TECHNICAL NOTE

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Boise, Idaho – Salt Lake City, Utah

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REVEGETATION EFFECTIVENESS

LONG TERM EVALUATION OF FOUR SELECTED WILDFIRE DISTURBED RANGELAND AND FORESTLAND SITES IN IDAHO AND OREGON

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Abstract - evaluations completed in 2002
This review covers four wildfires, three in Idaho and one in Oregon. All of the Emergency Watershed Protection (EWP) projects involved aerial reseeding on all or part of the burned area. Drill seeding was completed on portions of the three fires in Idaho in selected areas, generally slopes of 30% or less. Seed mixes were used in all projects. In most cases, seeded species were non-native but adapted to the local soil and climate of the particular area. Species were selected based on the following criteria: adaptability, availability, ease of establishment, erosion control ability and forage quality for wildlife.

This review covers species selection, seeding rates and techniques, long-term species adaptability and effectiveness of the seedings on state and private lands within the EWP project areas.

All drill seeding was successful. Aerial seeding had mixed success. Native species seeded generally did not establish successfully. Intermediate wheatgrass (*Thinopyrum intermedium)* was the most successful seeded species. Seeding rates were appropriate where improved watershed values and livestock forage production were the objectives. Seeding rates of sod forming grasses were too high where native species regeneration is an objective. Successful seedings were generally higher in species richness, forage, cover, watershed and wildlife habitat values compared to controls.

Key words: wildfire seedings; reclamation seedings; erosion, weeds, forage, Emergency Watershed Protection (EWP) seedings

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Program Overview
The Natural Resources Conservation Service (NRCS) administers the Federal Emergency Watershed Protection Program (EWP) to help people reduce threats to life and property following a natural disaster. NRCS works through local sponsors on a voluntary basis. Typical sponsors include city and county governments, soil and water conservation districts and state agencies such as fish and game departments and department of lands. EWP work can include: purchasing floodplain easements, removing debris from channels, culverts and bridges; stabilizing eroded streambanks; repairing levees and watershed structures; installing erosion control structures; and reseeding damaged areas.

Study Areas
EWP funds administered by NRCS can only be spent on private or state lands. For this reason, this review only covers EWP seeding on private and state lands. See Appendix 1.

The **Eight Street Fire** burned 15,300 ac. (6192 ha.) in the foothills north of Boise, Idaho. The fire started on August 26, 1996, and was declared controlled on September 2, 1996. At the time of ignition temperatures were in excess of 100 degrees Fahrenheit (38 C) with winds gusting to 30 mph (48 kph). Within the EWP-treated area ownership is both private and the State of Idaho. Elevation ranges from 2600-7000 ft. (792-2134 m.). EWP-treated lands ranged from 2600-4500 ft. (792-1372 m.) (USDA NRCS, Meridian Field Office). Average annual precipitation ranges from 12-17 in. (300-430 mm.) falling mostly as snow in the winter. Average annual air temperature ranges from 46 to 52 degrees Fahrenheit (8-11 C). Potential natural vegetation within the EWP-treated area includes bluebunch wheatgrass (*Pseudoroegneria spicata)*, Idaho fescue (*Festuca idahoensis)*, Thurber needlegrass (*Stipa thurberiana)*, NeedleandThread (*Stipa comata)*, basin big sagebrush (*Artemisia tridentata var. tridentata)*, foothills big sagebrush (*Artemisia tridentata var. xericensis)* and antelope bitterbrush (*Purshia tridentata)*. Existing vegetation at the time of the burn included mostly annual grasses such as cheatgrass (*Bromus tectorum)* and medusahead rye (*Taeniatherum asperum)*

The topography is predominantly rolling to steep hills and benches. Gently and moderately sloping stream terraces, draw bottoms and alluvial fans occur adjacent to drainage ways at the lower elevations.

The soils on mountains generally formed in residuum and colluvium from cretaceous granite rocks of the Idaho batholith. The soils on the hills generally formed in alluvium, colluvium and residuum from Tertiary lacustrine deposits of sand and mudstone. The hills are sometimes capped with arkosic sandstone or fan remnants composed of late Pliocene volcaniclastic sediments. The soils on structural benches and buttes are formed in residuum and colluvium from either early to mid-Pliocene basalt and tuff or in alluvium and colluvium from mixed sediments. The soils on stream terraces, draw bottoms and alluvial fans formed in alluvium from mixed sediments.

Soil surface textures range from coarse sandy loams to loams at the lower elevations. Soil textures at the middle and upper elevations range from fine gravelly coarse sandy loams to stony or cobbly loams (Harkness 1997).

The **Snow Basin Fire** burned approximately 4000 ac. (1619 ha.) of forestland in Wheeler County in North Central Oregon. The fire started on July 5, 1968 and was declared controlled on July 10, 1968. One timber company and several individual private landowners own the EWP-treated areas. Elevation ranges from 2800 ft. (853 m.) to 4400 ft. (1341 m.). The burned area includes portions of three range sites. The area between 2800 ft. (853 m.) and 3400 ft. (1036 m.) elevation

is in the Pine-Sedge site; between 3400 ft. ((1036 m.) and 3800 ft. (1158 m.) elevation is in the Pine-Mixed Fir site; and the upper portion of the burn, which lies between 3800 ft. (1158 m.) and 4400 ft. (1341 m.) elevation is in the Mixed Fir site. Average annual precipitation varies from about 15 (381 mm.) to 22 in. (559 mm.) within the burned area. Perennial grasses, elk sedge (*Carex geyeri*) and forbs are abundant, and shrubs are important in the potential native plant communities of the Pine-Sedge and Pine-Mixed Fir sites. The Mixed Fir site normally has a dense tree canopy under which herbaceous cover and shrubs are sparse. These species were present prior to the fire.

Most of the burned area has a southerly aspect. The Top soil series occurs over most of the burned area and is the principal soil of the two higher elevation sites that occur above 3400 ft. (1036 m.) elevation. The surface layer of this soil is silt loam about 14 in. thick, the subsoil is silty clay loam about 20 in. thick and the substratum is loam to a depth of about 50 in. Hankins silty clay loam, which is about 7 in. thick over clay and fine textured sediments, is the principal soil of the Pine-Sedge site. Tolo silt loam, a deep ashy soil, occurs on north exposures, which constitutes a minor portion of the area (Anderson 1975).

