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

2009 Annual Project Report

Modeling Component: OWEB # 208-8007-6459

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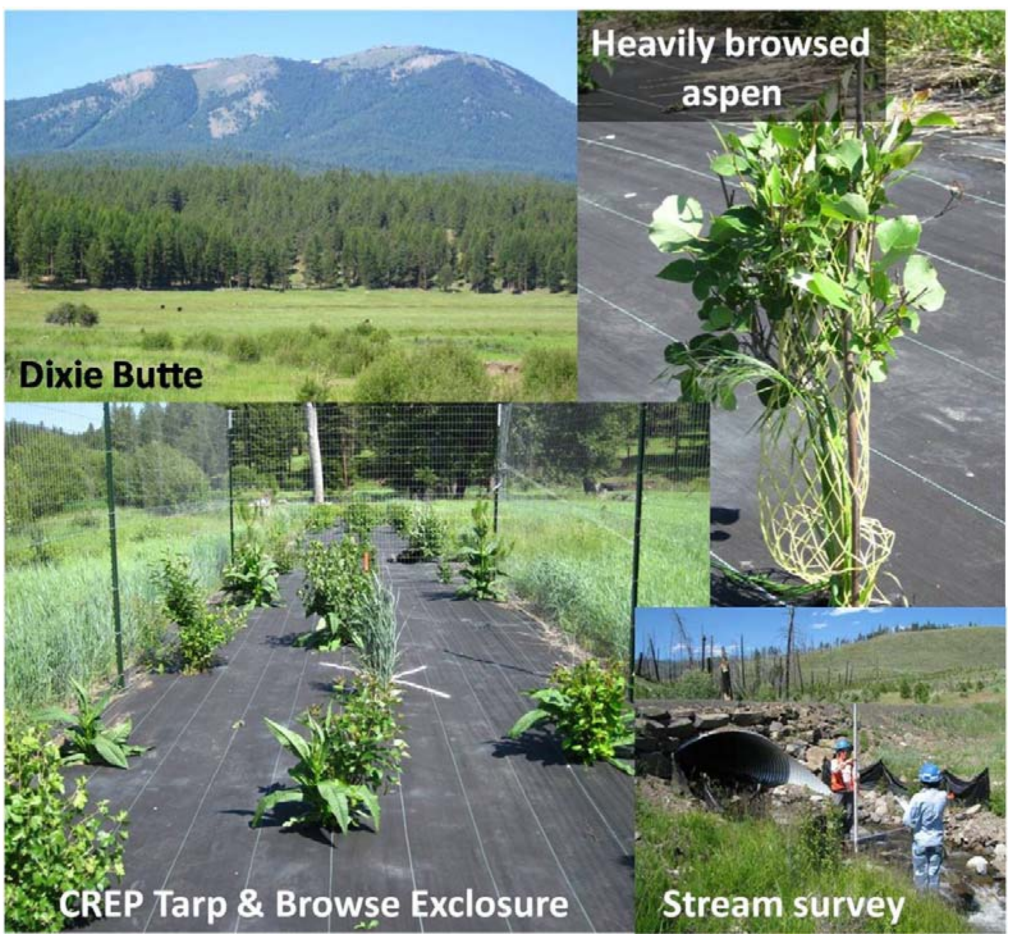


Tasks accomplished – 1 November 2008 to 31 October 2009:

We have completed the following tasks:

1. Completed the preliminary watershed analyses of both the Wilson River and Middle Fork John Day watersheds using NETRACE to classify and delineate stream reaches and their riparian zones. This analysis provided the basis for a randomized selection of stream reaches targeted for measurement during the summer 2009 field season.

2. Summer field work: We sampled 63 stream reaches (29 on the Wilson River network; 34 on the Middle Fork John Day river network) to characterize current conditions of stream channels and riparian forests. Data will be used for developing and validating VDDT models and by the remote sensing component of the project to develop methods to map current conditions of riparian forests in stream networks.

3. We hired a Work Study student from The Evergreen State College in Olympia WA to assist with computer entry of the summer's field data. *Data entry and QA/QC is progressing rapidly and should be completed in early 2010.*

4. Using data collected in the study watersheds over the summer of 2009, we are refining the watershed analysis of both the Wilson River and the MFJD Rivers, to more accurately classify channel types and better delineate the true boundary of the riparian zone. *This work is in progress but should be completed early in 2010.*

4. MFJD Browse Study: We initiated a study to monitor effects of wild ungulate browsing on riparian restoration planting of native riparian tree and shrub species. This project is funded by the USFS PNW Research Station, but complements work conducted uner the OWEB-funded project. We are working on the Forrest and Oxbow Conservation Areas in collaboration with Confederated Tribes of the Warm Springs Reservation. We have completed measurements on 40 browsing exclosures and matched browsed plots. Data entry is complete and some initial analysis has been conducted.

5. Continued development of VDDT state-and-transition models. To date we have developed VDDT models for the most common stream morphologies and the most common potential vegetation types. The completed models cover ~30% of the MFJD stream network. Models currently in development cover another ~30% of the MFJD stream network.

