

2012 Revegetation Monitoring

Introduction

The Rocky Flats Site (Site), a U.S. Department of Energy facility, is located near Golden, Colorado. For nearly 40 years during the Cold War, the facility produced nuclear weapons components and was an integral part of the United States' nuclear weapons program. In the early 1990s, the facility was shut down, and cleanup and closure activities began. As part of the cleanup and closure, the buildings, roads, and other infrastructure in the Industrial Area were removed. Approximately 650 acres were disturbed during cleanup activities, which were completed in fall 2005. The disturbed areas were revegetated to prevent erosion and sedimentation of the Site streams and to meet water quality standards. Reestablishment of native plant species is also beneficial to wildlife and provides desirable vegetation and ground cover adjacent to the Rocky Flats National Wildlife Refuge. As part of the revegetation process, monitoring is conducted to determine whether success criteria, as stated in the *Rocky Flats, Colorado, Site Revegetation Plan* (Revegetation Plan; DOE 2009) are being met, as well as to determine how these revegetation areas need to be managed.

The success criteria, as stated in the Revegetation Plan, are as follows:

- A minimum of 50 percent of the seeded native species will be present at the revegetation site.
- The revegetation site will have a minimum of 70 percent total ground cover that comprises litter cover, current-year live vegetation basal cover, and rock cover.
- The revegetation site will have a minimum of 30 percent relative foliar cover of live desired species (seeded or nonseeded native species). Relative cover is defined as the percentage of cover of a given species divided by the total amount of vegetation cover present.
Example: Species A has 20 percent absolute cover, and total vegetation cover (all individual species cover values summed) is 80 percent:

$$\text{Relative cover of Species A} = (20 \div 80) \times 100 = 25 \text{ percent}$$

- No single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives).

This report summarizes the revegetation monitoring results for data collected during 2012.

Methods

Each of the locations monitored in 2012 had previously met the success criteria. However, as part of the long-term stewardship of the Site, the various revegetation locations are monitored every few years to evaluate the long-term sustainability of the vegetation and the potential successional changes in plant community composition.

Semi-quantitative revegetation monitoring was conducted during the summer 2012. The monitoring method provided in the Revegetation Plan, with some modification, was used. The

revegetation areas were divided into units on the basis of geographic features (e.g., roads, streams) or previous building areas (e.g., 700 Area, 400 Area). The unit boundaries were the same as had been used for previous sampling efforts. Thirteen revegetation units were sampled in 2012 (Figure 1¹).

Within each revegetation unit, sample locations were randomly generated in the Geographic Information System and located on the ground using a Global Positioning System unit. Quadrats that measured 50 centimeters by 100 centimeters were used to sample the vegetation at each location. Depending on the size of the area, the number of quadrats sampled in each area varied from 10 to 30. A total of 240 quadrats were sampled in 2012 (Table 1). At each quadrat, both species richness and species cover were assessed. A species was listed as present for a quadrat if any part of the plant was located within or overhung inside the quadrat boundary. Foliar cover was estimated for each species using the following cover class system and midpoints (in parentheses): 1 = <5 percent (2.5 percent), 2 = 6–25 percent (15 percent), 3 = 26–50 percent (37.5 percent), 4 = 51–75 percent (62.5 percent), 5 = 75–95 percent (85 percent), 6 = >95 percent (97.5 percent). Basal vegetation cover, litter cover, rock cover, and bare ground cover were also estimated within each quadrat using the cover class system.

Species lists were generated for each revegetation unit by combining the quadrat data for that unit. The midpoint value of each cover class was used to calculate the average absolute and relative foliar cover by species across the quadrats sampled for each revegetation unit. The percentage of absolute foliar cover was calculated as the sum of cover values for a species in a revegetation unit divided by the number of quadrats sampled in that unit. Relative foliar cover was calculated as the sum of all cover values for a species in a revegetation unit divided by the sum of cover values for all species in the same revegetation unit, multiplied by 100. The midpoint values were used to calculate the average cover at each revegetation unit for basal vegetation, litter, and rock.

Results and Discussion

Table 2 shows the species richness (number of species) found at each revegetation location, a list of species seeded², and the seeded species found growing at each location in 2012. Species richness in 2012 ranged from a low of 13 species in unit L33, to a high of 34 species in unit L21. Tables 3 and 4 list the species present at each revegetation location. The wide range in the number of species present is attributable to a number of factors, including how long ago the area was revegetated, size of the location, number of quadrats sampled in the location, degree of disturbance in the area prior to revegetation, and management actions (e.g., weed control) that have been conducted in the area. Thirteen different seeded graminoid species had become established and were growing at some locations in 2012. These included slender wheatgrass (*Agropyron caninum* = *Agropyron trachycaulum*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), Canada wild rye (*Elymus canadensis*), junegrass (*Koeleria pyramidata*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and green needlegrass (*Stipa viridula*). Five species were established at all 13 locations in 2012: slender wheatgrass, western wheatgrass, sideoats grama, blue grama, and buffalograss. Several

¹ Although the text refers to the revegetation units with a prefix of “L,” (e.g., L1), the revegetation unit numbers are shown on Figure 1 without the “L”.

² Slightly different seed mixes were used at the revegetation locations depending on the year they were seeded and the slope position.

noxious weeds were also found at the locations monitored in 2012. These included quackgrass (*Agropyron repens*), downy brome (*Bromus tectorum*), filaree (*Erodium cicutarium*), diffuse knapweed (*Centaurea diffusa*), Canada thistle (*Cirsium arvense*), bindweed (*Convolvulus arvensis*), Russian olive (*Elaeagnus angustifolia*), St. John's-wort (*Hypericum perforatum*), Dalmatian toadflax (*Linaria dalmatica*), moth mullein (*Verbascum blattaria*), and common mullein (*Verbascum thapsus*). Total mean absolute foliar cover of noxious weeds at the various locations ranged from 0.1 percent to 12 percent (Tables 3 and 4). Weeds will continue to be managed as needed to reduce noxious weed populations in the revegetation areas and enable the desired seeded species to become established more quickly and compete with the weeds.

The Revegetation Plan states that at least 50 percent of the seeded species must be present in an area for it to be considered successful. All 13 locations met this criterion in 2012 (Tables 2 and 5). Ground cover protection from rock, litter, and current-year live vegetation varied from 72 percent to over 100 percent at the revegetation locations in 2012 (Table 6). The occasional values over 100 percent are the result of the class system used for estimating cover, which estimates cover values into a range and uses the midpoint of the cover class for analysis. The Revegetation Plan states that a minimum of 70 percent total ground cover comprising litter cover, current-year live vegetation basal cover, and rock cover is to be present to help prevent erosion. All 13 locations met this criterion in 2012 (Tables 5 and 6).

