**Soil Information for Range Resource Evaluation**

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**Highlight**

Soil is a major physical component of the ecosystem. To ignore soil or treat it superficially merely restricts knowledge of the resource. The amount of soil detail needed depends upon the character of the landscape, the complexity of the resource, the uses to be made of the survey data, and the amount of money available to do the job. Too much soil detail should be avoided and too little detail may make the survey worthless for evaluating the range resource. There is flexibility in how soil mapping units can be designed to meet the needs.

Grazing resource inventories historically have been made solely on the basis of existing vegetation. Some inventories of this kind still are being made. In other inventories, soils are considered but the quality of these considerations often is superficial. Resource people generally recognize the dire need to discontinue this approach. We rangemen should emphasize the need for adequate soil information in range inventories. We also should avoid too much soil detail because this generally results in indefensible costs and confused interpretations.

**Need for Soil Information**

Why do we need reliable and adequate soil information as a part of a grazing resource inventory?

First, soil is one of the major physical components of the ecosystem. To ignore soil or to treat it superficially merely restricts our knowledge about the resource.

Second, soil provides one reliable criterion by which areas that look differently or alike today due to past treatment and successional stages of vegetation can be related to the original ecosystem. Vegetation can be altered by such influences as fire, drought, and overgrazing, singly and in combination. As stages of recovery or deterioration take place, transitional plant communities develop. Therefore,
a variety of distinctive plant communities can exist on
what was originally the same ecosystem, all within the same
locality. Conversely, a single plant community such as
sagebrush-cheatgrass can exist on an area that was originally
several distinctive ecosystems. The soil of an ecosystem is
not altered, or altered very little, during ecological change.
The soil usually remains identifiable.

Third, because identifiable features of soil are relatively
stable, soil provides one good basis for comparing unknown
to known areas in terms of potential. This is probably
one of the most important uses of reliable soil data. His-
torically we have related potential to precipitation zones.
We have classified performance of species, grazing systems,
and techniques on the basis of average annual precipitation.
The precipitation rating commonly is merely an informed
guess, yet we carry such results to the far corners of the
country and apply them under other "guessed" condi-
tions. Seldom have we incorporated such important
factors as timeliness of precipitation, seasonal temperatures,
and physical soil characteristics, all of which can drastically
alter the influence of total annual precipitation locally.

Reliable predictions of potential are sorely needed in
range management today. Our ability to predict with rea-
sonable reliability largely controls the rate at which range
rehabilitation is applied. Other types of projects which
show favorable cost-benefit evidence will continue to be
given preference when it comes to investing the agricul-
tural dollar in resource improvement.

How Much Soil Information

Depth, stoniness, slope, aspect, surface and subsoil tex-
tures are among the soil factors that are important to
rangeland management. The need for having the soil
series properly named and classified within the national
soil classification system is debated, however, by well in-
formed resource people.

One strong argument against the national soil classifi-
cation process has to do with the time, people, and cost
involved. Unless special funds are made available, corpora-
tions and agencies making soil surveys might not afford
to add soil classification costs. Their soil surveys and in-
vestigations must be expedient and deal only with what is
essential for their resource management no matter how
strongly they feel toward wise use of natural resources.

On the other hand, there is a strong argument in favor
of national soil classification. All soils of our Nation should
be classified within a uniform system just as plants are. The
potential importance of this to the evaluation of our land
for agricultural as well as other uses is apparent. Soils in
the same class are alike in many ways which are important
for interpreting hazards, land use, treatments, and poten-
tial. An obvious benefit is the ability to transfer knowl-
edge and data of this kind from one locality to another
if the soils are in the same class. This speeds up develop-
ment of explicit interpretive data because it reduces the
need to "start from scratch" with each soil.

Whether classified or not, each kind of soil should be
identified, described, differentiated, and either named or
symbolized (or both). Directly or by interpretation, a soil
series description presents in writing certain assets, limita-
tions, hazards, and potentialities. These include such items
as kind of parent material; depth of rooting zone; character
of the surface soil, subsoil, and underlying material; perme-
ability and availability of water; natural fertility; erosion
hazard; trafficability to equipment and animals; seasonal
soil temperatures; chemical components. Soil series descrip-
tions are worthwhile written references for resource man-
gers. Furthermore, a soil series name personalizes the soil.
It provides a handle for identification that contributes to
brevity and clarity both in conversation and writing.

Classifying soils is the responsibility of people trained in
soil science.

Designating Soil Mapping Units

Soil mapping units on rangeland must be designed by
rangeland specialists and soil scientists working together in
the field. They assemble available information on climate,
physiography, geology, soils, and vegetation of the area to be
surveyed. They explore the area together, selecting and
studying locations on each important landscape where
typical soils and vegetation exist.

The investigative work of this team produces a list of
the soil series, which may be named or only symbolized. In
addition, significant phases of soil series, such as depth,
stoniness, slope gradient and aspect, which affect the char-
acter of the resource are studied. The soil taxonomic units
recognized are then described in terms of soil profile, top-
ographic, and climatic factors. These taxonomic units are
classified according to the various ecosystems or range sites
which, in turn, relate the soil taxonomic units to the vege-
tational, treatment, and management potentials.

