2013 Implementation and Effectiveness Monitoring Results for the Washington Conservation Reserve Enhancement Program (CREP): Buffer Performance and Buffer Width Analysis

December 2013

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Washington Conservation Reserve Enhancement Program: Buffer Performance and Buffer Width Analysis

Executive Summary

The Conservation Reserve Enhancement Program (CREP) is a voluntary program that offers financial incentives to farmers to restore riparian habitat and preclude agricultural activities in those buffers during the contract duration (10 or 15 years). The primary purpose of CREP is to restore habitat for salmon and steelhead and improve water quality in those streams. It is co-administered by the U.S. Department of Agriculture Farm Service Agency (FSA) and the Washington State Conservation Commission. Federal funding covers about 80% of the costs of CREP.

The program has been in operation for nearly 15 years, and has several important features that contribute to successful habitat restoration:

- By specializing in riparian restoration, staff are highly trained for this function.
- All CREP practices must follow federal standards, which increase the consistency of results.
- Contracts are visited on at least an annual basis in the first 5-6 years. They are sporadically visited thereafter. This assures landowner adherence to the program requirements and allows for measures to be taken to improve plant growth and survival.
- Oversight is provided by two separate agencies, FSA and the Conservation Commission, to help assure standards are met. In addition, the Natural Resources Conservation Service is often involved in site planning.
- Maintenance of the riparian area is funded for a five-year period after planting to control invasive plant species and provide watering during dry periods.
- Contracts are part of an effectiveness monitoring program using random sampling. In addition, all contracts are monitored for implementation performance.

The Washington State Conservation Commission monitors CREP in two ways. Implementation measures are collected for every contract on an annual basis to show the extent of restoration. Randomly selected contracts are monitored for their effectiveness in improving stream and riparian function and structure. This report summarizes the results of both types of monitoring for contracts signed through the end of 2013 and monitored for effectiveness for the calendar years of 2006, 2008-2013. Effectiveness monitoring was not done in 2007.

In 2013, the cumulative number of CREP contracts reached 1,113 with 56 new contracts signed in 2013. Compared to the total number of contracts (1,113), the riparian forest buffer practice is by far the most common (93%) with wetland

enhancement at 4% of total. Riparian hedgerows comprise 3% of the contracts, less than 1% are grass filter strip contracts. The 2013 contracts added 15 stream miles, 203 acres of buffer, 66,000 seedlings, and 25,000 feet of fencing.

These buffers are rapidly growing with average rates ranging from 12-18 inches per year in eastern Washington and 14-27 inches per year in western Washington (averaging across plant types). More importantly are the results of these actions on the environment. The canopy cover results were remarkable with approximately 68% coverage (shade) in the 5-10 year contracts compared to 13% in the 1-4 year old category. These measurements were conducted only in the small wadeable streams. It is likely that if wide streams were included, the results would be more variable and less significant. However, it shows how quickly and effectively buffers can shade small (25' or less bankfull width) streams enrolled in CREP.

A low level of invasive plant species presence was noted with 2% in younger contracts (1-4 years) compared to 4.5% coverage in mid-year contracts (5-10 years). Bank erosion was low with 13% average in younger contracts and 3% along older CREP sites.

The most common buffer width category is 180' or wider with 39% of all riparian forested buffers developed to 180' or greater in width. Eighty percent of all CREP forested buffers are 100' or greater in width. The average buffer width is 142' while the median is 150'.

These results indicate that CREP is successful in several ways. The sites are preventing the spread of invasive plant species while increasing the coverage by native species that can perform the necessary fish and wildlife functions of a riparian buffer. The CREP plants are surviving and growing quickly, providing important shade to the smaller streams. Previous monitoring has shown that when CREP and other riparian restoration are targeted to cover a major amount of stream length, water temperatures improve for salmonid use (Smith 2012a). The implementation of the program has been growing at a steady rate. With federal funding paying for 80% of the total costs, CREP remains an effective and cost-efficient program for riparian restoration on agricultural lands in Washington State.

Even with the demonstrated success of the Washington CREP coupled with average wide buffer widths, efforts are underway to increase the minimum buffer width from 35' to a significantly wider buffer. One suggested increase is to 100'. Widening our minimum buffer requirement will reduce the ability to develop site-specific plans that consider constraints within parcels that include: topography, hydrology, agricultural use, infrastructure, property boundaries, and valley configuration. Increasing the minimum width will not increase overall buffer widths in the program. Instead, the expected results are a decrease in some of the buffer sizes at the farm scale and decrease in the number of contracts. This will result in less stream length covered by high quality buffer; an overall decrease in riparian restoration at the watershed scale.

Introduction

The Conservation Reserve Enhancement Program (CREP) is a voluntary program that offers financial incentives to farmers to restore riparian habitat (streamside trees and shrubs) and to preclude agricultural activities in those buffers during the contract duration (10-15 years). The program began in 1998 with the first signed contracts in 1999. It is cooperatively administered by the U.S.D.A. Farm Service Agency (FSA) and the Washington State Conservation Commission. The federal government pays approximately 80% of the total costs.

In Washington State, about 37% of salmon streams on private land pass through agricultural land use (USFWS and NMFS 2000). Because much of the agricultural land is located in or near historic floodplain-rich habitat, it is important that efforts continue to develop opportunities to not only improve riparian habitat for healthy watersheds, but also to maintain viable agriculture. Once land is converted to more intensive development (urban and industrial), environmental impacts increase and the prospects to preserve or restore habitat near streams greatly decrease. Between 1982 and 1997, about 20% of the farmland in the Puget Sound region was lost to other uses, especially in King and Snohomish Counties where urban growth has been high (Canty and Wiley 2004).

The primary focus of the Washington CREP is riparian buffer restoration and protection along salmon streams. This includes buffers along streamside wetlands. CREP areas become “no touch” buffers. Fencing and livestock watering facilities are installed on livestock farms to prevent their access to the buffers and stream. The newly planted native trees and shrubs are then actively maintained for five years to increase the likelihood of success. Maintenance primarily includes weed control and watering.

Monitoring is an important component of habitat restoration. Without it, there can be no knowledge of what’s been done, where it has been done, and no measurement of success in the investments and techniques. Implementation monitoring of CREP tracks how much has been done. These measures are: acres treated, stream miles restored, number of contracts, feet of fencing installed, and number of plants planted. The implementation monitoring data is used to show program performance to the Office of Financial Management, the legislature, and the Farm Service Agency. It is also used for management purposes within the Washington Conservation Commission to allocate funds and better manage the program.

It is also important to know how effective CREP is. Our measures of success include plant growth, plant survival, buffer diversity, shade, bank erosion, and non-native plant species control. This year, the results are merged with data collected from past years to show plant growth and buffer composition by species. The species-specific information is of interest to the staff who develop the plans, aiding in future plant selection.

This report describes the methodologies and results for both implementation and effectiveness monitoring assessments in the Washington State CREP from its origins in 1999 through the 2013 calendar year. Together, these measures demonstrate the level of performance for both program growth and environmental benefit. In addition, the issue of buffer width is analyzed. Buffer widths are a contentious issue in Washington State. This report examines the current CREP buffer width status and discusses some likely outcomes if the CREP minimum buffer width is increased.

Methodology

Following Environmental Monitoring and Assessment Program (EMAP) protocols (Peck et al. 2001), 10 sites were randomly selected for field measurements for 2013 and the results were merged with data collected from 2006, 2008-2012. Monitoring was not done in 2007. Randomization was accomplished using the Research Randomizer (2012). Sites with a pre-existing canopy were either not included, or were measured for other parameters besides canopy cover because pre-established cover would skew the results in a favorable manner. For the analyses, all measurements were grouped according to the number of growing seasons. Projects from the westside or eastside were analyzed separately and/or together.

Effectiveness Monitoring Within the Buffer

Data were collected to answer the following buffer effectiveness monitoring questions by contract site, by growing season, by eastside versus westside, and statewide. Plant type is defined as conifer trees, deciduous trees, or shrubs. This year, results are both grouped by plant type and analyzed by species. Grouping by plant type should reduce some of the plant growth variability. However, it is valuable for technicians to know which plants are the dominant buffer species and which are growing the fastest.
What is the growth rate of plants overall, by type, by species?
What is the percent survival of plants overall?
What is the plant species diversity within buffers?

The field measurements for the buffer effectiveness measures followed the strip-plot design methodology described in Haight (2002). This design is a good choice for assessing a diverse buffer that often has differing conditions near the shoreline versus further upland. Details on setting up the strip-plot are described below. These 20-foot wide strips encompassing the buffer width were assessed for:

- Species of plant
- Plant type (conifer, deciduous, shrub)
- Height of plant (ground to tip of plant) using a laser rangefinder for taller trees
- Live/dead/missing status for each plant (sometimes missing plants are obvious, but other times are not and could be under-recorded)
- The number of plants total, by plant type, and by species per square foot of sampling area were obtained from these data (will likely be converted to per acre later) to calculate buffer density and diversity.
- Presence of non-native invasive plants and extent of coverage (area of plot)
- Notes about the site, such as predation, flooding, fire, and other issues.

The plots were at equally spaced intervals (100') beginning at a random start near the edge of a project and extending through the project site in areas without significant interplanting. Because some sites have buffer lengths approaching 20,000', it isn't feasible to treat large sites as a single site, and for those with distinctly different sections or parcels, one or more parcels would be randomly selected for sampling.

After the interval start point was found, the strip-plot was set up as follows. A tape was run through the buffer width perpendicular to the stream to create the perpendicular tapeline. The buffer width (length of tape) was recorded for later calculations of sample area used in diversity and density estimates (tape length (buffer width) X 20'). All CREP plants within 10-feet of each side of the tapeline were assessed. This has been shown to be a statistically valid yet efficient plot design for riparian buffers of varying ages (Haight 2002). Borderline plants were included if half or more of their trunk radii at diameter breast height (Dbh) (generally 4.5') is within the 10' mark.

In addition, data were obtained from the planting records regarding the original height of plants by species and the date of planting to determine the number of growing seasons. Any replanting or thinning data was also recorded.

Data was entered and stored in the Conservation Practice Data System at the Washington Conservation Commission. Data was grouped by plot, project, district, region (eastside/westside), and state to summarize at various levels. Plants were grouped by species and type.

Effectiveness Monitoring in Stream Channel

Stream channel effectiveness monitoring included in-channel measurements of percent canopy cover and condition of bank erosion. These were measured in the stream channel as an extension of the mid-point of the buffer plot described above.