5. We have applied for, and been granted, a no-cost extension, extending our project until 30 April, 2011. We were more than halfway through the originally funded grant period, but were behind schedule for some of the items detailed in the "Statement of Work". I projected the expected costs for the remaining grant period and determined that we would have reach the original termination date (April 30, 2010) with substantial funds remaining. In order to plan for the successful completion of the project, I requested a no-cost extension quite early. I now project that we will have sufficient time and resources to complete the “Statement of Work”.

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

The project is generally on time and well within budget. Some differences do exist between the original timeline and the actual accomplishments. Details are as follows:

- Initial watershed analysis is complete for both the MFJD and Wilson River stream networks.
    - This initial analysis was a required first step in designing the field sampling protocol and randomizing the selection procedure for sampled stream reaches. The analysis will be refined using data collected from the stream networks to more accurately classify channel types and better delineate the true boundary of the riparian zones.
    - Classifying and delineating riparian zones in the watershed analysis provides the critical foundation for mapping and modeling the riparian zones within these watersheds.

- All field work was completed on schedule.

Delayed elements and reasons for slippages if anticipated progress was not made:

- 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 have only recently been completed.

- Development of VDDT models continues to progress more slowly than anticipated:
    - 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.
    - Because our existing aquatic-riparian VDDT models will serve as templates for future model development, we want these models to tailor as closely as possible with existing upland VDDT models. Model codes and abbreviations have recently been extensively revised for the COLA IV upland forest models. Therefore, we back-tracked, and revised our models so that they will remain consistent with the COLA IV models. No further revisions of the model codes and abbreviations is anticipated for the COLA IV 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) is for bills sent to OWEB on or before 30 September 2009. Recent problems with the USFS bookkeeping system has delayed processing of bills. I have been keeping our OWEB contact, Ashley Seim, closely informed of these on-going problems.

Table 1: Summary of funds originally budgeted by OWEB, obligated on or before 30 September 2009, and funds remaining.

Budget Category	Funds budgeted by OWEB	Funds spent	Funds remaining
Capital Funds			
In-House Personnel	$226,718.00	$108,626.35	$118,091.65
Travel	$21,187.00	$14,161.35	$7,025.65
Supplies & Materials	$3,000.00	$1,727.23	$1,272.77
Fiscal Administration	$25,865.00	$12,591.19	$13,273.81
Non-Capital Funds			
Travel	$4,750.00	$635.95	$4,114.05
Equipment	$3,000.00	$1,199.98	$1,800.02
TOTAL	$284,520.00	$138,942.05	$145,577.95

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:

Middle Fork John Day Browse Study: We have used our involvement in the MFJD Intensively Managed Watershed (IMW) to leverage an additional study of the effects of wild ungulate browsing on riparian restoration plantings conducted as part of the overall effort to restore aquatic and riparian ecosystem within the MFJD. This project has been funded primarily through in-kind contributions of time from the USFS Pacific Northwest Research Station along with a one time contribution of $5,000 in supplies to assist in building browse exclosure cages.

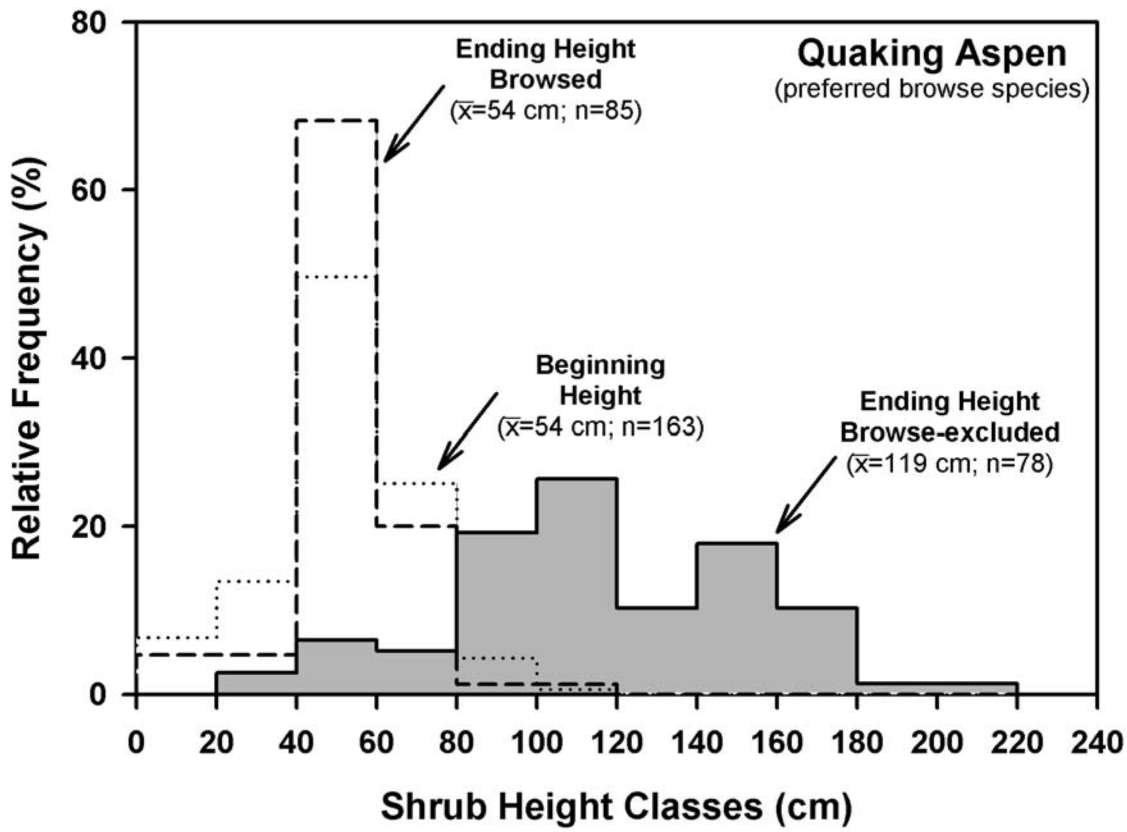
We have identified grazing by domestic livestock along with browsing by deer and elk as a major factor controlling the state and condition of riparian vegetation in the MFJD. Grazing by domestic livestock has long been identified as a major concern. As a consequence, substantial time and money has been invested into fencing riparian zones to exclude cattle and promote recovery. In many areas, riparian zones no longer support woody vegetation, especially broad leaved native species such as cottonwood, aspen, and willow (see Photos 1a and 1b, below). To promote vegetative restoration, planting of seedlings of native riparian species has occurred in many riparian areas. To date, these have mostly not had the desired outcome, even in areas fenced to exclude cattle. Browsing is thus implicated as a major factor limiting recovery of woody riparian vegetation.

