Mapping current conditions and modeling the dynamic responses of riparian vegetation and salmon habitat in Oregon.

<u>2008 Annual Project Report</u>

Modeling Component: OWEB # 208-8007-6459

7 January 2009

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Comparison of actual accomplishments to the tasks and timeline established in the Statement of Work:

The beginning of the project was delayed because of time required to recruit and hire a suitable candidate to fill the Post-Doctoral Position. We conducted a nation-wide search for Post-Doctoral Research Ecologist through the late fall and early winter of 2007. We selected an excellent candidate, Dr. Agnieszka Przeszlowska. Dr. Przeszlowska completed her Ph.D. in early June and began work on the OWEB-funded modeling project in July 2008.

Reasons for slippages if anticipated progress was not made:

Except for the delayed starting date, the project is generally on time and within budget. Some differences do exist between the original timeline and the actual accomplishments, as follows:

- Initial watershed analysis was completed ahead of schedule for the MFJD but has yet to be undertaken for the Coastal River basin:
    - This initial analysis is a required first step in developing the aquatic-riparian models. We have not yet begun developing models for the coastal forests, so we have not yet undertaken this step. These analyses are relatively rapid, however, requiring easily available data. We do not foresee any problems completing these analyses.

- Effort for developing VDDT models has focused entirely on the MFJD River basin to date, for the following reasons:
    - It makes more sense to us to focus our efforts within a single biogeographic region for which the models are similar and not to attempt to work on two biogeographic regions simultaneously.
    - Our modeling effort is based upon existing upland VDDT models. These models have already been developed for the east-side forests, but initial drafts of the VDDT models for the coastal Oregon forests are only now being completed.

- Development of VDDT models is progressing more slowly than we would like:
    - Development of the initial models has taken more time than expected. However, we consider this investment of time to be important as these models will serve as a template for all subsequent model development. We expect that the remaining models can be put together much more quickly.
    - During our October field trip to the MFJD, and discussions with interested parties, we realized that we needed to add substantial detail to our models to simulate the effects of both grazing and browsing. This has added considerable complexity to the models, slowing their development, but we believe it is critically important to address these issues early in the project rather than waiting which might require extensive revision of models.

Expenditure reports documenting use of project funds:

Please note: The USFS's Albuquerque Service Center (which handles all billing) does not necessarily forward bills on a monthly basis. The budget summary (shown below) and the "Transaction Registers" (see Apendix A) are only for bills sent to OWEB on or before 31 October 2008.

Table 1: Summary of funds originally budgeted by OWEB, obligated on or before 31 October 2008, and funds remaining.

Budget Category	Funds budgeted by OWEB	Funds spent	Funds remaining
Capital Funds			
In-House Personnel	$226,718.00	$18,879.71	$207,838.29
Travel	$21,187.00		$21,187.00
Supplies & Materials	$3,000.00		$3,000.00
Fiscal Administration	$25,865.00	$1,916.44	$23,948.56
Non-Capital Funds			
Travel	$4,750.00	$284.65	$4,465.35
Equipment	$3,000.00	$439.24	$2,560.76
TOTAL	$284,520.00	$21,520.04	$262,999.96

Progress toward meeting matching funds requirements

Matching funds constitute "in-kind" contribution of salary reflecting the time commitment of permanent, full-time, US Forest Service Research Scientists contributing to this project and related expenses for employee benefits along with the other costs to government (office space, utilities, telephone, etc.) calculated relative to the proportion of their time devoted to this project.

In-kind contributions are meeting projected time commitments for all personnel, except those of the PI, Steven M. Wondzell, who's actual time commitment exceeds that estimated in the original grant budget.

In short, we are fully meeting all matching fund requirements.

Detailed Description of Specific Accomplishments to Date:

Our efforts to date have focused on the MFJD Intensively Monitored Watershed.

Site visit to the MFJD Intensively Monitored Watershed: October 20 – 24, 2008.