The questions answered include:

- What is the percent canopy cover by site, by region, and by growing season?
- What is the condition of bank erosion by site, by region, and by growing season?
- How does each of these measurements change with age of project (number of growing seasons)?

Percent Shade (canopy cover) Measurements. The percent canopy cover was used to assess shade following EMAP protocols (Peck et al. 2001). At each instream transect, the percent canopy cover was measured using a convex spherical densitometer mid-channel. Four readings were taken at each transect of wadeable streams. They included: upstream, left bank, downstream, right bank. A score of 1-17 was given to each site. The readings were averaged for each transect.

Bank Erosion Measurements. The bank erosion condition was estimated by visually assessing the 20' length of bank (same side as CREP contract) centered around each in-channel transect (10' from each direction of transect point). The assessment included noting the percent of bank eroded, the percent of bank lacking vegetation, and the number of slides entering the stream

Data Analysis

Trends over time by growing season were analyzed, as well as differences between groups using ANOVA or Student's unpaired t-test.

Results

Implementation Monitoring: New Contracts

In 2013, we gained 56 new contracts for a total of 1,113 restored sites in Washington State (Figures 1 and 2). This is a remarkable number considering that we had a sign-up period of less than five months for the calendar year. Complications with farm bill extension funding prevented the ability to sign new contracts from January through early May, and farm bill extension expiration on October 1 prevented the approval of new contracts from October through December. The higher than expected number is likely because state funding for the program was fully restored, allowing conservation districts to provide technical assistance in a proactive manner with landowners in anticipation of a sign-up period.

Three to four years ago, new practices were allowed in the Washington CREP. In addition to the original riparian forest buffer practice, the new practices include wetland enhancement, riparian hedgerows, and grass filter strips. Of the 56 new contracts this year, ten were hedgerow buffers and ten were wetland enhancement contracts. Also, two CRP-1 contracts were signed for the grass filter strip practice in 2013. The cumulative total number of each of the new practices is: 40 wetland enhancement practices, 29 hedgerow contracts, and 2 grass filter strip contracts. Compared to the total number of contracts (1,113), the riparian forest buffer practice is by far the most common (93%) with 4% wetland enhancement practices, 3% riparian hedgerow practices, and less than 1% grass filter strip practices.

Figure 1. The total number of signed CREP contracts by year in Washington State.

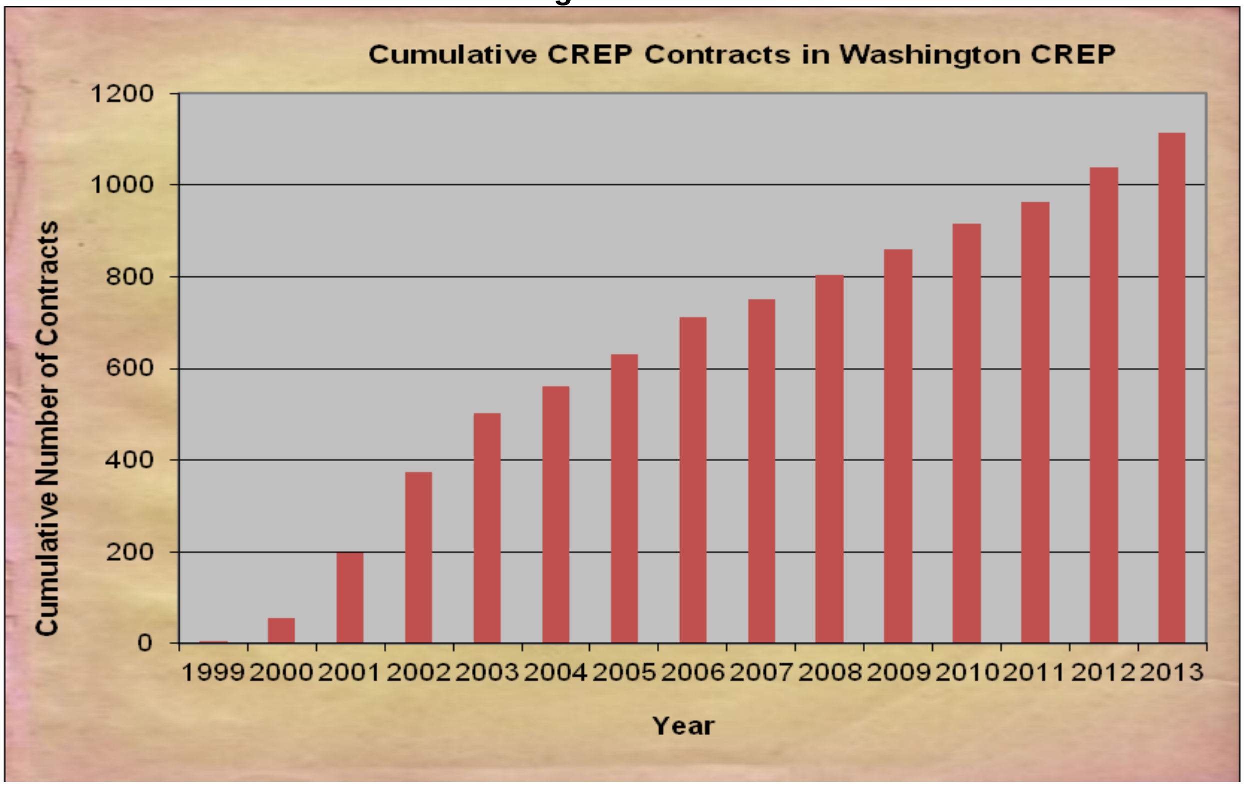


Figure 2. The number of contracts in the Washington CREP by year.

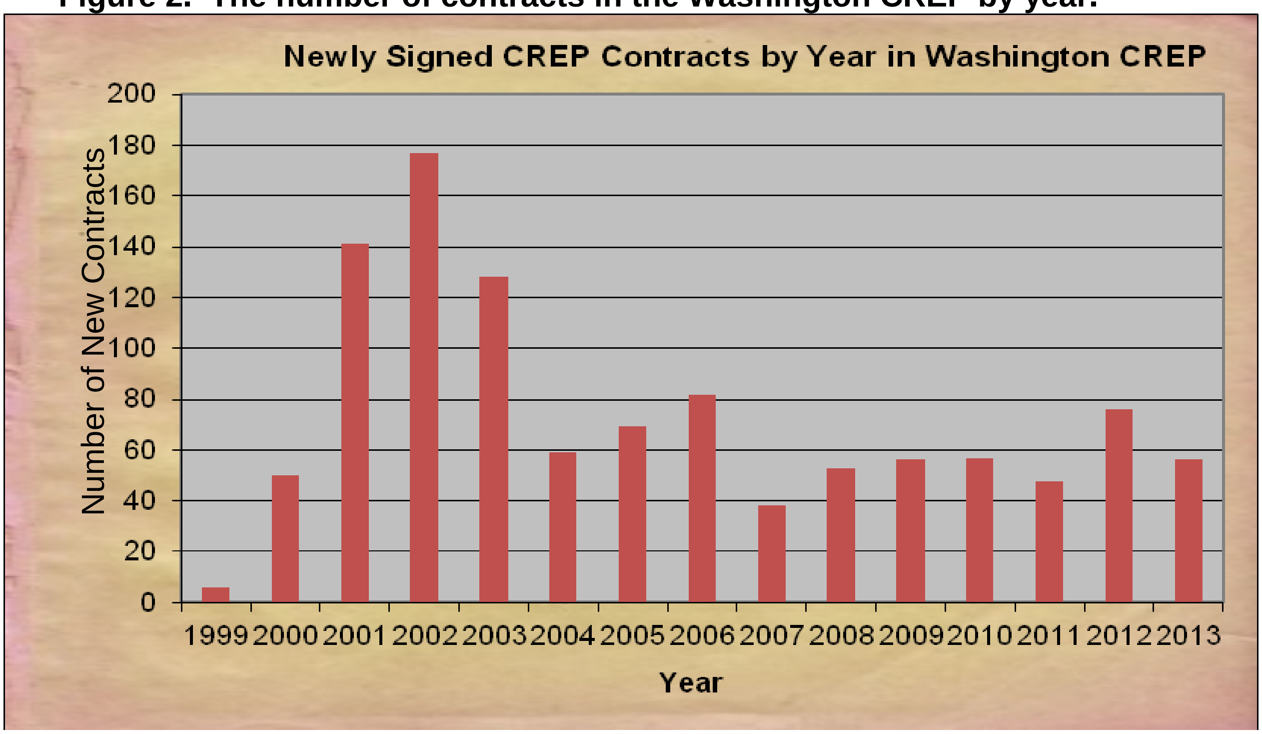
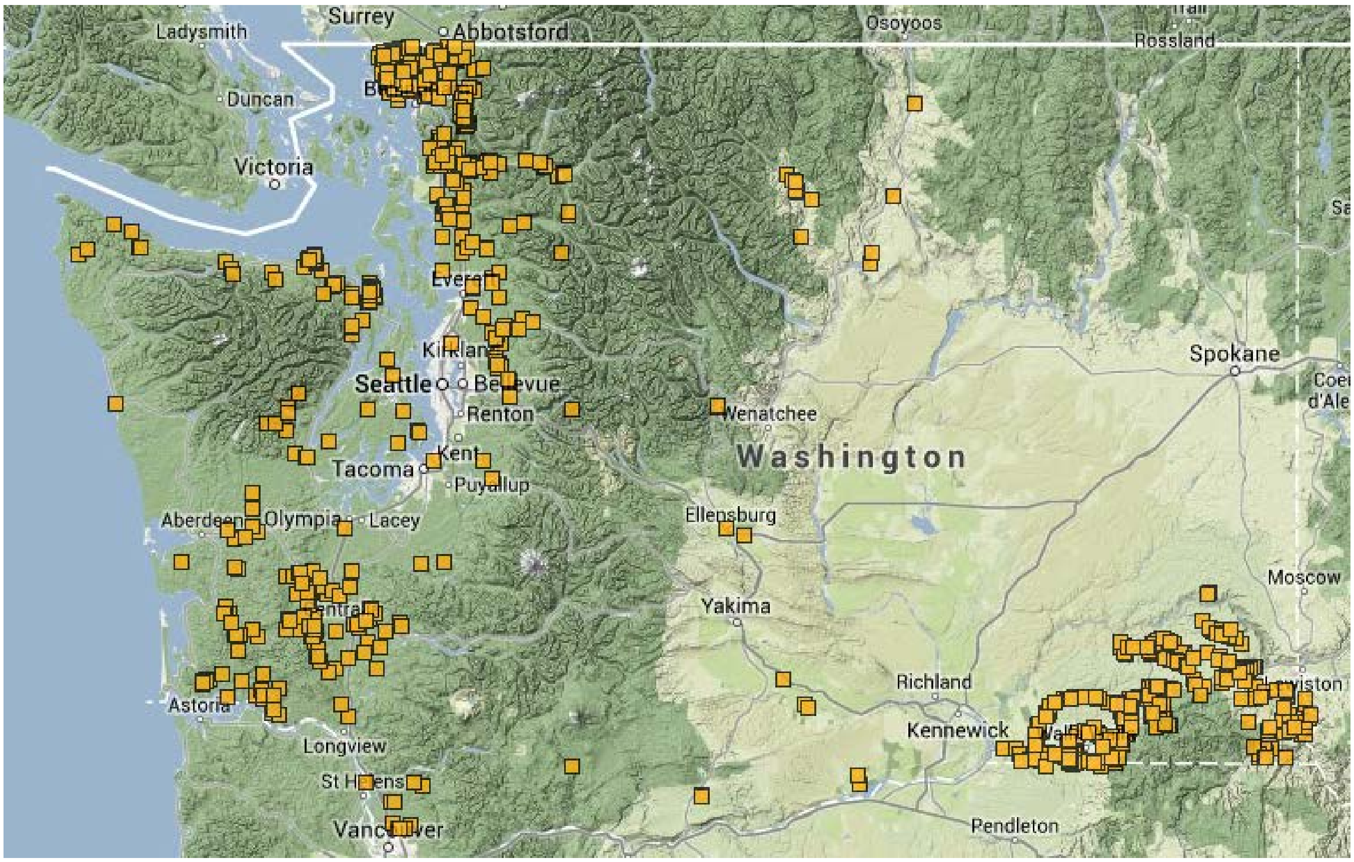


