Evaluation of the Oregon Conservation Reserve Enhancement Program

DRAFT

Study Design

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Introduction

A healthy riparian area provides many ecological benefits (Gregory et al., 1991), including maintaining cooler stream temperatures, reducing sediment erosion, intercepting pollution from runoff, stabilizing stream flows, and providing fish and wildlife habitat. Healthy streamside vegetation also provides forage, and nesting opportunities for birds and mammals, large woody debris for upland and aquatic species, and maintains the ecological connections between aquatic and upland ecosystems. Over time, many streams and associated riparian areas have been degraded and have lost their ability to provide important functions and services needed to maintain a healthy watershed.

Riparian restoration and conservation has been identified as an important activity for governmental agencies and local groups implementing watershed restoration actions. Riparian restoration is an important component of the Oregon Plan for Salmon and Watersheds because of the benefits of streamside vegetation to water quality and salmon and steelhead habitat. Oregon's Total Maximum Daily Loads (TMDLs) for temperature include streamside vegetation targets. Oregon's Agricultural Water Quality Management Plans include goals to restore streamside vegetation along agricultural lands, and accompanying regulations require agricultural producers to allow streamside vegetation to establish and grow. Oregon Watershed Enhancement Board (OWEB) funds have supported numerous riparian restoration projects on public and private lands in Oregon to achieve the state's natural resource goals. Riparian restoration projects may include shrub and tree planting, livestock exclusion fencing of the riparian area, invasive plant species removal in the riparian area or some combination of the above. The main goals for riparian restoration are to improve large wood recruitment, increase streambank stabilization, and increase stream shading. Riparian restoration ranks as the second highest investment for OWEB. According to the Oregon Watershed Restoration Inventory (OWRI) over $30,000,000 million dollars has been invested since 1997 on approximately 5,000 stream miles.

In 1998, a Conservation Reserve Enhancement Program (CREP) Agreement (Agreement) between the United States Department of Agriculture (USDA) Commodity Credit Corporation and the State of Oregon signaled the beginning of CREP in Oregon. The goals of CREP are to establish a properly functioning riparian area by paying eligible landowners an annual rental rate for the removal of acreage from agricultural use for the purposes of establishing a healthy and ecologically functioning riparian area. Since 1998, the state of Oregon has contributed more than $19,000,000 dollars and enrolled over 42,000 acres under this program. These investments have leveraged a huge amount of federal investment in streamside improvements in Oregon. The total investment in improving riparian areas under state and federal resources is approximately $75,000,000 dollars.

As part of the Agreement, the State of Oregon committed to contribute to no less than 20% of the overall program costs, and to be responsible for all monitoring costs. The Farm Service Agency (FSA) and the State of Oregon both committed to administrative responsibilities, including managing cost-share contracts and cost-share payments. The Oregon Department of Agriculture (ODA) and OWEB provide program implementation and coordination services. State funding is provided to support and fund technical assistance positions at Soil and Water

Conservation District (SCWD) offices around the state. The Oregon Departments of Forestry and Water Resources also contribute staff time and expertise to the program. In the original Agreement, FSA committed to cover all of the annual rental payment costs.

The Agreement was amended in 2000 to add restrictions on maximum average buffer and filter strips widths and to enroll lands adjacent to streams that support additional listed fish species other than salmon. Another amendment to the Agreement was signed in 2004 to expand the eligibility of acreage that can be enrolled into CREP and incorporate Clean Water Services of the County of Washington, in the State of Oregon, to provide additional payments to landowners and cover administrative costs for parties interested in enrolling in the Tualatin Watershed Option. This program in the Tualatin Watershed is commonly referred to as enhanced CREP or ECREP.

This amendment also revised the language to clarify that the CREP will address the following objectives:

1. Restore 100 percent of the area enrolled for the riparian forest buffer practice to a properly functioning condition in terms of distribution and growth of woody plant species, filtration of nutrients and sediment from agricultural runoff, shade, and stabilization of stream banks under normal non-flood conditions as provided for by FSA Handbook and the Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG).

2. Provide a way for farmers and ranchers to voluntarily meet the water quality requirements established under federal law and under Oregon's agricultural water quality laws.

