Statewide Survey of Oregon Watershed Enhancement Board Riparian and Stream Enhancement Projects

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By

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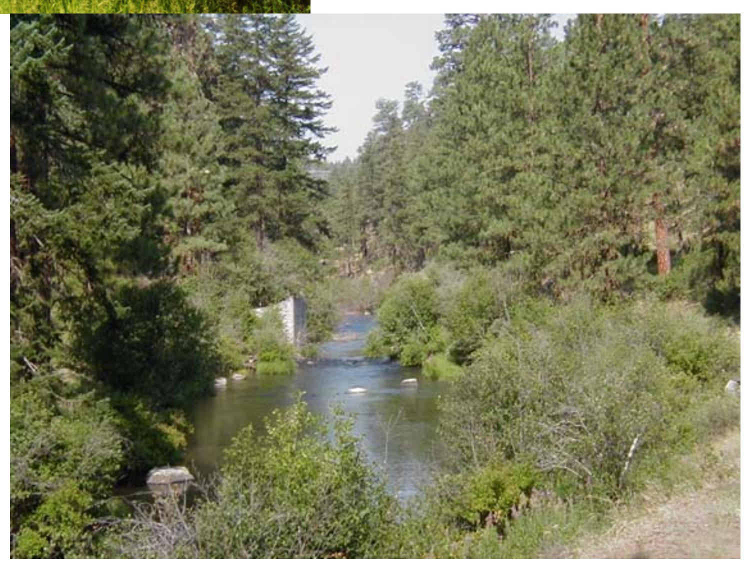

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Acknowledgements

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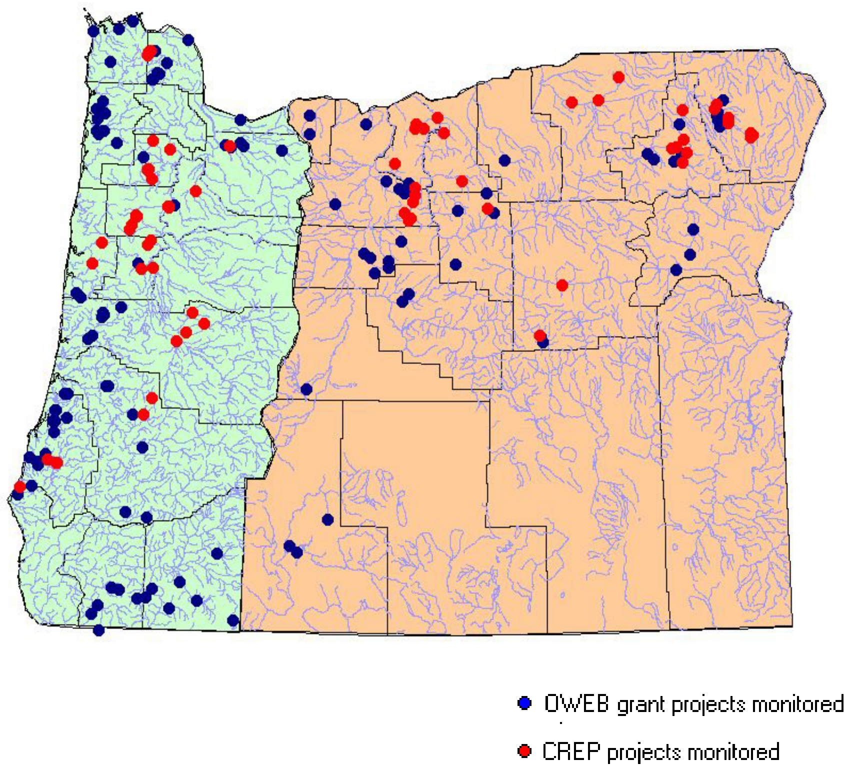
Abstract

This publication is aimed at the Oregon Watershed Enhancement Board's staff and board of directors, grant review teams, technical advisory committees, watershed councils, government agencies, and anyone else interested in watershed restoration. It contains a statewide analysis of riparian and in-stream restoration projects and their components. Analyses address restoration methods used, survival of plantings, fencing status, in-stream structure specifics, and landowner opinions. Conclusions and recommendations are based on 177 riparian enhancement projects and 48 landowner surveys. The results show regional variations in tree mortality, and that site preparation, post planting maintenance, and tree protection methods are effective. The use of these methods is increasing in frequency, but there are still many planting projects that are not properly addressing establishment problems. Livestock exclusion fence data shows the size of buffer widths throughout the state. Most fences and watering facilities are found to be intact. Additionally, the importance of maintaining livestock exclusion fences is illustrated by low tree survival on planting projects with failing or incomplete fences. The landowner surveys indicate that landowners are pleased with the projects on their property, and view them as effective. Some common and pertinent landowner opinions are also discussed.

Introduction



Over the past year, two AmeriCorps volunteers monitored a number of riparian and stream enhancement projects that have been funded by the Oregon Watershed Enhancement Board (OWEB)* over the last 15 years. This included OWEB grant generated projects and Conservation Reserve Enhancement Program (CREP) projects. The intent was to gain a more detailed understanding of the challenges involved in successfully and efficiently establishing and maintaining riparian restoration projects. Although individual OWEB projects have been monitored, this was the first attempt to look at a large number of restoration projects in Oregon.

OWEB has awarded over 3,000 grants since 1987, nearly half of which have been on-the-ground watershed enhancement grants.** Just over a third of the projects have been completed. The fact that nearly two thirds of the projects are still open reflects the dramatic increase in the number of technical projects recently funded. This increase in projects highlights the need to evaluate the work that has been completed and let past experience guide future efforts.

In 1999, the USDA and OWEB started funding riparian enhancement projects through the Conservation Reserve Enhancement Program (CREP). This program compensates farmers for taking riparian cropland or pasture out of production and converting the land into forested buffer, grass filter strip, or wetland. Oregon's CREP is still in the early stages of enrollment and implementation. The substantial state and

* Originally created as the Governor's Watershed Enhancement Board (GWEB), the 1999 legislature created Oregon Watershed Enhancement Board, which succeeded GWEB.

** OWEB has funded or awarded 3,040 grants to date. 1,474 of those include technical or on-the-ground elements. Of the technical projects, 536 are completed and the final reports submitted.

federal investment in this program make it a priority for analysis and evaluation to refine the program.

OWEB has always recognized the value of project monitoring and has required monitoring reports for each restoration grant. The monitoring reports for grant projects usually include a narrative summary of the project's condition and photo points of a portion of the project. Such information can be useful to the project manager in evaluating the specific project but is of limited value in evaluating statewide trends.

Prior to this monitoring effort there has been no broad-based attempt by OWEB to evaluate trends in project establishment. By looking at a large number of projects across the state, one can look for trends within climatic regions and trends that supercede regional boundaries. Another advantage of looking at a large scope of projects is the ability to compare and contrast project methods and results.

The monitoring work conducted this year was an experiment to see what information could be gained from a large-scale survey of projects. The protocol for the survey was developed without knowing what information would be available or what would be useful. Field monitors talked with project managers, tree planters, landowners, local monitors, resource managers, and volunteers to gain information about needs and conditions in the field. As OWEB staff implements their statewide monitoring strategy, the information from this survey will contribute to that effort.

Because of the wide variety of project types that OWEB funds, it was necessary to focus on a limited number of project types in order to collect standardized information for meaningful analysis. Riparian and stream enhancement projects were chosen because of their importance in the salmon recovery effort and lack of statewide evaluation. For riparian projects, tree and shrub planting, off-channel water facilities, and livestock exclusion elements were evaluated for implementation, establishment, and longevity. In-stream projects such as log and boulder placement, boulder weirs, and rock barbs were evaluated for current status and compliance with the Regional General Permit for Stream Restoration and the Oregon Aquatic Habitat Enhancement and Restoration Guide.

Nearly 20% of restoration investments have been spent on private, non-industrial land (Watershed Restoration Inventory 2000). These independent landowners play an enormous role in watershed restoration. The effort to monitor the projects provided an excellent opportunity to make contact with landowners that have implemented projects on their land. Landowners, particularly agricultural producers, were surveyed for the level of satisfaction with the work that has been done on their property, their opinion of the project effectiveness, and their investment of time and money. Landowners were also asked for any comments and suggestions about the delivery of conservation services.

Oregon is a highly diverse state, and the techniques of riparian and stream restoration are often unique to the different ecological regions of the state. This adds some complexity to analysis of statewide data. To address this diversity, every attempt was made to attain a representative sample of projects from each of the major regions. As well as geographic variability, the projects surveyed ranged in age from one season to fifteen years old. Although this complicates the data analysis, it is valuable to see how natural processes have affected these projects over time and how restoration methods have changed through time.

In some cases, the information needed to monitor projects and gain information about the project site was not available. Data on the number of plants and species planted was essential to evaluate restoration efforts. Similarly, when adequate maps of the site were available, it facilitated the location of project elements.

The essence of the study is to discover whether or not the conservation practices funded by OWEB are actually coming to fruition in the real world. Are livestock exclusion fences and watering facilities being maintained? Are riparian areas being successfully revegetated? What problems are occurring, and are there patterns? Are there tools or information that could increase the success and efficiency of restoration efforts?

The hypothesis is that efficiency of riparian plantings, indicated by tree survival, is increased with appropriate site preparation, maintenance, and tree protection methods. It is also expected that the integrity of fences on livestock exclusion projects will influence riparian condition.

Background and Literature Review

Riparian enhancement has been identified as a priority in a number of Oregon conservation strategies, ESA recovery plans, and watershed action plans (Nicholas 1997, EPA 1999, Jerrick 2001). Riparian planting and fencing can improve stream temperature, sedimentation loads, channel morphology, and habitat value (Oregon Plan for Salmon and Watersheds 1999). However, attempts to revegetate riparian areas have often failed due to insufficient establishment efforts (Kauffman et al. 1995). Because there is too little communication of experiences conducting restoration, mistakes are often repeated unnecessarily (Leopold 1997).

With the limited resources available for ecological restoration, it is essential that restoration efforts are effective and efficient. The first step in stream and riparian restoration is to remove the factors that are degrading the system (Kaufman et al. 1997). However, active restoration, such as riparian planting or large wood placement, is sometimes necessary to restore ecosystem function (Oregon Plan for Salmon and Watersheds 1999).

Riparian buffer zones are important factors in improving and maintaining water quality in streams adjacent to agriculture and forestry operations. Livestock reduce riparian vegetation, impact habitat features, and increase erosion (EPA 1993). Buffers reduce sediment and runoff, filter non-point pollution sources, lower water temperatures, provide valuable wildlife habitat, and stabilize stream banks. These functions can be maximized with buffers of adequate size (Todd 2000).

