

# *Completion of the Conterminous U.S. Geochemical Landscapes Project*



*Bull Run Mountain, VA  
November 18, 2010*

***Target sites for soil sampling***



***Sites actually sampled***



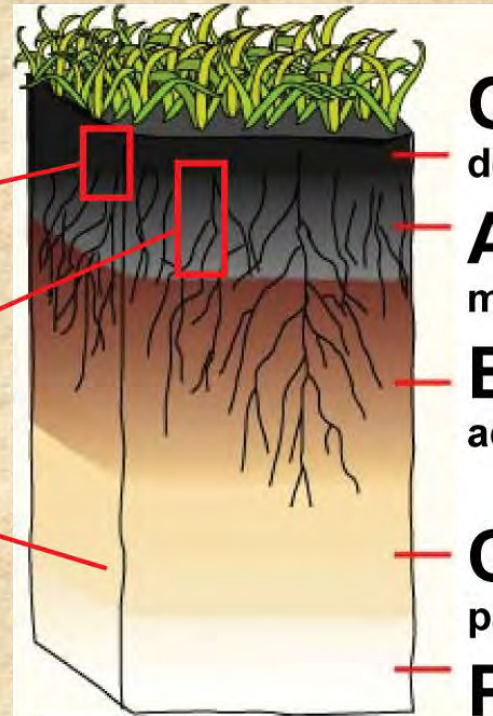
**3 samples collected  
at each site**

**Typical upland soil  
profile**

**0 to 5 cm depth**  
regardless of horizon

**Composite of A**

**B/C horizon**  
~ 1 meter in depth,  
if possible



**O horizon**  
decayed organic matter

**A horizon**  
mineral soil mixed with humus

**B horizon**  
accumulation of clays from above

**C horizon**  
partly weathered parent material

**Parent material**  
weathering rock, colluvium,  
alluvium, glacial materials

## ***STATUS IN MARCH 2012***

***All sites sampled and samples processed for analysis.***

***All chemical analyses scheduled for completion by end of this fiscal year.***

***All quantitative mineralogy scheduled for completion by July 1, 2012.***

***All data will be released by the end of CY 2012 or sooner.***

***Publicly accessible archive of all samples is being established at Denver Federal Center.***

# **QUANTITATIVE MINERALOGY**

***Done by x-ray powder diffraction and Reitveldt refinement calculations.***

***Directly useful for acid buffering capacity (carbonate content), properties related to clay content.***

***Allows inferences of mineralogical residence of trace elements and their likely behavior (bioavailability, mobility).***

***THE QUARTZ EFFECT The influence of quartz content on regional geochemical patterns.***

# **THE QUARTZ EFFECT**

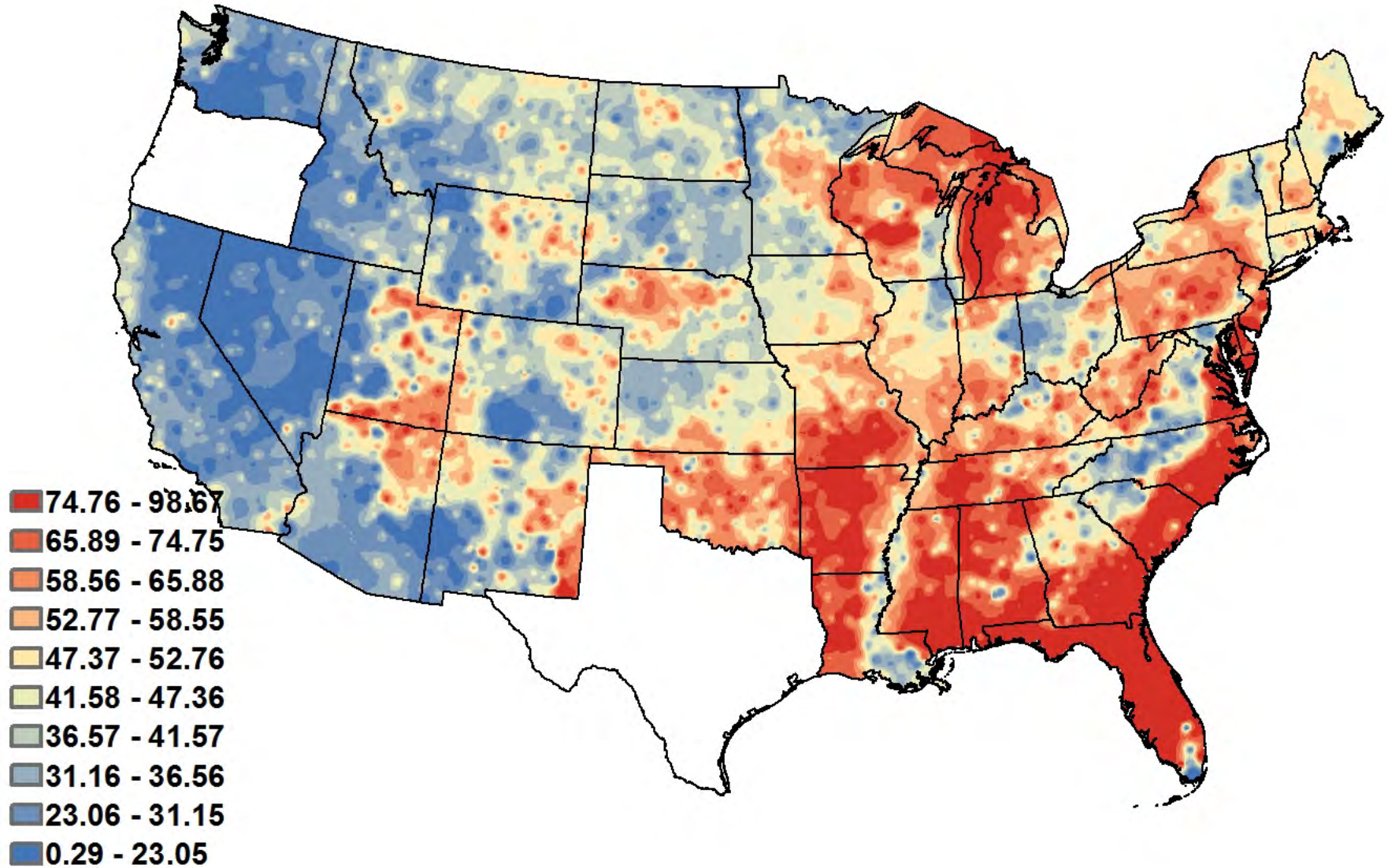
**Quartz =  $\text{SiO}_2$  and very little else**

