USDA

United States Department of Agriculture

Soil and Plant Science Division

Natural Resources Conservation Service


GLOBAL SOIL PARTNERSHIP

# NRCS Contributions to the GSP & Global Soil Property Maps

Natural Resources Conservation Service

nrcs.usda.gov/

# Global Soil Partnership

## Established 2012 to position soil in the Global Agenda through collective action

Food and Agriculture Organization of the United Nations

GLOBAL SOIL PARTNERSHIP

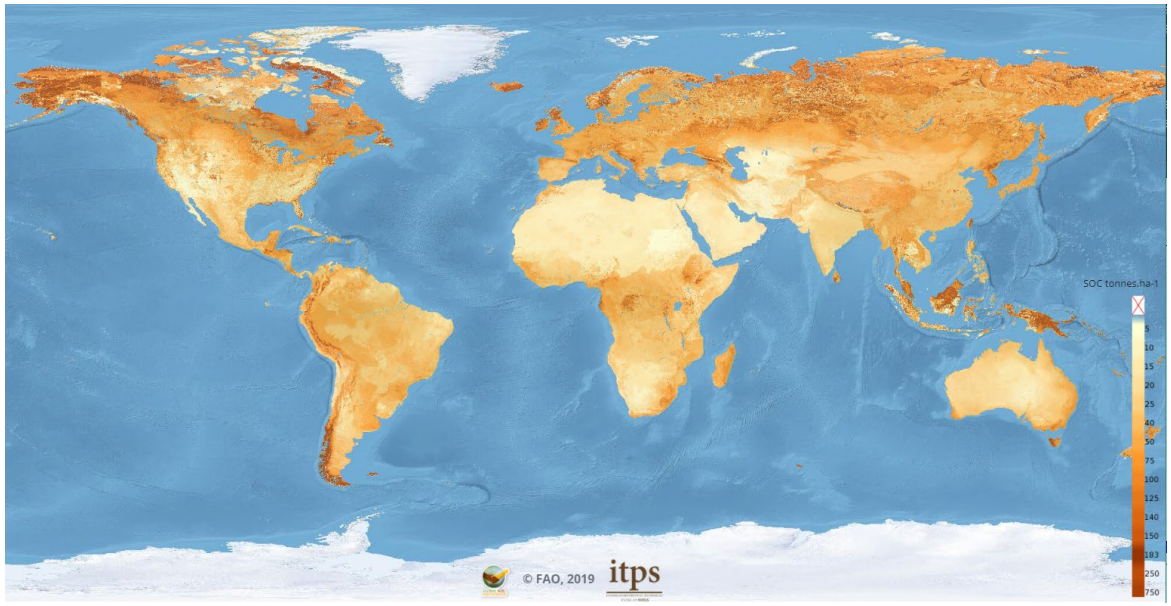
## Objectives

- Promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development

# Global Soil Partnership

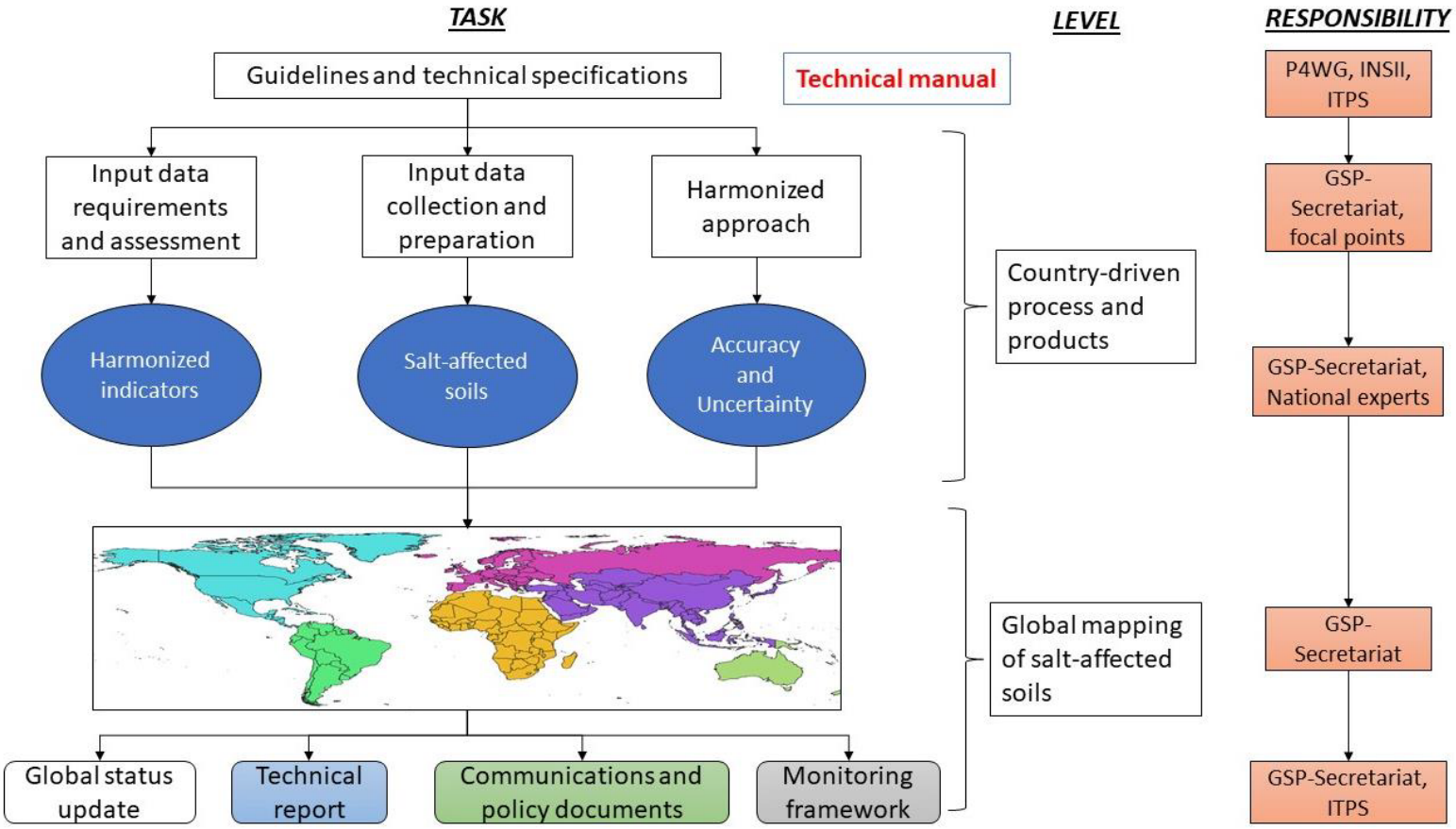
## Pillar 4: Information and Data

- 2018 Soil Organic Carbon
- **2020 Salt Affected Soils**
- 2021 Black Soils
- 2021 Soil Organic Carbon Sequestration



