Native Plants for Roadside Revegetation: Field Evaluations

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INTRODUCTION

Integrating the establishment of sustainable roadside vegetation with goals for safe transportation corridors is essential for improving efficient and cost-effective road systems. Establishing native vegetation communities on roadsides can be a proactive approach to sustainable roadways. Revegetation with native species is the preferred management practice of the Idaho Transportation Department, sponsor of this research project (Figure 1).[(A)]

The environmental and economic benefits of increasing desirable vegetation along Idaho roadways include:

- Improving slope stabilization and reducing surface soil failures, mass wasting, and erosion.
- Improving soil conservation, reducing sedimentation of surface waters, and protecting water quality.
- Controlling costs and reducing the need to repair failed best management practices.
- Reducing need for active management of noxious weeds in right-of-ways.
- Improving roadway safety and aesthetics.
- Improving wildlife habitat and connectivity where appropriate.
- Minimizing the ecological footprint of the roadway.

Selecting appropriate plant species for revegetation is the foundation for improving soil conservation, plant community stability, invasive plant resistance, wildlife habitat, and water quality. This study provides practical information for improving roadway revegetation in Idaho with an emphasis on native plants.

Figure 1. ITD's Albion revegetation site.

OBJECTIVES

Our objective was to measure vegetation and soil erosion to determine effective means for establishing perennial native vegetation, reducing surface erosion, and preventing weed encroachment. Data was synthesized to provide guidance and recommendations on species selection, seeding methods and site preparation techniques to improve the success of revegetation projects.

STUDY SITES

We evaluated the success of roadside revegetation on 16 sites in Idaho and one site in southwest Montana (Figure 2). The sites are in six different ecoregions of Idaho to represent a diversity of climatic, edaphic (soil characteristics), and topographic conditions.

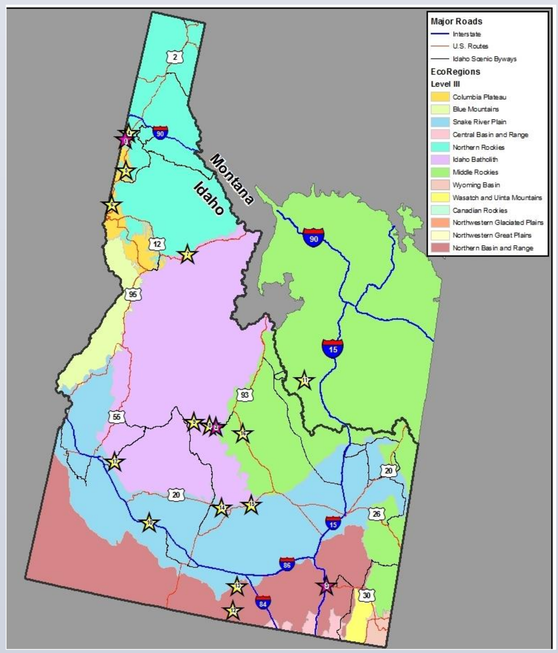

Figure 2. The 17 research sites within the ecoregions of Idaho.

METHODS

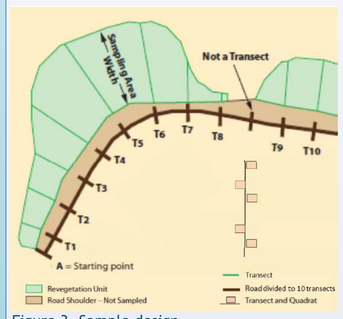

Figure 3. Sample design.

A linear systematic-random approach was used to sample vegetation species richness, percent canopy cover by species, and soil stability in 2012 and 2013 (Figure 3).[(B)] Due to unique site preparation and seed mixes used at each location, data were compiled, analyzed and discussed by site. For presentation, canopy cover and species richness is presented by functional groups.