***It is, on average, the most abundant mineral in soils (mean = 44%).***

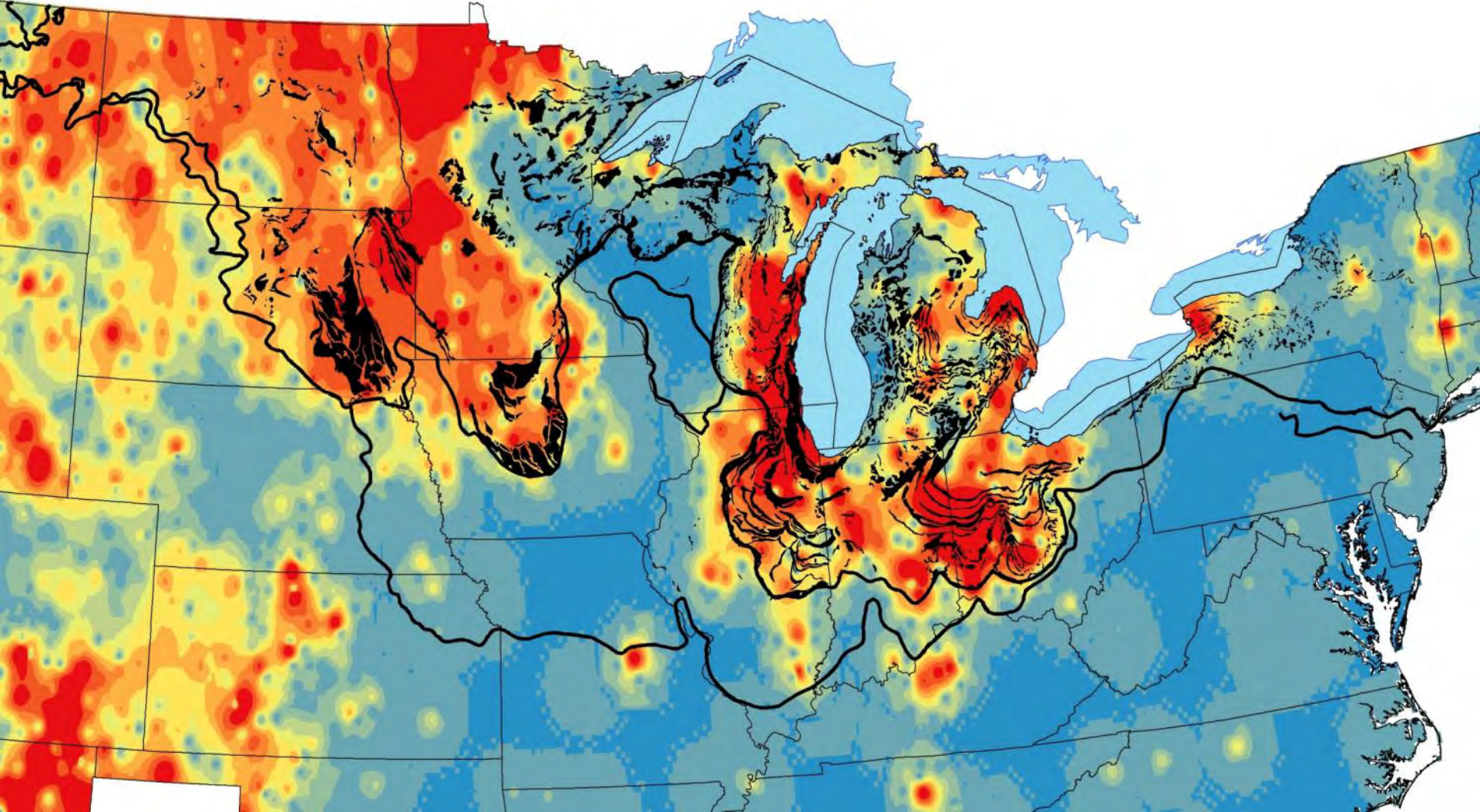
***It is also the most variable mineral ranging from 0% to 99%.***

***So, the regional variability of many elements reflects little more than the inverse of the quartz content.***

# Quartz in C-horizon



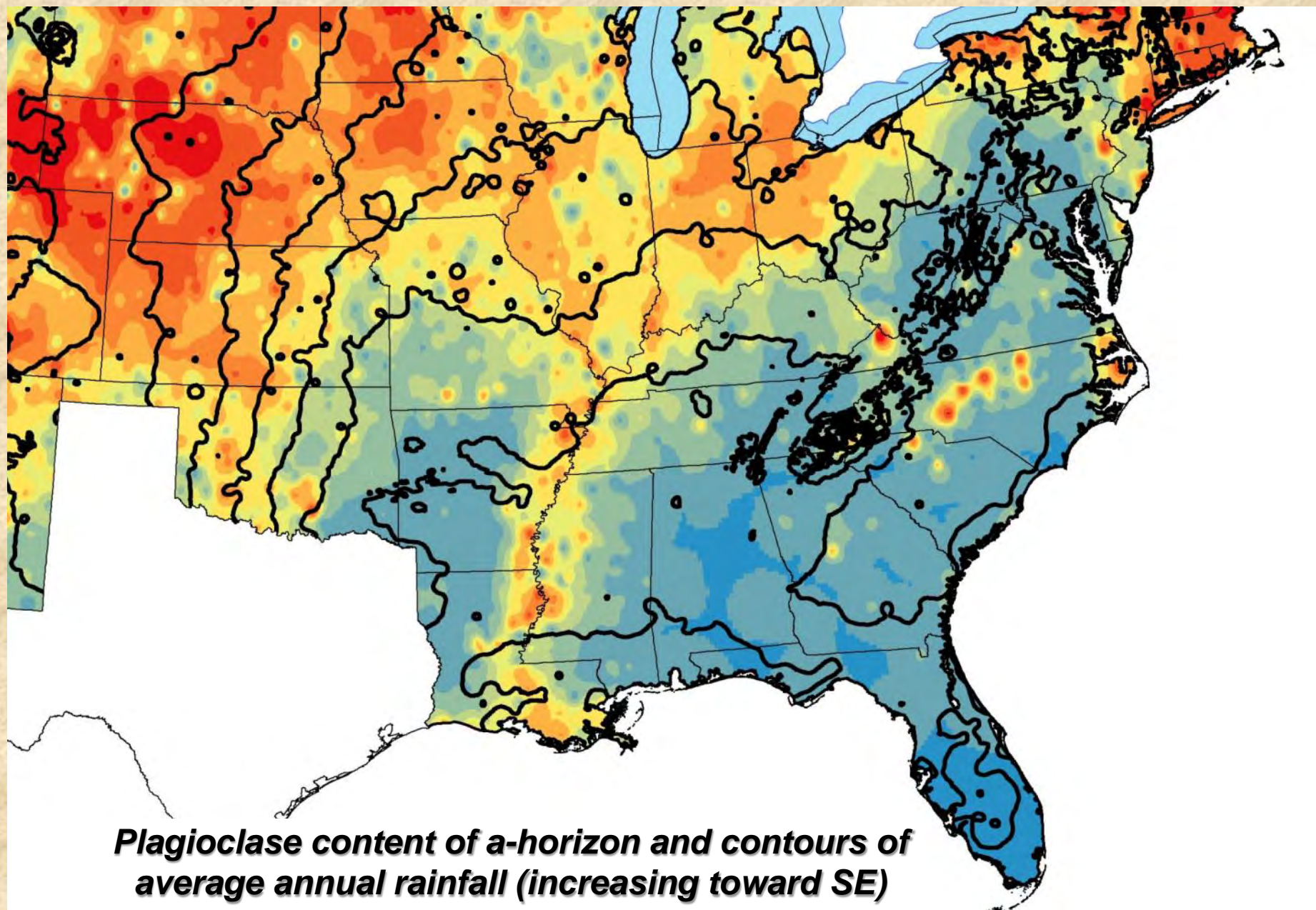
# ***Total carbonate minerals in C-horizon soils***



