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Potentially Restorable Wetlands in the Contiguous U.S.

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Introduction

Since 1780, over 50% of wetlands in the contiguous United States have been converted into farm fields or urban areas. Since experiencing such dramatic losses, we have come to understand the important role wetlands play in removing water pollution, regulating water storage and flows, and providing habitat for wildlife. Recognizing the benefits provided by wetlands, we developed a method to identify areas of the country where the restoration of wetlands could potentially result in the return of ecosystems services. In this study, we combined nationally available land cover, digital elevation, and soil maps to estimate areas of potentially restorable wetlands (PRWs). PRWs for the maps presented here are lands currently used for agriculture or pasture that naturally accumulate water and historically had poor drainage and hydric soils.

Data Assessment

Land Cover

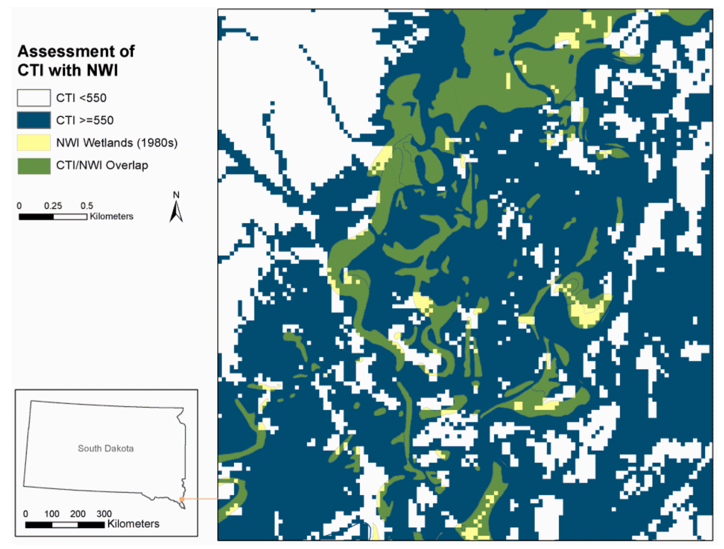
We first considered which classes within the National Land Cover Dataset (NLCD) would be most amenable to wetland restoration. Classes that were less realistic, such as developed land, or clearly unsuitable, such as water bodies or barren land, were removed from consideration.

Our next step was to combine two nationally available data layers, wetness and soils as further described below, as a means of estimating potential conditions that could support wetland land cover. To assess their ability to estimate wetland extent, we compared the separate and combined national layers to National Wetland Inventory (NWI) data. NWI is a multi-decadal inventory led by the US Fish and Wildlife that relies on aerial photography and field assessments to identify wetlands. We evaluated the NWI agreement for a select set of polygons from nine states (Arkansas, California, Florida, Mississippi, Missouri, North Carolina, North and South Dakota, and Ohio). The assessment involved rasterizing and clipping NWI emergent and forested wetlands, then applying the results as an extraction mask.

Wetness

The first layer, the Compound Topographic Index (CTI), a 30 meter steady state wetness index grid calculated from National Elevation Data, relates upstream contributing area and slope to overland flow (e.g., water is more likely to accumulate in an area that drains a larger area and has lower slopes). Results from previous studies suggest the majority of wetlands are captured by CTI values greater than 550.

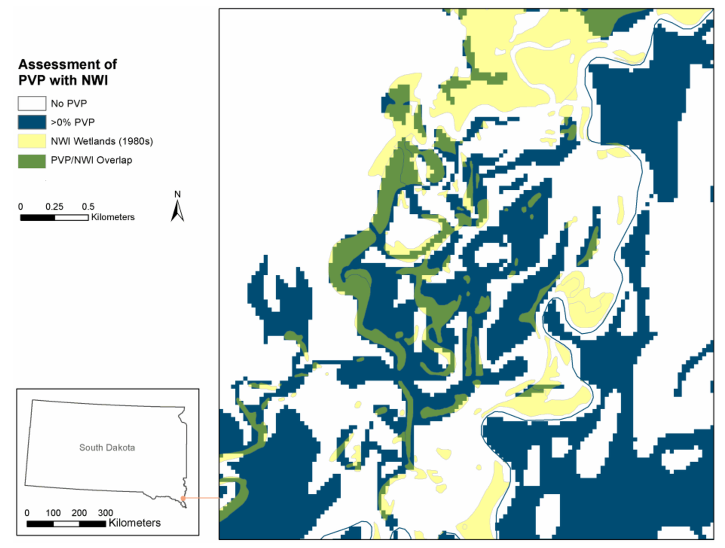
In the state of South Dakota, CTI values greater than or equal to 550 were able to predict 89% of NWI wetlands. A sample is included on the right.



