TECHNICAL MEMORANDUM ◦ REVISION#2 MARCH 2016

OWEB CREP
Effectiveness Monitoring
Field Methods and Analyses

PREPARED FOR

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Cover photos: Clockwise from top left: Inter-planting of trees and shrubs providing shade to a stream in Jackson County; Dense brush and blackberries being cleared to allow growth of native vegetation; Native plants installed to improve the riparian buffer after dense weeds were removed; Himalayan blackberry cleared to improve pasture and stream access (CREP site photos courtesy of USDA).

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1 INTRODUCTION AND PURPOSE

The Oregon Conservation Reserve Enhancement Program (CREP) is a cooperative venture between the Oregon Watershed Enhancement Board (OWEB) and the United States Department of Agriculture (USDA) in which enrolled landowners receive annual payments for conducting riparian restoration and livestock exclusion measures on their lands. The purpose of the program is to restore, maintain, and enhance streamside areas on agricultural lands to benefit fish, wildlife, and water quality. Landowners enrolled in CREP receive annual rental, incentive, and cost-share payments to implement conservation measures such as planting trees and shrubs, installing fencing and livestock watering facilities, and other approved conservation measures. Currently, approximately 41,000 acres of land are being conserved as a result of the nearly 1,600 contracts enacted to date. Given the overall investment in the program and the ongoing efforts to enroll additional landowners in CREP, it is critical to evaluate the program's success.

Stillwater Sciences has been contracted to develop and implement the CREP Effectiveness Monitoring Project to evaluate the effect of conservation measures on riparian areas and fish and wildlife habitat. The two most common CREP practices applied in Oregon are the focus of this effort: CP-22 Riparian Buffer and CP-29 Marginal Pastureland Wildlife Buffers (see full descriptions in Appendix A). The results of this project evaluation will provide guidance on the development and implementation of future CREP contracts. The project includes development of a sampling methodology and field methods, development of a monitoring database, a two-phase data collection effort at treatment and control sites, an evaluation of the program success to date, and recommendations regarding the development and implementation of future CREP contracts. Methods for selecting the treatment sites (those enrolled in the CREP program) and methods for selecting associated control sites are described in Technical Memorandum 1: *CREP Effectiveness Monitoring Sampling Design* (Stillwater Sciences 2016).

The over-arching questions we hope to address through this monitoring effort are:

1. Is the CREP program positively affecting riparian site condition as compared with control sites?
2. What are the most important factors affecting successful riparian restoration?

This report provides a consistent and efficient protocol for field data collection and statistical analysis in order to address these questions. The protocol provided in this document includes:

- Instructions for office preparations
- An equipment list
- Field site set-up methods
- Field data collection methods
- Methods for statistical analyses
- Task schedule.

Methods are adapted from the *Protocol for Monitoring Effectiveness of Riparian Planting Projects, MC-3* (Crawford 2011a), the *Protocol for Monitoring Effectiveness of Riparian Livestock Exclusion Projects, MC-4* (Crawford 2011b), *BPA-MBACI Protocol for Monitoring Effectiveness of Livestock Fencing Projects* (O'Neal 2014), *Natural Restabilization of Stream Channels in Urban Watersheds* (Henshaw and Booth 2000), and the *OWEB Guide to Photo Point Monitoring* (Shaff et al. 2007) and are consistent with the *Tier 2 Assessment of the Study Design*

(Fetcho 2015). A summary of the objectives for this monitoring effort as stated in Fetcho (2015), along with associated attributes and methods for measuring these attributes in the field per this protocol, are provided in Table 1-1.

Table 1-1. Objectives as stated in Fetcho (2015), along with associated attributes and field measurements to be made in treatment and control sites.

Objective	Attribute	Field measurements
1a. Compare the overall riparian vegetation cover layers within the treatment to a control area that has not been treated.	Vegetation structure	Percent cover for each of three vegetation layers (canopy, understory, ground cover) present in 100 m^2 (1076-ft^2) square plots on river left and on river right for each **channel** transect; distinctions recorded for hardwood vs. conifer dominated vegetation layers.
1b. Compare the overall riparian canopy cover density within the treatment area to a control area that has not been treated.	Vegetation overhang over channel	Channel edge and mid-channel densiometer readings for each **channel** transect.
2a. Compare the percent woody cover for the specific Conservation Practice implemented within the treatment area to a control area that has not been treated.	Woody cover	Total percent cover of woody species present in 18.7 m^2 (201-ft^2) circular plots for riparian forest buffers CP22 and marginal pastureland wildlife habitat buffers CP29 compared separately.
2b. Compare the potential vegetation for the specific Conservation Practice implemented within the treatment area to a control area that has not been treated.	Herbaceous cover	Total percent cover of herbaceous species present in 18.7 m^2 (201-ft^2) circular plots for riparian forest buffers CP22 and marginal pastureland wildlife habitat buffers CP29 compared separately.
3. Compare the overall proportion of stream bank actively eroding within the treatment area to a control area that has not been treated.	Bank stability	Reach length with actively eroding bank on river right and river left between each set of **channel** transects.
4. Determine the extent of livestock use in CREP buffers.	Livestock exclusion	Exclusion fencing is intact in sample reach, absence of livestock evidence in exclosure area.
5. Compare the percent cover of weed plant species, including noxious species within the treatment area to a control area that has not been treated.	Weed plant species cover	Total percent cover of woody and herbaceous weeds (one value for herbaceous weeds, another for woody weeds) in 18.7 m^2 (201-ft^2) circular plots using Oregon Department of Agriculture weeds lists per county.
6. Compare the percent cover of weed plant species, including noxious species within the treatment area to a control area that has not been treated.	Weed plant species cover	Total percent cover of woody and herbaceous weeds (one value for herbaceous weeds, another for woody) using Oregon Department of Agriculture weeds lists per county present in 100 m^2 (1076-ft^2) square plots on river left and on river right for each **channel** transect.

2 OFFICE PREPARATION

Office preparation will be initiated several months before entering the field. These are important steps for ensuring that the field effort is run efficiently and is successful in collecting complete and accurate data. Office preparation tasks include (1) organize regional and landowner information; (2) establish field data collection system, and (3) prepare field equipment. Some of these tasks include activities, such as identifying leaf-out dates per county, which will be done well ahead of time in order to establish a workable field schedule. Others, such as prepare field equipment, can be done at least one week ahead of time to allow time to resolve any unforeseen complications.

2.1 Organize Regional and Landowner Information

The Phase 1 field effort will occur in late spring/early summer 2016. In order to ensure that vegetation sampling data collected during Phase 1 are representative of field conditions during the growing season, site visits will be timed to occur once leaf-out is at least 90% complete for deciduous species. Sampling before leaf-out would compromise cover estimations and plant identification. Timing information will be gathered by county, since this can vary substantially with latitude, elevation and distance from the ocean. The CREP technicians, County Resource Conservation Districts, and Extension[1] offices will be queried for information on leaf-out timing and development, particularly for riparian trees along the cool river drainages. At the same time, county lists of noxious weeds will be gathered for all areas that include treatment and/or control sites in the state.

Stillwater will contact CREP technicians to identify top priority sites deemed eligible for sampling based on the prescreening criteria established in Technical Memorandum 1. Stillwater will provide the CREP technicians with a list of sites in each district, and a spreadsheet for retrieving and organizing landowner and CREP contract information. Stillwater will provide the CREP technicians with instructions and guidance in filling out these spreadsheet forms.

CREP technicians will establish contact with landowners via email or phone and debrief landowners about this monitoring study, including providing them with the OWEB letter to landowners and FAQ document, both prepared for this program by Ken Fetcho of OWEB (Appendix B). CREP technicians will secure access for the field crew to willing landowner property, and provide the field lead with information on site access points and other logistical information needed for getting to the site. The CREP technicians will ascertain from landowners if there are any timing constraints on their permission to access the site, such as months, days of the week, time of day, or considerations with management activities on the property. Where possible, broad timing windows for site access will be established to give field crews flexibility in timing site visits and to accommodate other landowners with constrained schedules. CREP technicians will let the field lead know if the landowner wants to be notified prior to the field visit, and/or wants to be present during the field visit, and will provide landowner contact information. The field crew lead will plan efficient and feasible sequences for site visits, taking into account site locations relative to one another, road access, and any landowner scheduling constraints.

[1] Extension offices per county: http://extensionweb.forestry.oregonstate.edu/county-extension-centers

As described in the project Technical Memorandum 1 (Stillwater Sciences 2016), information provided by CREP technicians from CREP contract files will be compiled for the treatment sites, and where applicable, for the control sites as well. This site-specific information will be compiled into a database so that the information is readily available to field crews in electronic and/or hard copy form, and can be reviewed and ground-truthed during the field visits. The information CREP technicians are expected to collect and compile for each treatment site is provided in Appendix C.

Field maps, in electronic and/or hard copy form and at approximately 1:2400 scales, will be prepared on basemaps of satellite imagery that show roads and site boundaries. Otherwise, CREP technicians will provide scanned and/or hard copy maps of site planting areas, exclusion fencing locations and site access points to the field crew lead. Site maps will be prepared and organized such that field crews will be able to view maps of the full site during field visits.

2.2 Establish Field Data Collection System

Field data collection forms will be prepared in electronic versions using the Sitka GeoOptix platform accessible using iPad hardware and in hard copy for back up. Application of field data collection forms will be tested and refined prior to initiation of field data collection. These tests will entail training with Sitka on use of the GeoOptix electronic interface in the field, uploading data to the icloud, reviewing and troubleshooting data, and downloading field data into a user friendly access database for analysis by Stillwater scientists. This last step will require combining both CREP contract data and data collected during the 2016 field effort. The first trial run of the GeoOptix interface, as tailored for application for this project, will be completed at least one month prior to initiation of field efforts to ensure that sufficient time is available to resolve any issues and to make all preparations for a successful and efficient field data collection campaign. Ancillary information, including field protocol documents, county weed lists, and information acquired from the CREP contract files by the CREP technicians, as described above in Section 2.1, will also be organized on the field iPads. Prior to initiation of the Phase 2 field sampling effort, the field data collection forms and process of recording, uploading, trouble-shooting and downloading data into an access database will be refined based upon the Phase 1 sampling experience.

2.3 Prepare Field Equipment

In addition to the data collection systems, maps, and landowner and access materials described above, other field equipment will be assembled for each field crew. A full checklist for field equipment is provided below.