- Met with the following people to introduce our project:
    - Holly Bentz, the USFS Restoration Coordinator for the MFJD;
    - Brian Cockran and Kristen Coles from the Confederated Tribes of the Warm Springs – *included visits to both the Forest and Oxbow Preserves in the MFJD and discussion of critical management and restoration issues important to tribal interests (especially restoration practices allowing some continued rangeland uses and impacts of browsing by native ungulates)*;
    - Jeff Fields, Jerry Ebeltoft, Margaret Carey, The Nature Conservancy – *included a visit to TNC's Dustan Homestead Preserve in the MFJD and discussion of critical restoration and conservation issues important to the TNC (especially restoration practices and impacts of browsing by native ungulates)*.
- Extensive tour / sampling across the watershed, including:
    - Reconnaissance sampling of 14 riparian plots for stream and vegetation conditions (*measured wetted, active, and total valley width; longitudinal gradient; and recording a brief description of site conditions, especially composition and condition of riparian vegetation*). The reconnaissance sampling conducted in preparation for FY2009 field sampling campaign.
    - Extensive reconnaissance of the watershed, collecting GPS points at all stream/road crossings to characterize the extent of the wetted stream network during the period of annual low flow. These data will be used to help validate the classification of the stream network with Netrace.

Preliminary watershed analysis:

- We used Netrace and publicly available 10-m DEM to classify stream reaches in the MFJD study area following the stream reach classification of Montgomery and Buffington (1998) (Figure 1).
- Collected available GIS coverages for current and potential vegetation, hydrography layers, watershed and HUC boundaries within the MFJD.
- Intersected classified stream network (Netrace) with potential natural vegetation layer and developed a cross-walk table to upland VDDT Potential Vegetation Types (PVTs; see Figure 2) to guide development of aquatic-riparian VDDT models (see Table #2).
- Collected available upland state and transition models from USFS (current Blue Mountain Models) and the IMAP project (current COLA IV models).
- Conducted comparison among the two suites of models to understand differences in model structure and associated utility for building aquatic-riparian VDDT models.
- Combined Blue Mountain and COLA IV mixed-dry conifer models to build aquatic-riparian VDDT model for step-pool channels flowing through mixed-dry

coniferous uplands (*This vegetation type / channel type is one of the two most common types present in the MFJD (Table 2). This model will serve as a template for the development of all future forested aquatic-riparian models. Consequently, building the first model is time consuming, but it is critical to take the time needed to build a functional model template that can be used for most of the other combinations of forest types and channel types. This will significantly speed the building of future models and minimize the time lost to future model revisions*).

Table 2: Cross-walk between Netrace Classification and the upland VDDT model potential vegetation types (PVTs).

COLA IV PVT Description	Channel Type	Network Length (km)	Network Length (%)
dry meadow - grassland	7 - Colluvial/Bedrock	0.6	0.0%
dry meadow - grassland	6 - Cascade	1.2	0.1%
dry meadow - grassland	5 - Cascade to wood-forced Step-Pool	4.3	0.3%
dry meadow - grassland	4 - Step-pool	11.0	0.7%
dry meadow - grassland	3 - Plane-bed to wood-forced Pool-Riffle	19.2	1.3%
dry meadow - grassland	2 - Pool-Riffle	12.4	0.8%
dry meadow - grassland	1 - Wet Meadow	2.3	0.2%
	Sub-Total -- all channel types	**51.0**	**3.4%**
mixed conifer dry	7 - Colluvial/Bedrock	24.5	1.6%
mixed conifer dry	6 - Cascade	29.7	2.0%
mixed conifer dry	5 - Cascade to wood-forced Step-Pool	170.7	11.4%
mixed conifer dry	4 - Step-pool	200.7	13.3%
mixed conifer dry	3 - Plane-bed to wood-forced Pool-Riffle	53.3	3.5%
mixed conifer dry	2 - Pool-Riffle	12.4	0.8%
mixed conifer dry	1 - Wet Meadow	3.7	0.2%
	Sub-Total -- all channel types	**495.1**	**32.9%**
mixed conifer moist	7 - Colluvial/Bedrock	32.3	2.2%
mixed conifer moist	6 - Cascade	37.4	2.5%
mixed conifer moist	5 - Cascade to wood-forced Step-Pool	196.4	13.1%
mixed conifer moist	4 - Step-pool	201.6	13.4%
mixed conifer moist	3 - Plane-bed to wood-forced Pool-Riffle	68.7	4.6%
mixed conifer moist	2 - Pool-Riffle	7.2	0.5%
mixed conifer moist	1 - Wet Meadow	1.4	0.1%
	Sub-Total -- all channel types	**545.0**	**36.2%**
Mnt. big sage-juniper	7 - Colluvial/Bedrock	1.6	0.1%
Mnt. big sage-juniper	6 - Cascade	1.3	0.1%
Mnt. big sage-juniper	5 - Cascade to wood-forced Step-Pool	5.8	0.4%
Mnt. big sage-juniper	4 - Step-pool	9.3	0.6%
Mnt. big sage-juniper	3 - Plane-bed to wood-forced Pool-Riffle	5.5	0.4%
Mnt. big sage-juniper	2 - Pool-Riffle	3.8	0.3%
	Sub-Total -- all channel types	**27.3**	**1.8%**

