

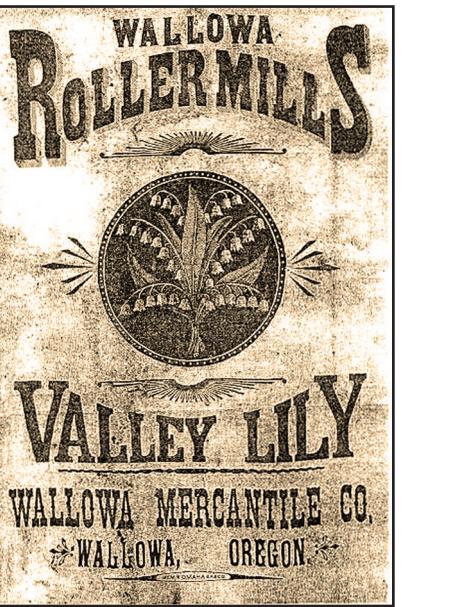
From the Archives

The Flour Mills of Wallowa County

by Lacey Moore, GRMW

According to the Oregon State University Extension service, there were 35,600 acres of wheat grown in Wallowa County in 1929, a figure nearly three times the amount grown in 2008. The harvesting of grain for human and animal consumption fueled the need for grist (grain) mills in the county. The earliest mill, the Joseph Milling Company, was opened in 1882, and the last to open, the Troy Roller Milling Company, was established in 1912. In all, eight mills of various sizes operated across Wallowa County. The towns of Joseph, Enterprise, Wallowa, Lostine, Flora, and Troy all had sizeable mills. Two smaller working mills were located at Spring Creek and Parsnip Creek. The mills played a large part in creating Wallowa County's infrastructure; one citizen's recollection was that "it was not until a millrace was diverted from the Wallowa River; a mill set up and a store opened that the city of Wallowa amounted to much." Like the town of Wallowa, Lostine, Enterprise, and Joseph have flour mills to thank for the establishment of the first electrical plants in their cities. An advertisement in the November 11, 1909, issue of the Wallowa County Chieftain encouraging "Investors and Land Buyers" to move to Wallowa County reports that Enterprise boasted the "best equipped flouring mill in Northeast Oregon."

The flouring mills of this time were especially susceptible to fire, which is evidenced by the fact that fires destroyed three of the mills, and the Joseph Milling Company actually burned twice. The vulnerability of flour mills to fire was the



ABOVE: A photo of a burlap grain sack used by Wallowa Roller Mills. result of the combustibility of flour dust-saturated air. Further to blame in causing mill fires was the mills' use of steam power and their largely wooden infrastructures.

Both Wallowa County farmers and millers contributed a sizeable amount of flour to the supplies sent to soldiers overseas in World War I. Eventually, the establishment of a national railroad system coupled with the development of economies of scale in large Midwest flour mills led to the downfall of the local mill companies. The last mill to operate was the Wallowa Roller Mills, which shut down in 1960.

Information compiled from "The Forgotten Flour Mills of Wallowa County" by Irene Locke Barklow



This newsletter is funded by the Bonneville Power Administration and the Oregon Watershed Enhancement Board