Photo 1: A) Forrest Conservation Area (left), where native hardwoods are entirely lacking from the riparian area; B) the mouth of a small tributary, Vinegar Creek, where it enters the Forrest Conservation Area (right) showing expected dense growth of native riparian hardwoods.

To document browse effects on riparian plantings, the Confederated Tribes of the Warm Springs Reservation established a number of small browsing exclosures surrounding riparian plantings on both the Forrest and Oxbow Conservation Areas. The exclosures were established in late spring of 2009, at the start of the growing season. We began monitoring of these exclosures this summer, pairing equal areas of browsed and browse-excluded plantings. We collected data on initial conditions in early June and remeasured the plots in October 2009, at the end of the growing season. Some preliminary data for two common species, quaking aspen (*Populus tremuloides*;Fig. 1)) and mountain alder (*Alnus incana*; Fig. 2) are shown below.

Quaking aspen is a highly preferred browse species. There was little change is the height distribution of browsed aspen saplings from initial conditions at the beginning of the study through the end of the first growing season (Fig. 1), as indicated by the lack of change in the overall average height of browsed saplings. There was a substantial change in the height of unbrowsed aspen. Saplings in browse exclosures grew by an average of 65 cm over the summer of 2009, and had an average height of 119 cm at the end of the growing season. The height distribution also changed, becoming much broader, with the tallest individual reaching 2.10 meters in height after only one growing season protected from browsing. Note that these aspens were planted as seedlings in 2006, protected by browse collars measuring 12.5 cm x 45 cm. That most individuals remain in the 40 to 60 cm height class shows that few individual saplings have grown larger than the protecting browse collar in the four years since planting.