- Electronic device(s) loaded with following information
  - Blank field data forms
  - Site-specific information from CREP contract files
  - County-specific noxious weed list
  - Map of sites including CREP action boundaries (tracts and CLUs by conservation practice)
  - Random number lists or generator
- Hard copies of the following
  - Site maps including CREP action boundaries (tracts and CLUs by conservation practice)

  - Back-up blank data sheets
  - Letter to landowners FAQ sheet on program from OWEB in case needed
- Handheld GPS
- 2 (100-m) metric tape measures
- 2.4-m (8-ft) rope length
- Flagging tape
- Surveyor stadia rod
- Densiometer
- Laser range finder
- Binoculars
- Digital camera incorporated in iPad

3 SITE SAMPLING METHODS

In this section, we provide detailed explanations of the actions that will be taken from the beginning of the first site visit to the end of each field day, to ensure that field crews collect data accurately and consistently and that unexpected issues are addressed quickly and consistently for the multiple field crews deployed. Each site visit will entail the following steps: (1) site orientation, (2) characterize riparian vegetation and bank erosion, (3) characterize vegetation in the riparian planting areas, (4) assess livestock exclusion conditions, (5) collect site photographs, and (6) on-site completion check and site sketch. Finally, step (7) perform check-ins and data storage, will be performed at the close of each field day; during this last step, field crews will upload data collected that day and have a check-in call with the home office. Each of these seven steps is detailed in the sections below.

To ensure that the terms are clearly understood, we copy language from Technical Memorandum 1 (Stillwater Sciences 2015) into this memo:

> In order to select appropriate sampling sites, tracts were identified as the preferred sampling unit by which to identify treatment sites. OWEB provided a geographic information system (GIS) database using the USDA nested system of units—"CLUs" (common land units) within "tracts," within "farms," within counties. CLUs are the smallest unit of land that has a permanent, contiguous boundary, a common land cover and land management, a common owner, and a common producer in agricultural land associated with USDA farm programs. CLUs were determined to be too small to serve as a sampling unit. The next larger unit of measure was tract, which consists of one or more CREP contracts and includes one or more CLUs. Each CLU within a CREP tract is associated with a conservation practice such as Forested Riparian Buffer CP22 or Marginal Pastureland Riparian CP29. In most, but not all cases, the conservation practices within a tract are the same. As described below …, in some specific cases, more than one field site could be selected within a given tract. Therefore, this report will adopt the term "site" (e.g. treatment or control site) to describe the sampling unit to be surveyed in the field.

To this terminology, we add 'sample reach', which refers to an area identified in the field to be representative of the site and in which measurements on site conditions will be recorded. More details on the sample reach selection and layout are provided in the subsections below.

3.1 Site Orientation

Upon arrival at a site, if the landowner wishes, field crews will meet briefly with the landowner to review the project and to answer any questions the landowner might have on the project. Field crews will carry copies of the OWEB letter to the landowners and an FAQ document on the program (Appendix B). At this point, the landowner might help orient the field crew to the site boundaries, any features of interest within the site or along the channel, and the location of the exclosure fencing. Otherwise, the field crew will use the site map and contract information to locate these features.

All enrolled CREP sites that are part of the randomly selected set of sites will be assigned unique identification numbers prior to the field effort. These unique identification numbers will link all of the CREP contract, site, and GIS data together in the project database. Unique identification codes for CREP enrolled sites will begin with a 'T' for 'treatment'. Control site codes will begin with a 'C' for 'control'. Field technicians will have the unique identification number for each CREP enrolled site prior to initiation of field sampling. These site numbers will be entered into the field data form at the beginning of every site visit and will be placed on any hard copy materials used during the site visit.

In order to become familiar with the area and CREP site boundaries and conditions, the field crew will first walk or if feasible, drive, the perimeter of the site to locate site boundaries, observe the range of conditions, management practices, and possible issues with livestock exclosures if fencing is part of the CREP contract. Discrepancies between site boundaries and feature locations indicated from the CREP contract files and what is observed in the field will be noted in the data form.

While walking the site, the field crew will also make observations of the range and distribution of variability on the site. Understanding how much variability exists within the site and how it is distributed will be important for establishing the sample reach, as described below.

3.2 Establish Sample Reach, Channel Transects, and Riparian Planting Plots

3.2.1 Locate sample reach

The size of the CREP treatment sites varies substantially across the state, with stream lengths within CREP treatment sites ranging from 120 m (394 ft) up to over 600 m (1,969 ft). In most cases, conditions in the entire CREP treatment site cannot be measured during this monitoring effort. Therefore the field crew will review the site via aerial imagery and from the ground to select an area that best represents the site. Thus, having become oriented with the site and range of variability present, the field crew will select an area of the channel that, to the degree possible, spans the range of conditions present on the site. This is where the sample reach will be established.

3.2.2 Set up channel cross-sections

Next, the crew will determine the center of the sample reach, referred to as the X location. They will record the X location latitude/longitude using a handheld GPS. The sample reach will include five channel transects that are established at intervals equal to four bankfull widths. To determine the sample reach length, the crew will measure the bankfull width at three representative points within an estimated five full stream widths above, and five full stream widths below the X location. The field crew will be trained in identifying bankfull width, and will have additional

supporting documents (e.g., example photographs of bank conditions) loaded on the iPads. Bankfull width measurements will be averaged and multiplied by 16 (four intervals between five transects, with each interval equal to four bankfull widths) to determine the sample reach length. The sample reach length should be between 120 m (394 ft) and 400 m (1,312 ft). Values that are greater than 400 m will be constrained to this maximum length. Sites with channel lengths less than 120 m are excluded from the site selection process, as described in Technical Memorandum 1 (Stillwater Sciences 2016).

The field crew will check that there are no issues in the upstream or downstream portions of the sample reach, such as significant obstacles or areas of the sample reach that extend outside of the site boundaries. The distance scouted will be approximately 8x the average stream width in both directions such that the X represents the center of the sample reach. Due to the maximum sample reach length of 400 m, crews will not scout more than 200 m up and downstream from the X location. Dry portions of the channel will still be measured and the field crew will attempt to capture all variation in the site within the sample reach. If a transect lands on a road or fjord crossing, the sample reach will skip the road or crossing and the sample reach will be continued beyond this road or crossing.

Once X has been established as the center of the sample reach, the field crew will extend one tape measure upstream and one downstream in the center of the channel to measure out the sample reach length. The downstream extent of the reach (8x the average bankfull width from X) will be flagged "Transect A." The field crew will walk the distance of 4x the average bankfull width (or 1/4 of the total reach) upstream and flag this point as "Transect B". Continuing upstream, point X will be flagged as "Transect C". Transects D and E will be established in the same manner (Figure 3-1). Transect E will be the upstream boundary of the sample reach. The field crew will note site codes on the flagging, which will all be removed prior to leaving the site. The field crew will record the average bankfull width and total length of the sample reach in the data form.

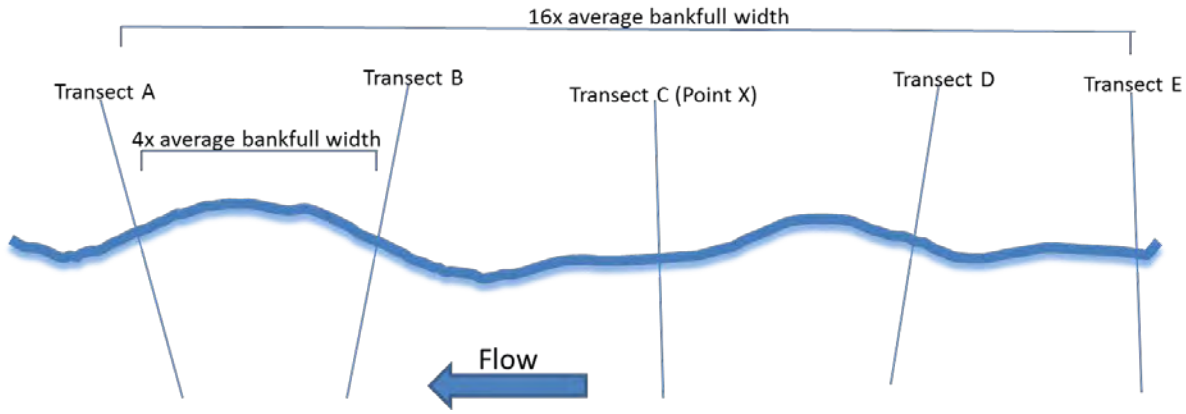


Figure 3-1. Channel transect layout within a sample reach.

3.2.3 Delineate channel paired plots

Once transects A through E are established along the sample reach, ten square paired plots will be delineated on the river left and river right (facing downstream) of each transect. These plots will be used to determine vegetation structure and percent weed cover, channel canopy cover, and bank stability. This method is adapted from Crawford (2011a) and O'Neal (2014).

At each transect, the field crew will delineate the bank-side boundary of a 10-m (33-ft) square riparian vegetation plot that extends 5 m (16 ft) upstream and 5 m downstream from their position and that reaches 10 m (33 ft) back into riparian vegetation, perpendicular to the channel and as seen from bird's eye view, as illustrated in Figure 3-2. In rivers with large active channels, the 10-m distance should begin at the edge of the riparian vegetation, not on cobble/gravel bars. To provide visual support for estimating percent cover, the field crew can install temporary flagging or stakes at the corners of the plot. The laser range finder may be helpful for setting up these plots if an unobstructed line of sight is possible through the transect.

