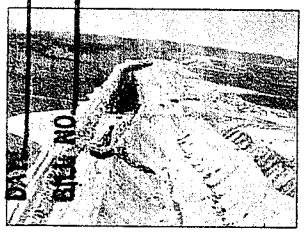
SENATE NATURAL RESOURCES
EXHIBIT NO. 3
DATE March 9, 2009
BILL NO. HB 278

Exhibit a 2008 product of Montana Department of Environmental Quality, presented by Montana Coal Council

SHRUBLAND RECLAMATION ON SOUTHEASTERN MONTANA COAL MINES



Rosebud Mine Pit 8; photo by T. Dickerhoff BSO

Rosebud Mine Area D

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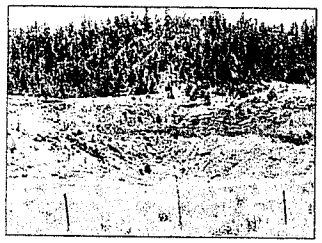
EARLY RECLAMATION EFFORTS

Reclamation of surface coal mines in Montana began in earnest in the 1970's, with the passage of the Montana Surface and Underground Mining Reclamation Act (MSUMRA) in 1973 and the national Surface Mining Control and Reclamation Act (SMCRA) in 1977.

Early concerns were whether or not reclamation was even possible. Early practices included lay down of a uniform layer of soil material (often 24 inches thick) over regraded spoils, followed by seed mixes that included a substantial portion of introduced cool season perennial grasses, such as smooth brome and crested wheatgrass. In many cases, forbs and shrubs were included in the seed mixes, and shrubs and trees (primarily ponderosa pine and Rocky Mountain juniper) were planted. Nonetheless, the result of these early efforts was relatively homogenous stands of introduced grasses, with few shrubs, forbs, or trees.

Big Sky Mine Early reclamation (pre-1979)



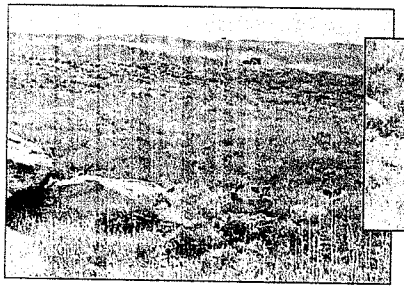
Big Sky Mine remnant highwall, circa the 1980's

OBSERVATIONS OF ACCIDENTAL SHRUB REESTABLISHMENT

As mine operators and reclamation specialists struggled to find the right combination of inputs and environmental factors to insure shrub establishment, they began to notice that shrubs were thriving in a most unexpected place: old spoil piles, dating from the 1950's that had little or no regrading, no covering of soil material, and no planting or seeding.

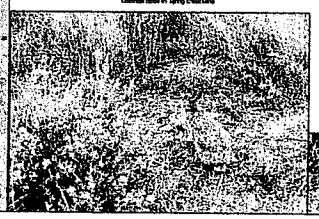
These steep, somewhat unstable, presumably infertile and inhospitable areas had some of the most robust shrub populations on the mines. Topography, landform, and substrate all seemed to contribute to an environment where various shrubs would colonize and grow. From these observations, combined with others over time, have emerged a suite of factors for shrub reclamation success on surface coal mines in southeastern Montana.

UTILITY FOR WILDLIFE HABITAT: *Wildlife use is substantial on mine reclamation where shrubs are present and vegetation diversity is high. Below are pictured some of the animals recently seen on mine reclamation.*



Mule deer buck on Spring Creek Mine

Pronghorn on Spring Creek Mine; photo by R. Fredgren



Cottontail rabbit on Spring Creek Mine

Trout on Rosebud Mine

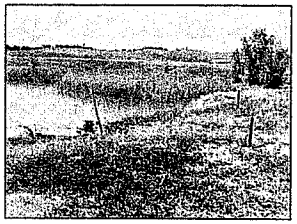
FACTORS FOR SUCCESSFUL SHRUB RECLAMATION: CURRENT EXAMPLES

The following factors have been observed to contribute positively to successful shrub establishment, as well as to general vegetation diversity, when compared with more traditional reclamation. The mechanisms for the various factors that favor shrubs are apparent in some cases and in other cases are purely speculative. None have been fully investigated to test the hypothesized causal factors in the context of surface mine reclamation.

