

FORESTRY TECHNICAL NOTE

Results of Reseeding a Fire Impacted Watershed in South Central Montana

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Abstract

The Black Butte fire (outside Big Timber, Montana) reseeded evaluation was established in March 1995 on a disturbed forestland site in South Central Montana to study the effectiveness of seeding in relation to erosion/sediment reduction, understory plant succession and its effects on tree regeneration. The herbaceous vegetation could be used to stabilize disturbed sites, manage noxious weeds and provide forage. The site, a Douglas-fir/common snowberry habitat-type, had received a light to severe burn from a wildfire (approximately 12,000 acres) that occurred in September 1994 and was salvaged logged over the next two years. Approximately 1,600 acres of the severely burned areas were seeded. Those acres were considered the most critical. Those sites had been densely forested and correspondingly had little vegetation growing on the forest understory before the fire. On such sites the fire had consumed the nearly continuous litter/duff layer that covers the soil surface. A seeding mix was designed based on the land managers' objectives and the site conditions. The seed mix consisted of 'Potomac' orchardgrass, 'Revenue' slender wheatgrass, 'Manchar' smooth brome and yellow sweetclover. A comparison study was established to compare the seeded versus unseeded responses in the plant communities. Permanent plots and transects were established and monitored for plant adaptation, percent canopy cover (seeded) and tree seedling regeneration over ten years.

The seed mix of 'Potomac' orchardgrass, 'Revenue' slender wheatgrass, 'Manchar' smooth brome and yellow sweetclover showed good stand establishment, plant vigor, forage production and percent canopy cover. The seeded sites substantially reduced erosion not only the first year but at the end of the evaluation period as well. Orchardgrass provided the most cover and production. The seeded sites did not add significantly to total canopy coverage in any given year and for the period average. Seeded sites have an impact on the number of species occupying the site over time. There were less species present on the seeded versus the unseeded sites. Clearly, the seeded sites are occupied by more desirable plant species from a forage stand point and reduce the amount of noxious weeds present on the site. There was a slight reduction in the number of tree seedling regenerating in the overall seeded plots versus the control (unseeded) plots. As a result of this information, land managers will be able to make more informed decisions about whether to seed herbaceous species on disturbed forestland sites.

History – The Black Butte fire, South of Big Timber, Montana, started September 8, 1994, and burned six days. A total of 12,208 acres of rangeland and forest burned. Approximately 30 percent (4,000 acres) of the fire impacted area was forestland. Most of the land (approximately 75 percent) impacted by the fire was privately owned (9,248 acres). Parts of the severely burned sites were helicopter seeded in March 1995.

The major justifications for moving forward with the project related to fisheries, soil erosion reduction, and control the spread of noxious weeds, such as leafy spurge, which was significantly present on the site before the fire. A pure strain of Yellowstone cutthroat trout was documented in a stream affected by the fire. Grass seeding was needed to: 1) reduce sediment delivery to streams, thereby reducing the impacts to cutthroat trout populations, 2) lessen downstream impacts of sediment moving through the stream system, 3) reduce adverse impacts to the productivity of the soil resource, and 4) reduce the incidence of noxious weeds.

Resources – Approximately 1,600 acres of the severely burned areas were seeded. Those acres were considered the most critical. Those sites had been densely forested and correspondingly had little vegetation growing on the forest understory before the fire. On such sites, the fire had consumed the nearly continuous litter/duff layer that covers the soil surface. Slopes are steep to very steep with little to no area to filter sediment before reaching the stream.

Treated sites were mostly very steep northerly facing slopes covered with a mixed sawlog and pole-sized Douglas-fir and ponderosa pine. Typical forest habitat-types identified are Douglas-fir/common snowberry and Douglas-fir/mallow ninebark. Soil parent material is primarily residuum composed of sedimentary volcanic mudflow material. Soils of the seeded areas are often moderately deep with moderate moisture-holding capacity. Soil surface textures are typically gravelly loam. Soil series are Winkler and Amor.