COLA IV PVT Description	Channel Type	Network Length (km)	Network Length (%)
Mnt. shrub - meadow	4 - Step-pool	0.3	0.0%
	Sub-Total -- all channel types	**0.3**	**0.0%**
ponderosa pine dry	7 - Colluvial/Bedrock	2.4	0.2%
ponderosa pine dry	6 - Cascade	4.0	0.3%
ponderosa pine dry	5 - Cascade to wood-forced Step-Pool	30.2	2.0%
ponderosa pine dry	4 - Step-pool	57.0	3.8%
ponderosa pine dry	3 - Plane-bed to wood-forced Pool-Riffle	33.2	2.2%
ponderosa pine dry	2 - Pool-Riffle	6.5	0.4%
ponderosa pine dry	1 - Wet Meadow	0.8	0.1%
	Sub-Total -- all channel types	**134.1**	**8.9%**
subalpine parklands	5 - Cascade to wood-forced Step-Pool	5.0	0.3%
subalpine parklands	7 - Colluvial/Bedrock	4.7	0.3%
subalpine parklands	6 - Cascade	1.2	0.1%
subalpine parklands	4 - Step-pool	0.2	0.0%
	Sub-Total -- all channel types	**11.1**	**0.7%**
upper montane cold	4 - Step-pool	57.2	3.8%
upper montane cold	5 - Cascade to wood-forced Step-Pool	38.5	2.6%
upper montane cold	3 - Plane-bed to wood-forced Pool-Riffle	33.5	2.2%
upper montane cold	7 - Colluvial/Bedrock	7.1	0.5%
upper montane cold	2 - Pool-Riffle	6.9	0.5%
upper montane cold	6 - Cascade	6.5	0.4%
	Sub-Total -- all channel types	**149.8**	**10.0%**
Wet Meadow	3 - Plane-bed to wood-forced Pool-Riffle	33.5	2.2%
Wet Meadow	2 - Pool-Riffle	25.1	1.7%
Wet Meadow	1 - Wet Meadow	15.6	1.0%
Wet Meadow	4 - Step-pool	11.5	0.8%
Wet Meadow	5 - Cascade to wood-forced Step-Pool	2.2	0.1%
Wet Meadow	7 - Colluvial/Bedrock	0.5	0.0%
Wet Meadow	6 - Cascade	0.2	0.0%
	Sub-Total -- all channel types	**88.6**	**5.9%**
WY big sage-juniper	2 - Pool-Riffle	1.0	0.1%
WY big sage-juniper	3 - Plane-bed to wood-forced Pool-Riffle	0.3	0.0%
WY big sage-juniper	7 - Colluvial/Bedrock	0.1	0.0%
WY big sage-juniper	6 - Cascade	0.0	0.0%
	Sub-Total -- all channel types	**1.4**	**0.1%**
	Total Stream Network Length	**1503.7**	**100.0%**

Figure 1. Map of the upper MFJD (Camp Creek and Upper MFJD HUCs) showing the Netrace stream classification developed in the initial watershed analysis.

