THE UTILITARIAN CONCEPT FOR DETERMINING MINED LAND RECLAMATION SUCCESS[1]

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Abstract.--This paper offers a new approach to determination of successful mined land reclamation. The new approach, which is called "utilitarian", differs fundamentally from the current approach of government regulations, which is called "numerical". The utilitarian approach is ecologically oriented and relies on demonstrated performance to satisfy reclamation requirements.

INTRODUCTION

One of the many concerns regarding reclamation of western lands surface mined for coal has been to develop a satisfactory means of evaluating reclamation success. Substantial bonds are required on each acre of land disturbed by mining, pending final determination of reclamation success. Federal and state governments have been instrumental in developing regulatory approaches, as well as success criteria, which will ensure responsible mining and reclamation of coal-bearing land.

Reclamation science and reclamation ecology are relatively new in the United States. Most reclamation research, especially on surface mined land, has occurred since 1950. In a discussion of "mining ecology", Coaldrake (1979) noted that Hall (1957) in England was probably the first to link ecology with the effects of mining on landscape. Our reclamation laws and standards are also relatively new and untested (Sindelar 1980).

This paper concerns the current methodology for determining revegetation success of surface mined land and presents an alternative approach. The principle thesis of the paper is that demonstrated performance and utility of reclaimed land is a better and more ecologically sound measure of success than the current numerical approach.

Current Methods for Determining Revegetation Success

In the United States, surface mining is regulated by both state and federal authorities, with the success standards of the stricter prevailing. Among the general requirements for revegetation in the federal regulations are provisions that "a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area or species that support the approved postmining land use" be established and that "the vegetative cover shall be capable of stabilizing the soil surface from erosion" and be "self-regenerating". In addition, state and federal regulations require that productivity of the land be restored to equal or exceed its original level. Such regulations necessarily require comparisons of "reclaimed" mined areas with premining site data or with "reference areas" maintained solely for determination of reclamation success when bond release is sought. The multitude of specific regulations and strict success standards has been controversial (Sindelar 1984).

Numerical Standards

Federal regulations regarding reclamation success standards call for comparison of ground cover, diversity, and productivity on revegetated mined land with that of unmined reference areas or with premining inventories and historical records. In this "numerical" approach, reference areas are defined as a land unit maintained under approved management for the purpose of measuring vegetation ground cover, productivity, and plant species diversity that is produced naturally or by crop production methods approved by the enforcement agency. Reference areas must be representative of the geology, soil, slope, and vegetation in the permitted area as determined by premining inventories. The reference area approach many be called "numerical" in that the success criteria call for 90 percent comparability of cover, diversity, and

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productivity on mined and unmined sites with 90 percent statistical confidence.

While such duplication of undisturbed ecosystems represents an apparently logical goal of reclamation, its feasibility is questionable, given the constraints of time, money, and the present levels of technology. In addition, reasonable concerns for the logistics involved in locating, protecting, and sampling reference areas representing each vegetation type in the permitted area have become apparent. The concept raises questions about the legitimacy of comparing a developing vegetative system with a mature vegetative system as discussed by Harthill and McKell (1979).

Another accepted variation of the numerical approach is "historical use" analysis. It relies on baseline vegetation surveys and records of livestock and wildlife use prior to mining. These data form the basis for postmining comparisons of revegetation success. Comparisons in this case are influenced by premining range and climatic conditions which may not accurately reflect the potential productivity of the site. Another variable is the assumed direct comparability of pre- and postmining sites where topography, parent materials, and soils may no longer be similar following mining. The potentially long period of time between collection of baseline data and application for bond release may also be responsible for significant differences in vegetation and soil development.

A Utilitarian Concept

As an alternative to the numerical approach, we advocate use of a "utilitarian" approach to determine reclamation success. This concept offers a practical way to meet the intent of state and federal laws for revegetation and reclamation success. Given the very real problems noted for numerical approaches, it may be worthwhile to consider the advantages of this alternative concept. The two approaches differ very much in philosophy, as well as methodology. Instead of using numerical vegetation measures to statistically postulate that a revegetated ecosystem will function due to its vegetational similarity to a reference area, the utilitarian concept uses performance data to prove that a reclaimed ecosystem functions satisfactorily. This difference cannot be overemphasized.