The third success criterion states that a minimum of 30 percent relative cover of desired species must be present, and the fourth criterion states that no single species should constitute more than 45 percent of the total relative cover. Tables 3 and 4 summarize the foliar cover data by location for 2012. The shaded row, titled "Total Herbaceous Native Cover," at the bottom of each table shows the percentage of cover of desired species at each location. The values that are higher than 30 percent at each revegetation location are shaded, indicating that these locations have met this success criterion. Total relative vegetation cover of desired (native) species was greater than 71 percent at all 13 of the locations monitored in 2012. Five of the 13 monitored revegetation locations (38 percent) had a single species that constituted greater than 45 percent of the relative cover in 2012 (Tables 3 and 4). Four of these locations were dominated by western wheatgrass (one of the seeded native species), and the other location was dominated by sideoats grama (also a seeded native species). All five locations failed to meet all four success criteria solely because they each had a single species that covered greater than 45 percent of the area (Table 5).

Regarding the use of the success criteria, the Revegetation Plan states:

Success criteria and monitoring are an important component of a revegetation project . . . *These success criteria are provided as initial guidance; however, common sense combined with scientific data must be applied to final evaluations to determine whether further management actions are required* [emphasis added].

Additionally, the Revegetation Plan's success criterion regarding dominance by a single species states that "[n]o single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives)" [emphasis added].

Western wheatgrass and sideoats grama are desirable native species. At locations that fail only this last criterion, and otherwise have a good stand of vegetation, several questions are worth considering:

- Is the dominance of these areas by a single species (with greater than 45 percent relative foliar cover) detrimental to long-term wildlife and habitat management?
- Is the dominance by these species likely to change in the future?
- Is there any other reason not to pass these locations in 2012, just because they failed this last criterion?

As discussed in previous years, one way to answer the first question is to evaluate the dominance of relative foliar cover of native species on the undisturbed native grassland areas of the Site. Do native species account for greater than 45 percent of the cover at some locations on the native grasslands? Monitoring data for several native grassland locations at the Site are summarized in Table 7. Monitoring in 2009 at two reference locations in native grassland used for Preble's meadow jumping mouse mitigation monitoring (Original Landfill and A-Ponds reference areas) showed that western wheatgrass provided, respectively, 54 and 59 percent relative foliar cover. At TR06, a xeric grassland monitoring location at the Site, data collected over multiple years showed that needle-and-thread grass (*Stipa comata*), a native grassland species, consistently provided greater than 45 percent relative foliar cover. Because it is not uncommon for some of the native graminoid species to dominate the foliar cover at some locations, it is unlikely that the dominance of western wheatgrass or sideoats grama at these revegetation areas will be detrimental to long-term wildlife and habitat management.

Relative foliar cover of different species and overall vegetation cover also commonly fluctuate in response to environmental conditions, such as temperature and the amount and timing of precipitation. Table 7 shows some of this fluctuation for western wheatgrass at TR02 and TR04 (both mesic grassland monitoring locations) and at the Original Landfill revegetation area, for needle-and-thread grass at TR06 and TR11 (mesic grassland monitoring locations), and for overall foliar cover at TR02. Annual fluctuations in species cover are common in response to changing environmental conditions. Therefore, although some of the locations monitored were dominated by individual species with greater than 45 percent cover in 2012, this may change over time as environmental conditions change. Given the evidence that dominance by a single species occurs on the native prairie, and given that annual fluctuations in foliar cover are common, there is no practical reason these locations cannot be considered to have passed all four criteria in 2012. David Buckner, an ecologist under contract with the U.S. Environmental Protection Agency (EPA), conducted revegetation monitoring for EPA at the Site in 2009, 2010, and 2011. He noted similar conditions in the revegetation areas they sampled, and he has no concerns for areas with greater than 45 percent cover by a single species. In the 2010 report, he states, "The single sample showed that western wheatgrass comprised half of the cover, and though slightly in excess of the 45% DOE criterion, it is not likely that this represents a problem situation. Many native stands on finer-textured soils 'naturally' have as much western wheatgrass as is present here, or more" (EPA 2010). Consequently, all of these locations are considered to have passed this criterion.

In summary, all 13 locations (approximately 74 acres) continued to meet all four criteria in 2012. This continues to demonstrate that the vegetation has become well established and that the vegetation should be sustainable in the long-term.

To evaluate potential successional change and trajectories in plant community composition a comparison of past monitoring data was made with the 2012 data for each location. Table 8 shows a comparison of the 2008 through 2012 summary data for total species richness found at each revegetation location, percentage of seeded species present, total absolute foliar cover, total

native relative foliar cover, total absolute ground cover, and the list of species that contributed 5 percent or more of total relative foliar cover at each location. Some locations have no data for a specific year because no monitoring was conducted at those locations in that year.

Changes in species richness from 2008 to 2012 varied by location. Four locations showed increases in species richness (ranging from one to eight species) while the other nine locations showed declines (ranging from a loss of one to 25 species). The declines are likely due to two primary causes. Initially most revegetation locations tend to have a flush of weedy species that can account for high species richness at the beginning of a project. As the seeded perennial graminoids begin to establish, some of the early successional weedy species are outcompeted and disappear from the area, thereby accounting for some loss of richness. An additional factor that probably accounts for the larger declines in richness are the herbicide applications that have been made at these locations to remove the weedy competition and allow the seeded native graminoid species a better chance to establish.

Total absolute foliar cover has gone up at 12 of 13 locations from 2008 to 2012. At one location it declined by one percent. An increase in the absolute foliar cover means the abundance of vegetation is continuing to increase across these areas and therefore providing additional soil protection and reducing the potential for surface erosion. The total relative native cover increased at 10 of 13 locations. These two measures suggests that a “native” prairie is establishing and is not merely weedy vegetation. The decrease in total relative native cover at three locations is largely a result of an increase in non-native graminoid cover [from species such as smooth brome (*Bromus inermis*), Japanese brome (*Bromus japonicus*), and Canada bluegrass (*Poa compressa*)] combined with a small increase from various species of non-native forbs.

The seeded native species continue to increase in dominance at each of these revegetation locations. Table 8 lists the species that contributed more than 5 percent cover at each location from 2008 through 2012 (where data are available). The early dominance by the native, short-lived, cool-season, perennial, slender wheatgrass has given way to an increase in western wheatgrass (a long-lived, native, cool-season species) as the slender wheatgrass has declined. Slender wheatgrass is used in the seed mixes at the Site because it is a good early native colonizer, which is expected to decline over time. It provides good vegetation cover for other slower establishing species such as many of the warm-season species. Examination of the species listed at the bottom of Table 8 shows the continuing increase in warm-season, native graminoid cover as time progresses. The mix of both cool-season and warm-season graminoids is desirable for long-term sustainability.