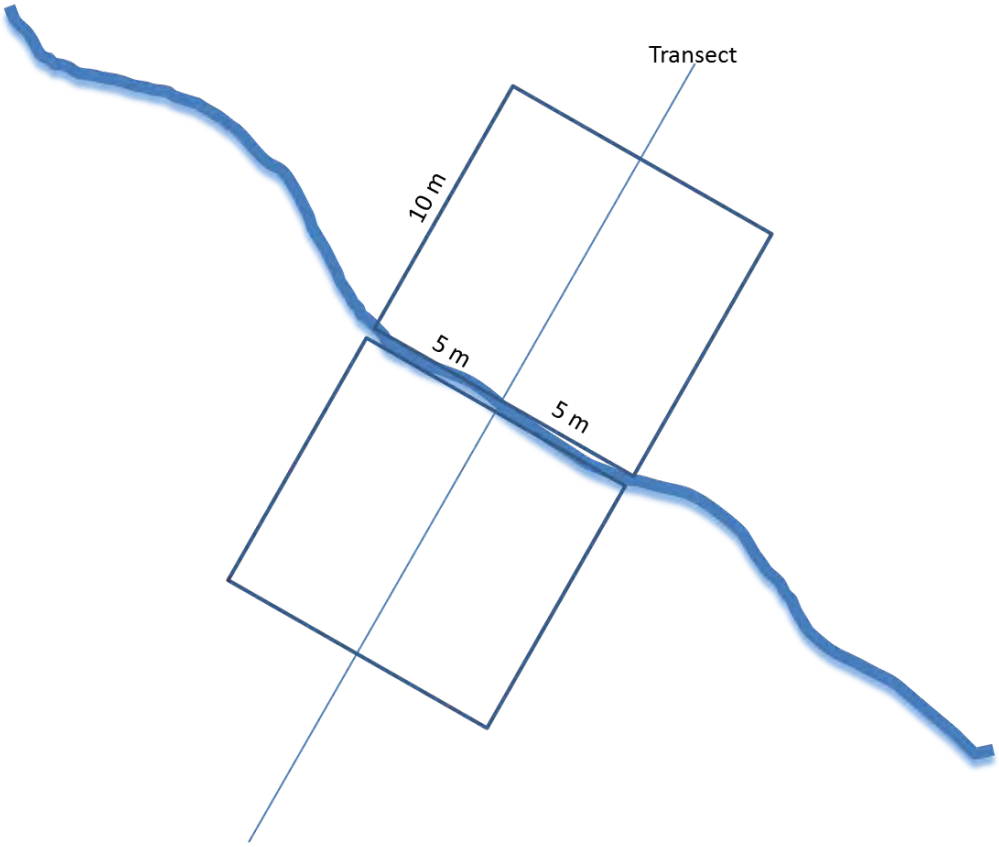


Figure 3-2. Layout of paired plots along channel transects.

3.2.4 Locate riparian planting vegetation plots

By measuring vegetation cover in the overall area where vegetation has been planted under a CREP contract, we will examine if vegetation is recovering in the areas within the riparian planting but that are not directly adjacent to the stream channel. Healthy native vegetation in the riparian zone provides multiple ecological benefits including wildlife habitat, filtration for water flowing to the channel, and sources of in-channel coarse woody debris. The overall cover of woody and herbaceous vegetation, weed species, and visible bare mineral soil will be recorded from five circular plots. Some of these data will be collected using very similar methods to those used to characterize streamside riparian vegetation to enable direct comparison of the conditions of streamside riparian vegetation and vegetation in the riparian planting areas.

Riparian planting plots will be set back from the channel, located at random distances along a line extended from the downstream, upland corner of each 10 m x 10 m riparian vegetation plot. Riparian planting plots will be located on both sides of the channel if the CREP site includes both sides. If the CREP site is only located on one side of the channel, then all of the riparian planting plots will be on the site side of the channel. To establish each riparian planting plot, crews will select a number from a list of random numbers that includes positive and negative values. Positive numbers will indicate that the riparian planting plot is on the river right; negative numbers will indicate it is on the river left. The value of the number indicates the number of meters from the downstream, upland corner of the 10 m x 10 m riparian vegetation plot (Figure 3-3). If only one side of the channel is included in the site, then only that side of the channel is sampled, locating plots with the absolute value of the random numbers selected. If the random number indicates a location outside the restoration activity, then the crew will continue down the list of random numbers until a smaller value is found. Distances are measured using a measuring tape and each location is temporarily marked with flagging or a wooden stake that will be removed by the field crew before they depart that day. Details on the vegetation cover assessment methods are provided below in Section 3.3.3.

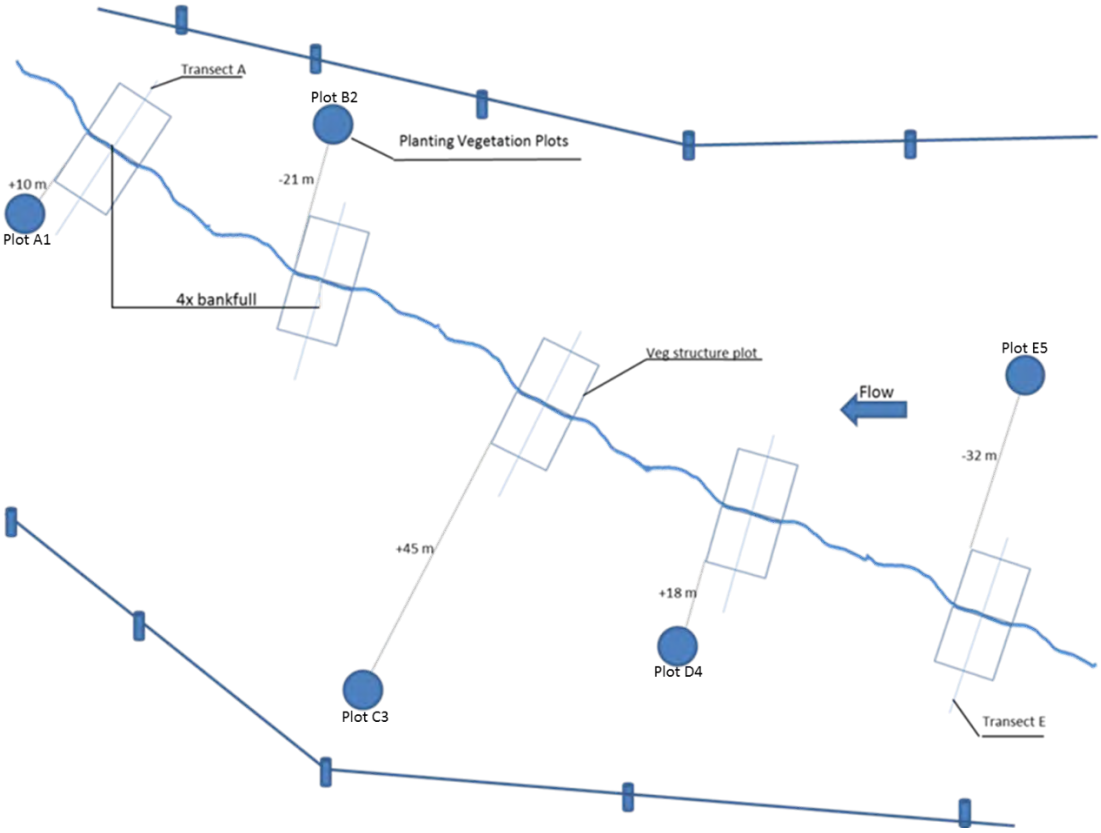


Figure 3-3. Circular planting vegetation plots, shown as blue circles set a random distance from the downstream, upland corner of the square riparian plots that straddle each transect. The full sample reach is 16x bankfull width; exclosure fencing is indicated by the line with posts.

3.3 Characterize Riparian Vegetation along Channel and in Planting Area and Bank Erosion

The intent of this set of measurements is to assess riparian vegetation structure, the extent of weeds, canopy cover that shades the channel, and channel bank stability. Measurements of these features will be made along the sample reach that is at least 120 m (394 ft) long and in an area representative of the overall site conditions. This set of protocols is adapted from Crawford (2011a) and O'Neal (2014).

3.3.1 Measure channel canopy cover

At each channel transect, the field crew will record measurements for canopy cover over the channel to quantify vegetation recovery along the bank. Vegetation cover reduces water temperature by shading the stream from solar insolation, and improves aquatic habitat quality. To measure vegetation cover of the channel, the field crew will use a 17-point convex spherical densiometer. The field crew will record four mid-channel and two channel bank readings at each of the five channel transects according to the following steps adapted from Crawford (2011a) and O'Neal (2014).

- Standing mid-channel at transect A, face upstream and hold the densiometer 0.3 m (1 ft) above the water surface. Level the instrument with the bubble level. Position yourself so that your face is just below the taped "V" and off of the mirrored reflection.
- Count the number of grid intersections that are shaded with no sky visible. Shade sources can include vegetation, high banks, or permanent human structures such as buildings or bridges (not cars or trucks). Record this value (1-17) in the data form.
- Record three additional measurements from the mid-channel while facing river-right, downstream and river-left (Figure 3-4).
- Take a photograph from each of the four densiometer measurement positions with the camera held at the same location as the densiometer and with approximately the same field of view. Record the photo number in the data form for each densiometer reading.
- Repeat the above four steps while standing at the left bank of the channel transect, facing the bank while holding the densiometer 0.3 m (1 ft) above the water at the wetted edge. Record the grid counts in the data form for the river left bank. Repeat this process while standing at the river right bank, facing the bank. Take pictures of each measurement location according to the protocol above.
- Repeat these steps for each of the five transects.

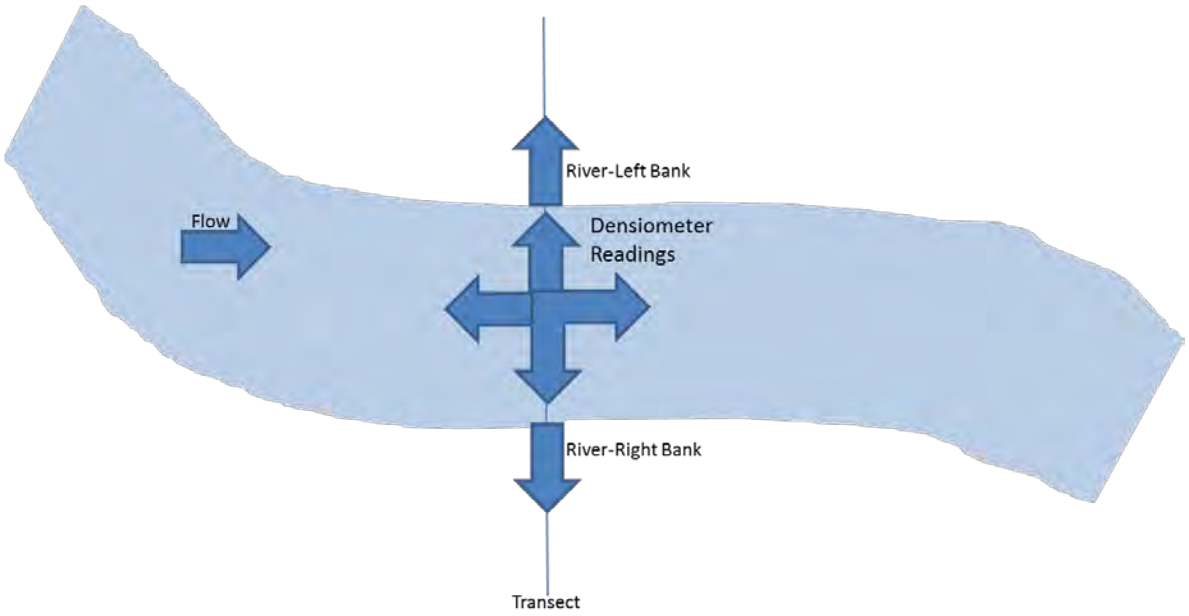


Figure 3-4. Six densiometer reading locations and directions the user faces at each location for a channel transect.