3. Subject to other limitations, attain enrollments up to the following annual enrollment targets, including those within the existing Oregon CREP enrollment, for the following geographic regions within Oregon during the duration of this agreement:

<u>Coastal Basins:</u>
1,250 acres of riparian forest buffer.
1,000 acres of restored wetlands.
2,250 total acres (180 total stream miles) of riparian forest, wetland and wildlife buffers.

<u>Columbia Basin:</u>
8,000 acres of riparian forest buffer and filter strips.
1,000 acres of restored wetlands.
9,000 total acres (700 stream miles) of riparian forest, wetland and wildlife buffers

<u>Interior Drainages:</u>
3,500 acres of riparian forest buffer and filter strips.
1,000 acres of restored wetlands.
4,500 total acres (375 stream miles) of riparian forest, wetland and wildlife buffers

4. Conduct effectiveness monitoring of CREP projects in each of the three regions by:

- Developing a study plan by December 30, 2004,
- Identifying study watersheds and implementing field studies by December 30, 2005, and
- Providing data and monitoring results by December 30, 2006 and 2007.

5. Implement these Additional Provisions Specific to the Tualatin Watershed Option:
   A. The Tualatin Watershed Option is sponsored by Clean Water Services (CWS)
   B. The additional benefits and assistance available through the Tualatin Watershed Option will be the responsibility of CWS.

Finally, in 2007 an addendum to the Agreement was agreed upon to state that the Agreement shall not terminate automatically on December 31, 2007 as was referenced in the original Agreement and new enrollments were allowed to occur, subject to the availability of funds so long as there is statutory authority for such enrollments.

Summary of Previous Riparian Monitoring

In 2002, OWEB sponsored a statewide survey of riparian and stream enhancement projects implemented from 1987 to 2001 (Anderson and Graziano, 2002). Projects included in the evaluation were funded either through the Governors Watershed Enhancement Board (GWEB) a predecessor to OWEB, or through CREP beginning in 1999. Goals of the monitoring project were to evaluate how riparian restoration projects have fared over time, what were leading causes of failure, and what factors could be attributed to project success. Results from the 2002 study suggest an increase in site preparation activities, post-planting maintenance, and tree protection may help achieve increased tree survival rates. Conclusions of the authors suggest that CREP riparian restoration projects had higher rates of success than OWEB grant projects due to requirements for plant maintenance contained in CREP contracts. The authors also suggest that a lack of consistent information and detailed planting plans was a major hindrance in identifying the number of trees planted, species planted, planting method, etc. that may have enabled additional analyses on riparian project success. Because of this work, several programmatic changes were made to state natural resource agencies involved with CREP, including increased training and refinements to the quality of planting plans.

In 2009, OWEB completed an assessment of CREP projects in Wasco County (Bartuszevige et al., 2009). The objectives of this evaluation were to determine the effect, if any, of selected buffers of various lengths to determine their effectiveness compared to unbuffered reaches. The project also focused on stream macroinvertebrates and presence of invasive plants as indicators of riparian restoration project success. Twelve riparian areas were selected, nine of which received CREP projects and three sites which were untreated. Results at that time, suggest that there was no difference between restored sites compared to non-restored sites for plant species richness, plant community composition, and nutrient levels. There was no evidence to suggest that longer stream buffers were more effective than shorter stream buffers. However, analysis revealed a difference in macroinvertebrate community composition suggesting that CREP sites experienced improved water quality conditions compared to unbuffered sites. The restored CREP sites were relatively young (all less than 5 years since establishment) and were only studied for one summer.

In 2010, OWEB commissioned a contractor to complete an evaluation of riparian restoration projects implemented between 1995 and 1998 in the South Coast and Grande Ronde watersheds funded by GWEB (Demeter Design, 2010). These were the first watershed councils in Oregon and represent "pilot" watershed council areas. Questions from this monitoring project were:

1) Do the projects still exist on the landscape?

2) Are projects meeting original objectives?

3) What is the current riparian vegetation condition?

Only 77 (16%) sites from a sample population of 485 could be located and accessed. The sites that were included in the study did not perform substantially better in terms of canopy density and invasive species composition compared to non-restored sites located on a nearby stream reach. Restoration project sites also exhibited planted vegetation composition that was inconsistent with natural vegetation composition at reference sites, which could result in lower success rates and species diversity at the treated sites. In addition, the authors noted that physical damage (mowing, grazing, etc.) and invasive species encroachment were main causes of project failure.