Because of the difficulty of establishing trees in riparian areas, various forms of site preparation, post-planting maintenance, and tree protection may be employed to improve tree survival. Insufficient, clearing of plant competition will hinder plant growth therefore increasing risk of mortality from girdling, browsing, or breaking (Emmingham 2000). Research also shows that tree protection, depending on specific site conditions, can prevent wildlife browsing (Bishaw 2002). Emmingham et al. (2000) also recommends planting good stock types (plug +2, 1+1, and 2+1). Irrigation is also recommended to increase survival especially when long hot summers are experienced in the first year after planting (WDFW 2001). It is also important to maintain planting projects in arid regions for several years after planting, “so don’t just plant and walk away” (Hoag, 2001).

Materials and Methods

Conducting a statewide survey of OWEB and CREP projects required isolating a subset of projects, acquiring pertinent project specifics, and developing a monitoring protocol to conduct site visits. The project was completed in 11 months including data analysis. Approximately 7 months was devoted to site visits and data collection.

In order to identify the grant projects that were appropriate to monitor, the OWEB project database was queried for all restoration projects with submitted completion report. Each project was then characterized by project type. Riparian area enhancement and stream habitat enhancement projects became the body of projects that qualified for monitoring. These projects were divided into east side and west side categories and assigned to the project survey technicians for site visits.

Much of the information on the grant projects was found in the OWEB files. The primary sources were the grant applications, grant completion reports, and monitoring reports. Sometimes, information could be gained from newspaper clippings, photographs, and other supplemental information added to the project files. Because grant requirements changed over the 13 years, there were differences in the information available on various projects. The information reported also seemed to vary somewhat based on the individual grantee.

Some of the necessary information on CREP projects was on file in the OWEB office: however, in order to get a full, updated set of information, it was necessary to visit each of the county Farm Service Agency offices to obtain the information from their files. The data was copied from the conservation plans, forms CRP-1, CRP-2, cost-share receipts, and acreage reports. While filling this information need, the statewide CREP Project Information (CPI) database was formed. The form used (appendix A) illustrates the data fields that were gathered.

The body of projects was clearly larger than could be monitored in the given time frame. This allowed for some flexibility when coordinating with watershed councils and soil and water conservation districts that had a large number of projects. By allowing such flexibility, there was some danger of only being taken to showcase projects; however, it was made clear that the monitoring effort was to increase understanding, and the grantees that helped tour the projects seemed interested in showing the full spectrum of projects.

Site visits varied based on the elements and size of the projects. Every effort was made to visit the project with the landowner and/or someone who was familiar with the project history and technical aspects of the work. The standard visit consisted of a walk-through of the project. Notes were taken on existing vegetation, planting methods, tree survival, and/or stream and structure condition. All elements of the project were recorded including unique circumstances and implementation issues.

In some cases, the standard site visit was not possible. For example, some fences in Eastern Oregon were more than seven miles in length thus spot checks had to suffice instead of entire project surveys. At the other extreme, some grants included participation of over 100 small acreage landowners. With the monitoring time constraints, there was no way to visit every property; so a few properties were monitored, and each planting was treated as an individual project.

For the purposes of the data collection and analysis, a project carried the same weight no matter the scope, even though they ranged from .1 to 180 acres.

Riparian Monitoring Form (Appendix B)

Following is a detailed description of the methods used to gain project information for each data field included in the riparian monitoring survey form. Special considerations and clarifications are discussed where appropriate. Hopefully, this will provide a clear and realistic picture of the monitoring process in the case that any aspects of the monitoring protocol are repeated or expanded in the future.

1. **Project Goals** were gathered from the project completion report, the project application, and personal communication with project managers and landowners.

2. **Riparian Planting**
   - **Length of stream treated** was taken from the OWEB grant application, completion report, or CREP conservation plans. On projects that this information was not provided, the distances were measured from maps, or, on some small projects, estimated in the field.
   - **Area planted** was taken from the application, completion report, or calculated from the length of stream treated, and the average setback or buffer width.
   - **Number of trees** planted could usually be found in the grant completion report, conservation plan, or reimbursement receipts. In some cases this information was not available, which made a realistic assessment of the planting much more difficult.
   - The **interplanted** category was marked when there had been tree planting done on the site after the original planting date. In many cases, the number of trees originally planted was recorded, the number of trees that were planted during subsequent establishment efforts or annual maintenance was not recorded.
   - **Original planting date** was recorded to the highest resolution available: day, month or season, and year. Year planted was available for each project.
   - In many cases, information about **species planted** was available in the project completion reports of the OWEB grants or in the CREP conservation plans. When available, this information was highly valuable in evaluating the viability of each species planted. Without the planting record, field observations were used and species planted was based on the species found in the field.
   - **Site prep**aration data was taken from grant completion reports, conservation plans, and field observations. **Herbicide** was marked only if applied prior to the tree planting. **Clearing** referred to any physical clearing of vegetation, either mowing, scalping, or burning. **Tilling** indicated full tillage of the planting area. **Sub-soiling** (chiseling) referred to breaking up rows of soil only where trees were planted, or digging trenches in rock dominated substrate to allow plants to reach the water table.
   - **Tree protection** included a number of methods: **tubes** indicated either mesh or solid tree protection tubes. **Cages** consisted of woven wire or chicken wire placed around each tree. **Mulch mats** referred to any material placed around the base of the tree to retard plant competition. **Foil** indicated wrapping the base of the tree with aluminum foil to protect from rodent girdling damage. **Exclusion fence** was

marked when semi-permanent fencing was used to exclude wildlife from some part of the tree planting area.

- **Post-plant maintenance** includes the following categories: **Irrigation** indicated any method to provide additional water to the trees after they had been planted. **Herbicide** use was recorded when any application of chemicals was used to control plant competition with planted species. **Physical clearing** included any systematic effort to mechanically remove competing vegetation from planted areas. **Repellant** referred to application of natural or chemical substances used to deter wildlife browsing.
- **Tree survival** was estimated, by category, from observation and communication with the project implementers. Whenever possible, the number and density of the trees planted was used. By having large categories, an estimate of survival provided an adequate reflection of project trends.
- **Species survived** was the on-site evaluation of the trees that had been planted as part of the project. The presence of any planted member of a species within the project area was enough to be included on this list. Any species that could not be found was not included.
- **Observed causes of mortality** were determined from field observations and conversation with landowners and project implementers. There was no validation of the observations, but often the causes of mortality were clear after examining dead specimens for evidence of damage or surveying the riparian area for clues of causal factors of tree mortality.

3. Livestock Exclusion

- **Length of stream treated** was determined with the same methods as planting lengths.
- **Average setback** was determined from the project report in CREP projects. In projects where this information was not available the avg. setback was determined using a hip chain. Three representative measurements were taken and averaged. In other cases, visual estimates were used.
- For each exclusion project, the **type of fence** was recorded: barbed, electric, woven, or high-tensile.
- **Location of fence** referred to whether the fence was built on one side of the stream, both or other locations.
- **Current status** of livestock exclusion. In order to be considered **intact**, fences had to be structurally sound and used in conjunction with exclusion management practices. A **failing** exclusion project occurred when a fence was structurally impaired or management practices allowed livestock access to the riparian area.
- **Evidence of failure** included a description of how livestock were entering the project area (i.e. crossing the river from the neighbor’s property) or a description of damage incurred to bank stability and plant communities by intruding livestock.
- An **actively maintained** fence is one in which the landowner had taken, or plans to take the necessary steps to ensure the continued function of the fence.
- **Not actively maintained** exclusion projects were those that had evidence of long-term neglect. A fence could potentially be intact and not actively maintained or even not intact and actively maintained provided the project manager or landowner was planning to repair the damaged fence.

4. **Off–Channel Water Supply**
   - All the information in this category was taken from completion reports, observations, and land operators/project implementers.

5. **Riparian Management**
   - This section of the form was primarily intended to address current livestock management practices. **Livestock exclusion** referred to projects that intended to permanently and completely remove livestock from the stream with the possible exception of severe drought. **Riparian pasture** projects were those that planned either flash grazing or open access during any part of the year,. The **other** category was left open-ended because of the potential diversity of riparian management (i.e. timber, residential, recreation, etc.).

6. **Riparian Vegetation**
   - The **dominated by** category recorded the dominant plant cover type within the treated area. In cases where there were both a complete grass cover and a closed tree canopy, a hierarchical system was used based on a vegetation types influence on stream shading.
   - The **typical species** category characterized vegetation based on the most common species in the area.
   - **Canopy closure** indicated the extent of shading that the riparian vegetation provided to the stream. A **full** canopy indicated a stream reach that would be nearly fully shaded throughout the day. A **partial** canopy was marked if the riparian vegetation allowed any significant shading of the channel. Those projects that were **planted within the last two years** and did not provide significant shade were marked as such to compensate for recent implementation.

7. The **other project components** section recorded any other project elements that were conducted on the same property. Some examples are bridge crossings, culvert replacements, or physical bank stabilization efforts.

In-stream Structure Monitoring Form (Appendix C)

Detailed stream habitat surveys were beyond the scope of this survey, and no protocol was available for rapid in-stream structure assessment. This test protocol was created to gather key pieces of information to assess the structure for design, orientation, and function while spending only a few minutes on each structure. The data categories were developed based on field observations, the Oregon Aquatic Habitat Restoration and Enhancement Guide, the Regional General Permit for Stream Restoration, and A Guide to Placing Large Wood in Streams (ODFW 1995). It was determined that there was insufficient data from this portion of the survey to draw significant conclusions.

1. Information on the project **location** was found in OWEB grant applications and completion reports.

2. The **Project area conditions** were evaluated as follows:

- The **estimated channel gradient** was created as large categories to minimize the error in field observations. Gradients were determined from visual assessment.
- The **estimated channel confinement** was based on the current status of the channel's ability to move laterally. A **highly confined** stream referred to either a steep, headwater channel or a valley basin channel with highly altered, hardened banks. A **moderately confined** stream was one that could migrate 1-3 active channel widths before reaching the edge of the meander belt. An **unconfined** stream indicated a highly braided stream, or one with little restriction to its meander patterns.
- The **dominant channel substrate** was visually assessed and referred only to the treated reach.
- The **riparian area** was evaluated as being **well vegetated** with regionally appropriate species with potential for future large wood recruitment, in the process of **being restored** to that state, or **neither**. This is based upon the premise that restoration projects should restore long-term ecological function (Oregon Aquatic Habitat Restoration and Enhancement Guide, yr).

3. **Structures**, for the purposes of this survey, are defined as any material, physically connected or functioning as a single unit, added to the stream to increase habitat value. In some cases, only a representative sample of structures was surveyed from a project, but when possible, every structure was surveyed.