Soils

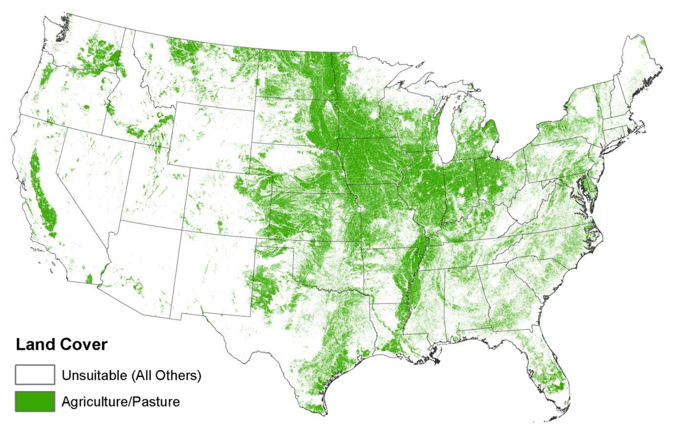
The second data layer was the combined drainage classes of poorly drained and very poorly drained (PVP) from the Soil Survey Geographic (SSURGO) database. These drainage classes have been shown to be associated with past or current wetland locations. Polygons with >0% PVP were rasterized to 30 meter cells and analyzed for their ability to predict wetlands, as well as what percentage was more indicative of wetlands.

In South Dakota, >80% PVP covered 56% and >1% PVP covered 93% of NWI wetlands. The same sample area to the right shows PVP predictability.

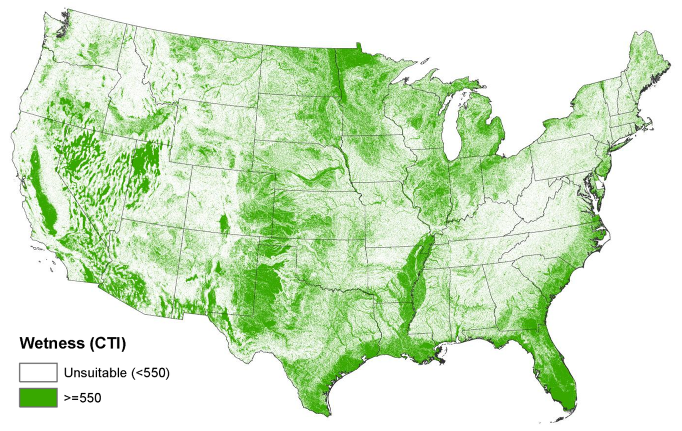


Methodology

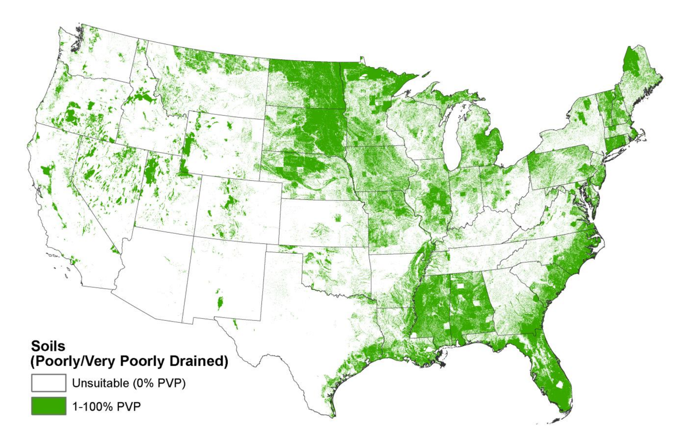
Reclassed Pasture/Hay (81) and Cultivated Crops (82) as potentially suitable and all other classes as unsuitable for wetlands.



Reclassed CTI >= 550 as potentially suitable and <550 as unsuitable for wetlands.



Added Poorly Drained and Very Poorly Drained soil classes. Reclassed PVP as likely suitable (80-100%), potentially suitable (1-79%), and unsuitable (0%) for wetlands.