Results from previous monitoring of riparian areas have demonstrated poor success rates thus far. There is evidence to suggest that some riparian restoration projects have not yielded the suite of intended benefits as designed, including increased stream shade, sustained increase of native plant composition, and decreased bank erosion. This could either be the result of poor site conditions, poor planting schemes or implementation, lack of maintenance, or a combination of these or other factors. In addition, the monitoring projects listed above were completed on some projects that were relatively young and additional time may be necessary to gather information on long-term project outcomes. Given the significance, in terms of both past investment in CREP and the ongoing efforts to enroll additional landowners in CREP, it is critical to ensure project success. In addition, knowing what and where improvements have been made to riparian areas and fish and wildlife habitat is critical to understanding the outcome of CREP projects across Oregon in support of the Oregon Plan for Salmon and Watersheds. The evaluation of these projects could provide guidance for the development and implementation of future CREP projects.

OWEB and the Washington Salmon Recovery Funding Board (SRFB) are currently working cooperatively to monitor livestock exclusion projects in both states as part of a "project-scale" effectiveness monitoring program for watershed and salmon habitat restoration projects. Livestock exclusion has been identified as an important action for restoring fragile riparian areas. Livestock exclusion includes building and maintaining fences along riparian areas. Project data and results are shared between the states. This coordinated approach represents a successful effort to collect comparable and compatible data across jurisdictional boundaries.

When data from Oregon and Washington are combined the latest preliminary results indicate that after 5 years 64% of monitored project sites were effective in keeping livestock from

riparian areas and a statistically significant reduction in actively eroding banks. In addition, a slight average increase in canopy density following project implementation was apparent when comparing average pre-project and post-project conditions (Tetra Tech 2012). These results are promising and begin to shape the understanding of the importance of livestock exclusion as a restoration action that improves stream quality.

Goals

The goals of this study plan are to:

1) Report on the status and condition of previously implemented CREP projects.

2) Establish a long-term monitoring program to evaluate the effectiveness of CREP projects implemented across Oregon to meet the objectives agreed upon in the 2004 CREP Agreement Amendment.

Study Design

Due to the large time span of previous project implementation and new projects being enrolled into CREP every year, a three tiered project design is planned to meet the goals and objectives for this study. OWEB is planning to convene a CREP Advisory Group as it further refines and implements this study design. Several staff from federal, state and local agencies administers CREP in Oregon and their roles vary widely across Oregon. The Advisory Group will be comprised of staff from various agencies that administer different aspects of the CREP Program. These staff are commonly referred to as "CREP partners" in this document. OWEB would like to solicit technical input from the Advisory Group on topics such as appropriate vegetation assessment approaches for conservation practices, criteria to evaluate success of CREP projects and the selection and use of control sites. The participation of the Advisory Group can assist in interpretation of the findings and development of any recommendations that may result from this monitoring effort.

Tier 1 Assessment

Tier 1 of this study design will consist of office work to provide background information on the existing CREP projects across the State of Oregon. Data collected by the CREP districts will be compiled to summarize the status of existing CREP projects. Localized staff that work with landowners in the CREP Program are typically organized at the county level although some locations have staff that is responsible for more than one county. This document refers to these distinct CREP geographic administrative units as "CREP Districts". Each "district" spans a distinct geographical area and is administered by a mixture of agencies that implement CREP locally with support from the State FSA office personnel.

The intent of Tier 1 is to determine how projects are distributed across the State, which Conservation Practices (CPs) are being enrolled and the current condition utilizing existing information. This information will help establish the sampling universe for more detailed information to be collected in Tiers 2 and 3.