In general, the successional trajectory of the revegetation areas is on track and should result in long-term sustainable native grassland communities in the Central Operable Unit. Continued proactive management of noxious weeds using an integrated vegetation management program will aid in that process.

Correction

While comparing the 2008 revegetation foliar cover data to the 2012 data it was discovered that there was an error in a few of the spreadsheet calculations that were presented in the foliar cover tables (Tables 3-8) in the 2008 revegetation report. The errors did not change the results or conclusions stated in the 2008 report, but corrected tables are provided on the Ecology DVD.

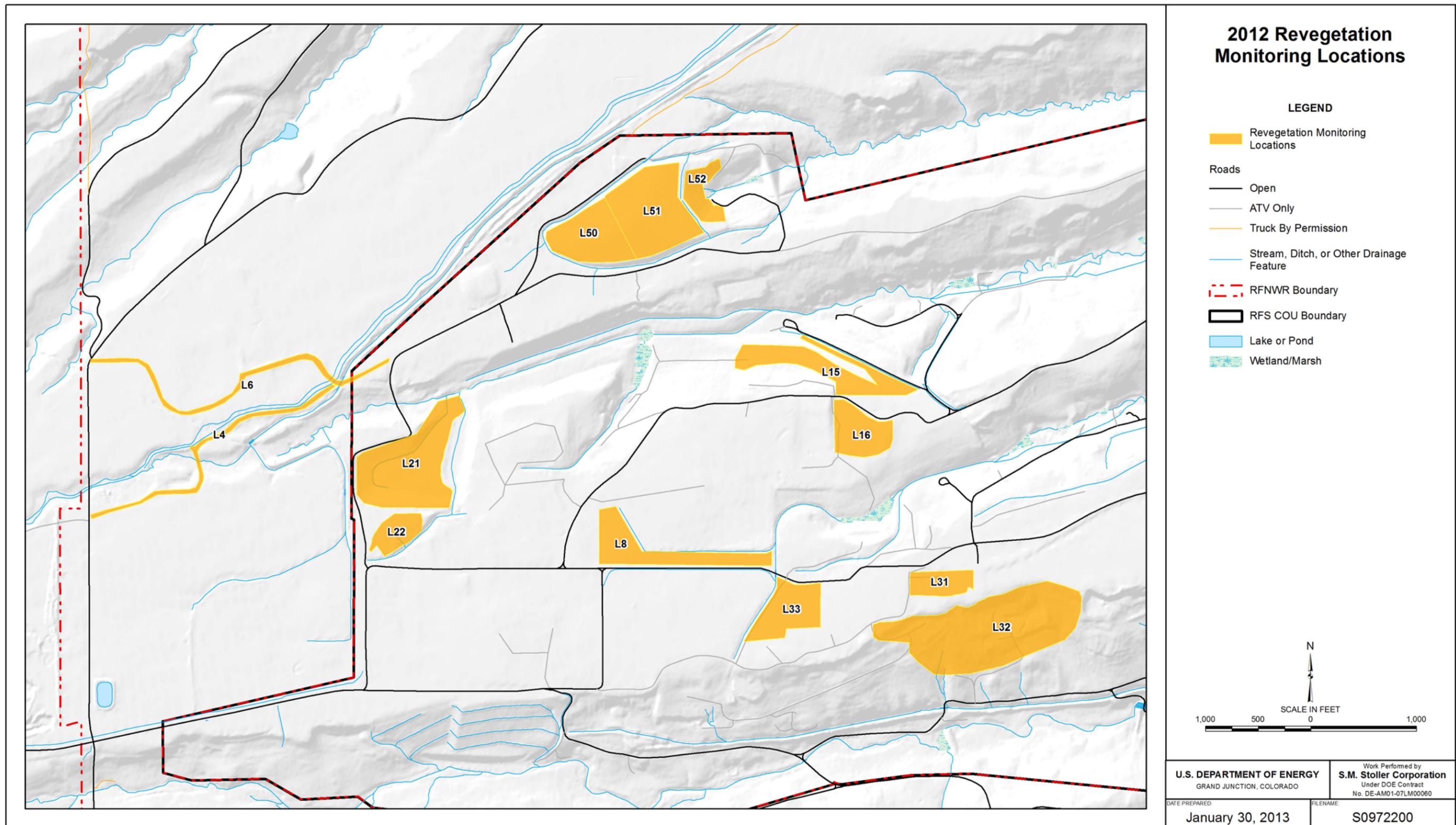
Summary

Thirteen revegetation units, all of which had previously met the success criteria, were monitored again in 2012. The data showed that they continue to meet the success criteria and should be sustainable in the long term for stabilization of the soils, providing erosion protection, and providing good habitat for wildlife.

References

DOE (U.S. Department of Energy), 2009. *Rocky Flats, Colorado, Site Revegetation Plan*, LMS/RFS/S04513, Office of Legacy Management, Grand Junction, Colorado, January.

EPA (U.S. Environmental Protection Agency), 2010. *Report of Findings Revegetation Assessment, Rocky Flats Site, Jefferson County, CO*, prepared by ESCO Associates Inc., October.



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Figure 1. 2012 Revegetation Monitoring Locations

Table 1. Number of Quadrats Sampled per Location in 2012

Location	# Quadrats Sampled
L4	20
L6	20
L8	20
L15	20
L16	20
L21	30
L22	10
L31	10
L32	30
L33	20
L50	15
L51	15
L52	10
Total Quadrats Sampled	240
Total Locations Sampled	13