- The **number of logs** and **number of boulders** indicated the sum of pieces evident from field observations and available reports.
- In order to be considered **in place**, a structure had to be generally in the same location and interacting with the stream. A **washed out** structure was one that had moved significantly from its original location.
- The **type of structure** referred to the fabrication of the structure. Large wood placements that relied on natural features of the stream, bank, and riparian vegetation were considered **placed**. If cable or any other permanent, static materials were used, the structure was considered **fixed**. A **rock weir** was a boulder structure that traversed the entire length of the active channel. A **rock barb** was a boulder structure placed on the side of the channel only. A **gabion** consisted of a cage filled with small rocks instead of boulders that relied upon their own weight for stability.
- The **estimated log length** categories were taken from the minimum guidelines of the Regional General Permit for Stream Enhancement. They included **1.5 times** bank full width **(BFW) with rootwad**, **2 times BFW without rootwad**, and large woody debris **(LWD) too small for stream**.
- Within the **secured by** category, any method used to keep the in-stream structure in place was noted. Unfortunately, it was often impossible to know which methods were used on structures that had washed out.
- The orientation of each structure was marked. A single complex structure could potentially have more than one category marked. Structures that were placed perpendicular to the direction of flow were **across stream,** structures placed with the upstream end on one bank and the downstream end in the channel were **diagonally deflecting**, those angled upstream into the flow were marked **diagonally inflecting**. When two or more logs were positioned end to end in a V-

shape from opposite sides of the bank it was considered a **downstream V**, or **upstream V**.

- The **adjacent channel conditions** noted the stream features that were directly associated with the structures. The date of the survey was recorded because the observable features may vary seasonally. For example, a side channel that is active in the winter may be abandoned in the summer. **Upstream/downstream gravel deposition** was marked when the substrate immediately above or below the structure was dominated by moderately or well-sorted gravel deposits. **Upstream/downstream silt deposition** was marked when fine-grained sediment consisting of poorly sorted particles from silt to gravel accumulated above or below the structure that was dominated by sand, silt, or. **Backwater pool** was marked when the structure backed up a significant amount of water to create a pool upstream of the structure. **Plunge pool** indicated a situation in which flow spilled over the structure, scouring the bottom of the channel, and depositing the tailings downstream to create a pool. **Side channel** indicated a secondary channel that started within the structure's area of influence. **Natural debris** recruitment noted the accumulation of an observable amount of organic material such as wood debris, leaves, and other detritus.

Landowner Survey Forms (Appendix D)

The survey is aimed at private, non-industrial timber and agriculture landowners. The forms were not used when projects were on state, federal, or private industrial land. Because of the difficulty of getting landowner surveys returned, a couple of methods of distribution and collection were attempted. When the landowner was available for the site visit, they were given the option of being interviewed or takin the form with them. When landowners were not available, the forms were mailed directly to them. Nearly all landowner survey forms were filled out and returned to the field technician by the landowners themselves.

Results

The following information was generated from a database created with the information gathered on the Riparian Monitoring Form, the In-stream Structure Form, and the Landowner Survey Form. Data was presented on statewide and regional scales where appropriate. The total body of data consisted of 192 total restoration projects, 177 of those had riparian enhancement elements and 40 included stream enhancement structures. A total of 389 individual structures were monitored although no significant conclusions were drawn. Of approximately 120 landowner survey forms distributed, 48 were returned.

Riparian Planting Data

Figures 1-4 show the observed causes of mortality to riparian plantings in four regions of Oregon. The regions were delineated based upon similarities in climate, vegetation, and geography. The graphs depict the percent of projects that had evidence of mortality caused by animal damage, desiccation, plant competition, or soil conditions. Although there were other causes of mortality, these were the most common. The graphs do not show the severity of the damage, only that there was one or more mortality of that type recorded at the project site.

Figure 1: Observed causes of plant mortality on 81 riparian planting projects in the Willamette, North Coast, South Coast, and Lower Columbia basins

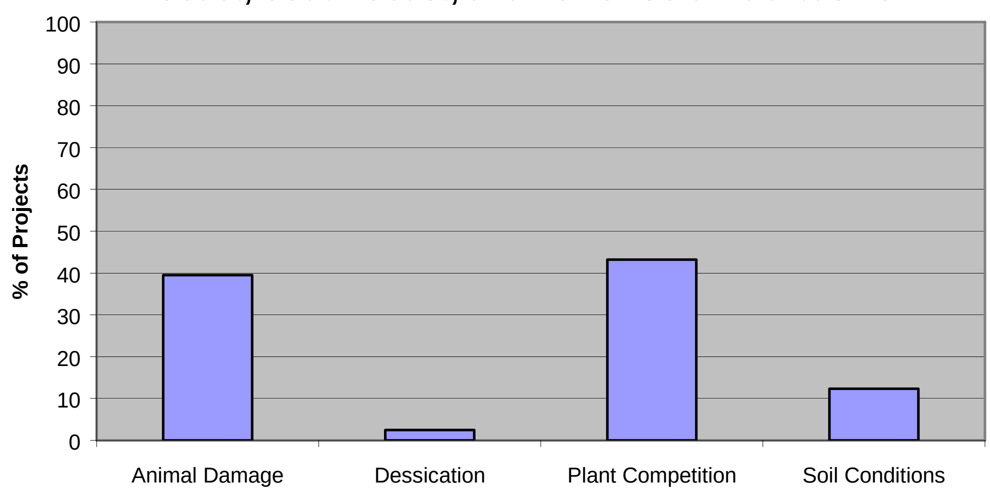


Figure 2: Observed causes of plant mortality on 22 riparian planting projects in the Umpqua, Rogue, and Klamath basins

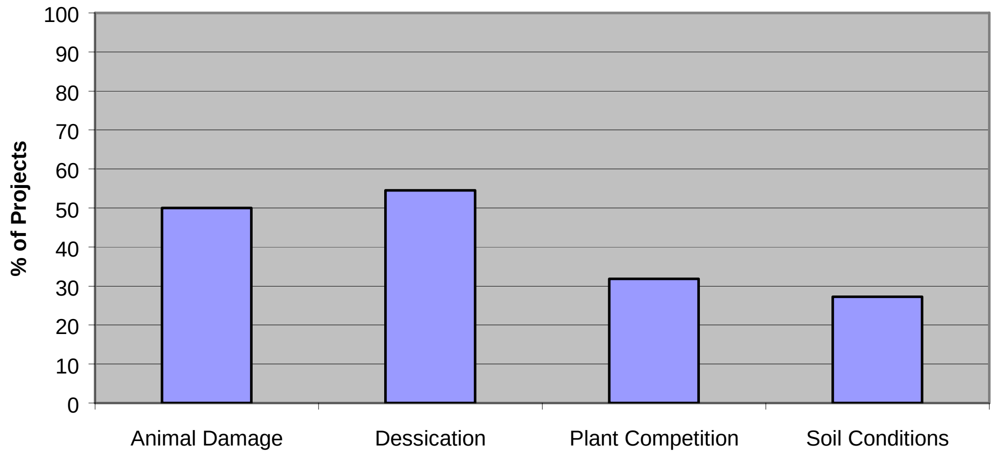


Figure 3: Observed causes of plant mortality on 39 riparian planting projects in the Deschutes, John Day, and Umatilla basins

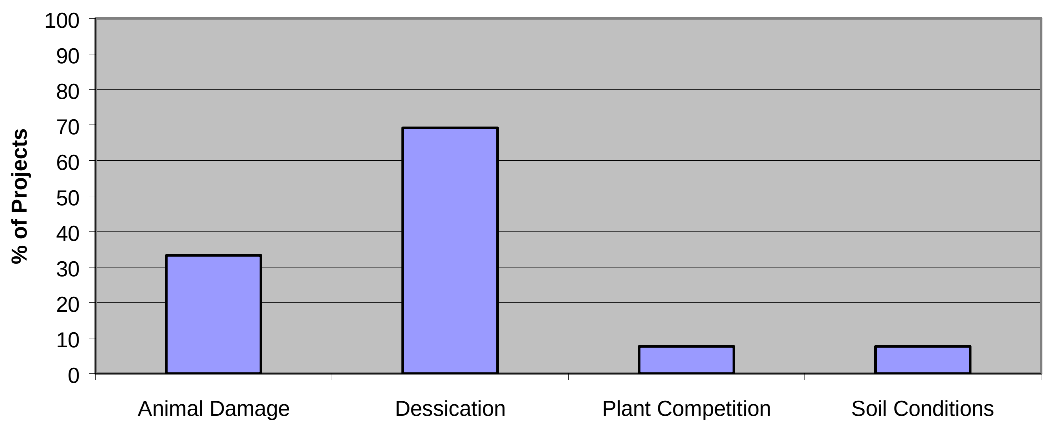


Figure 4: Observed causes of plant mortality on 23 riparian planting projects in the Grande Ronde and Powder basins

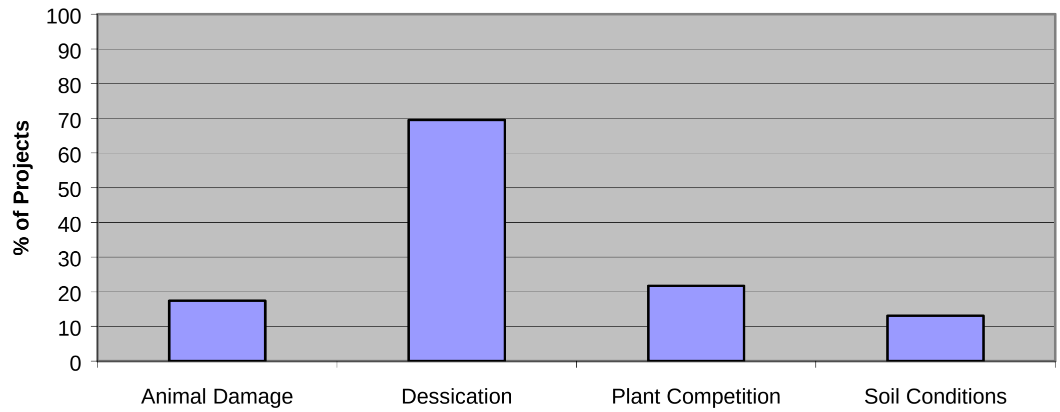


Figure 5 depicts the ratio of CREP and grant generated projects that have received site preparation. Site preparation includes clearing, spraying, tilling, scalping, or sub-soiling to prepare the soil or clear existing vegetation. Of the projects surveyed, 83 received site preparation and 78 did not.