Figure 3 shows the distribution of CREP projects across Washington State. Most contracts are located in north Puget Sound and southeast Washington. However, almost all of the new contracts for 2013 are located in western Washington with 37 in Whatcom, 9 in Lewis/Grays Harbor, 5 in Skagit, 2 each in Pacific and Snohomish, and 1 in Walla Walla Counties.

Figure 3. Location of CREP Sites in Washington State.



Implementation Monitoring: Riparian Benefits

In 2013, 15 additional stream miles were restored and protected in the Washington CREP, bringing the total number of stream miles under contract to 803 (Figure 4). CREP buffer acres increased by 203 for a new total of 13,879 acres of riparian buffer (Figure 5).

Figure 4. Stream miles protected by CREP buffers.

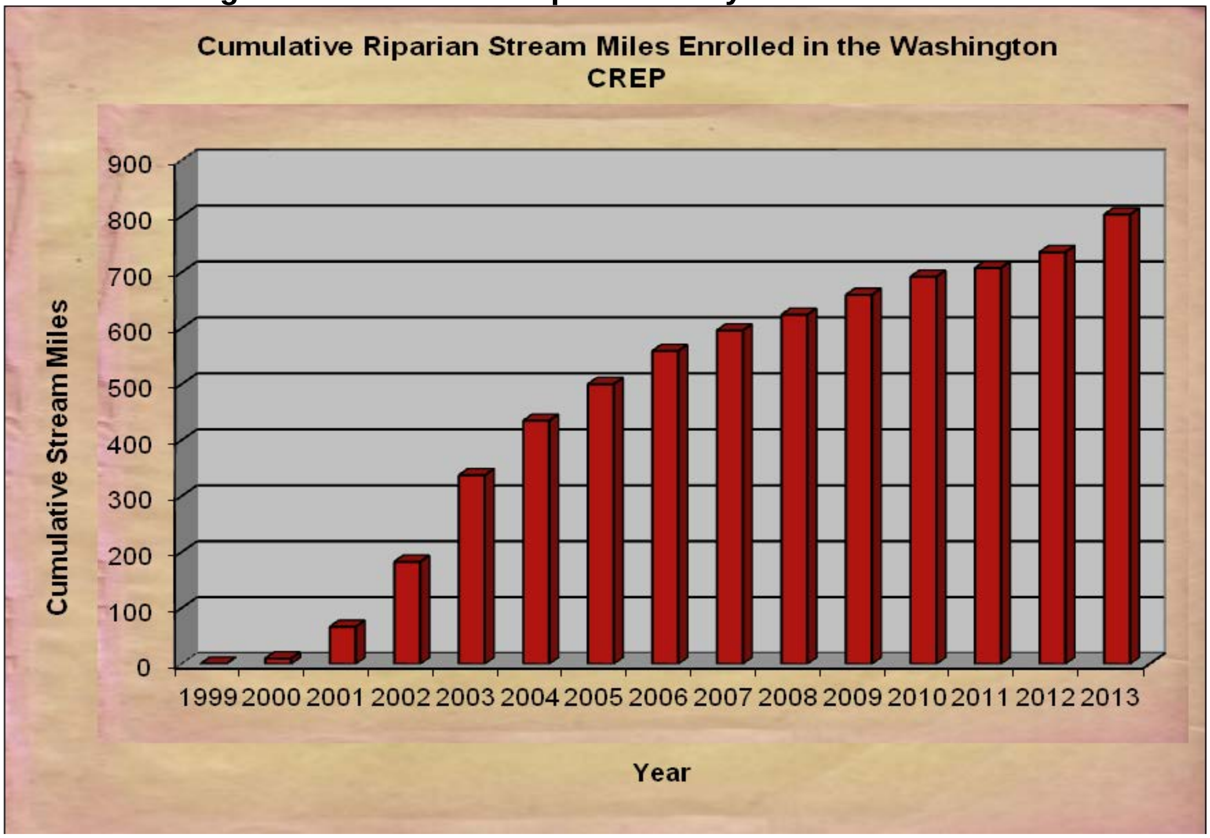
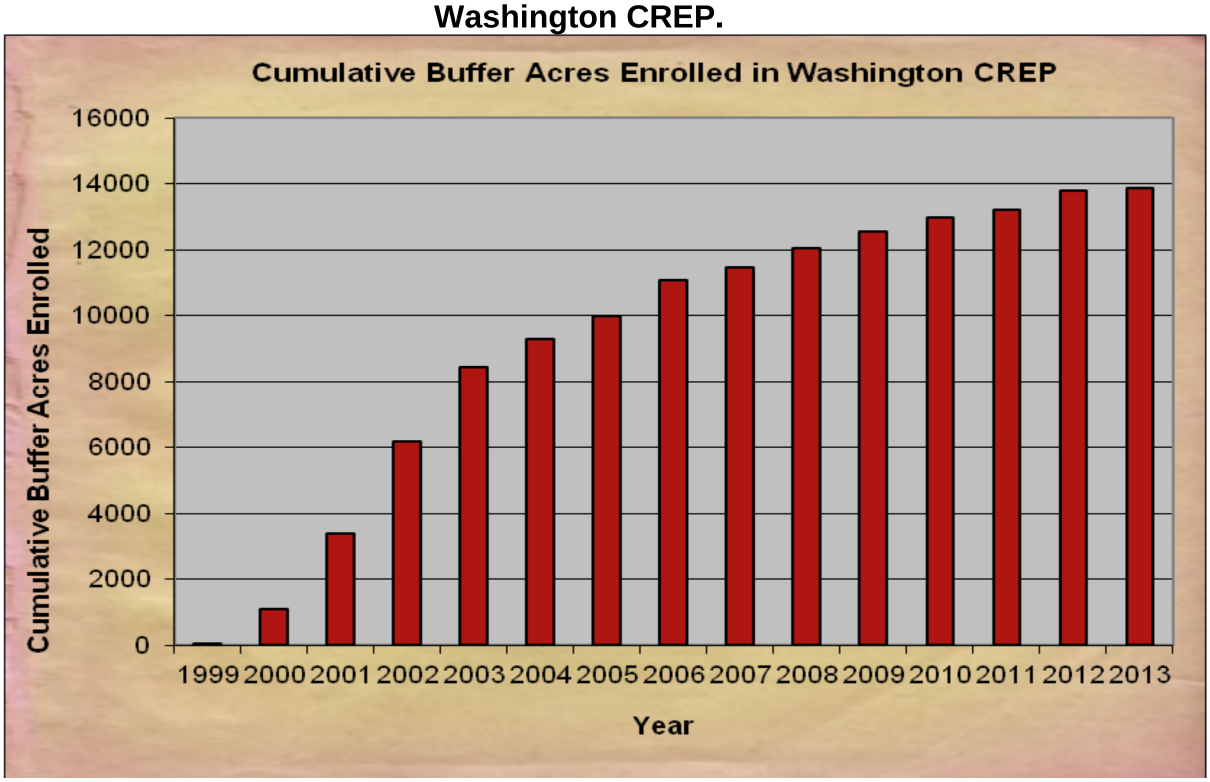
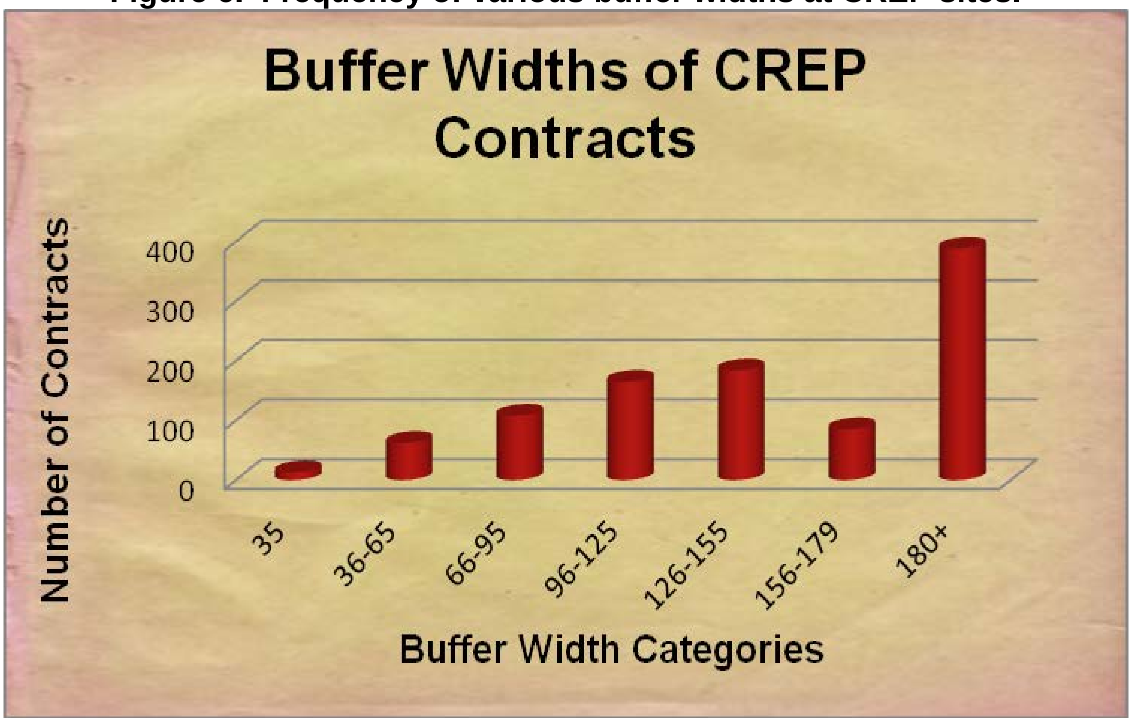


Figure 5. Total cumulative acres of riparian buffer enrolled in the Washington CREP.



