

Derivation and Interpretation of Wyoming's Post-Mining Shrub Density and Composition of Standards for Coal Mine Lands

B. Giurgevich¹, P. Smith², and S. Page¹

Abstract

Since its approval in 1980, the Wyoming Coal Program has had a variety of post-mining shrub density and shrub composition standards. This paper briefly outlines the history of those standards and how they have changed. The current standards make distinctions between density and composition for coal mine lands affected prior to August 6, 1996 and lands affected after that date.

This paper was originally presented at the 2000 Billings Land Reclamation Symposium; however, this version of the paper makes significantly different interpretation of the historical standards based upon the Land Quality Division's reassessment of a 1986 Federal Register which approved 1986 Rules and Regulations for the Wyoming Coal Program.

This paper presents and discusses select vegetation data which bear on the question of whether coal permittees are achieving the historical and current shrub density and shrub composition standards for reclaimed lands.

Introduction

The history of shrub restoration requirements for Wyoming coal mine lands is checkered and complex. The general topic of shrub restoration has all too often devolved to haggling over the contribution of one or more of the three subspecies of big sagebrush (*Artemisia tridentata*). The emotionally charged opinions about big sagebrush confound and do not help elucidate the more general topic of the restoration of shrub habitat and shrub composition. The use of the term shrub in this paper includes a variety of shrub species, including all shrubs and sub-shrubs which were identified in baseline vegetation surveys.

Historical Perspectives

The 1973 Wyoming Legislature promulgated the Wyoming Environmental Quality Act (Wyoming EQA) which held that lands affected by mining operations shall be reclaimed to the highest previous use of the affected lands. The Wyoming EQA uses words such as "surrounding terrain and natural vegetation", "wildlife and aquatic habitat and resources" and the "utility and

¹ Wyoming Department of Environmental Quality, Land Quality Division, Sheridan, WY 82801.

² Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne, WY 82001.

capacity of the reclaimed lands to support such (highest previous) uses”. The Wyoming EQA has never detailed shrub restoration requirements, but it does establish a requirement to consider habitat when reclaiming mined lands.

The 1973 Wyoming EQA directed the establishment of rules and regulations for reclamation standards. By November 1975, the Wyoming Department of Environmental Quality, Land Quality Division (LQD) had published a set of Rules and Regulations which required permittees to restore the land to a condition equal to or greater than its highest previous use and required permittees to restore wildlife habitat commensurate with or superior to pre-mining habitat. The 1975 Rules and Regulations did not specifically require shrub replacement and did not establish a quantitative or qualitative replacement standard.

The United States Congress promulgated the Surface Mining Control and Reclamation Act (SMCRA) and thereby established the Office of Surface Mining Reclamation and Enforcement (OSM) in 1977. SMCRA included a quantitative post-mining shrub density standard for coal mine lands. Perhaps more importantly SMCRA provided a mechanism by which states could assume primacy for implementation of SMCRA.

After lengthy negotiations, the OSM approved the Wyoming State Coal Program (Wyoming Coal Program) in November 1980. When the Wyoming Coal Program was approved, the LQD Rules and Regulations required that operators restore post-mining shrub density *equal to* pre-mining shrub density.

Subsequent changes to the LQD Rules and Regulations in 1981 through 1985 retained the performance standard that “when wildlife is part of the post-mining land use, shrubs and trees shall be returned to a density at least equal to that existing on the area before mining”.

In 1986, revised LQD Rules and Regulations introduced the terms “... the goal for shrub restoration...”. Historically, the LQD has interpreted these words to introduce a fundamental shift from a quantitative performance standard (restore equal shrub density) to a more qualitative, non-absolute standard. The historical interpretation implied that it was (or would be) adequate for coal permittees **to attempt to attain** the shrub restoration goal, even if vegetation data did not unambiguously demonstrate attainment of the goal. The components of the shrub restoration goal/standard are outlined later in this paper.

Later in 1986, the Wyoming Game and Fish Department (Wyo. G&FD) petitioned the LQD to modify the revised shrub restoration goal of the 1986 LQD Rules and Regulation. Negotiations on this petition continued into the third quarter of 1994. The LQD eventually took revised Rules and Regulation through the complex rule making process. On August 6, 1996, the OSM approved the new LQD Rules and Regulations which created a dual shrub restoration standard:

1. restoration of one shrub per square meter in patches totaling 10% of all lands affected prior to August 6, 1996.
2. restoration of no more than a total density of one shrub per square meter in patches totaling 20% of all lands affected after August 6, 1996. These shrub patches also have defined species composition requirements.

These shrub restoration revisions were not the only revisions to the Wyoming EQA and LQD Rules and Regulations over these years. The cumulative effect of all revisions created a great deal

of uncertainty concerning what goal or standard applied to specific affected land units. On October 31, 1998, the LQD Administrator published a document entitled “How To Handle Bond Release On Coal Mined Lands Affected During Various Regulatory Time Frames”. This document was also the product of extensive interaction between LQD staff and members of the Wyoming coal industry.