# Global Soil Partnership

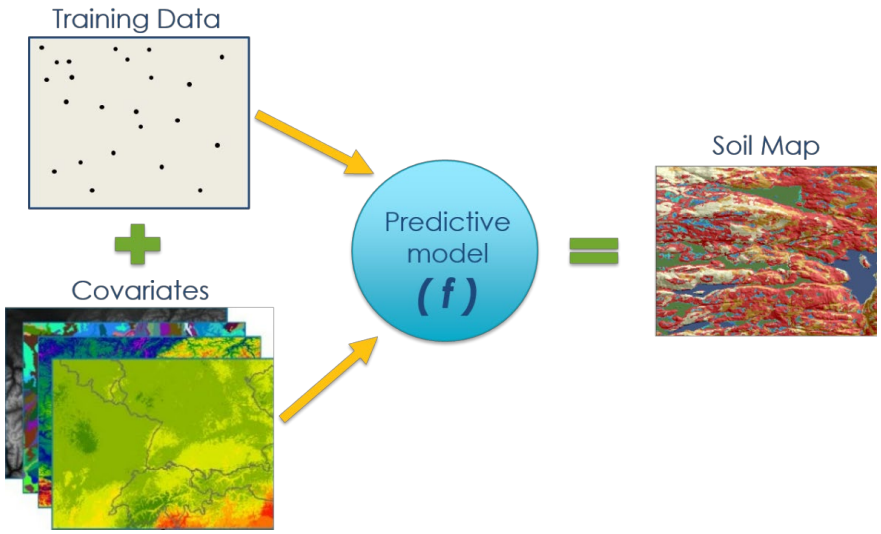
## Country-driven approach



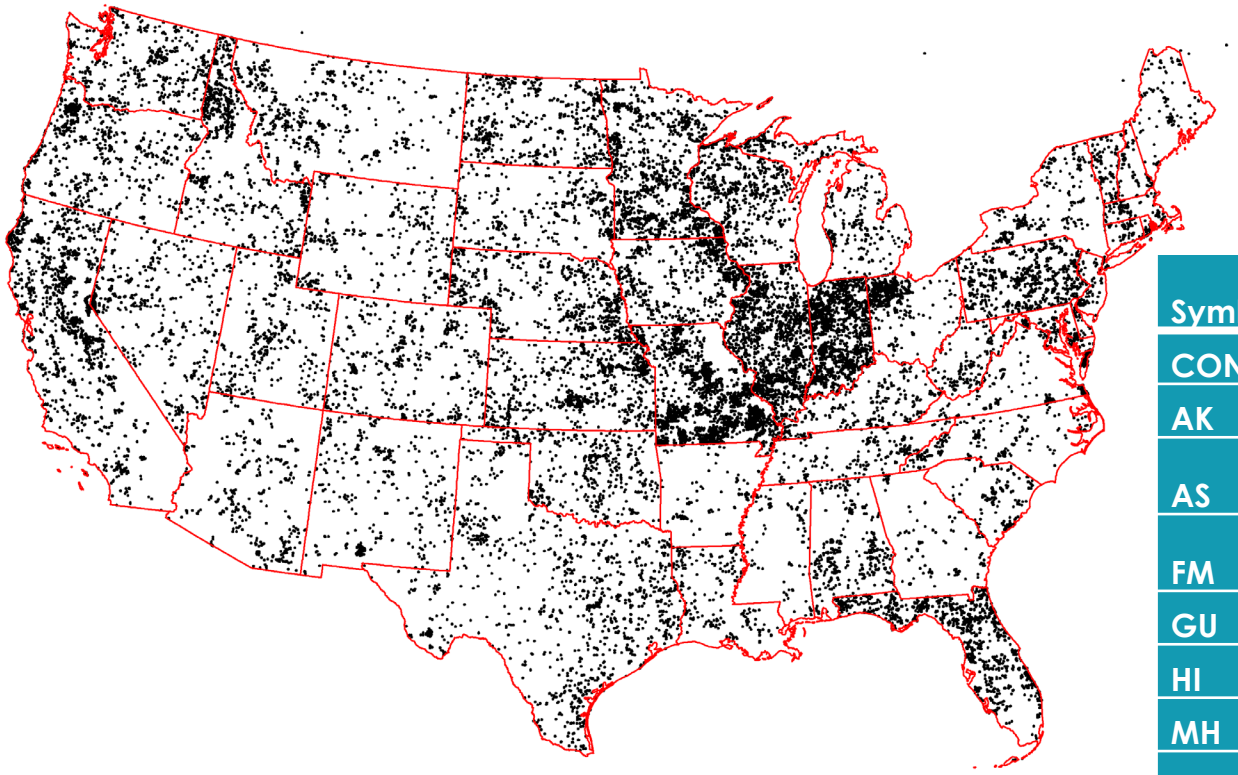
# Global Soil Partnership

## Methods for mapping soils

- Methods based on soil maps and expert opinion (legacy maps)
- Remote sensing applications (imagery)
- Modelling of soil properties and classes (DSM)