The Foothills Fire burned approximately 250,000 ac. (101,171 ha.) north and east of Mountain Home, Idaho from August 19, 1992 to September 10, 1992. Land ownerships included private, state, BLM and Forest Service. The EWP project covered reseeding of 31,918 ac. (12917 ha.) of private and state land. About 6400 ac. (2590 ha.) of this was drill seeded with the remainder aerially applied with a helicopter. Elevation ranges from 3500 ft. (1067 m.) to 6300 ft. (1920 m.) (USDA NRCS, Mountain Home Field Office). Average annual precipitation ranges from 11 in. (279 mm) to 27 in. (686 mm) at the highest elevations. Average annual air temperatures range from 40 to 50 degrees Fahrenheit (4-10 C). Potential natural vegetation ranges from Wyoming big sagebrush (*Artemisia tridentata var. wyomingensis*) with bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*) at the lower elevations and drier slopes to mountain big sagebrush (*Artemisia tridentata var. vaseyana*) with Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*) at the higher elevations. At the highest elevations, there are scattered areas of forestland consisting mostly of Douglas fir (*Pseudotsuga menziesii),* mallow ninebark (*Physocarpus malvaceus*), white spirea (*Spiraea betulifolia*), and elk sedge (*Carex geyeri*). Pre-fire vegetation consisted of these species with some invaded cheatgrass (*Bromus tectorum)* and other annual weeds.

The topography is predominantly rolling to steep and very steep hills and mountains. Ridge tops, toe slopes, foothills and shoulders are often 10- 30 percent slopes. Slopes range from 20-70 percent on all aspects.

Some of the soils on foothills were formed dominantly in material weathered from rhyodacitic rock. Soils on mountains and foothills in the northern part of the area were formed in materials weathered from intermediate intrusive rock (granitic). There are small areas within the project where the soils were formed in loess, mixed alluvium, and material weathered from basalt.

Soil surface textures vary over the area. Large areas within the project area have surface textures of sandy loams to gravelly sandy loams. There are other large areas of loams, stony fine sandy loams and stony loams. There are small areas formed from residuum basalt that are silty clays (Noe 1991).

City Creek Fire started on August 30, 1987 at 1:30 p.m. with air temperatures of 90 degrees Fahrenheit (32 C) and winds of 15-35 mph (24-56 kph). It burned 2680 ac. (1085 ha.) of

rangeland and forest adjacent to the City of Pocatello, Idaho. The fire burned on city, state, private, BLM, and Forest Service land. Elevation ranges from 5000 ft. to 6476 ft. (1524-1974 m.) (USDA NRCS, Pocatello Area Office). Average annual precipitation ranges from 12-17 in. (305-432 mm.) falling mostly as snow in the winter. Average annual air temperature ranges from 40 to 47 degrees Fahrenheit (4.4-8.3 C) from the lower to higher elevations. Potential natural vegetation within the EWP-treated area includes bluebunch wheatgrass (*Pseudoroegneria spicata ssp spicata*), Thurber needlegrass (*Stipa thurberiensis*), Wyoming big sagebrush (*Artemisia tridentata var. wyomingensis*) at lower elevations and mountain big sagebrush (*Artemisia tridentata var. vaseyana*) at the higher elevations and Utah juniper (*Juniperus utahensis*). Some north exposures have bigtooth maple (*Acer grandidentatum*), quaking aspen (*Populus tremuloides*), common chokecherry (*Prunus virginiana*) and mountain brome (*Bromus marginatus*). At the time of the burn there was some cheatgrass (*Bromus tectorum*), broom snakeweed (*Gutierrezia sarothrae*), rabbitbrush (*Chrysothamnus sp.),* Dyers woad (*Isatis tinctoria*), tumble mustard (*Sisybrium altissimum*) and thistle (*Cirsium sp.)* particularly at the lower elevations. Utah juniper encroachment had occurred on some sites.

The topography is moderately sloping foothills to steep and very steep mountainsides.

The soils are generally formed in alluvium, colluvium and residuum derived from loess or sedimentary or metasedimentary rock or quartzite. The soils are generally moderately deep to very deep.

Soil surface textures range from gravelly silt loams, silty loams, loams and stony loams (McGrath 1987).

Methods and Materials

On all study areas, a post-fire reconnaissance survey was completed immediately following control of the fire to determine acres burned, severity, location, land ownership and major plant associations by staff associated with EWP. A EWP project plan was then developed that included species to be seeded, methods, amounts and timing for application of seed. Seed purchase contracts were developed and contracts awarded. In some cases, the desired species or cultivars were not available and suitable substitutions were made. On all four-study areas the majority of the seed was applied using a helicopter. On three of the study areas, flatter slopes were seeded using a rangeland drill. All seeding was done in the fall, late October through mid-December. High quality seed was used in all cases. The files indicate that certified seed or better was used but complete documentation was not available. Seed tags indicate that there were no noxious weeds, germination was high and little inert matter was present.

The following tables summarize acres treated, methods, seed quality, species used, rates and timing by EWP project.

Table 1. Acres treated by method, rate and date of each study area (USDA NRCS Meridian and Mountain Home Field Offices, Pocatello Area Office, Anderson 1975)

Project	Broadcast Seeded (ac.)	Drill Seeded (ac.)	Rate PLS Lbs./ac.	Date Seeded	Mixture Reference	Notes
8th Street Fire	3312		10.5	11/27-12/2/96	1	
		1820	10.5	10/15-11/15/96	1	
Snow Basin Fire	4000	0	11.87 14.4 12.18	10/30-11/2/68	1 2 3	Pine-Sedge Pine-Mixed Fir Mixed Fir
Foothills Fire	25,456		11.7	Mid-November-Early Dec. 92	1,2,3	
		6462	10	October 92	1,2,3,4	
City Creek Fire	848		13.6	Nov.1-15/87	1	
		390	10.2	Oct.15-Nov.15/87	1	

Table 2. Species seeded, cultivar, origin, rate, percent germination, and percent of mix and certification status for Eighth Street Fire, Boise, ID (USDA NRCS Meridian Field Office)