***Solid lines are maximum extent of glaciations. Black polygons are end moraines of Wisconsin glacial system.***



## ***Rainfall effect***



***Plagioclase content of a-horizon and contours of average annual rainfall (increasing toward SE)***

# ***GEOCHEMICAL MAPS—THE NORTHEAST IN NATIONAL PERSPECTIVE***

***All analyses are on “near total” digestion of <2mm fraction.***

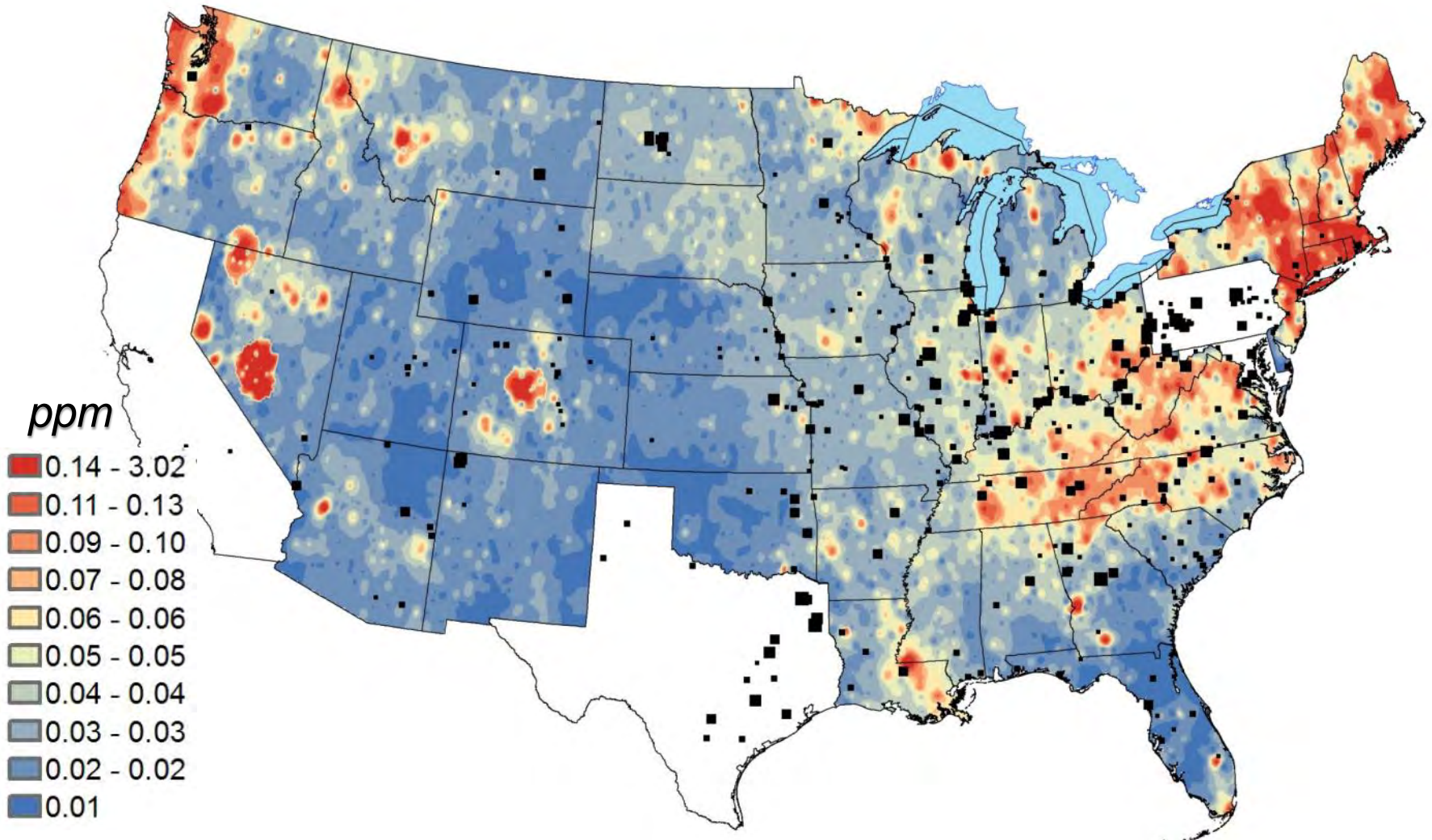
***Maps were made with Inverse Distance Weighted method.***

***They are classified into ten quantiles so each color represents 10% of the data.***

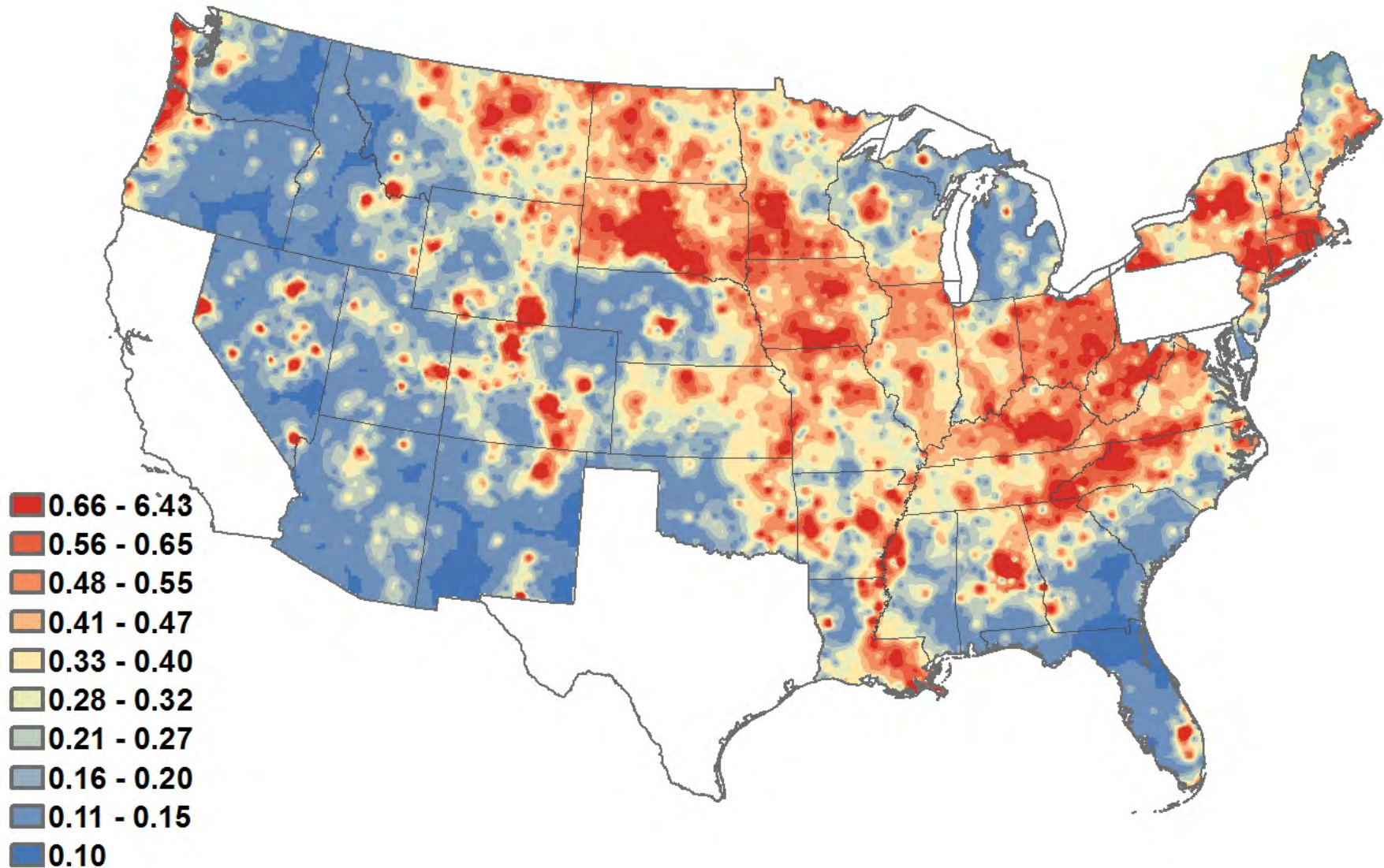
***These are probability surfaces which smooth over variability at scales smaller than our sample spacing.***

***The standard error of the surface can be estimated and tests show that it is fairly large. So caution is needed if the maps are used to predict compositions at specific sites.***