Grande Ronde Model Watershed

1114 J Avenue • La Grande OR 97850
ph 541-863-0570 • fax 541-962-1585

Board of Directors

Mike Hayward, Chairman
Wallowa County Board of Commissioners

Mark Davidson, Vice Chairman
Union County Board of Commissioners

Laura Mahrt, Eastern Oregon University

Allen Childs,
Confederated Tribes of the Umatilla Indian Reservation

Dave Yost, Public Interest Representative

Ted Taylor, Public Interest Representative

Norm Cimon, Conservationist Representative

Larry Cribbs, Economic Development & Industry Representative

Nick Myatt, Fish and Wildlife Representative

Daryl Hawes, Private Landowner Representative

Joe McCormack, Nez Perce Tribe

Kathryn Frenyea, Union Soil and Water Conservation District

Larry Nall, Private Forest and Landowners

Troy Abercrombie, EOU/DSU Student Representative

Emily Spangi, FFA Student Representative

Staff Members

Jeff Oveson, Executive Director

Lyle Kuchenbecker, Project Planner

Coby Menton, Monitoring Coordinator

Jesse Steele, Field Biologist

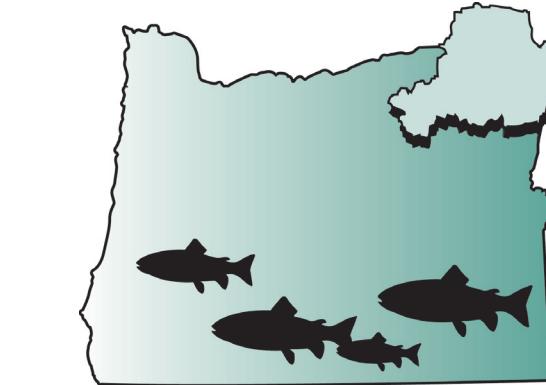
Leigh Collins, Public Involvement/Education Coordinator

Mason Bailie, Database Manager

Mary Estes, Office and Fiscal Manager

Lacey Moore, GIS Technician

Margaret McGladrey,
Ripples Editor
grmw.ripples.editor@gmail.com



Ripples in the Grande Ronde

Winter 2013

RIVERS UNITING NEIGHBORS • QUARTERLY NEWS FROM THE GRANDE RONDE MODEL WATERSHED

Meadow Creek Restoration Project

A Starkey Experiment

by Jeff Oveson, GRMW
with Chris Horn, ODFW; Mike Wisdom, USFS
Pacific Northwest Research Station; Tim Del
Curto, OSU Agricultural Research Station; Joe
Platz, USFS

Since 1989, the Starkey Experimental Forest and Range (Starkey) on USDA Forest Service (USFS) land 28 miles southwest of La Grande has been home to a multitude of research projects. Probably the most significant and comprehensive research project, which has been simply labeled "The Starkey Project," has looked at the effects of ungulates on ecosystems, including key questions about elk, timber, cattle, deer, recreational uses, and nutrient flows on National Forests. Although the Starkey Project asked and answered numerous questions, it was never really intended to involve fish habitat restoration or the evaluation and monitoring of restoration efforts.

Meadow Creek, a tributary of the Upper Grande Ronde River and an important summer steelhead stream, runs through Starkey for a length of more than eight miles. This stream has been enhanced with a three-phase habitat restoration project implemented by USFS Fisheries Technician Joe Platz and his crew from the La Grande Ranger District. The project was supported by Bonneville Power Administration funds secured through the Grande Ronde Model

Watershed. The primary objective of the project is to improve summer steelhead habitat by enhancing the quality and quantity of pools, increasing fish cover, and increasing habitat complexity. Habitat enhancements were achieved by strategically placing large woody debris (LWD) in the form of trees, logs, and rootwads in combination with large boulders used as ballast to help secure the LWD. LWD installations occurred in 2012 and 2013.

In the spring of 2013, approximately three miles of streambanks were planted by hand, including 8,500 deciduous rooted seedlings, 8,000 conifer seedlings, and 3,500 cuttings. The deciduous seedlings were protected as much as possible from drought. Drought protection involves placing sod at planting sites, watering the trees twice during the first year, and adding soil moisture granules, shade cards, and tree mat placements. Small exclosures also were constructed on approximately 50 percent of the deciduous seedlings. In the spring of 2014, an additional 3.5 miles of stream will be planted with 10,000 deciduous seedlings, 12,000 conifer seedlings, and 5,500 cuttings using the same techniques to assure survival



ABOVE: A helicopter picking up rootwads for transport to the Meadow Creek project site for installation. Photo by USFS.

and growth.

How Do Ungulates Graze, and What Effects Do They Have on Habitat Restoration?

