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Soil Survey Technical Note 430-SS-2
Soil Color Contrast

Purpose

This technical note explains criteria for color contrast classes as presented in the *Soil Survey Manual*, the *Field Book for Describing and Sampling Soils*, and the *Field Indicators of Hydric Soils in the United States*. It also describes the best procedure to determine the difference in hue between colors and further explains color contrast determination when neutral or gley colors are present.

Background

In 1998, a provisional definition for color contrast was field-tested nationally to synchronize the definition among the *Soil Survey Manual*, the *Field Book for Describing and Sampling Soils*, and the *Field Indicators of Hydric Soils in the United States*. In 2023, the technical note was updated to further explain color contrast determinations when neutral or gley colors are present.

Introduction

This technical note provides guidelines for assigning soil color contrast classes. Contrast refers to the degree of visual distinction that is evident between associated colors. Contrast class is assigned based on the visual difference between the dominant soil color (matrix) and adjacent colors of lesser extent (e.g., features such as redox features, concentrations, and mottles).

A soil horizon that has several colors exhibiting little contrast requires time and close inspection to distinguish colors and assign color contrast. Furthermore, when comparing the color patterns of two soil features, visual perception of color can be affected by water state; quality of light; time of day; surface roughness; and the quantity, size, shape, and boundary distinctness of the two features. Thus, care in the identification of soil colors in the field is of particular importance for accurate and consistent soil description.

Definitions and Criteria of Soil Color Contrast Classes

The *Soil Survey Manual* defines three soil color contrast classes:

1. Faint soil color contrast is evident only on close examination. Color contrast is faint if the compared colors show one of the following attributes:

1) difference in hue = 0, difference in value is ≤ 2, and difference in chroma is ≤ 1, or
2) difference in hue = 1, difference in value is ≤ 1, and difference in chroma is ≤ 1, or
3) difference in hue = 2, difference in value = 0, and difference in chroma = 0, or
4) regardless of hue differences, have both a value of ≤ 3 and chroma of ≤ 2.

2. Distinct soil color contrast is readily seen but contrasts only moderately with the color to which it is compared. Color contrast is distinct if the compared colors show one of the following attributes:

1) difference in hue = 0, and
    a) difference in value is ≤ 2 and difference in chroma is > 1 to < 4, or
    b) difference in value is > 2 to < 4 and difference in chroma is < 4.
2) difference in hue = 1, and
    a) difference in value is ≤ 1 and difference in chroma >1 to < 3, or
    b) difference in value is > 1 to < 3, and difference in chroma is < 3.
3) difference in hue = 2, and
    a) difference in value = 0 and difference in chroma > 0 to < 2, or
    b) difference in value is > 0 to < 2 and difference in chroma is < 2.
4) Exception: if the compared colors have both a value of ≤ 3 and a chroma of ≤ 2, then the color contrast is faint, regardless of hue differences.

3. Prominent soil color contrast is visually conspicuous and contrasts strongly with the color to which it is compared. Color contrast is prominent if the compared colors show one of the following attributes:

1) difference in hue = 0, difference in value is ≥ 4 or difference in chroma is ≥ 4, or
2) difference in hue = 1, difference in value is ≥ 3 or difference in chroma is ≥ 3, or
3) difference in hue = 2, difference in value is ≥ 2 or difference in chroma is ≥ 2, or
4) difference in hue is ≥ 3.
5) Exception: if the compared colors have both a value of ≤ 3 and a chroma of ≤ 2, then the color contrast is faint, regardless of hue differences.

Procedure for determining the difference between hues and chromas

Using Color Chips

The National Cooperative Soil Survey (NCSS) standards for describing soil colors use the Munsell soil color system, which is based on hue, value, and chroma. The color chips included in the standard soil-color charts (a subset of all colors in the system) were selected so soil scientists

can adequately describe the normal range of soil colors. These chips have sufficient contrast between them to enable different individuals to match a soil sample to the same color chip.

Color must be described by using Munsell notations to the nearest color chip. Interpolating between color chips is not recommended in standard soil survey operations because visual determinations cannot be repeated with a high level of precision (Simonson, R.W. 1993). Describing soil color by other methods (e.g., a soil color meter) or by interpolating between color chips for purposes outside of routine soil survey (such as for research, special studies, or hydric soil determinations) is not restrained by NCSS standards.

Using the Hue Circle

The spokes of the Munsell® hue circle in figure 1 represent hues spaced at intervals of 2.5. Spokes colored red (or in bold if in black and white) are the hues approved by the NCSS for soil color determinations. Moving clockwise, the NCSS-approved hues from 5R through 5Y are spaced at 2.5-unit intervals. From 5Y through 5PB, the spacing of NCSS-approved hues changes to 5-unit intervals.