Table 2. Species Seeded By Location and 2012 Total Species Richness Summary

	Location	L4	L6	L8	L15	L16	L21	L22	L31	L32	L33	L50	L51	L52
	Seed Mix	X	X	X	M	X	X1	X	X	M	X	X3	X3	M
Family	Scientific Name													
Graminoids														
POACEAE	Agropyron caninum	X	X	X	X	X	X	X	X	X	X	X	X	X
POACEAE	Agropyron dasystachum				X					X		X	X	X
POACEAE	Agropyron lanceolatus (= A. griffithsii)											X	X	
POACEAE	Agropyron smithii	X	X	X	X	X	X	X	X	X	X	X	X	X
POACEAE	Andropogon gerardii	X	X	X		X	X	X	X		X	X	X	
POACEAE	Andropogon scoparius	X	X	X		X	X	X	X		X			
POACEAE	Bouteloua curtipendula	X	X	X	X	X	X	X	X	X	X	X	X	X
POACEAE	Bouteloua gracilis	X	X	X	X	X	X	X	X	X	X	X	X	X
POACEAE	Buchloe dactyloides	X	X	X	X	X	X	X	X	X	X	X	X	X
POACEAE	Elymus canadensis						X							
POACEAE	Koleria pyramidata	X	X	X		X	X	X	X		X	X	X	
POACEAE	Panicum virgatum						X							
POACEAE	Poa canbyi											X	X	
POACEAE	Sorghastrum nutans	X	X	X		X	X	X	X		X	X	X	
POACEAE	Sporobolus cryptandrus	X	X	X		X	X	X	X		X	X	X	
POACEAE	Stipa viridula	X	X	X	X	X	X	X	X	X	X	X	X	X
Forbs														
ASTERACEAE	Achillea millifolium													
ASTERACEAE	Gallarida aristata													
ASTERACEAE	Liatris punctata													
ASTERACEAE	Ratibida columnifera													
LINACEAE	Linum lewisii (L. perenne)													
	Total # Species Seeded	11	11	11	7	11	13	11	11	7	11	13	13	7
	# Present in 2012	8	7	6	6	7	11	9	9	6	8	10	9	6
	% Seeded Species Present in 2012	73	64	55	86	64	85	82	82	86	73	77	69	86
	Total Species Richness in 2012	31	23	19	21	20	34	22	18	24	13	27	30	18

Seed Mixes: X = Xeric Seed Mix, X1 = Variation on Xeric Seed Mix, X3 = Variation on Xeric Seed Mix, M = Mesic Seed Mix, (see above list for specific species in seed mix).

Yellow shaded cells mean the success criterion of >50% of seeded species was met in 2012.

Blue shaded cells mean the species was present at this location in 2012.

Table 3. Revegetation Locations L4 to L22 Foliar Cover Summary 2012

Scientific Name	Speccode	Growth Form	Native	Cool/Warm Season	Noxious Weed	L4		L6		L8		L15		L16		L21		L22	
						Absolute Cover (%)	Relative Cover (%)												
<i>Alyssum minus</i> (L.) Rothmaler var. <i>micranthus</i> (C. A. Mey.) Dudley	ALM11	F	N			2.3	3.4	0.4	0.7	0.6	1.4					0.1	0.3	2.5	4.8
<i>Centaurea diffusa</i> Lam.	CED11	F	N		X	0.1	0.2			0.3	0.6			0.1	0.2				
<i>Cirsium arvense</i> (L.) Scop.	CIAR1	F	N		X														
<i>Convolvulus arvensis</i> L.	COAR1	F	N		X	0.4	0.6					1.0	1.8	1.8	2.9				
<i>Erodium cicutarium</i> (L.) L'Her.	ERCI1	F	N		X	1.4	2.1	0.6	1.1			0.1	0.2	0.4	0.6			0.3	0.5
<i>Hypericum perforatum</i> L.	HYPE1	F	N		X														
<i>Kochia scoparia</i> (L.) Schrad.	KOSC1	F	N					1.0	1.8	2.1	4.8			1.3	2.1				
<i>Lactuca serriola</i> L.	LASE1	F	N							0.1	0.3	0.1	0.2	0.3	0.4	0.2	0.6		
<i>Linaria dalmatica</i> (L.) Mill.	LIDA1	F	N		X														
<i>Medicago lupulina</i> L.	MELU1	F	N													0.5	1.8		
<i>Melilotus officinalis</i> (L.) Pall.	MEOF1	F	N			0.1	0.2					0.1	0.2			1.2	4.3		
<i>Oxalis dillenii</i> Jacq.	OXDI1	F	N			0.1	0.2												
<i>Plantago lanceolata</i> L.	PLLA1	F	N			1.8	2.7	0.3	0.4	0.1	0.3	0.3	0.5					0.5	1.0
<i>Scorzonera laciniata</i> L.	SCLA1	F	N					0.1	0.2			0.1	0.2						
<i>Tragopogon dubius</i> Scop.	TRDU1	F	N			0.1	0.2	0.3	0.4					0.1	0.2				
<i>Verbascum blattaria</i> L.	VEBL1	F	N		X			0.1	0.2										
<i>Verbascum thapsus</i> L.	VETH1	F	N		X									0.9	1.4	0.1	0.3		
<i>Ambrosia psilostachya</i> DC.	AMPS1	F	Y			0.8	1.1							0.3	0.4				
<i>Artemisia campestris</i> L. ssp. <i>caudata</i> (Michx.) Hall & Clem.	ARCA1	F	Y			0.1	0.2									0.1	0.3		
<i>Artemisia dracunculus</i> L.	ARDR1	F	Y					0.1	0.2										
<i>Artemisia ludoviciana</i> Nutt. var. <i>ludoviciana</i>	ARLU1	F	Y					0.1	0.2										
<i>Astragalus canadensis</i> L.	ASCA1	F	Y													0.1	0.3		
<i>Aster falcatus</i> Lindl.	ASFA1	F	Y																
<i>Aster porteri</i> Gray	ASPO1	F	Y			0.4	0.6	0.9	1.6							0.7	2.4	0.3	0.5
<i>Chrysopsis fulcrata</i> Greene	CHFU1	F	Y			0.1	0.2											2.0	3.8
<i>Chrysopsis villosa</i> Pursh.	CHVI1	F	Y			0.8	1.1	0.1	0.2										
<i>Conyza canadensis</i> (L.) Cronq.	COCA1	F	Y																
<i>Dalea purpurea</i> Vent	DAPU1	F	Y													0.1	0.3		
<i>Erigeron divergens</i> T. & G.	ERDI1	F	Y													0.1	0.3		
<i>Erigeron strigosus</i> Muhl. ex Willd.	ERST1	F	Y																
<i>Grindelia squarrosa</i> (Pursh.) Dun.	GRSQ1	F	Y			0.5	0.8			0.1	0.3	0.9	1.6			0.8	3.0		
<i>Helianthus annuus</i> L.	HEAN1	F	Y									0.1	0.2						
<i>Lippia cuneifolia</i> (Torr.) Steud.	LICU1	F	Y																
<i>Liatris punctata</i> Hook.	LIPU1	F	Y																
<i>Plantago patagonica</i> Jacq.	PLPA1	F	Y			0.1	0.2												
<i>Psoralea tenuiflora</i> Pursh.	PSTE1	F	Y																
<i>Senecio spartioides</i> T. & G.	SESP1	F	Y																
<i>Solidago mollis</i> Bart.	SOMO1	F	Y			0.1	0.2									0.1	0.3		
<i>Talinum parviflorum</i> Nutt.	TAPA1	F	Y													0.1	0.3		
<i>Verbena bracteata</i> Lag. & Rodr.	VEBR1	F	Y											0.4	0.6	0.1	0.3		
<i>Agropyron cristatum</i> (L.) Gaertn.	AGCR1	G	N	C										0.8	1.2				
<i>Agropyron intermedium</i> (Host) Beauv.	AGIN1	G	N	C		0.1	0.2												
<i>Agropyron repens</i> (L.) Beauv.	AGRE1	G	N	C	X							1.9	3.4						
<i>Bromus inermis</i> Leyss. ssp. <i>inermis</i>	BRIN1	G	N	C								2.5	4.6	0.1	0.2			5.3	10.1
<i>Bromus japonicus</i> Thunb. ex Murr.	BRJA1	G	N	C		0.6	1.0	0.1	0.2	0.3	0.6					0.3	1.2	0.5	1.0
<i>Bromus tectorum</i> L.	BRTE1	G	N	C	X	3.1	4.8	1.0	1.8	4.1	9.4	0.1	0.2	8.9	14.6			1.8	3.4
<i>Dactylis glomerata</i> L.	DAGL1	G	N	C		0.3	0.4			0.1	0.3								
<i>Festuca pratensis</i> Huds.	FEPR1	G	N	C						0.9	2.0	0.1	0.2					1.8	3.4
<i>Lolium perenne</i> L. var. <i>aristatum</i> Willd.	LOPE1	G	N	C														0.3	0.5
<i>Poa compressa</i> L.	POCO1	G	N	C		1.1	1.7	0.3	0.4							0.6	2.1	0.5	1.0
<i>Agropyron caninum</i> (L.) Beauv. ssp. <i>majus</i> (Vasey) C. L. Hitchc.	AGCA1	G	Y	C		1.0	1.5	2.3	4.0	4.8	10.8	4.9	9.0	5.4	8.9	1.1	4.0	0.3	0.5
<i>Agropyron smithii</i> Rydb.	AGSM1	G	Y	C		29.8	45.3	27.3	49.0	15.3	34.8	35.3	64.8	20.9	34.4	1.6	5.8	6.0	11.5
<i>Aristida purpurea</i> Nutt. var. <i>robusta</i> (Merrill) A. Holmgren & N. Holmgr	ARLO1	G	Y	C														1.5	2.9
<i>Elymus canadensis</i> L.	ELCA1	G	Y	C												0.5	1.8		
<i>Festuca ovina</i> L. var. <i>rydbergii</i> St. Yves	FEOV1	G	Y	C						0.8	1.7								
<i>Hordeum jubatum</i> L.	HOJU1	G	Y	C						1.8	4.0	0.8	1.4	0.1	0.2				
<i>Juncus balticus</i> Willd.	JUBA1	G	Y	C												0.1	0.3		