Seed Mix – The seed mix consisted of 3 lbs./ac. Pure Live Seed (PLS) ‘Potomac’ orchardgrass (65 percent), 2 lbs./ac. PLS ‘Revenue’ slender wheatgrass (12 percent), 2 lbs./ac. PLS ‘Manchar’ smooth brome (12 percent) and 1 lb./ac. PLS yellow sweetclover (12 percent). The seed mix was based on the land manager’s objective(s) of species suited to the site, forage values, erosion control and their ability to compete with noxious weeds. The mix was applied at the rate of about 55 PLS per square foot.

Sites – The effectiveness of the seeding was monitored in relation to erosion/sediment control, understory plant succession and tree regeneration. Two pairs of sites representative of the area were selected. Each pair is of similar soil, aspect, elevation and slope steepness. One unit of each pair was seeded and the other unit was not seeded to serve as a control. Each site was monitored in 1995, 1996, 1997, 1999 and 2005.

Sites One (seeded) and Two (unseeded) are on strongly sloping to very steep slopes of 18 to 41 percent. Aspect ranged from 310 to 0 degrees. Elevation of both sites was 4,500 feet above mean sea level. Habitat-type is Douglas-fir/common snowberry. Soil series is Amor gravelly loam on Site One and Winkler gravelly loam on Site Two.

Sites Three (seeded) and Four (unseeded) are on very steep slopes of 70 percent. Aspect was 342 degrees and elevation was 4,600 feet above mean sea level. Habitat-type is Douglas-fir/mallow ninebark. Soil series is Winkler gravelly loam.

Results – Attached are various tables that show the results from the data that was collected over the ten-year period. Each of the sites evaluated the impacts on: 1) ground and canopy cover, 2) reducing erosion, 3) number of species in a plant community, and 4) tree regeneration.

Cover – On the seeded sites, orchardgrass provided the most ground cover and forage production. Maximum cover recorded was 52 percent. The seeded sites did not add significantly to total canopy coverage in any given year and for the period average. The unseeded sites provided canopy coverage, but the sites were occupied by weeds and other less desirable plants.

Erosion – The seeded sites substantially reduced erosion not only the first year, but at the end of the evaluation period as well. The average erosion rate on the seeded sites for the 1995 through 1999 period is over half (77 percent) of that of the unseeded sites.

Plant Community Succession – The seeded sites have an impact on the number of species occupying the site over time. There is less species diversity on the seeded sites. Depending on the objectives of the seeding, the seeded sites are occupied by more desirable plant species from a forage stand point and reduce the amount of noxious weeds present on the site.

Tree Regeneration – Seeding did not preclude tree regeneration. Seeding did reduce tree seedling numbers established. Lack of a seed source around the plots may influence the number of tree seedlings present. Outside the plot, the total average tree seedlings on the seeded sites would still make a fully stocked stand of trees.

Summary

- The seed mix of ‘Potomac’ orchardgrass, ‘Revenue’ slender wheatgrass, ‘Manchar’ smooth brome and yellow sweetclover showed good stand establishment, plant vigor, forage production and percent canopy cover.
- The seeded sites substantially reduced erosion not only the first year, but at the end of the evaluation period as well.
- Orchardgrass provided the most cover and production. The seeded sites did not add significantly to total canopy coverage in any given year and for the period average.
- Seeded sites have an impact on the number of species occupying the site over time. There were less species present on the seeded versus the unseeded sites.
- Clearly, the seeded sites are occupied by more desirable plant species from a forage stand point and reduce the amount of noxious weeds present on the site.
- There was a slight reduction in the number of tree seedling regenerating in the overall seeded plots versus the control (unseeded) plots.

As a result of this information, land managers will be able to make more informed decisions about whether to seed herbaceous species on disturbed forestland sites. Selecting the appropriate seed species for the site and the intended purposes cannot be overstated. In many cases, selecting the appropriate species can make a difference between success and failure of the seeding establishment.

Where to get help

For more information, contact the local office of the USDA Natural Resources Conservation Service, or your local Soil and Water Conservation District.