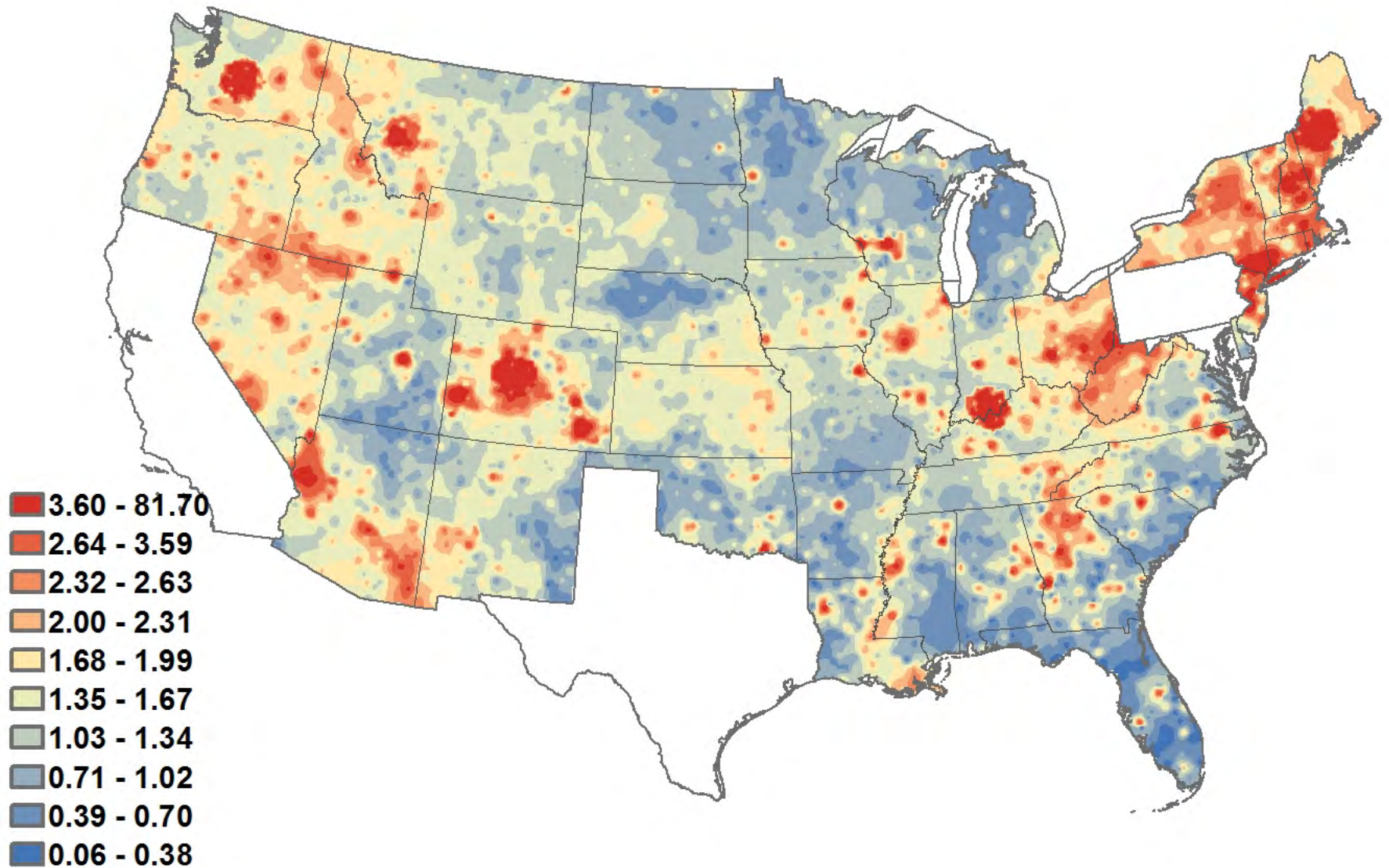
# ***Mercury concentration in the upper 5 cm of soil and mercury emissions from coal-fired power plants***