Table 3. Revegetation Locations L4 to L22 Foliar Cover Summary 2012 (cont.)

Scientific Name	Speccode	Growth Form	Native	Cool/Warm Season	Noxious Weed	L4		L6		L8		L15		L16		L21		L22	
						Absolute Cover (%)	Relative Cover (%)												
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C				0.1	0.2			0.4	0.7						
Stipa comata Trin. & Rupr.	STCO1	G	Y	C															
Stipa viridula Trin.	STVI1	G	Y	C								1.0	1.8	6.6	10.9				
Andropogon gerardii Vitman	ANGE1	G	Y	W		0.4	0.6					0.3	0.5			2.3	8.5	1.5	2.9
Andropogon scoparius Michx.	ANSC1	G	Y	W												2.5	9.1	0.5	1.0
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W		4.3	6.5	1.9	3.4	1.5	3.4	0.5	0.9	4.6	7.6	2.9	10.7	13.3	25.5
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W		4.4	6.7	4.4	7.9	1.5	3.4	1.5	2.8	2.1	3.5	2.5	9.1	2.0	3.8
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	G	Y	W		5.0	7.6	13.0	23.4	8.0	18.2	2.5	4.6	5.4	8.9	1.4	5.2	5.8	11.1
Juncus torreyi Cov.	JUTO1	G	Y	W												0.1	0.3		
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W		0.8	1.1	0.9	1.6							0.8	3.0		
Panicum virgatum L.	PAVI1	G	Y	W		1.6	2.5									3.9	14.3		
Sorghastrum nutans (L.) Nash	SONU1	G	Y	W		0.8	1.1									0.8	3.0	4.5	8.7
Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	G	Y	W		3.4	5.1	0.3	0.4	1.4	3.1			0.4	0.6	0.5	1.8	0.8	1.4
Unknown Species	UNKN							0.3	0.4	0.3	0.6							0.5	1.0
Amorpha fruticosa L.	AMFR1	S	Y													0.1	0.3		
Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	S	Y													0.6	2.1		
Yucca glauca Nutt.	YUGL1	S	Y																
Elaeagnus angustifolia L.	ELAN1	T	N		X											0.1	0.3		
Populus deltoides Marsh. ssp. monilifera (Ait.) Eckenw.	PODE1	T	Y													0.5	1.8		
Total Foliar Cover						65.6	100.0	55.6	100.0	43.9	100.0	54.4	100.0	60.6	100.0	27.3	100.0	52.0	100.0
Total Forb Cover						9.1	13.9	4.0	7.2	3.4	7.7	2.8	5.1	5.4	8.9	4.1	14.9	5.5	10.6
Total Non-Native Forb Cover						6.3	9.5	2.8	4.9	3.3	7.4	1.8	3.2	4.8	7.8	2.0	7.3	3.3	6.3
Total Native Forb Cover						2.9	4.4	1.3	2.2	0.1	0.3	1.0	1.8	0.6	1.0	2.1	7.6	2.3	4.3
Total Graminoid Cover						56.5	86.1	51.4	92.4	40.3	91.7	51.6	94.9	55.3	91.1	22.0	80.5	46.0	88.5
Total Non-Native Graminoid Cover						5.3	8.0	1.4	2.5	5.4	12.3	4.6	8.5	9.8	16.1	0.9	3.4	10.0	19.2
Total Native Graminoid Cover						51.3	78.1	50.0	89.9	34.9	79.5	47.0	86.4	45.5	75.1	21.1	77.1	36.0	69.2
Total Herbaceous Cover						65.6	100.0	55.6	100.0	43.9	100.0	54.4	100.0	60.6	100.0	26.1	95.4	52.0	100.0
Total Herbaceous Native Cover						54.1	82.5	51.3	92.1	35.0	79.8	48.0	88.3	46.1	76.1	23.2	84.8	38.3	73.6
Total Herbaceous Non-Native Cover						11.5	17.5	4.1	7.4	8.6	19.7	6.4	11.7	14.5	23.9	2.9	10.7	13.3	25.5
Total Warm-Season Graminoid Cover						20.5	31.2	20.4	36.6	12.4	28.2	4.8	8.7	12.5	20.6	17.8	65.2	28.3	54.3
Total Cool-Season Graminoid Cover						36.0	54.9	31.0	55.7	27.9	63.5	46.9	86.2	42.8	70.5	4.2	15.2	17.8	34.1
Total Noxious Weed Cover						5.0	7.6	1.8	3.1	4.4	10.0	3.1	5.7	12.0	19.8	0.2	0.6	2.0	3.8
Total Shrub Cover						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.4	0.0	0.0
Total Tree Cover						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.1	0.0	0.0

Absolute Cover = The percentage of the number of hits on a species out of the total number of hits possible.