3.3.2 Measure riparian vegetation structure

The field crew will use the steps listed below to record information on riparian vegetation structure within these square 10 m x 10 m plots. The field crew will perform these estimates from a position either in or adjacent to the plot from which the field crew has a good view of the vegetation in the plot. In many cases, it might be necessary for the field crew to walk around or even inside the plot to get a good view of the vegetation being assessed.

- Visually divide this space into three vegetation layers: canopy (>5 m [16 ft] high), understory (0.5–5 m [20 in–16 ft] high) and ground layer (<0.5 m [20 in] high). In the steps below, once vegetation has been included in the percent cover of one layer, exclude it from estimates of percent cover of other layers (e.g., no double-counting).
- View the 10 m x 10 m plot and record the **dominant vegetation type of the canopy layer** as Deciduous, Coniferous, Broadleaf Evergreen, Mixed, or None. The layer is mixed if over 10% of it is composed of a type other than the dominant one.
- Estimate the **percent areal cover of the canopy layer** by considering the amount of shadow cast by the canopy if the sun were directly overhead. See Appendix D for guidance on estimating percent cover. Record canopy cover using the following categories: 0-absent: zero cover, 1-sparse: <10%, 2-moderate: 10%-20%, 3-heavy: 40%-75%, 4-very heavy: >75%.
- Repeat the two steps above for the understory cover by recording the **understory dominant vegetation type** and estimating the **understory woody vegetation percent cover,** excluding herbaceous plants and the canopy layer. Record the percent cover of **herbaceous vegetation in the understory** (0.5-5 m [20 in–16 ft]) separately. Use the cover categories listed above.
- Repeat this method for **the ground layer dominant vegetation type** and **ground layer woody vegetation percent cover**, considering small woody shrubs and saplings as woody and excluding the canopy and understory layers. Record the percent cover of **herbaceous**

vegetation in the ground layer (<0.5 m [20 in] high) separately. Use the cover categories listed above.

- Estimate the **total percent cover of all woody plants**, regardless of height, for the entire plot by considering all layers together as if viewing the entire plot from above. Lower layers of woody plants that have been covered by higher layers will not be added to this estimate. Use the cover categories listed above.
- Estimate the **total percent cover of all herbaceous plants**, regardless of height, for the entire plot by excluding the woody vegetation and imagining that only the herbaceous species exist. Estimate the percent of the plot that would be shaded by these plants alone. Use the cover categories listed above.
- Estimate the **total percent cover of all woody weed species**, regardless of height, for each square plot. Use the list of woody weed species obtained from the Oregon Department of Agriculture weed list for the site's county. Use the cover categories listed above.
- Estimate the **total percent cover of all herbaceous weed species**, regardless of height, for each square plot, as included in the Oregon Department of Agriculture weed list for the site's county. Use the cover categories listed above.
- Estimate the **percent exposed visible bare ground**. This does not include surface that is covered with live or dead vegetation, litter, thatch, or rocks exceeding 6.4 cm (2.5 in) in diameter (cobbles and larger). Record visible bare mineral soil in the plot. Use the cover categories listed above.
- Repeat the above steps for each of the 10 plots.

3.3.3 Measure vegetation in planted area

The riparian zone vegetation is characterized using several measurements made within the five circular plots that are established as described above in Section 3.2.4. As described for the channel transects, field crews will use weed lists for the site's county. The methods field crews will use to collect this information, adapted from Crawford (2011a) and O'Neal (2014), are described below:

- Attach a 2.4-m (8-ft) rope to the rebar stake installed at the center of the first riparian plot.
- Use the rope to walk the perimeter of a 2.4-m (8-ft) radius circle to delineate the vegetation plot (Figure 3-3).
- As you do so, estimate the **total percent cover of herbaceous vegetation** in the circular plot and record this value in the data form. Use the cover categories listed above.
- Similarly, estimate the **total percent cover of woody vegetation** in the circular plot and record in the data form. Use the cover categories listed above.
- Use the same method to estimate and record the **total percent cover of herbaceous weed species** and a separate value for **total percent cover of woody weed species**. Use the cover categories listed above.
- Estimate the **percent bare ground** in the circular plot. This does not include surface that is covered with live or dead vegetation, litter, thatch, or rocks exceeding 6.4 cm (2.5 in) in diameter (cobbles and larger). Record visible bare mineral soil in the plot. Use the cover categories listed above.
- Repeat these steps for all five circular plots (Figure 3-3).

3.3.4 Characterize bank erosion

Although channels tend to migrate laterally over time in response to natural geomorphic processes, the rates of such migration tend to be slow and the areas of bank erosion rather localized. Generally stable, non-eroding banks minimize the amount of siltation in the channel, which protects aquatic habitat quality. Stable banks also provide long-term support for trees and shrubs that overhang the channel, creating shade, contributing litter and nutrients, and improving aquatic habitat quality. Actively eroding banks can be distinguished from stable banks by the presence of exposed soils and inorganic substrate, recently exposed tree roots and fallen trees, undercut banks, or active sloughing of material into the channel. Vegetation may be present on actively eroding banks but will have shallow rooting that does not contribute to increased bank stability. Field crews will be trained in identifying accelerated bank erosion and will have supporting documents loaded onto the field iPads.

Between each pair of channel transects, the field crew will categorize the length of bank, in 10-m increments with the option of a final partial increment, into four bank stability classes (Figure 3-5). The methods to do this are described below, as adapted from O'Neal (2014), Moore et al. (1998), and Henshaw and Booth (2000). Henshaw and Booth (2000) provides a set of visual indicators that can be used to classify a length of bank into one of four classes of bank stability, ranging from stable to completely unstable (Table 3-1). This method applies a "weight of evidence" approach to the classification, so that the number and extent of indicators present in each stability class are used to determine the appropriate classification for a particular length of bank. If any particular indicator is ambiguous or not present (e.g., no trees and so no opportunity to evaluate the frequency of tree fall), the other indicators are used to classify the bank segment.

The number of 10-m bank segments classified as Moderately Unstable (2) or Completely Unstable (1) will be summed up between each pair of transects for river left and for river right, and multiplied by ten to determine the number of meters of "unstable" bank observed. In this hypothetical example shown in Figure 3-5, there are 30 m of actively eroding bank on river-left and 10 m on river-right. These can be converted into the percentage of river bank by dividing each value by the distance between transects (4x bankfull; Figure 3-5) to produce a summary index value for the entire sample reach.

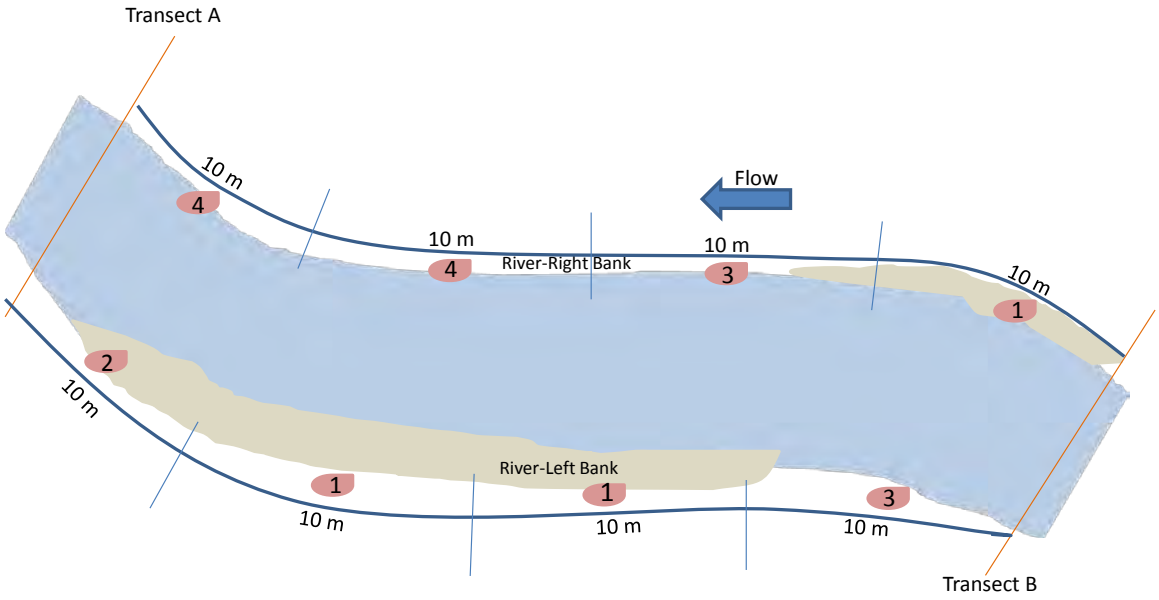


Figure 3-5. Measuring distance of actively eroding stream bank. Maroon circles show hypothetical bank stability class assignments to 10-m bank lengths between transects A and B.

Table 3-1. Streambank stability classification criteria (adapted from Henshaw and Booth 2000).

Class	Description
4 – Stable	• Perennial vegetation to waterline • No raw or undercut banks (some erosion on outside of meander bends okay) • No recently exposed tree roots • No recent tree falls
3 – Slightly Unstable	• Perennial vegetation to waterline in most places • Some scalloping of banks (i.e., no more than 1–2 meters in lateral extent) • Minor erosion and/or bank undercutting • Recently exposed tree roots are rare but present • No recent tree falls
2 – Moderately Unstable	• Perennial vegetation at waterline sparse (<25% of length and mainly scoured or stripped by lateral erosion) • Bank held by hard points (trees, boulders) and moderately eroded back elsewhere • Extensive (over 50% of length) bank erosion and with undercutting • Recently exposed tree roots • Recent tree falls may be present
1 – Completely Unusable	• No perennial vegetation at waterline • Bank held only by hard points (trees, boulders) • Severe erosion and bank undercutting along over half of the bank length • Recently exposed tree roots • Tree falls and/or severely undercut trees common

To measure the extent of actively eroding banks within the sample reach, the field crew will use the following steps:

- Walk 5 m (16 ft) upstream from transect A (towards transect B) and position yourself so that you can see (and are at the midpoint of) the first 10-m segment of the left bank between transects A and B.
- Visually review this segment of bank, using the indicators listed in Table 3-1, and determine which of the four bank stability classes best describes that bank segment (only use whole numbers; e.g., no '3.5' class assignments).
- Record this rank (1, 2, 3, or 4) in the data form.
- Turn around and repeat the evaluation for the right bank at this location.
- Walk 10 m upstream and repeat these steps. Continue in 10-m intervals between transect A and B until you complete the last 10-m segment that ends at transect B. The number of 10-m segments between transects will vary among sites, based on the full sample reach length (which in turn is based upon bankfull width). If the last segment is <5m; include in prior segment. If it is >5m then include as another segment (e.g. round up or down if greater than or less than 5m respectively).
- Apply the same steps between transects B and C, C and D, and D and E, river right and river left.

