

SOIL Discuss., author comment AC6
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Reply on RC3

David G. Rossiter et al.

Author comment on "How well does Digital Soil Mapping represent soil geography? An investigation from the USA" by David G. Rossiter et al., SOIL Discuss.,
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RC3: 'Comment on soil-2021-80', H. Curtis Monger, 01-Mar-2022

1. This is a timely article on a subject of importance to many involved in soil survey programs. As the metrics show, some 400 views have been made in the United States alone.

A: Thank you for this acknowledgement. Indeed we hope this stimulates further studies in this direction. And the linked code allows anyone to make our same comparisons for their area and properties of interest in the CONUS. These could be interesting papers, since the authors would be familiar with the soil geography of their areas.

2. Many soil scientists and administrators involved in soil survey see Digital Soil Mapping (DSM) as more than just a tool to aid the field soil scientists mapping soils using traditional methods. In their view DSM is the new method for mapping soils. Artificial intelligence and machine learning are tremendous tools in many medical and scientific studies, and it is logical to conclude that these methods when applied to soil survey will generate significant results, which they may. Yet, an assessment of DSM methods at this stage of development is needed that can articulate strengths, weaknesses, and opportunities.

A: Agreed. However this paper is not about a SWOT of DSM in general, rather on how to compare of DSM products, and vs. a "traditional" product. We do discuss DSM in general but that is not the main focus.

3. The assessment that is made in this paper uses visual and statistical techniques that compare the DSM methods of POLARIS, SoilGrids, and SPCG to gSSURGO (and gNATSGO), which are used as references. Many challenges to DSM have come from field soil scientists using traditional methods—that is, an understanding of soil genesis, geomorphology, and Quaternary geology of the soils being mapped combined with on-site hypothesis testing. Authors of this study have such field experience as well as backgrounds in computer-assisted soil survey studies.

A: Thank you. Authors Beaudette (NRCS) and Libohova (formerly NRCS, now ARS, and with extensive field experience during his Purdue PhD time) are the co-authors with the

most expertise.

4. McBratney et al. object to comparing DSM to gNATSGO as the reference, stating that both DSM and "conventional" soil mapping have uncertainties and often a different focus (classes vs properties), why should one be used to measure the quality of the other? "Would we not reach a similar conclusion if we take maps from different soil surveyors to compared them with a DSM product? In order to do a convincing comparison, it is important to have an independently observed dataset with which to compare the various representations else we might simply realise a self-fulfilling prophecy." I predict that such a comparison will soon be made and, thus, reinforces the merit of this paper for moving the science forward.

A: Agreed. This is not the focus of our paper. However, in the Conclusion we will make a reference to a very early, but still relevant, study comparing soil surveyors: Bie, S. W. and Beckett, P. H. T.: Comparison of four independent soil surveys by air-photo interpretation, Paphos area (Cyprus), 29, 189–202, 1973.

From the Abstract to that paper: "[T]he four interpreters used quite different strategies for mapping the same soil landscape, to produce soil maps which differed considerably in the percentage purity of their mapping units [based on 30 profiles] and the extent to which the variability of soil properties within mapping units was less than that of the landscape as a whole." So which of the four maps would be used as a "reference"?

5. Comments about retaining the familiar term "digital soil mapping" instead of the new term "predictive soil mapping" are reasonable. Overall, the paper generated a lot of discussion and thought and will be a good contribution to the literature. It may prompt some in the DSM community to reflect on whether DSM is over-sold, at least in some cases. The paper also makes a contribution by explaining terms to the non-specialists, such as SSURGO, STATSGO, WoSIS, NASIS, SPCG, etc.

A: Yes, we agree to continue with DSM instead of PSM, the arguments of the Sydney group convinced us. We did try to define the various sources so readers can understand their purposes and methods.

6. The manuscript, combined with the discussion, will prompt many of us involved in soil survey to rethink about what is meant by soil classes versus soil properties, soil entities, taxonomic units or mapping units in the context of DSM. It may even cause many to re-visit the foundational mapping and taxonomy concepts of "soil body," "polypedon," and "soil individual."

A: Agreed. This discussion is outside the scope of this paper, and we hesitate to include it in our conclusions, as it opens a wide area which is better placed in a separate "concept" paper.

7. Several comments were made by the community and referee, which the authors acknowledge. I would add to those comments the need for making the figure captions (those actually attached to the figures) independently lucid.

A: RC2 also commented on this: "Most figure captions are more like titles. Please elaborate in the figure captions to guide the reader in what to look for in the figures."

We responded: "Our practice has been to point out the most important features of a figure in the text, at the point the figure is referenced. In some cases this text would be too long to fit into a caption. However we will expand the figure texts to make them independently understandable."