This habitat restoration work is not the only activity slated for Meadow Creek. Currently, Starkey is grazed by cattle, elk, and deer. To study the influence

of differential grazing, fenced exclosures were built along Meadow Creek in summer and fall 2013. These exclosures, each approximately one hectare in area (2.47 acres), represent a type of passive stream restoration commonly used on salmon and trout streams known as riparian fencing. Changes associated with these exclosures will be monitored in combination with the LWD installations and plantings.

During the last two summers, Oregon Department of Fish and Wildlife (ODFW) research biologists along with Eastern Oregon Agriculture Research Center and USFS Pacific Northwest Research Station (PNW) personnel have collaborated on the development of monitoring and evaluation protocols to assess changes associated with the above-mentioned USFS restoration activities.

Ted Sedell and Chris Horn of ODFW Fish Research are monitoring both fish abundance and distribution as well as physical changes to the stream associated with habitat restoration. The ODFW monitors juvenile summer steelhead and spring Chinook salmon as well as adult steelhead spawning in Meadow Creek. The ODFW's specific objectives include comparing the distribution, abundance, and density of juvenile salmonids with the physical habitat of the stream.

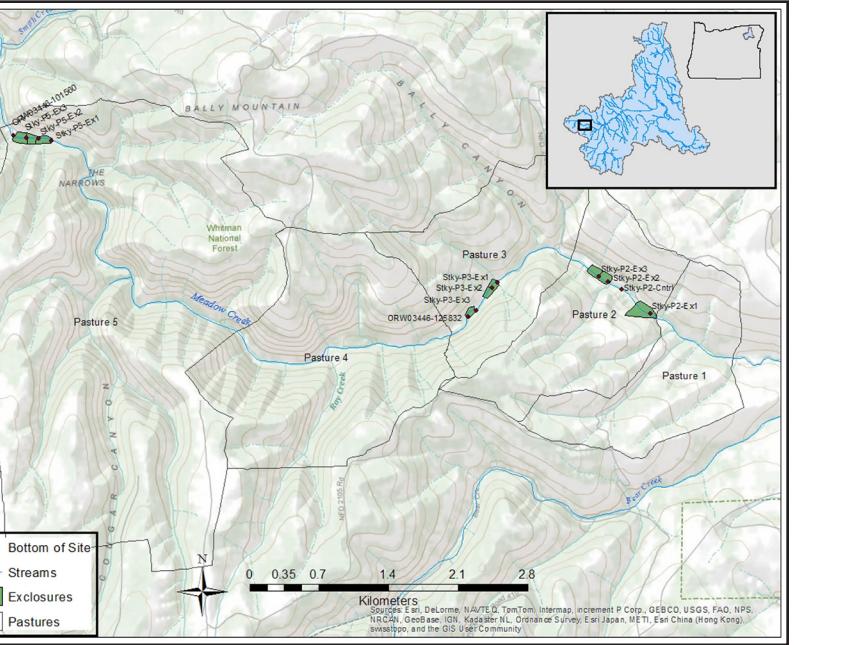
To monitor physical habitat attributes, the ODFW uses the Columbia Habitat Monitoring Program (CHaMP)



ABOVE: Chris Horn and crew conducting a habitat survey within the Starkey Project.

method. CHaMP is used by many groups around the Columbia River basin to evaluate the status and trend of salmon/steelhead habitat. The ODFW has integrated CHaMP into its ongoing habitat monitoring program in the Grande Ronde basin and can use the method to assess stream habitat conditions both before and after restoration. They will be able to characterize the stream's responses to placement of LWD, riparian plantings, and alternative grazing treatments.