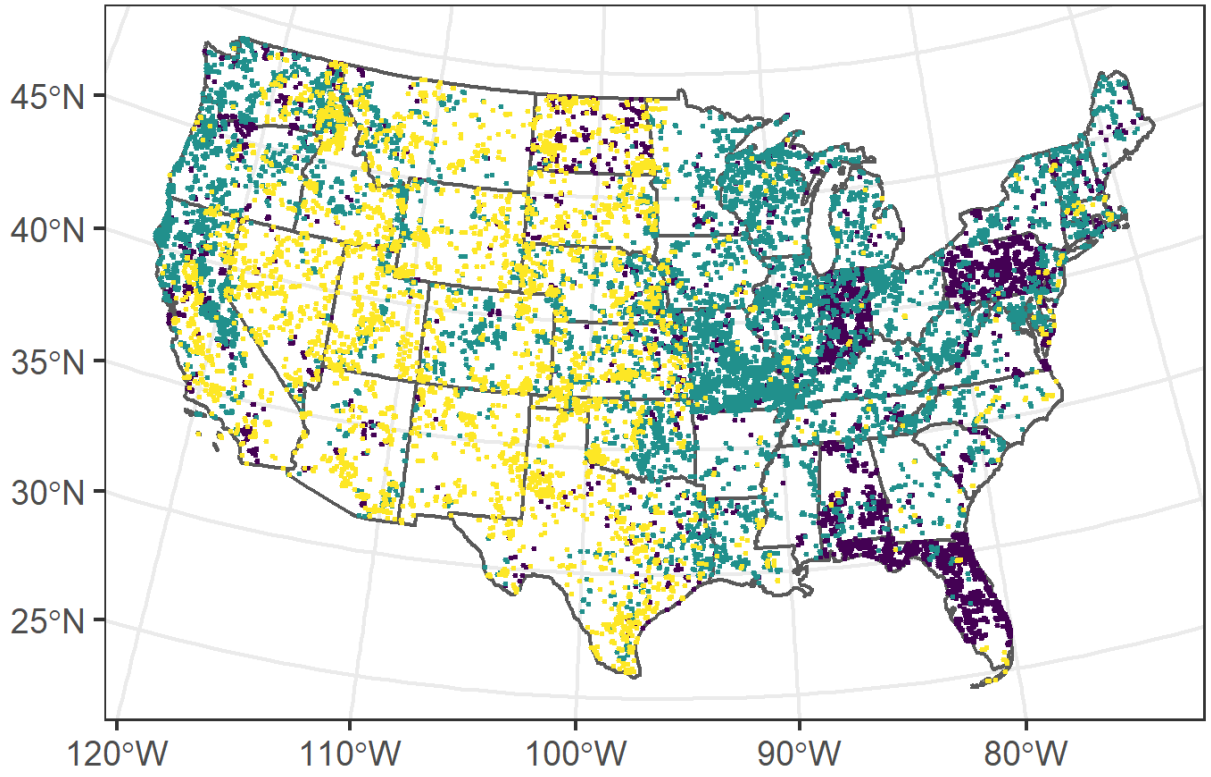


# NCSS Training Data- SCD Locations



| Symbol | Name | # of KSSL Points |
|---|---|---|
| CONUS | Continental US | 65,966 |
| AK | Alaska | 324 |
| AS | American Samoa | 0 |
| FM | Fed. States of Micronesia | 13 |
| GU | Guam | 8 |
| HI | Hawaii | 332 |
| MH | Marshall Is. | 0 |
| MP | Northern Mariana Is. | 0 |
| PR | Puerto Rico | 166 |
| PW | Palau | 35 |
| VI | Virgin Is. | 35 |