Application of Current LQD Rules and Regulations

The LQD Administrator’s October 1998 statement of policy outlined five time periods which help frame application and interpretation of the many historical laws and policies. This paper compresses and rearranges the five temporal categories outlined in the original document and addresses only the shrub restoration topic. This compression is not appropriate for other post-mining topics.

Lands Affected After June 30, 1973 And Prior To March 26, 1981

The Wyo. EQA (effective July 1, 1973) and OSM approval of the 1981 LQD Rules and Regulations (effective March 26, 1981) frame this period. If these affected lands were not used after March 26, 1981 in support of continuing mining operations, these lands have no shrub restoration goal or standard. The date the land was affected, not the date of permanent reclamation, establishes the applicable trigger date.

For various reasons, the LQD Administrator has stated that no quantitative or qualitative evaluation of shrub density or composition will be required on lands disturbed during this time frame.

Lands Affected After March 26, 1981 And Prior To August 6, 1996

The OSM’s August 6, 1996 approval of revised LQD Rules and Regulations established a separate *shrubs restoration goal/standard* for lands affected in this category and where those affected lands have not been used after August 6, 1996 in support of continuing mining operations.

When wildlife use is part of the post-mining land use, this 1981-96 shrub restoration goal/standard required that:

1. a set percent of the reclaimed surface shall have an average density of one shrub per square meter in a mosaic of shrub patches.
2. the percentage and distribution of shrub patches shall be determined through site specific evaluation of the pre-mining shrub cover, density, distribution and wildlife use. Except where a lesser density may be justified from pre-mining conditions, 10% of the reclaimed lands shall be restored to shrub patches.
3. best technology available shall be applied to achieve the shrub density goal/standard.
4. approved shrub species and seeding techniques shall be applied to all residual reclaimed lands used jointly by livestock and wildlife .

The interpretation of this goal/standard has been widely debated since the 1986 LQD Rules and Regulations revision. All parties in these debates apparently overlooked the November 24, 1986 Federal Register (51FR12217) under which the OSM approved the 1986 LQD Rules and Regulations. The Federal Register stated that “the Director interprets Wyoming’s use of the term “goal” as equivalent in meaning to that of a required standard and he is approving the proposed rule on that basis”. The LQD will evaluate the attainment of this goal/standard at final incremental bond release (Phase 3 bond release) using qualitative and quantitative data.

Lands Affected After August 6, 1996

The OSM’s August 6, 1996 approval established a *shrub restoration standard* for lands in this category and for all lands which were affected before this date but which have been used after August 6, 1996 in support of continuing mining operations. The shrub restoration standard applies to all reclaimed lands which have the designated land uses of grazing land and fish and wildlife habitat.

Appendix A of the LQD Coal Rules and Regulations holds that coal permittees shall:

1. except where a lesser density is justified by pre-mining conditions, restore at least 20% of eligible lands to shrub patches supporting an average density of one shrub per square meter.
2. ensure that shrub patches are no smaller than 0.5 acres each and are arranged in a mosaic that will optimize habitat interspersion and edge-effect.
3. use plant community-specific, pre-mining shrub density and shrub composition data to determine the post-mining areal extent of shrub patches and their specific post-mining density and composition.
4. choose one of four calculation options for all eligible land within each permit area or amendment area.
5. ensure that the average post-mining total and species-specific shrub densities are at least 90% of the calculated densities at the time of final incremental bond release (Phase 3 bond release).

The shrub restoration standard is an absolute, statutory requirement which must be unambiguously achieved on all eligible lands at the time of final incremental bond (Phase 3) release. Simply trying to attain the performance standard is not adequate.

Appendix A of the LQD Rules and Regulations details the four options and calculation procedures for the shrub restoration standard. The calculation procedures are complex and use pre-mining baseline data. The fact that some of the pre-mining data sets are now as old as 25 years, that they were gathered by many different consultants and that the data sets were seldom developed with the detail required in Appendix A, calculation creates some distinct challenges. Table 1 is a brief

summary of the four possible options. To date, most coal permittees in the Wyoming Powder River Basin have chosen Option II or III.

Table 1. Characteristics of Options I through IV for a post-mining shrub restoration standard

Option	Distinguishing Characteristics
I	Post-mining standard is not community-specific, but is based upon the pre-mining density of only full shrubs; reductions in pre-mining shrub density are possible if any pre-mining community has a shrub density greater than one per square meter and is less than 20% of the eligible lands.
II	Post-mining standard is not community-specific, but is based upon the pre-mining density of only full shrubs; the post-mining shrub density is set at one per square meter.
III	Post-mining standard is community-specific and is based upon the pre-mining density of only full shrubs; each eligible pre-mining community contributes to the calculation of post-mining density and areal extent of community-specific shrub patches.
IV	Post-mining standard is community specific, but is based upon the pre-mining density of full and subshrubs; each eligible pre-mining community contributes to the calculation of post-mining density and areal extent of community- specific shrub patches.