The vast majority (93%) of CREP contracts use the riparian forest buffer practice. In this practice, buffer widths can range from a minimum of 35' to 180' from the stream edge. Buffers can and do extend wider than 180', but rental payments do not pay for buffers greater than 180'. Figure 6 shows the frequency of various buffer widths found in CREP. The most common buffer width category is 180' or wider with 39% of all riparian forested buffers developed to 180' or greater in width. Eighty percent of all CREP forested buffers are 100' or greater in width. The average buffer width is 142' while the median is 150'. Less than 1% are 35' wide.

Figure 6. Frequency of various buffer widths at CREP sites.



Implementation Monitoring: Seedlings, Troughs, and Fencing

About 66,000 native tree and shrubs were planted in 2013 for a total, cumulative 5.3 million seedlings planted throughout the last 15 years of CREP (Figure 7). In addition, a total of over 1.5 million feet of fencing has been installed along CREP riparian buffers to exclude livestock from these sensitive areas with about 25,000 feet installed in 2013 (Figure 8). Lastly, a total of 229 watering facilities have been installed in CREP over the last 15 years to facilitate livestock exclusion from salmon streams.

Figure 7. Total, cumulative seedlings planted in the Washington CREP.

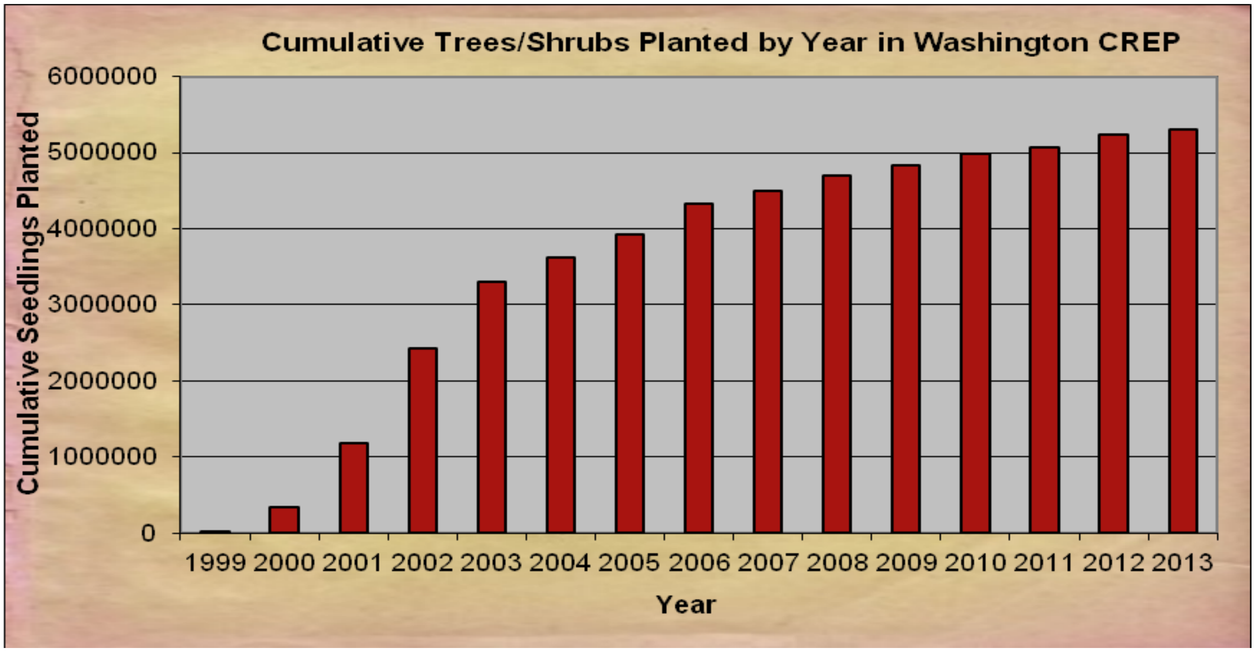
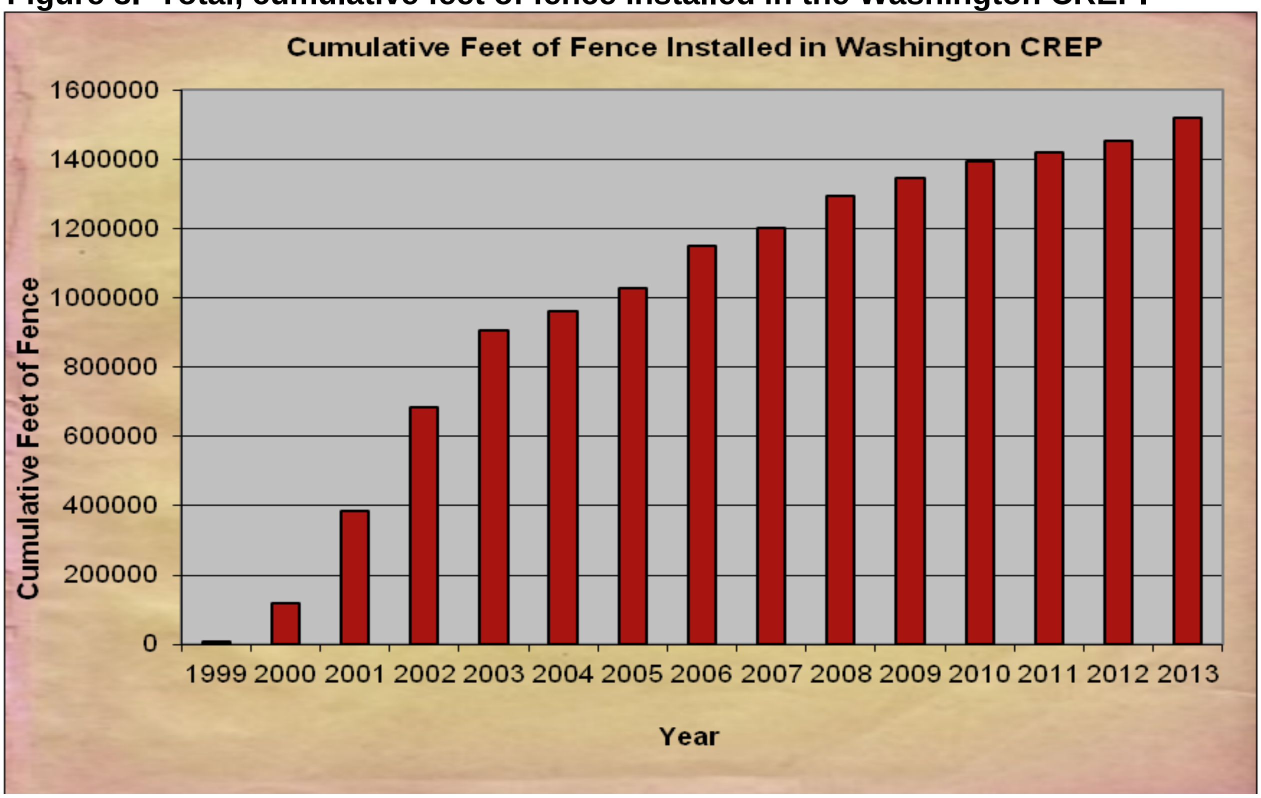


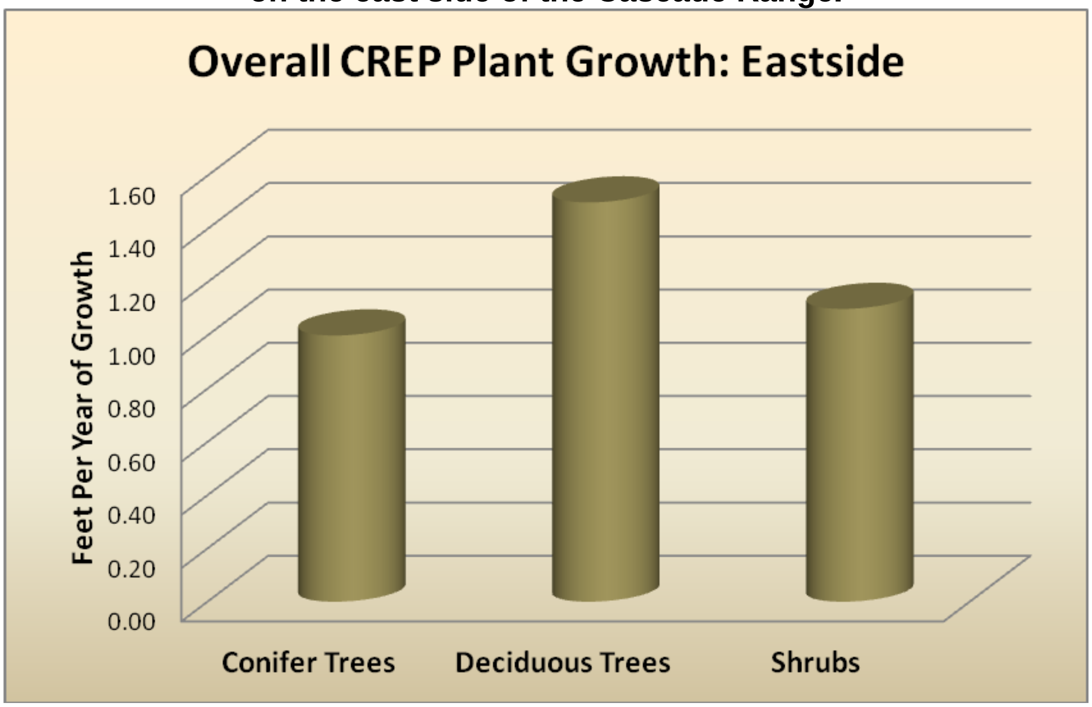
Figure 8. Total, cumulative feet of fence installed in the Washington CREP.