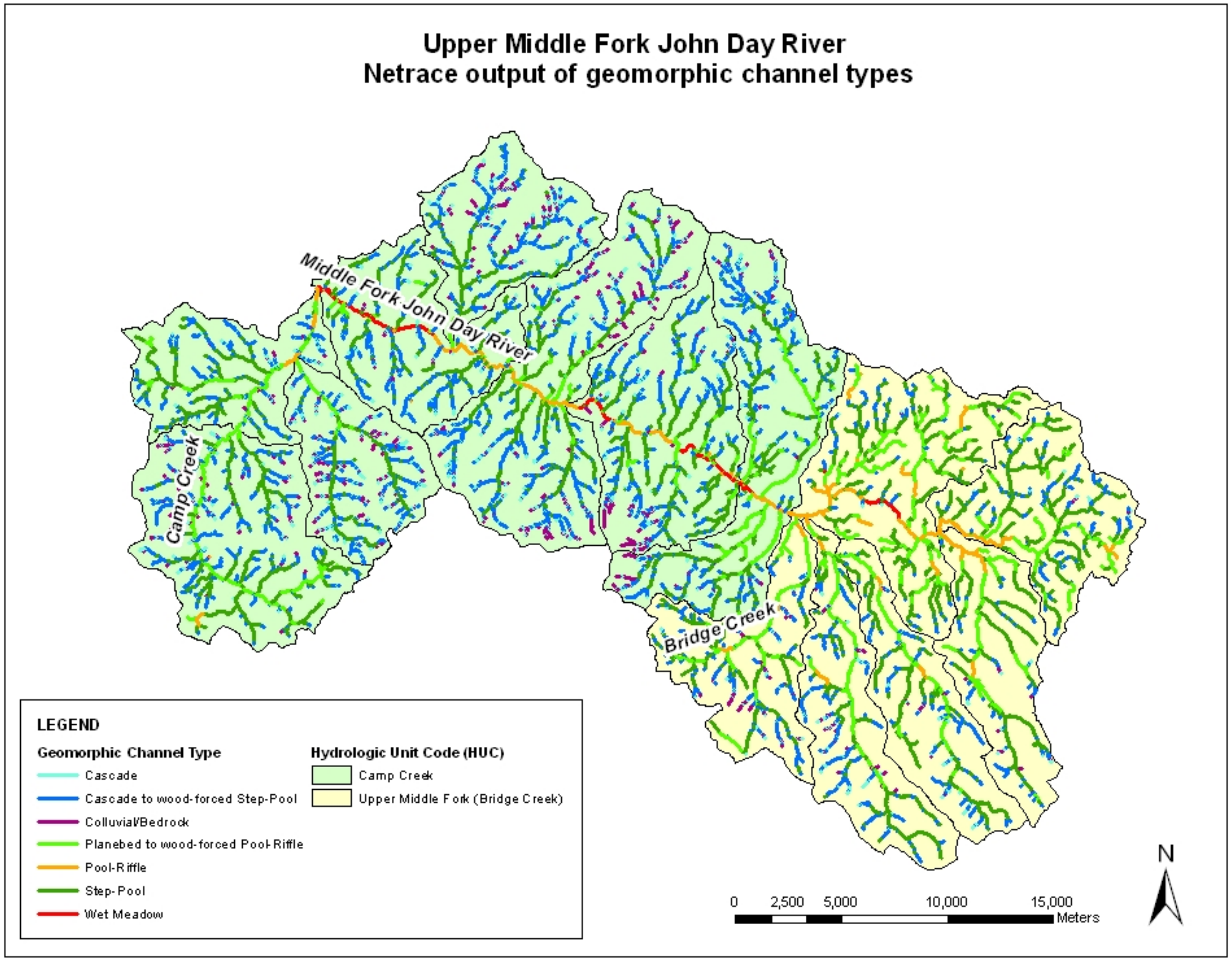