3.4 Assess livestock exclusion conditions

Livestock in the riparian floodplain and channel can negatively impact channel conditions and riparian vegetation. Therefore, the CREP program supports installation of livestock exclosures around impacted channels and riparian areas to allow these areas time to recover from the effects of livestock.

CREP contracts that include requirements that landowners exclude livestock from riparian areas will be identified through the CREP contract review process. At such sites, field crews will follow methods modified from O'Neal (2014) to assess the effectiveness of the livestock exclosures, as described below.

- Walk the length of the fence within the sample reach, looking for breaks or evidence that livestock are moving through or under the fence.
- Indicate whether or not the exclusion **fence appears intact** within the sample reach in the data form (Y/N).
- If there are signs of livestock within the exclusion area, note potential causes. Are there breaks in the fences? Can the animals move around/under the fence? Is there a gate that could have allowed entrance?
- Record apparent source of problem in the data form.
- Record observations of wildlife browsing, including signs of beaver, in the 'notes' field of the data form for Livestock Exclusion.
- Examine the exclusion area for signs of livestock. These signs include but are not limited to: tracks/trails, cow paddies, livestock hair, or presence of livestock themselves. Be careful not to mistake signs of wildlife, such as elk or deer, with signs of livestock.
- Record whether or not there is **evidence of livestock present** in the exclusion area in the data form.

3.5 Collect Site Photographs

Site photographs serve not only to verify the location of study reaches but also to record current stream conditions. Future field efforts can replicate previous photographs in order to create a visual timeline of ongoing processes such as vegetation growth and bank stability. Field crews will take site photographs using methods described below, as modified from Shaff et al. (2007) and O'Neal (2014).

3.5.1 Site overview photographs

Site overview photographs are similar to the "Landscape Photographs" described in Shaff et al. (2007), and are intended to provide an overview of the restoration action areas at a site. The exact location from which these photographs are taken should be recorded so that future photographs can be taken and compared with those taken through this effort to provide a visual documentation of change over time.

- Take one to three photographs from a high elevation point within or adjacent to the site. Find a tree or building or other permanent marker that can be used, along with the GPS location, to re-locate the photo-point during any future surveys.
- Capture as much of the site extent as possible. It may be helpful to use surrounding topography to gain vantage of the stream as well as the total riparian area.

- Be sure that the photograph is focused on the restored area of the site and is at a scale from which the restoration changes can be discerned.
- Include the skyline in the field of view of the photograph to provide a scale reference.
- Record the GPS location, compass bearing from which the photo was taken, photo number, and any permanent marker (e.g., "adjacent to large grand fir tree") in the site data form.

3.5.2 Transect photographs

Transect photographs are similar to the "Feature Photographs" described in Shaff et al. (2007), and are intended to document changes associated with specific restoration activities. In the case of this effort, such changes include (1) changes in bank erosion and riparian vegetation; and (2) changes in vegetation cover in riparian planting areas. In addition, feature photographs of the (3) exclosure fencing condition, would also provide important documentation of the site restoration effectiveness. Methods for collecting these three types of feature photographs are detailed below.

3.5.2.1 Photos of bank condition and riparian vegetation

- Include two images each from the bank at transects A, C, and E (downstream end of reach, middle, and upstream end of reach.
- One image should be captured from the river-left bank while facing upstream towards river-right, and a second image captured from the river-right bank while facing downstream towards river-left (Figure 3-6).
- Record the transect letter, direction (upstream river-river right, downstream river-left), and GPS location of these six photographs in the data form.

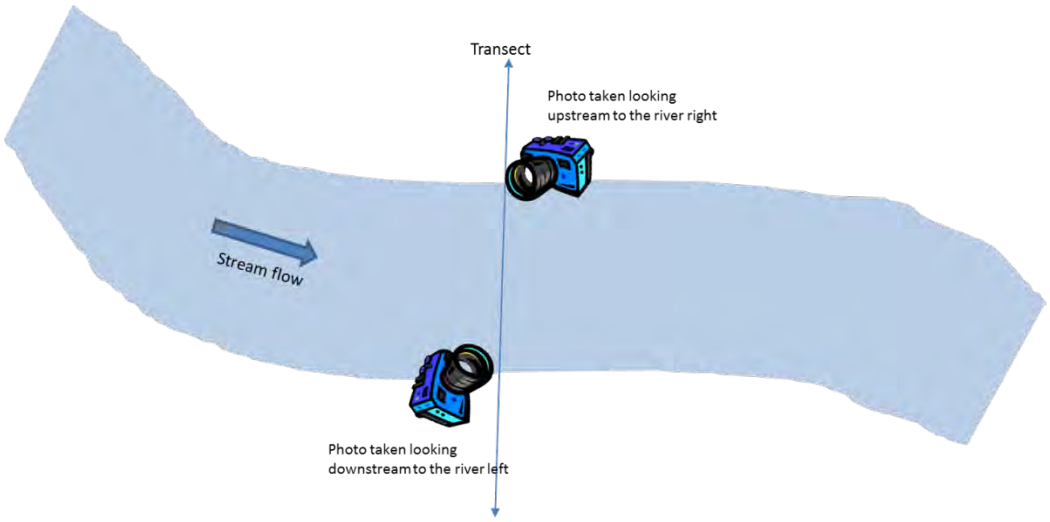


Figure 3-6. Transect photograph locations.

3.5.2.2 Vegetation cover in riparian planted areas

- Stand 5 m (16 ft) back from riparian vegetation plot 1 in order to capture the full plot in the camera field of view.
- Capture one image of this plot, ensuring that the camera is not directed into the sun.

- Record the plot number and GPS location in the data form.
- Repeat these steps for riparian vegetation plot 5.

3.5.2.3 Exclosure fencing conditions

- While walking the length of the fence within the sample reach (see Section 3.4 above), photograph any apparent breaks or weak points in the fence line; if there are none, photograph an area of the fencing that is typical of the overall exclosure condition at the site.
- Record the photograph number and GPS location in the site data form, along with a notation on the apparent condition of the exclosure fencing photographed.

3.6 On-site Completion Check and Site Sketch

At the end of the site visit, one field crew member will check to ensure that all data fields are completed. The other field crew member will create a sketch of the overall site. The site sketch will be used during the data management and interpretation phase to help address uncertainties in field data or other unanticipated questions that might arise. An example of such a site sketch is provided in Figure 3-7. The site sketch will be made either electronically using the tablet or in hard copy form. The site sketch will be completed in less than seven minutes. The following features will be labeled for the sample area in each site sketch:

- Date
- Site number
- Name of crew members
- North arrow
- Channel and direction of stream flow
- Channel transect locations
- Planting transect locations
- Forested and/or shrub covered areas
- Exclosure fencing
- Other important ecological features and landmarks such as sand bars, islands, or roads

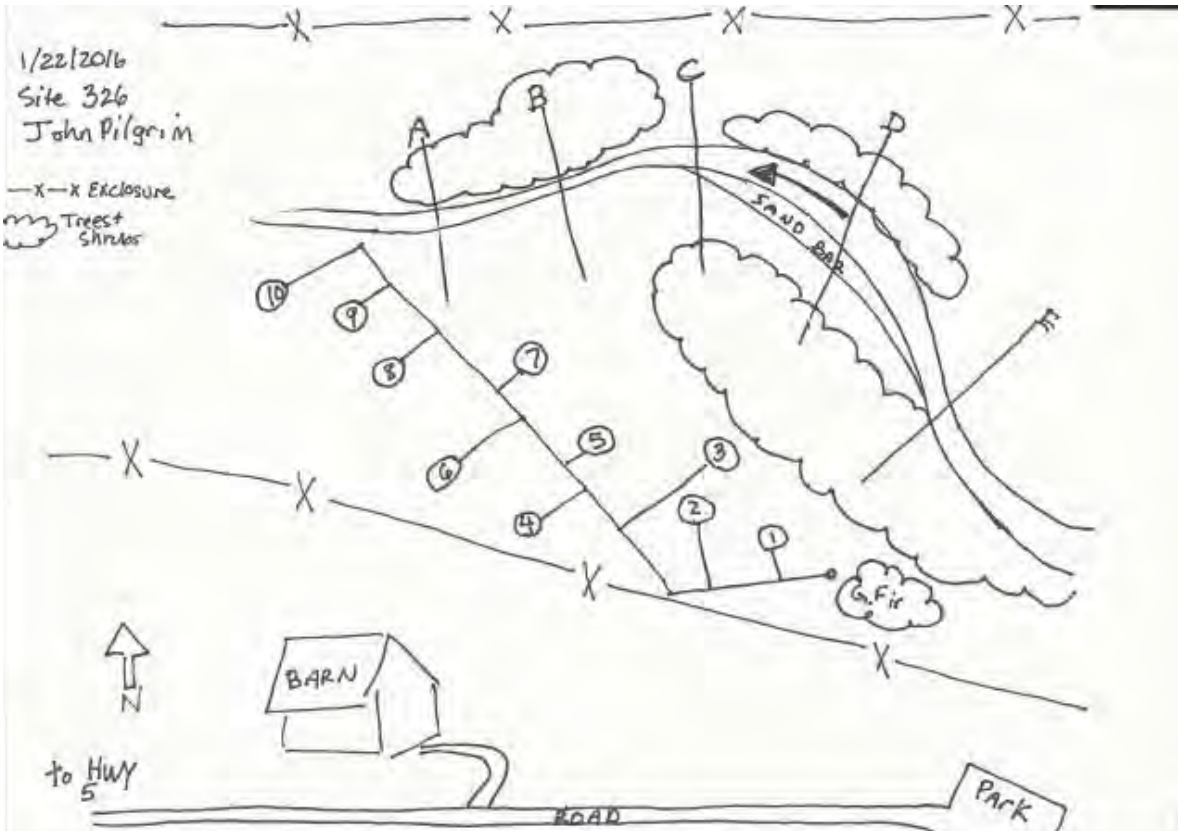


Figure 3-7. Example of a site sketch for a hypothetical area, showing features listed above.