# NCSS Training Data - KSSL Soil Properties



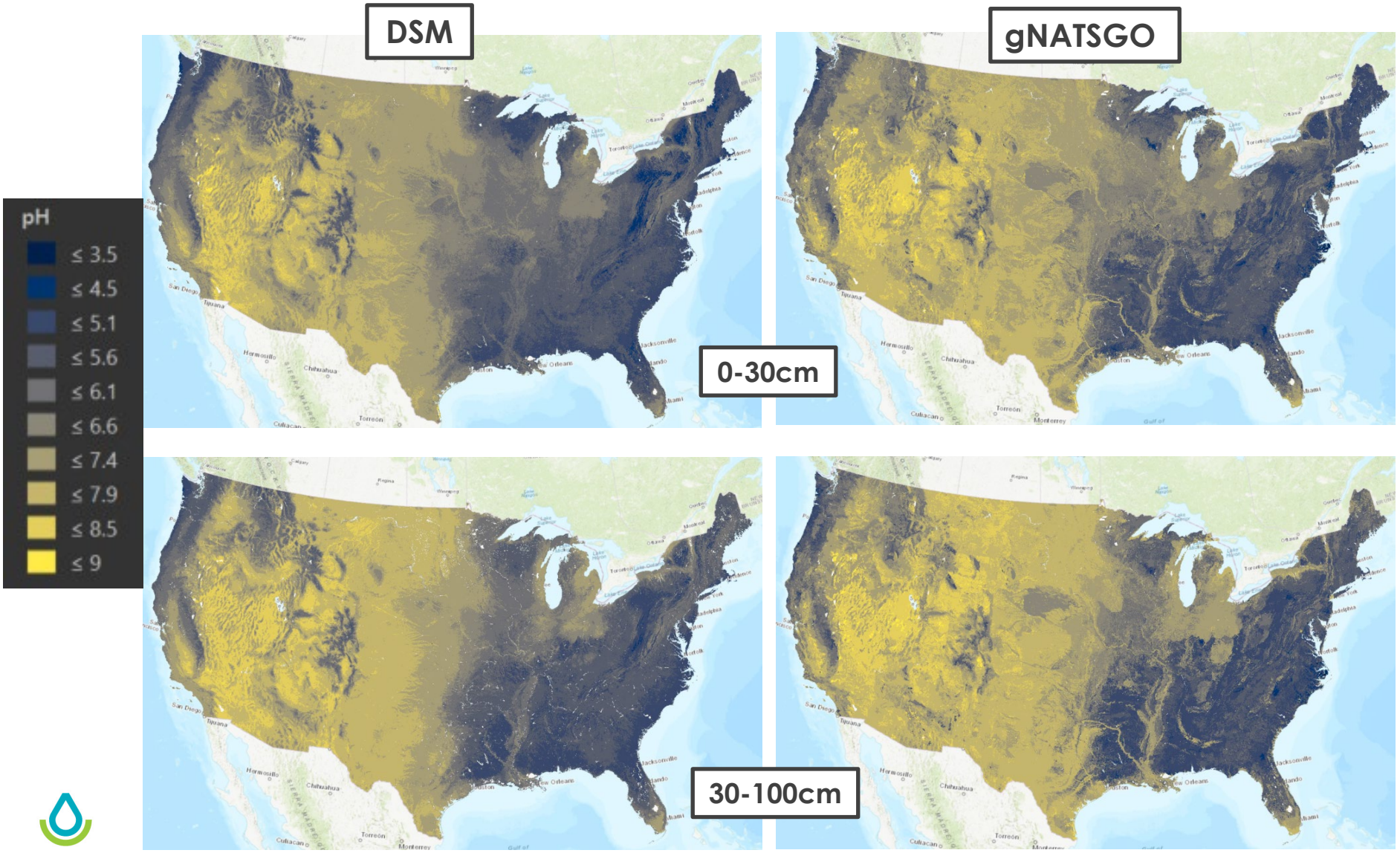

| Property | Depth Interval (cm) | Total Pedons |
|---|---|---|
| pH | 0-30 | 27,533 |
| | 30-100 | 27,305 |
