

## Building a library of source samples for sediment fingerprinting – potential and proof of concept

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### Extended Abstract

**Purpose:** Sediment fingerprinting of fluvial targets has proven useful to guide conservation management and prioritize sediment sources for federal and state supported programs in the United States.

However, the collection and analysis of source samples can make these studies unaffordable, especially when needed for multiple drainage basins. We investigated the potential use of source samples from a basin with similar physiography (using samples from one of a “pair” to evaluate samples from the other ) or combined from multiple basins (a “library”). **Methods:** Source samples from eight basins across six ecoregions were gathered from existing, published studies. Individual source samples were fingerprinted using SedSAT (Gorman Sanisaca and others, 2017) to build a mixing model derived from source samples from other basins. The ability to identify source category was evaluated both as part of source verification and by classifying source samples as “targets” (Figure 1). **Results:** Approximately half of cropland samples were identified as targets, both as pairs and with the multi-basin source dataset, indicating that cropland samples could be shared for basins in similar ecoregions and be combined for larger stream systems. Streambank samples were better identified with the multi-basin analysis relative to the pairs and those from mixed land-use basins improved this differentiation except for samples from basins with little-to-no development. Inconsistent identification of pasture samples highlighted the

need for local samples. Inconsistent identification of forest samples indicated that upland- and riparian- forest samples are distinct. Road samples were identified as both sources and targets and other source types were rarely apportioned as road: these may have the best potential to supplement local source samples. Samples from each source type and each basin were included in the final library (Figure 2). This source-sample library was then used to improve the accuracy of sediment-source apportionment for a previously studied basin. **Conclusion:** Ultimately, the source verification process already used in individual basin studies to evaluate the accuracy of sediment-fingerprinting apportionments was useful for determining how to supplement local source samples with those from other basins. This study shows that supplementing local source samples with those from basins with similar physiography has the potential to both improve fingerprinting accuracy and decrease the cost of this type of study. This research is published in the Journal of Environmental Management (Williamson and others, 2023).

## References Cited

- Gorman Sanisaca L.E., Gellis A.C., Lorenz D.L. (2017) Determining the sources of fine-grained sediment using the Sediment Source Assessment Tool (Sed\_SAT), Open-File Report, Reston, VA. pp. 116. <https://doi.org/10.3133/ofr20171062>
- Williamson T.N., Fitzpatrick F.A., Kreiling R.M. (2023) Building a library of source samples for sediment fingerprinting – Potential and proof of concept. Journal of Environmental Management 333:117254. <https://doi.org/10.1016/j.jenvman.2023.117254>

Figure 1. Characterization of samples in SedSAT using the mean maximum apportionment for both source verification and as targets for the paired (a-c) and Set296 (d-f) analyses. The mean maximum source apportionment was generally higher as part of source verification relative to apportionment as a target (a,b and d,e). The proportion of 1000 Monte Carlo (MC1000) iterations that identified samples was highest among those identified as both a source and target (c and f). Samples identified as a target were commonly identified as a source; the width of the box (c and f) relates to the number of samples in this category.