Topography and Landform

Steep slopes that allow erosion within the natural range of variability encourage the development of channels and gullies. Such areas provide microtopographic variation in substrate qualities, aspect and insolation, exposure and concentration of rock fragments, and other environmental factors that favor shrub establishment and plant diversity. Given natural landscape development over a long time, such areas may eventually evolve into wooded coulees, typical of breaks topography.

Rosebud Mine; main "wildlife" designation areas, natural drainages



Rosebud Mine; pans in Area A

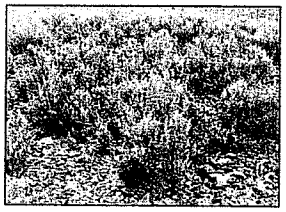
Rosebud Mine; shrub regrowth in Area C

Big Sky Mine; pasture underlying an remnant highwall

Surface and Subsurface Materials

Very thin topsoil layers, suitable spoil material with no topsoil applied, thick surface layers of moderately crushed scoria, and high percentage coarse fragment subsurface layers have shown fairly consistent success in establishing shrubs and trees from seeding or planting. These results contrast

Rosebud Mine; big sagebrush and rabbitbrush on spoil substrate



Decker Mine; big sagebrush on scoria substrate

Reduce Competition from Cool Season Grasses

Reducing competition from cool season grasses also contributes to increased woody plant establishment and growth. Reducing the amount of grass in the seed mix, providing spatial separation between grasses and shrubs, or seeding shrubs first, followed by a later interseeding of grasses are some of the various approaches that have been used.

An interactive effect is also apparent between special substrates, such as suitable spoil and scoria, and reduced competition from annual and perennial cool season grasses. In trials done with different substrates and seed mixes at Spring Creek Mine, annual brome cover in 2007 (a banner

Percent cover by substrate and functional group	Topsoil	Spoil	Scoria
Annual bromes	34.7	6.4	10.6
Cool season perennial grass	44.1	33.4	24.5
Shrub	5.7	20.2	14.0

Data derived from Fredgren, R. 2008. Spring Creek Coal Co. Revegetation Report

Scoria substrates on old and spoil substrates on right, both with low and mixed grasses; photo by R. Fredgren

Spring Creek Mine; topsoil on the left, spoil on the right; photo by R. Fredgren

Habitat Preservation

Preserving habitat features, even small ones, results in the local retention of native substrates, native seed sources, and a large complement of local flora and microfauna. The native substrates are sites to which local species are pre-adapted, and these sites are colonized quickly after disturbance. The preservation of habitat features with intact flora and fauna can serve as a close source of propagules when they are interspersed throughout the surface-mined area. By their nature, habitat preservation features also provide suitable topographic sites and landform diversity.

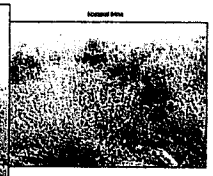
Arnotte Mine; pond with preserved habitat; cottonwoods naturally established

Big Sky Mine; native pondweed in lake and shrub community in the middle of reclamation

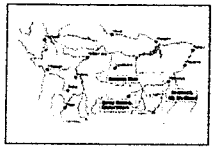
Good Practices and Serendipity

A mix of shrubs and forbs is included in most seed mixes used for general reclamation (as distinct from shrub concentration areas). Shrub seed is often handled separately from that of grasses. Grazing may be used to reduce grass competition. Nonetheless, many stochastic variables, such as weather after seeding, soil anomalies, interspecific competition, and unknown factors influence shrub revegetation success. Even after decades of practice and experimentation, a formula for predictable and reliable shrub establishment in general reclamation remains elusive.

Decker Mine



Rosebud Mine



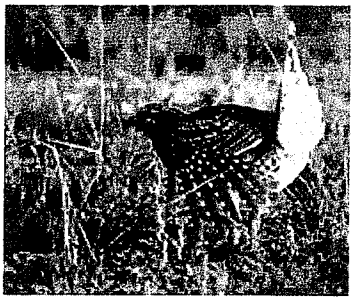
Spring Creek Mine

RECLAMATION SUCCESS

Rosebud Mine

Mine Regularly Reclaims 350 Acres per year, building grouse habitat.