| ESP | 0-30 | 21,502 |
| | 30-100 | 21,388 |
| EC | 0-30 | 7,023 |
| | 30-100 | 7,021 |

# Covariates

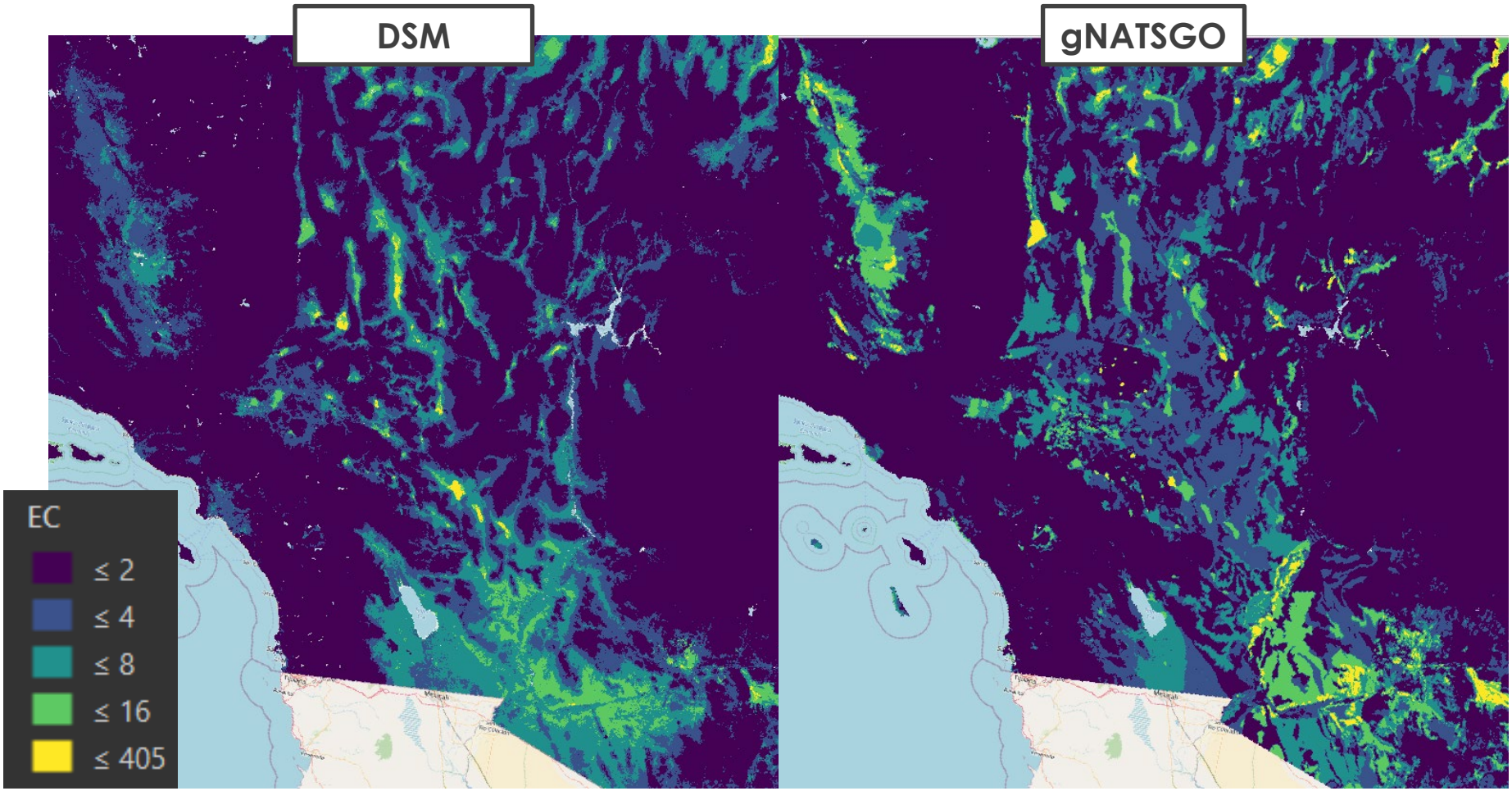
## (soil, climate, organisms, relief, parent material)