Species seeded Common name	Scientific name	Cultivar	Origin	Rate Lbs./ac.	% Germination	% of mix	Certified Y/N
8th Street Fire Mixture 1							
Intermediate wheatgrass	Thinopyrum intermedium	Rush	ID	5 lbs.	95%	47	Y
Thickspike wheatgrass	Elymus lanceolatus	Bannock	ID	0.5 lbs.	87%	5	Y
Thickspike wheatgrass	Elymus lanceolatus	Critana	ID	1.5 lbs.	91%	14	Y
Slender wheatgrass	Elymus trachycaulus ssp. trachycaulus	Pryor	MT	1.5 lbs.	96%	14	Y
Yellow blossom sweetclover	Melilotus officinalis		Canada	0.5 lbs.	92%	4	N
Small burnet	Sanguisorba	Delar	ID	1.5 lbs	90%	14	Y

	minor						
Foothills big sagebrush*	Artemisia tridentata ssp. xericensis	Unk.**	Unk.	0.125 lbs.	Unk.	Unk.	N
Basin big sagebrush*	Artemisia tridentata ssp. tridentata	Unk.	Unk.	0.25 lbs.	Unk.	Unk.	N
Mountain big sagebrush*	Artemisia tridentata ssp. vaseyana	Unk.	Unk.	0.125 lbs.	Unk.	Unk.	N

* Seeded on state land only
**Unk. Is Unknown

Table 3. Species seeded, cultivar, origin, rate, percent germination, percent of mix, certified status of Snow Basin Fire, Wheeler County, OR (Anderson 1975)

Species seeded Common name	Scientific name	Cultivar	Origin	Rate Lbs./ac.	% Germination	% of mix	Certified Y/N
Snow Basin Fire* Pine-Sedge Mixture 1							
Big bluegrass	Poa secunda	Sherman	WA	2	Unk.	17	Unk.
Desert wheatgrass	Agropyron desertorum	Unk.	Unk.	7	Unk.	59	Unk.
Hard fescue	Festuca trachyphylla	Covar	WA	1	90	8	N
Bitterbrush	Purshia tridentata	Unk.	Unk.	0.6	Unk.	5	Unk.
Lana vetch	Vicia villosa	Unk.	Unk.	0.32	Unk.	3	Unk.
Sainfoin	Onobrychis viciifolia	Unk.	Unk.	0.63	Unk.	5	Unk.
White clover	Trifolium repens	Unk.	Unk.	0.32	Unk.	3	Unk.
Pine-Mixed Fir Mixture 2							
Hard fescue	Festuca trachyphylla	Durar	WA	1	90	7	N
Intermediate wheatgrass	Thinopyrum intermedium	Greenar	WA	8	85-94	56	N

Timothy	Phleum pratense	Climax	ID	1	85	7	N
White clover	Trifolium repens	Unk.	Unk.	1.6	Unk.	11	Unk.
Rose clover	T. hirtum	Unk.	Unk.	2.8	Unk.	19	Unk.
Mixed Fir Mixture 3							
Intermediate wheatgrass	Thinopyrum intermedium	Greenar	WA	5	85-94	41	N
Timothy	Phleum pratense	Climax	ID	1	85	8	N
Orchardgrass	Dactylis glomerata	Unk.	OR WA	4	92	33	N
White clover	Trifolium repens	Unk.	Unk.	0.38	Unk.	3	Unk.
Rose clover	T. hirtum	Unk.	Unk.	1.8	Unk.	15	Unk.

* Poison rodent bait and tree seed (Ponderosa pine and Douglas fir) was applied aerially on 800 ac. of the mixed fir site.

Table 4. Species seeded, cultivar, origin, rate, percent germination, percent of mix, certified status of Foothills Fire, Mountain Home, ID (USDA NRCS Mountain Home Field Office)

Species seeded Common name	Scientific name	Cultivar	Origin	Rate Lbs./ac.	% Germination	% of mix	Certified Y/N
Foothills Fire							
Mix #1				11.7			
Crested wheatgrass	Agropyron cristatum	Hycrest and/or Fairway	Unk.		Unk.	58	Both
Intermediate wheatgrass	Thinopyrum intermedium	Greenleaf and/or Luna and/or Mandan	Unk.		Unk.	29	Both
Yellow sweetclover	Melilotus officinalis		Unk.		Unk	4	Y
Mix #2				11.7			
Crested wheatgrass	Agropyron cristatum	Hycrest and/or Fairway	Unk.		Unk.	29	Both
Intermediate wheatgrass	Thinopyrum intermedium	Greenleaf and/or Luna	Unk.		Unk.	60	Both

		and/or Mandan					
Yellow sweetclover	Melilotus officinalis		Unk.		Unk	4	Y
Mix #3				11.7			
Crested wheatgrass	Agropyron cristatum	Fairway	Unk.		Unk.	46	N
Intermediate wheatgrass	Thinopyrum intermedium	Luna	Unk.		Unk.	47	Both
Yellow sweetclover	Melilotus officinalis		Unk.		Unk.	4	Y
Mix #4				10			
Crested wheatgrass	Agropyron cristatum	Hycrest	Unk.		Unk.	21	Y
Intermediate wheatgrass	Thinopyrum intermedium	Greenar	Unk.		Unk.	9.5	Unk.
Intermediate wheatgrass	Thinopyrum intermedium	Oahe	Unk.		Unk.	21.7	N
Orchardgrass	Dactylis glomerata	Paiute	Unk.		Unk.	20.8	Unk.
Small burnet	Sanguisorba minor	Delar	Unk.		Unk.	6.4	Unk.
Alfalfa	Medicago sativa	Ladak	Unk.		Unk.	20.8	Unk

Table 5. Species seeded, cultivar, origin, rate, percent germination, and percent of mix and certification status of City Creek Fire, Pocatello, ID (USDA NRCS Pocatello Area Office)

Species seeded Common name	Scientific name	Cultivar	Origin	Rate lbs./ac.	% Germination	% of mix	Certified Y/N
City Creek Fire Mixture 1 *							
Siberian wheatgrass	Agropyron fragile	P-27	ID	1.3	96	12	Unk.
Intermediate wheatgrass	Thinopyrum intermedium	Greenar	ID	4.7	93	44	Unk.
Streambank wheatgrass	Elymus lanceolatus	Sodar	ID	1.2	91	11	Unk.
Lewis flax	Linum lewisii	Appar	ID	0.7	73	7	Unk.
Small burnet	Sanguisorba minor	Delar	ID	1.8	96	17	Unk.
Alfalfa	Medicago sativa	Ranger	ID	0.5	94	5	Unk.