Figure 5: Site preperation use on riparian planting projects over time

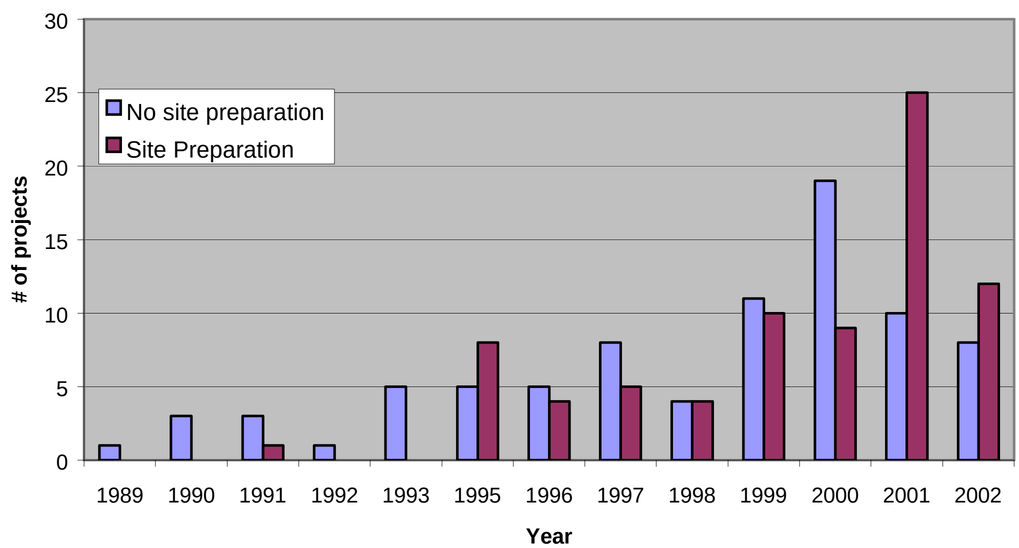


Figure 6 shows the number of projects per year that have received irrigation, physical clearing, or herbicidal clearing. Of the projects, 97 have had no post-planting maintenance and 64 have had some post-planting maintenance.

Figure 6: Post-planting maintenance use on riparian planting projects over time

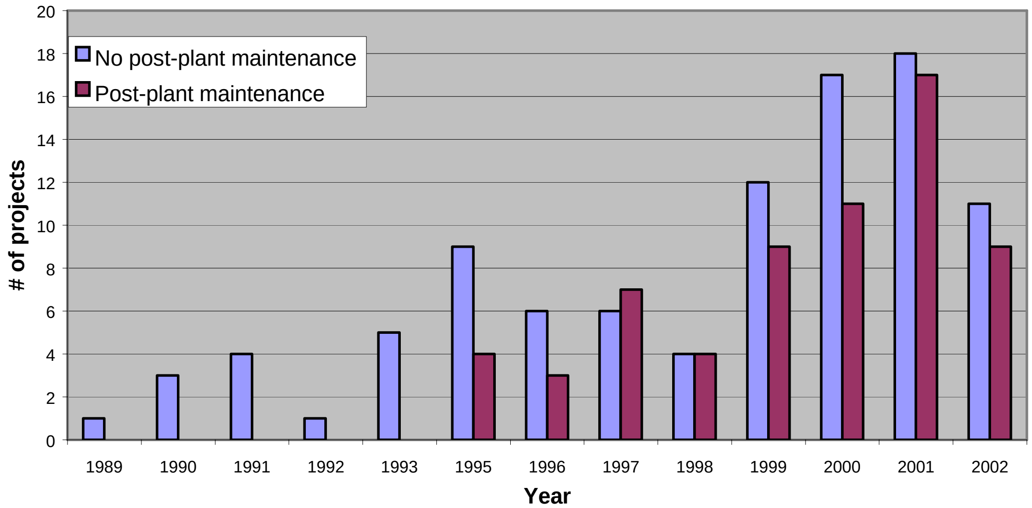


Figure 7 shows the plantings, by year, that have used tree protection such as tubes, cages, mulch mats, aluminum foil, or wildlife exclusion fencing. Of the projects surveyed, 59 used some form of tree protection and 102 did not.

Figure 7: Tree protection use on riparian planting projects over time

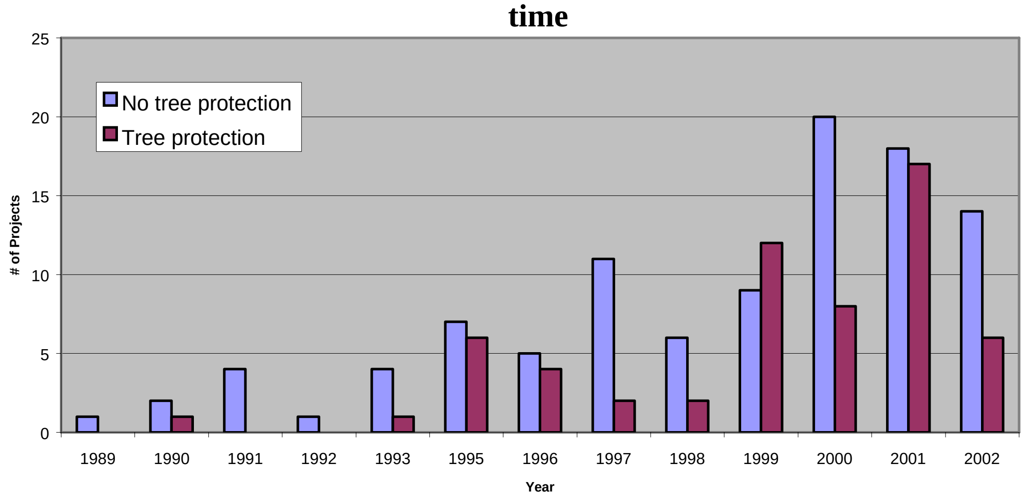


Figure 8 depicts the tree survival on 104 riparian planting projects implemented since 1999. Tree survival of each project is considered based on the use of site preparation, post-planting maintenance and tree protection. For example, 47 projects had 76-100% survival, of those 38 had site prep and 9 did not.

Figure 8: Tree survival based on site preparation, post-planting maintenance, and tree protection

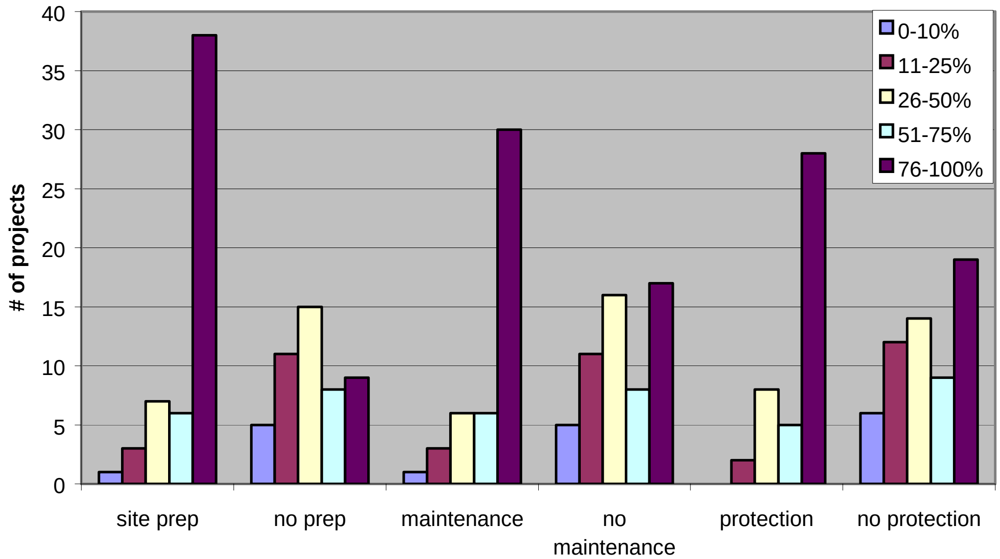


Figure 9 Compares percent of projects, based on tree survival, that were interplanted.

Figure 9: Percent of projects interplanted in each tree survival category

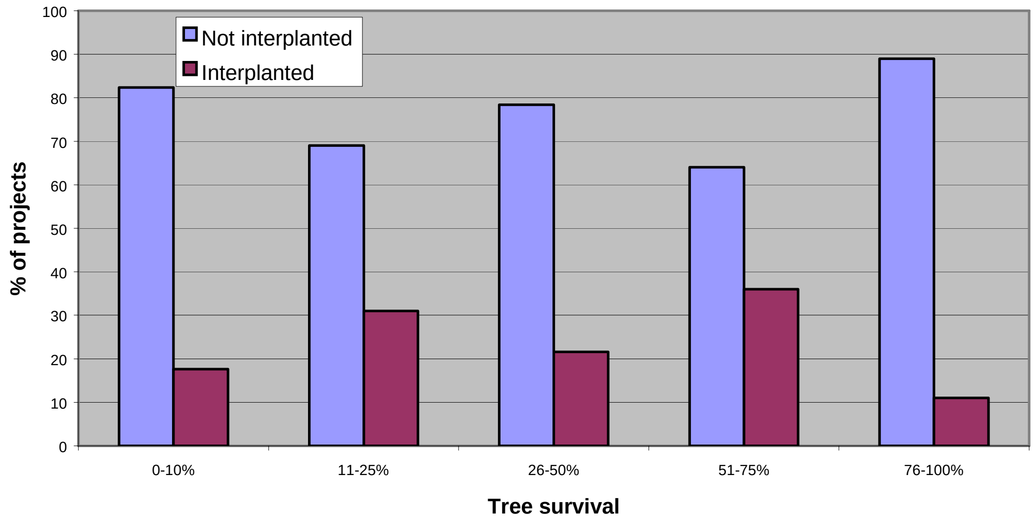


Figure 10 shows tree survival on projects in the coastal basins of Oregon that received efforts to control competing vegetation after planting versus those that did not. Of this data set, 29 (60%) of the projects did not receive this post-planting vegetation release and 19 (40%) did.