- GSP/ISRIC provided (72)
  - Elevation and spectral data (MODIS) derivatives
  - Vegetation
- NRCS derived (23)
  - Elevation derivatives
  - CONUS Landsat – salt indices
  - Landfire existing vegetation
  - NLCD
- gNATSGO (2)
  - pH
  - SAR
  - 0-30cm, 30-100cm
- STATSGO (2)
  - MLRA – dominant MRLA by STATSGO key
  - Parent material

# Soil Maps - pH Comparison



# Soil Maps - $EC_{sa}$ Comparison

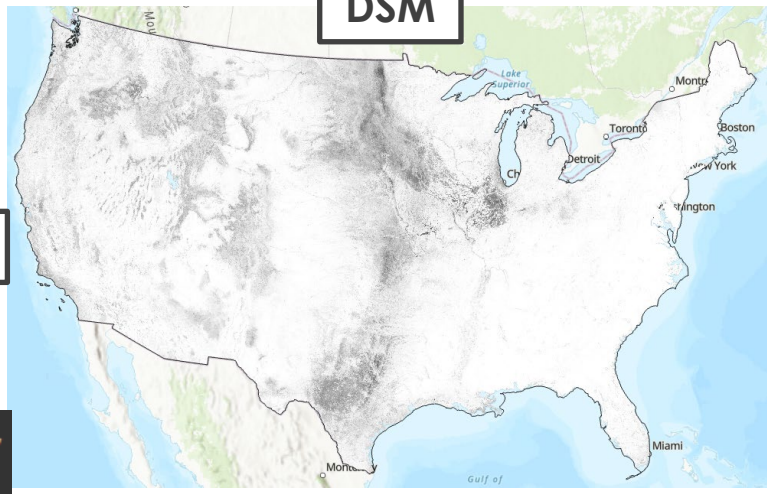


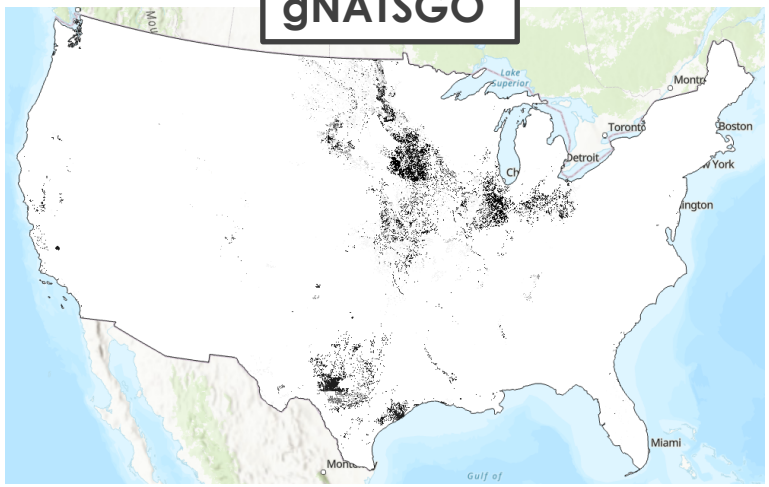
# Soil Maps - Black Soil Comparison

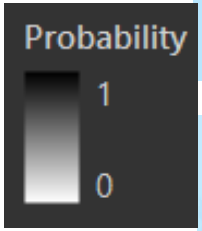
DSM

gNATSGO

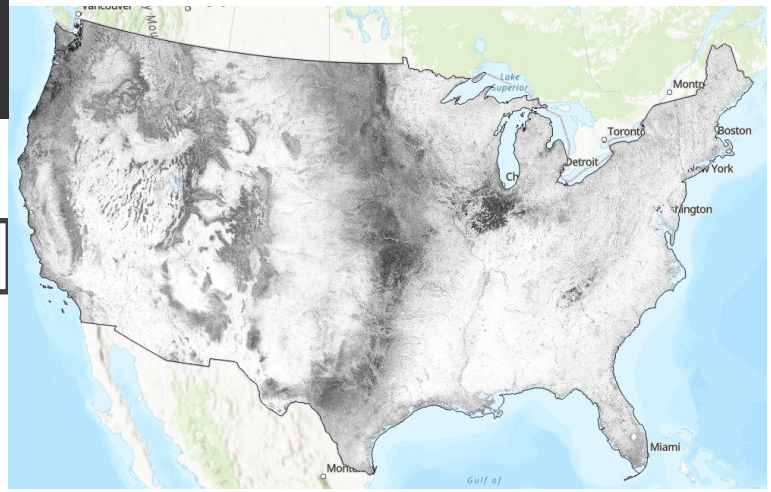
BS1

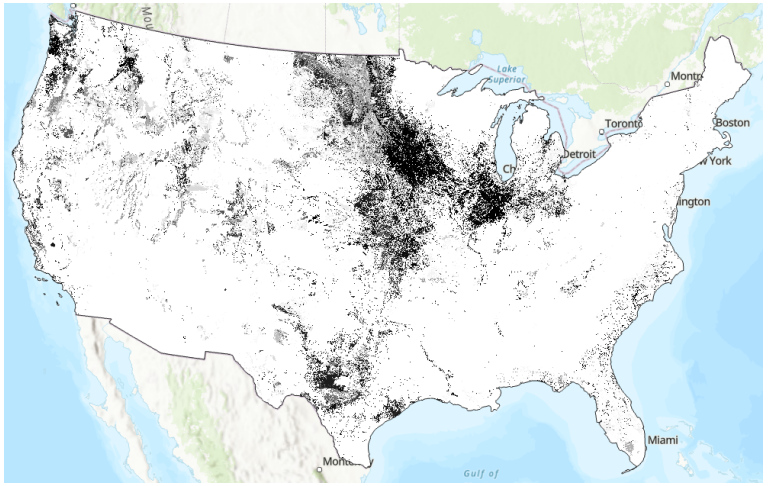