Effectiveness Monitoring: Plant Growth

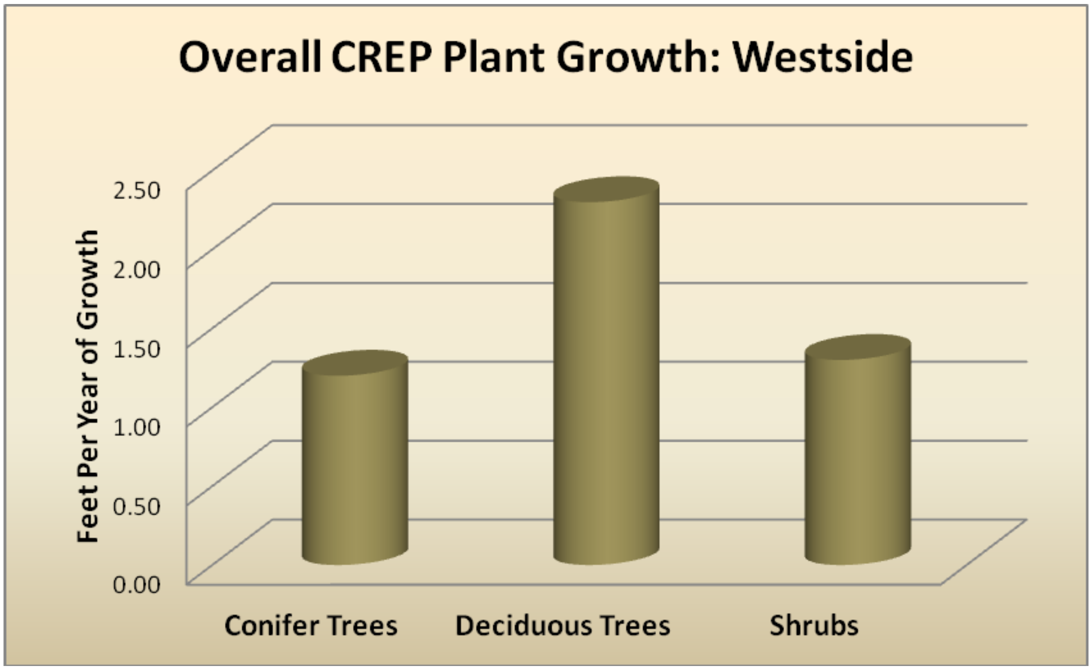
The year 2013 marked our seventh year of effectiveness monitoring sampling of Washington CREP sites. Data has been inputted into the Conservation Practice Data System enabling us to combine results across those years, stratified into two groups: western and eastern Washington. Across the eastern Washington CREP sites, conifer (ponderosa pine) grew an average of 12 inches per year. Deciduous trees grew an average of 18 inches per year, while shrubs (mostly willow) grew an average of 13 inches per growing season (Figure 9).

Figure 9. Plant growth per year of installed plants in the Washington CREP on the east side of the Cascade Range.



In western Washington, conifers and shrubs grew at an average of 14 and 15 inches per year respectively, and deciduous trees grew at a mean of 27 inches per growing season (Figure 10).

Figure 10. Plant growth by plant type in western Washington CREP sites.



Effectiveness Monitoring: Plant Survival

Survival of CREP plants at eastern Washington sites is shown in Figure 11 with mean survival of 80%. Mean survival across western Washington CREP sites is 91% (Figure 12). Our plant survival goal is 85%.

Figure 11. CREP plant survival (mean of 2006, 2008-2013 results).

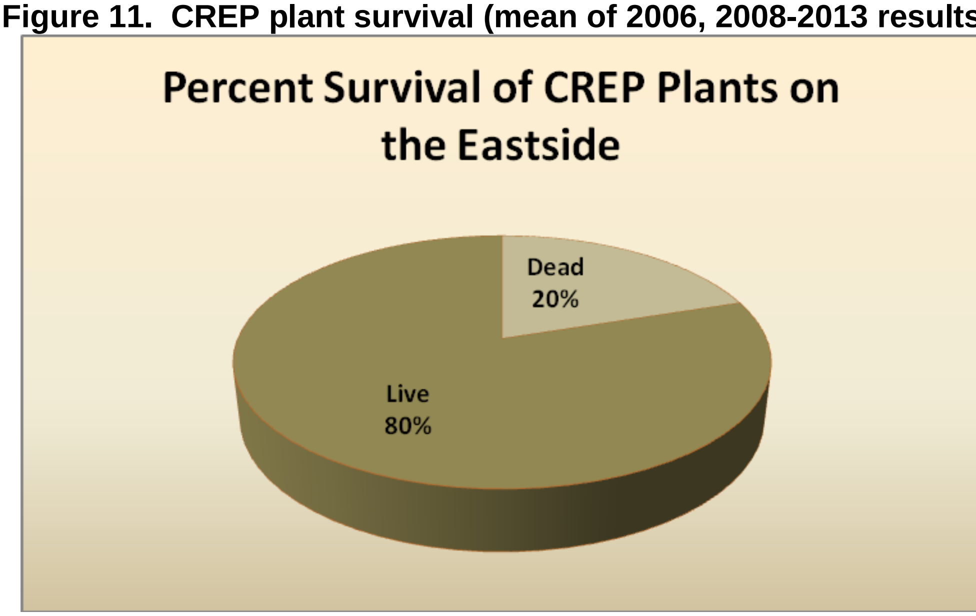
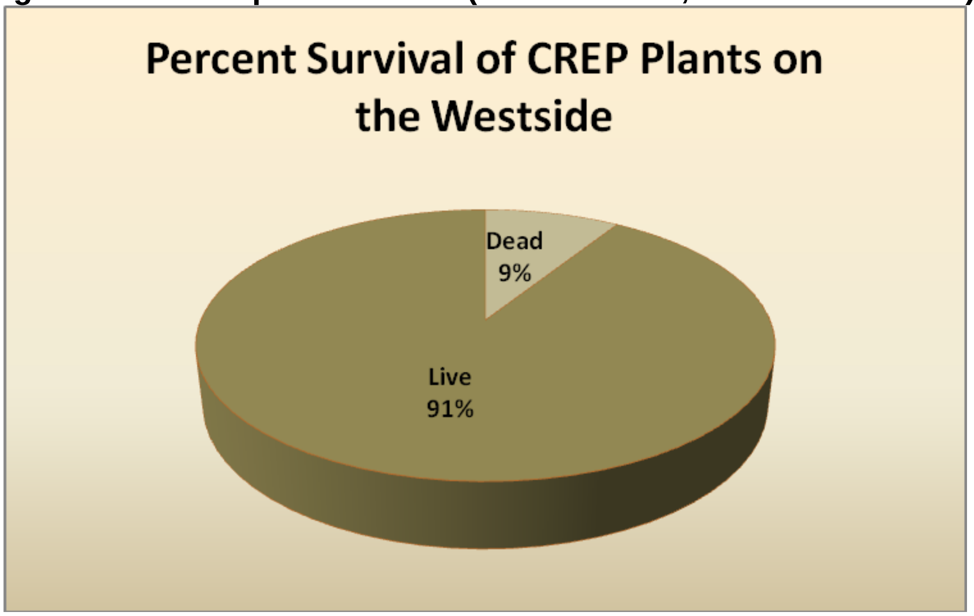


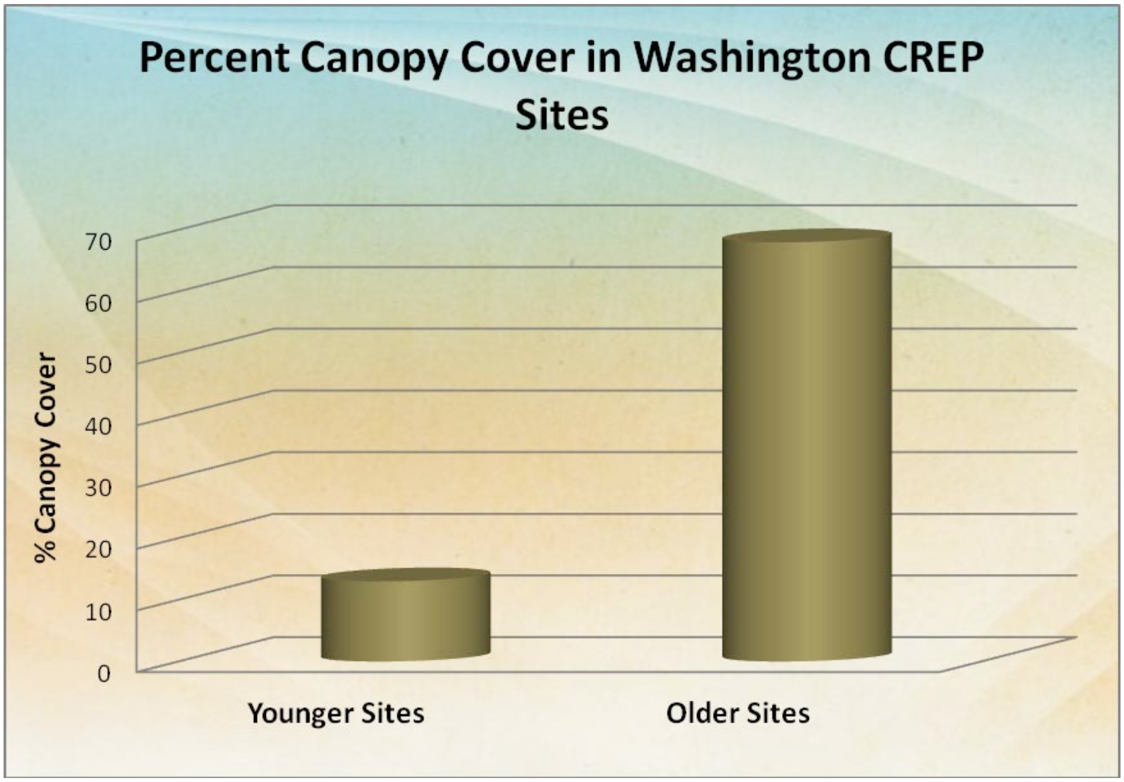
Figure 12. CREP plant survival (mean of 2006, 2008-2013 results).