3.7 Check-ins and Data Storage during Field Effort

Field data will be uploaded from field electronic devices to the cloud and backed up to hard drives that are carried with the field crew (similar to thumb drives) following each day of data collection. Protocols for weekly status checking and trouble-shooting with our lead riparian ecologist (Amy Merrill) will be developed prior to initiation of the field effort. This will include coordination among field crews to continue optimizing where and when field crews visit specific sites, communicating any concerns or clarifications needed regarding field methods, tracking progress in site sampling rates, trouble-shooting, and addressing any problems with field equipment.

4 STATISTICAL ANALYSES

4.1 Analysis of Phase 1 Field Sampling Data to Structure Phase 2 Sampling

As described in the project Technical Memorandum 1 (Stillwater Sciences 2016), data collection for this study will occur in two phases during spring and summer 2016. Phase 1 sampling will provide information on variability within and among sites, which will be used to conduct a statistical power analysis for tailoring the Phase 2 monitoring design. During Phase 1, up to 20 sites (control plus treatment) will be evaluated within three representative strata: West/Small watershed/CP22, East/Small watershed/CP 22, and East/Large watershed/CP 29 (Stillwater Sciences 2016). Lessons learned during the Phase 1 monitoring will also be used to modify the

protocols to make the second phase of sampling more accurate, feasible, and efficient. Information from the CREP contract files will be used to inform interpretation of study results. Data from both Phase 1 and Phase 2 will be compiled in order to perform the statistical analyses described below.

4.2 Statistical Analysis of Data Collected

Field and contract data will be used to address these primary monitoring questions:

1. Is the CREP program positively affecting riparian site condition as compared with control sites?
2. What are the most important factors affecting successful riparian restoration?

The following statistical methods and tests will be used with the field and contract information collected through this effort to address these questions.

4.2.1 Methods validation

In Technical Memorandum 1, we described the process of site selection and stratification in order to account for the wide range of variability in site conditions that occurs throughout the state of Oregon. The three strata are:

- Ecoregion—east of the Cascades and west of the Cascades;
- Contributing watershed area—small (<200 km^2) and large (>200 km^2); and
- Conservation Practice (CP)—Forested Riparian Buffer (CP 22) and Marginal Pastureland Riparian Buffer (CP 29).

This stratification is based on the assumption (hypothesis) that this framework reduces variation within the strata and therefore increases the power of the statistical tests described below. Therefore, as an initial step this assumption will be tested using two measurements: one that is representative of riparian conditions (mid-channel densiometer readings of canopy cover) and a second that is representative of conditions within the planting area (percent cover of woody species for CP22 and herbaceous species for CP29). Significant differences in mean values among strata for these two measurements will be tested using analysis of variance (ANOVA).

4.2.2 Hypothesis testing

The primary question to be addressed through this monitoring effort can be stated as follows: *Are conditions in treatment (restored) sites significantly improved compared with those at control sites within a stratum?* The addition of stratification is an essential step in reducing variability that would otherwise obscure our ability to detect meaningful differences between treatment and control sites. Metrics will be derived for each of the measurements outlined in Table 1-1 and then will be used to test for significant differences using one-tailed t-tests if the assumptions of normality can be met. If those assumptions cannot be met (including with transformations), then a non-parametric permutation test will be applied.

In discussions with the CREP Advisory Group (November 10, 2015), it was agreed that there is insufficient information available from reference sites for each field measurement and for each of the six strata to establish specific quantitative thresholds of success. Therefore, **indicators of success** will be based upon whether or not the attributes collected at CREP treatment sites within each stratum are statistically different from those collected at control sites within that stratum,

and if that difference is in the direction that provides greater habitat quality for the CREP sites. Thus, a set of CREP sites within a stratum with significantly more canopy cover over the channel than the set of control sites will be considered successful for that particular metric, regardless of whether the mean is, for example, 10% or 90% greater than the control site mean. A list of the target attributes, associated field measurements, and proposed statistical tests is provided in Appendix E.

4.2.3 Exploratory analyses

A secondary but important question that will be addressed through this monitoring effort can be stated as follows: *Are there any important co-variates influencing the difference between the treatment (restored) and control sites within a stratum?* Potential covariates include field and CREP contract information such as: (1) project age, (2) planting density, (3) site preparation requirements, (4) prior land use, and (5) maintenance practices. We will apply ANOVA to address this question; the preferred model fit will be determined based on Akaike's Information Criterion (AIC) (Akaike 1973). AIC is an index that evaluates both the statistical goodness of fit and the number of parameters estimated to achieve a particular degree of fit. The resulting score points to the preferred model, which is indicated as the model with the fewest parameters that still provides an optimal fit to the data. It should be noted that although these questions are compelling, the analysis is exploratory, the extent of available information is uncertain, and the site conditions are expected to be highly variable. For these reasons, the statistical tests for significance will indicate the degree of correlation between co-variates and treatment site conditions, but will not prove causation.

5 SCHEDULE

The anticipated schedule is outlined in Table 5-1 below. This schedule could change if leaf-out occurs earlier or later than expected in some areas of the state, or if delays occur in availability of CREP contract information that is being gathered by CREP technicians.

Table 5-1. Estimated timing for completion of tasks to prepare for, perform, and report upon field sampling.

Task description	Timing (2016)									
	March	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**
Office preparation	x									
Organize CREP contract information	x	x								
Identify potential control sites	x	x								
Establish field data collection system	x	x								
Prepare field equipment		x								
Test field methodology and tablets		x	x							
Map out and schedule Phase 1 site visits			x							
Phase 1 field work				x						
Phase I field data analysis					x					
Presentation of Phase 1 findings to OWEB					x					
Revise field methods for Phase 2 as needed					x					
Phase 2 field work						x	x			
Phase 1 and 2 field data analysis							x	x		
Reporting, draft								x	x	
Review, final report									x	x

6 LITERATURE CITED

Akaike, H. 1973. Information theory as an extension of the maximum likelihood principle. Pages 267–281 *in* B. N. Petrov and F. Csaki, editors. Second International Symposium on Information Theory, Akademiai Kiado, Budapest.

Crawford, B. A. 2011a. Protocol for monitoring effectiveness of riparian planting projects, MC-3. Washington Salmon Recovery Funding Board.

Crawford, B. A. 2011b. Protocol for monitoring effectiveness of riparian livestock exclusion projects, MC-4. Washington Salmon Recovery Funding Board.

Fetcho, K. 2015. Evaluation of the Oregon Conservation Reserve Enhancement Program. Draft Study Design. Oregon Watershed Enhancement Board, Monitoring and Reporting Division, Salem, Oregon.

Henshaw, P., and D. Booth. 2000. Natural Restabilization of Stream Channels in Urban Watersheds. Journal of the American Water Resources Association 36: 1.219–1.236.

O'Neal, J., and R. Scranton. 2014. BPA - MBACI protocol for monitoring the effectiveness of livestock fencing projects. Bonneville Power Administration, Portland, Oregon.

Shaff, C., J. Reiher, and J. Campbell. 2007. Oregon Watershed Enhancement Board guide to photo point monitoring. Salem, Oregon.

Stillwater Sciences. 2016. OWEB CREP effectiveness monitoring sampling design. Prepared by Stillwater Sciences, Portland, Oregon for the Oregon Watershed Enhancement Board.

Appendices

Appendix A

CP-22 and CP-29 Descriptions

Conservation Reserve Program

CP-22

RIPARIAN BUFFER

Water Quality Enhancement | Wildlife Habitat Enhancement | Carbon Sequestration

Why Choose CRP? You Benefit. Land, Water and Wildlife Benefit.

Riparian tree buffers improve water quality and provide vital habitat for wildlife. The Conservation Reserve Program (CRP) provides farmers and landowners with practices like this to achieve many farming and conservation goals. Whatever the conservation challenge - soil conservation, water quality protection, or wildlife habitat enhancement - CRP is a proven land performance and management solution.

Why Riparian Buffers?

For farmers and landowners interested in improving water quality and creating habitat for fish and wildlife, a riparian buffer - a strip of trees bordering perennial or seasonal streams, waterbodies and wetlands areas - is a beneficial solution. Offered in **continuous sign-up**, CP-22:

- Filters nutrients from runoff
- Traps sediment
- Cools water temperatures
- Stabilizes stream banks
- Sequesters Carbon

Financial Benefits

CP-22 participants are guaranteed:

- 10-15 years of annual rental payments with an additional 20% Rental Rate Incentive
- Payments covering up to 90% of the eligible costs of establishing the practice
  - 50% from a Cost-Share Payment and
  - 40% from a Practice Incentive Payment (PIP)
- Sign-up Incentive Payment (SIP) up to $100/acre
- Maintenance Rate Incentive
- Mid-Contract Management Cost Share
- Additional incentives may be available in your state under the Conservation Reserve Enhancement Program (CREP)

Photo courtesy of Benjamin Longstaff, Integration and Applications Network, UMCES

CP-22

Eligible Land

- Suitable for planting trees
- Compliant with USDA's highly erodible land and wetland provisions
- Planted or considered planted 4 out of 6 years between 2008 and 2013 or meets marginal pastureland eligibility requirements
- Located immediately adjacent to and parallel to one of the following:
  - Permanent water body
  - Perennial or seasonal stream
  - Sinkhole or karst area
  - Semi-permanent or seasonally flooded area
  - Wetlands

Practice Requirements

- Not be less than 35' and not more 100' (or 30% of the floodplain unless under certain circumstances)
- Begin at the top of the stream bank
- Consist of naturally regenerated seeded or planted trees and shrubs suitable for the site

For More Information:

Contact your local USDA, Farm Service Agency:

http://offices.usda.gov

Owner/Operator Eligibility

Participants must:

- Have owned or operated the land for more than 12 months prior to program sign-up
- Be in control of the land for the length of the contract
- Meet USDA payment eligibility provisions

Obligations

Participants will:

- Not harvest or graze the practice area
- Work with USDA-approved conservationist to develop a conservation plan
- Perform periodic management activities according to the conservation plan
- Complete seeding/planting of the practice within 12 months of the effective date of the contract

Proven Conservation Benefits

- An acre of buffer adjacent to cropland holds back 2.5 tons of soil, 6.4 pounds of nitrogen, and 1.1 pounds of phosphorus in runoff
- In 2014, CRP lowered greenhouse gas emissions by the equivalent of 43 million metric tons of CO2 - the same benefits as taking nearly 8 million cars off the road for a year

FSA will ultimately determine participant and land eligibility.

