

Alternative Methods for Determining Land Use History in South Dakota and Minnesota

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Introduction

Southwest Minnesota and South Dakota encompass a diverse mosaic of landscapes and features commonly found in the transition zone between eastern and western biomes. Within this matrix are a variety of grassland and woodland types, including those grasslands and woodlands that are considered undisturbed or native (those that have never been cultivated or mechanically disrupted for agriculture or other uses). Understanding both the location and extent of these remaining grasslands and woodlands is an essential first step in ensuring the future of these important natural resources.

In 2014, South Dakota State University and The Nature Conservancy initiated a pilot project to analyze undisturbed land in the 17-county Prairie Coteau region of eastern South Dakota. The objective was to develop a simple, systematic, repeatable, and cost-effective approach to estimate the location and total area of land tracts that are potentially undisturbed (i.e. native) grasslands or woodlands, in response to concerns with the accuracy of satellite-based data.

Based on the success of the original pilot project, we expanded the analysis to include portions of southwestern Minnesota and the entirety of South Dakota. To date, we've completed mapping all or portions of 14 southwestern Minnesota counties, the entirety of the 44 eastern South Dakota counties, and a 5-county region of northwestern South Dakota. The remainder of western South Dakota is in progress.

Methods

We utilized the South Dakota Farm Services Agency's (FSA) Common Land Unit (CLU) layer from 2013 and 2012 USDA National Agricultural Imagery Program (NAIP) county mosaic aerial imagery to define undisturbed land as that which the soil has not been mechanically manipulated. Analysis includes native remnant grasslands, pastures, prairies, and other natural herbaceous plant communities such as natural forests, woodlands, and shrublands; as well as non-developed and non-farmed wetlands. We relied primarily on the 3-CM Cropland Indicator Code for our initial CLU process step as we implemented our deductive analysis procedures as follows:

- Step 1: Interpreting CLU Data
 - Step 1: Interpreting 'Other' Disturbances
 - Step 3: Identifying Go-Back and Land with an Uncertain Management History
 - Step 4: Designating Potentially Undisturbed Woodlands
 - Step 5: Error Analysis and Accuracy Review
 - Step 6: Lakes and Wetlands Identification
 - Step 7: Evaluation of Undisturbed Land Protection Status
 - Step 8: Identification of Energy Industry Footprint (oil, gas, wind)
- Woodlands:** Woodlands of primarily native species with no proven disturbance history and with a canopy at or near closure were recorded as 'undisturbed woodlands'. Open, scattered woodlands were retained in the grassland layer.
- Wetlands:** Wetlands <40 acres with no proven disturbance history were retained in the native grasslands layer, while those >40 acres were removed along with all other large water bodies so as not to inflate total grassland acres.
- Large Water Bodies:** Were removed according to South Dakota Department of Game, Fish, and Parks statewide water data layer.