* Antelope bitterbrush was seeded using a “Hansen Dribbler” mounted on tractor at a targeted rate of 3.0 lbs. per acre on acres that were drilled.

Post Seeding Monitoring
8th Street Fire
No post-seeding monitoring was found in the records for the 8th Street Fire.

Snow Basin Fire
Post-seeding monitoring on Snow Basin Fire was done from 1969 through 1972 (Anderson and Brooks, 1975). The methods are described below.

Herbage production for each site was determined at the end of the growing season by clipping plots 9.6 sq. ft. in size. No attempt was made to randomize. Two steel-staked belt transects 100 ft. long and 1 ft. wide were established on each site. Annual changes in native and seeded species and other items were documented by:
1) Counting the number of plants of each species in each transect and averaging the two transects.

2) Using the above data to compute the percent composition of each species in the plant community.

3) Estimating the percent ground cover of each plant species, mosses and lichens, litter and mulch, and the percent of bare ground in the vicinity of each transect. This procedure results in a total that exceeds 100% when all items are added together, as illustrated by Table 2, because bare ground occurs beneath the foliage of plants and the foliage of different species is often layered. It also reveals the dynamics of changes within a plant community with a minimum input of time and money and thereby adequately fulfilled the objective of this field study.

4) Rating each plant species according to its dominance in the physiognamy of the plant community in the immediate vicinity of each transect. A 5-digit system was used in which 5 represents the dominant species, 3 represents species that are common, and 1 represents species that are rare in the stand (Anderson and Poulton, 1958).

5) Counting the number of standing snags, by species, in each of the seven diameter classes having 2-inches through 12- inches + on plots 100 feet square in which each transect was the centerline.

6) Taking photos of each transect at the time data were recorded (Anderson 1975).

The authors concluded the following: A satisfactory vegetation cover was established by seeded grass the first year after seeding on all three sites, whereas natural re-vegetation did not provide satisfactory cover on an unseeded area within four years. Seeded legumes did not survive. Broadcasting tree seed was a failure. Seeded grasses suppressed development of some native shrubs. Herbage production on seeded areas was four times greater than unseeded areas.

Foothills Fire
There was a Master's Degree thesis written by Marlene Eno in 1996 for the Foothills Fire. She monitored plots in all vegetation zones and on north and south aspects for two growing seasons following seeding. Her analysis of success or failure was based on measurements of frequency, density, canopy cover and basal cover. Species diversity was also evaluated.

She concluded that Intermediate wheatgrass and alfalfa should continue to be seeded on both north and south aspects in the mountain big sagebrush vegetation type. She also concluded that Hycrest

crested wheatgrass, Paiute orchardgrass, yellow sweetclover and small burnet should be re-considered based on low seeding success, within a burned mountain big sagebrush/bluebunch wheatgrass habitat type with a pre-fire community in mid to late seral successional stage. This conclusion is for the north and south aspect Loamy 300-400 mm. site. She also concluded that a better use of existing soils information would improve overall aerial seeding success.

City Creek Fire

The City Creek Fire, had a report prepared called "Final Report, Agreement Number ID910-CA8-07 entitled Post-fire Vegetation Development on Seeded and Unseeded Areas of the 1987 City Creek Burn, Pocatello, Idaho" July 1990 authored by Teresa D. Ratzlaff and Jay E. Anderson. The data collected for this report was used to complete a master's thesis by Teresa Ratzlaff.

They concluded "seeding of the benches burned by the City Creek Fire was unnecessary because of the abundance of fire-adapted perennial species present at the time of the fire." The benches include moderately sloping foothills. They also concluded "disturbance of the site by drilling increased the erosion potential and resulted in lower plant cover on the site during the first two post-fire seasons".

2002 Evaluation Methods

All four EWP seedings were visited in the summer of 2002. For each seeding, a reconnaissance survey was first completed to determine access and which soils/range sites were seeded. For three of the projects, 8th Street, Foothills and City Creek, it was determined that evaluation should be done on north, south and non-aspect sites. These three situations represented in excess of 90% of the treated areas. For Snow Basin, the previously read site locations, except one that could not be found, were evaluated.

Numerous procedures were used on all four fires to evaluate seeding effectiveness following each burn and seeding effort. The two Master's degrees that were written on City Creek and Foothills re-seeding efforts used very labor intensive vegetation measuring techniques on relatively small areas. Monitoring on Snow Basin used a belt transect to initially evaluate the seeding. It was decided that none of these procedures would adequately evaluate large areas that were seeded, measure success on different range sites and soils, or address the dynamics of the plant communities over time.

The selected procedure was to use the NRCS inventory write-up procedure with some minor modifications. Idaho NRCS ID-190-002, Range Condition (Ecological Rating) Forage Quality and Apparent Trend Worksheet were used. Intermountain Rangeland Consultants, LLC modified the form by adding Rangeland Health Indicators to the form.

An indeterminate plot was selected for each site and treatment to be evaluated. A uniform, representative area was selected for the plot. Data gathered includes: range site, soil mapping unit where available, plant species present, estimated total annual production in pounds by species, apparent trend, percent slope, aspect, percent cover for vascular plants, litter and bare ground and up to seventeen of the rangeland health indicators as appropriate for the situation. See exhibit A.

A total of 54 write-ups were completed. At least two write-ups were completed for each site and treatment, where possible, including controls (not seeded). In some cases controls could not be found due to the completeness of the seeding effort. See Appendix 2.

Results

Tables 6-9 arrays the data collected in the field for each EWP project.

Tables 10-13 summarizes the data from Tables 6-9 by averaging values by treatment and range site or aspect.