There are potential variations of the utilitarian approach, but it basically consists of:

1. premining inventory and documentation
2. defining the reclamation goals and objectives
3. developing a revegetation and reclamation plan
4. developing a resource management program
5. monitoring the revegetation and soil-building process
6. documenting performance of the reclaimed system under its prescribed uses
7. comparing performance and utility of the new ecosystem with that of the preceding one using a simple rating system

Using this approach, reference areas are not required. Postmining sampling of the vegetation is limited to determination of species composition and net productivity of the revegetated areas for management purposes. Major emphasis is placed on developing the kind of vegetation and habitat consistent with management goals and then documenting ecosystem performance including soil, watershed, vegetation, livestock, and wildlife categories. Documentation is accomplished through basic sampling techniques which may include, but do not require, diversity indices, statistical comparisons, or plant numbers. Emphasis is placed on examination of the functioning of the ecosystem, which is a rather more holistic approach befitting the intent of reclamation laws.

An Example of the Utilitarian Approach

In an example of the utilitarian approach, a permitted area would be studied during the baseline survey. Records of current and historical use and performance would be gathered. This activity is shared with numerical approaches simply because it is important for reclamation managers to know the nature and history of the resource. It is also necessary for final reclamation performance evaluation. A reclamation plan would be developed which would clearly define the goals of reclamation. In this example, the goal is restoring mined land to its original use -- rangeland used by livestock and wildlife. Objectives of reclamation are to provide livestock forage and water, wildlife habitat, and watershed values with limited long-term maintenance costs.

The reclamation plan would be implemented using the most recent technology to recreate basic soil and vegetation systems. Monitored periodically, the revegetated land would be managed as necessary to allow livestock and wildlife use, which would be documented. Livestock behavior and performance would be monitored to determine use patterns, animal health, and livestock impacts on the area. The relationships between primary producers, primary consumers, secondary consumers, and decomposer organisms would be examined. Vegetation would be qualitatively and quantitatively assessed for management purposes, including production, forage value, and species composition. Watershed stability including soil and water characteristics and erosion would be periodically assessed. Management plans would be developed which utilized any improved technology necessary during the bonding period. This could include interseeding, grazing, fertilizing, burning, or irrigating to promote desired functioning of the ecosystem.

Complete documentation of the reclamation and development of the permitted area would be provided at the time of application for bond release. It would indicate the performance levels achieved for its prescribed use in each of four critical areas: 1) soil and watershed performance, 2) vegetation performance, 3) livestock performance, and 4) wildlife performance. Performance of each critical area, e.g. vegetation, would consist of one of the following ratings: less than premining, comparable to premining, or greater than premining. Performance levels would be compared with premining levels and judged to be "adequate" or "inadequate". Given the nature of the documented performance data, objective scoring by regulators would be enhanced. The final basis for determination of reclamation success would be the performance and utility of the treated land.

CONCLUSION

Reclamation success is not achieved until functioning ecosystems are developed. Ecosystem functioning is relatively well-understood, and the basics of reconstructing disturbed ecosystems have been studied intensively although for a relatively short period (Sindelar 1985). It must be noted that the potential for successful reclamation may be related as much to the progress of reclamation technology as to the limitations of the environment.

Two approaches to evaluation of reclamation success have been briefly described. The numerical approach currently used implies that success may be determined by comparing vegetation parameters on revegetated land with those of reference areas. The utilitarian approach contends that success is best determined by the ability of the reconstructed ecosystem to support the uses specified in the reclamation plan. This approach requires that utility be successfully demonstrated and that restoration of basic ecosystem functioning has been or can be achieved. Analysis of the performance and utility of revegetated land is more effective in determining reclamation success than measures of vegetation alone. Thus, the major advantages of the utilitarian approach are greater ecological validity, less intensive vegetation sampling, reference areas are not required, revegetated land can be used during the bonding period, and greater management flexibility is possible.

The utilitarian approach, in order to be successful, requires superior management of the entire reclamation process. Quality control and timeliness of data collection are important, as is development of a holistic resource management program (Savory 1985). Because utility of the revegetated land is central to the concept, prescribed uses must be well-documented. The utilitarian approach to determination of reclamation success is not necessarily easier or less intensive in application than use of numerical approaches, but it is more efficient, potentially more effective, and ecologically more valid. Properly utilized it will document success and assure sound resource management throughout the affected period.

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