Effectiveness Monitoring: Canopy Cover

The amount of shade over the CREP-planted stream reaches was estimated as percent canopy cover measured mid-channel. This was measured only in wadeable CREP stream reaches because the larger mainstem reaches were not able to be sampled mid-channel. For the sampled streams, shade significantly increased ($P<0.0001$) over the CREP reaches that were planted at least 4 years prior as compared to younger CREP sites (Figure 13). The mean percent canopy cover for young sites (0-4 years old) was 13, while older sites had a mean of about 68%. These results are not applicable to wider streams as those are more difficult to shade and require a combination of wide buffers and taller (more mature) trees. If canopy cover were measured for the wider streams, the results would likely be much more variable and less significant between the two age groups.

Figure 13. Percent canopy cover over small (wadeable) CREP enrolled-stream reaches.



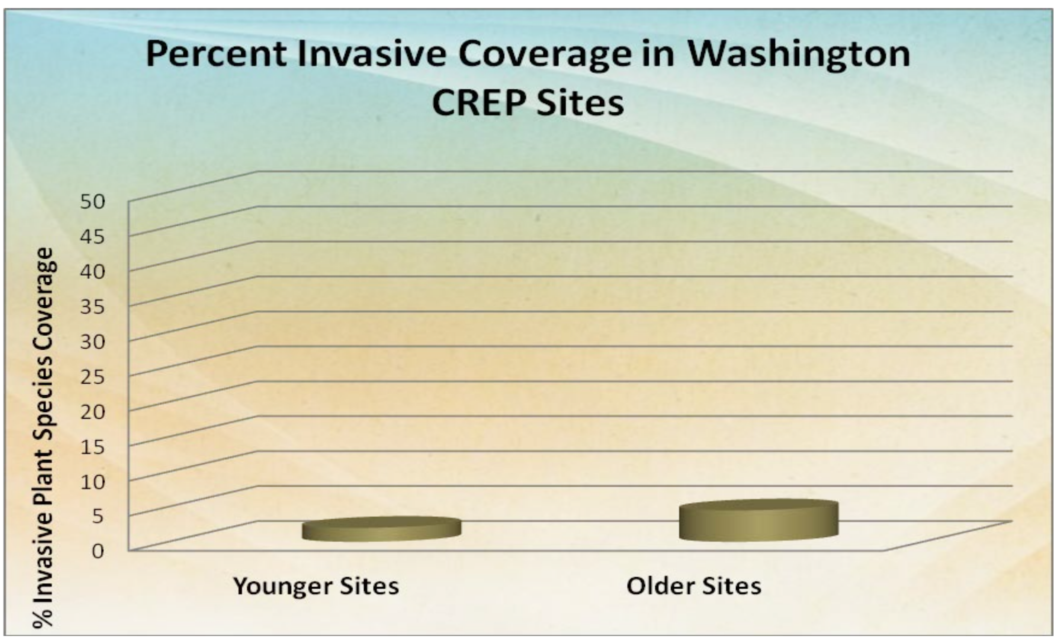
Effectiveness Monitoring: Bank Erosion and Extent of Invasive Species

The percentage of eroding banks was low throughout most Washington CREP sites with an average of 13 percent along younger (less than 5 years) sites and 3 percent along older sites (Figure 14). These two groups are not significantly different from each other (P=0.08). Bank erosion is expected to be low within CREP projects because sites with significant levels of erosion are not eligible for CREP. However, we monitor to make sure that our actions are not contributing to increased bank erosion over time.

The percentage of land coverage by invasive plant species averaged 2% for younger (0-4 growing seasons) and 4.5% for older (5-10 years) contracts (Figure 15). There were no significant differences between these two groups (P=0.47).

Figure 14. Percent bank erosion along CREP reaches in eastern Washington.

Figure 15. Percent of invasive plant species coverage within CREP buffers.



Discussion

Program Progress

The number of CREP contracts enrolled in 2013 was greater than expected. Farm Bill expiration issues reduced the enrollment period to less than five months for the calendar year. The main reason for the relatively high number of new contracts is that the state funding was fully restored this year, allowing conservation districts to proactively provide technical assistance to landowners in advance of the short sign-up period.

Another interesting change is the shift in location of project activity in the state. In the past, southeast Washington and north Puget Sound have been our most active areas in CREP. That appears to be changing. While north Puget Sound remains very active, there is much less activity in southeast Washington and more activity in other western areas such as Lewis, Snohomish, and Pacific Counties.

CREP Buffer Composition and Plant Growth

CREP riparian buffers are designed to primarily benefit salmon and steelhead. Desirable characteristics of such buffers include:

- Native plants to support a native ecosystem.
- A significant conifer component in areas that historically supported conifers to provide longer-lasting large woody debris to streams.
- A diversity of tree and shrub species to support an array of functions and food web components.
- A component of fast-growing native plants to aid in controlling invasive plant species and more quickly provide shade to cool water temperatures.
- The inclusion of other farm practices, where needed, to reduce land management impacts. These typically include fencing and upland water facilities to exclude livestock from riparian areas. It could also include the use of a grass filter strip between cropland and streams to reduce pollutants.

Two of these characteristics are required: the use of native plants (with rare exception) and inclusion of other farm practices where needed. All CREP buffers are “no touch”. Contracts are signed with landowners to require the ecological functionality of the buffers and no management (agriculture) is allowed within them. Part of this includes the requirement for fencing to be installed where livestock are present to preclude them from riparian and stream areas. In addition, native plants are used as much as possible. Funding reimburses plant costs, but will only do so when acceptable plants are used for a given region. These programmatic requirements are in place to assure that CREP buffer objectives are met.

The remaining characteristics are desired, and our monitoring shows how close we are to achieving those objectives and points out where improvements could be made. Buffer plant diversity is one of those characteristics. The most effective riparian buffers will ultimately have a mix of plant types as they mature, and diversity is a characteristic that develops over time in natural forests. Old growth forests are much more heterogeneous than young forests (Franklin et al. 1981). Past monitoring has shown that CREP buffers are very diverse in western Washington with a median of 11 plant species per sampled area and less diverse, but still adequate in eastern Washington with 5 plant species per sampled area (Smith 2011).

Yet another desired characteristic is the presence of conifer trees. These are important to contribute large wood to the stream. As trees mature and fall into the stream, they help shape streambed and channel morphology to the benefit of native fish species (Bisson et al. 1987; Cederholm et al. 1997). Western Washington CREP sites had a large conifer component (34%) in their buffers. Eastern Washington sites, much less (13%) (Smith 2012b). However, some riparian areas historically did not support conifers. For example, the low to mid-reaches of the Snake River tributary systems were historically dominated by cottonwood (Kuttel 2002). This is the area where much of the eastern Washington CREP sites are located and current levels of conifer are low. Because this area did not historically support much conifer, the lower levels are justified.

Another desirable component is to have at least some fast-growing native plants. This can provide shade and cooler water temperatures sooner, and can aid in the control of invasive plant species. Invasive plant species are a major problem. Changes in dominant riparian plants result in changes in riparian function (Richardson et al. 2007), and invasive plants generally have reduced riparian function. Maintenance of newly restored riparian buffers is vital to the control of invasive species and for improved growth and survival of the native tree and shrub species (Roni et al. 2002, Oregon Watershed Enhancement Board 2010, Cramer 2012). Many authors recommend several years of maintenance, with one recommending up to ten years to control invasive species (Lennox et al. 2011). We fund active maintenance of the buffers for up to five years after planting, primarily to assure control of invasive plant species. Invasive plant species coverage is low in CREP sites (3% or less average). This compares to riparian restoration sites in Oregon had invasive plant species coverage ranging from 1-49% depending on the region (Demeter Design 2010).

It is useful though to know which native tree and shrub species are high growth performers so that they can be used in problematic sites if appropriate for those sites (selected plants must still meet the local conditions such as flood/drought tolerance, etc.). The plants with the greatest growth in eastern Washington restoration sites are: blue elderberry, serviceberry, and willow (Smith 2012b).

Western Washington CREP plants with high growth rates are: Pacific willow, black cottonwood, red alder, and birch.

Overall, the CREP plants in Washington State are growing at rates that are generally equivalent or greater than those documented elsewhere. Growth rates for most of the sampled contracts are high for both the arid regions in the east and the wet areas of the west. When comparing to the available information, the CREP sites are meeting or exceeding expectations. In these other studies, conifer growth of 1+0 Douglas fir plugs and 2+0 bareroot was 4.2 inches and 4.3 inches per year after two years respectively, in western Oregon (Helgerson 1985). Ponderosa pine grew 4.1 and 4.7 inches per year for plugs and bareroot. In another study, mixed age conifers grew an average of 1.9 inches per year for Douglas fir and 2.6 inches per year for western hemlock along the Pacific coast (Hann et al. 2003). British Columbia reported riparian conifer growth rates of 6.1 to 17.6 inches per year (Poulin and Warttig 2005). Most of these growth rates are lower than our conifer rates of 10.6 inches per year in eastern Washington and 14.3 inches per year in western Washington.

Results for deciduous tree growth are highly variable. Washington CREP deciduous trees averaged 29.3 inches per year in western Washington and 10.6 inches in eastern Washington, while shrubs grew an average of 15.4 inches per growing season in western Washington and 12.7 inches per year in eastern Washington. In a similar restoration project in western Oregon, red alder grew an average of 39.4 inches per year (Bishaw 2002), compared to 30.7 for the same species in the Washington CREP. In another study in British Columbia, black cottonwoods grew an average of 66 inches per year over a ten-year period (Burns and Honkala 1990), whereas the same species in western Washington CREP sites grew 48.4” per year. Along the Sacramento River, cottonwoods and willows planted in restoration sites were the most successful species in terms of growth, at 28” per year (Alpert et al. 1999). Pacific willow, a commonly used small tree in CREP projects, averaged 13.2-36” per year in Corvallis, Oregon (USDA Soil Conservation Service and Oregon State University Agriculture Experiment Station 1988). Pacific willow in the Washington CREP was our fastest growing plant at 49.8” per year.

While there are no set standards for plant growth in CREP, we consider sites successful if the growth/year of CREP plants plus the original height are showing a 20% increase compared to the original height. All of the sampled CREP plant types (conifer, deciduous, and shrub) in both regions greatly exceeded this measure of success.

Plant Survival

Plant survival is another measure of riparian buffer success. It is more difficult to measure, especially as the buffers age, because missing plants become more difficult to notice. Average percent survival of sites across eastern Washington was under the goal of 85%. It averaged 80%. The western Washington sites performed very well with 91% average survival.

