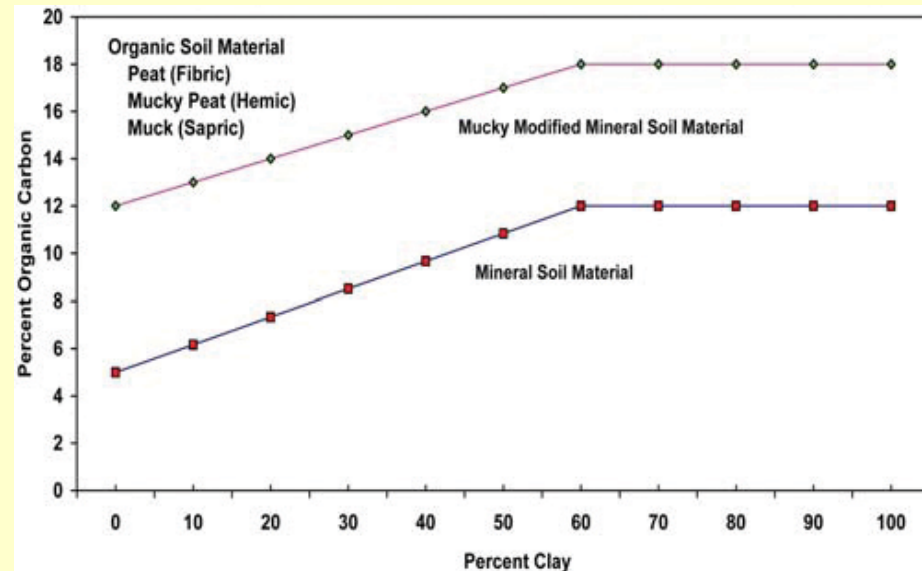


Inconsistencies in terminology and definitions of organic soil materials



Mineral soil material (less than 2.0 mm in diameter) *either*:

1. Is saturated with water for less than 30 days (cumulative) per year in normal years and contains less than 20 percent (by weight) organic carbon; *or*
2. Is saturated with water for 30 days or more (cumulative) in normal years (or is artificially drained) and, excluding live roots, has an organic carbon content (by weight) of:
 - a. Less than 18 percent if the mineral fraction contains 60 percent or more clay; *or*
 - b. Less than 12 percent if the mineral fraction contains no clay; *or*
 - c. Less than $12 + (\text{clay percentage multiplied by } 0.1)$ Percent.



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Folistic Epipedon

- when mixed to a depth of 25 cm, has an organic-carbon content (by weight) of:
- a. 16 percent or more if the mineral fraction contains 60 percent or more clay; *or*
 - b. 8 percent or more if the mineral fraction contains no clay; *or*
 - c. $8 + (\text{clay percentage divided by } 7.5)$ percent or more if the mineral fraction contains less than 60 percent clay.