In support of habitat restoration, rehabilitation, and conservation action performance assessments and adaptive management requirements of the 2008 Federal Columbia River Power System Biological Opinion (FCRPS BiOp), the Bonneville Power Administration is working with National Oceanographic and Atmospheric Administration (NOAA) and other regional fish management agencies to monitor fish habitat status and trends for each major population group (MPG) in the Pacific Northwest identified through the Endangered Species Act (ESA). Status monitoring provides information about the quantity and quality of current habitat and thereby maximizes spatial coverage with a given number of sample sites. Trend monitoring is used to detect changes in habitat through time and thus requires collecting repeat samples at given sites. Minimizing sampling and measurement error is crucial in order to differentiate this variability from natural variability through time and space. In order to compare information across multiple MPGs, BPA is adopting the standardized fish habitat monitoring protocol, CHaMP, across the entire Columbia River Basin.



ABOVE: Meadow Creek project area. Map courtesy of ODFW

CHaMP is particularly well suited to monitor changes in a stream's physical condition due to its detailed topographic survey method. ODFW staff use a total station (similar to what road and building surveyors use) to survey the stream and its flood zone, then use computer software to convert the survey to a 3D model. Developing the model before and after restoration creates a picture of how restoration activities, such as large wood placement, change the physical characteristics of a stream channel.

To look at fish, ODFW crews also conduct snorkel surveys each summer at CHaMP sites. Snorkelers count and estimate sizes of all fish species but pay particular attention to juvenile salmon and steelhead. By determining how many fish are present at both restoration sites and non-restored sites, the ODFW can determine whether restoration leads to more fish using those sections of streams. They also can compare the physical habitat to the abundance of fish to determine which characteristics are important to fish.

All of ODFW's monitoring looks at restoration sites (i.e., treatments), non-restored sites (controls), and sites outside of Meadow Creek entirely (references).

GRMW Mobile

Simple Data Collection

by Mason Bailie

The Grande Ronde Model Watershed (GRMW) has managed more than 400 projects since our founding in 1992. Located at www.grmw.org/projectdb, our project database contains documents and information about each of these projects. The GRMW would like to be able to monitor the status of these projects every three to five years in an efficient manner that would not require extensive data entry. To achieve this objective, we created a mobile application called GRMW Mobile that handles all of the data entry and organization for routine project monitoring.

Why We Built It

GRMW Mobile is an application that runs natively on Android, iOS, and Windows Mobile. It uses Global Positioning System (GPS)/Global Navigation Satellite System (GNSS) to capture data in the field and upload it to the GRMW's project monitoring server. The mobile application allows users to link pictures and comments to specific data sets (i.e., projects and restoration actions). Also,

because the majority of our projects are located out of range from cellular service, GRMW Mobile can operate without the use of cellular signals. The GRMW Mobile application can store project information on the user's phone until a cellular signal or internet access is available, when it will upload all gathered information to the GRMW's database.



LEFT: A screen shot of how the mobile application will look when accessed on a cellular phone. The user in the view screen is Mason Bailie.

With GRMW Mobile, our staff members are able to collect geospatial data in the field and view this data on their computers as soon as they return to the office. They now have an interactive project database that contains geospatial data which can be displayed in a web browser, Google Earth, or ArcMap.

This functionality also allows for us to share more exciting information about each project. Whenever our project manager uploads his data via GRMW Mobile, it becomes immediately accessible to the public as well.

What's Next

What will we do with all of this data that we are collecting with our phones? By the time the next issue of *Ripples* is published, you will have access to the GRMW Monitoring section of our website. This section will allow you to see the new data from all of our projects in the Grande Ronde Basin from your browser. You also will be able to download data from each project and view it in Google Earth or ArcMap.

Fish Online!

www.grmw.org

- Adult salmon counts at the dams
- Snake River Basin stream flows
- Snow and precipitation reports
- Habitat enhancement projects
- Meetings, activities, and events
- Past issues of *Ripples* and more!

Grande Ronde Model Watershed

Upcoming Board Meetings

The public is welcome to attend

- Tuesday, January 28: 5:00 p.m. Wallowa Community Center 204 East Second Street Wallowa, Oregon
- Tuesday, February 28: 5:00 p.m. Elgin Community Center 260 N. 10th Street Elgin, Oregon

Meeting dates are subject to change. Please call 541-663-0570 to confirm.