Survival results differ greatly in the literature, and depend heavily on weather patterns and environmental conditions, which can vary locally. In an Oregon study, survival of conifers averaged 98% for bareroot stock and 89% for plugs after two growing seasons (Helgerson 1985). However, in a recent restoration project along Beaver Creek in Oregon, survival was about 50% during the first year (due to beaver damage), but after providing better protection, increased to a range of 67-75% after three years (Bishaw et al. 2002). A riparian project in the Oregon high desert reported early survival results of 70-80% for a mix of ponderosa pine, deciduous trees, and shrubs (Fox Creek Farm 2006). The Oregon Watershed Enhancement Board (Anderson and Graziano 2002) monitored many riparian restoration sites and found that slightly less than half of these projects had tree survival rates of 75% or greater. Riparian restoration projects in Vermont had better survival of around 72% at year three after planting (Szafranski 2012). These comparisons are similar to our results in eastern Washington and lower than our western Washington average.

The Salmon Recovery Funding Board (SRFB) in Washington State defines plant survival as successful when survival is 50% or greater at year 10 (Crawford 2004). In year 3, 89% of their riparian projects met this criterium (Tetra Tech 2011). Several of our sampled CREP contracts are 8-9 years old with survival of 80-100%. The NRCS plant stocking specifications assume a15-20% mortality within the first few years, which is why we chose a goal of 85% survival. The majority of Washington CREP sites are generally performing better than these assumptions.

These results demonstrate that the Washington State CREP buffers are successfully growing and surviving with generally rich plant species diversity. The small streams are quickly shaded, and the five-year maintenance program appears to be successful in controlling invasive plant species at least through the 10 years of sampled contracts.

CREP Buffer Widths and Function

The vast majority (93%) of CREP projects use the riparian forest buffer practice. This has a minimum buffer width of 35’ and the program provides funding for up to 180’ in buffer width. Some buffers extend past 180’ using exclusion fencing and upland watering facilities to direct livestock away from steep areas. The most common buffer width used in the Washington CREP is 180’ and 80% of existing CREP contracts have riparian buffer widths of 100’ or greater. The average width is 142’.

Riparian buffers that are 100’ or wider are able to provide a wide-array of functions. Literature values indicate that high levels of shade (50-100%) are achieved with these widths (see review by Knutson and Naef 1997, Spence et al. 1996). Riparian buffers at these widths are fully functional for filtering nutrients, controlling bank erosion, supplying leaf litter and organic material, and retaining soil moisture (Spence et al. 1996, Knutson and Naef 1997, Fischer and Fishenich 2000). The provision of large woody debris requires buffer widths of approximately 100-180’ (Cederholm 1994, Knutson and Naef 1997). Many of the CREP buffers are adequate for this function. However, for wide streams with narrower buffers (35-100’), it is likely that those sites will not be fully functional in large woody debris recruitment. These are low in number in the Washington CREP.

CREP Minimum Buffer Width Issues

Riparian buffer widths are a contentious issue in Washington State. Some entities are demanding wider minimum buffer widths in voluntary incentive programs. One current proposed new minimum is 100’. CREP buffer widths are based upon NRCS practice standards and associated tools. Our current minimum buffer width for CREP is 35’. However as discussed above, less than 1% of our contracts are at this minimum width, and our average buffer width is 142’.

Even though most of the Washington CREP sites have an average buffer width that is greater than 100’, it is important to continue to offer a minimum buffer width that is narrower, such as the current minimum of 35’. This serves two purposes: 1) it allows site-specific flexibility when developing the resource plan and 2) it is a tool to begin conversations with landowners about riparian buffers. Often, landowners first want to know how much land they have to give up when initially approached about the program. We had higher minimum buffer widths in the past, and found that landowners were more difficult to sign-up when we only had wide buffer width options. However, when approached with a narrower buffer width, landowners were open to conversation and some would not only sign-up in the program, but agree to a wide buffer width as the conversations progressed. When they see a larger financial benefit for an enrollment of a 180’ buffer, many decide to accept even though they first were adamant about discussing the program. The narrower minimum opened the door to the discussion, and follow-up visits resulted in a wide buffer acceptance.

The need for site-specific flexibility is even more important. The 2-CRP Handbook states a minimum buffer width that must be followed by technicians when designing CREP buffers. The minimum must be adhered to with very few exceptions. For example, the buffer cannot dip below 35’ to accommodate roads, property boundaries, agricultural use, etc. It is common for CREP sites to be irregular in shape. A site with an average width of 100’ may dip inwards to 35’ in places to accommodate productive agricultural fields and then balloon out in wetter, less-productive areas. While the average buffer width of such a site is 100’ wide, the minimum is 35’, and the maximum could be 180’ or more. Without the flexibility of such a minimum, the site would either not be enrolled at all, or less length of the property would be enrolled. This will result in fewer contracts and smaller sized buffers. Examples are shown in Figures 16-18.

Figure 16. An existing CREP site outlined in yellow designed to preserve an agricultural field. If the minimum buffer width is increased to 100', the buffer would be smaller and would exclude the areas to the left of the red lines. This would result in a smaller buffer and much less stream length coverage.

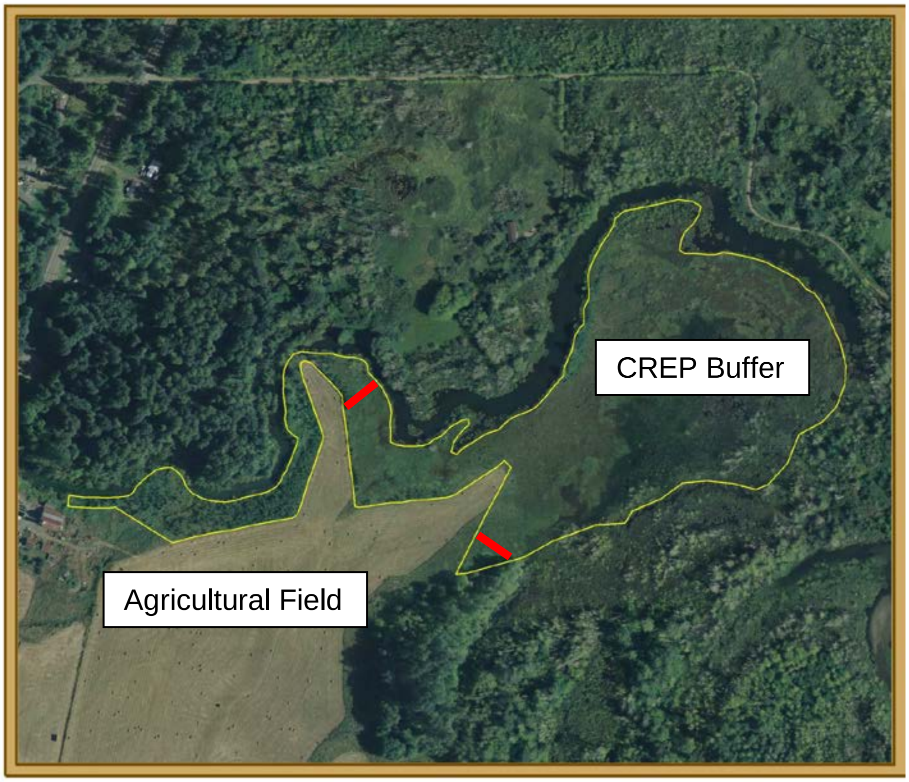


Figure 17. A planned CREP site that would be greatly reduced in size if the minimum buffer width were increased to 100'. The current buffer plan averages 180' with minimums of 35' at each end of the buffer as outlined in green. This accommodates the landowner's need to preserve their agricultural area, while still providing a maximum sized buffer. If the buffer minimum is changed to 100', the flexibility to work around the agricultural fields decreases. This would delete planned buffer areas that are less than 100' in width (both ends of the buffer) and also narrow the middle, wider part of the buffer so that an average of 180' is not exceeded. Overall result is that livestock will be closer to the river and the buffer length will be reduced by about 1700'. The outer boundaries of this new, smaller buffer are outlined in red.