Table 6. Field Data for 8th Street Fire

									% Composition			
Write-up Number	Seeding method 1/	Range site	Aspect/ % slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/ # perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
G-9	A	North slope loamy 12-16	North/ 45	765	10	40	60	18/13	44	56	Trace	Int. whgr. trace small burnet trace
F-9	A	North slope loamy 12-16	North/ 30	1330	10	60	40	21/14	39	57	4	Int.whgr.20 Cr. whgr. trace Bitterbrush 20
G-6	A	South slope loamy 12-16	South/ 25	485	20	45	40	17/9	71	27	2	0
G-7	A	South slope loamy 12-16	South/ 50	375	50	25	20	15/9	80	7	13	Int. whgr. 10
F-4	A	South slope loamy 12-16	So. 15	615	30	20	30	12/7	76	22	2	Int. whgr. 150 Bitterbrush 15
G-8	A	Loamy 12-16	Non-aspect< 2	653	10	40	60	22/12	81	17	2	Int. whgr. 20 Small burnet 3 Bitterbrush 5
F-12	A	Loamy 12-16	Non aspect < 5	455	30	30	50	16/13	77	21	2	Int. whgr.10 Bitterbrush 10
G-3	D	North slope loamy 12-16	North/ 20	1180	5	65	45	11/6	98	1	< 1	Int. whgr.1100 Small burnet 5 Bitterbrush 5
F-2	D	North slope loamy 12-16	North/ 15	485	10	20	60	17/10	55	33	12	Int. whgr. 25, Small burnet 10 Bitterbrush 20
G-1	D	South slope loamy 12-16	South/ 20	950	15	50	45	12/5	63	37	T	Int. whgr.125 Small burnet 15
F-6	D	South slope loamy 12-16	South/ 15	1120	10	30	40	12/7	95	4	1	Int. whgr. 400 Small burnet trace
F-11	D	South slope loamy 12-16	South/ 12	550	10	50	30	10/4	35	65	Trace	Int. whgr.125
G-2	D	Loamy 12-16	Non-aspect < 5	1122	10	50	45	12/6	93	7	T	Int. whgr. 900 Small burnet 12
F-3	D	Loamy 12-16	Non-aspect 5	465	20	50	25	11/4	32	68	0	Int. whgr20 Sweet clover 10
F-13	D	Loamy 12-16	Non- aspect < 2	745	10	10	70	11/6	74	10	1	Int. whgr. 200
G-4	C	North slope loamy 12-16	North/ 30	650	5	60	40	11/7	98	2	T	0

F-1	C	North slope loamy 12-16	North/ 65	1055	20	30	50	8/6	50	50	None	0
F-7	C	North slope loamy 12-16	North/ 50	575	5	30	30	11/10	89	5	6	0
G-5	C	Stony South 12-16	South/ 30	490	20	40	40	16/8	83	16	1	0
F-8	C	Loamy 12-16	Non-aspect 5	650	5	30	30	13/9	82	10	8	0
F-10	C	Loamy 12-16	Non-aspect< 5	950	10	20	20	12/9	74	8	18	0

Table 7. Field Data for Snow Basin Fire

										% Composition			
Write-up No.	Seeding method 1/	Range site	Soil depth/texture	Aspect/ % slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
I-1	A	Pine-sedge		South 8%	812	20	50	47	24/19	63	0.6	37	Hard fescue 500 Bitterbrush 20
I-2	A	Pine-sedge		SE/5-8	768	15	45	50	21/16	84	0.7	16	Hard fescue 600 Int. whgr. 10 Crest. whgr. Trace Bitterbrush 10
II-4	A	Pine-Fir		South/10-15	1647	25	50	37	15/10	96	0.06	4	Int. whgr. 1500 Hard fescue 75
II-5	A	Pine-Fir		Non-aspect/7	405	10	75	44	17/16	72	1.2	27	Int. whgr. 250 Hard fescue 25
III-6	A	Mixed Fir		Non-aspect/10	458	8	65	10	22/15	72	4	24	Int. whgr. 200 Timothy 1 Orchardgrass Trace
III-7	A	Mixed Fir		Non-aspect/10	456	10	50	58	22/20	56	6	40	Int. whgr. 250

Table 8. Field Data for Foothills Fire

									% Composition			
Write-up No.	Seeding method 1/	Range site	Aspect/ % slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
F-2	A	North slope	North/40	1150	T	70	40	11/10	80	13	7	Int. whgr. 600 Cr. whgr. 100
G-2	A	North slope	North/55	715	10	25	50	16/15	90	2	8	Int. whgr. 450 Cr. whgr. 100
G-6	A	North slope	North/45	1760	T	45	75	20/15	88	8	4	Int. whgr. 1400 Cr. whgr. 75
F-4	A	South slope	South/25	385	20	20	30	11/9	47	4	49	Int. whgr. 125 Cr. whgr. Trace
G-1	A	South slope	South/45	480	45	10	30	20/15	75	3	22	Int. whgr. 75 Cr. whgr. Trace
F-3	A	Loamy 12-16	Non-aspect/3	450	10	20	40	11/11	28	27	45	Int. whgr. 25
F-5	A	Loamy 12-16	Non-aspect/3	595	20	25	35	16/13	63	8	29	Int. whgr. 300 Cr. whgr. 50
F-10	D	North slope	North/20	1425	0	90	40	10/10	61	28	11	Int. whgr. 800 Cr. whgr. 75
G-5	D	North slope	North/20	1005	5	35	70	16/14	75	24	1	Int. whgr. 375 Cr. whgr. 150
F-8	D	South slope	South/10	1025	<5	50	50	13/11	47	51	2	Int. whgr. 35 Cr. whgs. 150
G-4	D	South slope	South/15	855	20	35	60	12/11	52	19	29	Int. whgs. 370 Cr. whgs. 25
F-9	D	Loamy 12-16	Non-aspect/1	1585	<5	40	60	15/10	87	12	1	Int. whgs. 1200 Cr. whgs. 20
G-3	D	Loamy 12-16	Non-aspect/10	1315	2	40	70	13/9	90	10	T	Int. whgs. 900 Cr. whgs. 75
F-1	C	North slope	North/55	555	20	30	35	15/15	78	7	15	0
F-7	C	South slope	South/25	420	20	10	30	10/8	49	11	40	0
F-6	C	Loamy 12-16	Non-aspect/3	725	10	20	40	12/10	31	39	30	0