Relative Cover = The percentage of the number of hits on a species out of the total number of vegetation hits.

Native Categories: Y = Native, N = Non-Native, NA = Not Available

Growth Form Categories: F = Forb, G = Graminoid, T = Tree

Cool/Warm Season Categories: C = Cool-Season Graminoid, W = Warm-Season Graminoid

Noxious Weed Category: X = Noxious Weed (listed on May 2006 Colorado State Noxious Weed List)

Yellow shaded cells indicate success criteria were met in 2012.

Blue shaded cells indicate this species provided greater than 45 percent of the relative cover in 2012.

Table 4. Revegetation Locations L31 to L52 Foliar Cover Summary 2012 (cont.)

Scientific Name	Speccode	Growth Form	Native	Cool/Warm Season	Noxious Weed	L31		L32		L33		L50		L51		L52		
						Absolute Cover (%)	Relative Cover (%)											
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C					0.8	1.6			2.8	5.4	0.5	1.0		
Stipa comata Trin. & Rupr.	STCO1	G	Y	C				1.3	2.0									
Stipa viridula Trin.	STVI1	G	Y	C		0.3	0.4	1.3	2.0	0.1	0.3	0.7	1.3			2.0	4.6	
Andropogon gerardii Vitman	ANGE1	G	Y	W				0.2	0.3			2.2	4.1	11.2	22.7			
Andropogon scoparius Michx.	ANSC1	G	Y	W		7.8	12.1	1.0	1.6									
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W		29.8	46.3	20.8	32.8	7.1	15.2	3.7	6.9	2.2	4.4	3.5	8.0	
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W		5.3	8.2	5.6	8.8	7.1	15.2	1.5	2.8	0.5	1.0	3.0	6.9	
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	G	Y	W		9.3	14.4	5.0	7.9	5.0	10.7	5.5	10.4	14.7	29.8	1.5	3.4	
Juncus torreyi Cov.	JUTO1	G	Y	W														
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W														
Panicum virgatum L.	PAVI1	G	Y	W				0.1	0.1									
Sorghastrum nutans (L.) Nash	SONU1	G	Y	W		4.8	7.4	0.2	0.3			0.3	0.6	0.2	0.3			
Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	G	Y	W		0.5	0.8	0.6	0.9	0.8	1.6	0.3	0.6	0.2	0.3			
Unknown Species	UNKN											0.2	0.3					
Amorpha fruticosa L.	AMFR1	S	Y															
Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	S	Y															
Yucca glauca Nutt.	YUGL1	S	Y											0.2	0.3			
Elaeagnus angustifolia L.	ELAN1	T	N		X													
Populus deltoides Marsh. ssp. monilifera (Ait.) Eckenw.	PODE1	T	Y															
Total Foliar Cover						64.3	100.0	63.3	100.0	46.8	100.0	52.8	100.0	49.2	100.0	43.8	100.0	
Total Forb Cover						2.0	3.1	3.4	5.4	0.1	0.3	6.7	12.6	8.3	16.9	11.3	25.7	
Total Non-Native Forb Cover						1.0	1.6	0.4	0.7	0.1	0.3	4.7	8.8	3.0	6.1	5.3	12.0	
Total Native Forb Cover						1.0	1.6	3.0	4.7	0.0	0.0	2.0	3.8	5.3	10.8	6.0	13.7	
Total Graminoid Cover						62.3	96.9	59.8	94.6	46.6	99.7	46.0	87.1	40.7	82.7	32.5	74.3	
Total Non-Native Graminoid Cover						3.5	5.4	17.4	27.5	0.5	1.1	8.3	15.8	1.5	3.1	6.8	15.4	
Total Native Graminoid Cover						58.8	91.4	42.4	67.1	46.1	98.7	37.7	71.3	39.2	79.7	25.8	58.9	
Total Herbaceous Cover						64.3	100.0	63.3	100.0	46.8	100.0	52.8	100.0	49.0	99.7	43.8	100.0	
Total Herbaceous Native Cover						59.8	93.0	45.4	71.8	46.1	98.7	39.7	75.1	44.5	90.5	31.8	72.6	
Total Herbaceous Non-Native Cover						4.5	7.0	17.8	28.2	0.6	1.3	13.0	24.6	4.5	9.2	12.0	27.4	
Total Warm-Season Graminoid Cover						57.3	89.1	33.3	52.7	20.0	42.8	13.5	25.6	28.8	58.6	8.0	18.3	
Total Cool-Season Graminoid Cover						5.0	7.8	26.5	41.9	26.6	57.0	32.5	61.5	11.8	24.1	24.5	56.0	
Total Noxious Weed Cover						1.3	1.9	0.6	0.9	0.1	0.3	1.7	3.2	1.0	2.0	4.0	9.1	
Total Shrub Cover						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	
Total Tree Cover						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Absolute Cover = The percentage of the number of hits on a species out of the total number of hits possible.

Relative Cover = The percentage of the number of hits on a species out of the total number of vegetation hits.

Native Categories: Y = Native, N = Non-Native, NA = Not Available

Growth Form Categories: F = Forb, G = Graminoid, T = Tree

Cool/Warm Season Categories: C = Cool-Season Graminoid, W = Warm-Season Graminoid

Noxious Weed Category: X = Noxious Weed (listed on May 2006 Colorado State Noxious Weed List)

Yellow shaded cells indicate success criteria were met in 2012.

Blue shaded cells indicate this species provided greater than 45 percent of the relative cover in 2012.

Table 5. Success Criteria Evaluation Summary 2012

Location	>30% Relative Cover of Desired Species	>70% Total Ground Cover (Litter, Rock, and Basal Veg Cover)	50% or More of Seeded Species Present	No Single Species With >45% Relative Foliar Cover	PASS/FAIL
L4	PASS	PASS	PASS	FAIL	PASS
L6	PASS	PASS	PASS	FAIL	PASS
L8	PASS	PASS	PASS	PASS	PASS
L15	PASS	PASS	PASS	FAIL	PASS
L16	PASS	PASS	PASS	PASS	PASS
L21	PASS	PASS	PASS	PASS	PASS
L22	PASS	PASS	PASS	PASS	PASS
L31	PASS	PASS	PASS	FAIL	PASS
L32	PASS	PASS	PASS	PASS	PASS
L33	PASS	PASS	PASS	FAIL	PASS
L50	PASS	PASS	PASS	PASS	PASS
L51	PASS	PASS	PASS	PASS	PASS
L52	PASS	PASS	PASS	PASS	PASS
% Passing	100	100	100	100	100

Yellow shaded cells indicate all success criteria were met in 2012.

