OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Assessing Heterogeneity of Soils (updated)

Keyword(s): Soil, Heterogeneity, Interpretation, Comparison, Variability, Urban, Rural, Land Use

Submitting subcommittee(s): Trace Materials **Date Approved:** 02/24/2021

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

This research need is a fundamental study that would impact the interpretation of soil as forensic evidence.

2. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

There are small-scale limited studies. There are no large-scale, systematic studies that address soil heterogeneity, both across the landscape and with depth, in a forensic context. Ideally this assessment should use methods that are analogous to those commonly used in forensic soils analysis (not bulk chemical methods).

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

1. Graham, R.C. and O'Geen, A.T. (2009) Soil mineralogy trends in California landscapes. Geoderma, doi:10.1016/j.geoderma.2009.05.018
2. Lark, R.M. and Rawlins, B.G. (2008) Can we predict the provenance of a soil sample for forensic purposes by reference to a spatial database? European Journal of Soil Science, 59: 1000–1006
3. Morrison, A.R. et al. (2009) Characterization and Discrimination of Urban Soils: Preliminary Results from the Soil Forensics University Network. In Ritz, K. et al. (Eds) Criminal and Environmental Soil Forensics, Springer.
4. Suarez MD, Southard RJ, Parikh SJ. Understanding Variations of Soil Mapping Units and Associated Data for Forensic Science. J Forensic Sci. 2015 Jul;60(4):894-905. doi: 10.1111/1556-4029.12762. Epub 2015 Mar 24. PMID: 25808848.
5. Idrizi, Hirijete, Metodija Najdoski, and Igor Kuzmanovski. "Classification of urban soils for forensic purposes using supervised self-organizing maps." Journal of Chemometrics: e3328. https://doi.org/10.1002/cem.3328

4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest? Is your research need identified by NIJ?

This research addresses: “Quantitative methods to augment visual trace evidence screening and examinations ”; “Scientific foundations for expert conclusions of forensic evidence”; “Scientific foundations for expert conclusions of forensic evidence”

5. In what ways would the research results improve current laboratory capabilities?

This research would enable laboratories to better understand the significance of soil examination conclusions (associations, exclusions, inconclusive findings) for cases involving soil from different land use types, geomorphic position, landscape age, and bedrock/parent material characteristics. Appropriate limiting statements could be inserted into reports, and findings could be qualified in court testimony in more rigorous ways than simply based on examiner experience. For example, if research demonstrates that soil tends to be more homogeneous across certain types of settings (i.e., prairie underlain by granitic bedrock), this would be important for a soil examiner to know as they evaluate the significance of a soil association in a case involving this type of setting.

6. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

This research would provide those performing forensic soil examinations with a better understanding of the significance of soil examination results to enable better conclusions (associations, exclusions, inconclusive findings) for cases involving soil from different land use, geomorphic position/age, and bedrock characteristics. It would also assist the subcommittee in developing a statistical approach to estimating population size for comparisons. This would enable the subcommittee to make informed interpretation and report writing recommendations to forensic practitioners in future standards and/or guidelines.

7. In what ways would the research results improve services to the criminal justice system?

It would improve the assessment of the probative value of any particular soil comparison result. It would aid in appropriate testimony and reporting. This research is needed to address the strength of a comparison, assessment of inconclusive, or exclusion.

8. Status assessment (I, II, III, or IV): I

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.