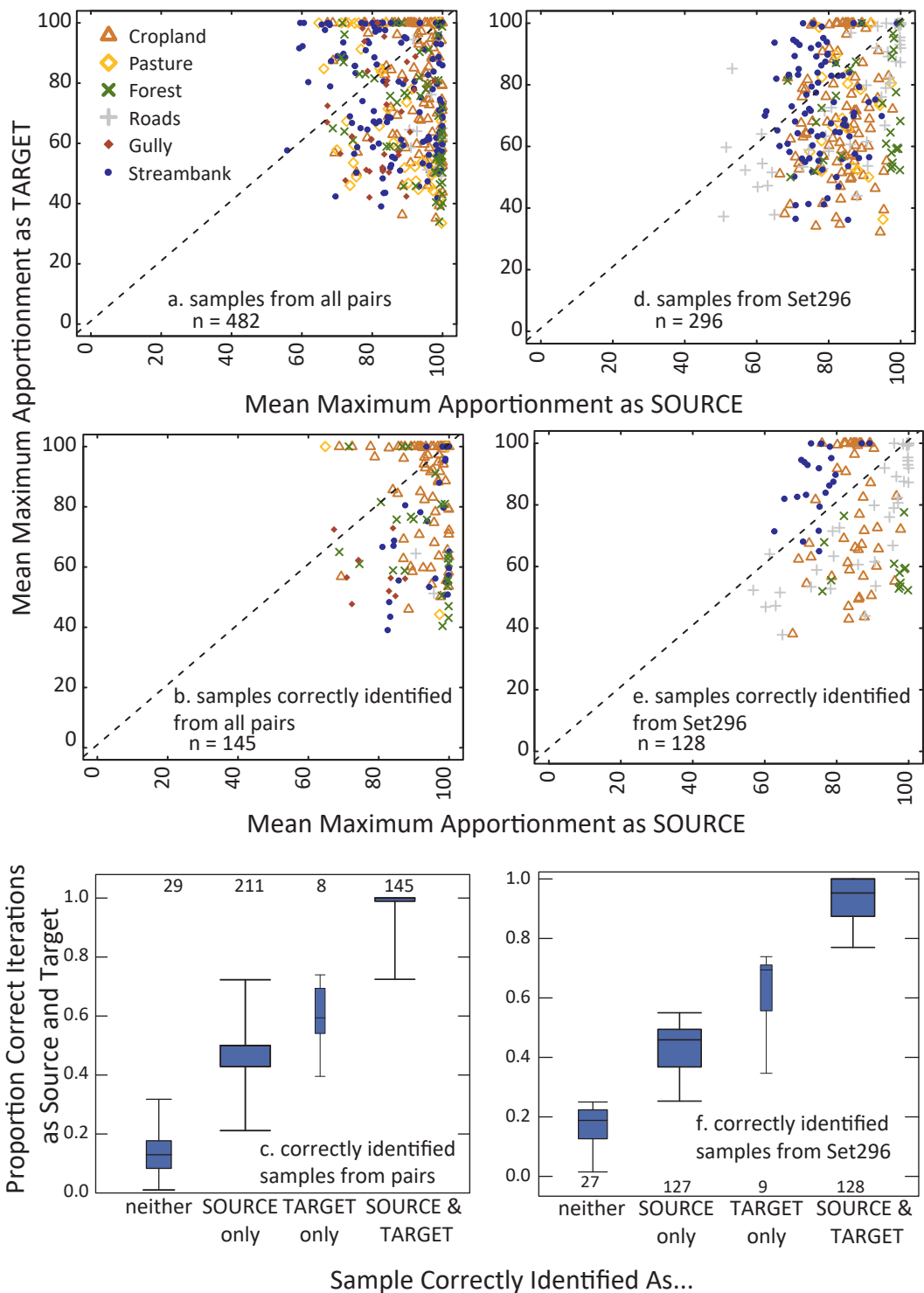
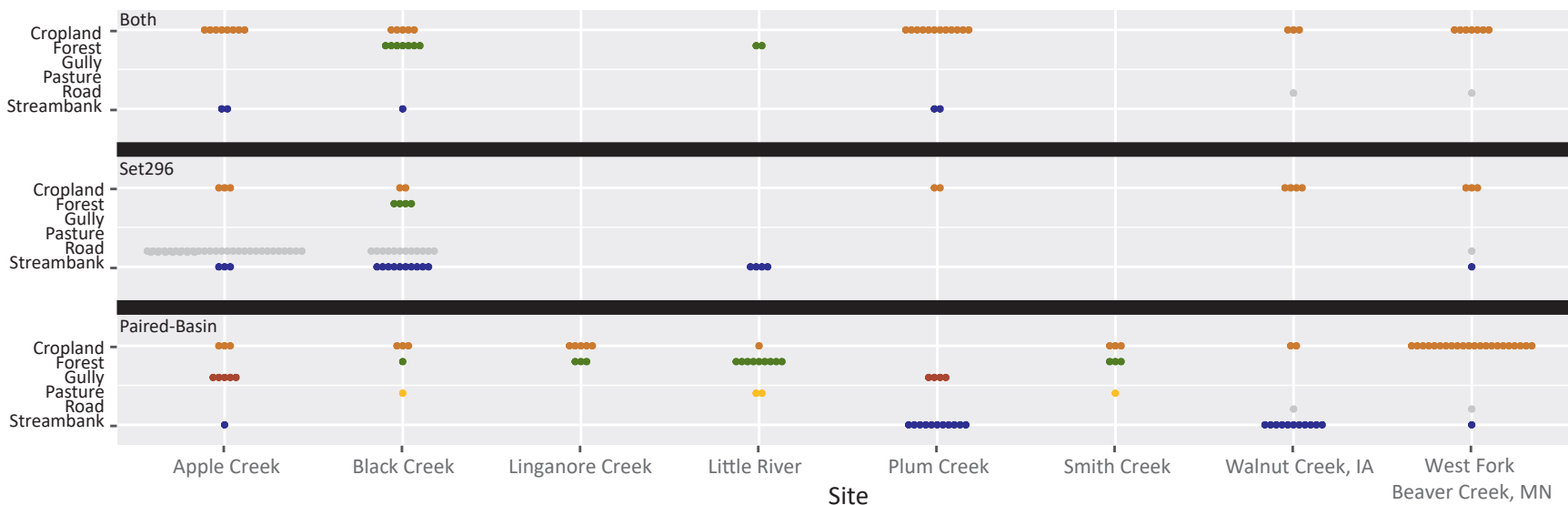


Figure 2. Sample retained from paired-basin analysis, Set296 (combined samples from 6 basins), or both. Samples organized by (a) basin and (b) source.

### a. By Basin



### b. By Source Type