Thank you!

Restoration on Graves Creek

by Travis Dixon, CTUIR Fish Habitat Technician,
Allen Childs, CTUIR Fish Habitat Project Lead,
Les Naylor, CTUIR Fish Habitat Assistant Biologist,
and Jake Kimbro, CTUIR Fish Habitat Biologist

In 2010, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Grande Ronde Fish Habitat Program initiated the Rock Creek Fish Habitat Restoration and Enhancement Project to address problems associated with historic land use practices on streams within the 516 ranch near La Grande. The owner of the ranch initially approached the CTUIR for assistance in addressing poor fish habitat conditions. Then, the CTUIR partnered with the Natural Resource Conservation Service (NRCS) and Rick Wagner of the Oregon Department of Forestry (ODF) to develop a comprehensive conservation plan for water, fisheries, and upland habitat enhancements. These enhancements to the 516 ranch property ultimately will be completed with the support of multiple programs, including Bonneville Power Administration (BPA)-sponsored fish habitat programs, the Conservation Reserve Enhancement Program (CREP), the Environmental Quality Incentives Program (EQUIP), and ODF programs.

The 516 ranch is located in northeast Oregon near Hilgard State Park and contains 15 miles of fish-bearing streams that are part of the Rock Creek drainage. Due to the size and complexity of the habitat enhancement project, construction is being phased, beginning with work on 3.8 miles of Graves Creek and 1.4 miles of Little Graves Creek in 2013. The project will address natural resource management opportunities to protect and enhance significant riparian, floodplain, and in-stream habitat for Endangered Species Act (ESA)-listed Snake River Basin spring Chinook salmon, summer steelhead, and resident fishery stock.



ABOVE: April 2013 image of Graves Creek. Showing limited riparian vegetation, entrenched cut banks, and abandoned historic side channels. (Before restoration)

The Need for the Project

Fish habitat has been adversely affected by historic land uses, including livestock overgrazing, road construction, logging, and the conversion of natural stream meanders into straightened channels, which is known as channelization. Approximately 0.2 miles of Graves Creek has been channelized, resulting in a deepened channel, increased channel slopes, and streambank erosion. The loss of floodplain and stream-side groundwater connectivity has led to elevated water temperatures, decreased flow conditions, degradation of riparian and wetland vegetation, and reductions in habitat diversity and complexity. Riparian conditions throughout the project area are poor, as the stream has been disconnected from its floodplain and its flow altered. The poor conditions of the stream have

led to limited recovery of riparian and wetland vegetation and associated beaver colonization.

The project aims to follow the landowner's vision to restore and protect water flow and streambank processes and functions that provide high-quality spawning and rearing habitat for Snake River Basin fish stocks listed by the ESA as threatened and resident fishery resources on a working livestock ranch. Project objectives include protecting existing habitat, re-activating the historic floodplain and associated channel network, increasing stream-side groundwater connectivity and cold water refuges for fish, facilitating vegetation recovery, encouraging long-term beaver re-colonization, and developing off-channel livestock watering opportunities.

Constructing the Enhanced Habitat

Phase 1 of the project was initiated

in 2013 on Graves Creek and Little Graves Creek. This phase was implemented by Hixson Construction, Inc., and Britt Corporation and included the installation of approximately 180 large wood complexes (LWD), which will facilitate bank stabilization, provide overhead cover for fish, create low-velocity stream flows, and diversify stream flow conditions to support in-stream habitat. The LWD structures will provide in-stream control of streambank erosion and maintain optimal stream flow speeds.

Constructed riffles, or shallow lengths of stream where flows are faster and more turbulent, were installed at 25 strategic locations along Graves Creek in segments exhibiting erosion and a lack of connection with associated floodplains in order to restore critical habitat functions. Large wood was placed along the riffle margins to support low-velocity and forage habitat as well as to provide bank stability to protect against erosion while riparian vegetation recolonizes and stabilizes each site.