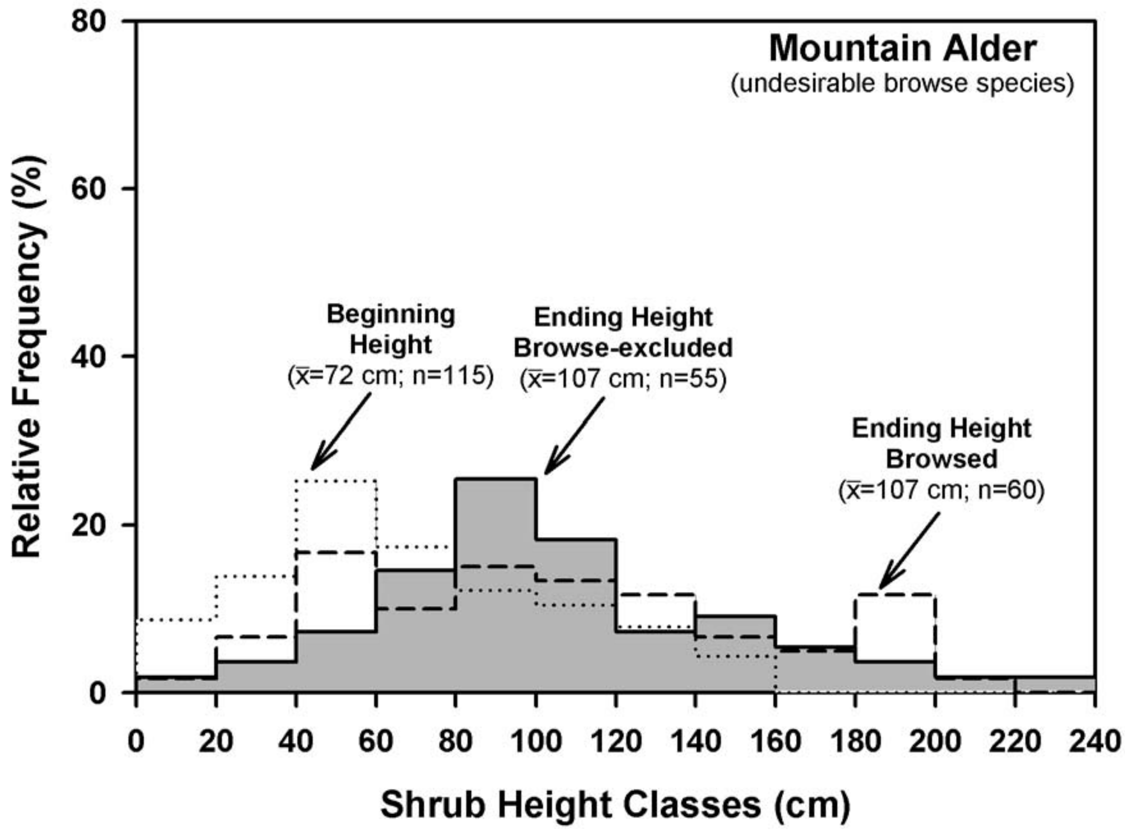
Figure 1: Browse impacts on quaking aspen, a highly preferred browse species. The graphs show the percentage of saplings in each height class. For example, at the end of the first growing season, ~70% of the browsed aspen were 40 to 60 cm tall.



Mountain alder is a less desirable browse species. In early June 2009, at the start of the browsing-exclusion study, alder averaged 72 cm tall. Our observations in the field showed that some individual saplings were severely browsed, remaining quite small, but most saplings grew significantly over the summer. At the end of the growing season, there was no difference in the average height of saplings exposed to browsing compared to those in browsing exclosures. The height distributions were also surprisingly similar, indicating that, over the summer of 2009, the average height of these alder saplings was not significantly impacted by browsing from deer and elk.

These alders were planted as seedlings in 2006, protected by browse collars measuring 12.5 cm x 45 cm. The relatively short stature of alder saplings at the beginning of the 2009 growing season, and the browsed condition of those saplings, suggest that browsing has impacted alders on these sites. With only one growing season's worth of data, we do not yet know if browsing throughout the fall, winter, and spring will have a significant impact on the height of this species.

Figure 2: Browse impacts on mountain alder, a less desirable browse species.



Watershed Analysis and VDDT modeling: Effort for developing VDDT models has focused entirely on the MFJD River basin to date. We feel that it makes more sense 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. The MFJD includes far more potential vegetation types than does the Wilson River and the modeling efforts are therefore much more involved and time consuming. We feel that it is critically important that we spend the time necessary to build sufficiently complex models to capture the critical attributes of riparian forest and stream channel conditions. To this end, discussions with various interested parties in the MFJD, review of the pertinent literature, and our own observations during the 2009 field season have all shown 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. The relative importance placed on grazing and browsing also prompted our involvement in the MFJD browse study, described above.

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.

To date we have developed VDDT models for the most common stream morphologies and the most common potential vegetation types. The completed models cover ~30% of the MFJD stream network. Models currently in development cover another ~30% of the MFJD stream network. In addition we are currently building the habitat evaluation models with which we can examine projected change in habitat suitability for spring chinook, steelhead, and bull trout.

Below we show examples of our preliminary watershed analysis for the MFJD, starting with maps showing the classification of geomorphic channel types (Fig. 3) and potential vegetation types (Fig. 4). We show an example of a portion of a VDDT model, illustrating the concept of state classes (Fig. 5) and then present some preliminary results from running this model (Fig. 6A – 6C). These results are from the completed first versions of these models. The models have not been extensively tested so these results should be viewed as examples of the kinds of analyses possible, and the types of information potentially resulting from analyses using these models. We discourage drawing any specific conclusions from these early model projections

Figure 3: Map of the upper MFJD (Camp Creek and Upper MFJD HUCs) showing the Netrace stream classification developed in the initial watershed analysis.