START: LANDSCAPE: 1 mi²



First: Remove crop history tracts, regardless of current land use



CLU: Crop Coded Tracts

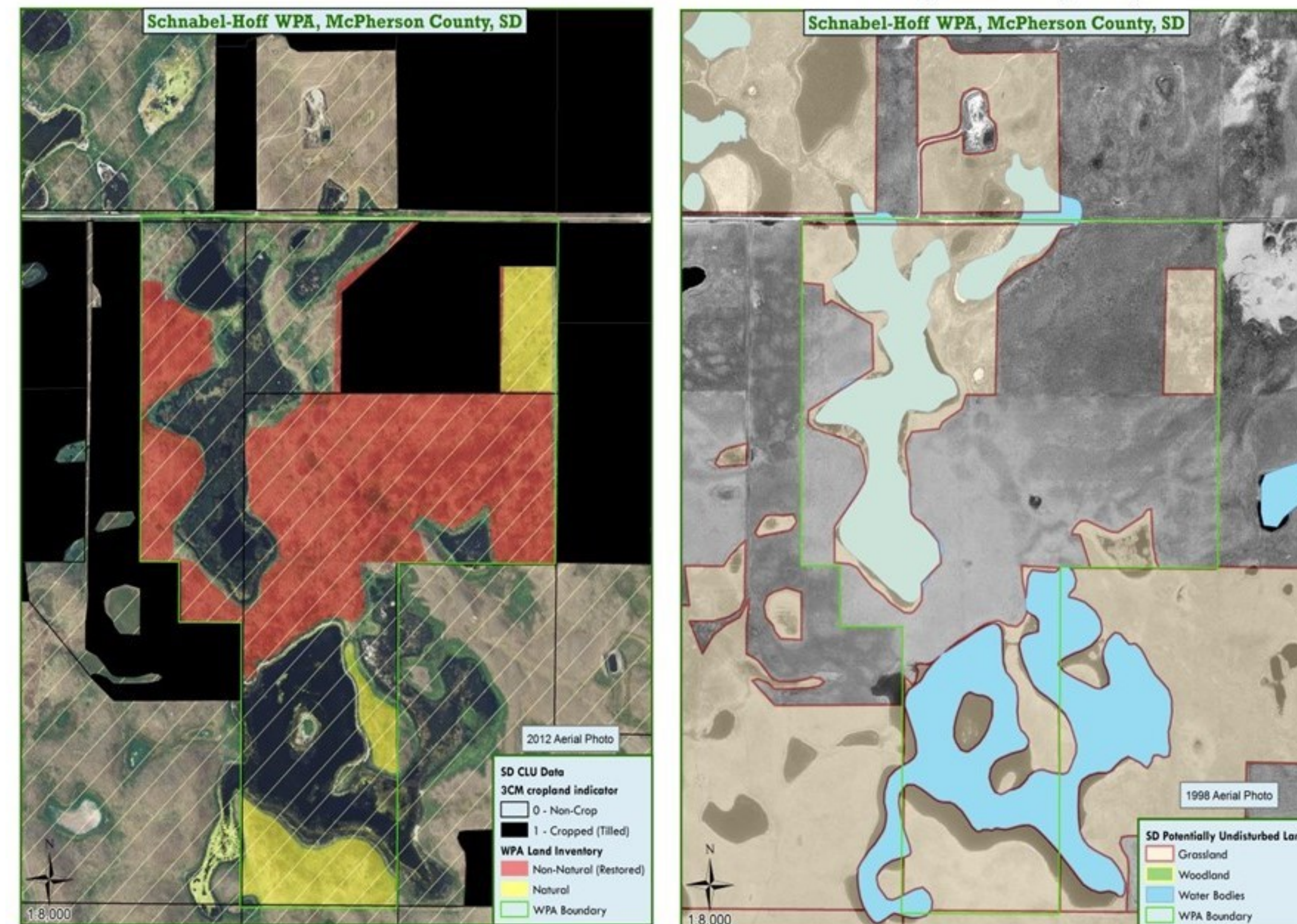
Then: Remove all non-recorded cropland, municipal, commercial, industrial, Ag., energy, etc.



Finish: Potentially Undisturbed Land (PUDL) layer consist of all land without proof of disturbance history, regardless of current ownership, condition, use, or protection status.