For the habitat restoration design to mature to its full potential, it will be essential to integrate a comprehensive re-vegetation strategy, which will be implemented during future phases of project construction. The planting strategy will incorporate a combination of techniques, including installation of shrubs and trees in containers, deep live-whip willow plantings, installation of sedge/rush plugs and mats, and custom seeding with a native seed mix that is complementary to upland and riparian/wetland species present in the project site. The ultimate success of the proposed restoration effort will be assessed by the degree to which the diversity of plant species in the stream reach increases.

The Long-term Plan for Sustaining the Fish Habitat Enhancements

A 15-year riparian easement agreement was signed by the CTUIR and the 516 ranch in 2012 that establishes a riparian buffer along 15 miles of ESA streams. The long-term vision for the project area

is to create a diverse assemblage of native plant communities that reflect site potential and contribute to the natural function, resiliency, and stability of a self-sustaining environment. Conservation easement planning incorporates the landowner's desire to enroll as much of the project area into the CREP program as possible following completion of habitat enhancement efforts.

As part of the landowner's larger goal to enhance riparian conditions within the Rock Creek drainage, a network of springs will be developed through a partnership with the NRCS EQUIP program as well as funding from the Union County Soil and Water Conservation District (UCSWCD) small grants program and the Oregon Watershed Enhancement Board (OWEB). The springs will be fenced to protect against cattle disturbance and piped to trough locations outside the riparian boundary.

The Rock Creek drainage falls within the UGC-2 and UGS-16 recovery plan assessment units and has been identified by the Biological Opinion Expert Panel as one of the highest-priority geographic units for protecting and restoring summer steelhead habitat. Given the high value of this project area, the CTUIR Fish Habitat Program has monitored the Rock Creek Fish Habitat Restoration and Enhancement Project since 2010 and has focused on baseline data collection for use in a "Before/After" experimental design and to provide data for use in project planning and design. The metrics that have been gathered in this monitoring

effort include water temperature, stream morphology (cross-sections and longitudinal profiles, pebble counts, topographic data), adult steelhead spawning surveys, and presence/absence of juvenile fish snorkel surveys, and photo-points. The landowner also has provided access to the property for the CTUIR Fisheries Research and Monitoring, and Evaluation Department, the Columbia River Inter-Tribal Fish Commission, and the Oregon Department of Fish and Wildlife to collect stream habitat and biological data on Rock Creek as part of the Columbia Habitat Monitoring Programs extensive monitoring efforts.



ABOVE: Graves Creek in June 2013 before incorporation of large wood structures.



ABOVE: Graves Creek in October 2013 after project implementation. These structures will stabilize actively eroding streambanks and provide habitat complexity and diversity.

Fishing for New Angling Opportunities: *The ODFW's Steelhead Broodstock Collection Program*

by Lyle Kuchenbecker

In October 2013, the Oregon Department of Fish and Wildlife (ODFW) invited steelhead anglers to participate in a steelhead broodstock collection program in the lower Grande Ronde River at Troy, Oregon. The overall objective of this program is to enhance fall steelhead angling opportunities in the lower Grande Ronde River. By collecting hatchery steelhead (wild fish are not included in the program) in October and raising and releasing their progeny, the ODFW hopes to increase opportunities for fall angling by creating an earlier run-timing for the adult steelhead returning to the Grande Ronde River.

The initial Grande Ronde steelhead production hatchery program began in the late 1970s with the goal of creating a steelhead fishery in the Grande Ronde and Wallowa Rivers. Due to low numbers, the native steelhead fishery was closed in 1974. The original hatchery broodstock were collected in the spring at the Ice Harbor and Little Goose dams on the Snake River. The peak harvest timing of returning hatchery adults typically occurred in the spring, possibly as a result of the timing of when the founding parents were selected.