Histic vs Folistic Epipedons

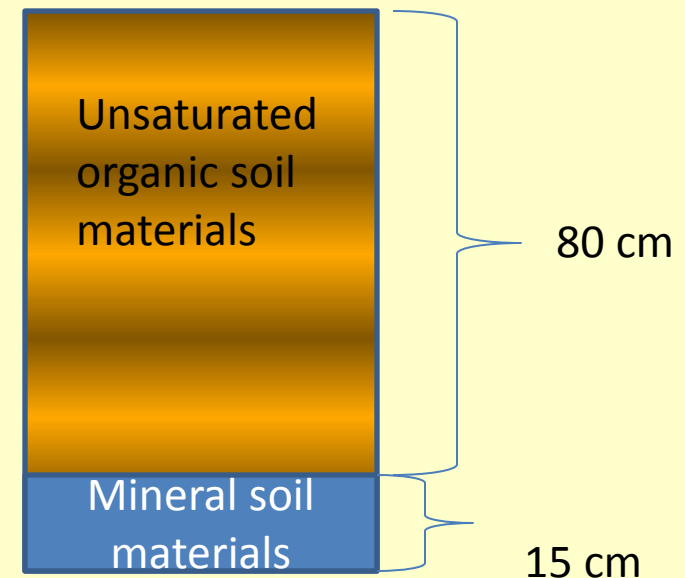
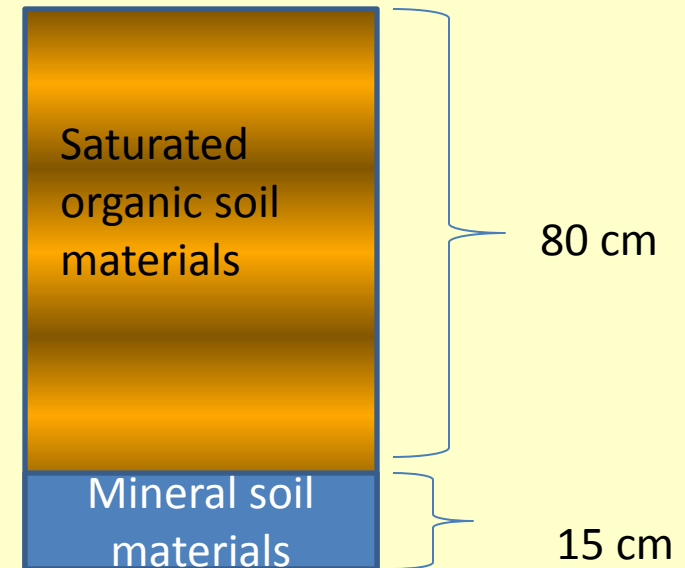
Histic:

- saturated soil materials;
- 20 to 40 cm thick,
- if composed of sphagnum fibers can be as much as 60 cm thick.
- Any thickness >40 cm is a Histosol

Folistic:

- saturated for <30 cumulative days;
- at least 15 cm thick;
- if composed of Sphagnum fibers at least 20 cm thick;
- no maximum thickness;
- only a Histosol if directly overlies a contact such as bedrock

Histosol



Mineral Soil

QUESTIONS

When do you use sapric?

When do you use muck?

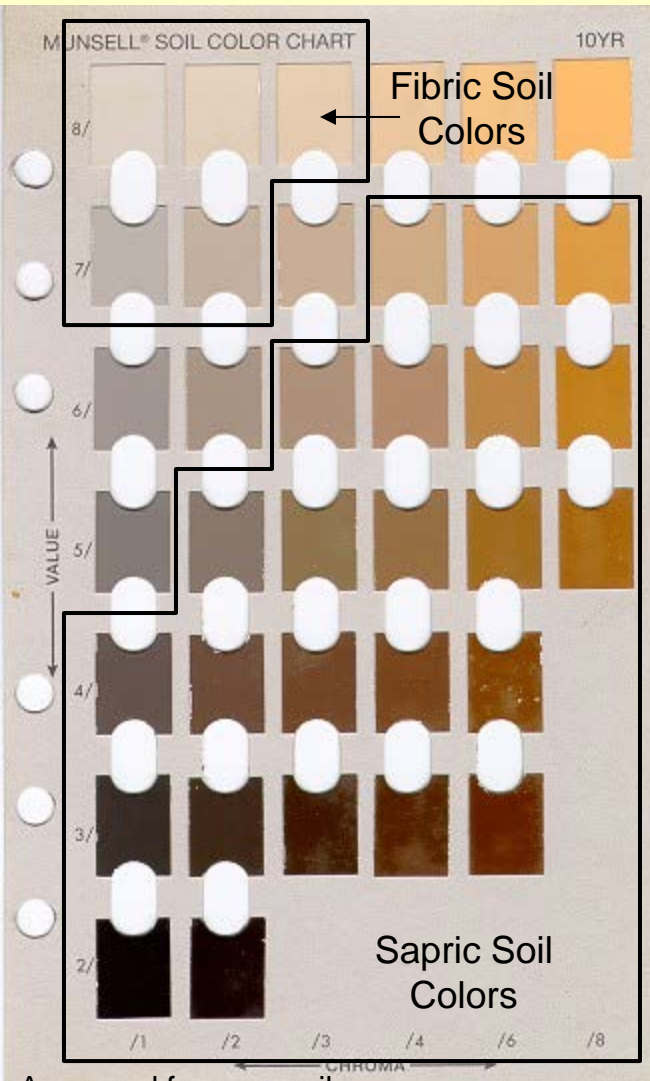
When do we use hemic?