Table 9. Field Data for City Creek Fire

									% Composition			
Write-up No.	Seeding method 1/	Range site	Aspect/ % slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
G-2	A	Steep slopes 16-22	North/55	1345	8	40	65	25/23	46	43	11	P-27 200 Int. whgr. 5
F-2	A	Steep slopes 16-22	North/60	2040	5	70	40	31/27	90	6	4	Int. whgr. 1700 Cr. whgs. 5 P-27 5
F-4	A	Steep slopes 16-22	North/55	2080	10	30	75	11/11	55	44	1	Int. whgr. 900
G-3	A	Steep slopes 16-22	South/40	878	5	35	40	23/16	43	56	1	0
F-3	A	Steep slopes 16-22	South/45	1305	10	35	35	15/8	79	18	3	Int. whgr. 800
F-1	A*	Loamy 12-16	Non-aspect/10	2749	10	60	50	22/17	95	5	Trace	Int. whgr. Luna2000 Greenar 500
F-5	A	Loamy 12-16	Non-aspect/10	826	10	40	40	28/26	79	8	13	P-27 80 Cr. whgr. 20 Int. whgr. 120
G-1	D	Loamy 12-16	Non-aspect/10	1890	<5	75	50	29/26	81	13	6	Int. whgr. Luna 1350 Greenar 150 P-27 10 Alfalfa T
G-5	D	Loamy 12-16	Non - aspect/10	2435	<5	65	60	23/21	80	13	7	Int. whgr. Luna 1600 Greenar 200 P-27 60
G-4	C	Loamy 12-16	Non-aspect/10	1125	<5	45	65	28/22	28	42	30	Cr. whgr. 15 Int. whgr. 5
F-6	C	Loamy 12-16	Non-aspect/15	815	15	55	40	28/26	51	18	31	0

* Area chiseled prior to aerial seeding

1/ A = Aerial application
D = Drill seeded
C = Control (not seeded)

Table 10. Average Field Data Values for 8th Street Fire

									% Composition			
Aspect	Seeding method 1/	Range site	% slope	Total lbs./ac	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forbs	Shrubs	Lbs./ac. seeded species present
North	A	North slope loamy 12-16	30-45	1047	10	50	50	20/13	42	56	2	Int. whgr. 10 Bitterbrush 10
South	A	South slope loamy 12-16	15-50	492	34	30	30	15/8	76	19	6	Int. whgr. 53 Bitterbrush 5
Non-aspect	A	Loamy 12-16	2-5	554	20	35	55	19/12	79	19	2	Int. whgr. 15 bitterbrush 8
North	D	North slope loamy 12-16	15-20	832	7	43	52	14/8	77	17	7	Int. whgr. 562 Small burnet 7 Bitterbrush 12
South	D	South slope loamy 12-16	12-15	873	12	43	38	11/6	63	35	T	Int. whgr. 175
Non-aspect	D	Loamy12-16	2-8	725	17	32	45	11/6	73	22	1	Int. whgr.324 Small burnet 3 Bitterbrush 2
North	C	North slope loamy 12-16	30-65	750	10	40	40	10/8	79	19	2	0
Non-aspect	C	Loamy 12-16	5	800	8	25	25	13/9	78	9	13	0
South	C	South slope loamy 12-16	30	490	20	40	40	16/8	83	16	1	0

Table 11. Average Field Data Values for Snow Basin Fire

								% Composition			
Seeding method 1/	Range site	Aspect/ % slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
A	Pine-sedge	South /7	790	17	48	48	23/17	74	0.6	26	Hard fescue 550 Int. whgr. 5 Cr. whgr. trace Bitterbrush 15
A	Pine-Fir	South/10	1026	17	62	41	16/13	84	.63	15	Int. whgr. 875 Hard fescue 50
A	Mixed Fir	Non-aspect/10	457	17	57	34	22/18	64	5	32	Int. whgr. 225 Timothy 1 Orchardgrass trace

Table 12. Average Field Data Values for Foothills Fire

									% Composition			
Aspect	Seeding method 1/	Range site	% slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
North	A	North slope loamy 12-16	North/47	1208	3	47	55	16/13	86	8	6	Int. whgr. 817 Cr. whgr. 92
South	A	South slope loamy 12-16	South/35	433	33	15	30	16/12	61	4	36	Int. whgr. 100 Cr. whgr. trace
Non-aspect	A	Loamy 12-16	Non-aspect <5	523	15	23	38	14/12	46	18	37	Int. whgr. 163 Cr. whgr. 25
North	D	North slope loamy 12-16	North/20	1215	3	63	55	13/12	68	26	6	Int. whgr. 588 Cr. whgr. 113
South	D	South slope loamy 12-16	South/13	940	10	43	55	13/11	50	35	16	Int. whgr. 203 Cr. whgr. 88
Non-aspect	D	Loamy 12-16	Non-aspect/5	1450	1	40	65	14/10	89	11	1	Int. whgr. 1050 Cr. whgr. 48
North control x	C	North slope loamy 12-16	North/55	555	20	30	35	15/15	78	7	15	0
South control x	C	South slope loamy 12-16	South/25	420	20	10	30	10/8	49	11	40	0
Non-aspect x	C	Loamy 12-16	Non-aspect<5	725	10	20	40	12/10	31	39	30	0

X not an average-one plot only

Table 13. Average Field Data Values for City Creek Fire

									% Composition			
Aspect	Seeding method 1/	Range site	% slope	Total lbs/ac.	% bare ground	% litter	% cover vascular plants	Number of species/# perennials	Grass	Forb	Shrub	Lbs./acre seeded species present
North	A	Steep slopes 16-22	North/57	1822	8	47	60	22/20	64	31	5	Int. whgr.868 P27 68 Cr. whgr. 2
South	A	Steep slopes 16-22	South/43	1092	8	35	38	19/12	61	37	2	Int. whgr. 400
Non-aspect	A	Loamy 12-16	Non-aspect 10	1788	10	50	45	25/22	87	7	7	Int. whgr. 1310 P27 40 Cr. whgr. 10
Non-aspect	D	Loamy 12-16	Non-aspect 10	2163	<5	70	55	26/24	81	13	7	Int. whgr. 1656 P27 35
Non-aspect	C	Loamy 12-16	Non-aspect/13	970	8	50	53	28/24	40	30	31	Int. whgr. 3 Cr. whgr. 8

1/ A = aerial seeding application
D = drill seeded
C = control (not seeded)

Interpretations and Analysis

The results of the field inventory are summarized in the following tables. The following criteria were developed in order to interpret and analyze the field data. The values are admittedly subjective but the author's felt that the following criteria adequately analyzes and interprets the wide array of data gathered from the field.

