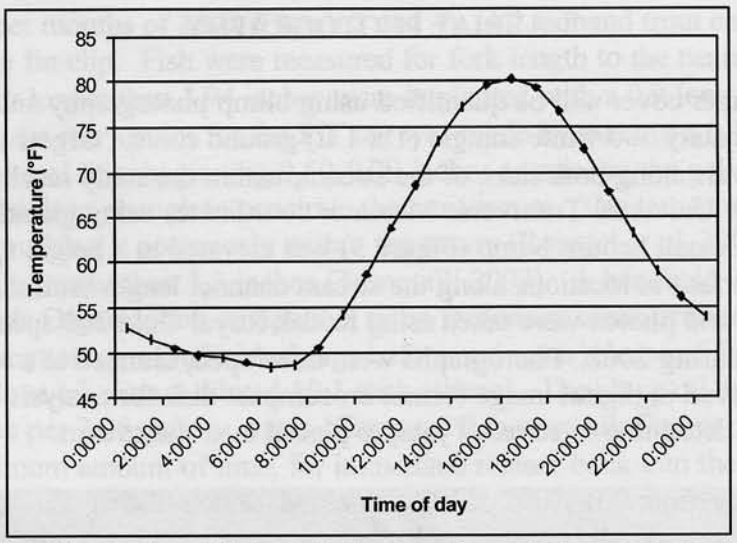

Figure 6. Temperature fluctuation (24 hours) for a section of stream study reach recorded on June 11, 2002.

During May 2002, only 2 fish were found within the study reach, but from June-October, 62 fish were recorded moving throughout the area. During September and October 2002, fish that had not been recorded during the early part of the summer were found leaving the uppermost section of stream and entering into the stream study reach. Some fish were also found to be leaving the study reach and moving downstream during this time. It is not known if this movement was due to the cooling of stream water temperature during this period. Further information will be available 2004, following the 2003 field season.

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