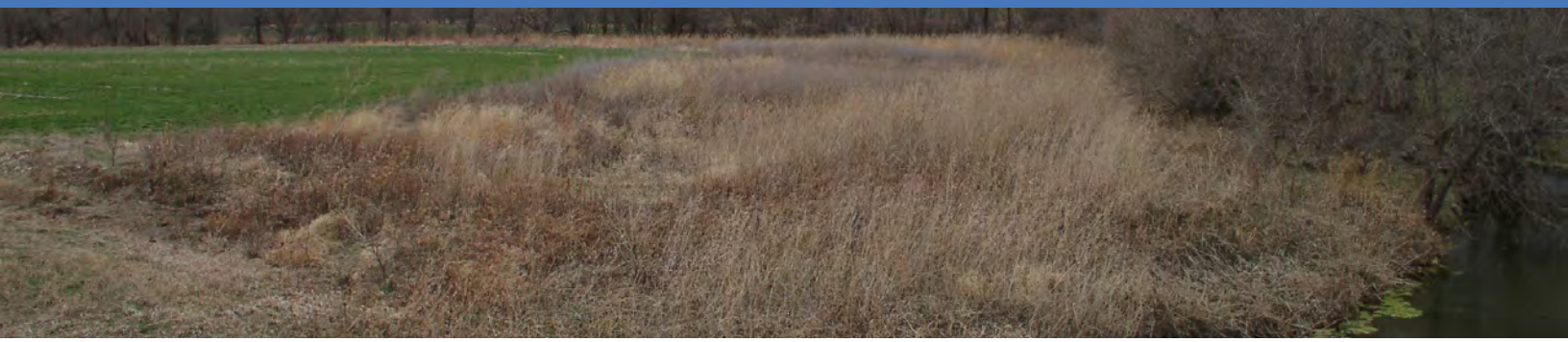
Photo courtesy of VA, FSA and PA, FSA respectively

Conservation Reserve Program

CP-29

MARGINAL PASTURELAND WILDLIFE BUFFERS

Wildlife Habitat | Soil and Water Quality | Flood Control



Why Choose CRP? You Benefit. Land, Water and Wildlife Benefit.

Grass buffers bordering waterbodies play a critical role in enhancing water quality and restoring wildlife habitat. The Conservation Reserve Program (CRP) provides farmers and landowners with practices like this to achieve many farming and conservation goals. Whatever the conservation challenge – soil conservation, water quality protection, or wildlife habitat enhancement – CRP is a proven land performance and management solution.

Why Wildlife Buffers?

For landowners and farmers with marginal pastureland adjacent to streams, wetlands, and other water body types, creating Wildlife Habitat Buffers reduces sediment, nutrient, and pesticide runoff. They also restore native plant communities that stabilize stream banks and reduce erosion. Made up of native grasses, wildflowers or shrubs, Wildlife Habitat Buffers provide shelter and food for wildlife, as well as vital nutrition for pollinators and other beneficial insects. Offered in **continuous sign-up**, CP-29:

- Improves water quality by intercepting and filtering sediment and nutrient runoff
- Provides vital habitat for wildfowl, grassland birds, pollinators and other wetland species
- Protects soil

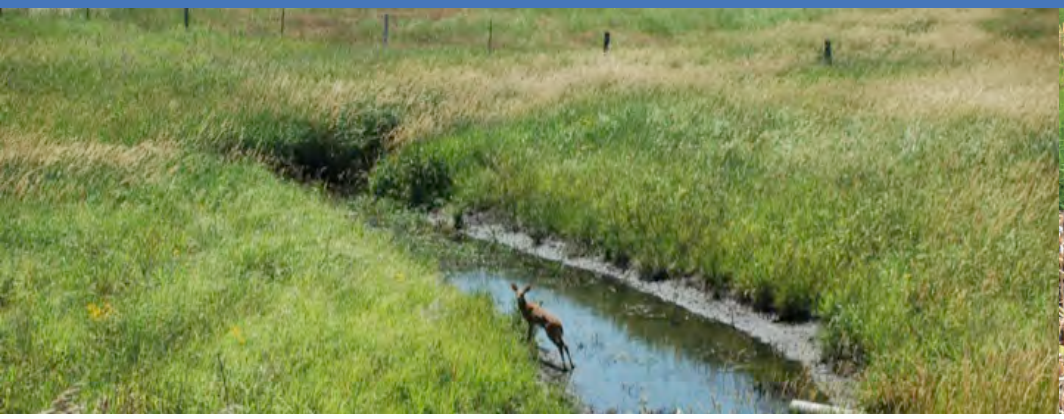
Financial Benefits

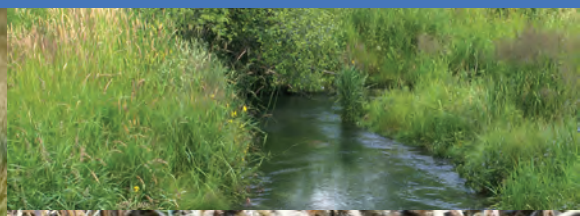
CP-29 participants are guaranteed:

- 10-15 years of annual rental payments with an additional 20% Rental Rate Incentive
- Payments covering up to 90% of the eligible costs of establishing the buffer practice
  - 50% from a Cost-Share Payment and
  - 40% from a Practice Incentive Payment (PIP)
- Sign-up Incentive Payment (SIP) up to $100/acre
- Maintenance Rate Incentive
- Mid-Contract Management Cost Share
- Additional incentives may be available in your state under the Conservation Reserve Enhancement Program (CREP)

Photo provided by FSA, Kansas

CP-29





Eligible Land

- Meets marginal pastureland eligibility requirements and is immediately adjacent to and parallel to one of the following:
  - Permanent waterbody
  - Perennial or seasonal stream
  - Sinkhole or karst area
  - Semi-permanent or seasonally flooded area
  - Wetlands
- Suitable to be devoted to a wildlife habitat buffer
- Compliant with USDA's highly erodible land and wetland provisions

Practice Requirements

- Buffer will not be less than 20' and not more 120' in width
- Buffer will begin at the top of the stream bank
- Shall consist of naturally regenerated or seeded, planted trees, and shrubs suitable for the site
- Noxious weeds and other undesirable plants, insects, and pests shall be controlled

Owner/Operator Eligibility

Participants must:

- Have owned or operated the land for more than 12 months prior to program sign-up
- Be in control of the land for the length of the contract
- Meet USDA payment eligibility provisions

Obligations

Participants will:

- Not harvest or graze the practice area
- Work with USDA-approved conservationist to develop a conservation plan
- Perform periodic management activities on the wetland and buffer according to the provided conservation plan
- Complete seeding of the practice within 12 months of the effective date of the contract

Proven Conservation Benefits

- An acre of buffer adjacent to cropland holds back 2.5 tons of soil, 6.4 pounds of nitrogen, and 1.1 pounds of phosphorus in runoff
- In 2014, CRP lowered greenhouse gas emissions by the equivalent of 43 million metric tons of CO2 - the same benefits as taking nearly 8 million cars off the road for a year
- In prime habitat, a 4% increase in CRP vegetation is associated with a 22% increase in pheasant counts

FSA will ultimately determine participant and land eligibility.

For More Information:

Contact your local USDA, Farm Service Agency:

http://offices.usda.gov

Photos provided by Iowa Dep.t of Agriculture-Div of Soil Conservation, NRCS Bob Nichols and Pheasants Forever Peter Berthelsen respectively

Appendix B

Letter to Landowners and FAQ Sheet for Landowners

To: Landowners

From: Farm Service Agency (FSA) and Oregon Watershed Enhancement Board (OWEB)

Subject: State of Oregon CREP Effectiveness Monitoring Study

The Conservation Reserve Enhancement Program (CREP) has funded improvements to riparian areas throughout the state since 1998. Oregon's CREP program is implemented by a strong partnership between federal, state, and local organizations working closely with private landowners to manage 1,600 CREP projects covering over 41,000 acres.

OWEB is responsible for conducting an evaluation of CREP projects throughout the State. Given the investment in CREP and its potential benefits, it is important that we evaluate what is working and what isn't with the CREP program, so that the partners can make appropriate adjustments to future projects. A study to evaluate the CREP program statewide has been developed and guided by an Advisory Group. The goal of this study is to report on the overall status and condition of currently enrolled CREP projects statewide.

To assist in this process, FSA and OWEB have recently signed a Memorandum of Understanding (MOU) to ensure that landowner privacy is protected. Existing Federal and State laws and policies pertaining to information sharing will be followed during the term of this study.

This winter or spring you may be contacted to have your revegetation and/or fencing project(s) surveyed in 2016. The on-the-ground data collection that will occur from May – September 2016 involves taking measurements of the vegetation and streambanks in the buffer, and assessing the condition of the fence. We encourage you to actively engage in this process. The data collected will not be used to evaluate the performance of an individual landowner's project and will be summarized to evaluate the overall CREP program in Oregon.

We look forward to working with you during this important process to evaluate CREP in Oregon. Please contact your local FSA office or CREP technician if you have any questions or concerns.

Frequently Asked Questions for Conservation Reserve Enhancement Program (CREP) Effectiveness Monitoring

1. How will personal landowner information (e.g. name, address, and telephone number) be kept confidential?

The data collected for this study and stored in a database will not include landowners' personal information. The CREP technicians who are familiar with a particular CREP contract will assist OWEB and the contractor to communicate with landowners to request permission to access their property (to perform monitoring by collecting field data) and to respond to landowner questions and concerns.

2. Will landowners have access to the field data that has been collected on their property?

Yes, all field data, including photographs of the buffer, will be made available upon request. Once it is complete, the final report can also be made available upon request.

3. Will this monitoring effort result in regulatory actions by the Farm Services Agency (FSA)?

No, the intent of this study is not to determine contract compliance. FSA and the local agency implementing CREP in your area already have a process in place to ensure contract compliance. The field data collected for a specific CREP contract will be combined with field data from additional CREP contracts to describe the conditions of a specific Conservation Practice. In the event concerns about a specific CREP contract are identified during monitoring, the local CREP tech will be notified and work with the landowner to address the concern.