Figure 10: Tree survival on 48 Coast Range projects with and without vegetation release

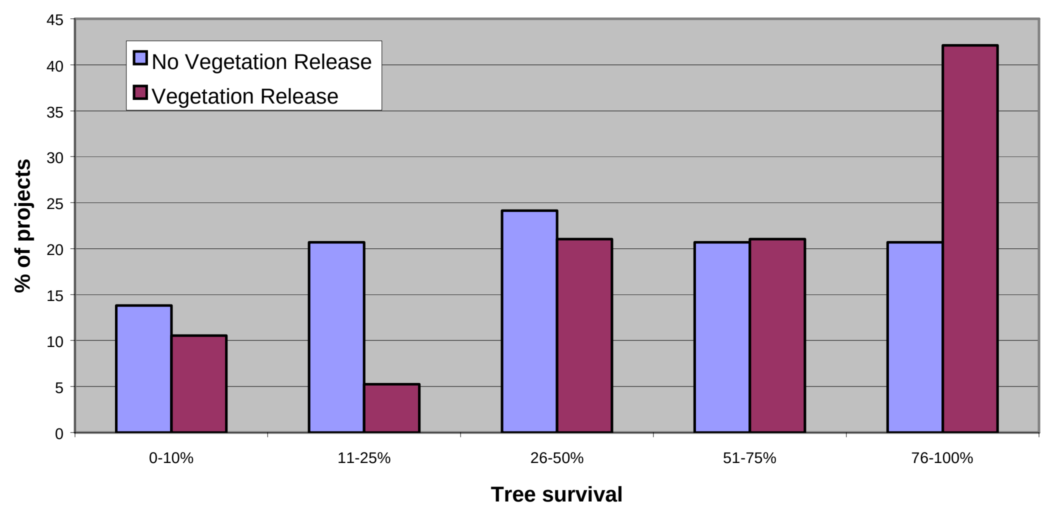


Figure 11 shows the use of irrigation with the riparian planting projects conducted in the arid basins (John Day, Umatilla, Deschutes, Klamath, Hood, Powder, Grande Ronde, and Rogue). Only 13 of 68 (less than 20%) had irrigation applied to the plantings. Figure 3 shows the difference in tree survival in those projects. Since there was a large difference in the number of projects irrigated and not irrigated, it was necessary to depict the projects as percent of projects per survival category (e.g. 46% of irrigated projects had greater than 75% survival, while only 9% of non-irrigated projects had such high survival rates).

Figure 11: Tree survival of irrigated and non-irrigated projects in arid basins

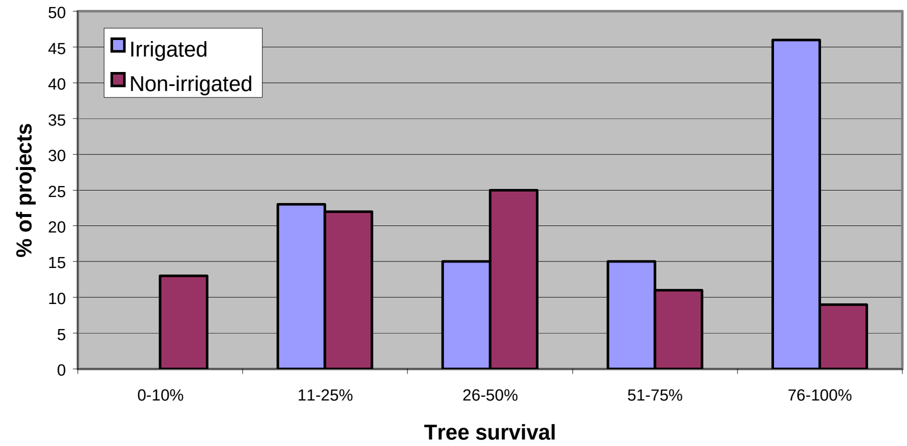


Figure 12 depicts the use of site prep, post-planting maintenance, and tree protection since 1999 for grant and CREP projects separately. Of the 104 total projects since 1999 surveyed 41 are OWEB, and 63 projects are CREP.

Figure 12: Comparison of site preparation, maintenance, and tree protection frequency between grant and CREP projects

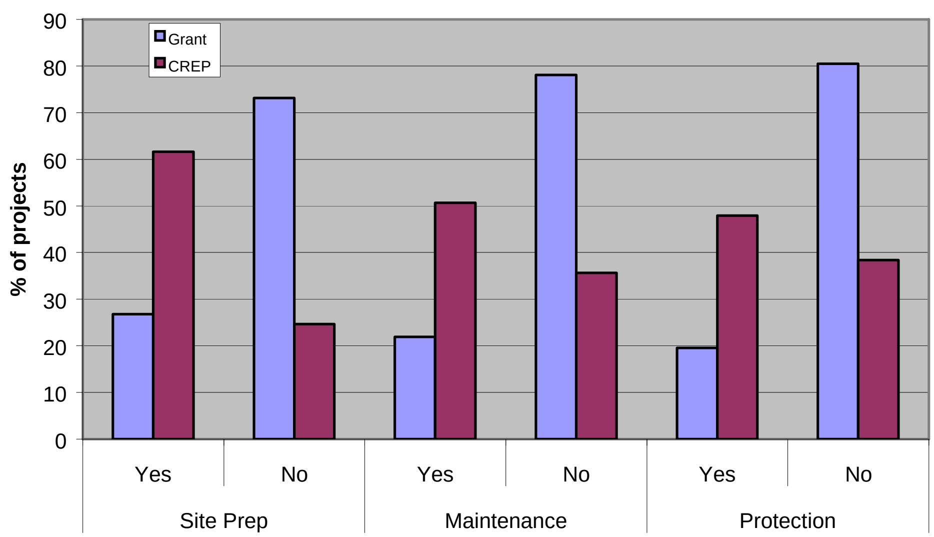


Figure 13 shows the tree survival of 63 CREP projects and 41 grant projects since 1999. The use of this subset of grant projects is to compare only the years that CREP has been active.

Figure 13: Tree survival on grant and CREP projects since 1999

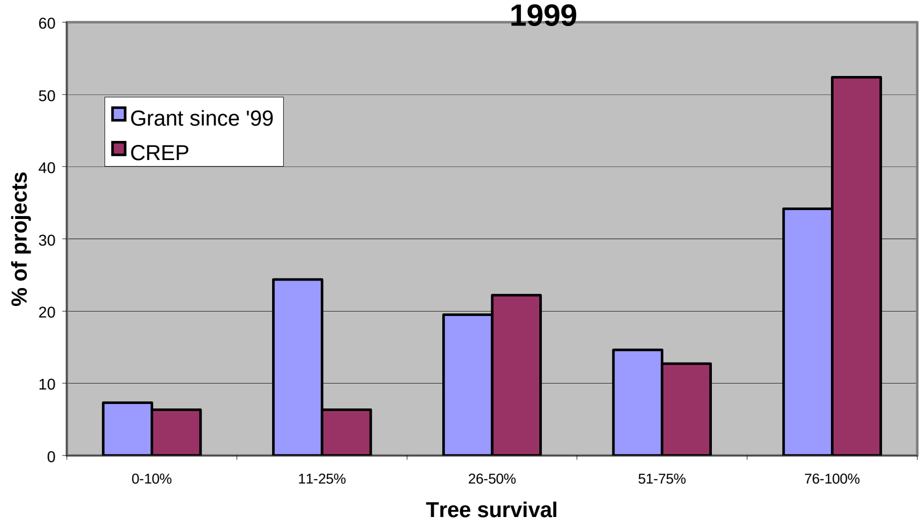
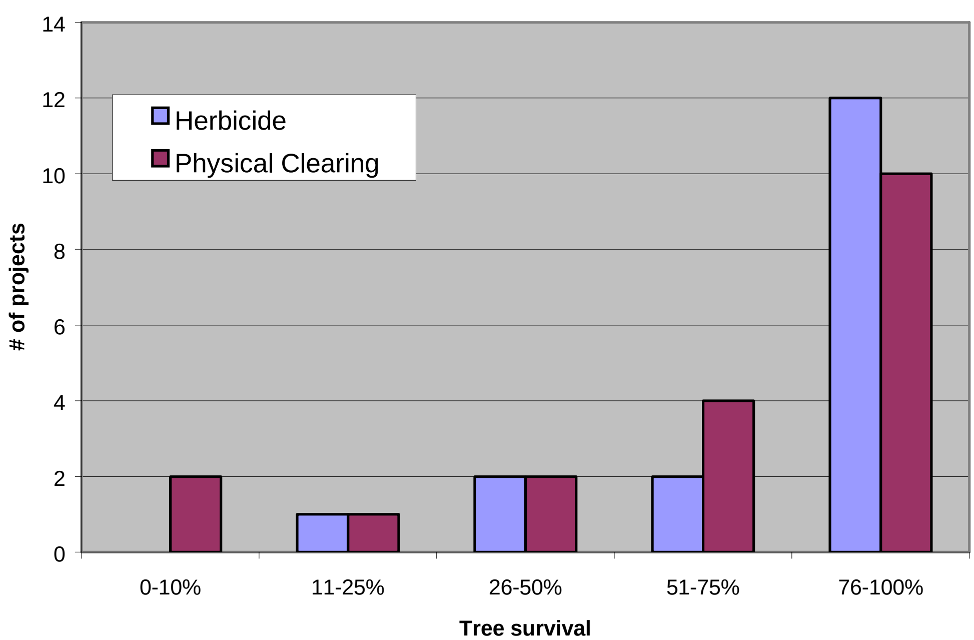


Figure 14 shows the relative survival on projects that used herbicide for release from plant competition and those that used physical clearing. There were a total of 17 projects that used only chemical methods and 19 projects that used only physical methods. Compared to 71% of CREP only 15% of grant projects use herbicidal clearing methods.

Figure 14: Herbicide versus physical clearing on tree survival



Fencing Data

Figure 15 shows the status of 104 fully constructed fencing projects. Of these, 48 were barbed wire, 7 failing (14.6%), 31 electric, 6 failing (18.8%), 19 woven wire, 1 failing (5.3%), 6 smooth, all intact.

Figure 15: Fencing status on 108 projects

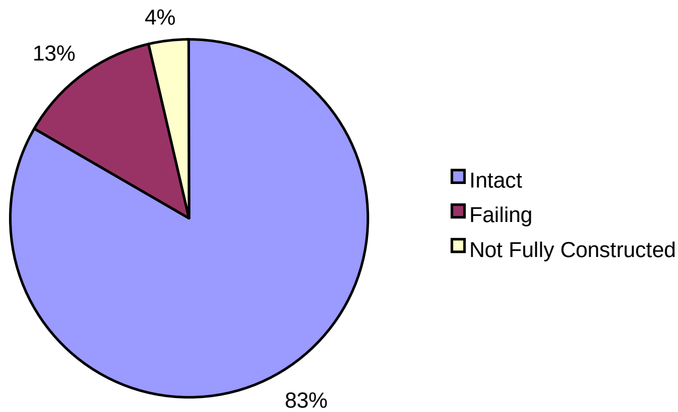


Figure 16 shows the tree survival on CREP and grant projects with intact, versus failing or incomplete fences. Trees were planted on 16 projects that have failing or incomplete fences. 13 of those projects (81%) had less than 50% tree survival. 81 tree planting projects had intact fences, 42 of those (52%) had greater than 50% tree survival.