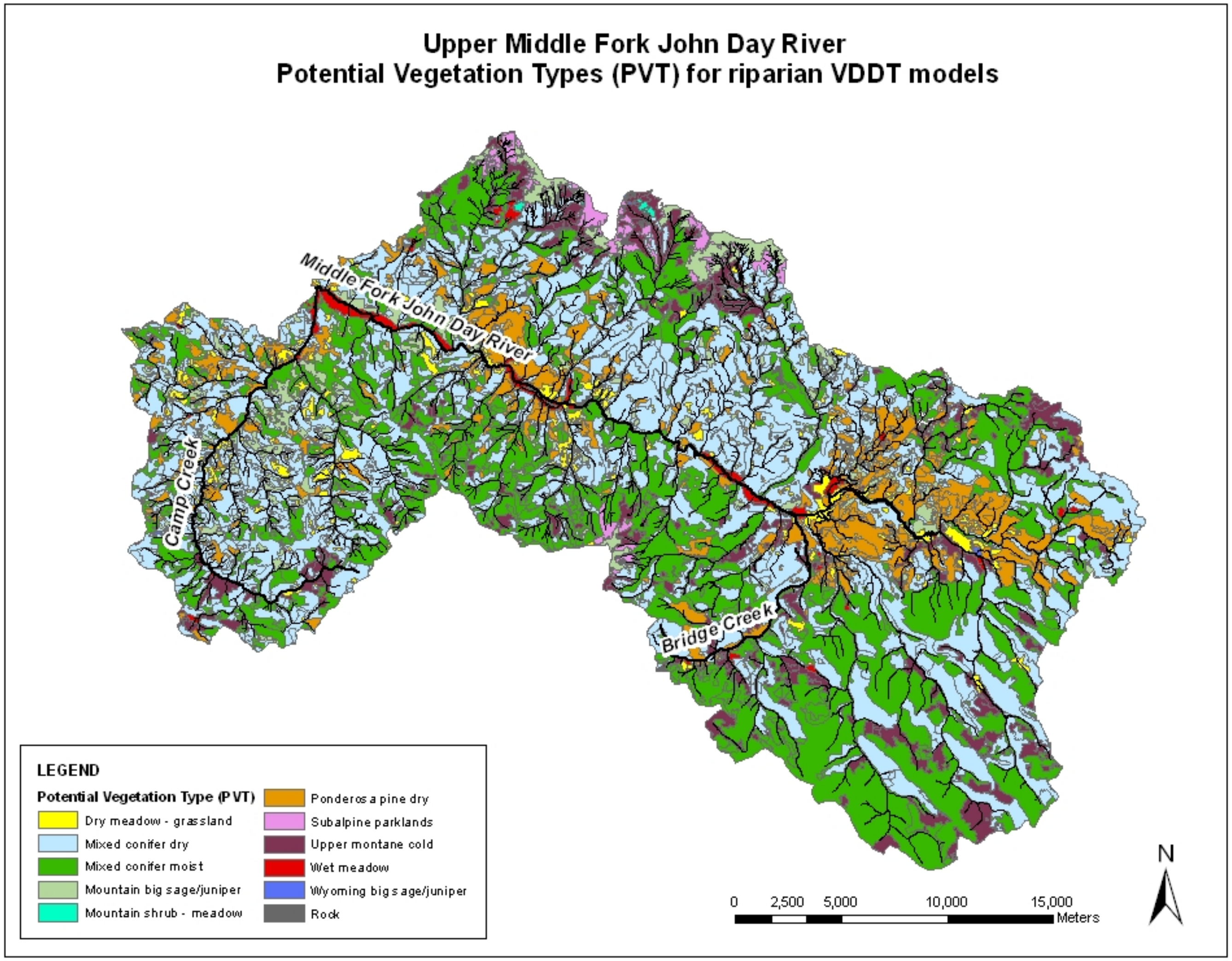