Criteria for value ratings:

Seeding Success.

- A successful seeding on north slope to non-aspect sites of seeded species is > than 300 lbs/ac.
- A successful seeding on south slope sites is greater than 100 lbs/ac. of seeded species.

Species richness is the total number of species (seeded and unseeded), number of perennials and relative composition.

- High species richness has more than 20 species in the plant community, more than 15 perennials and a composition of grasses > 70%, forbs > 15% and shrubs > 10%.
- Medium species richness has 15-19 total species, 8-14 perennials and a composition of 40-70% grasses, forbs less than 30% and 4-9% shrubs.
- Low species richness has less than 15 total species, less than 8 perennials and a composition of less than 40% grasses, greater than 30% forbs and less than 3% shrubs.

Forage Value was determined by using a 25% harvest efficiency multiplied by total lbs/ac annual production.

- High forage value is greater than 200 lbs/ac.
- Medium forage value is 100-199 lbs/ac.
- Low forage value is less than 100 lbs/ac.

Cover Value is derived from estimated total vascular plant cover.

- Good cover value is > 45%.
- Fair cover value is 30-44%.
- Poor cover value is < 30%.

Watershed value is derived by adding total vascular plant cover, litter percentage and a factor for bare ground.

- High watershed value is total vascular plant-litter cover > 80% and bare ground < 15%.
- Medium watershed value is total vascular plant-litter cover from 60-79% and bare ground < 25%.
- Low watershed value is total vascular plant-litter cover < 60% and bare ground > 25%.

Big game wildlife habitat value uses values already determined for cover, species richness, forage and percent composition of shrubs.

- High big game wildlife habitat value has a medium to high forage value, medium to high species richness, good cover, and the composition of shrubs > 10%.
- Medium big game wildlife habitat value has a medium forage value, medium species richness, fair cover, and the composition of shrubs is 5-9%.
- Low big game wildlife habitat value has a low forage value, low species richness, poor to fair cover, and the composition of shrubs is < 5%.

Future fire resistance was a value that was reviewed and rated. It was determined that all the seedings have a high resistance to future fires due to the extended green period of the successfully seeded species. Therefore the ratings were not included in the tables.

Table 14. Summary of Seeding Success

Fire	Aspect	Seeding success-drilled	Seeding success-aerial
8th Street	North	--	No
	South	--	No
	Non-aspect	--	No
	North	Yes	--
	South	Yes	--
	Non-aspect	Yes	--
Snow Basin	Pine-sedge	--	Yes
	Pine-mixed fir	--	Yes
	Mixed fir	---	Yes
Foothills	North	--	Yes
	South	--	Yes
	Non-aspect	--	No
	North	Yes	--
	South	Yes	--
	Non-aspect	Yes	--
City Creek	North	--	Yes
	South	--	Yes
	Non-aspect	--	Yes
	Non-aspect	Yes	--

Table 15. Summary of values for unsuccessful seedings

Fire	Aspect or Site	Method	Species richness	Forage value	Cover value	Watershed value	Wildlife habitat value
8th Street	North	Aerial	Low	High	Good	High	Low
	South	Aerial	Medium	Medium	Poor	Low	Low
	Non-aspect	Aerial	Low	Medium	Good	Medium	Low
Foothills	Non-aspect	Aerial	Low	Medium	Fair	Medium	Low

Note: No unsuccessful seedings were found at City Creek or Snow Basin.

Table 16. Summary of values for successful seedings

Fire	Aspect or Site	Method	Species richness	Forage value	Cover value	Watershed value	Wildlife habitat value
8th Street	North	Drilled	Low	High	Good	High	Low
	South	Drilled	Low	High	Fair	High	Low
	Non-aspect	Drilled	Low	Medium	Good	Medium	Low
Snow Basin	Pine-sedge	Aerial	Medium	Medium	Good	Medium	Medium
	Pine-mix. Fir	Aerial	Medium	High	Fair	Medium	Medium
	Mix. fir	Aerial	Medium	Medium	Fair	Medium	Medium
Foothills	North	Aerial	Medium	High	Good	High	Medium
	South	Aerial	Medium	Medium	Fair	Low	Medium
	North	Drilled	Low	High	Good	High	Low
	South	Drilled	Low	High	Good	High	Low
	Non-aspect	Drilled	Low	High	Good	High	Low
City Creek	North	Aerial	Medium	High	Good	High	Medium
	South	Aerial	Low	High	Fair	Medium	Low
	Non-aspect	Aerial	Medium	High	Fair	High	Medium
	Non-aspect	Drilled	Medium	High	Good	High	Medium

Table 17. Summary of values for controls.

Fire	Aspect or Site	Method	Species richness	Forage value	Cover value	Watershed value	Wildlife habitat value
8th Street	North	NA	Low	Medium	Fair	High	Low
	South	NA	Low	Medium	Fair	Medium	Low
	Non-aspect	NA	Low	High	Poor	Medium	Low
Foothills	North	NA	Medium	Medium	Fair	Medium	Low
	South	NA	Low	Medium	Fair	Low	Low
	Non-aspect	NA	Low	Medium	Fair	Medium	Low
City Creek	Non-aspect	NA	Medium	High	Good	High	Medium

Note: No controls were found at Snow Basin

Weather Data
The following tables give monthly precipitation for the water year (October to June) for the nearest weather station for each of the EWP seedings. Figures are in inches.

Tables compare long-term average precipitation by month to monthly precipitation the first year following seeding.

Green indicates above average precipitation for the period.

8th Street Fire
Boise Airport – Monthly Precipitation Means
Period of Record: 1/1/1940 to 12/31/2001.