OWEB will work with CREP partners to identify and compile existing information so it can be summarized at the district, ecoregion, geographic region and at the state level. The specific information reported will be determined by communicating with a variety of CREP partners across the state of Oregon to understand what data is readily available. The following metrics will be investigated:

- Total number of CREP contracts enrolled
- Number of CREP contracts enrolled by year
- Total acres enrolled in each Conservation Practice by year
- # of contracts reenrolled after contract expiration
- # of contracts disenrolled
- % of contracts inspected
- Amount of water leased for instream flow benefits by year
- Miles of stream planted
- Miles of fencing installed
- # of acres, stream miles and landowners enrolled in the cumulative impact incentive bonus option
- # of watering facilities, pipelines and livestock crossings installed
- # of plantings
- Buffer plant composition type i.e, grasses, forbes, shrubs, conifer or deciduous trees
- Common species planted for each plant composition type
- Plant density
- Survival and growth rates
- Buffer widths i.e, average and/or range
- % of CREP projects that performed site preparation methods
- Maintenance requirement details, spraying
- Invasive plant information, related to site preparation and maintenance
- % of projects that performed supplemental plantings
- Inventory of existing monitoring sites located in the vicinity of CREP projects

In addition to the information compiled above, a map of all CREP projects will be developed in coordination with CREP Partners at the state and district level to establish the sampling universe in order to select sites in Tier 2. These CREP project sites may also be mapped with local, state, federal and tribal long term monitoring sites. This information could be used to determine where opportunities exist to measure relationships with CREP buffers and trends in water quality, quantity and fish abundance in the future.

A final report will be written to summarize the information provided by the CREP districts. This report will include the following information:

- Summarized CREP data and discussion of these results

- Lessons learned and recommendations, highlight any common themes or trends among the information
- Discussion of next steps to proceed with Tier 2 Assessment

Tier 2 Assessment

Tier 2 will consist of a more detailed assessment of existing CREP projects that involves collecting field data. As part of this process landowners will be contacted to gain permission to access their land. The Tier 2 Assessment description is composed of two different levels of field data collection. The first description lays out a low intensity assessment of existing projects. The second description prescribes a higher intensity to collect more detailed field data to assess the development of riparian vegetation and the condition of streambanks and compare those sites to suitable control sites. The intensity of field data collected in Tier 2 is dependent upon the outcome of the Tier 1 assessment. The availability of sufficient information to evaluate existing CREP projects will determine how much information is collected in Tier 2. A lower intensity of data will be collected if there is sufficient existing information to evaluate the status and conditions of existing projects. If there is not enough existing information to evaluate the projects then a higher intensity assessment will be performed.

LOW INTENSITY ASSESSMENT

The low intensity assessment will collect a limited amount of field data to evaluate the current vegetation and fencing conditions of existing CREP projects.

Objectives

1. Determine the extent of livestock use in CREP buffers.
2. Determine the percent woody cover or the potential vegetation indicator of buffer success for the specific Conservation Practice implemented.

Site Selection

Sites that will be selected for sampling will be informed by findings of the Tier 1 assessment. Sites will be selected to stratify a range of ages of projects from 0-5, 6-10 and 10-15 years. The specific number of sites will be based on selecting a representative sample pool to characterize the age, the potential vegetation type and geographic distribution of existing CREP projects. Computerized mapping will be used to assign random locations within strata to evaluate the objectives listed above. Projects that have endured major natural disturbances (fire, major flooding, etc.) in the immediate vicinity will be reviewed and may possibly be excluded from the study.

Methods

Information should be obtained from the responsible agency (FSA, NRCS, SWCD, WC) that describes the details of the CREP project to aid in the field assessment and data analysis process. In particular, the buffer width, the CP implemented, the number of plants installed or seed applied per acre, per year and the number and types of maintenance treatments will be recorded for each CREP contract that is sampled. Field methods are largely adapted from two existing protocols that OWEB has utilized in past effectiveness monitoring projects. These two

protocols are titled “Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011” and “Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4, Crawford 2011”. Both of these protocols are available for download at: http://www.rco.wa.gov/doc_pages/other_pubs.shtml#effectiveness

Reach Establishment

Establishing a stream reach will follow the procedures described in the Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011, which was adapted from EMAP protocols (Peck et al. 2003) and Mebane et al. 2003. These methods are described in detail in the Method for Laying out Control and Impact Stream Reaches for Wadeable Streams on pages 15-17.

Livestock Exclusion

The presence or absence of livestock inside the exclusion can be used as a measure of the effectiveness of the fencing design in excluding livestock from the riparian area. Livestock exclusion fencing can also be evaluated by counting the number of holes in the fencing (Crawford, 2011). The procedures detailed in the Method for Detecting Presence/Absence of Livestock as described in the Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4, Crawford 2011, shall be followed to evaluate objective #1.

