Soil Classification: from Dokuchaev to a Comprehensive Sequential Quantitative Centroidal System

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Humans have been classifying soil entities for millennia. With Dokuchaev's systematic understanding of soil formation, classification was put onto a more objective basis. Today we still have many systems extant. Soil profile descriptions have always been difficult to successfully translate between taxonomic systems. In order to do this, there is the requirement for a comprehensive system of soil classification. We need a way of objectively comparing and coalescing taxa from existing systems to remove redundancy, and recognize gaps and eventually obtain a comprehensive set of quantified taxa. Such a system is under development. As a first step centroids were estimated for taxa within four existing systems at various categorical levels based on 22 soil variables at 20 depths. Nearest-neighbour distances were calculated based on the principal component space of the soil variables to remove redundancy of the existing soil classification and evaluate the equivalence between the different soil classification systems. After removing the redundancy, Great Groups of the New Zealand Classification and Australian Soil Classification and Soil Groups of the World Reference Base for Soil Resources were sequentially added to the Great Groups of the US Soil Taxonomy. This resulted in a comprehensive soil classification system. The comprehensive soil classification allowed for the further addition of taxa from other soil classification systems and was capable of robustly allocating unknown soil profiles via either hard or fuzzy allocation methods. A dynamic systematic nomenclature algorithm has also been developed. Merging and simplifying of such different systems demonstrates the possibility of similar mergers with taxonomies of other nations, creating a fully populated taxonomic space – a truly global or universal soil classification system. Experiments are underway with the Brazilian and French soil classification systems. Further development now requires systematic international cooperation.

References

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