Figure 2. Map of the upper MFJD (Camp Creek and Upper MFJD HUCs) showing the distribution of Potential Vegetation Types used to develop the upland VDDT models used in our initial watershed analysis



Outreach:
Wondzell has made three general overview presentations detailing the background and future research direction for the project, as follows:

- Department of Fisheries and Wildlife, Oregon State University.
- Western Division of the American Fisheries Society, Portland OR.
- USFS Region 6 – Hydrologist and Fish Biologist Program Managers Annual Meeting, Hood River, OR.

We have put together a one-pager documenting our project which we have made available to potential interested parties (Appendix B).

Referece Cited:

Montgomery, D. R. and Buffington, J. M. 1998. Chapter 2: Channel processes, classification, and response. Pages 13-42. In: R. J. Naiman and R. E. Bilby (eds.) River Ecology and Management - Lessons from the Pacific Coastal Ecoregion. Springer-Verlag. New York, NY.

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Appendicies

“Mapping current conditions and
modeling the dynamic responses of
riparian vegetation and salmon habitat in Oregon

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7 January 2009

Appendix A

Transaction Registers for Bills Submitted to OWEB on or before 31 October 2008

“Mapping current conditions and
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Appendix B

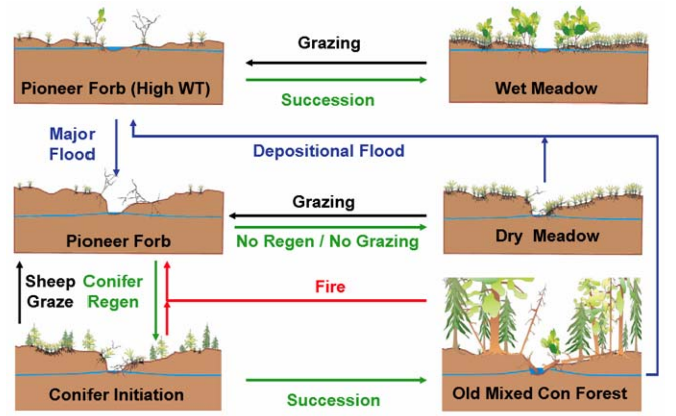
One-page description of the modeling component of the OWEB-funded project

"**Mapping current conditions and**
modeling the dynamic responses of
riparian vegetation and salmon habitat in Oregon

Projecting the responses of riparian vegetation and salmonid habitat to alternative land-use policies and aquatic habitat restoration.

Objective: The overall objective is to produce landscape-planning models for evaluating alternative land-use policies and aquatic habitat restoration plans at the watershed scale. Our models will project the response of riparian zones, stream channels and fish habitat to natural disturbance and land-use activities. The models will include plant succession, background natural disturbances (including hydro-geomorphic disturbances) and land-management activities to simulate temporal dynamics of riparian vegetation, channel conditions, and habitat quality for salmonids.

Methods: Aquatic-riparian models are being developed using a state-and-transition framework in VDDT (the Vegetation Dynamics Development Tool). We are building from prototype aquatic and riparian models we developed for the upper Grande Ronde River (Wondzell et al., 2007) and the current version of VDDT models used by the Blue Mountain Forests for Forest Plan revisions (Interior Columbia River Basin) and the IMAP models developed for Oregon (Western Oregon). To specify initial conditions, models analyses will use existing inventory data and other GIS coverages typically available from USFS planning units. These data will be augmented using remotely sensed data from a companion mapping project. The mapping project is developing new tools using Landsat, lidar, and NAIP imagery to delineate, classify and map the conditions of riparian zones over large areas.



Example of a simplified aquatic-riparian state and transition model for wet meadow potential vegetation.

Outcomes: Pilot-scale applications of our modeling framework will be applied to two intensively monitored watersheds – the Wilson and the Middle Fork John Day Rivers – to examine:
1) current conditions relative to the historic range of variability; 2) likely trajectories of aquatic and riparian habitats given current and expected land-use practices; 3) the potential of passive restoration to meet recovery goals; and 4) the potential of active restoration to accelerate recovery.

<u>Our remote sensing and aquatic-riparian modeling approaches will be designed for portability – to facilitate their use in other landscape analyses of large watersheds in the western US</u>.

For more information, please contact:
<u>Modeling</u>: Steve Wondzell, PNW Research Station, Olympia WA. 360-753-7691 swondzell@fs.fed.us
<u>Mapping</u>: Warren Cohen, PNW Research Station, Corvallis OR. 541-750-7322 wcohen@fs.fed.us

Other Information:
Wondzell, S. M., Hemstrom, M. A., and Bisson, P. A. 2006. Simulating riparian vegetation and aquatic habitat dynamics in response to natural and anthropogenic disturbance regimes in the Upper Grande Ronde River, Oregon, USA. Landscape and Urban Planning 80:249-267.
Wondzell, S. M., and Bisson, P. A. 2007. Simulating the consequences of land management. Pacific Northwest Research Station, Sciences Findings #92. http://www.fs.fed.us/pnw/sciencef/scifi92.pdf
VDDT: http://www.essa.com/downloads/vddt/index.htm

Current Funding: Oregon Watershed Enhancement Board and PNW Research Station