Riparian Vegetation

Naturally recruited woody individuals are often difficult to differentiate from planted individuals in riparian buffers that are older than 5 years of age. Including naturally recruited individuals is a more relevant measure of success as these individuals add to the functions provided by the original plantings. Therefore, post-project sampling will consist of estimating percent cover of planted trees and shrubs and natural recruitment of woody riparian species. If additional plantings occur after the beginning of the project, these should be noted and included in the analysis (Crawford, 2011). The procedures detailed in the Method for Quantifying Riparian Plantings, specifically steps 1, 2 and 5 as described in the Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011, shall be followed to evaluate objective 2.

Different sampling methods will be used to measure the potential vegetation indicator for the specific CP implemented that does not require planting trees or shrubs. These methods will be developed in consultation with the multi-agency Advisory Group and contractor.

Data Analysis

Data should be collected to the extent possible with hand held data recorders and a database will be designed to store data and perform a basic summary analysis of completed project data to identify any data irregularities and calculate summary statistics. The summary of statistics to be completed is listed for objectives number 2 and 4 in the Summary Statistics section below.

HIGH INTENSITY ASSESSMENT

The more detailed assessment of the existing CREP projects will be assessed utilizing an Extensive Post-Treatment (EPT) Study Design. The extensive post-treatment study is the one endorsed by Hall et al. (1978) as being most useful in providing information about watershed practices on streams, and is also a commonly used design in water quality monitoring (MacDonald et al. 1991). Short-term monitoring (on the order of one or two seasons) will be conducted in both control and treated sites and differences in response variables will be attributed to treatment effect. Control sites are locations that are actively managed in a manner consistent with the use before the treatment site was enrolled in CREP.

This post-treatment study will evaluate the effectiveness of CPs on bank stability, canopy cover, vegetation structure and invasive plant presence. The effectiveness of livestock exclusion fencing will also be evaluated where fencing has been installed.

Objectives

1. Compare the overall riparian vegetation cover layers and canopy cover density within the project area to a control area that has not been treated.
2. Compare the percent woody cover or the potential vegetation indicator for the specific Conservation Practice implemented within the project area to a control area that has not been treated.
3. Compare the overall proportion of stream bank actively eroding within the project area to a control area that has not been treated.
4. Determine the extent of livestock use in CREP buffers.
5. Compare the percent cover of invasive plant species, including noxious species within the project area to a control area that has not been treated.

Site Selection

Sites that will be selected for sampling will be informed by findings of the Tier 1 assessment. Sites will be selected to stratify a range of ages of projects. The specific number of sites will be based on selecting a representative sample pool to characterize the age, the potential vegetation type and geographic distribution of existing CREP projects. Computerized mapping will be used to assign random locations within strata to evaluate the objectives listed above. Projects that have endured major natural disturbances (fire, major flooding, etc.) in the immediate vicinity will be reviewed and may possibly be excluded from the study. A control reach of equal size and habitat type, located upstream of the project site, should be selected and designed in the same manner as the impact reach. Ideally, the property would have a riparian area that would remain in an unmanaged condition. A nearby location could alternatively be used if a control area on the applicant's property is not available.

Methods

Information should be obtained from the responsible agency (FSA, NRCS, SWCD, WC) that describes the details of the riparian planting and exclusion fencing project to aid in the field assessment and data analysis process. In particular, the buffer width, the CP implemented, the

number of plants installed or seed applied per acre, per year and the number and types of maintenance treatments will be recorded for each CREP contract that is sampled. Field methods are largely adapted from two existing protocols that OWEB has utilized in past effectiveness monitoring projects. These two protocols are titled "Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011" and "Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4, Crawford 2011". Both of these protocols are available for download at:
http://www.rco.wa.gov/doc_pages/other_pubs.shtml#effectiveness

Reach Establishment

Establishing a control and impact stream reach will follow the procedures described in the Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011, which was adapted from EMAP protocols (Peck et al. 2003) and Mebane et al. 2003. These methods are described in detail in the Method for Laying out Control and Impact Stream Reaches for Wadeable Streams on pages 15-17.

