The Use of Soil Forming Factors in the Development of *Soil Taxonomy*

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Introduction

- The five soil forming factors have influenced the development of classification systems.
- The influence has been different in different countries.
- This presentation analyzes the presence and importance of soil-forming factors in *Soil Taxonomy*.

History of the Soil Forming Factors in USA Soil Classification Systems

- The first USA soil classification system was to support soil surveys, which started in the USA in 1899, it was not based on the soil forming factors.
- Russian concepts of soil classification were transferred to the USA in the 1920–30s.
- USA soil classification systems of the 1930s and 1940s were derived from factor-genetic principles and concepts of zonality.
- The Russian soil-factorial concept was used in USA pedology through the 1950s. However, it was found that the USA soil series were incompatible with the Russian-inspired system of great soil groups.
- In the mid-1940s the USDA Soil Conservation Service set about to improve the definition of the great-soil groups and develop a set of quantitative criteria.
- This led to the 7th Approximation in 1960.
- The use of concepts associated with soil processes and factors was limited in the 7th Approximation in favor of a more quantitative approach.
- Eventually the 7th Approximation was revised into *Soil Taxonomy*, which was published in 1975.
- *Soil Taxonomy* returned to a more factorial-genetic approach of classification (Table 1) as was seen in early USA systems.

Table 1

The soil-climatic (factorial) formative elements in the suborder names of the 7th Approximation and Soil Taxonomy.

7th Approximation	Soil Taxonomy (1975)
Aqu—excessive wetting	Aqu-
Alt—high-mountain climate	Ud-
Ud—humid climate	Ust—intermediate between udic and aridic
Ust—dry climate	Bor—boreal
	Torr—dry with heavy showers
	Trop—tropical
	Xer—moist cool winters, dry hot summers

Figure 1. A Gelisol, showing permafrost in the C horizon. Photo from the SSSA Marbut Memorial slide collection.

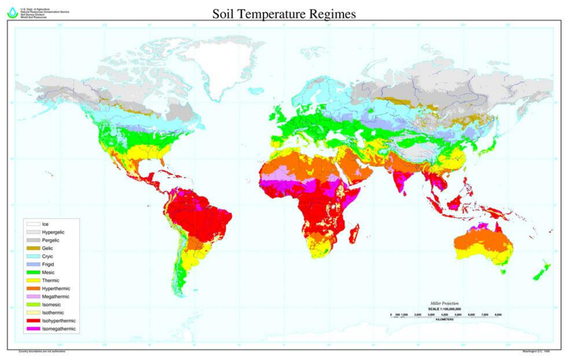

Figure 2. Global distribution of soil temperature regimes.

Figure 6. National Cooperative Soil Survey map for a portion of Tompkins County, NY. The third letter in the symbols (i.e., BgC) gives information on the slope (relief) of the soil map unit.

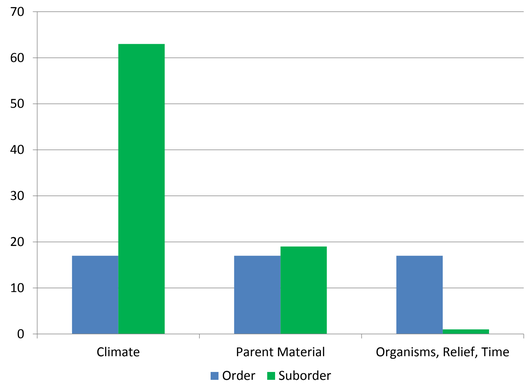

Figure 3. Proportion (percent) of orders and suborders affected primarily by climate, parent material, or the other soil-forming factors.

Figure 4. A Fluvent, showing the characteristic layering of floodplain deposits. Scale is in feet. Photo from the SSSA Marbut Memorial slide collection.

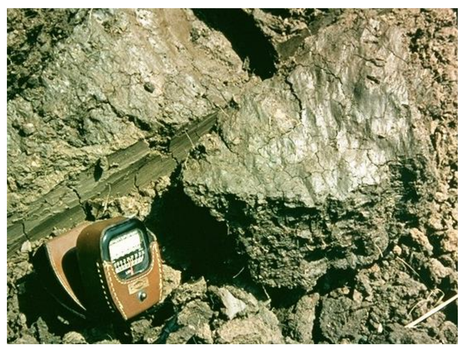

Figure 5. Features like slickensides in Vertisols are due to the high shrink-swell clay content. Photo from the SSSA Marbut Memorial slide collection.

Soil Forming Factors in *Soil Taxonomy*

- Climate is the primary factor used to key out two orders in *Soil Taxonomy*: Aridisols (dry soils) and Gelisols (very cold soils) (Figure 1).
- Climate is also used to differentiate suborders in eight other orders: Alfisols, Andisols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols.
- A second example of the emphasis of soil climate in *Soil Taxonomy* is the importance given to soil-temperature regimes (Figure 2).
- The second most important factor in distinguishing among taxa in *Soil Taxonomy* is parent material (Figure 3).
- Parent material is used to identify three soil orders: Histosols, Andisols, and partially for Entisol suborders derived from fluvial or sandy materials (Figure 4).
- Parent material is also important for Vertisols (Figure 5).
- Parent material is used at the subgroup level for most of the soil orders.
- Relief is recognized in *Soil Taxonomy* at the finest level, the soil phase (unofficial), primarily for mapping purposes (Figure 6).
- Organisms are recognized in *Soil Taxonomy* at the great-group and subgroup level (the worms, vermic) and at the suborder and great-group levels (humans, anth-). No human-influenced soil series have formally been identified to date.
- Time is not recognized directly in *Soil Taxonomy* but is recognized indirectly in the Pale- great groups.

Conclusions

- The soil-forming factors were used in the first soil classification systems in the US following the genetic approach developed in Russia.
- The 7th Approximation was developed to break-away from the soil-forming factors.
- In the 1975 *Soil Taxonomy* system the soil forming factors resurfaced.
- Climate and parent material are used disproportionately in comparison to the other three soil forming factors.