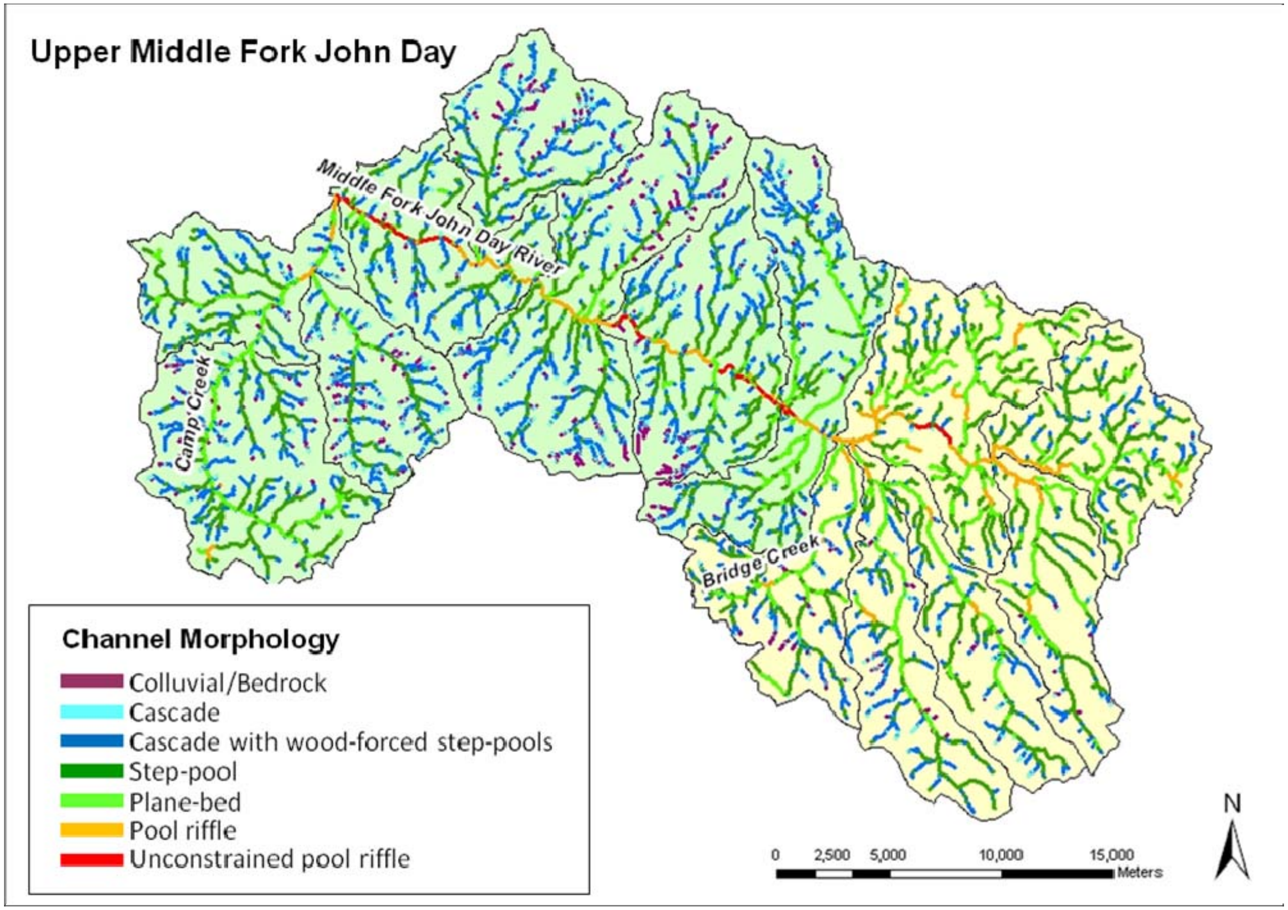


Figure 4: Map of the upper MFJD (Camp Creek and Upper MFJD HUCs) showing the distribution of Potential Vegetation Types used to develop the upland VDDT models used in our initial watershed analysis