Riparian Vegetation

CREP projects that have implemented Forest Riparian Buffer CPs will measure canopy cover, percent woody cover, riparian vegetation and structure following procedures described in the Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011, to evaluate objectives 1 and 2. These methods are described in detail in the Method for Characterizing Riparian Vegetation Structure on pages 18-22. Measuring percent woody cover will occur in treated reaches only and will follow procedures detailed in the Method for Quantifying Riparian Plantings, specifically steps 1, 2 and 5 on pages 11 and 12. In addition to the methods described above, the percent cover of invasive plant species will be estimated for the understory (0.5 to 5m high) and ground cover (0 to 0.5m high) vegetation layers in each transect to evaluate objective 5. Noxious species significant to the State of Oregon presence will also be summarized per species.

Different sampling methods may be used to measure the potential vegetation indicator for the specific CP implemented that does not require planting trees or shrubs. These methods will be developed in consultation with the multi-agency Advisory Group and contractor.

Streambank

Measuring the percentage of actively eroding streambanks will follow procedures described in the Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3, Crawford 2011, which was adapted from Moore et al. 1998 to evaluate objective 3. These methods are described in detail in the Method for Measuring Actively Eroding Streambanks on page 27.

Livestock Exclusion

Measuring the overall use by livestock in the riparian area will follow procedures described in the Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4, Crawford 2011, to evaluate objective 4. These methods are described in detail in the Method for Detecting Presence/Absence of Livestock.

Photo Points

Photo point monitoring can be a useful and inexpensive tool for qualitatively documenting conditions of the CREP buffer. Well-documented photo points can also be used to support conclusions reached through other, more rigorous monitoring techniques. Photo points should be established to document current conditions and to be utilized if further monitoring occurs. Photo points will be established following procedures described in OWEB Guide to Photo Point Monitoring, Shaff et al 2007.

Data Analysis

Data should be collected to the extent possible with hand held data recorders and a database will be designed to store data and perform a basic summary analysis of completed project data to identify any data irregularities and calculate summary statistics.

Summary Statistics

1. Compare the overall riparian vegetation cover layers and canopy cover density within the project area to a control area that has not been treated.

Overall vegetation cover layers will be calculated by determining the proportion of the reach containing all 3 layers of riparian vegetation: canopy cover, understory and ground cover. Each of the three layers of riparian vegetation is defined by two constituent layers, and we count a layer as containing riparian vegetation if either of its two constituents is present. The constituents for canopy cover are small trees and big trees. Understory layer is divided into woody understory and non-woody understory, and ground cover is divided into woody ground cover and non-woody ground cover. At each transect a value is recorded for all six constituents at each bank. For instance a value is recorded for big trees on the left bank and big trees on the right bank at each transect. The values are integers from 0 to 4, representing percentage ranges. A 0 means no presence whatsoever, 1 means less than 10 percent, 2 means 10-40 percent, 3 is 40-75 percent, and 4 is greater than 75 percent.

The calculation is the percentage of the 22 possible locations in the reach that have each of the three layers of riparian vegetation present. The right and left banks are treated separately to come up with the 22 possible locations (the right and left banks for each of the 11 transects). Since presence of a layer is shown if either of its constituents are present, the calculation is started by looking at the canopy cover, and if the value for big trees OR the value for small trees is 1 or greater, then count that location to have canopy cover present. In a similar way we judge understory and ground cover and if the location has all 3 layers present we contribute that location to the percentage of the full 22 locations in the reach (Crawford, 2011). In some locations only one side of the stream will have a buffer enrolled in CREP. In these instances calculations will only include 11 possible locations to generate the summary calculations. These sites will be denoted in the report and summarized appropriately. The appropriate statistical tests to be performed will be determined as the data is analyzed. Statistically significant differences between the project area and control in overall riparian vegetation cover layers will be attributed to treatment effect. The CREP Advisory Group will assist in generating the success criteria to evaluate this metric.

Canopy cover density within the project area will be calculated by summarizing the canopy cover measurements taken at the center and banks of the stream. These measurements will be summed for all 11 Transects and converted to a percentage. The reading is a value between 0 and 17, with 0 indicating no canopy density whatsoever and 17 reading 100 percent canopy density. The results are then averaged to produce a mean % canopy density at mid-stream. Canopy cover measurements taken at the banks of the stream have a separate metric calculated and are summed for all 11 Transects and are also converted to a percentage. The final variable takes the measurements read from each transect, both left and right, and calculates the mean to produce a mean % canopy density at the stream bank (Crawford, 2011). The appropriate statistical tests to be performed will be determined as the data is analyzed. Statistically significant differences between the project area and control in mean % canopy density at mid-stream and at the stream bank will be attributed to treatment effect. The CREP Advisory Group will assist in generating the success criteria to evaluate this metric.