Blue shaded cells indicate all success criteria would be met in 2012 if >45% cover of a single species was removed as criteria.

For reasons outlined in the text, these areas are considered to have passed as of 2012.

Table 6. Basal Cover Summary at Revegetation Locations 2012

Location	Basal Vegetation Cover (%)	Litter Cover (%)	Rock Cover (%)	Total Ground Cover (%)*
L4	6.3	66.6	29.1	102.0
L6	9.8	61.0	23.4	94.1
L8	6.1	64.4	24.0	94.5
L15	5.6	78.4	5.3	89.3
L16	6.9	87.6	4.6	99.1
L21	3.7	16.2	52.2	72.0
L22	11.3	62.0	26.3	99.5
L31	15.0	52.5	33.3	100.8
L32	10.2	73.6	10.7	94.4
L33	8.1	66.0	22.1	96.3
L50	5.8	71.5	18.5	95.8
L51	8.3	73.7	24.8	106.8
L52	2.5	84.0	16.0	102.5
Grand Mean	7.7	66.5	21.4	95.6

* Numbers greater than 100 are an artifact of the sampling method using a cover class system and midpoints for analysis. The Total Ground Cover value is the sum of the Basal Vegetation Cover, Litter Cover, and Rock Cover.

Shaded cells indicate that the success criteria of >70% total ground cover were met in 2012.

Table 7. Relative Foliar Cover of Selected Species on Native Grasslands at Rocky Flats

Location	Species	1993	1994	1995	1998	1999	2000	2001	2007	2008	2009	2010
TR02	Agropyron smithii	40.5	33.0	31.5		23.5	23.2					
TR02	Total Foliar Cover	68.2	88.0	97.2		77.4	71.6					
TR04	Agropyron smithii	28.6	15.7	19.3		13.7	10.0					
TR06	Stipa comata	61.5	62.4	49.4	50.8			45.7				
TR11	Stipa comata	11.6	8.7	3.2		6.6	12.6					
OLF Reference Area	Agropyron smithii								21.8	33.4	59.0	33.3
A-Ponds Reference Area	Agropyron smithii										54.2	18.0

These data are from various other studies that have been conducted at Rocky Flats. The sporadic nature of the timing of some studies is a result of the purpose of the individual studies.

See the text for more information.

Table 8. Evaluation of Successional Changes in Plant Community Composition at Revegetation Locations