Western Energy Company (WECo) has operated a surface coal mine in Southeastern Montana since 1968. Located in Rosebud County near the town of Colstrip, WECo's mine produces approximately 10 million tons annually. The mine typically disturbs and reclaims approximately 350 acres per year. For its exemplary reclamation program successes, the Rosebud Mine was presented the Office of Surface Mining's 1999 Excellence in Surface Coal Mining Reclamation Award.



Sharp-tailed grouse dancing on reclaimed land.

Prior to large-scale mining activities, wildlife surveys conducted at Colstrip documented the area to be excellent sharp-tailed grouse *(Tympanuchus phasianellus)* habitat. In addition to being an important game bird, this grouse is also of interest because of its "communal" courtship display, which is very unique in nature. Typically the dancing ground is on a slightly elevated knoll giving the birds a stage to attract the attention of females. When displaying, the male grouse appear like wind up toys, whirling in full and half circles with wings outspread, heads lowered and tails pointed up. They stomp their feet in rapid succession and seem to dance with their rivals.

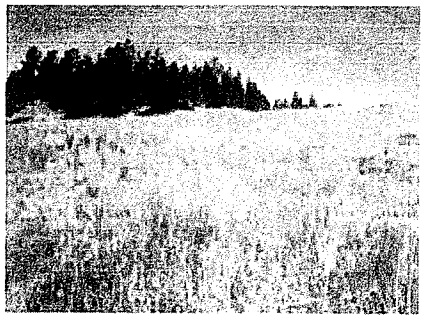


Photo of reclamation grasslands showing positive effects of grassland diversity – red grasses are warm season grasses that grew after cattle had grazed cool season grasses

Dancing grounds and the habitat needs of grouse were an important permitting issue for WECo in the mid 1970's. There were questions about the effect of mining through a dancing ground and whether dancing grounds could be re-established on reclaimed mined land. Studies had been conducted on sage grouse *(Centrocercus urophasianus)* to determine the birds' response to a relocated dancing ground. These studies documented some success.

Efforts to re-establish sharp-tailed grouse on reclaimed mine lands at WECo have used the following three components; luring, habitat re-establishment and rangeland management.

Luring - In 1975, a professional quality tape recording of sharp-tailed grouse display vocalizations from a dancing ground was acquired. This tape was the basis of an innovative approach to acoustically lure the sharp-tailed grouse to a predetermined reclamation site or "dancing ground". Styrofoam decoys depicting displaying male sharptailed grouse were used to provide additional stimuli at the dancing ground.

WECo has involved the local public in the appreciation of the "reclamation" resource by providing a bird watching tour van and interpreter to observe the courtship display of the grouse on reclaimed mine lands. The first van hosted people coming as far away as 120 miles before sunrise.

Western Energy is committed to protecting Montana's sharp-tailed grouse population by returning them to reclaimed land. This effort will ensure that sharp-tailed grouse will remain a part of Montana's natural heritage for the community and future generations.

The grouse luring technique developed by the surface mining industry has been a positive innovation for the management of grouse in other wide ranging applications. The Colorado Division of Wildlife, the State of Missouri's Department of Wildlife, and the Nature Conservancy have all used WECo's system for relocating grouse. The Nature Conservancy presented Western Energy with a Certificate of Appreciation for the outstanding cooperation in the conservation of the Columbian sharp-tailed grouse on the Montana's Tobacco Plains and at the Montana Nature Conservancy's Dancing Prairie Preserve. These are examples of an innovative method developed by the coal mining industry that has transferred positive value to other agencies with public benefits as well.

Habitat - WECo has reclaimed nearly 6,000 acres of rangeland, and plants approximately 20,000 shrub and tree tublings each year. A diverse mixture of native grass, forbs and shrubs is required for grouse. Grouse have responded positively to these reclaimed habitats by the spontaneous establishment of dancing grounds on the reclaimed lands. WECo's use of both warm and cool season grasses has improved the reclamation for grouse by providing a diversity of grasses that respond differently to climatic variations.

Management - Once a diverse mixture of vegetation has been established, proper management is critical to maintain and improve good habitat components. Proper management benefits both sharp-tailed grouse and wildlife in general. WECo's most important management tool is a well planned and implemented grazing plan. Grazing is important because it removes, at regular intervals, the accumulated standing litter which would eventually reduce diversity by choking out plants that are not adapted to the thatched conditions. WECo grazes approximately 600 head of cattle each year, utilizing a modified rest-rotation grazing system. Pastures are generally grazed two years out of three and rested the third year.

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