2. Compare the percent woody cover or the potential vegetation indicator for the specific Conservation Practice implemented within the project area to a control area that has not been treated.

Percent cover of woody vegetation within the riparian planting area is the average aerial percent cover of woody species in the riparian planting area. This statistic is calculated by estimating aerial cover of woody species present in ten 201 ft^2 circular riparian planting plots. The variable percent woody cover is the mean of the estimates from the 10 plots (Crawford, 2011). The CREP Advisory Group will assist in generating the success criteria to evaluate this metric.

3. Compare the overall proportion of stream bank actively eroding within the project area to a control area that has not been treated.

Bank erosion is a measure of the proportion of the reach containing actively eroding stream banks. This is calculated by taking at each transect an estimation in percent (0-100) along the left and right banks. The variable bank erosion is the mean of all the measurements, right and left banks combined. The appropriate statistical tests to be performed will be determined as the data is analyzed. Statistically significant differences between the project area and control with actively eroding banks will be attributed to treatment effect. The CREP Advisory Group will assist in generating the success criteria to evaluate this metric.

4. Determine the extent of livestock use in CREP buffers.

The presence or absence of livestock inside the exclusion can be used as a measure of the effectiveness of the fencing design in excluding livestock from the riparian area. The number of CREP projects with no livestock presence and/or with minimal impacts to the riparian will be used to evaluate this objective. The CREP Advisory Group will assist in generating the success criteria to evaluate this metric.

5. Compare the percent cover of invasive plant species, including noxious species within the project area to a control area that has not been treated.

Invasive plant species within the project area is the proportion of riparian zone with invasive plant species present in the ground cover and understory. This statistic is calculated separately for the ground cover and understory layer by taking the frequency of invasive plant species that are recorded in each transect. The right and left banks are treated separately to come up with the 22 possible locations (the right and left banks for each of the 11 transects.) The calculation is the percentage of the 22 possible locations in the reach that have the invasive plant species present.

Further statistics can be developed to determine the percent ground cover and understory occupied by invasive plants. This statistic is calculated separately for the ground cover and understory layer. Percent cover of invasive plant species is calculated by determining the percent cover of invasives for the left and right bank of each transect and calculating the mean in percentage of the 22 possible locations in the reach. The appropriate statistical tests to be performed will be determined as the data is analyzed. Statistically significant differences between the project area and control with a proportion of riparian zone with invasive plant species present will be attributed to treatment effect. In addition, statistically significant differences between the project area and control percent ground cover and understory percent cover of invasive plant species present will be attributed to treatment effect.

Relationships between planting success and presence of invasive species will be explored and summarized. The presence of noxious weeds will also be summarized for the project area and control area. Additional observations of adjacent lands to the buffer area will be included to provide context in evaluating the presence of invasive plants in the riparian buffer areas. Observations of off-site mature invasive plant species or propagules within 1,000 feet of the riparian buffer site boundary will be recorded to place the buffer's condition in context of the surrounding landscape.

Reporting

Deliverables for this assessment will include the data stored in database format and a final report to be presented to OWEB in writing by the monitoring entity after the sampling season.

The following information will be included:

- Description of sites and statewide map showing distribution of sites selected
- Summarized CREP data and discussion of these results
- Discussion of projects and which decision criteria was met for effectiveness
- Lessons learned and recommendations, highlight any common themes or trends among the project areas and CPs
- Discussion of completeness of data, potential sources of bias

Results will be reported to OWEB Board Members during a regular meeting and shared with the CREP districts. The final report will be shared with the public by posted it on OWEB's Monitoring and Reporting website. These findings may result in recommendations to CREP partners to incorporate findings from this evaluation.

Tier 3 Assessment

A select number of projects that will be enrolled in CREP will be assessed following a Before and After Control Impact (BACI) experimental design to test for changes associated with livestock exclusions and riparian planting projects. A BACI design samples the control and impact simultaneously at both locations at designated times before and after the impact has occurred. For this type of restoration, riparian plantings and livestock exclusion would be the impact, that is, the location impacted by the restoration action, and a location upstream of the riparian plantings would represent the control (Crawford, 2011).