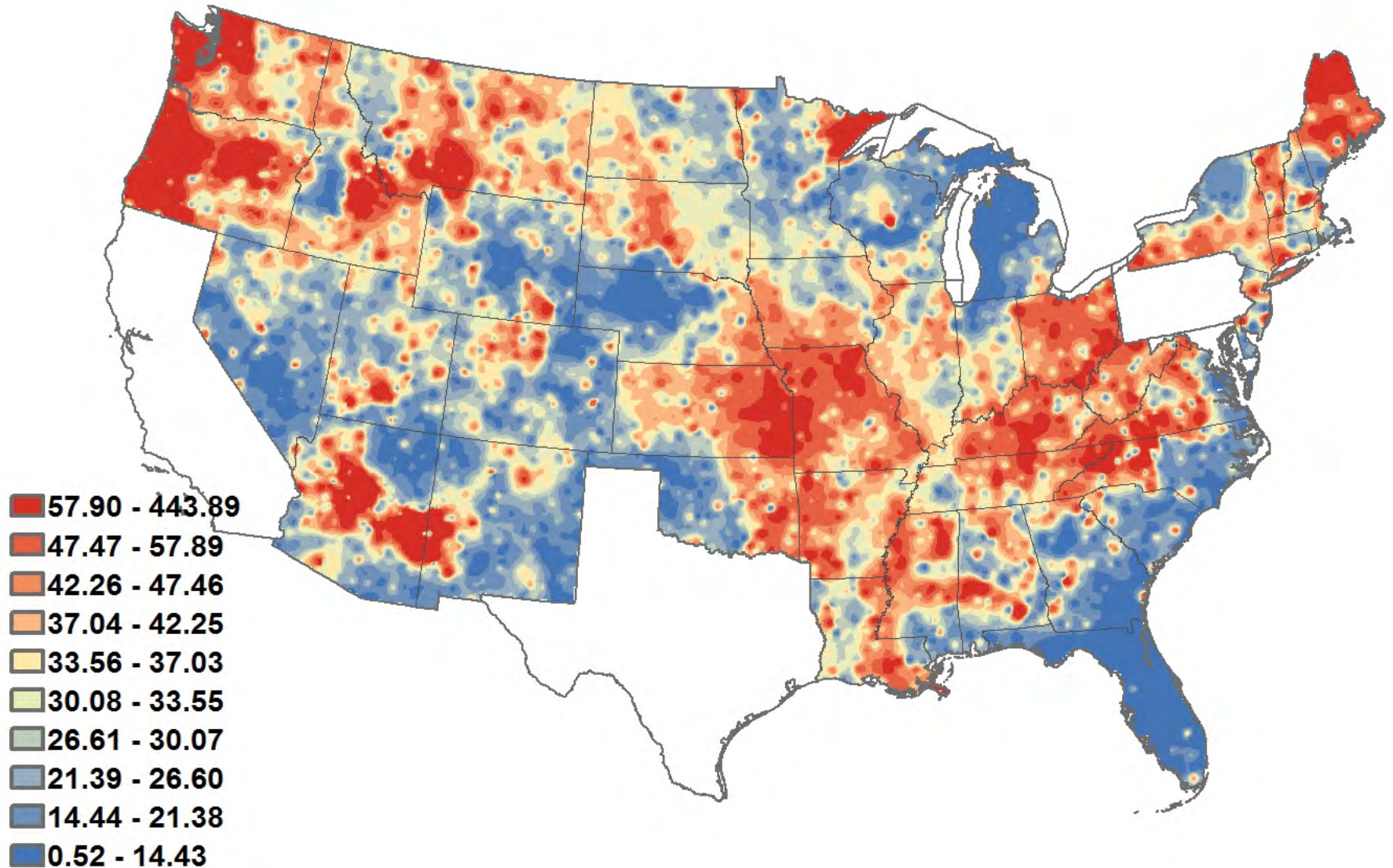
# *Selenium in upper 5 centimeters*



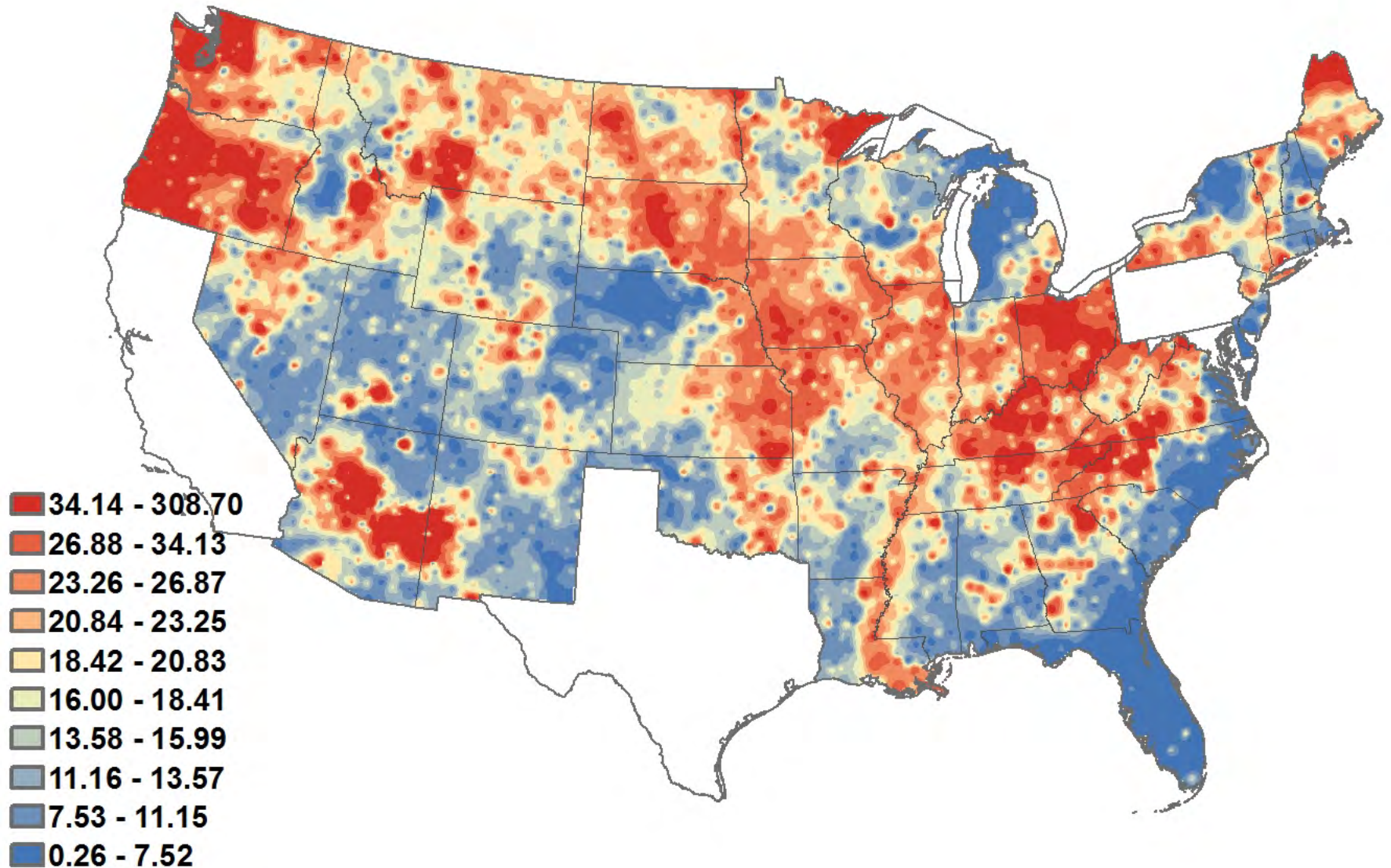
# *Tin in upper 5 centimeters*



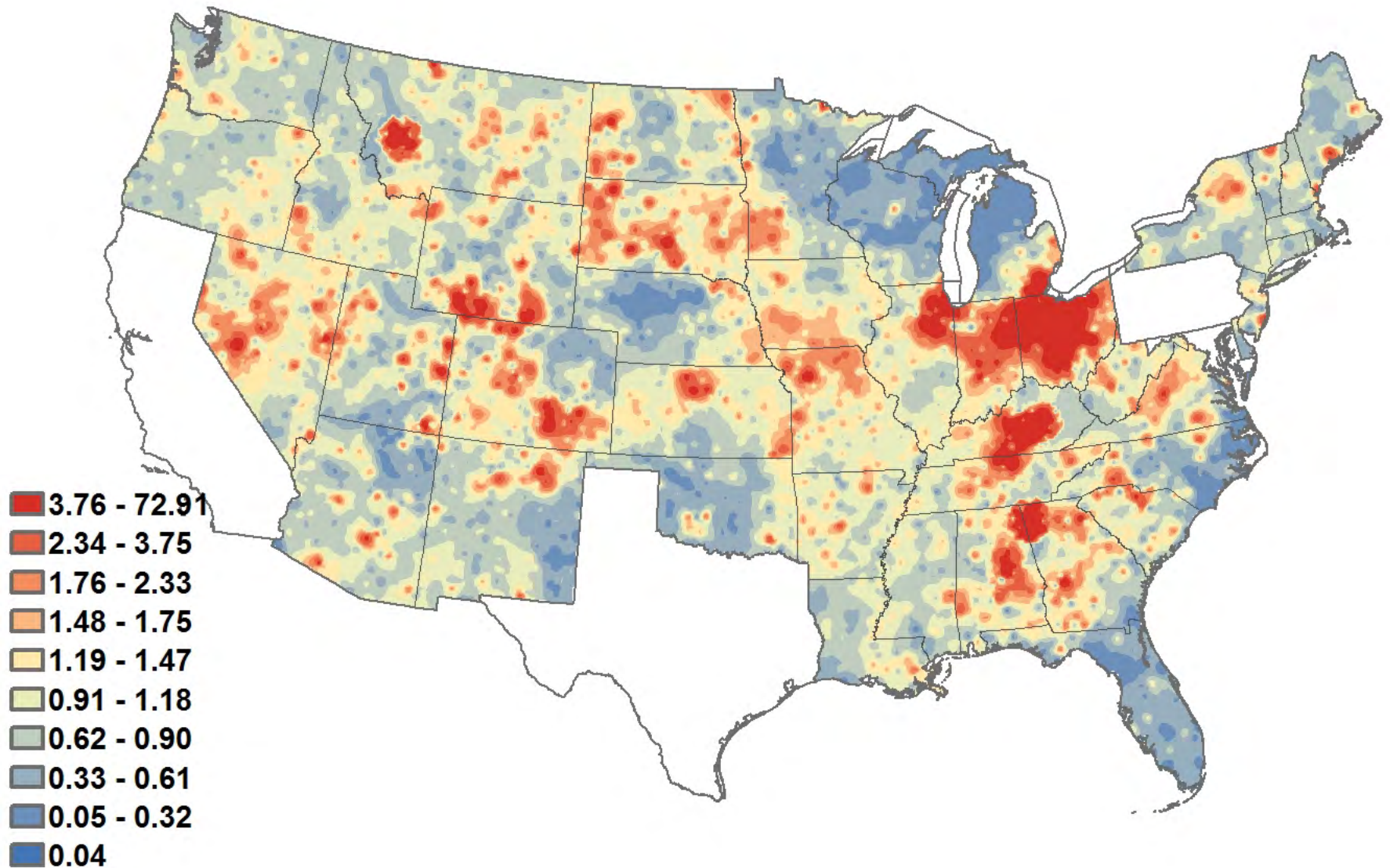
# *Chromium on C-horizon*



# *Nickel in C-horizon*

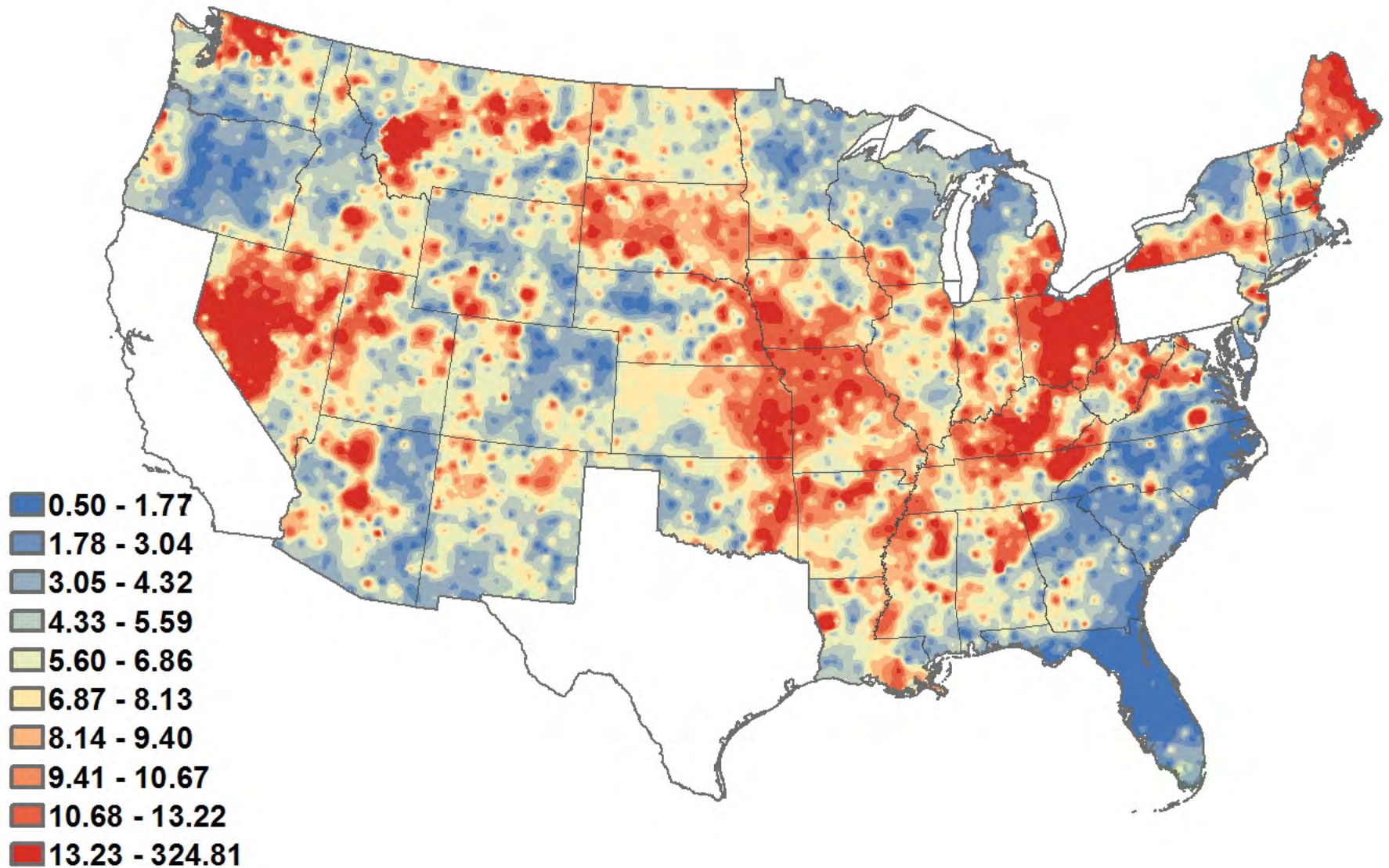