Neutral colors (N) have neither hue nor chroma. They are listed in the color charts as N 4/, N 7/, etc. The hue difference between a neutral color (N) and any hue is considered to have a proxy value of 1 for color contrast class determination purposes. For neutral colors (N), use a chroma of "0" to determine the difference in chroma.

Gley colors, such as 10Y and 5GY, are non-neutral colors and therefore have hue, value, and chroma. These non-neutral colors carry chroma of 1 or more. Even though chroma is not listed on the color chip page for each column, a chroma of 1 or 2, depending on the hue, is assigned as documented on the opposing page to the color chip (see figure 2). For example, 10GY 4/1 is the notation for the color chip at the fourth column from the left and third row from the bottom on the Gley 1 color chip page.

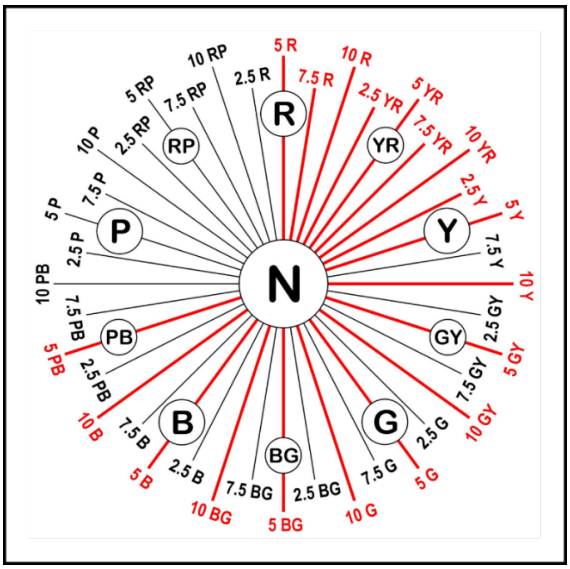

Figure 1.—Munsell® hue circle (modified from Munsell Book of Color, 1976).

To determine the difference in hue between colors, count the number of 2.5-unit intervals separating them. For example, hues of 2.5Y and 7.5YR differ by two 2.5-unit intervals, so their difference in hue is counted as "2." Hues of 5Y and 5GY differ by four 2.5-unit intervals, so their difference in hue is counted as "4." The suggested procedure is to write down the colors as observed then determine the difference between hues (number of spokes) using the Munsell® hue circle rather than count pages.

Counting the number of page separations to record the difference in hue is not recommended for the following reasons:

1) It is difficult to know the interval spacing where hues may occur on the same page, such as on the Munsell® color gley charts (figure 2).
2) Hue pages might be missing or out of place relative to the ordered progression of the Munsell® hue circle (figure 1).
3) Although separate hues may occur on adjacent pages, their hue spacing may be either 1 or 2, depending on whether the hues are at 2.5- or 5-unit intervals (figure 1).
4) The same hue can occur on adjacent pages, such as in the EarthColors™ soil color series book, from Color Communications, Inc.