Figure 16: Comparison of tree survival on projects with intact versus failing or incomplete fences

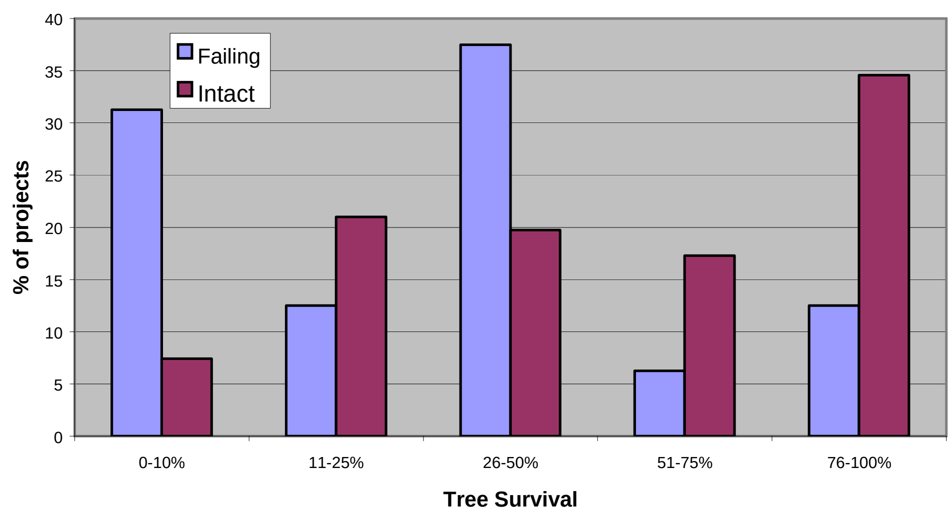
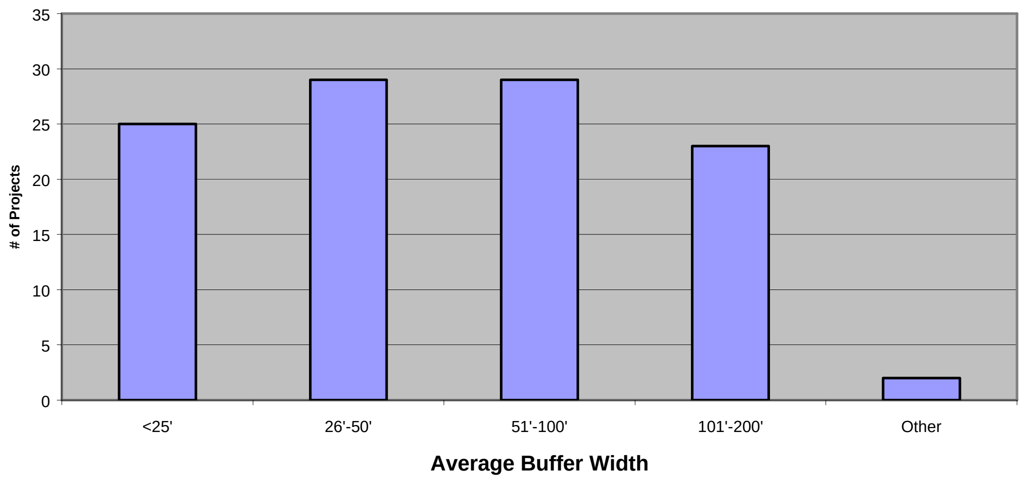


Figure 17 depicts the number of projects in five livestock exclusion buffer width categories. Of 106 active livestock exclusion projects, 25 had 25’ or less average buffer width, 29 had between 25’ and 50’ average, 29 had between 50’ and 100’ average, 23 had between 100’ and 200’ average, and 2 did not follow the creek.

Figure 17: Number of projects in each livestock exclusion buffer width category



Off-Channel Water Facility Data

Figure 18 depicts the percent of off channel watering facilities that are in use, not in use, or failing. All but three of these watering facilities were related to livestock exclusion fencing projects. Of those three projects, 2 were riparian pasture projects, and one project no longer used the riparian area as a pasture.

Figure 18: Status of 32 off-channel watering facilities

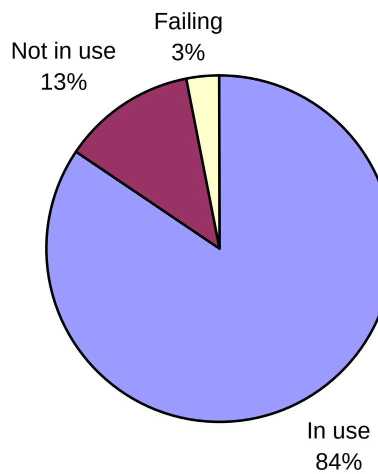
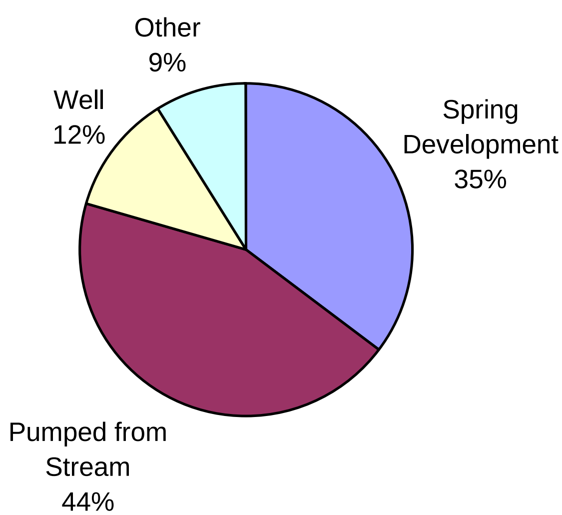


Figure 19 shows the ratio of water sources on the 32 off-channel watering facilities monitored.

Figure 19: Water sources for 32 off-channel watering facilities



Landowner Survey Data

Figure 20 and 21 depict overall landowner satisfaction and opinion of overall project effectiveness for projects done on their property. 48 total landowner surveys were used in this data set.

Figure 20: Landowner satisfaction with projects on his/her property

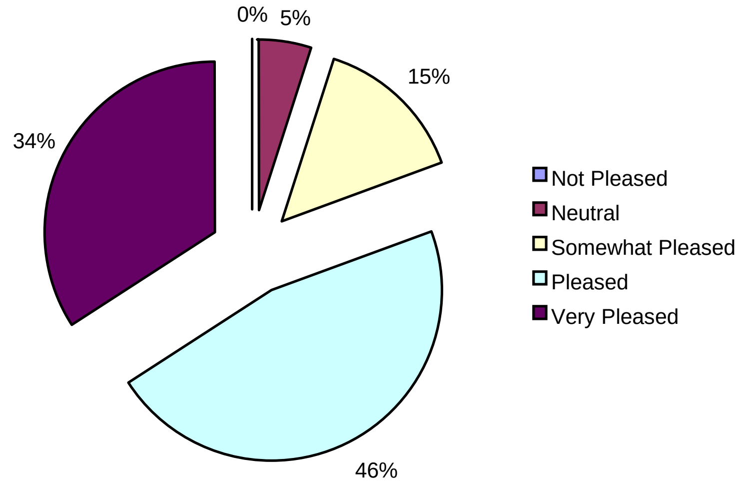
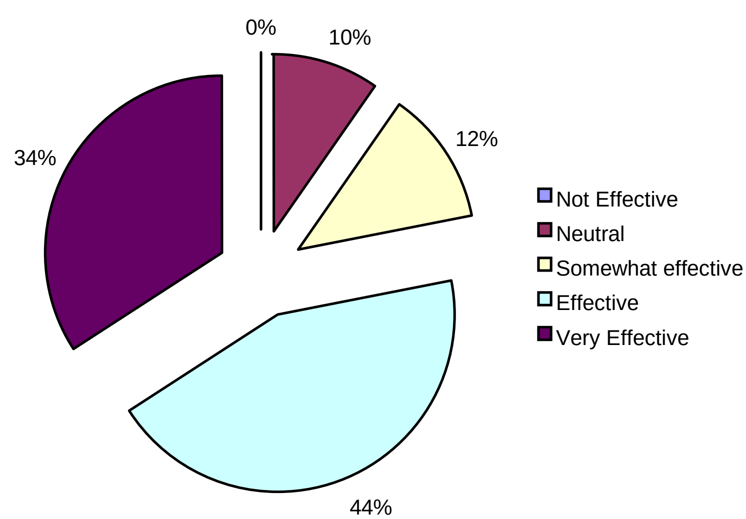


Figure 21: Landowner opinion on project effectiveness



Discussion

Riparian Planting

The results of this study show that various factors lead to attrition in the riparian plantings surveyed. Although there are many causes of mortality noted, desiccation, wildlife damage, soil conditions, and plant competition are the most common. This data does not quantify the extent of each of these causes of mortality, but rather shows the number of planting projects that have some evidence of the respective type of damage. There may be some observer bias in this data set due to the variation in the ease of diagnosis of the various causes of tree mortality. Plant competition and wildlife damage are easily identified, but desiccation and soil conditions are harder to distinguish, especially during a plant's dormant season.

The data indicates that the frequency of causes of mortality varies significantly from region to region. Plant competition and animal damage are the most common causes of mortality for tree planting projects in wet, west-side basins. Mortality from desiccation and soil conditions are considerably less common in this region (figure 1). In arid basins, desiccation is the most important factor affecting riparian plantings, but animal damage is also common (figure 3). In Southern Oregon, over 50% of projects have some mortality related to desiccation and soil conditions, over 30% have suffered from plant competition, and 50% from animal predation (figure 2). In the Grande Ronde and Powder basins, desiccation is by far the most common cause of mortality, impacting 70% of the projects surveyed. Each of the other mortality factors is observed on less than 25% of the projects in this region (figure 4).

These results indicate a high degree of geographic variability in the factors that influence tree planting projects. Additionally, site-specific variations in mortality will exist due to factors such as surrounding vegetation (Emmingham 2000, Bishaw 2002). The potential impact that each type of mortality will have on a planting project should be considered wherever a riparian planting project is planned. Knowledge of local and regional conditions will be useful in improving plant establishment efforts.

Photo 1- This western red cedar, planted in the south coast area, has been browsed by elk and is threatened by blackberry competition.

Various methods have been used over the years to prevent the more common causes of mortality in tree planting projects. Figure 5 shows the use of site preparation on the planting projects surveyed based on the year planted. Site preparation can be used to remove competing vegetation and improve soil conditions. Before 1995, very few sites received site preparation efforts, its use increased to just under 50% between 1995 and 2000, but projects implemented since 2001 received site preparation treatments almost 70% of the time (figure 5). The use of post-planting maintenance, by year of project implementation, shows no maintenance before 1995, and approximately 40-50% since that time (figure 6). The use of tree protection has also increased (figure 7). Use of tree protection has fluctuated from less than 20% in 1997 to almost 60% in 1999. Overall since 1995, 39% of projects have had some form of protection from animal damage.