OWEB invested in a Coordinated Monitoring Program for Livestock Exclusions in partnership with the Washington Salmon Recovery Funding Board in 2006. Subsequently, Tetra Tech received a contract to collect, manage and analyze the data. Under both monitoring programs, the intent of the monitoring efforts was to test whether habitat targeted for restoration had been improved or preserved. This partnership leverages the investment of both states to increase the sample size for monitoring, while at the same time reducing costs for each agency (Tetra Tech, 2012).

This coordinated monitoring program used field sampling indicators and techniques that were adapted from the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) (Peck et al. 2003). Specific protocols were developed to detect changes in habitat expected to result from project implementation. Each project was monitored before and after implementation and is scheduled to be monitored on a rotating schedule in Years 1, 3, 5, and 10. As of 2012, Year 5 data have been collected for 11 of the Livestock Exclusion Projects in the program. Annual Summary Progress Reports have been completed for Years 0, 1, 3 and 5 detailing the findings of this study. In addition, Tetra Tech has developed specific protocols to detect changes in habitat expected to result from riparian planting project implementation.

This BACI study will follow the specific protocols developed by Bruce Crawford and recently revised by Tetra Tech in 2011 to monitor the effectiveness of riparian planting and livestock exclusion projects enrolled in the Oregon CREP. These protocols are titled *Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3* and *Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4.*

OWEB will work closely with the local CREP district personnel to identify properties that have been approved for CREP funding and conduct pre-implementation surveys in the treatment and suitable control areas to establish current conditions to track spatial and temporal changes. A total of 15 treatment sites will be selected for this BACI study. Stratification of sampling sites and specific CPs to monitor will be informed by findings of Tier 1 and 2 Assessments. Ideally,

the property would have a riparian area that would remain in an unmanaged condition in order to establish a control area to compare changes over a 10 year period. A nearby location could alternatively be used if a control area on the applicant's property is not available.

References

Anderson, M., Graziano, G., 2002.Statewide survey of Oregon Watershed Enhancement Board riparian and stream enhancement projects. Oregon Watershed Enhancement Board. August,

Bartuszevige, A.M., Diebel, K.,. Kennedy. P.L., 2009. An ecological assessment of Oregon's CREP cumulative impact incentive program. Eastern Oregon Agricultural Research Center.

Crawford, B.A., 2011. Protocol for Monitoring Effectiveness of Riparian Planting Projects MC-3. Washington Salmon Recovery Funding Board.

Crawford, B.A., 2011. Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4. Washington Salmon Recovery Board.

Demeter Design., 2010. Riparian restoration effectiveness monitoring. Oregon Watershed Enhancement Board.

Gregory, S.V., Swanson, F.J., McKee, W.A., Cummins, K.W., 1991. An ecosystem perspective of riparian zones. Bioscience 41, 540-551.

Hall, J.D., M.L. Murphy, and R.S. Aho., 1978. An improved design for assessing impacts of watershed practices on small streams. International Vereinigung fur Theoretische und Angewandte Limnologie 20: 1359-1365.

Kauffman, P.R., P. Levine, E.G. Robinson, C. Seeliger, and D.V. Peck., 1999. Quantifying physical habitat in wadeable streams. EPA/620/R-99/003. U.S. Environmental Protection Agency, Washington, D.C.

MacDonald, L.H., A.W. Smart, and R.C. Wissmar., 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest and Alaska. USEPA Report EPA 910/9-91-001. USEPA, Region 10, Seattle, WA.

Peck, D.V., J.M. Lazorchak, and D.J. Klemm (editors)., Unpublished draft 2003. Environmental Monitoring and Assessment Program -Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. EPA/XXX/X-XX/XXXX. U.S. Environmental Protection Agency, Washington, D.C

Shaff, Courtney., et al., 2007. OWEB Guide to Photo Point Monitoring. Oregon Watershed Enhancement Board, Salem, OR.

Tetra Tech., 2012. OWEB-SRFB Coordinated Monitoring Program for Livestock Exclusion Projects, 2012 Annual Progress Report.