		Location													
		L4	L6	L8	L15	L16	L21	L22	L31	L32	L33	L50	L51	L52	
Species Richness	2008	29	29	20	22	23	38	35	34	45	38	19	29	17	
	2009	39	36	20	17	38	40	30	14	38	22	27	31	13	
	2010	ND	ND	ND	ND	ND	32	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	29	ND	ND	49	ND	ND	ND	ND	
	2012	31	23	19	21	20	34	22	18	24	13	27	30	18	
Percent Seeded Species Present	2008	82	73	27	43	18	77	82	82	86	64	77	92	71	
	2009	55	55	55	86	64	77	73	73	86	64	62	77	57	
	2010	ND	ND	ND	ND	ND	77	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	62	ND	ND	86	ND	ND	ND	ND	
	2012	73	64	55	86	64	85	82	82	86	73	77	69	86	
Total Absolute Foliar Cover	2008	36.1	29.6	31.0	30.8	42.3	21.2	53.0	37.4	44.5	39.0	51.5	40.7	37.5	
	2009	56.8	52.5	59.5	67.0	83.5	32.1	76.5	57.3	71.1	51.8	63.7	55.0	31.0	
	2010	ND	ND	ND	ND	ND	29.6	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	29.6	ND	ND	76.1	ND	ND	ND	ND	
	2012	65.6	55.6	43.9	54.4	60.6	27.3	52.0	64.3	63.3	46.8	52.8	49.2	43.8	
Total Relative Native Foliar Cover	2008	47.8	67.1	52.0	60.6	36.7	74.4	84.9	53.8	50.2	67.0	86.4	84.4	81.3	
	2009	64.7	65.2	86.3	87.3	65.9	79.0	64.4	88.2	53.6	87.2	85.3	89.1	91.9	
	2010	ND	ND	ND	ND	ND	83.4	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	91.8	ND	ND	58.9	ND	ND	ND	ND	
	2012	82.5	92.1	79.8	88.3	76.1	84.8	73.6	93.0	71.8	98.7	75.1	90.5	72.6	
Total Absolute Ground Cover (Basal Veg, Litter, Rock)	2008	69.4	76.8	50.3	45.5	56.0	58.5	66.3	91.9	84.6	66.1	108.0	91.5	94.0	
	2009	79.1	84.8	85.6	68.5	76.5	50.8	101.3	95.8	88.3	76.0	98.2	91.0	89.5	
	2010	ND	ND	ND	ND	ND	63.1	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	77.2	ND	ND	90.3	ND	ND	ND	ND	
	2012	102.0	94.1	94.5	89.3	99.1	72.0	99.5	100.8	94.4	96.3	95.8	106.8	102.5	
Species with greater than 5 percent relative foliar cover	2008	Centaurea diffusa (23.2%) Agropyron caninum (18.3%) Agropyron smithii (12.1%) Grindelia squarrosa (8.3%) Alyssum minus (7.3%)	Agropyron caninum (31.6%) Agropyron smithii (14.3%) Centaurea diffusa (7.6%) Kochia scoparia (6.8%) Verbascum blattaria (5.9%) Bromus tectorum (5.1%)	Agropyron caninum (41.1%) Kochia scoparia (24.2%) Agropyron smithii (7.3%)	Agropyron caninum (19.1%) Agropyron smithii (18.3%) Grindelia squarrosa (17.5%) Centaurea diffusa (14.6%) Plantago lanceolata (10.2%) Melilotus officinalis (5.7%)	Agropyron smithii (17.2%) Agropyron caninum (10.7%) Polygonum arenastrum (11.5%) Melilotus officinalis (5.3%) Cirsium arvense (5.0%)	Centaurea diffusa (33.7%) Agropyron smithii (17.2%) Agropyron caninum (10.7%) Elymus canadensis (7.9%) Scirpus validus (6.3%) Bouteloua curtipendula (6.3%) Panicum virgatum (5.5%)	Agropyron caninum (20.9%) Salsola iberica (5.9%) Elymus canadensis (7.9%) Scirpus validus (6.3%) Bouteloua curtipendula (6.3%) Panicum virgatum (5.5%)	Agropyron caninum (22.2%) Agropyron smithii (22.2%) Bouteloua curtipendula (20.3%) Buchloe dactyloides (5.2%)	Bromus inermis (22.7%) Agropyron smithii (21.1%) Stipa viridula (5.4%) Bouteloua curtipendula (12.7%) Centaurea diffusa (5.0%) Bromus tectorum (5.0%) Poa compressa (5.0%)	Centaurea diffusa (13.5%) Agropyron caninum (11.2%) Agropyron smithii (10.7%) Buchloe dactyloides (9.6%) Bromus inermis (9.4%) Bromus tectorum (6.0%) Bouteloua curtipendula (5.8%)	Agropyron smithii (29.5%) Agropyron caninum (17.0%) Centaurea diffusa (14.4%) Bouteloua gracilis (7.7%) Bouteloua curtipendula (5.1%)	Agropyron caninum (58.3%) Agropyron smithii (12.6%) Poa compressa (8.7%) Buchloe dactyloides (7.1%)	Agropyron caninum (34.0%) Agropyron smithii (15.2%) Andropogon gerardii (11.9%) Centaurea diffusa (5.3%)	Agropyron smithii (48.7%) Agropyron caninum (16.7%)
	2009	Agropyron smithii (18.1%) Alyssum minus (10.6%) Ambrosia artemisiifolia (8.4%) Agropyron caninum (7.9%) Centaurea diffusa (7.0%) Grindelia squarrosa (5.9%)	Agropyron caninum (24.0%) Agropyron smithii (20.5%) Melilotus officinalis (9.5%) Centaurea diffusa (7.9%) Poa compressa (5.5%)	Agropyron smithii (37.6%) Agropyron caninum (37.0%) Kochia scoparia (7.8%)	Agropyron smithii (43.1%) Agropyron caninum (26.9%) Kochia scoparia (10.3%) Hordeum jubatum (9.5%)	Agropyron smithii (18.3%) Agropyron caninum (13.6%) Kochia scoparia (9.9%) Melilotus officinalis (6.1%) Helianthus annuus (5.7%) Ambrosia artemisiifolia (5.5%)	Agropyron caninum (20.8%) Melilotus officinalis (15.3%) Juncus balticus (8.3%) Bouteloua gracilis (7.0%) Bouteloua curtipendula (5.7%) Carex nebrascensis (5.7%)	Agropyron caninum (19.8%) Agropyron smithii (16.0%) Bouteloua gracilis (15.2%) Melilotus officinalis (11.2%) Bouteloua curtipendula (6.6%) Buchloe dactyloides (6.0%) Astragalus canadensis (5.4%)	Agropyron smithii (20.3%) Agropyron caninum (16.1%) Bouteloua curtipendula (9.6%) Juncus balticus (8.7%) Buchloe dactyloides (7.9%) Panicum virgatum (7.0%) Andropogon gerardii (5.4) Bouteloua gracilis (5.6%)	Agropyron smithii (19.9%) Centaurea diffusa (11.8%) Plantago lanceolata (10.8%) Agropyron caninum (10.8%) Buchloe dactyloides (9.8%) Bouteloua gracilis (5.9%)	Bouteloua curtipendula (54.1%) Andropogon scoparius (12.2%) Kochia scoparia (5.7%) Buchloe dactyloides (5.0%)	Agropyron smithii (35.3%) Agropyron caninum (16.9%) Bouteloua gracilis (15.7%) Bouteloua curtipendula (10.6%)	Agropyron caninum (41.4%) Agropyron smithii (21.2%) Buchloe dactyloides (6.8%)	Agropyron smithii (18.2%) Agropyron caninum (17.0%) Andropogon gerardii (16.1%) Buchloe dactyloides (15.5%) Bouteloua curtipendula (11.2%)	Agropyron smithii (56.5%) Agropyron caninum (13.7%) Artemisia ludoviciana (12.1%) Bouteloua gracilis (5.6%)
	2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	2012	Agropyron smithii (45.3%) Buchloe dactyloides (7.6%) Bouteloua gracilis (6.7%) Bouteloua curtipendula (6.5%) Sporobolus cryptandrus (5.1%)	Agropyron smithii (49%) Buchloe dactyloides (23.4%) Bouteloua gracilis (7.9%)	Agropyron smithii (34.8%) Buchloe dactyloides (18.2%) Agropyron caninum (10.8%) Bromus tectorum (9.4%)	Agropyron smithii (64.8%) Agropyron caninum (9.0%)	Agropyron smithii (34.4%) Bromus tectorum (14.6%) Stipa viridula (10.9%) Agropyron caninum (8.9%) Buchloe dactyloides (8.9%) Bouteloua curtipendula (7.6%)	Panicum virgatum (14.3%) Bouteloua curtipendula (10.7%) Bouteloua gracilis (9.1%) Andropogon scoparius (9.1%) Agropyron caninum (8.9%) Agropyron smithii (5.8%) Bouteloua curtipendula (7.6%)	Bouteloua curtipendula (25.5%) Agropyron smithii (11.5%) Buchloe dactyloides (11.1%) Bromus inermis (10.1%) Sorghastrum nutans (8.7%)	Bouteloua curtipendula (46.3%) Buchloe dactyloides (14.4%) Agropyron caninum (12.1%) Bouteloua gracilis (8.2%) Sorghastrum nutans (7.4%)	Bouteloua curtipendula (32.8%) Bromus inermis (21.9%) Agropyron smithii (9.4%) Bouteloua gracilis (8.8%) Buchloe dactyloides (7.9%)	Agropyron smithii (47.1%) Bouteloua curtipendula (15.2%) Bouteloua gracilis (15.2%) Buchloe dactyloides (10.7%) Agropyron caninum (7.0%)	Agropyron caninum (19.9%) Agropyron smithii (18.6%) Buchloe dactyloides (10.4%) Bouteloua curtipendula (6.9%) Koleria pyramidalis (5.4%)	Buchloe dactyloides (29.8%) Andropogon gerardii (22.7%) Agropyron smithii (14.6%) Agropyron caninum (5.4%)	Agropyron smithii (32.6%) Bromus japonicus (9.7%) Ambrosia psilostachya (9.1%) Bouteloua curtipendula (8.0) Bouteloua gracilis (6.9%)	

* Values greater than 100 percent are a result of the monitoring protocol that uses the midpoints of the cover class system for analysis.
 ND = No Data collected at this location for this year.