When do we use mucky peat?

When do we use fibric?

When do we use peat?

What methodology do we follow to decide which class is correct?



Accessed from: nesoil.com

In Soil Taxonomy

- 1) The terms sapric, hemic, and fibric are defined only for Histosols
 - 2) The terms peat, mucky peat, and peat are not used anywhere except as example of organic soil materials.
- Fibric soil materials contain three-fourths or more (by volume) fibers after rubbing, or contain two-fifths fibers (by volume) after rubbing along with the appropriate pyrophosphate colors.
 - Sapric soil materials must contain less than one-sixth fibers (by volume) after rubbing along with the appropriate pyrophosphate color.
 - Hemic soil materials are an intermediate between sapric and fibric, and are identified by meeting neither the sapric or fibric criteria.

History Lesson

- The 1962 Soil Survey Manual supplement and Soil Taxonomy 1975 define O horizons as organic horizons of minerals soils.
- Soil Taxonomy (1975, page 460) states that O horizons in organic soils (Histosols) are not yet defined, but are under discussion.
- The first traceable record for the current O horizon and O layer concept is the 1981 Soil Survey Manual Draft -Chapter 3. The O designation takes on two meanings. One meaning is soil horizons formed by litter fall and decomposition at the soil surface on both mineral and organic soils. The second applies to organic layers that accumulate in wet environments. The material is referred to as muck, mucky peat, and peat. The 1981 Draft defines a, e, and i subscripts with the current rubbed fiber criteria. The 1993 Soil Survey Manual follows the same definitions and criteria except it does not mention the terms muck, mucky peat, and peat.

We assumed the horizon designations came from the “a” in sapric, the “e” in hemic, and the “i” in fibric. I checked the Field Book. It does not use these terms at all.

In the **Field Book**: The distinction between wet and non-wet organics remains in the terms that describe “texture”:

- wet; use muck, mucky peat, or peat,
- non-wet; use slightly, moderately, or highly decomposed.

Field Book for Describing and Sampling Soils



Version 3.0

**National Soil Survey Center
Natural Resources Conservation Service
U.S. Department of Agriculture**

September 2012

The **National Indicators** uses sapric and muck; hemic and mucky peat; and fibric and peat interchangeably.

“Mucky peat. Hemic organic material, which is characterized by decomposition that is intermediate between that of fibric material and that of sapric material. Bulk density is normally between 0.1 and 0.2 g/cm³. Mucky peat does not meet the fiber content (after rubbing) or sodium pyrophosphate solution extract color requirements for either fibric or sapric soil material.”

In the user notes for indicator **A9-1 cm Muck** it is written “Muck is sapric material....Hemic soil material (mucky peat) and fibric soil material (peat) do not qualify .”



