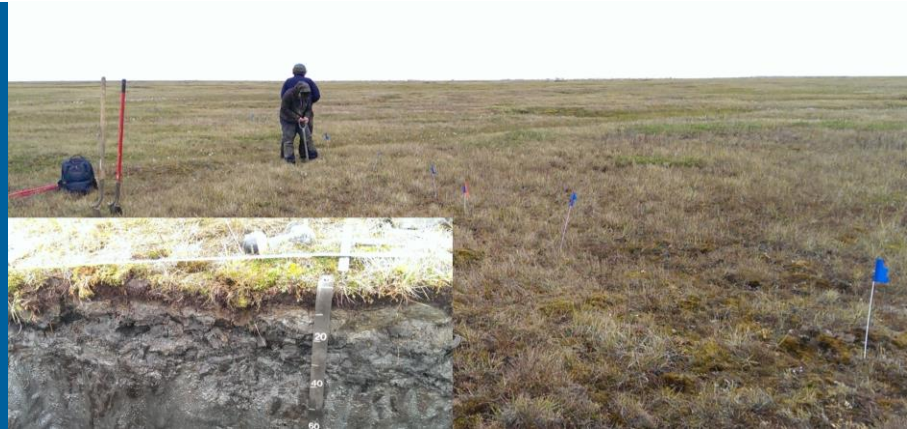
DERIVING FUNCTIONAL RELATIONSHIPS BETWEEN ENVIRONMENTAL FACTORS AND SOIL ORGANIC CARBON STOCKS



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U.S. DEPARTMENT OF ENERGY

SCIENCE MOTIVATION AND SUMMARY

MOTIVATION

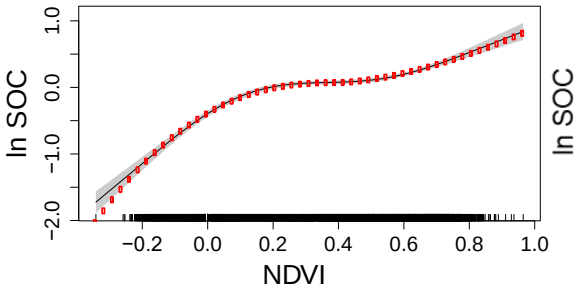
- Current generation of earth system models poorly represent the magnitude and distribution of baseline soil organic carbon (SOC) and show a large uncertainty in future carbon climate feedback projections.

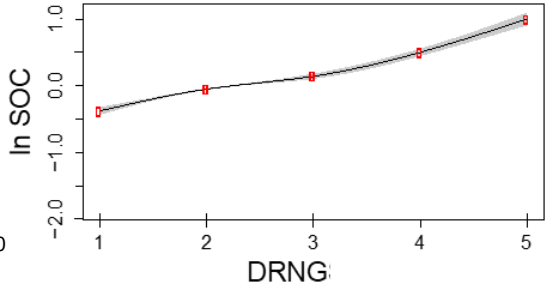
APPROACH

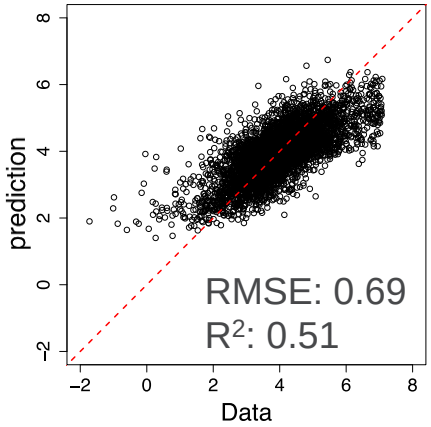
- Datasets of environmental factors (n=31)
- Field observations of SOC (6,213)
- Machine learning and generalized additive modeling (GAM)

OUTCOMES AND IMPACTS

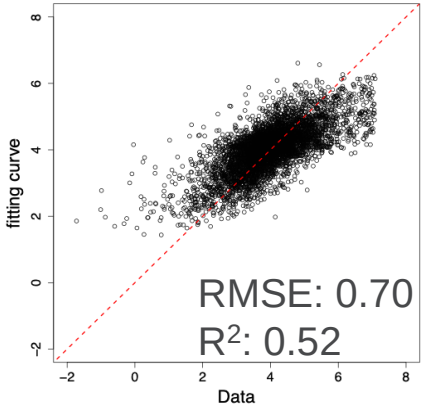
- Machine learning and GAM models identified six environmental factors as important predictors of SOC stock.
- Derived functional relationships of these six environmental factors explained 52% of the observed variability of continental US SOC stocks.
- Functional relationships we derived can serve as important benchmarks to evaluate environmental control representations of SOC stocks in Earth System Models.







Random forest using 22 variables

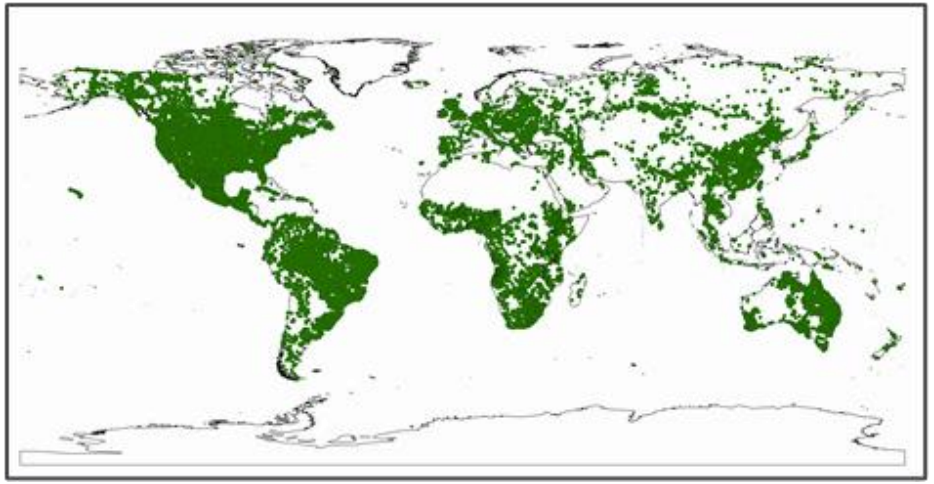


Functional relations of 6 variables

(Mishra et al., in prep.)

FUTURE RESEARCH (3-5 YEARS)

- **Use machine learning to identify environmental drivers of SOC stocks both in observations and CMIP model datasets.**
- **Derive functional relationships of environmental factors both in observations and CMIP model datasets.**
- **Evaluate the similarities and differences in derived relationships between observations and model datasets.**
- **Explore the global and continental scale SOC dynamics.**



- ~110,000 SOC profile observations
- 62 Environmental factors

RELATIONSHIP TO WHITE PAPER

Our future research activities addresses both short (SOC dynamics) and long-term (data model inter comparison) research goals identified in the “Ecosystem Responses and Feedbacks” white paper.