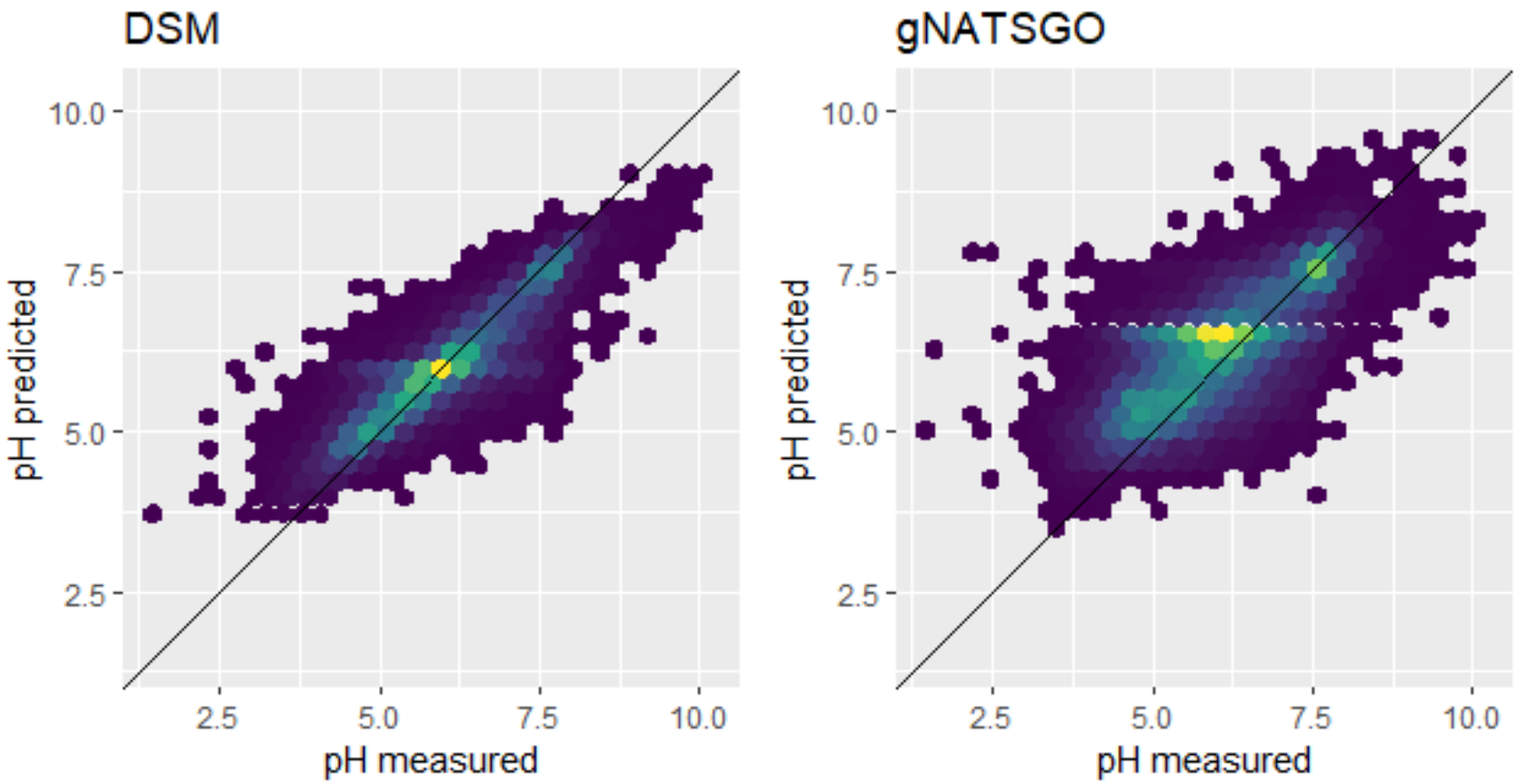




BS2



# Soil Maps - pH Comparison 0-30cm



# DSM/gNATSGO vs KSSL: Accuracy Metrics

| source | property | interval | RMSE | Rsquared |
|---|---|---|---|---|
| DSM | EC | 0-30 | 15.84 | 0.60 |
| gNATSGO | EC | 0-30 | 23.09 | 0.09 |
| DSM | EC | 30-100 | 18.45 | 0.47 |
| gNATSGO | EC | 30-100 | 23.17 | 0.11 |
| DSM | ESP | 0-30 | 13.85 | 0.38 |
| DSM | ESP | 30-100 | 8.46 | 0.60 |
| DSM | pH | 0-30 | 0.47 | 0.81 |
| gNATSGO | pH | 0-30 | 0.75 | 0.56 |
| DSM | pH | 30-100 | 0.49 | 0.83 |
| gNATSGO | pH | 30-100 | 0.73 | 0.64 |
| gNATSGO | SAR | 0-30 | 40.94 | 0.21 |
| gNATSGO | SAR | 30-100 | 39.39 | 0.18 |

** Metrics are based on the full KSSL dataset.*

# Summary

## Takeaways

- Reaffirms previous comparisons between DSM and SSURGO
- Different soil properties are more accurate than others
- Many areas lack pedon data (especially OCONUS)
- SSURGO+STASTGO are useful DSM covariates
- Our soil databases are challenging to use

## Recommendations

- Develop a national strategy to close data gaps
  - Sample to capture temporal trends in DSPs (e.g. salinity, carbon, moisture)
  - Increase adoption of proximal sensing
- Investigate SSURGO where it diverges significantly from DSM
- Update STATSGO
- Simplify our databases/tools to make them more friendly ☺