4. Will this monitoring effort result in regulatory actions by other state or federal agencies?

No, the intent of the study is to determine the effectiveness of the CREP program, not to identify potential violations of state or federal regulations.

5. Who will do the monitoring?

The Oregon Watershed Enhancement Board (OWEB), with the assistance of the CREP Advisory Group, has hired a qualified contractor to conduct the monitoring. This contractor is required to follow the data sharing conditions specified in the Memorandum of Understanding (MOU) between OWEB and FSA.

6. **Am I required to allow access to my land for this study?**

No, Landowners do not have a contractual responsibility to provide access to their land for this study. However, the more landowners that participate, the better the study results will reflect conditions on the ground.

7. **If I allow access to my land for this study, can I / must I / should I be present during the field data collection?**

We encourage landowners to actively engage in this evaluation so it can accurately and precisely reflect the current conditions on the ground. When the CREP technician contacts a landowner to request access, the CREP technician will ask the landowner if they will be present for the field data collection.

8. **How long will the field data collection take on my land?**

We estimate that it will take the contractor approximately 6-8 hours to complete the field data collection on each site.

9. **How will results from this study be utilized?**

Results from this study will be summarized in a final report that will characterize the condition of the different Conservation Practices that are enrolled in CREP and compare these results with areas that have not been fenced and/or planted. This report will include recommendations to improve the likelihood of CREP contracts meeting objectives in Conservation Plans. For example, the report may recommend site preparation practices and planting techniques that were successful, or may include contract administration recommendations to ensure adequate documentation to describe the CREP contract and track performance metrics in a central database.

10. **Who is the OWEB point of contact for this study if I have more questions or concerns?**

Ken Fetcho, the Effectiveness Monitoring Coordinator, can be reached at 503-986-0035 or at ken.fetcho@state.or.us.

Appendix C

Information to be Compiled from CREP Contract Files

- **Basic contract and landowner/manager information:** Contract length, contract start and end dates, contact information for landowner/manager, size of project site, and other basic information will be requested.
- **Project initiation date:** While uncertainty will exist regarding project age because some projects have been managed under multiple sequential contracts, which may or may not be evident in current contract files, an attempt should be made to determine the minimum project age in order to ascertain whether the site meets the minimum age threshold of $\geq$7 years.
- **Catastrophic events:** If the local CREP technician is aware of any natural disasters at a candidate site that would likely influence the vegetation, streambanks, and/or fencing to the extent that the site would not be comparable to a control site, such sites would be removed from further consideration. (A site could also be removed from further consideration if initial field inspection revealed such catastrophic disturbance.)
- **Maps**: Maps displaying exclosure fencing and planting boundaries are requested to be scanned and submitted for each contract.
    - Exclosure fencing boundaries: The planned location of livestock exclosure fencing will be needed in order to assess whether or not the fencing has been installed and maintained according to the CREP contract.
    - Planting: The planned and implemented locations of plantings will be needed in order to determine transect locations.
- **Buffer width and length (feet or meters):** Specific buffer widths set for each site will be needed. The CREP program sets minimum and maximum buffer widths at 35 and 180 feet, respectively (Fetcho 2015b, p. 7).
- **Planting density (stems/acre or pounds of seed/acre) and planting year:** Acknowledging the important role of natural recruitment, information on planting density will provide insight on planting investment vs. survival and recruitment. The standard CREP target tree density is 200 stems per acre (Fetcho 2015b, p. 6); however, planting densities can range from 200 to 500 trees/acre to account for mortality and differences in species composition. For example, in some districts, Douglas-fir is planted at 300 stems/acre (Fetcho 2015b, p. 6). Information on the number of plants or cuttings is expected to be in the CREP contract; combined with project acreage, this can be converted to planting density. The number of plants for each of the following categories will be needed:
    - Woody (stems/acre) and includes all of the following:
        - Conifer tree (stems)
        - Deciduous tree (stems and cuttings)
        - Shrub (stems and cuttings)
    - Herbaceous - forb or grass and grass-like plants (pounds of seed/acre)
- **Replanting density (stems/acre or pounds of seed/acre) and planting year:** Information on replanting numbers (stems, cuttings, pounds of seed) is also expected to be available in the contract files and will be required to understand overall planting density.
    - Woody (stems/acre) and includes all of the following:
        - Conifer tree (stems)
        - Deciduous tree (stems and cuttings)
        - Shrub (stems and cuttings)
    - Herbaceous - forb or grass and grass-like plants (pounds of seed/acre)

- **Site preparation requirements:** Site preparation requirements and methods are anticipated to vary across the state and therefore differences in relation to success of the conservation practices applied could be informative. Activities performed prior to and during the year of initial planting are considered site preparation.
- **Site maintenance practices:** All contracts are required to maintain the riparian buffers through methods such as irrigation, mowing, and spraying. Activities performed after the year of initial planting are considered site maintenance. (Information on contract requirements may be available, but information on implementation of these maintenance practices may not be.)
- **Prior land use:** Land use at the site prior to project initiation should be included in the original Conservation Plan and could be an important explanatory variable for observed variation in weed cover and other indications of project success.
- **Control site:** Suitable control sites will be identified within each stratum and should have similar climate, geography, and land use. They also need to be accessible, have landowner approval, and meet the minimum size criteria established for treatment sites. Suitable and accessible control sites are commonly located upstream of treatment at a distance sufficient to isolate any confounding effects. Such control sites are expected to be available in some cases on the same landowner's property as a treatment site, or on an adjacent neighbor's property. Input from the local CREP technicians will be critical for identifying possible control sites and cooperative landowners.

Appendix D

Estimating Percent Cover

Estimating Percent Vegetation Cover

One method for estimating percent cover in diverse vegetation is to divide the plot into quarters or eighths. Since one quarter is 25% of the total and one eight is 12.5% of the total, the percent cover of an individual slice should be multiplied by the appropriate number. In the figure below, a slice that is one quarter covered is multiplied by .125 to get roughly 3% cover. The sum of all slices gives the total percent cover for the plot.

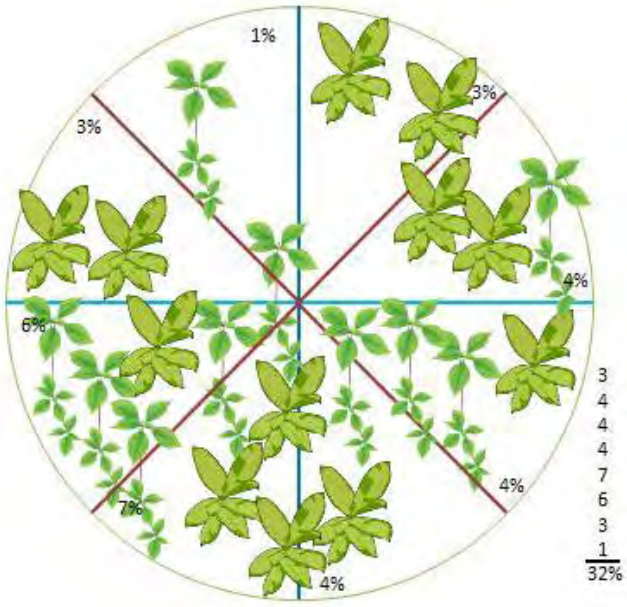


Figure C-1. Estimate percent cover of each 1/8 plot and sum total

In very low cover, it can be useful to mentally group existing vegetation in order to estimate its cover. In the figure below, one quarter of the plot would have 50% cover, giving a total percent cover of 12.5%.

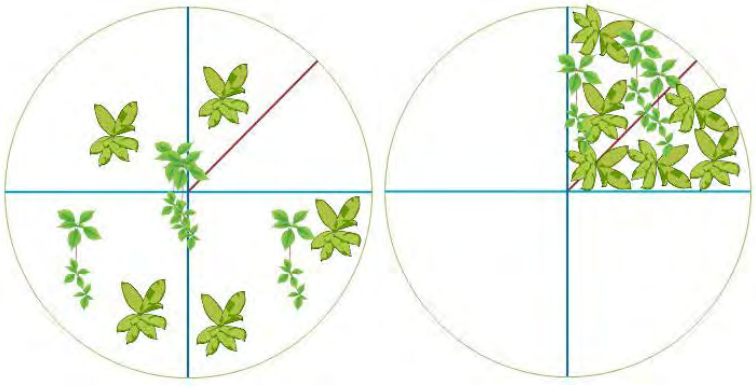


Figure C-2. Group existing vegetation in low-cover plots, 50% of ¼ gives 12.5% total coverage.

Appendix E

Attributes, Field Measurements, and Statistical Tests

Target attribute	ID No.	Field measurement	n per site	Improvement over controls in stratum?	Important co-variates?
				Statistical tests	
Vegetation structure along channel bank	1	Presence of >0% cover for all three vegetation layers, including river left and river right plots along 5 transects per site	10	One-tailed t-test	ANOVA
	2	Percent canopy cover (>5 m)	10		
	3	Percent understory (0.5 m to 5 m)	10		
	4	Percent ground cover (<0.5 m)	10		
Vegetation overhang over channel	5	4 mid-channel densiometer readings for each of 5 channel transects	20		
Woody cover and LWD recruitment potential for riparian forest buffers	6	Percent cover for all woody species for river left and river right plots along each channel transect	10		
	7	Percent cover for conifer tree species for river left and river right plots along each channel transect	10		
	8	Percent cover for broad leaf tree species for river left and river right plots along each channel transect	10		
Herbaceous cover for filtering potential	9	Percent cover of herbaceous species for river left and river right plots along each channel transect	10		
Control of woody weeds	10	Percent cover of woody weed species for river left and river right plots along each channel transect	10		
Control of herbaceous weeds	11	Percent cover of herbaceous weed species for river left and river right plots along each channel transect	10		
Bank stability	12	Reach length with actively eroding bank on river right and river left between each set of channel transects	8		
Livestock exclusion	13	Fencing intact (Yes/No)	1	Binomial test	Binomial test
	14	Absence of livestock evidence in exclosure area (Yes/No)	1		
Herbaceous cover for riparian buffers	15	Percent cover of herbaceous species in planting transect circular plots	10	One-tailed t-tests	ANOVA
Woody cover for riparian buffers	16	Percent cover of woody species along planting transect circular plots	10		
Control of herbaceous weeds	17	Percent cover of herbaceous weed species along planting transect circular plots	10		
Control of woody weeds	18	Percent cover of woody weed species along planting transect circular plots	10		