United States
Department of
Agriculture

In cooperation with
the National Technical
Committee for Hydric Soils



NRCS

Natural Resources
Conservation
Service

Field Indicators of Hydric Soils in the United States

A Guide for Identifying and Delineating
Hydric Soils, Version 7.0, 2010



Soil Taxonomy

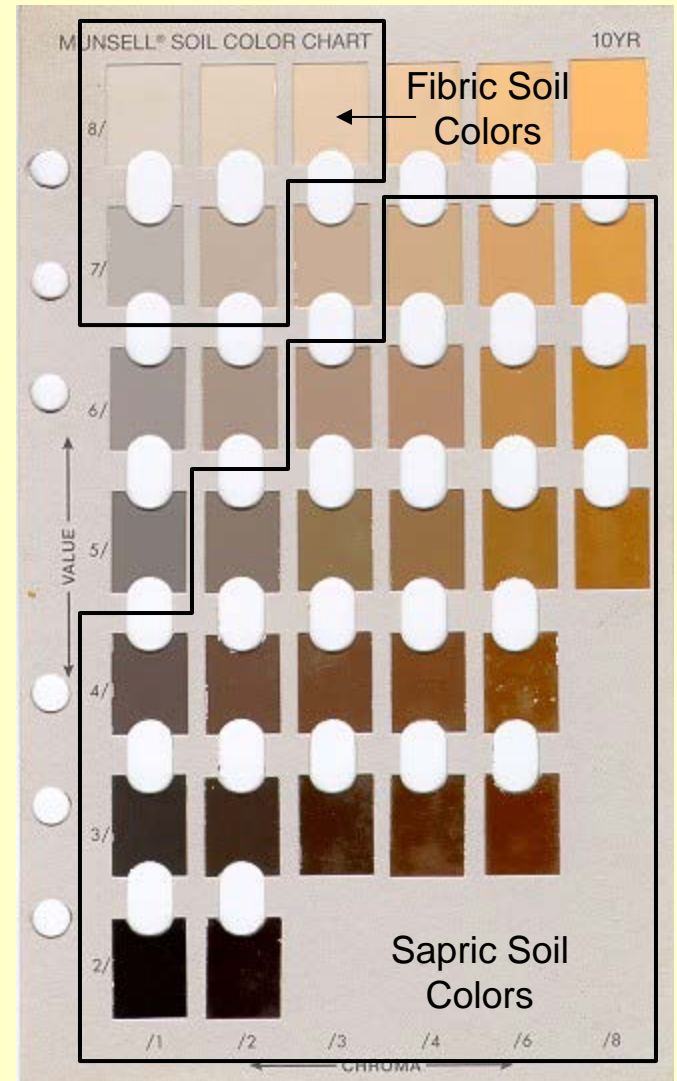
- Sapric, hemic, and fibric only used for Histosols
- Defined by both rubbed fiber and pyrophosphate color
- Muck, mucky peat, peat not used.

Field Book for Describing Soils

- Sapric, hemic, fibric not used;
- Muck, mucky peat, peat used for saturated mineral and organic soils
- Defined by rubbed fiber content

National Indicators of Hydric Soils

- Sapric-muck, hemic-mucky peat, fibric-peat used interchangeably
- Defined by both rubbed fiber and pyrophosphate color

