OSMRE National Technology Transfer Team (NTTT), **Applied Science Final Report***
U.S. Department of the Interior, OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Topsoil Depth and Sagebrush Establishment on Reclaimed Mine Sites

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Project Background and Objectives:

The presence of topsoil is critical to sagebrush establishment. Topsoil provides not only a medium for plants to grow, but also plant-available nutrients, mycorrhizae, and organic matter that are all important for plant growth and survival. While the presence of functional topsoil is important, research has also shown that areas with shallower topsoil can have greater plant diversity and less competition from perennial grasses than areas with deeper topsoil. Deep topsoil is conducive to perennial grasses that can competitively suppress the establishment of shrubs, such as sagebrush, and some forbs, leading to overall reduced diversity of species and plant types. The mine reclamation industry has adopted the practice of placing different topsoil depths across a site to encourage plant diversity.

The objective of our study was to determine if topsoil depth at reclaimed mines impacted sagebrush density, cover and volume.

Applicability to Mining and Reclamation:

The results of this study provide a better understanding of how topsoil depth plays a role in the establishment and growth of sagebrush on reclaimed mine sites. This knowledge could aid practitioners in meeting bond release requirements around shrub density.

Methodology:

We conducted a descriptive study over six reclaimed mine sites (4 former coal mines and 2 former uranium mines) in Wyoming. We measured sagebrush density, cover and volume along 100 m transects across varying topsoil depth at those mines.

Figure 1: Sagebrush transect at the Seminoe mine in an area with 15 inches of topsoil. This mine was reclaimed between 40 and 37 years ago and is located in Hanna Basin, Wyoming.

Highlights:

The most significant results from this study are:

1. Perennial grass cover is higher at deeper topsoil depths, which could negatively impact the establishment and survival of sagebrush.
2. Very shallow (6 inches or less) or no topsoil is detrimental to sagebrush establishment.
3. Higher seeding rates of sagebrush do not always translate to higher densities of sagebrush plants even at rates several times the industry standard.
4. Topsoil depth is only one factor that can influence sagebrush establishment and growth. Other environmental factors, like precipitation, may be equally or more important.

Figure 2: Transect at EDC mine with 11 inches of topsoil. This mine was reclaimed between 41 and 37 years ago and is located in Hanna, Wyoming.

Conclusions:

Establishment of sagebrush on reclaimed mines is affected by numerous factors, with topsoil being only one part of the puzzle. Our study suggests that deeper topsoil applications during reclamation may lead to better establishment, but other factors like spring and annual precipitation and time are also important to restoration success. It has been common practice in reclamation to have a mosaic of topsoil depths with the goal of inhibiting the establishment of dense stands of perennial grasses and thereby increasing plant diversity in those areas. This study indicates that there may be benefits to this practice as long as the topsoil depths are over 6 inches.

Figure 3: Transect at Shoshone mine in area with 6 inches of topsoil and a notable lack of sagebrush in the reclamation area. This mine was reclaimed 21 years ago and is located in Hanna, Wyoming.

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