Achievement of Shrub Restoration Goal and Standard

The LQD has at least four information sources to evaluate a permittee’s progress toward and final achievement of the applicable goal and standard. The first source contains the only data which will be used to make a final determination that the goal and standard were achieved. The other three sources will provide some insight that the permittee is moving toward achievement. The four data sources are:

1. formal data submitted in support of final incremental bond (Phase 3) release. These data derive from detailed quantitative field sampling regimes and rigorous statistical tests of sample adequacy.
2. formal data submitted in fulfillment of Interim Vegetation Monitoring (IVM) programs. These data derive from moderately detailed quantitative field sampling regimes, but are without rigorous tests of sample adequacy.

3. limited data from qualitative and semi-quantitative field surveys conducted by LQD staff. These field surveys are moderately detailed, but are without any tests of sample adequacy.
4. other observations or data submitted by coal permittees or their consultants.

In relation to achievement of the shrub restoration goal, the LQD has received only one request for final incremental bond (Phase 3) release. This single request is not representative of the process and will not be discussed.

However, all coal permittees in the Wyoming Powder River Basin are required to sample reclamation under IVM programs. Table 2 presents a select summary of a partial survey of data from IVM program data from LQD Annual Reports.

Table 2 is not a complete survey of the approximately 24 coal mine permits in the Wyoming portion of the Powder River Basin. Table 2 presents select data which illustrate the conclusions presented below. It is possible to draw only general conclusions from these IVM program data because:

1. permittees have not always seeded specific shrub patches and/or shrub mixes on the shrub restoration goal lands, and
2. the submitted IVM program data do not consistently and clearly specify sampling methods; methods sometimes differ from one sampling period to the next, and
3. the sampling methods do not consistently and clearly state whether sampling occurred within defined shrub patches or within general reclaimed plant communities, and
4. sampling is seldom subjected to a sample adequacy test and may not be representative of all reclaimed lands at a specific mine.

Table 2 data suggest that coal permittees may attain the shrub restoration goal when they selectively seed and specifically map and sample defined shrub patches. Second, these data suggest that coal permittees will not attain the shrub restoration goal if they do not selectively seed shrub patches. The general, background plant communities are not showing adequately dense patches even when reclamation is as old as 20 years. Third, data are not available to clearly assess whether shrub patches cover 10% of the reclaimed goal lands.

The first two conclusions are generally supported by semi-quantitative surveys conducted by Richard Vincent of the LQD on five mines in the Powder River Basin in 1999. Coal permittees or their consultants have not submitted other observations or field data which would alter these conclusions concerning attainment of the shrub restoration goal.

There are very few hard data (but many opinions) available to determine whether coal permittees are achieving the shrub restoration standard, primarily because lands affected after August 6, 1996

Table 2. Total (full plus sub-shrubs) shrub density data from permanently reclaimed lands covered by the shrub restoration goal for select coal mines in Campbell County, WY.

Mine	Field Sample Year	Reclamation Sampled*		Age of Reclamation at Sample Year	Range of Full and Sub-shrub Density (no./m ²)
		Seeded Shrub Patch	General Plant Community		
Belle Ayr	1995		X	10-16	0 - 0.5
Rawhide	1994	X		3-8	0.1 - 12.1
	1995		X	7-16	0 - 0.5
	1995	X		6-8	0.2 - 4.2
	1996		X	4	0.02 - 0.1
	1996	X		4-10	0.03 - 3.5
	1997		X	3	0.1 - 0.4
	1997	X		3-10	0.01 - 5.4
	1998		X	4-20	0.01 - 0.6
Caballo Rojo	1995		X	1-6	0.2 - 2.8
	1998		X	5-9	0.01 - 2.9
Black Thunder	1993		X	1-3	0.2 - 5.8
	1995		X	2-4	0.4 - 1.3
	1997		X	2-6	0 - 1.6
	1998		X	1-7	0 - 2.7
	1999		X	1-3	0 - 4.5

* Unless the methods clearly stated that sampling occurred within a specific shrub patch, this table assumes sampling occurred in the general reclaimed community. Terri Hatch, a Sheridan College student, compiled most of these data during a Practicum with the LQD District III office.

are only now being permanently reclaimed. The permanent reclamation has not yet been sampled under IVM programs. This acreage is progressively increasing, but the authors found only one IVM program data set which addresses lands reclaimed under the standard. A portion of the Black Thunder Mine's 1998 IVM program sampled one-year old shrub patches and recorded total shrub densities ranging from 0.5 - 2.3 shrubs per square meter. The data were not presented in a format suitable to assess the shrub composition element of the shrub restoration standard.

No other specific data have been presented to the LQD in support of attainment of the shrub restoration standard.

The authors conclude that to clearly achieve the shrub restoration goal and standard, coal permittees must:

1. choose and apply the best available technology for establishing diverse (as approved) mixtures in distinct shrub patches.

2. regularly observe and quantitatively sample the established shrub patches to evaluate the areal extent component, the compositional element, and the density elements of the shrub standard.
3. conduct best available husbandry practices to protect and encourage shrub establishment and survival in the shrub patches.