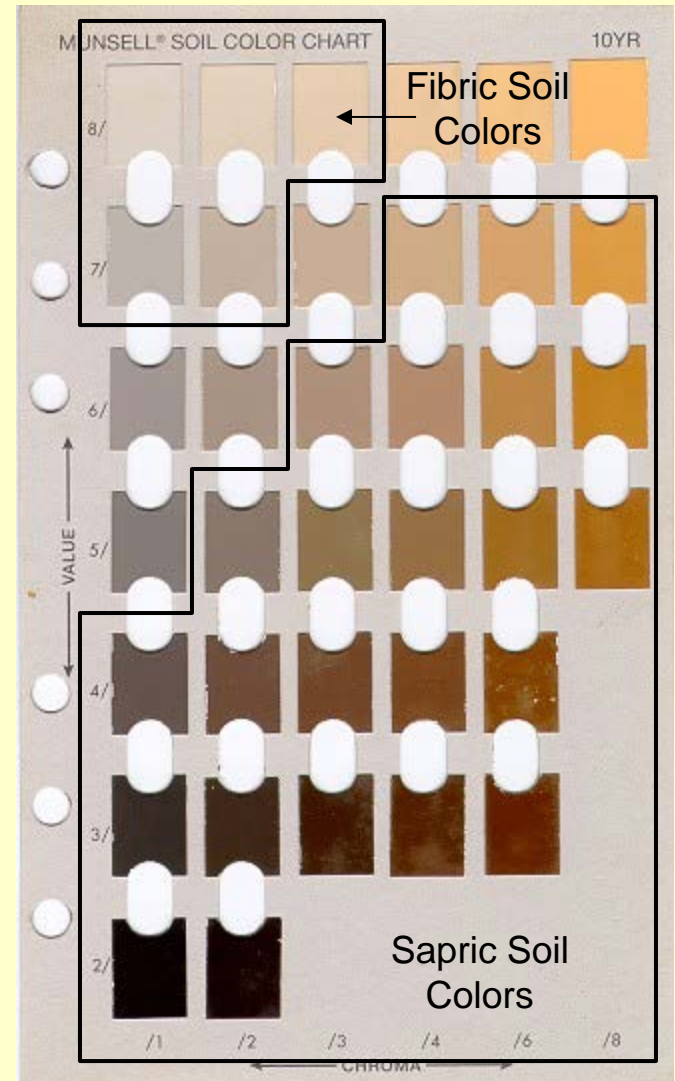


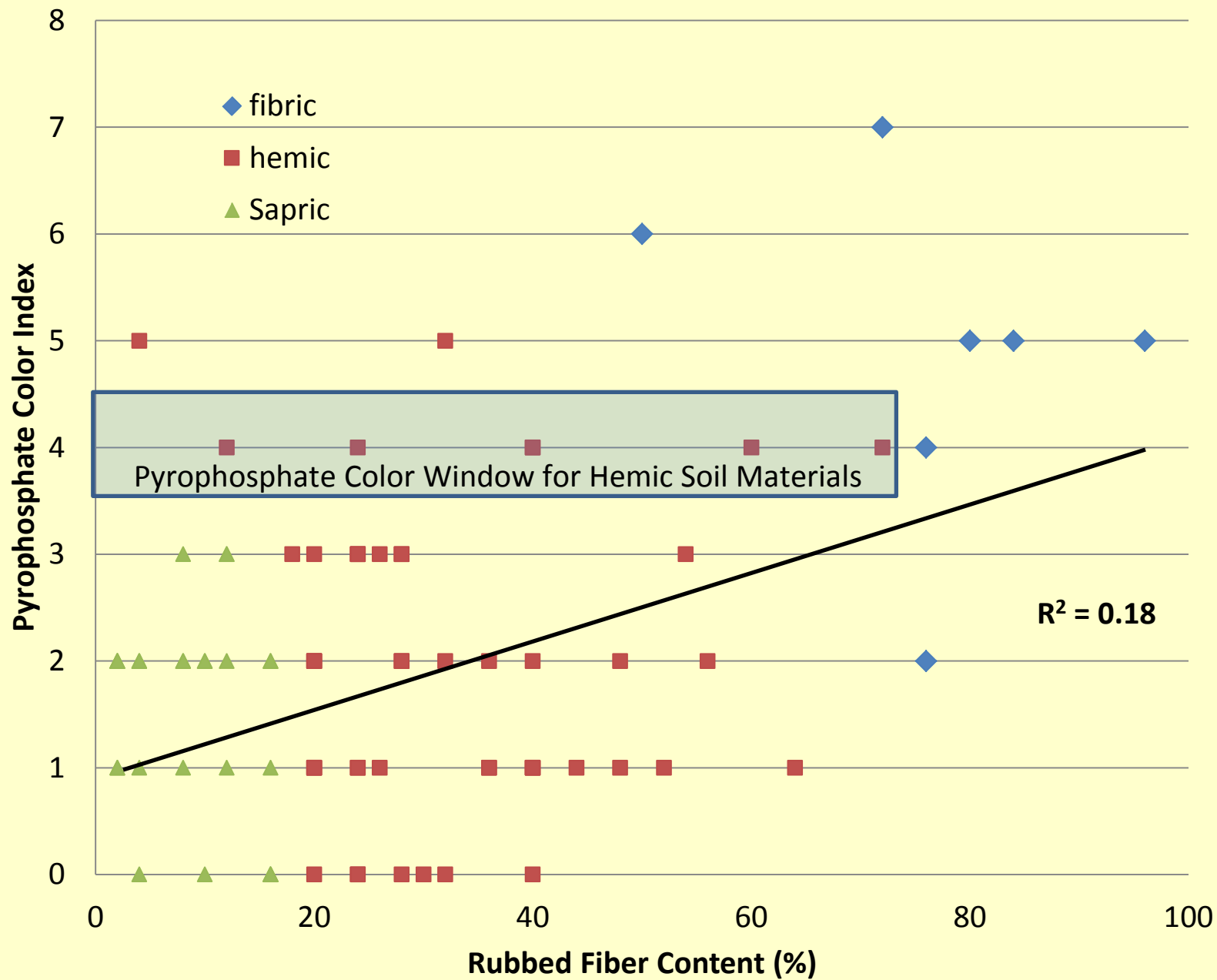
Methods

- Lynn et al. 1974. Field Laboratory tests for characterization of Histosols. IN SSSA special publication.
- Soil Taxonomy (1975)
 - 1) Pack 2.5 cc sample into a half syringe
 - 2) Transfer 2.5 cc sample to a 100 mesh sieve and run under stream of water until clear
 - 3) Pack into half syringe and record unrubbed fiber
 - 4) Transfer sample to 100 mesh sieve and rub sample between thumb and forefinger under a stream of water until effluent is clear
 - 5) Re-pack into half syringe and record rubbed fiber content