# *Molybdenum in C-horizon*

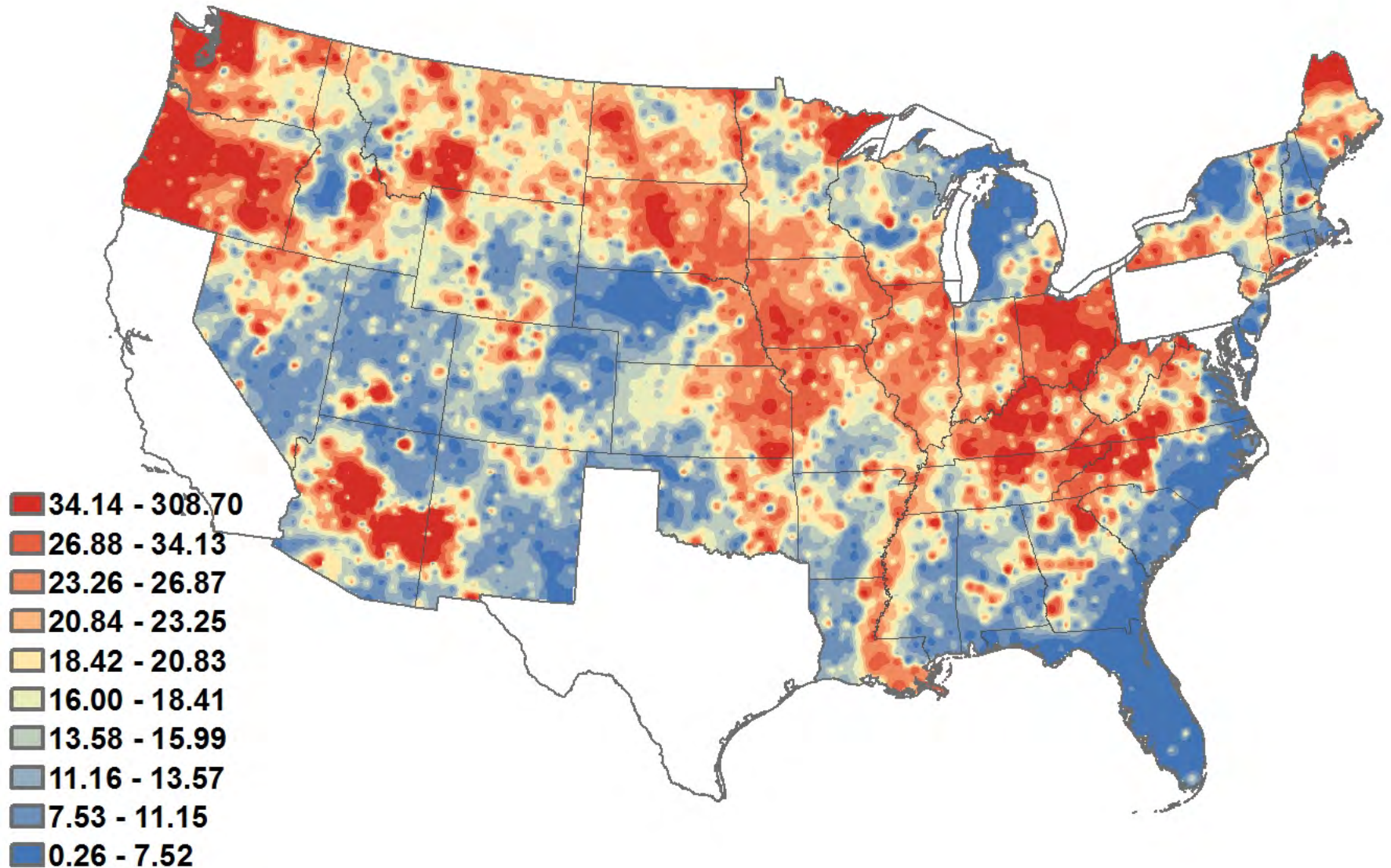




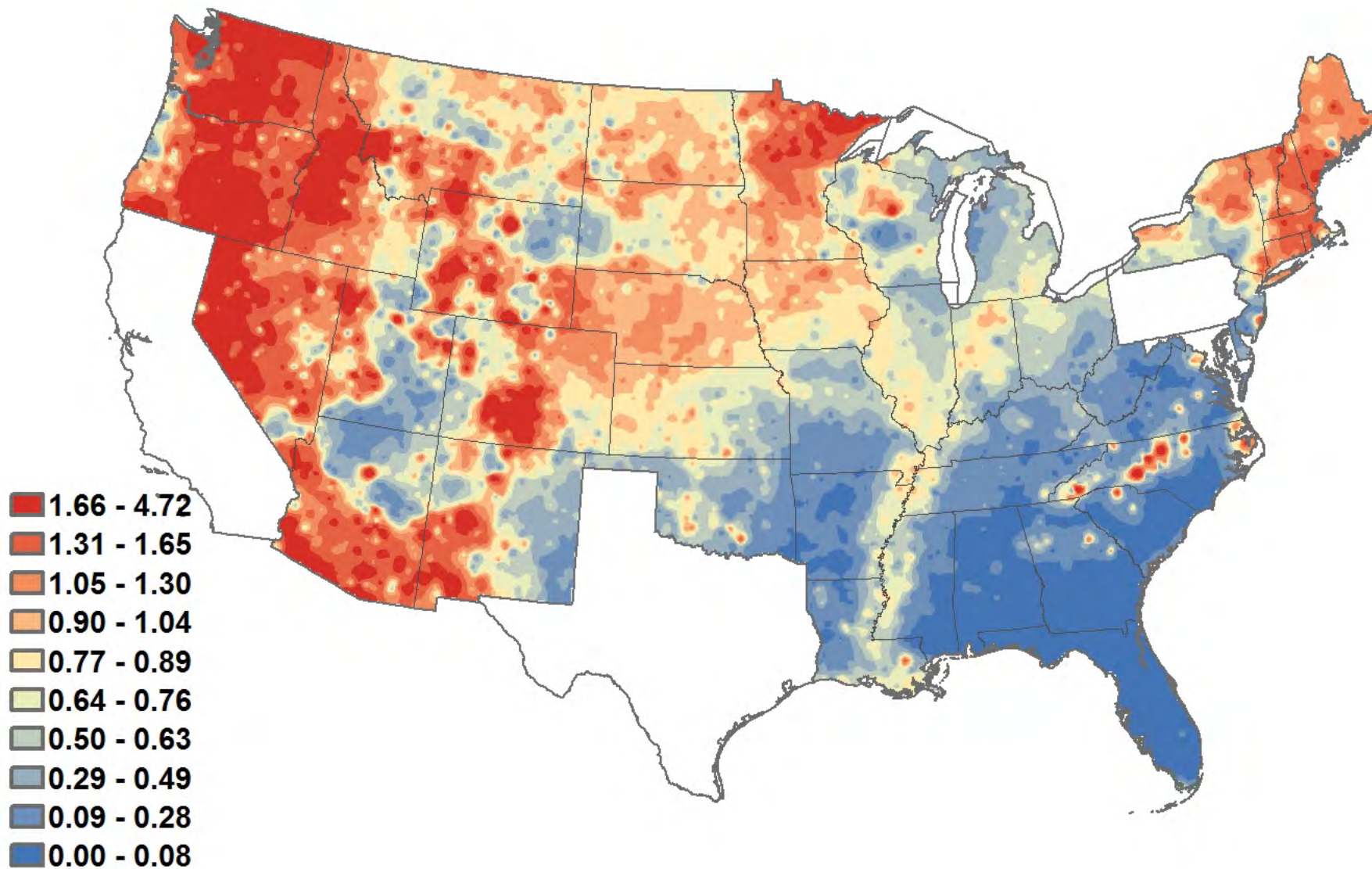
# ***Arsenic in C-horizon***



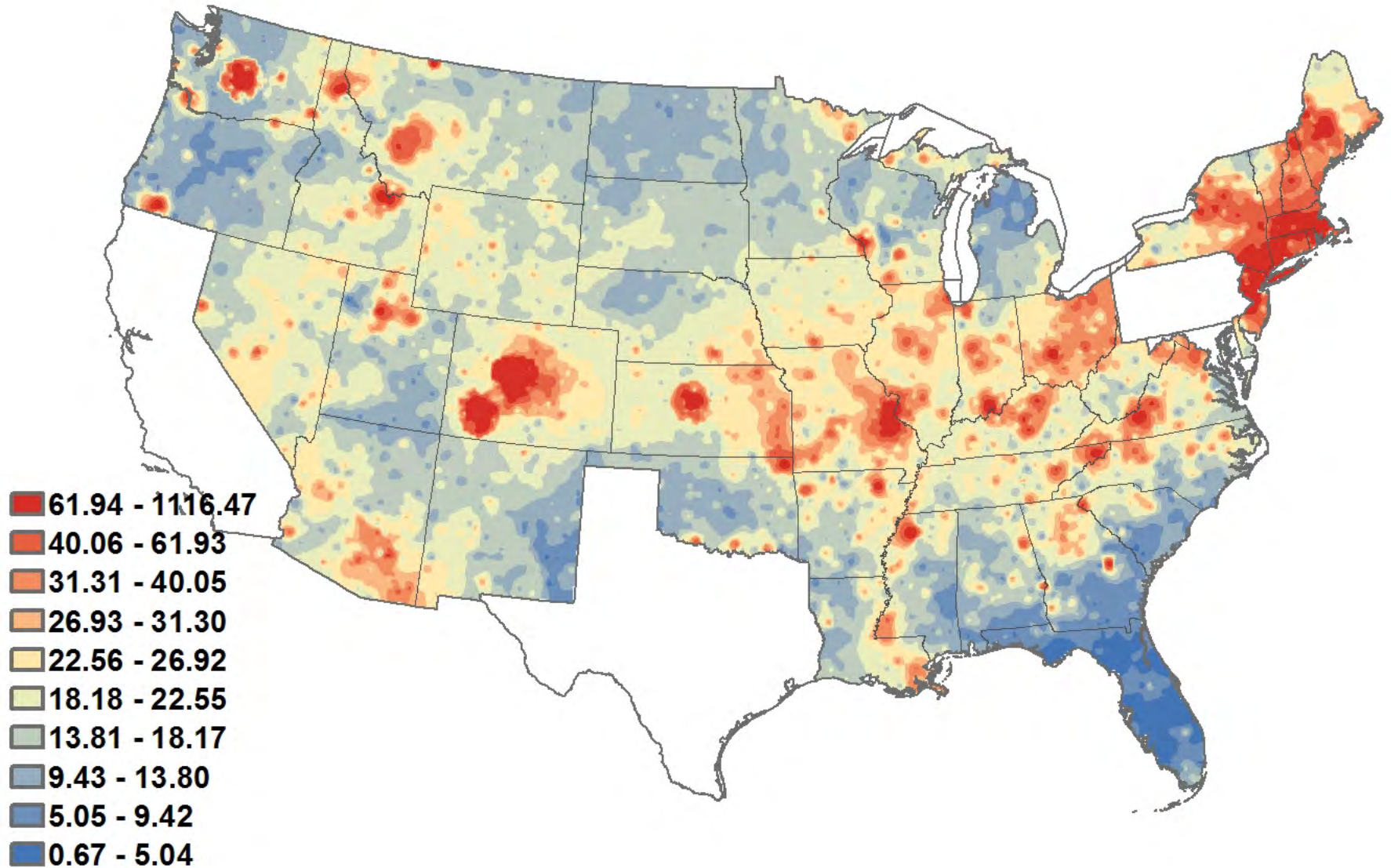
# *Nickel in C-horizon*



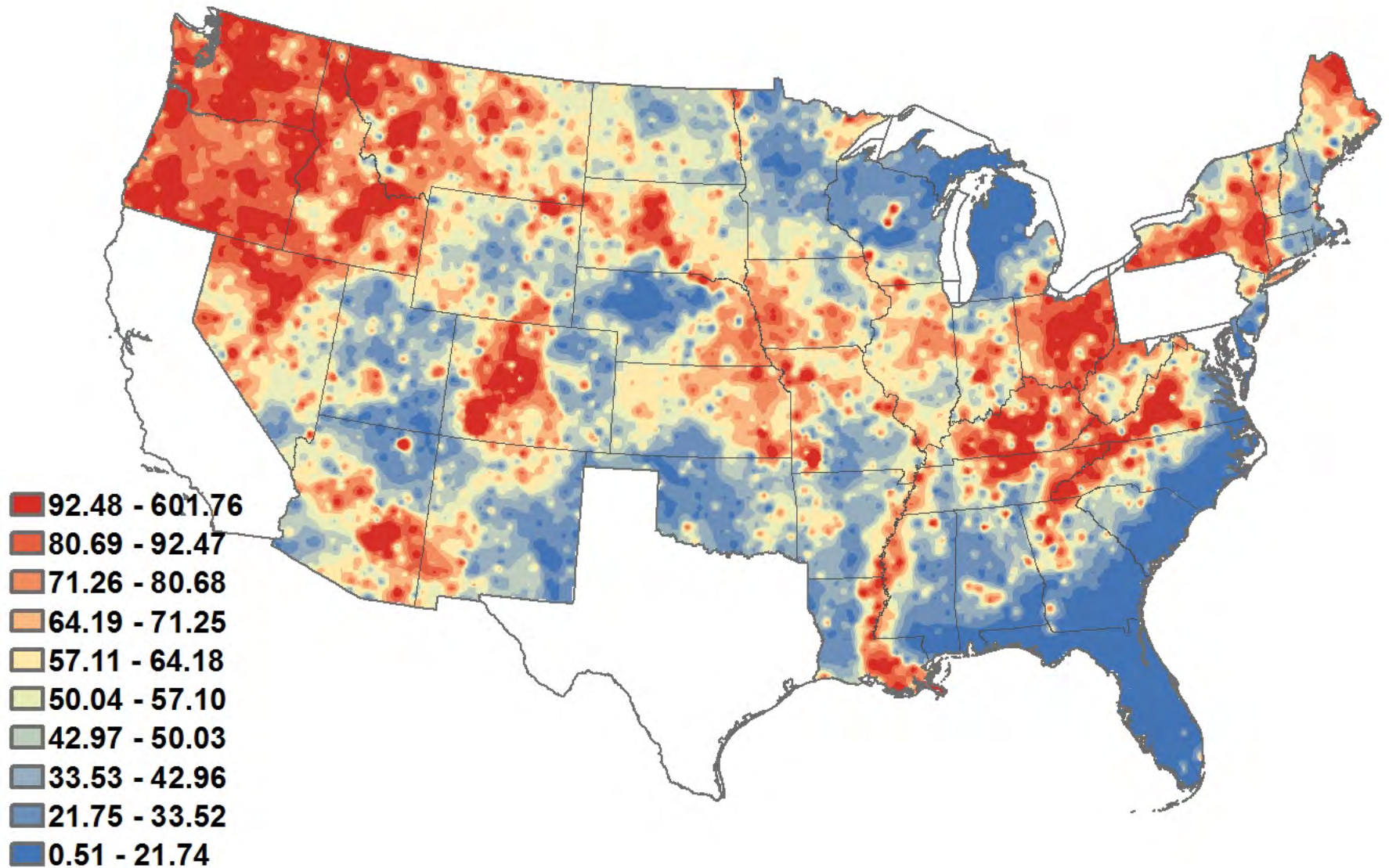