Fisheries managers began an experiment in 2003 with the intent of increasing fall harvest opportunities in the Grande Ronde River. The idea they tested was to collect fall returning fish, hold them at the Wallowa Hatchery, and spawn those fish separately in the spring. Volunteers collected 109, 109, 115, and 77 hatchery steelhead via hook-and-line during the Octobers of 2003, 2004, 2005, and 2006, respectively. The fall brood progeny were marked with a right ventral fin clip to distinguish them from production fish when they returned as adults. To evaluate the objectives of the experiment, four groups of fall brood progeny and four groups from



ABOVE: Jeff Yanke and Dee Lester process an adult steelhead before transport to Wallowa Hatchery. Photo courtesy of ODFW

standard production were fitted with Passive Integrated Transponders (PIT) and coded-wire tags to monitor migration timing into the Columbia River and its tributaries.

Results indicated that the program was successful in producing earlier returns and higher catch rates. The first generation of fall brood (direct offspring of angler-caught fish) returned, on average, three weeks earlier than the standard production-line fish collected at the Wallowa Hatchery in the spring. However, preliminary data suggested that the difference in run-timing for the second generation was only approximately one week. Based on these data, the Wallowa District Fish Biologists this year recommended a "refreshing" of the fall brood line to maintain the early run-timing and fisheries benefits.

The ODFW set up a base camp at Griz Flats on the Wenaha Wildlife Area just above Troy during the week of October 20 to run the fall brood collection operation.

Anglers camped at Griz Flats or at other spots along the river and were supplied lunches and evening meals prepared by ODFW staff and former staff. Throughout the week, 49 volunteers and 13 ODFW staff members fished a total of 835 hours and caught 62 steelhead. Of those 62 steelhead, 23 were hatchery fish and 39 were wild fish. Wild fish were returned to the river, and

hatchery fish were kept to be transported to the hatchery. Fishing conditions throughout the week were tough, as evidenced by the catch rate of more than 13 hours per fish. The flows were dropping, and the water was clear and cold throughout the week.

Following the collection method developed by the ODFW to tag hatchery fish, anglers were supplied with PVC pipe tubes vented on each end. Upon catching a hatchery fish (adipose fin-clipped), the angler put the fish in the tube and placed it in the river where flow through the tube would be constant. Anglers marked locations of tubes by hanging flagging along the road. The next morning, the fish truck (a pick-up with an aerated tank) collected the fish and transported them to the Wallowa Hatchery. The fish will be held at the hatchery and spawned next spring.

The Wallowa Hatchery releases a total of about 800,000 steelhead smolts annually. ODFW biologists recommend increasing production of the fall brood line from the current 160,000 smolts to 400,000 smolts in 2014 and reducing the regular production releases to maintain the total release of 800,000 smolts. It may be necessary to regularly infuse the fall brood line with fall-collected adults to maintain the earlier run-timing in the future. The ODFW is considering repeating the program next year during a similar time frame.

The lower Grande Ronde fall steelhead fishery has become very popular in recent years. The number of angler days fishing steelhead on the lower river has ranged from 2,000 to more than 5,000 days per year since 2000. Catch rates (hours/fish) are some of the best in the west. It is a great time to experience good fishing in very colorful surroundings.

No small thanks go to Wallowa District Fish Biologists Jeff Yanke and Kyle Bratcher for promoting, organizing, and supervising the operation and to Craig Ely and Jon Paustian for running a great camp and preparing outstanding meals for the hungry anglers. The ODFW is to be commended for dedicating the resources to maintain and enhance this fishery.

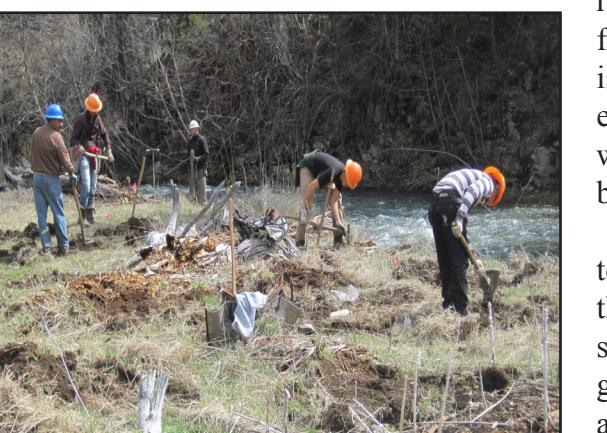
Through this research design, they hope to shed light on the question of great interest to conservation groups and funding agencies through the Pacific Northwest: namely, "How does restoration help fish?"

