

## Soil Quality Information Sheet

# Pastureland Soil Quality—Introduction

USDA Natural Resources Conservation Service

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## What is pastureland?

Pastureland supports introduced or domestic native forage species and is used primarily for livestock production. It receives periodic renovation and/or cultural treatments, such as tillage, applications of fertilizer, mowing, and weed control. Permanent pastureland is in areas where the present operator has no desire to change the land use or rotate crops in the field. Some areas of pastureland are irrigated. Some may have trees growing on them as part of a secondary, silvicultural enterprise. Others are open savannas or partially cleared forests where introduced forage species have naturalized and supplanted all, or nearly all, of the native herbaceous plants.

## What is pastureland condition?

Pastureland condition is the status of the plant community and the soil in a pasture in relation to its highest possible condition under “ideal” management. The land user selects and establishes the desired plant community unless a preexisting one is acceptable or can be developed from the existing site. The desired plant community should be selected on the basis of the adaptability to the existing soils and climate at the site. Livestock production goals and livestock forage preferences should also be considered.

Where “ideal” pastureland management is applied, grazing pressure and agronomic inputs are managed in a manner that keeps the desired plant community reasonably stable at the species proportions desired for the livestock type and class. Over time, permanent pastures tend to naturalize. Other unintended plants invade and become part of the plant community. Some of these are acceptable forage species; others are not. Shifts in plant species composition, if allowed to proceed without intervention, usually result in a plant community that does not meet the goals of the land user. This plant community often produces lower quality forage than the established pasture plant community, sometimes yields less forage, and may not respond as well to agronomic inputs.

## What is soil?

Soil is a dynamic resource that supports plants. It consists of mineral particles of different sizes (sand, silt, and clay), organic matter, air, water, and numerous species of living organisms. Soil has biological, chemical, and physical properties, some of which change in response to how the soil is managed.

## What is soil quality?

Soil quality is the capacity of a specific kind of soil to function within natural or managed ecosystem boundaries, sustain plant and animal productivity, maintain or enhance the quality of water and air, and support human health and habitation. Soil quality reflects changes in the capacity of soil to function in response to management within a particular environmental setting.

## What does soil quality affect on pastureland?

- Plant production, reproduction, and mortality
- Erosion
- Vegetation composition
- Water availability and water quality
- Wildlife habitat
- Carbon sequestration
- Livestock health and production

## How are soil quality and pastureland condition related?

Pastureland condition and soil quality are interdependent. Pastureland condition is characterized by the functioning of both the soil and the plant communities. The capacity of the soil to function affects ecological processes, including the capture, storage, and redistribution of water; the growth of plants; and the cycling of plant nutrients. For example, increased surface compaction caused by excessive or untimely livestock traffic decreases the infiltration capacity of the soil and thus the amount of water available to plants. As the

availability of water decreases, plant production declines. Some plant species may disappear, and less desirable species may increase in abundance. Where livestock traffic is very heavy and prolonged, bare areas become evident. In contrast, vigorous, rapidly growing plants increase the inputs of organic matter into the soil and thus improve water infiltration and the subsequent availability of water to plants, and they reduce the potential for erosion by providing a vegetative cover, which reduces the impact of raindrops and minimizes subsequent soil movement. Changes in vegetation may precede or follow changes in soil properties and processes. Significant shifts in vegetation generally are associated with changes in soil properties and processes and/or the redistribution of soil resources across the landscape. In some cases, such as accelerated erosion resulting in a change in the soil profile, this shift may be irreversible. In others, recovery is possible with changes in grazing management.

## Why is soil quality important?

Changes in soil quality that occur as a result of agronomic and grazing management affect:

- the amount of water from rainfall and snowmelt that is available for plant growth;
- surface runoff and the potential for erosion;
- the availability of nutrients for plant growth;
- seed germination, seedling establishment, vegetative reproduction, root growth, forage production; and
- the ability of the soil to filter and protect water and air.

## How are soil quality indicators integrated into pastureland assessments and monitoring?

Changes in pasture condition are evaluated on the basis of soil and vegetation indicators. Evaluations made through assessment and monitoring provide information about the functional status of soil and pastureland. Soil quality indicators are properties that change in response to management, climate, or both and reflect the current functional status. Functions include maintaining soil and site stability; distributing, storing, and supplying water and plant nutrients; and maintaining a healthy plant community.

## How are soil quality indicators used on pastureland?

**Assessment.**—Soil quality indicators are used to increase the value and accuracy of pastureland assessments and trends. Assessments help to identify pastured areas where problems occur and areas of special interest. Land managers can use this information and other inventory and monitoring data to make management decisions, which, in turn, affect soil quality. When assessments or comparisons are made, the desired plant community is the standard. For the soils associated with a given forage suitability group, the properties that change in response to management or climate are used as indicators.

**Monitoring.**—Tracking trends in the functional status of the soil and the plant community helps to determine the success of the management practices or the need for additional management changes or adjustments. Regular measurement of soil quality at the same location can detect changes over seasons or years and provide early warning of future problems.

## How do I get more information?

For additional information, refer to pastureland soil quality information sheet 2, “Indicators for Assessment and Monitoring.”

**Pasture condition indicators.**—Descriptions of the following qualitative assessment indicators are available in the “Guide to Pasture Condition Scoring” and the “Pasture Condition Score Sheet” at <http://www.glti.nrcs.usda.gov>.

Percent desirable plants	Plant cover
Plant residue	Plant diversity
Plant vigor	Livestock concentration areas
Uniformity of use	Erosion
Percent legume	Soil compaction

**Soil quality and rangeland soil quality information sheets.**—The following fact sheets include information about additional soil quality indicators that can be used on pastureland. Download the sheets from <http://soils.usda.gov/sqi>.

Aggregate stability	Compaction
Infiltration	Organic matter
Physical and biological crusts	Soil biota
Soil pH	Salinization
Water erosion	Wind erosion

Other fact sheets are also available.

(Prepared by the Soil Quality Institute, Grazing Lands Technology Institute, National Soil Survey Center, Natural Resources Conservation Service, USDA and Agricultural Research Service, USDA)

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