A soil taxonomic unit, then, consists of a phase of a soil
series which is important for stratifying the landscape soils-
wise into delineations that are meaningful for range man-
agement as well as other foreseeable uses of the land.
Usually, it is impractical or even impossible to draw a line
around a pure soil taxonomic unit on a map. Areas of
other soil taxonomic units would be included. Therefore,
the soil mapping unit as drawn on the map consists of the
soil taxonomic unit, plus some other things, such as areas
of other taxonomic units or patches of bare rock, which
have been identified and occur within allowable limits.
These "other things" are called inclusions.

This principle that distinguishes between a soil taxonomic
unit and a soil mapping unit is highly important. Unless
it is understood clearly, soil surveys on rangeland cannot be
understood nor can they be used properly.

Kinds of Mapping Units

Several different kinds of soil mapping units may be
designed to fit the needs of a survey:

1. A single taxonomic unit, together with minor, limited
inclusions, may be mapped within a single delineation
(Fig. 1). It normally represents a single range site and
the inclusions may be areas of other sites.

2. Two distinctly different soil taxonomic units which occur
more or less regularly in proportion and pattern and
which have unlike behavior in terms of vegetation and
management may be mapped in a single delineation
(Fig. 2) with minor, limited inclusions. This is a
grouping of unlike soils in which the pattern of
occurrence is too fine and the soil bodies are too small
to delineate separately at the usual mapping scale of 3
or 4 inches/mile. This is called a complex mapping unit.
It normally represents a complex of range sites.

3. Two or more soil taxonomic units which commonly
occur side-by-side but without regularity of proportion
and pattern and which have similar behavior in terms
of vegetation and management may be mapped within a single delineation (Fig. 3). Of course, minor, limited inclusions occur here also. This is called an undifferentiated mapping unit. It normally represents a single range site and the inclusions may be areas of other sites.

4. Two or three distinctly different soil taxonomic units which occur regularly together in repeating, roughly similar patterns may be mapped in a single delineation together with limited inclusions. This is a grouping of unlike soils in which the pattern of occurrence is broadly presented generally on small-scale maps. Its soil bodies are large enough to be delineated separately at the usual mapping scale of 3 or 4 inches per mile. This is called a soil association mapping unit (Fig. 4). It normally represents an association of range sites.

Designing Detail

From these illustrations of how soil taxonomic units can be combined in various ways to form soil mapping units, it should be clear that this is the machinery or procedure by which detail of soil mapping is adjusted according to the complexity of the resource and to the uses to be made of the survey. Soil surveys on cropland generally have soil mapping units that are made up of a single soil taxonomic unit, with allowable inclusions. High-producing rangeland can be mapped with about the same detail as dry cropland if desired. Most rangelands are mapped using relatively heterogeneous soil mapping units such as soil complexes, undifferentiated groups, or associations as well as simple mapping units.

The decision as to how much detail is needed involves consideration of the character of the landscape, the complexity of the resource, the uses to be made of the survey data, and the amount of money available to do the job.
A high proportion of the cost of any survey is the cost of time and transportation going to and from the job and traversing the land. Therefore, it is highly desirable to do the best allowable job of collecting resource data while in the design of the soil taxonomic and soil mapping units the surveyor is on the land. A good job costs very little at the inception of the survey. Otherwise, the resulting soil survey may have very little, if any, value as far as the range resource is concerned.

The way soils on rangeland have been mapped is sometimes criticized because delineations on the map include areas which obviously are not the same soil unit indicated by the name assigned to the mapped area. This criticism stems primarily from a lack of understanding of what a mapping unit is and how it differs from a taxonomic unit from which the name is derived. On the other hand, it is not uncommon to find that a single soil taxonomic name was applied to a delineation on the map which actually is a complex, undifferentiated group, or association. In this case it was a mistake to not use the names of the major taxonomic units involved.

Unquestionably, a statistical sampling of any soil mapping unit as delineated on a map would show significant deviations from the central concept as represented by the taxonomic unit. This is the nature of rangeland soil variability. The major portion of the delineation, however, should be acceptable as being the taxonomic unit or units for which it was named, if the mapping job has been done properly.

If properly designed and mapped, soil maps of rangeland generally connote ecosystems or range sites, the usefulness of which has been fairly well accepted by range resource workers. In addition, soil taxonomic units may provide information which is valuable for making decisions on certain kinds of treatments or improvements. For example, suitability for seeding is often more clearly related to individual soil taxonomic units than it is to a range site which usually includes several soil taxonomic units. Information contained in soil taxonomic unit descriptions and shown on maps can help in making decisions on locating a pipeline for stockwater or in estimating its cost. Fencing involves similar decisions for which the use of soil maps and their descriptive legend can be beneficial.

Conclusion

It should be emphasized strongly that soil criteria alone are used to differentiate soil series. Vegetation is not used as a factor even though distinct vegetational differences may exist between soil series. Therefore, a single soil series may or may not coincide with a certain distinctive ecosystem. It is essential that vegetation and other considerations needed for the evaluation, management and treatment of the range resource be given due consideration in the design of the soil taxonomic and soil mapping units at the inception of the survey. Otherwise, the resulting soil survey may have very little, if any, value as far as the range resource is concerned.

SELECTED BIBLIOGRAPHY