Comparing Different Grazing Patterns

An additional component of the Meadow Creek project is being undertaken by scientists from the Oregon State University Agricultural Research Center (EOARC) and the USFS PNW Research Station. Additional fencing is being constructed to create a fifth pasture by dividing the largest of the four existing pastures into two more manageable units (see map). With all five pastures to be used in a deferred rotational grazing system, one of the lower elevation pastures will be rested during the latter part of each grazing season, the period of time when ungulates are most likely to browse on deciduous riparian vegetation.

As part of the third phase of the restoration, watering sources are being developed in the higher elevations of these new pastures to encourage ungulates to disperse more broadly rather than concentrating in the riparian areas where they currently have to go for water.

Among the practices to be evaluated will be a five-pasture rotational grazing system using Oregon State University's Union Station cattle. Approximately 120 pair (15 to 20 cattle fitted with GPS collars) will be utilized in a 10-year



ABOVE: USFS crew planting native vegetation along Meadow Creek. Photo courtesy of USFS.

"best management practices" research approach. The focus will be on optimal utilization of the forages, and identifying strategies to encourage cattle to move away from the riparian areas will be a key goal.

Specific strategies will include developing upland water sources, strategic supplementation in the uplands, herding, and cow age/type evaluation. Oregon State University also will cooperate with PNW scientist to evaluate four distinct levels of access by ungulates (cattle, elk, and deer). Type 1 will be free-access grazing by all ungulates, with some controls on cattle to achieve browse utilization objectives

specifically for cattle; Type 2 will include complete exclusion of cattle but with open access to free-range grazing by elk and deer; Type 3 will include complete exclusion of elk and deer with open access to cattle grazing; and Type 4 will exclude all ungulates. A variety of fence types and heights will enable the implementation of the four different grazing types. Specific studies will involve visiting these enclosures with cattle to evaluate composition of diet throughout the summer grazing period.

By understanding the diet composition of both cattle and elk, scientists will be able to model the impact of herbivores on riparian vegetation diversity and ecological function. The new livestock grazing system is scheduled to begin in 2015 following the establishment of the new pasture fences, while the different ungulate exclosures will be constructed by PNW.

Monitoring vegetation responses to the new livestock grazing system and to the different types of ungulate exclosures is scheduled to start in the summer of 2014 to gain a pre-treatment estimate of conditions and will continue at least through the summers of 2015 and 2016 to assess riparian vegetation response to varying levels of



ABOVE: Tyler Warner counts juvenile fish while crew member Ali Fitzgerald records data. Photo courtesy of ODFW.

protection and/or herbivory. EOARC and PNW scientists, who will be conducting the vegetation response monitoring, hope to be able to provide a foundation for future designs of integrated management of domestic and wild ungulates to complement future salmonid enhancement projects.

Monitoring the vegetation responses to these four different management treatments will focus particularly on willows, one of the most common riparian shrubs. A sampling of up to 500 randomly selected willows, cottonwoods, and other shrubs that are highly palatable to ungulates will be assessed for survival, height, canopy volume, and ungulate utilization throughout the life of the project. These assessments will be used to estimate the survival and structural development in response to different grazing management treatments and ultimately to evaluate cattle versus deer and elk effects on shrub recovery goals for effective management of riparian systems for salmonids.

Additional vegetation sampling will monitor long-term changes in structure and composition of conifers, shrubs, grasses, and forbs in response to the new cattle grazing system and in relation to the different types of ungulate exclosures.