BLACK BUTTE FIRE
FIRE IMPACTED WATERSHED MONITORING DATA SUMMARY

Site:	1	2
Aspect:	310 degrees azimuth	0 degrees azimuth
Elevation:	4,500 feet	4,500 feet
Slope:	18%	41%
Soil Series:	Amor gravelly loam	Winkler gravelly loam
Habitat-Type:	Douglas-fir/mallow ninebark	Douglas-fir/mallow ninebark

	SEEDED					UNSEEDED				
	Year					Year				
	1995	1996	1997	1999	2005	1995	1996	1997	1999	2005
Ground Cover:										
Ground Cover Disturbance										
Ground Cover (%)										
Bare Soil	62	40	8	22	20	47	44	10	8	12
Gravel	2		2		3	4			2	2
Rock	2	4		1			3			
Moss			30	18		2	4	31	29	1
Litter/Duff	24	40	52	38	34	44	42	47	46	18
Basal Vegetation	10	16	5	19	22	1	3	9	11	46
Wood			3	2	21	2	4	3	4	21
Total	100	100	100	100	100	100	100	100	100	100
Canopy Cover (Species%)										
Seeded Grasses										
'Manchar' smooth brome		T		T	3		T	10	T	T
Perennial ryegrass	3	T	T	T					T	
'Potomac' orchardgrass	39	48	52	32	7	T	5	12	36	6
'Revenue' slender wheatgrass										
Subtotal	42	50	52	33	10	T	6	22	38	7
Grasses and Grass-likes										
Canada bluegrass	T		T	T	T					
Cheatgrass				T				4	T	
Grass					T			4		
Needleleaf sedge					T					T
Northwestern sedge						T		T	1	
Pinegrass									2	3
Redtop									2	
Sedge	T			T			T			T
Subtotal	1	0	T	2	2	T	T	8	6	4

	SEEDED					UNSEEDED				
	Year					Year				
	1995	1996	1997	1999	2005	1995	1996	1997	1999	2005
Canopy Cover (Species%)										
Forbs										
Annual forbs	3		T		T		T	5		
Bicknell geranium						2				
Blue lettuce							T	T	T	
Broadleaf arnica						2				
Canada thistle						T				
Claspleaf twistedstalk							T	T		
Common salsify				T						
Common dandelion				T	T					
Desert alyssum			T	1						
European stickseed							T			
Fireweed willowherb						2	T	1	T	
Flannel mullein						T	T			
Forb					T		T			
Lambsquarter goosefoot						8	T			
Mustard					3		8			T
Northern bedstraw				T		T	T		3	T
Showy aster						9	8	8	9	9
Subtotal	3	0	1	2	4	26	20	15	13	10
Canopy Cover (Species%)										
Shrubs										
Common snowberry					T	T	T	4	T	3
Mallow ninebark									T	T
White spiraea						3	5	T	3	4
Subtotal	0	0	0	0	1	4	6	4	4	8
Trees										
Ponderosa pine						T	T			
Subtotal	0	0	0	0	0	T	T	0	0	0
Moss										
Total	46	50	52	37	17	30	33	49	61	29
Total No. of Species	7	5	5	10	10	13	18	12	15	11
Adjusted No. of Species	3	0	3	7	8	12	15	10	11	9
Tree Regeneration (no./ac.)	0	0	Y	Y		Y	Y	Y	Y	
Ponderosa Pine			+	+		40	13	+	+	
Douglas fir									+	
Subtotal			+	+		40	13	+	+	
Erosion Index										
RUSLE "C" Factor	0.018	0.009	0.006	0.002		0.031	0.028	0.016	0.007	
Soil Surface Status	4	4	4	3		4	4	4	1	
Erosion Depth	0.5	0.8	0.8	0.8		0.2	0.2	0.2	0.2	
Percent of Area Eroded	70	20	20	30		20	20	20	5	

Site:	3	4
Aspect:	342 degrees azimuth	12 degrees azimuth
Elevation:	4,600 feet	4,500 feet
Slope:	70%	75%
Soil Series:	Winkler gravelly loam	Winkler gravelly loam
Habitat-Type:	Douglas-fir/mallow ninebark	Douglas-fir/mallow ninebark