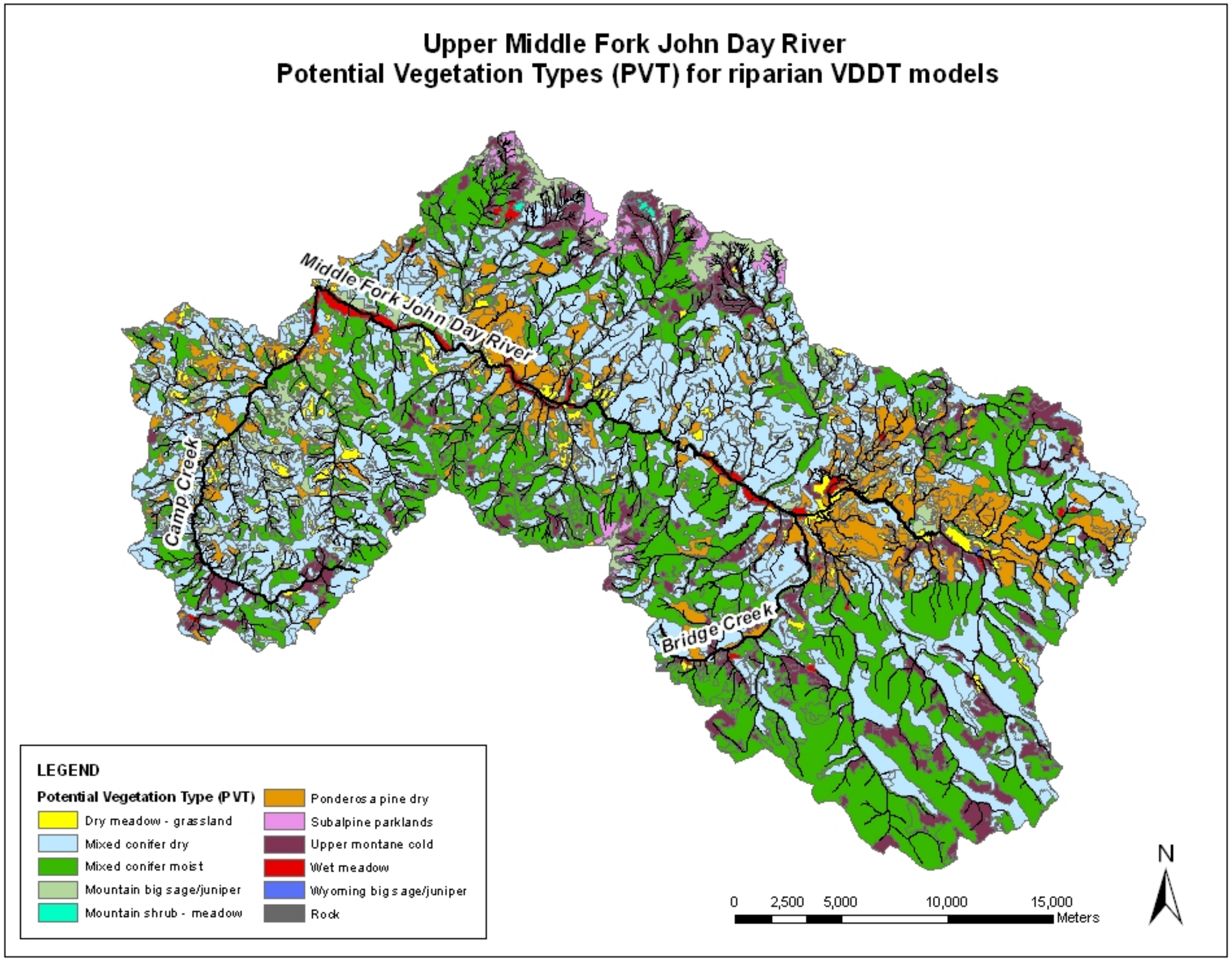


Figure 5: Example of part of the VDDT model for Step-Pool Channels in the Mixed-Dry Conifer Potential Vegetation Type. The "green boxes" represent distinct states; lines show transitions between states caused by disturbance, land use or forest succession. States are coded by dominant canopy cover (upper right), age (middle left), an ID code (lower left), and stand structure (lower right). Photo graphs illustrate two state classes. We include canopy cover, age and structure codes and write out the code definitions.