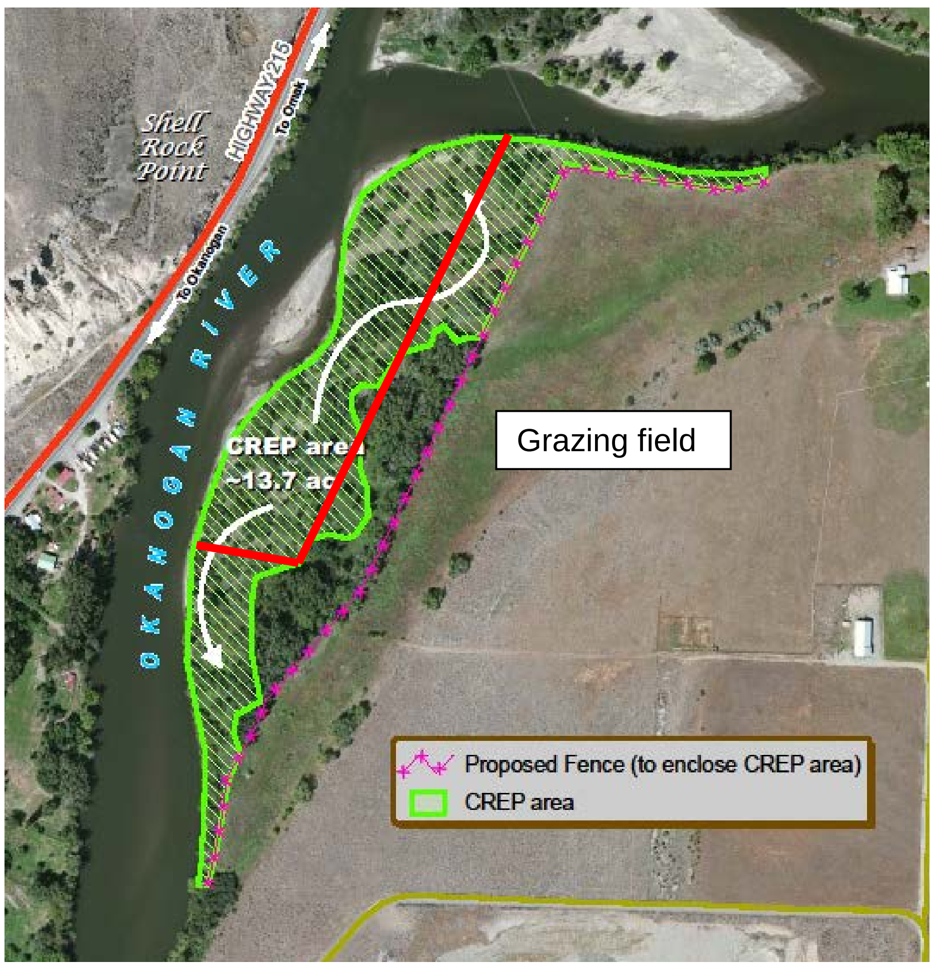
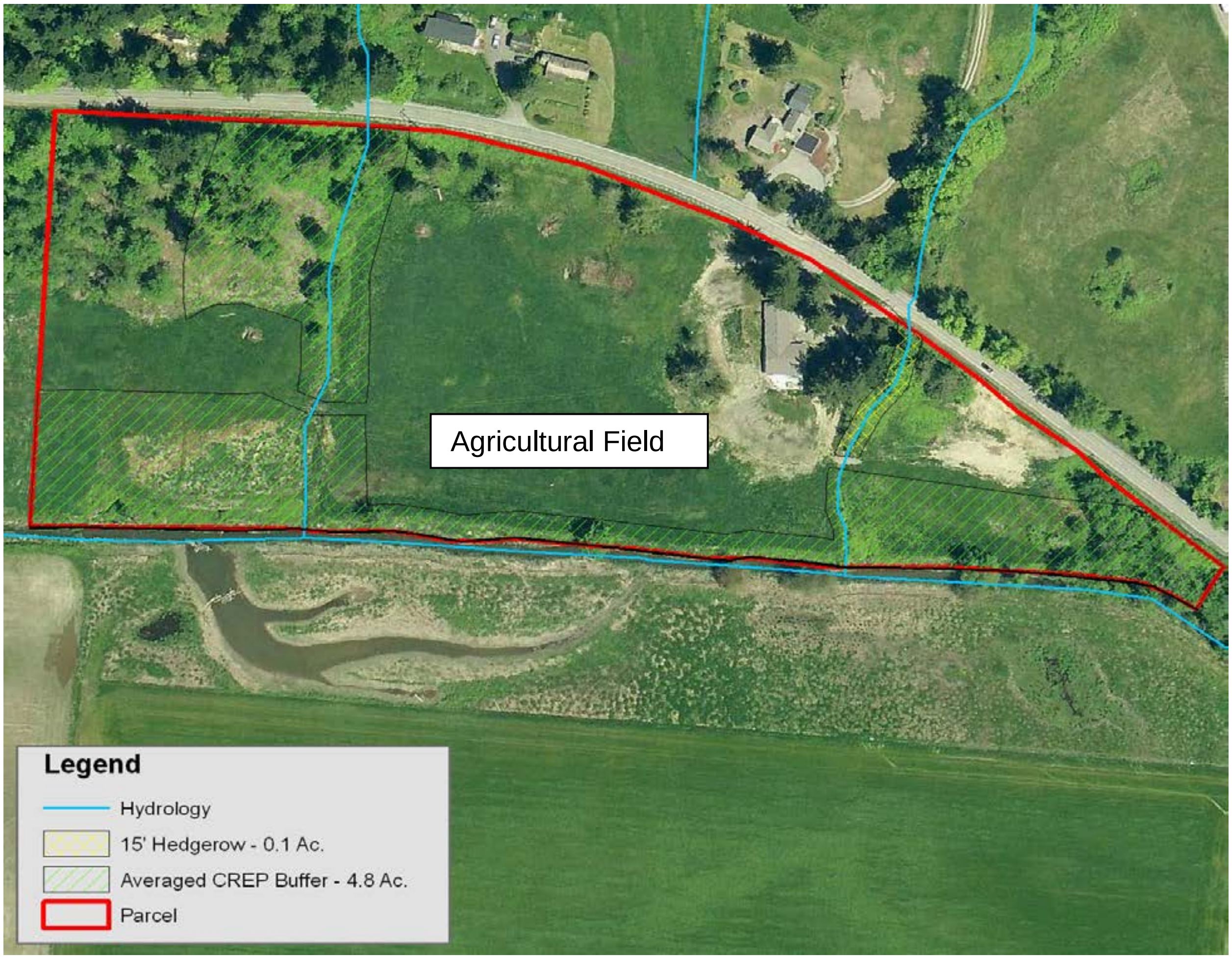


Figure 18. This is a planned CREP buffer that varies in width for an overall average of 96'. The parcel is outlined in red and is irregularly shaped, constrained by a road to the east. The landowner will not enroll more than 35' of buffer in the middle section to protect a productive agricultural field. The planned buffer is denoted by the hatched area and designed to preserve the center field. If the minimum buffer width were increased to 100', the landowner would not enroll.



Meeting Environmental Goals

There are many different types of environmental goals and concerns in Washington State, but two directly pertain to the Washington CREP. Those are salmon riparian habitat recovery/salmon populations and water quality improvements, especially water temperature. In 2011, the CREP monitoring results were examined in concert with salmon numbers and water quality measurements (Smith 2012a). Two watersheds showed significant improvement in at least one of those two environmental goals. Water temperatures in the Tucannon River decreased by 10^o F in the decade following riparian restoration

(Steve Martin, Snake River Salmon Recovery Board, personal communication). As water temperatures cooled, juvenile spring Chinook salmon began using 20 miles of the river that were previously too warm. Adult returns of spring Chinook also increased (Gallinat and Ross 2011). In this example, both salmon and water quality improved. The second example is in the Nooksack Basin, where Ten Mile Creek had a significant level of riparian restoration, much through CREP, and also showed an improvement in summer water temperatures (Smith 2012a).

The reason these two areas showed improvements at the watershed scale for large environmental goals is because high quality work was done that encompassed a significant length of the stream. There was targeted outreach and a critical number of landowners enrolled, allowing enough length of the riparian at the watershed scale to be restored to produce a measureable difference. Another key requirement is that monitoring data were available to show the difference throughout the years, documenting conditions from the beginning of the efforts to present time.

One of the primary mechanisms for improving water temperature is increased shade or canopy cover and this is measured in the Washington CREP. Increasing shade is an effective way to decrease water temperatures and improve conditions for salmon and steelhead that rely on cool water temperatures. Opperman and Merenlender (2004) have shown that restored riparian areas led to acceptable water temperatures for steelhead as compared to controls. In concert with the literature results, our monitoring shows that shade (canopy cover) is greatly improved in as little as five years. Projects under five-years old were compared against those that were five-years or older. The older contracts averaged 68% canopy cover compared to 13% in younger contracts.

This compares to a review of riparian restoration studies in the Pacific Northwest Inland, which showed shade improvements from 3% at baseline to 31% by year four (Wall 2011). Oregon projects increased to supply 46% shade by years 10-14 after planting (Demeter Design 2010). Riparian restoration projects funded by the Salmon Recovery Funding Board did not show in increase in canopy cover at year 5, the oldest year in their study (Tetratech 2010). The Washington CREP results demonstrated increased canopy cover more quickly. Maintenance oversight and is funded and implemented for at least five years after planting. Because of this, increased plant survival and growth result in faster developing canopy cover.

Will Increasing Buffer Width Increase Success?

Although we can show success at the landowner scale with the canopy cover results, we can only show success at the watershed scale in the two above examples. Because of this and the slowness in seeing sufficient salmon recovery, there has been increasing criticism regarding riparian restoration in Washington State. That criticism has led to an assumption that the problem is buffer width. The criticism fails to notice that buffer width is only one criteria of a successful riparian buffer. May and Horner (2000) have clarified the definition of successful riparian buffers. They state that resource concerns should be addressed at a watershed level, and successful buffers should be judged based upon 1) width, 2) quality, and 3) corridor connectivity (length) at the watershed scale. Richardson et al. (2012) also report the need to assess riparian buffers at a watershed scale.

The response by critics in Washington State is to address future habitat restoration needs by focusing only on riparian buffer widths at the landowner scale. This will result in a new, wider, riparian buffer width. As shown in the previous section, increasing the minimum riparian width will have unintended consequences. It will decrease the size of CREP buffers by reducing the flexibility to work around agricultural fields, property boundaries, infrastructure, roads, and other site-specific issues. It will also result in fewer CREP contracts. The final result will be smaller buffers in length and fewer contracts yielding further decreases in buffer length at the watershed scale.

Instead of focusing on buffer width at the landowner scale, increased effort is needed to focus on buffer *length* at the *watershed scale*. There are three major riparian buffer criteria to meet (width, quality, and length). Regarding current width, the average, current CREP buffer is 142’ and the desired, proposed buffer width is 100’. This suggests that buffer width is not the problem. The monitoring results demonstrate that the quality of CREP buffers is not a problem either with a diverse array of native trees and shrubs surviving at 80-91%. However, statewide the length of streams covered with high quality buffer remains low. In the Washington CREP, we have identified 10,000 miles of streamside habitat that is eligible for CREP. Not all of this is likely degraded, but much probably is. There isn’t a complete inventory to estimate the quantity. To-date, only about 800 miles of stream have been restored in CREP. This is only 8% of the total length. Even if 10,000 miles is an overestimate of the need, the amount restored is still not close to the needed length of buffer statewide.

To increase buffer length, increased participation and more contracts are needed. Increasing the buffer width will have the opposite effect. Instead, there are other actions that can have a positive effect on participation. These include:

- Increase financial incentives to increase participation. This could be used to prioritize areas or to increase sign-ups statewide.
- Target contiguous landowners within a watershed. This has been shown to lead to increased water quality and salmon numbers in the Washington CREP (Smith 2012a). Priority watersheds could be identified and additional outreach efforts used to target those areas. This could be combined with higher financial incentives.

- Increase financial incentives to those who enroll a wide buffer. While they already receive more money because they are enrolling a greater amount of land, this could be further incentivized if wider buffers are desired.
- Reduce financial constraints on buffer enrollment in CREP. These include the cap on CRP and CREP payments and the Adjusted Gross Income cap.

Tools to increase incentives could include raising rental rates, increasing the sign-up bonus, or providing a contiguous parcel bonus. The CREP in Oregon has a contiguous parcel bonus, called a cumulative impact bonus (CIB). It is a one-time payment equal to 4 times the rental rate given to all the participating landowners who together enroll at least 50% of a given 5-mile stretch into CREP (Lois Loop, personal communication, Oregon FSA).

The Washington CREP has demonstrated success at the landowner level to improve riparian conditions for salmon and water quality. This indicates that buffer width and quality of the buffer are not the issues that prevent success from being demonstrated at a broader level. Instead, the amount of stream length restored appears to be the greater issue. This can be overcome with increased participation. Increased incentives and/or a reduction of hurdles to enroll in the program are possible solutions. Targeting outreach to priority watersheds would also help in demonstrating positive results.

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