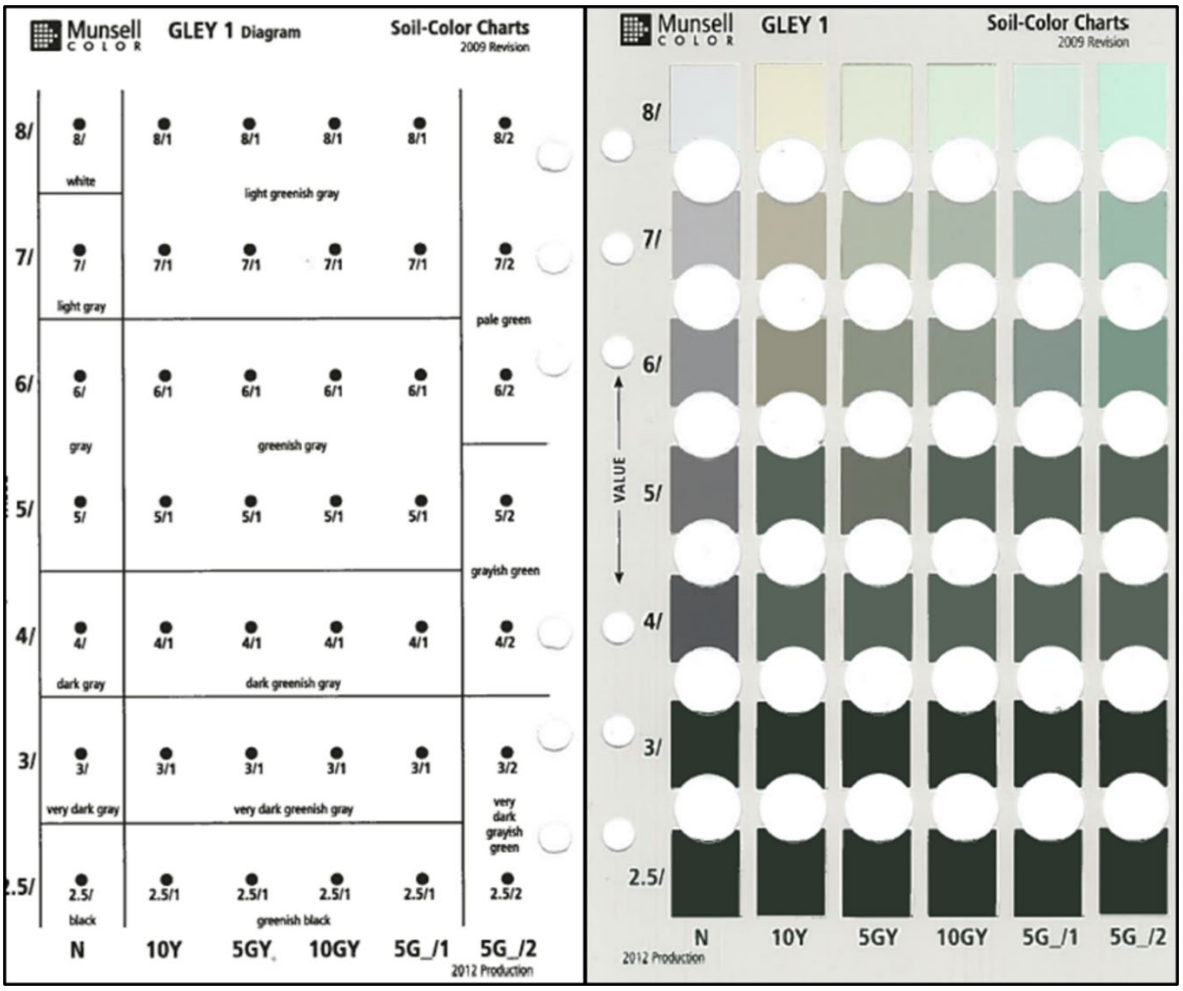

Figure 2.—The Gley 1 pages of the Munsell Soil Color Chart.

Tabular keys for soil color contrast determination using the Munsell® color notation*

Table 1.—Hues are the same (Δ h = 0) [1]

Δ Value	Δ Chroma	Contrast
0	≤ 1	Faint
0	2	Distinct
0	3	Distinct
0	≥ 4	Prominent
1	≤ 1	Faint
1	2	Distinct
1	3	Distinct
1	≥ 4	Prominent
2	≤ 1	Faint
2	2	Distinct
2	3	Distinct
2	≥ 4	Prominent
3	≤ 1	Faint
3	2	Distinct
3	3	Distinct
3	≥ 4	Prominent
≥ 4	---	Prominent

Table 2.—Hues differ by 1 (Δ h = 1) [1]

Δ Value	Δ Chroma	Contrast
0	≤ 1	Faint
0	2	Distinct
0	≥ 3	Prominent
1	≤ 1	Faint
1	2	Distinct
1	≥ 3	Prominent
2	≤ 1	Distinct
2	2	Distinct
2	≥ 3	Prominent
≥ 3	---	Prominent

* Schoeneberger, Philip J., Douglas A. Wysocki, Ellis C. Benham, and Soil Survey Staff. 2012. *Field Book for Describing and Sampling Soils, Version 3.0.* Lincoln, NE: Natural Resources Conservation Service, National Soil Survey Center.

Table 3.—Neutral colors (N) to other hues (Δ h = 1) [1]

Δ Value	Δ Chroma	Contrast
0	≤ 1	Faint
0	2	Distinct
0	≥ 3	Prominent
1	≤ 1	Faint
1	2	Distinct
1	≥ 3	Prominent
2	≤ 1	Distinct
2	2	Distinct
2	≥ 3	Prominent
≥ 3	---	Prominent

Table 4.—Hues differ by 2 (Δ h = 2) [1]

Δ Value	Δ Chroma	Contrast
0	0	Faint
0	1	Distinct
0	≥ 2	Prominent
1	≤ 1	Distinct
1	≥ 2	Prominent
≥ 2	---	Prominent

Table 5.—Hues differ by 3 or more (Δ h ≥ 3) [1]

Δ Value	Δ Chroma	Contrast
Color contrast is prominent, except when both value ≤ 3 and chroma ≤ 2, then faint.	Color contrast is prominent, except when both value ≤ 3 and chroma ≤ 2, then faint	Prominent

[1] Exception: If the compared colors have both a value of ≤ 3 and a chroma of ≤ 2, the color contrast is faint, regardless of hue differences.

References

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