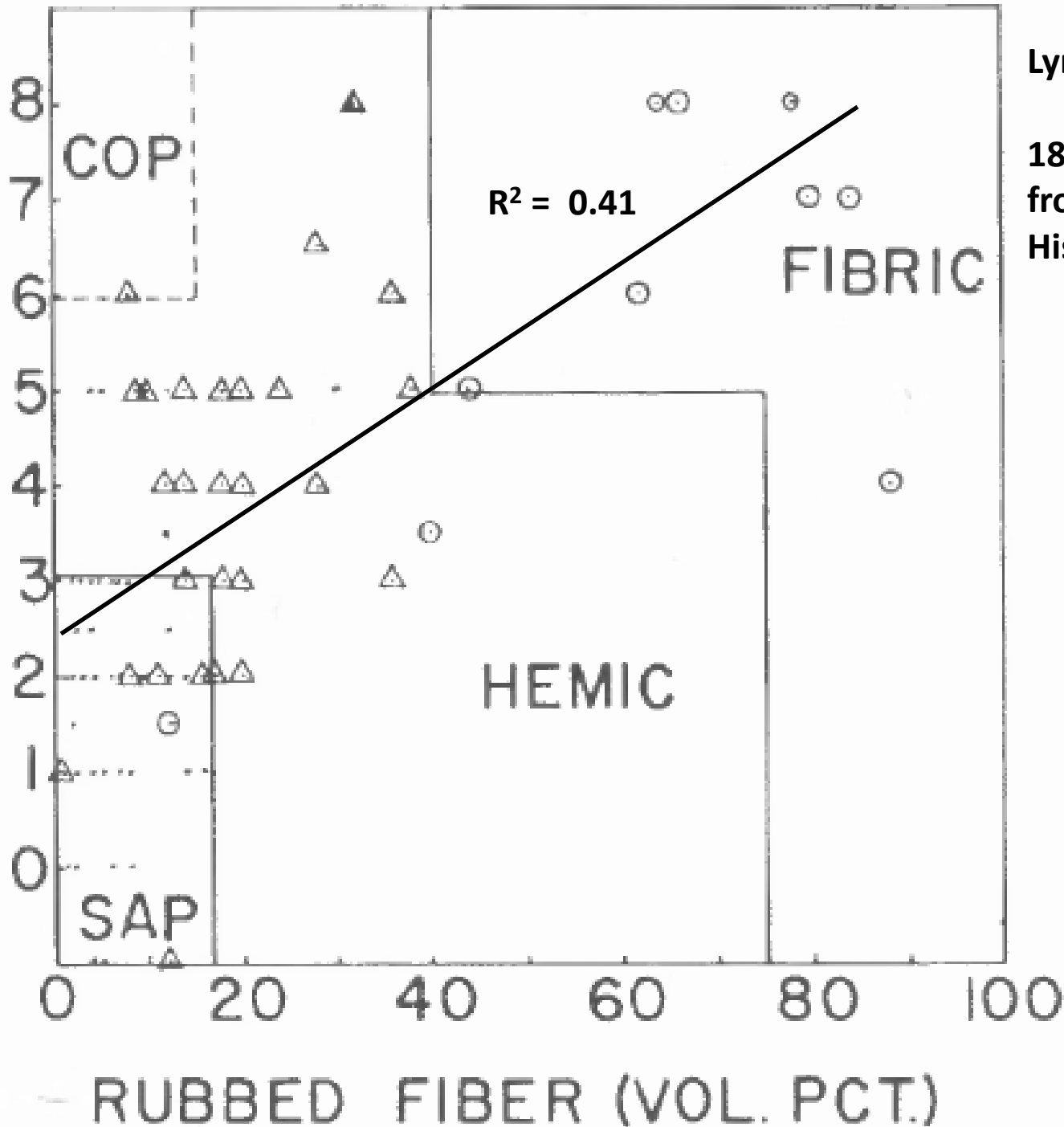
Classification of the decomposition state of 84 organic soil horizons. Field assessment was based on visual estimates of rubbed fiber content. Combined lab assessment was based rubbed fiber and sodium-pyrophosphate color results from laboratory analysis.