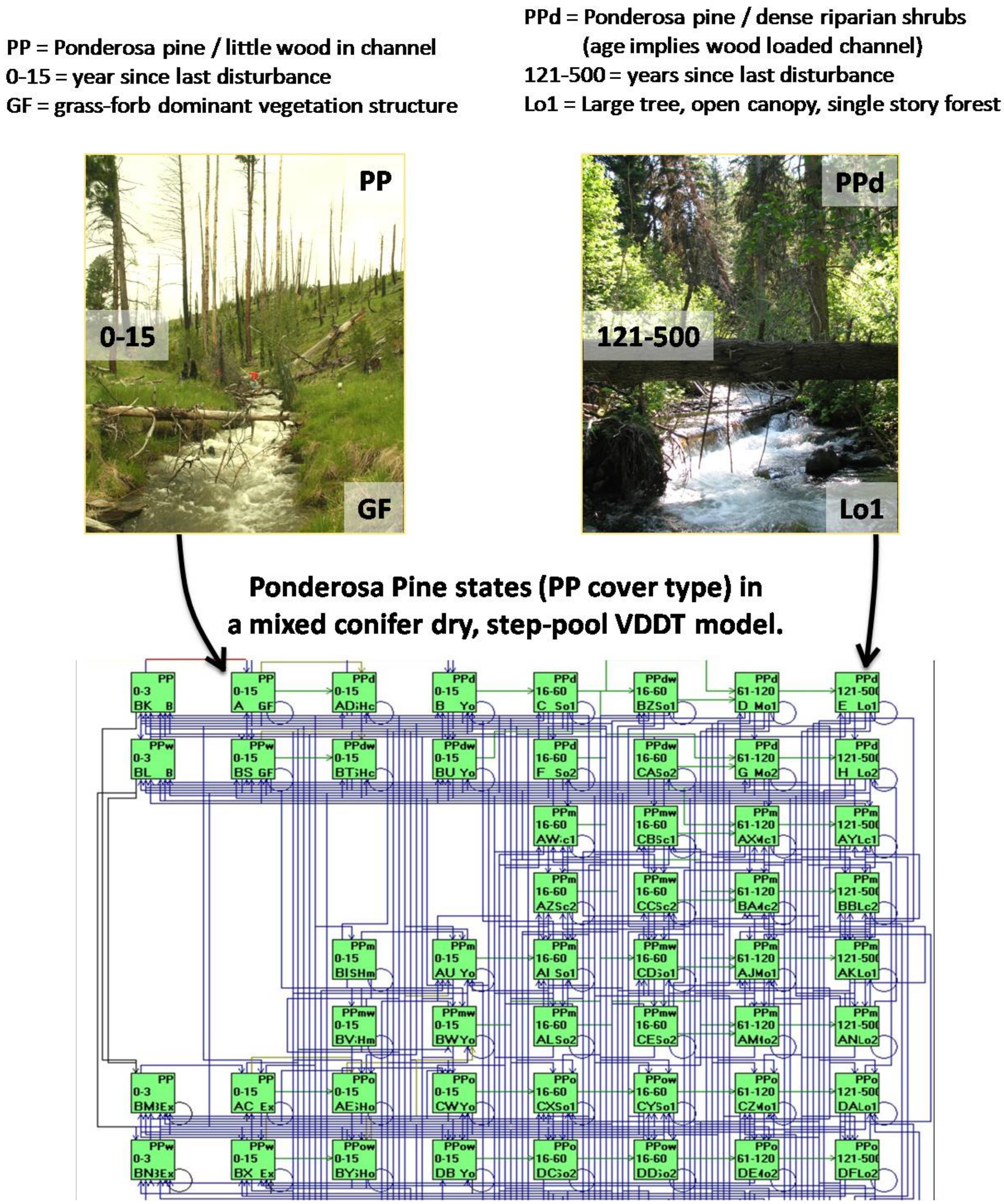


Figure 6A: Example results from the Mixed-Dry Conifer VDDT model for Step-Pool Channels showing historic vegetation structure ca. 1880 and simulated changes resulting from historic land uses, especially grazing, through 2000. ***Note: All model results are preliminary and shown here only as an example of model output.***