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
.79	1.35	1.36	1.44	1.16	1.23	1.21	1.28	.89	10.71

Data for water year 1996-1997

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
1.03	1.3	3.38	2.1	.30	.39	.90	.43	.21	10.04

The official weather station is located on the Boise River valley floor approximately four miles from the seeding. The seeding is on the foothills of the Boise Front at a higher elevation. Monthly precipitation is likely higher than the official weather station but it is assumed that the weather patterns are similar.

Foothills Fire
Mountain Home—Monthly Precipitation Means
Period of Record: 8/1/48 to 12/31/2001

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
.63	1.20	1.28	1.38	.90	1.08	.84	.90	.76	8.97

Total monthly precipitation for water year 1992-1993

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
.90	1.37	.89	1.65	.96	2.45	2.09	2.10	.52	12.93

The official weather station at Mountain Home is located approximately 10-15 miles from the seeding. The seeding is in the foothills at a higher elevation than the weather station. Monthly precipitation is likely higher than the official station but it is assumed that the weather patterns are similar.

City Creek Fire
Pocatello Airport—Monthly Precipitation Means
Period of Record: 1/3/1939 to 12/31/2001

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
.87	1.07	1.04	1.11	.92	1.21	1.11	1.36	1.07	9.76

Data for water year 1987-1988

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
.25	.44	1.21	1.06	.21	.83	.97	.78	.37	6.12

The official weather station at Pocatello is located approximately 8-10 miles from the seeding. The seeding is in the foothills at a higher elevation than the weather station. Monthly precipitation is likely higher than the official station but it is assumed that the weather patterns are similar.

Snow Basin Fire
Fossil—Monthly Precipitation Means
Period of Record: 1961-1990 and 1971-2000. The reason for two sets of weather data is unknown.

Record period	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
1961-1990	1.16	1.92	1.80	1.66	1.23	1.34	1.41	1.27	1.03	12.82
1971-2000	1.33	1.77	1.57	1.50	1.27	1.49	1.42	1.66	1.11	13.12

Data for water year 1967-1968

Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
1.10	.86	1.20	1.10	1.25*	.64	.21	1.31	1.07*	8.74

* monthly data not available. Values shown are the average of the two figures in previous table.

The official weather stations at Fossil are located approximately 20-30 miles from the seeding. The seeding is in the mountains at a much higher elevation than the weather stations. Monthly precipitation is undoubtedly higher than the official stations.

Conclusions

The following species were seeded but not found during the inventory process:
8th Street: Thickspike wheatgrass, Slender wheatgrass and Yellow sweetclover.
Snow Basin: Big bluegrass, Lana vetch, Sainfoin, White clover and Rose clover.
Foothills: Yellow sweetclover and Alfalfa.
City Creek: Lewis flax and Small burnet.
In conclusion, these species are apparently not well adapted to the site, there was no initial establishment, they established but did not persist or they do not compete well with other established species.

Intermediate wheatgrass, where seeded, has become established and has persisted. Hard fescue was seeded on one site in Snow Basin. It has become the dominant grass species on that site. All other seeded species that were recorded during the inventory were found in relatively minor amounts.

All four EWP seedings that were evaluated had some degree of success. All drill seeding was successful on north, south and non-aspect sites. Mixed success was obtained by aerial seeding regardless of aspect. Observations during the inventory suggest that aerial seeding success is higher on concave slopes and where shrubs had a high density before burning. This is probably due to heavier ash accumulation, better coverage of the seed and more effective precipitation in

the concave locations. These areas probably burned hotter and resulted in a greater reduction of understory competition the first growing season.

The water year immediately following the fire was compared to long-term averages of the nearest official weather station for each seeding. Below average monthly precipitation for the water year and during the growing season appeared to have no effect on the long-term success of City Creek and Snow Basin seedings. Below average precipitation during the first growing season on the 8th Street Fire resulted in very poor establishment of the aerial seeding. Drill seeding success on 8th Street fire is probably due to the above average fall and winter precipitation that occurred before and after seeding. Above average precipitation during the spring of the first growing season unquestionably influenced the success of Foothills seeding.

Aerial seeding of tree species on the Snow Basin fire was a failure. Direct tree planting of seedlings was partially successful and repeated attempts have been made. Intermediate wheatgrass is retarding Ponderosa pine regeneration and re-establishment by hand planting.

The 8th Street fire area had burned prior to 1996. The number of shrubs was probably already low at the time of this fire. This reduced the amount of ash on the ground, thus reducing soil/ash covering of aerially applied seed. This and the below average spring precipitation may be the causes of the aerial seeding failures.

Successful seedings are generally higher in values for all categories i.e. species richness, forage, cover, watershed and wildlife.

Unsuccessful seedings are generally no better than controls in all categories.

Results or values for cover and watershed on unsuccessful seedings are mixed and inconclusive.

Species richness and wildlife habitat values rated low to medium on successful seedings. Unsuccessful seedings and controls were generally low in species richness. Species richness and wildlife habitat values are inconclusive regardless of aspect and seeding method.

Successful seedings were generally high or good in forage, cover and wildlife values. North slopes were generally higher in forage, cover and wildlife values than south slopes and non-aspect sites. Controls were generally medium or fair in these values.

Where post-fire restoration or rehabilitation objectives are improved watershed and livestock forage, the seeding rates used for these EWP seedings would be appropriate.

Where species richness needs improvement due to pre-fire dominance of annuals and/or weedy species, seeding of native species would be beneficial.

Where natural regeneration of native species, particularly shrubs, is a major objective, EWP seeding rates of introduced sod-forming species need to be reduced. If an increase in native shrubs is an objective, a better effort is needed to seed or plant shrubs or use less competitive grass species.

Introduced species were the dominant seeded species on these fires. An observation during field data collection indicated that native Big bluegrass was successfully aerially seeded on BLM land

and added to species diversity. Big bluegrass should be considered as a mixture component in future watershed protection seedings.

Foothills and City Creek seedings are suppressing native plant succession, especially shrubs. In those areas where intermediate wheatgrass was seeded and is rated successful, it is the dominant species in the plant community. Little shrub recruitment is occurring. In these areas, low species richness and low big game wildlife habitat values were recorded. In Snow Basin, Hard fescue and Intermediate wheatgrass are retarding Ponderosa pine regeneration.

Intermediate wheatgrass, Crested wheatgrass and Hard fescue have an extended green period compared to most native species and therefore are resistant to future fires.

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