RESULTS

Vegetation Establishment

We considered a species established if it was present in the 2 x 2 ft. sampling frames used to estimate vegetation canopy cover. Canopy cover is the percentage of ground covered by a vertical projection of live plant foliage or abiotic features (rock, litter, or bare ground) on the soil surface. Figure 4 provides typical canopy cover results for a study site. The entire report is available online.[(C)]

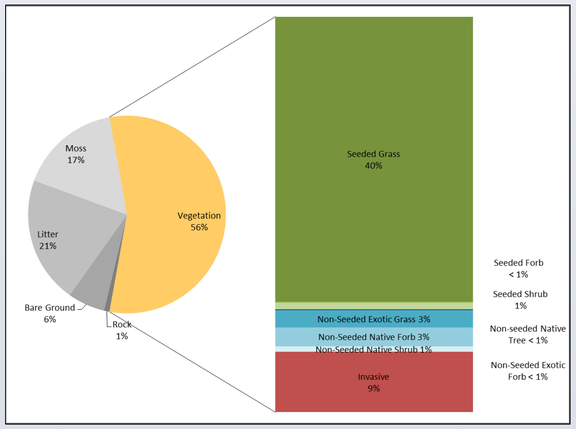

Figure 4. Mean percent cover by functional group at Electrical Substation site.

Grass Species

- Of the seeded grass species, 21 of 27 (78%) established on the sites.
- Grass species with the highest average canopy cover were streambank wheatgrass (13%), bluebunch wheatgrass (12%), crested wheatgrass (11%), Idaho fescue (10%), and Canada bluegrass (8%).
- Bluebunch wheatgrass and Idaho fescue, both native grasses, had high success of establishing (92% and 71% respectively).
- Grass species that consistently established on all sites where seeded but have a low canopy cover included sheep fescue , western wheatgrass , and basin wildrye.

Forb and Shrub Species

- Ten of 23 seeded forb (43%) and 4 of 11 seeded shrubs species (36%) established (Figure 5).
- Only 4 forb species had an average canopy cover over 1% including alfalfa (17%), silky lupine (13%), western yarrow (7%), and sulfur flower buckwheat (5%). Alfalfa and silky lupine established at 25% and 10% of sites, respectively.
- No forb species had over 1% cover and >50% establishment success rate.
- Mountain big sagebrush was the only seeded shrub with >1% cover.

Figure 5. The Tom Cat Hill site had good establishment of seeded grasses and forbs.

RESULTS CONTINUED

Seeding Method

Three seeding methods were used. We evaluated the resulting canopy cover of seeded species when each of the methods were used (Table 1).

Table 1. Canopy cover by seeding method. Seed rate includes all life forms.

Site Name	Seeding Method	Rate (lbs/acre)	Seeded Species Canopy Cover
Worley SH-58	Hydroseed	89	44%
Clayton SH-58	Hydroseed	66	9%
McCammon US-30	Drill Seed	85	18%
Setters US-95	Hydroseed	64	7%
Electrical Substation US-95	Hydroseed	44	42%
Genesee US-95	Drill Seed	33	22%
Syringa Creek US-12	Hydroseed	86	65%
Basin Creek Bridge SH-75	Broadcast Seed	124	10%
Slate Creek Bridge SH-75	Hydroseed	25	Not Assessed
Glenns Ferry I-84	Hydroseed	42	13%
Clark Canyon MT SH-324	Drill Seed	19	53%
City of Rocks STC-2841	Drill & Broadcast Seed	20	29%
Albion SH-77	Drill Seed	30	25%
Silver Creek Bridge US-20	Drill Seed	22	24%
Tom Cat Hill US-93	Drill & Broadcast Seed	24	33%
Willow Crk. Summit US-93	Hydroseed	Unknown	16%
Wildlife Crossing SH-21	Drill and Hydroseed	65	21%

- Drill seeding was the most effective seeding method, even at low seeding rates (Figure 6).
- Drill seeding resulted in consistently higher canopy cover of seeded species.
- Hydroseeding results were variable and site dependent.
- Broadcast seeding alone was not an effective revegetation method.