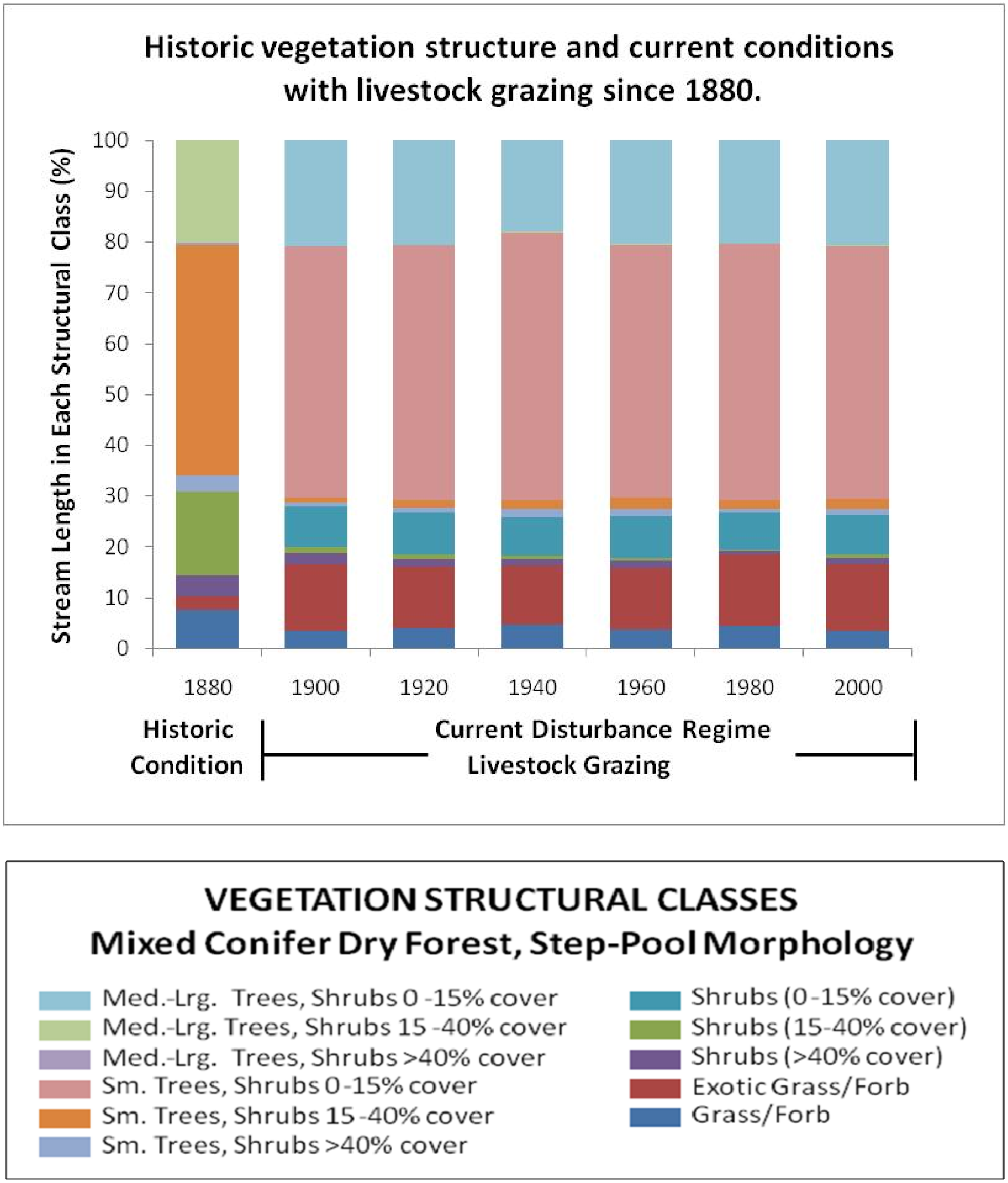


Figure 6B: Projected future changes in forest structure for the Mixed-Dry Conifer PVT in riparian areas adjacent to Step-Pool Channels following the exclusion of both domestic livestock and native wild ungulates. *Note: All model results are preliminary and shown here only as an example of model output.*

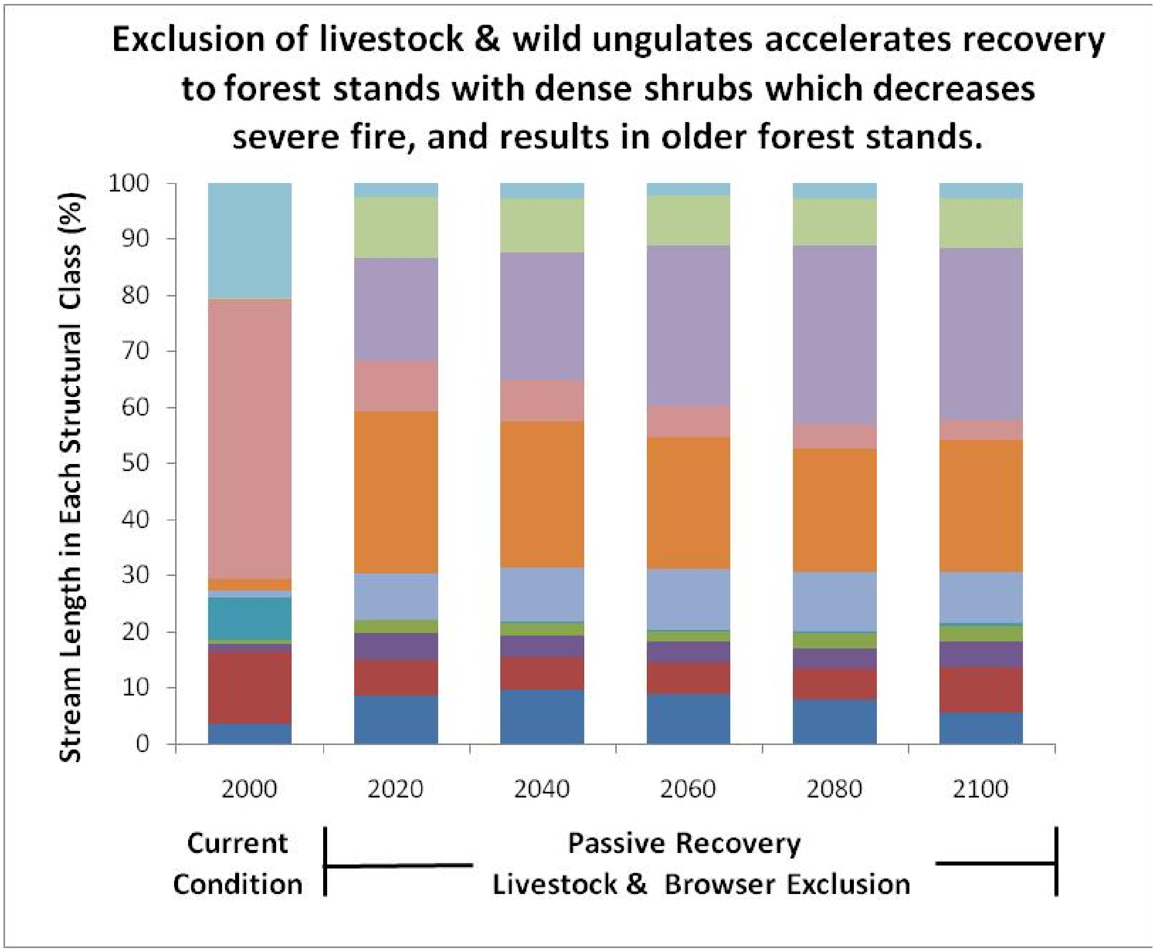


Figure 6C: Projected future changes in forest structure for the Mixed-Dry Conifer PVT in riparian areas adjacent to Step-Pool Channels following planting of riparian shrubs in addition to the exclusion of both domestic livestock and native wild ungulates. *Note: All model results are preliminary and shown here only as an example of model output.*