	SEEDED					UNSEEDED				
	Year					Year				
	1995	1996	1997	1999	2005	1995	1996	1997	1999	2005
Ground Cover:										
Ground Cover Disturbance										
Ground Cover (%)										
Bare Soil	78	38	21	8	33	81	47	11	3	8
Gravel			1		2	2				
Rock		1					1	1	1	
Moss		1	15	6		1		9	3	
Litter/Duff	7	41	40	61	23	14	32	53	72	14
Basal Vegetation	10	15	21	22	29	2	18	24	17	73
Wood	5	4	2	3	13		2	2	4	5
Total	100	100	100	100	100	100	100	100	100	100
Canopy Cover (Species%)										
Seeded Grasses										
'Manchar' smooth brome	T	1	1	22	4			T		
Perennial ryegrass		1	1							
'Potomac' orchardgrass	19	19	33	22	5					
'Revenue' slender wheatgrass	1	1						T	1	
Subtotal	20	22	35	22	9	0	0	1	1	0
Grasses and Grass-likes										
Canada bluegrass			T	T				15	5	3
Cheatgrass			T				1	5	1	
Japanese brome										1
Mountain brome	T									
Northwestern sedge						1	1	6	T	
Pinegrass					T		5		T	
Redtop									3	
Sedge			T							
Western wheatgrass								T		T
Subtotal	T	0	2	T	T	1	7	26	10	4

	SEEDED					UNSEEDED				
	Year					Year				
	1995	1996	1997	1999	2005	1995	1996	1997	1999	2005
Canopy Cover (Species%)										
Forbs										
American vetch						1	1			
Blue lettuce			2				1	1		
Broadleaf arnica	1									
Canada thistle								T	1	
Cinquefoil						T		T		
Claspleaf twistedstalk		1	1		T		T	T	1	
Common salsify					T		T	T		T
Common dandelion	T				T			3	T	
Desert alyssum								1		
Flannel mullein						2		2	T	
Forb			1		1	T	3	T		T
Franklin phacelia		T	T							
Heartleaf arnica		1								
Houndstongue									T	
Lambsquarter goosefoot	1					2				
Larkspur									T	
Leafy spurge						1	T	12	16	3
Lupine					T			T	1	4
Miners lettuce			T		T					
Mustard		T	1				3			
Nightshade						T				
Northern bedstraw							T	1	1	
Pepperweed		T			1		3			
Plantain						T				
Showy aster	1	1	T	2	T				T	
Violet						T			T	T
Western yarrow				T	T	T	6	2	2	T
Yellow sweetclover	4	3	2							
Subtotal	8	8	8	2	4	9	19	26	24	8
Shrubs										
Common snowberry	1			1	1	1	6	6	10	5
Mallow ninebark	T	2		1	3	2	5	8	4	3
White spiraea			1			14	21	2	10	5
Subtotal	2	2	1	2	4	17	32	16	24	13
Trees										
Ponderosa pine						T				1
Subtotal	0	0	0	0	0	T	0	0	0	1
Moss	0	0	0	0	0	0	0	0	0	0
Total	30	32	46	26	17	18	58	69	59	26
Total No. of Species	11	11	15	7	14	16	16	24	20	13
Adjusted No. of Species	7	6	11	5	12	16	16	22	19	13

	SEEDED					UNSEEDED				
	Year					Year				
	1995	1996	1997	1999	2005	1995	1996	1997	1999	2005
Tree Regeneration (no./ac.)	0	0	0	0	0	Y	0	0	0	0
Ponderosa Pine						13				
Douglas fir										
Subtotal	0	0	0	0	0	13	0	0	0	0
Erosion Index										
RUSLE "C" Factor	0.077	0.023	0.014	0.005		0.106	0.021	0.005	0.005	
Soil Surface Status	2	1	1	1		4	4	4	1	
Erosion Depth	0.2	0.4	0.6	0.7		0.1	0.2	0.3	0.4	
Percent of Area Eroded	80	20	20	10		50	40	20	0	