

# 10 Years of Testing Indigenous Plant Material on Drastically Disturbed Mineland in Western Montana.

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## I. Introduction

Mining and smelting activities were the major industries around the Butte-Anaconda area in Montana for nearly 100 years. The smelter stack emissions blanketed a 300-square-mile region with particulates high in sulfides and heavy metals such as arsenic, cadmium, copper, lead, and zinc. Acidic mine tailing sediments and smelter waste carried overland by surface erosion, streams, and irrigation ditches was deposited on floodplains and agricultural lands. These emissions and sediments caused local soils to become extremely acidic, which resulted in large-scale plant die-off and increased wind erosion.

Ongoing reclamation efforts on this vast, severely degraded watershed have relied almost exclusively on commercial seed from non-local sources. There has been a relatively low plant establishment success rate due to many factors, most of which stem from the use of material that is not adapted to survive the locally severe conditions nor the regional climate of western Montana.



Washoe Reduction Works Chimney, 1999



Site conditions north of chimney, 1997



Old Works Golf Course, former site of Upper Works Smelter



Anaconda Copper Company, September 1928  
Photographer: Chris Strakal

## II. Development of Acid-Tolerant Cultivars Project

The Deer Lodge Valley Conservation District, in cooperation with the Natural Resources Conservation Service's Bridger Plant Materials Center, initiated this project in 1995 to test and select locally adapted plant materials that demonstrate superior tolerances to acidic/heavy-metal contaminated soils. The goal is to provide a reliable supply of quality seed that is adapted to the intermountain climate of western Montana and to soils impacted by mining and smelting. The use of locally adapted, superior-proven seed will increase plant establishment and cover, thereby decreasing wind and water erosion. Benefits include improving soil structure, nutrient cycling, plant community dynamics, wildlife habitat, water quality, and fisheries.

### A. Wildland Seed Collection

The initial wildland seed collection were from lands impacted by mining throughout areas in western and central Montana. Seed of approximately 75 species was collected from a wide range of climate, elevation, plant communities, and levels of heavy-metal soil contamination.



Location of seed collection sites on the Anaconda Superfund Site.



Collecting seed of big bluegrass *Poa secunda*.



Basin wildrye *Leymus cinereus* and scarlet globe-mallow *Sphaeralcea coccinea* survive on land affected by fallout from the historic Washoe stack.



Original collection site of common snowberry *Symphoricarpos albus* and silver buffaloberry *Shepherdia argentea*.



Little alumroot *Heuchera parvifolia* growing on land affected by aerial deposition of heavy metals from past smelter operations.



Collecting seed of Indian ricegrass *Achnatherum tamenoides*.



Original collection site of woolly cinquefoil *Potentilla hippiana*.

### B. Evaluation and Test Plots

Since the inception of the project, there have been eight study plots established as Initial Evaluation Plantings (IEP) or Comparative Evaluation Plantings (CEP) at six distinct locations to test locally collected material and ecotypes obtained from commercial sources. Entries were evaluated for percentage survival, vigor, height, and reproductive potential. The best performing accessions were identified for seed increase.



Location of field test sites on the Anaconda Superfund Site.



Site 1 IEP in 1995 tested 140 entries in an area that has a 5.5 pH and high levels of copper, zinc, and cadmium.



The 1999 CEP on Willow Glen Road was seeded with 85 entries on a site with a pH of 4.5 and contaminants in the upper few inches of soil profile.



The 2000 Woody CEP on Willow Glen Road was planted with 19 entries of indigenous and non-local trees and shrubs.



Site 2 IEP in 1996 tested 135 entries on the Opportunity Tailings Ponds. This area has a 3.0 pH and has high salt loading and extremely high metal levels.



The 2000 Greenhouse Tailings Treatment Study tested 70 seeded entries in contaminated media from the Anaconda Superfund Site.



The 2001 Mill Creek Lowland Species Mixture CEP tested 4 local and 4 non-local seed mixes for adaptation and interspecies compatibility.



The 2001 Stuckey Ridge Upland Species Mixture CEP tested 4 local and 4 non-local seed mixes for adaptation and interspecies compatibility.



The 2003 Stuckey Ridge Motocross CEP is evaluating the performance of 12 single species entries and 4 seed mixtures.

### C. Seed Increase at the Bridger Plant Materials Center

Only a relatively small amount of seed can be collected from wild plant populations. The need for further on-site testing and eventual seed distribution to commercial seed growers requires a consistently large supply of seed. To accomplish this, seed production of the best performing accessions is under way at the Bridger Plant Materials Center. Seed production is conducted through direct-seeding in the field and transplanting of container-grown material. Proper cultural treatments are determined for each species to sustain cost-effective methods of production.



Direct seeding with 2-row planter.



Cone-tainers<sup>TM</sup> of seedlings grown for transplanting to field.



Mechanical transplanting of container-grown grass plugs.



Transplanting seedlings of Woods' rose *Rosa woodsii* with tree planter.



Slender wheatgrass *Elymus trachycaulus* seed production field.



Furrow irrigating seed production field of silverleaf phacelia *Phacelia hastata*.



Containers of silver buffaloberry *Shepherdia argentea* ready for field planting.



Seed production of silverleaf phacelia *Phacelia hastata* and fuzzytongue penstemon *Penstemon eriantherus*.

### D. Seed and Plant Release

The best performing accessions are further tested by comparison to other accessions of the same species with unrelated origins. Results of field trials will determine the selection of superior material. The final selections are then released through the Montana Seed Growers Association's Pre-Varietal Release program.

There are presently three releases of acid/heavy-metal tolerant plant species: Selected class of Washoe Germplasm basin wildrye and Prospectors Germplasm common snowberry, and Source-Identified class of Old Works Germplasm fuzzytongue penstemon. The Bridger Plant Materials Center maintains Generation 1 (G1) material, which is equivalent to Foundation class, and distributes seed to qualified growers.



Several other native indigenous species that have performed very well in the evaluation trials are scheduled for release in 2006.



Slender wheatgrass *Elymus trachycaulus*



Big bluegrass *Poa secunda*



Bluebunch wheatgrass *Pseudoroegneria spicata*



Silverleaf phacelia *Phacelia hastata*

Many other species have shown potential and will be considered for future release.



Western aster *Symphiotrichum ascendens*



Woolly cinquefoil *Potentilla hippiana*



Woods' rose *Rosa woodsii*



Silver buffaloberry *Shepherdia argentea*

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Seed is stored and periodically tested for seed viability.