Figure 6. Drill seeding resulted in 53% cover of seeded species at Clark Canyon site when seeded at 19 lbs/ac.

Erosion Condition

Erosion condition classification scores were "stable" for 10 sites, "slight" for 6 sites, and "moderate" for 1 site. Sites that scored "stable" or "slight" had minor indicators of erosion including litter and soil movement. No "critical" or "severe" sites were observed.

The ability of revegetation practices to control erosion is testament to the practicality and effectiveness of seeding with slope stabilization techniques (e.g. compost, erosion blankets, soil texturing) at the sites (Figure 7).

- The "moderate" erosion rating should be monitored annually.
- Compost should be applied at 0.5 to 1.0 inch depths.
- Roughened soil surface conditions facilitate water infiltration.
- For good quality topsoil, fertilizer is not necessary.
- For moderate quality or thin topsoil, apply fertilizer to achieve 25 - 50 lbs/acre available nitrate-nitrogen.
- Wattles are a proven BMP to deploy on slopes greater than 3:1.

Figure 7. The combination of surface roughening, wattles, mulch, and seeding resulted in stable conditions at the Electrical Substation Site.

RESULTS CONTINUED

Weed Management

Invasive plant species (Idaho noxious weeds, annual exotic grasses, and exotic forbs known to be aggressive) occurred at all the sites. Noxious weeds occurred at 47% of sites. The most common invasive plants were cheatgrass, annual forbs, and spotted knapweed (Table 2, Figure 8). Although frequency of invasive plants was high, cover was generally low and ranged from <1% to nearly 60%, but averaged less than 10% for all but 2 sites.

Table 2. Frequency of Occurrence of Invasive Plants.

	Total (17 sites)
Invasive Plants	100%
Idaho Noxious Weeds	47%
Spotted Knapweed	24%
Field Bindweed	12%
Oxeye Daisy	12%
Rush skeletonweed	12%
Other Invasive Plants	100%
Cheatgrass	82%
Other annual grasses	41%
Annual forbs	82%
Salsify	29%
St. Johnswort	24%
Bull Thistle	18%

Figure 8. Cheatgrass, the most common invasive plant along Idaho roadways.

- For sites with relatively low cover of invasive plants, careful management of desired vegetation is critical to prevent weedy plants from increasing.
- Target annual grasses with herbicide in fall and spring for best control and to minimize impacts to desired grasses.
- For areas where introduced grasses are prevalent and site conditions suggest that establishment of natives is not feasible, consider benefits of using exotic grasses that establish quickly.
- Mow when weeds are at an early flowering stage to prevent seed production and weaken perennial weeds over time. Time mowing to occur when desired vegetation is dormant.
- Do not mow if weeds have already produced seeds because mower blades can scatter seeds beyond the existing infestation.

Additional Recommendations

- When seeding aggressive exotic grass species, eliminate or limit native species in the seed mix because they will have low establishment.
- Do not include forbs and shrubs in seed mixes where herbicides are used.
- Use forb species that are known to establish, are relatively inexpensive and tolerant of herbicides (Figure 9).
- For native forbs and shrubs, consider creating seeded "islands" rather than seeding the entire site.
- High seeding rates do not necessarily improve species establishment and cover.
- Seed mixes should be limited to 6 to 9 species.

Figure 9. Silky lupine had 13% cover where it did establish and is tolerant of some herbicides.

References

A. **Idaho Transportation Department.** *Best Management Practices Manual, Environmental Section*. Boise, ID: Idaho Transportation Department, 2011.

B. **Kingery, J., A. Cotter, and K. Moseley.** *Idaho Roadside Revegetation Handbook*. Boise, ID: Idaho Transportation Department, Research Program, 2003.

C. Ament, R., M. Pokorny, J. Mangold, N. Orloff, and S. Jennings. *Native Plants for Roadside Revegetation: Field Evaluations and Best Management Practices Identification*. Boise, ID: Idaho Transportation Department, Research Program, 2014. Available: http://itd.idaho.gov/highways/research/

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