# *Sodium in C-horizon*



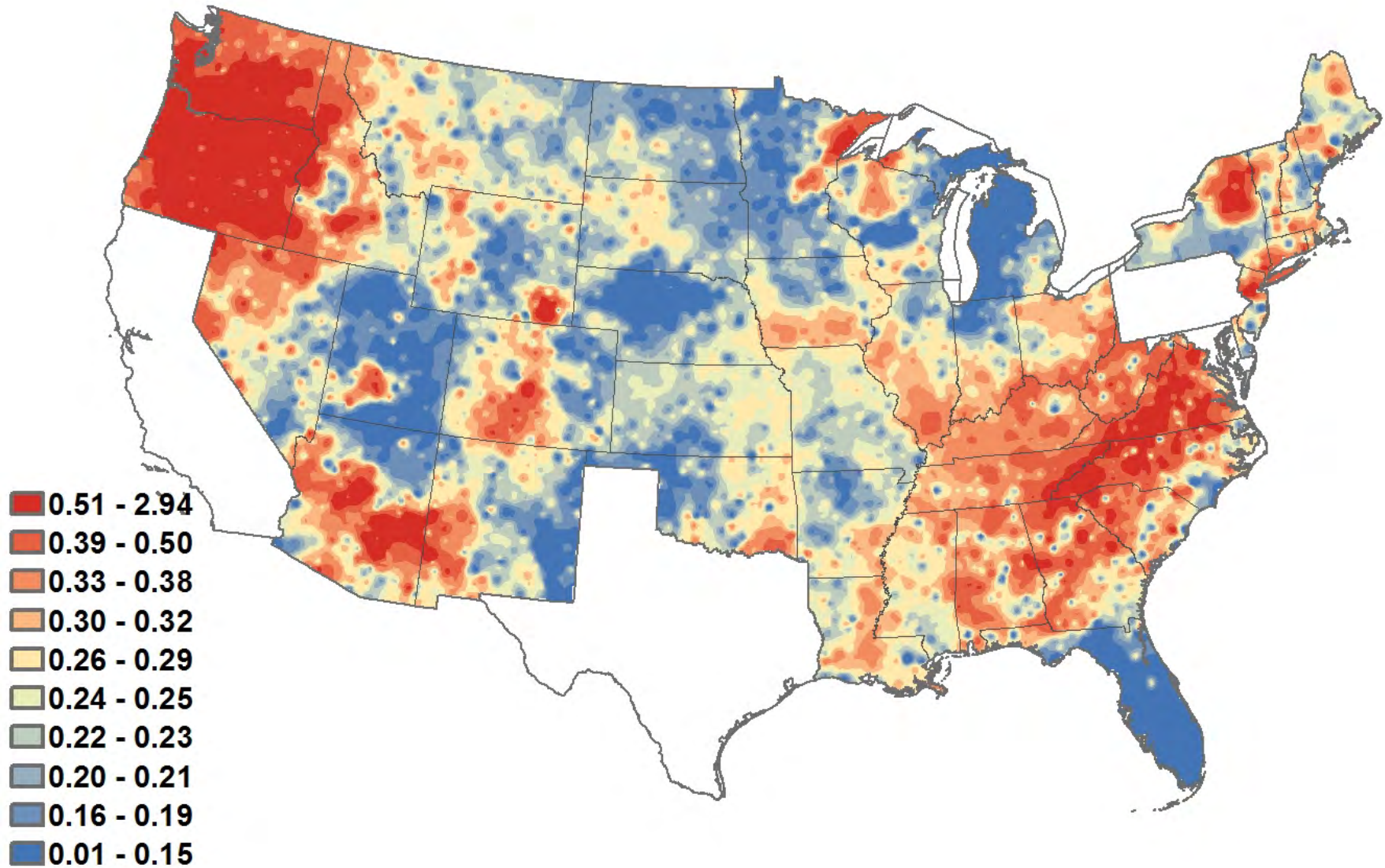
# *Lead in C-horizon*



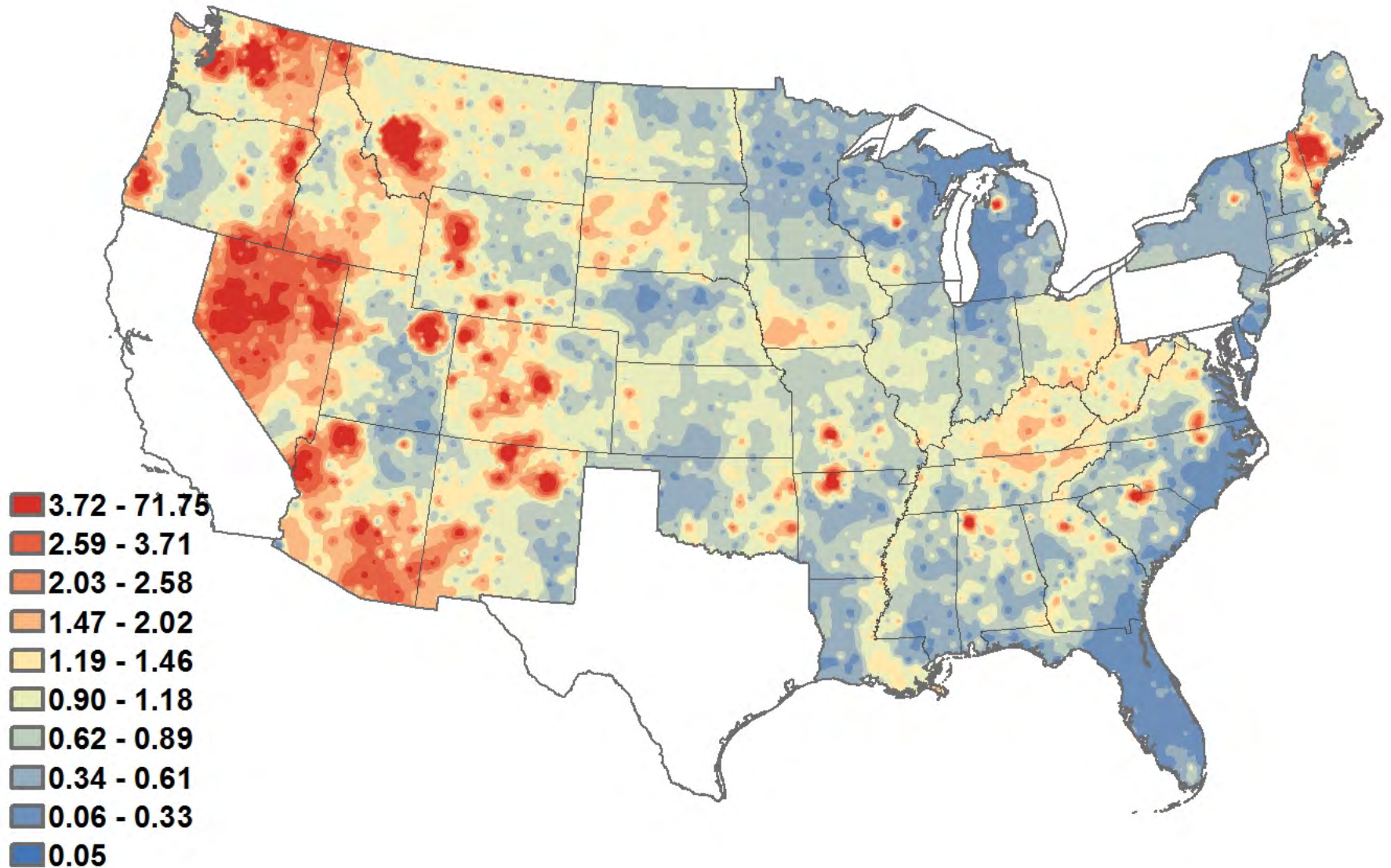
# Zinc in C-horizon



# *Titanium in C-horizon*



# *Tungsten in C-horizon*



# ***From the first to the last:***

***First site***



***Salida, Colorado***



***4860<sup>th</sup> site***



***Bull Run Mtn., VA***

***Thanks to our talented and tireless student field crews and to the thousands of land owners who graciously (for the most part) allowed us access to their land.***