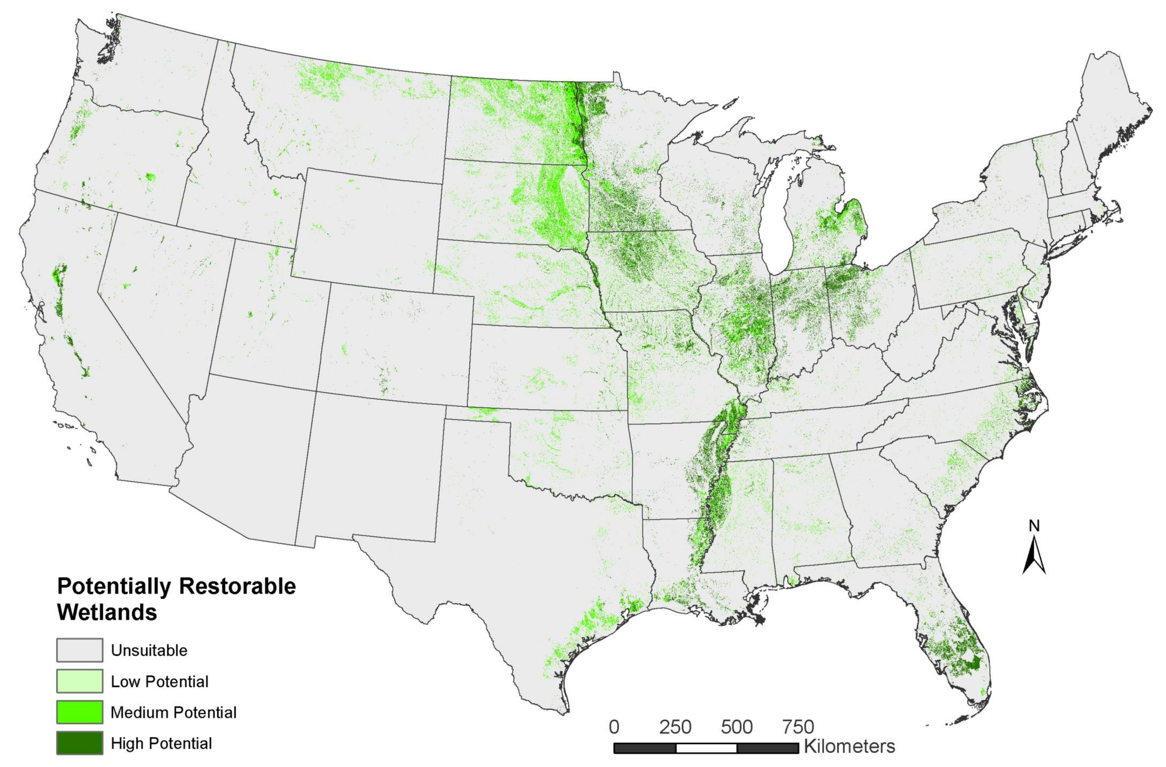


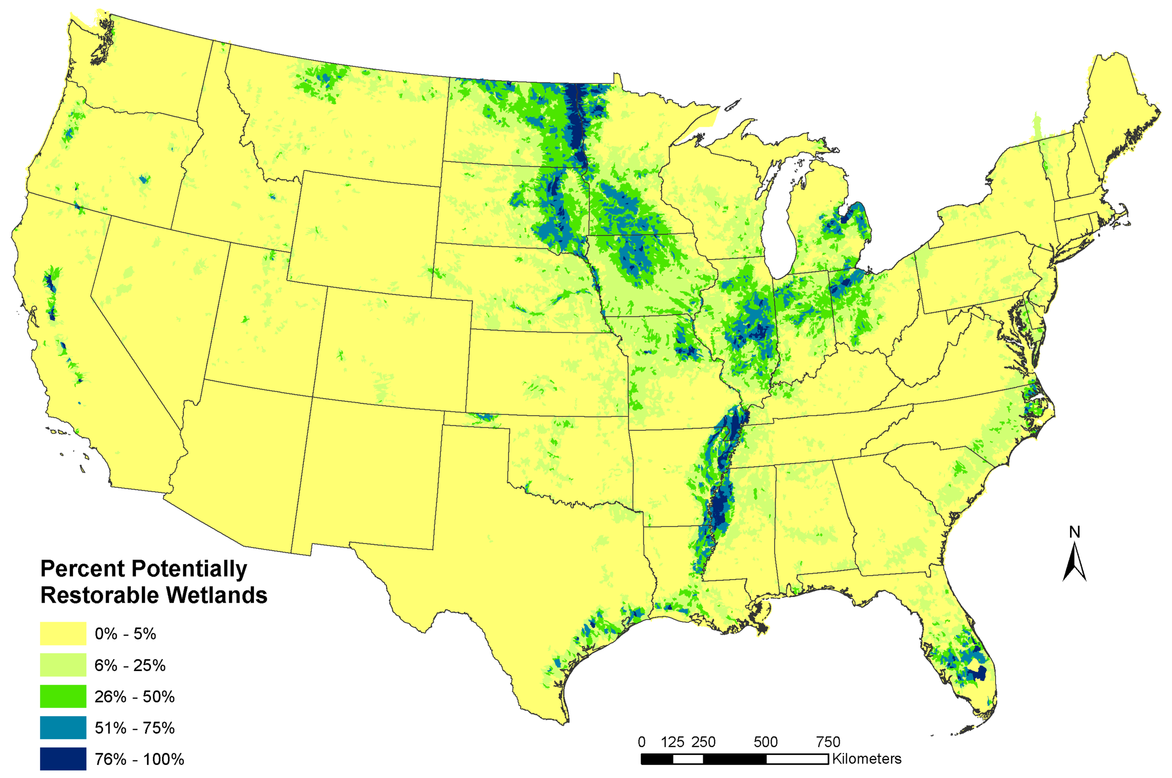
The reclassed land cover, wetness, and soils layers were then added and reclassed by potential, resulting in a 30 meter raster.