Photo 2 This four-year-old Central Oregon planting project, visited in November, has high survival in a site prepared by sub-soiling to plant willow sticks in rocky substrate.

When considering the information on tree establishment techniques, both similarities and differences can illuminate trends in riparian restoration efforts. The percentage of projects using site preparation has increased dramatically in 2001 and 2002, post-planting site maintenance has been used at a fairly consistent rate over the past 5 or 6 years, but the use of tree protection has varied significantly from year to year since 1995. Overall this data indicates that more project managers have been considering and implementing these methods in recent years.

Photos 3 & 4 – This Lincoln County CREP project illustrates the benefits of tree tubes and mulch mats. On the left, red alder are growing out of tubes, and on the right, a fragile big leaf maple is adequately protected.

There are potentially several reasons for the increase in the use of site preparation, post-planting maintenance, and tree protection techniques. One reason is the development of the Conservation Reserve Enhancement Program (CREP) in 1998. CREP is a cooperative OWEB and USDA program that pays a conservation rental to landowners for the restoration of riparian areas along agricultural lands adjacent to salmon bearing streams. Figure 11 depicts that CREP projects use more tree establishment techniques than grant generated projects. This is likely due to the landowner investment and accountability that CREP requires. If a planting fails due to landowner negligence, the landowner must replant without cost-share, or return all rent, cost-share, and incentive payments.

Tree survival is used throughout this report to compare the effectiveness of establishment techniques; however, keep in mind while looking at the data that tree survival is a measure of planting efficiency and not project success. A healthy riparian forest is one with a desirable species composition and density. A planting with high survival, but lacking diversity, is of limited conservation value. Furthermore, some project planners will plant fewer trees in order to afford larger stock, better protection, etc. Others will 'saturate' a site with many more trees than are needed, hoping enough will reach maturity. Hence, projects have different tree survival goals.

The frequency that projects are planted after the first planting (interplanted) in each survival category is an indicator of project follow-up. Projects that have low tree survival should have a higher frequency of interplanting than projects that have high tree survival. The frequency which projects in each tree survival category are interplanted (figure 9) shows 82% of projects in the 0-10% tree survival category are not interplanted. This data indicates that the vast majority of planting projects with low survival are being abandoned.

Photo 5 - This interplanted project in Grant County with unprotected willows is an example of establishing a site with persistent planting. Note the beaver dam, evidence of the main cause of mortality at this project site.

The results from this study indicate that site preparation, post-planting establishment, and tree protection, when used appropriately, can significantly increase tree survival. Figure 8 compares the tree survival on 104 projects receiving or not receiving site preparation, maintenance, or tree protection. This figure indicates the value of using each of these methods. According to this information, there is a dramatic difference in the number of projects with very high survival based on whether or not site preparation is used. Likewise, projects with maintenance generally have much higher survival than those that do not. The fact that there are more projects with low survival that do not have site preparation or maintenance indicates more projects could benefit from these efforts. There is less discrepancy between the number of protected and unprotected plantings with high survival, but very few protected projects have extremely low survival. This indicates that tree protection is a valuable method and could be useful on more projects but is being employed judiciously most of the time. These results indicate that ensuring a site is in the proper condition prior to planting (i.e. cleared of invasive species, proper soil conditions, etc.) is essential to a successful planting project.

The data does not indicate that all planting projects should be using every tree establishment technique. Even though more treated projects have high survival, there are many untreated projects with high survival as well. While a significant difference exists between the number of projects in each tree survival category using each technique, there still exists a significant number of projects with high survival that do not employ site preparation, post-planting maintenance, or tree protection. This indicates that these techniques are not necessary at every site. If a site has good soil conditions, adequate water, and plenty of alternative foliage for wildlife, it may not be necessary to use any of these techniques on the planting project. Planting projects should be individually evaluated to determine which methods will be needed for satisfactory planting success.

Given the differences in frequency of observed causes of mortality in the various regions, the following analyses address the use of regionally appropriate measures. Since competing vegetation is primarily a problem in the coastal drainages and desiccation is the main problem in the arid basins, it is interesting to see how well these regional sources of mortality are being addressed.

Projects that received physical or herbicide clearing on coastal drainage projects have greater than 75% survival twice as frequently as those that did not (figure 9). Twice as many projects with less than 25% survival have not received vegetation release. The fact that only 40% of coastal projects had efforts to control plant competition, suggests that more maintenance can be done to improve efficient establishment of plantings in coastal drainages.

Photo 6 – Plant competition can be a formidable obstacle when planting in a riparian area like this one in the north coast region. Although the invasive species are the most notorious, native plants such as snowberry can also suppress plantings.

Figure 11 shows the tree survival of irrigated and non-irrigated projects in arid basins. Irrigated projects surveyed were twice as likely to be in the 76-100% survival range than the less than 25% survival range. In contrast, non-irrigated projects were three times more likely to have less than 25% survival than 76-100% survival. Despite the evidence that high tree survival in these areas is related to irrigation effort, less than 20% of the projects received such treatment. The results reinforce the idea that, to ensure successful planting projects, it is imperative to address regional conditions.

Photos 7 and 8 - Desiccation is a significant cause of mortality on plantings in arid and semi-arid regions such as this one in northeast Oregon. Utilizing irrigation with a gas powered pump (right) and drip line (left) is an excellent way to increase survival of these planted ponderosa pines in their most vulnerable years.

CREP projects receive site preparation, post planting maintenance, and tree protection more often than grant planting projects. By comparing grant and CREP tree survival, figure 12 depicts the difference that a more frequent use of tree establishment techniques can have on a program's overall tree survival. Of CREP planting projects 52% fall into the 76-100% survival category, while the grant program has ~35% of tree planting projects in this category. The data shows that more frequent use of these methods increases tree survival.

The data is useful not only in evaluating various tree establishment techniques but also in comparing the relative effectiveness of those techniques. Since herbicide and physical clearing methods have the same goals, to release plantings from competing vegetation, a comparison between the two is appropriate. Figure 14 shows little difference between the effectiveness of herbicide and physical clearing. Project managers should choose their approach to vegetation release based on site-specific considerations and potential side effects of each method. For example, in an area where increased sedimentation from physical clearing will cause significant damage to the system, herbicide treatments may be a safer alternative. Conversely, if physical clearing will not significantly affect sedimentation, it is likely a better alternative than chemical runoff.

Riparian Fencing

The status of the fences for each livestock exclusion project surveyed is shown in figure 14. The majority of projects have intact fences while few are failing and even fewer are incomplete. Most landowners are committed to the maintenance of their fences. As well as landowner inattentiveness, failing fences can represent changes in land use, or recent fence damage.

Photo 9 – Livestock exclusion and riparian planting project in the Umpqua valley.

On projects that involve tree planting and have failing or incomplete fences, livestock can do a significant amount of damage to the planting. Of the projects that livestock have had access to, 30% are decimated (less than 10% survival) and less than 20% of those projects have greater than 50% survival (figure 15). This finding suggests the need for diligent fence maintenance and strong landowner involvement.

Figure 16 shows the distribution of the size of each project's average buffer width. This graph shows a large variation in buffer sizes; however, since the bankfull width was not recorded on each project, it is impossible to analyze the appropriateness of the buffer sizes.

Off-Channel Watering Facilities

Of the 32 off-channel watering facilities surveyed, a large majority (84%) is currently in use. Of the facilities monitored, almost half pump water from the stream, 35% flow from a spring, and 12% are pumped from a well. In many ways, the spring development is the best method for off-channel watering development in that it requires little to no maintenance and does not directly impact stream flows. Additionally, spring developments may allow for easier distribution of watering facilities. However, natural springs can provide excellent wetland habitat that may be impacted by such developments.

Photo 10 - These stock watering tanks in Gilliam County allow better livestock distribution and reduced pressure on the riparian area.

In-stream structures

In-stream structures were surveyed for size, orientation, and adjacent channel condition. Since streams are dynamic systems, viewing a structure once does not provide the cumulative observations necessary to determine a structures interaction with the channel. Additionally, no discernable pattern for use of various log sizes could be drawn.

Landowner Surveys

The landowner survey forms received indicate that landowners are generally pleased with the projects on their property, and generally see them as effective. No landowner surveys received indicated that they were not pleased with the project on their property, or that they perceived the project as ineffective. Considering the relatively high return rate on surveys, landowners seem to be interested and involved in their projects.

Much of the value of the landowner survey is in the comments that landowners made on the short answer sections of the questionnaire. In order to increase the applicability of the comments, they are separated by comments on grant and CREP projects. All told, there were 22 CREP respondents and 26 grant respondents.

Landowners that have grant projects on their properties have a variety of concerns and suggestions. Some landowners express interest in research and increased project monitoring to help prioritize restoration efforts. Additionally, some interest is expressed in knowing about other projects across the state. Others deal with some of the specific issues on their projects. For example, one landowner feels that the project had provided inadequate livestock crossings for full access to his pastures. Where some landowners are interested in putting more shrubs and trees on the bank for stability, others advocated the use of more rock riprap.

Photo 11 – Richard Girton proudly shows the impressive growth of a western red cedar planted one year earlier under the CREP program. Although his property is frequented by wildlife, the existing herbaceous and woody vegetation provide other foraging alternatives.

Whereas most of the grant comments on project problems and suggestions for improvement concentrate on the logistics of the practice, many of the CREP comments reflect financial concerns as well. One concern for CREP enrollees is the inequity of compensation between those that signed up early and those that signed up after the soil rental rates were modified and incentive payments were added. Some landowners express frustration about the limitations of the cost-share and seem to have been unclear about exactly what was going to be cost-shared while implementing the project. Another concern is that the program does not adequately address site preparation needs. Some respondents note difficulties in attaining permits associated with the projects. While some specifically mention how helpful the involved agencies had been, a lack of continuity between planning, implementing, and the financial reimbursement of the program is another concern mentioned.

A number of CREP enrollees have suggestions for other landowners that may be considering the program. One landowner warns that projects can involve large up-front expenditures since the cost-share is a reimbursement. Some landowners encourage others to participate in order to be good land stewards and warns against enrolling to make money. One comment speaks to timely tree plantings with live stake cuttings, and another mentions the importance long-term establishment efforts. A couple of landowners encourage enrollment as a way of enhancing land value. One landowner's simple suggestion seems especially pertinent: "be patient."

Conclusions and Recommendations

From the information gathered in this project, it is evident that most successful tree planting projects require significant effort. In order for a planting project to be successful, a well-thought-out tree establishment plan is necessary. The site needs to be visited regularly to ensure that the plantings are performing as anticipated. When plantings are performing poorly, an adjustment to the establishment strategy can help improve establishment of trees in the riparian areas.