	Fibric	Hemic	Sapric
Field Assessment	0	3	81
Combined Lab Assessment	7	49	28





PYROPHOSPHATE INDEX
(VALUE - CHROMA)



Lynn et al, 1974

183 samples
from a range of
Histosols

Final comments:

Although Lynn et al. (1974) concluded that there is a tendency for the PI to increase with increasing rubbed fiber content; they used rubbed fiber content **instead of pyrophosphate color** to make their assessments of relationships between sapric, hemic, and fibric materials and bulk density and mineral content. Lynn et al. (1974) justified this by saying that “rubbed fiber content corresponds closer to daily field mapping operations than does the pyrophosphate color test”.

What do we do?

- Reconcile terms in our standards?
- Decide if the field approach of rubbed fiber content is what we want to continue to use.
- Reconcile approaches
- Consider some fundamental changes to Soil Taxonomy (to simplify and increase consistency)

Although all of our standards use the same rubbed fiber contents as criteria for identifying decomposition class of organic soil materials, and the same subordinate distinction suffixes (a, e, and i), these documents do not treat or use the terms sapric, muck, hemic, mucky peat, fibric, and peat in the exact same manner.

Recommendations

Our suggestion is that only the terms sapric, hemic, and fibric be used to name decomposition classes of all organic soil materials regardless of if these are mineral, organic, hydric, or upland soils. These names match up with horizon designations (e.g. Oa for sapric) that we use every day regardless of the soil type.

Our studies, and earlier studies done by Lynn et al. (1974), suggest that our ability to determine rubbed fiber content in the field needs calibration. Calibrations are done in the lab with a plastic syringe, sieve, and stream of water.

Recommendations

This approach should be applied in the field by using the same syringe and sieve while using a squirt or shaker bottle as the stream of water.

We found that the correlation between rubbed fiber content and pyrophosphate color is not very strong ($R^2 = 0.18$ to 0.41), that <25% of the materials classified as hemic materials fell within the hemic pyrophosphate color window, and that in our over 30 years of field experiences classifying soils and working in wetlands, we have never seen the field application of pyrophosphate color. Our simple polls suggest that very few soil scientists even know how to measure pyrophosphate color.

Recommendations

Our suggestion is to follow the rationale posed by Lynn et al. (1974) that “rubbed fiber content corresponds closer to daily field mapping operations than does the pyrophosphate color test” and to only use rubbed fiber content to define decomposition class. The qualifier here is that a syringe, sieve, and stream of water be used to help measure rubbed fiber content.

Additional Issues

There is too much complexity in how OSM are defined and in the criteria for organic epipedons

The amount of soil organic carbon that is necessary for organic soil materials can be as little as 12% but vary by as much as 8% (66% relative to the minimal amount) depending on if the soil is saturated and how much clay there is in the sample.

For the organic epipedons, different thickness requirements are used depending on if the soil is saturated (histic) or unsaturated (folic). If histic epipedons exceed a certain thickness (generally 40 cm) they become Histosols. In contrast, for soils with a folic epipedon at least 40 cm thick, what defines whether it is a Histosol is not the thickness of the organic soil materials but the thickness of the mineral component (at least 10 cm) of the soil.

Final Comments

As we move forward in our attempts to describe and classify soils, inventory SOC stocks, and identify hydric soils we should all be using the same standards, definitions, terminology, and underlying criteria for organic soil materials and the associated horizons.

Our studies suggest that we may need to collectively reconsider our current approach and strive to be more consistent in our terminology and how we define soil organic materials.