High potential – Crop/pasture, CTI >= 550, 80-100% PVP
Medium potential – Crop/pasture, CTI >= 550, 1-79% PVP
Low potential – Crop /pasture, 80-100% PVP
Unsuitable – All others

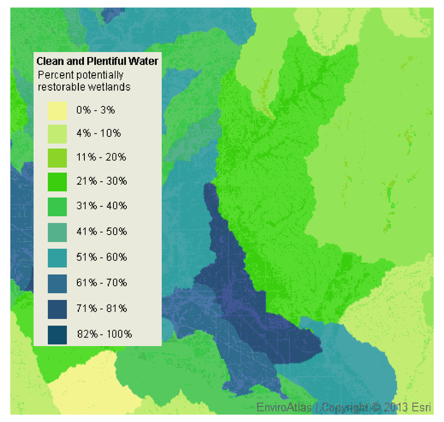
A second layer summarized all levels of potential by watershed (12-digit HUC).

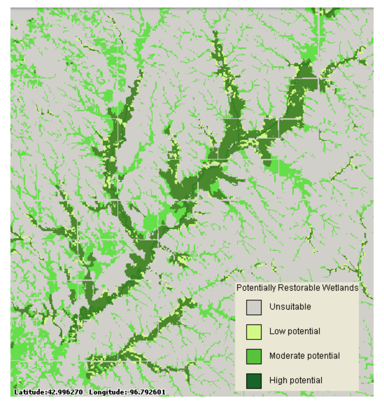
Results





Application





One application of the results might be to evaluate need or priority by watershed (left) and possible restoration areas for further review via the raster (right).

Conclusion

Overall, the CTI and PVP adequately accounted for the location of NWI wetlands. CTI captured 66-96% of NWI wetlands across the nine evaluated states. However, CTI tended to overestimate potential wet areas, in part, because it does not consider precipitation/evaporation water balances, resulting in large areas of the arid Southwest being classed as wet. Results for the PVP layer were more variable then the CTI. When we used a grid of high potential PVP soils (greater than 80%), we captured 16-98% of NWI polygons. When including any PVP soil presence (1% or greater), the coverage of NWI polygons ranged from 41-99%. In Ohio and California, where agreement between PVP and NWI was low, we found that many of the non-identified NWI polygons were classified as temporary wetlands where water is only present for short periods of the year. While PVP reflects the on-the-ground conditions, soil classification can be subject to surveyor and boundary/definitional biases. PVP of 1-79% and PVP>80% acted as two tiers of suitability for potential wetlands in the analysis. When CTI was used in combination with PVP, the CTI data layer can act as a mask eliminating upland areas from consideration.

By including agricultural land cover classes with the CTI and PVP combined grids, we were able to highlight areas in the contiguous US that would potentially benefit from wetland restoration, including HUCs along the lower Mississippi Valley, the agricultural lands of the Prairie Pothole region (portions of Iowa, South and North Dakota, and Minnesota), and the Eastern Corn belt (Illinois, Indiana, and Ohio).

Acknowledgements

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