The relative success of CREP riparian tree establishment projects over grant program projects is likely due to mandatory tree establishment and practice cost-share with landowners. Because grant projects do not provide money for maintenance, the CREP program may be more appropriate for eligible landowners interested in riparian buffers.

More region specific data on the causes and extent of mortality would provide valuable information to project designers. In order to expand upon the observations of causes of mortality in this study, annual surveys of sample planting plots in each region are needed. Such a survey would allow for causes of mortality to be quantified for various species considering surrounding vegetation, tree establishment techniques used (i.e. tubes, mulch mats, physical clearing, etc.), soil conditions, and other factors. Additionally, follow-up monitoring of plant survival could lead to a more detailed evaluation of how planting can improve riparian and stream health.

More detailed and uniform annual monitoring and completion reports would provide sufficient background information for future studies. During this monitoring effort, the lack of appropriate information was the biggest hindrance to thorough project evaluation. Some reports had sufficient detail to provide the information necessary to complete the monitoring worksheets used, but other times, the number of trees planted, species planted, methods used, location of the planting project, or the location of in-stream structures was unknown. Such baseline data is essential in order to adequately analyze statewide and regional patterns in watershed restoration.

Since tree survival can vary based on the methods used, a more thorough survey of tree establishment approaches and survival is necessary. A cost-benefit analysis of restoration techniques would be valuable in increasing riparian planting efficiency. For example, if projects using a saturation approach are spending more time and money replanting to achieve the same goal as projects planting fewer trees with more maintenance and protection, adjustments should be made to planting strategies.

This study has also shown little difference in tree survival on projects using herbicide or physical clearing for release from plant competition. Project managers should consider the potential cumulative impacts that herbacides can have on water quality and wildlife. Likewise, consideration should be given to the potential sedimentation that would result from physical clearing. Additional studies should focus on a cost-benefit analysis of these two plant release methods.

A more thorough evaluation of the appropriateness of riparian livestock exclusion buffer widths being used is also necessary. This survey did not take into consideration the bankfull width on riparian livestock exclusion projects. Without this information it is not possible to determine where appropriately sized livestock exclusion buffers are used.

In addition to evaluation of project effectiveness, a more detailed and regular survey of landowner opinion would be valuable. This study did not address the reasons landowners chose to participate in the OWEB grant program, CREP, or neither. A more thorough study of how to reconcile the goals of these programs with landowner needs will encourage participation, which is essential to the success of statewide watershed restoration.

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Appendix A

Date:___________________ Contract Number:_________________________

Participant and Funding Information

Fill in participant information in the table below. Under '**organization name**' list project participants including grant programs, watershed councils, local, state, or federal agencies, SWCDs, conservation or sporting groups, job or volunteer programs, other private landowners, etc. *Contact name, phone number, and e-mail for landowner is optional.*

Your name	Affiliation	phone number	e-mail	funding amount
				$
Operator/Landowner name	**contact person**	**phone number**	**e-mail**	**funding amount**
				$
organization name	**contact person**	**phone number**	**e-mail**	**funding amount**
				$
				$
				$
TOTAL COST (make sure this equals the sum of all contributions):				$

Project Information

STREAM NAME _______________________________

BASIN____

TOWNSHIP ________ RANGE_______ SEC __________

COUNTY __________________________

PROJECT DATES: Start (mo)______(yr)______ Completion (mo)______(yr)______
(do not report planned projects)

TARGET FISH SPECIES: ____

MAP: Attach a map of the site showing the stream and the CREP enrollment.

1. Use a 1:24,000 map (USGS quad sheet) and aerial photo (if available). Photocopies are acceptable.
2. *Highlight* treatment area(s) and *label* activities.
3. Label map with contract number and/or landowner name.
4. Label map with township, range, and section coordinates.

-OVER-

Practice Information

Check (✓) the practice (Riparian Buffer, Filter Strip, or Wetland Restoration) that was applied in this CREP project, check (✓) the land type in the table below the practice, and fill in the questions in that row of the table.

☐ **Riparian Buffer** (CP22) Planting trees, grasses, shrubs (zone one of riparian buffer planted to trees)

Land Use Type	Acres Enrolled	Average buffer width	Length of stream treated	Age & Species Type Planted	Soil Type
☐ non-irrigated cropland	ac	ft	mi		
☐ irrigated cropland	ac	ft	mi		
☐ pasture land	ac	ft	mi		

☐ **Filter Strip** (CP21) Planting grasses and shrub

Land Use Type	Acres Enrolled	Average buffer width	Length of stream treated	Age & Species Type Planted	Soil Type
☐ non-irrigated cropland	ac	ft	mi		
☐ irrigated cropland	ac	ft	mi		
☐ pasture land	ac	ft	mi		

☐ **Wetland Restoration** (CP23)

Land Use Type	Acres Enrolled	Description of Restoration Practice
☐ non-irrigated cropland	ac	
☐ irrigated cropland	ac	
☐ pasture land	ac	

Additional Information: fill in questions that apply to this project

1) LENGTH of Riparian Fence built along stream: _____________miles
2) AMOUNT of Water Rights leased to state for instream use: ____________cu ft/sec
3) Describe methods for ensuring survival of plantings

4) Describe Livestock Crossings or Watering Facilities developed

Appendix B

Riparian Project Information/ Monitoring Form

Project Name______________________________________ Project #________________

Landowner Name___________________________ Phone #_______________________

STREAM NAME_______________________________ BASIN___________________

COUNTY_________________TOWNSHIP_______RANGE_________SEC_________

What were the project goals?

o Streambank stabilization/protection o Reduce erosion/sediment input
o Reduce run-off contaminant input o Prevent livestock access
o Increase stream shading o Other_______________________________

o Riparian Planting

Length of stream treated _________mi (_________ft)
Area planted _________acres # trees planted____________
Orig. planting date: _____________ o Interplanted
Species planted: ____
____
Site prep: o Herbicide o Clearing o Tilling o Disking o Sub-soiling o None
Tree protection: o Tubing o Cages o Mulch mats o Foil o Wildlife Excl. fence
Post-plant main: o Irrigation o Herbicide o Phys. clearing o Deer rep. o None
o Grass seeding - type________________ o Geotextile mats
Tree Survival rate: o 0-10% o 10-25% o 26-50% o 51-75% o 76-100%
Species survived: ____
____
Obs. causes of mort____

o Livestock Exclusion

o Fencing o Surrounding area not used as pasture.
Length of stream treated _________mi (__________ft)
Avg setback ________ft Area protected _________acres
Type of Fence: o Barbed o Electric o Woven o High Tensile ____Strands ____Ft. High
Location of Fence: o Both sides of stream o One side of stream o Other:______
____
Current Status: o Intact o Failing o Not constructed
Evidence of failure: ____
o Actively maintained o Not actively maintained

o Off-stream Water Supply

Water Source: o Spring o Pumped from stream o Other:__________
Power Supply: o None (Gravity) o Electrical o Solar o Nose pump
o Other:____

o # of water developments: ___________

Water Distribution: o None o Pipe (length: ______ft) # troughs/tanks: ______

Current Status: o In use o Failing o Not in use

Riparian Management:

o Riparian Pasture

o Livestock Exclusion Fence

o Other: ____

Riparian Vegetation:

Dominated by: o Trees o Shrubs o Grasses

Typical species: ____

____

Canopy closure: o Full o Partial o Planted w/in last 2 yrs.

Other Project Components:

o In-stream structures:

o Logs

#________________ Stream Length ____________ft.

o Boulders

________________ Stream Length ___________ft.

o Other: ____

#________________ Stream Length ___________ft.

Additional comments on riparian area and stream condition.

____

____

____

____

____

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____

____

____

____

Appendix C

In-stream Structure Monitoring Form

Location:

Project Name____ Project # ____________

Stream Name____

Basin________________

County____________________________

Date______________

Project Area Conditions:

Est. channel gradient: o <5% o 5-15% o >15%

Est. channel confinement: o Highly confined o Moderately confined o Unconfined

Dominant channel substrate: o Bedrock o Silt/sand o Gravel

Riparian area: o Well vegetated o Being restored o Neither

Structure(s):

Structure 1: # of logs__________ # of boulders __________ o In place o Washed out

Type of Structure: o Fixed o Placed o Rock Weir o Rock Barb o Gabion

Est. log length: o 1.5 x BFW w/ rootwad o 2x BFW w/out rootwad o LWD small for stream

Secured by: o Boulders o Cable o Rope o Riparian veg o Both banks o One bank o Embedded o Entangling

Lay of ISS: o Across steam o Diagonally deflecting o Diagonally inflecting

o Upstream V o Downstream V

Adjacent channel condition: o Upstream gravel dep. o Upstream silt dep. o Slack pool

o Downstream gravel dep. o Downstream silt dep. o Scour pool

o Side channel o Natural debris recruitment

Comments:____
____
____
____

Structure 2: # of logs__________ # of boulders __________ o In place o Washed out

Type of Structure: o Fixed o Placed o Rock Weir o Rock Barb o Gabion

Est. log length: o 1.5 x BFW w/ rootwad o 2x BFW w/out rootwad o LWD small for stream

Secured by: o Boulders o Cable o Rope o Riparian veg o Both banks o One bank o Embedded o Entangling

Lay of ISS: o Across steam o Diagonally deflecting o Diagonally inflecting o Upstream V o Downstream V

Adjacent channel condition: o Upstream gravel dep. o Upstream silt dep. o Slack pool
o Downstream gravel dep. o Downstream silt dep. o Scour pool
o Side channel o Natural debris recruitment

Comments:____
____
____
____

Appendix D

Landowner Survey Form

Project Name________________________Project #__________________________
(optional)

Landowner Name_____________________ Phone #___________________________

1. Has the project been completed? □ Yes □ No

2. Is the project still in place? □ Yes □ No
   If no, why?____

3. Is the project being maintained?
   □ Yes Cost: Time_______________ $_______________
   □ No, because: □ Never worked □ Too costly □ Inaccessible
   □ Too time consuming □ No landowner benefit
   □ Other____

4. In the past, has the project been effective?
   □ not effective □ neutral □ somewhat effective □ effective □ very effective

5. Is the project still effective?
   □ not effective □ neutral □ somewhat effective □ effective □ very effective

6. Are you pleased with the project?
   □ not pleased □ neutral □ somewhat pleased □ pleased □ very pleased

7. What would have made the project better?__________________________________
   ____
   ____

8. What problems did you encounter in implementing the project? _________________
   ____
   ____

9. What would you suggest to other landowners wishing to do a similar project? ______
   ____
   ____
   ____
   ____