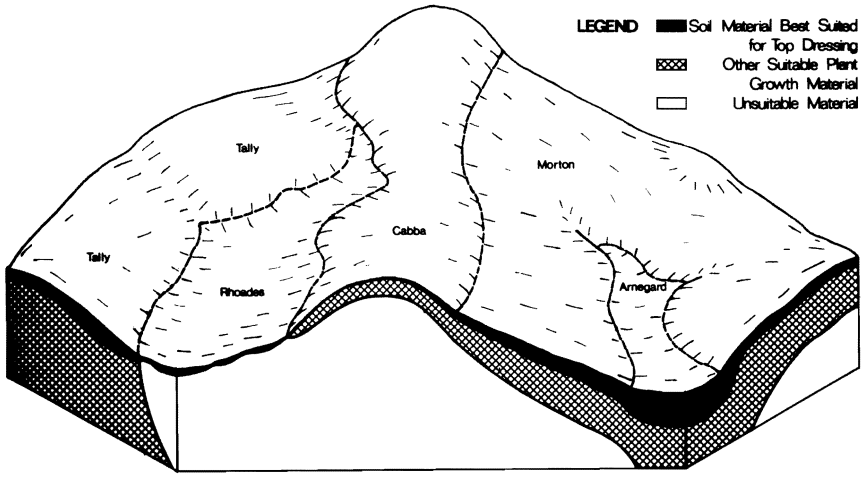

Figure 1. Landscape Relationships and Relative Amounts of Suitable Plant Growth Material for Several Southwestern North Dakota Soils.

The Soil Map . . .

A PREREQUISITE TO MINING AND RECLAMATION

Donald D. Patterson

Surface mining of agricultural land is on the increase in southwestern North Dakota. Reclamation of mined land is essential to the maintenance of our food production base—our soil resources. Planning, prior to mining, is a necessary part of the reclamation effort. Preparation of detailed soil inventories—soil maps and interpretations—is one of the most important steps in the planning process. Soils information provides the basis for determining the reclamation potential of areas proposed for mining.

Introduction

In recent years, surface mining of lignite has been accelerated to meet national energy needs. Proposals for additional power generation and gasification facilities suggest that further development can be expected. Expansion of the industry must be accomplished with minimal adverse effects on the environment. Soil resources, in particular, must be restored to productive agricultural uses.

North Dakota legislators have shown foresight in passing sound reclamation legislation prior to the beginning of large-scale surface mining operations (1). The North Dakota Public Service Commission (PSC) has established rules and regulations for reclamation of strip-mined land as directed by the 1975 Legislative Assembly (2). Undoubtedly, reclamation requirements now in effect will be modified as more information becomes available through research and observation.

Legal Requirements

Research is currently being conducted to determine the amount of suitable plant growth material[1] which must be placed on mine spoil to sustain long-term plant production (4). The PSC, however, requires that suitable plant growth material saved from property owned by one party must be respread within the boundaries of that property unless owners of adjoining land within a permit area agree otherwise (2). The soils which dominate a particular mining permit area will determine, therefore, the volume of suitable plant growth material available for use in reclamation of disturbed areas. Permit areas which consist mainly of sodium-affected soils (Rhoades and Daglum) provide a minimal amount of suitable plant growth material while areas which include extensive acreages of soils with thick surface layers (Arnegard, Grail and Parshall) contain ample material for reclamation. Hence, the soils of a permit area will be a major factor in determining

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[1]*See footnotes 3 and 4. Table 1, for definition.*

the use and long-term agricultural productivity of reclaimed areas.

Successful reclamation requires careful planning prior to mining. If soil productivity is to be restored, an inventory of the soil resources is a prerequisite to mining. The North Dakota Century Code requires that mine operators submit a soil survey and an interpretation of the survey when applying for a permit to engage in surface mining of lignite. The Code also provides that the mine operator shall "save, segregate and respread suitable plant growth material within the permit area up to a maximum of five feet" (1).

The Soil Map

Soil maps are designed to show the location and extent of the various soils in the survey area. Areas of soils with similar properties are delineated on aerial photographs which show cultural features and land use patterns. Soil maps are made at various scales and levels of detail, depending on the purpose of the survey.

In the case of surface mining, the soil map is needed to determine the soil resources prior to mining and to predict the relative ease or difficulty of reclamation. Also, soil maps could be useful in establishing permit area boundaries on the basis of soil resources, particularly if a large tract of land proposed for mining is to be separated into several permit areas. Reclamation over the entire tract might be improved if permit area boundaries were designed to combine soil areas having ample amounts of suitable plant growth material with soil areas having limited amounts of suitable material (3).

Conventional soil maps can be interpreted for many uses. Mining permit areas, however, are likely to include small areas of soils with contrasting properties which cannot be delineated on standard scale soil maps (1:20,000). Also the ranges of soil properties recognized in conventional soil mapping are too broad for specialized uses such as mined-land reclamation.

Large-scale maps (1:4800 or 1" = 400') which show the kinds and classes of soil properties significant to reclamation are required to ensure adequate information for reclamation (3). The soil properties most significant to reclamation, particularly with respect to placement of soil material on the surface, are soluble salts, sodium, organic matter and calcium carbonate (lime). Other soil properties which affect the relative ease or difficulty of reclamation are texture, structure, bulk density and pH.

Figure 1 shows the soil relationships of a typical landscape in southwestern North Dakota and illustrates the kinds of information which can be interpreted from a detailed soil map. The information in Table 1 illustrates the wide variation between and among these soils with respect to volumes of soil material suitable for plant growth and best suited for top dressing. The depth ranges given under the headings "Approximate Depth of Suitable Plant Growth Material" and "Approximate Depth of Soil Material Best Suited for Top Dressing" represent the mode for the particular soil series.

Table 1. Selected properties and interpretations of several southwestern North Dakota soils.

Soil Series[1]	Textural Group[2]	Approximate Depth of Suitable Plant Growth Material[3] (inches)	Approximate Depth of Soil Material Best Suited for Top Dressing[4] (inches)
Arnegard	medium	60+	20-30
Cabba	medium	8-20	0-3
Morton	medium to moderately fine	30-40	6-12
Rhoades	fine to moderately fine	2-5	2-5
Tally	moderately coarse	60+	6-12

[1] *A soil series consists of soils which are essentially alike in all major profile characteristics except the texture of the surface layer. Within a particular series, however, soil characteristics vary within a defined range. Morton soils on 3 to 6 per cent slopes, for instance, have thicker surface and subsoil layers and are deeper to the zone of lime accumulation and to soft, sedimentary bedrock than are Morton soils on steeper slopes.*

[2] *Texture is a measure of the coarseness or fineness of a soil and depends on the proportion, by weight, of clay, silt, sand and/or gravel.*

[3] *PSC standards for suitable plant growth material: electrical conductivity (EC x 10^3), less than 4 millimhos/centimeter; sodium adsorption ratio, less than 10; or exchangeable sodium percentage, less than 12.*

[4] *PSC standards for soil material best suited for top dressing: organic matter content, 1.5% or greater; calcium carbonate equivalent, less than 10% (medium to fine-textured soils); electrical conductivity (EC x 10^3), less than 2 millimhos/centimeter; sodium adsorption ratio less than 4; or exchangeable sodium percentage, less than 5.*

References

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