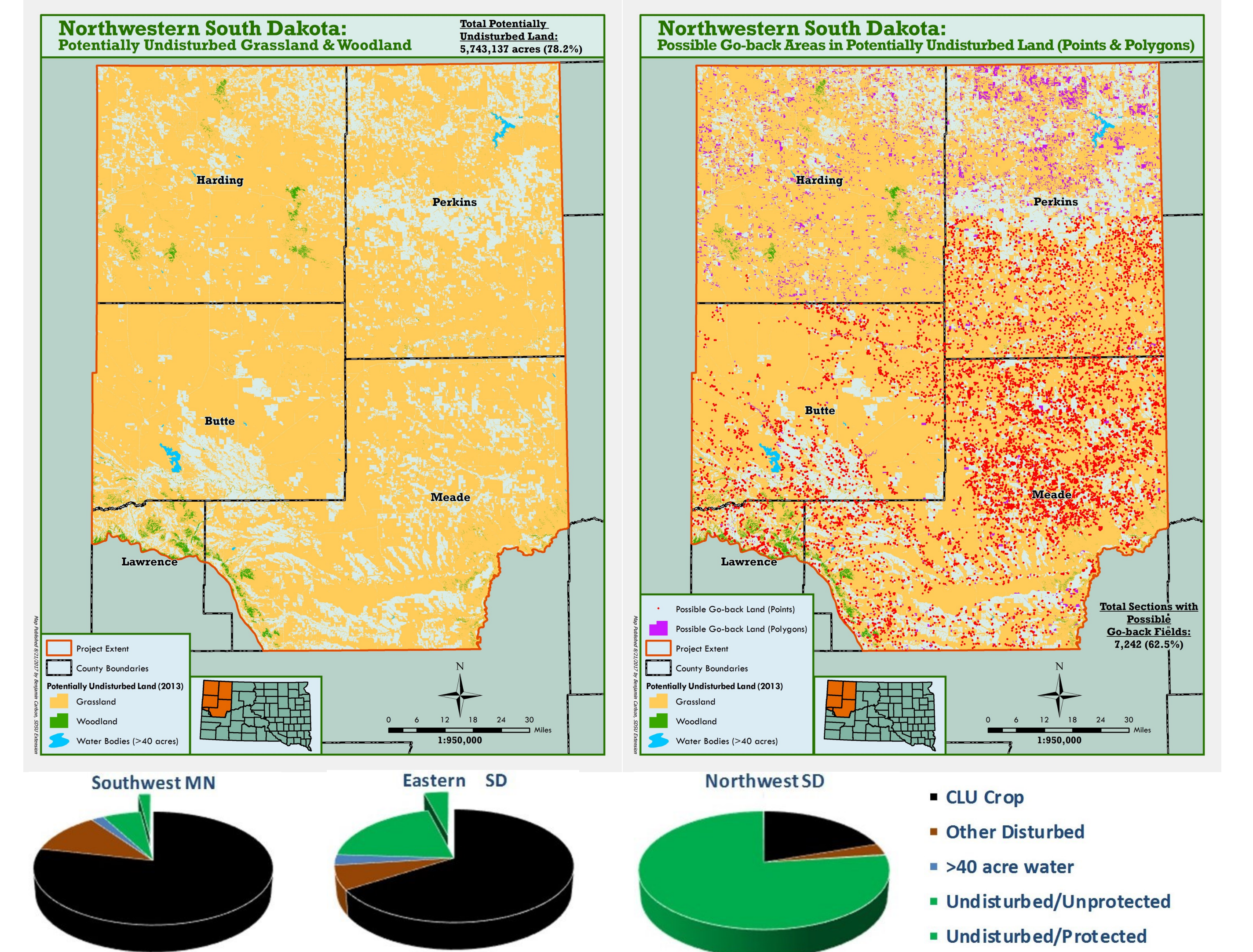
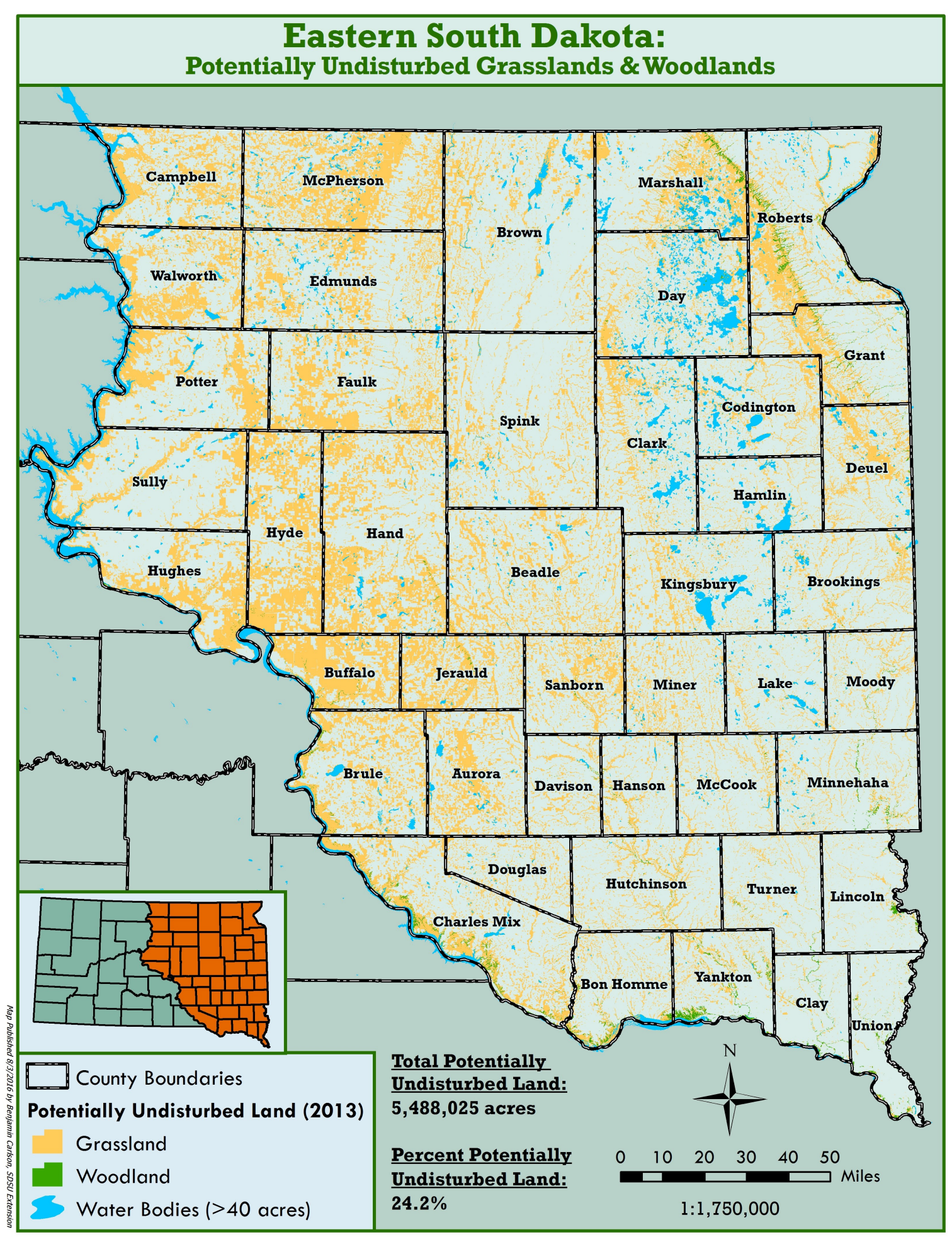
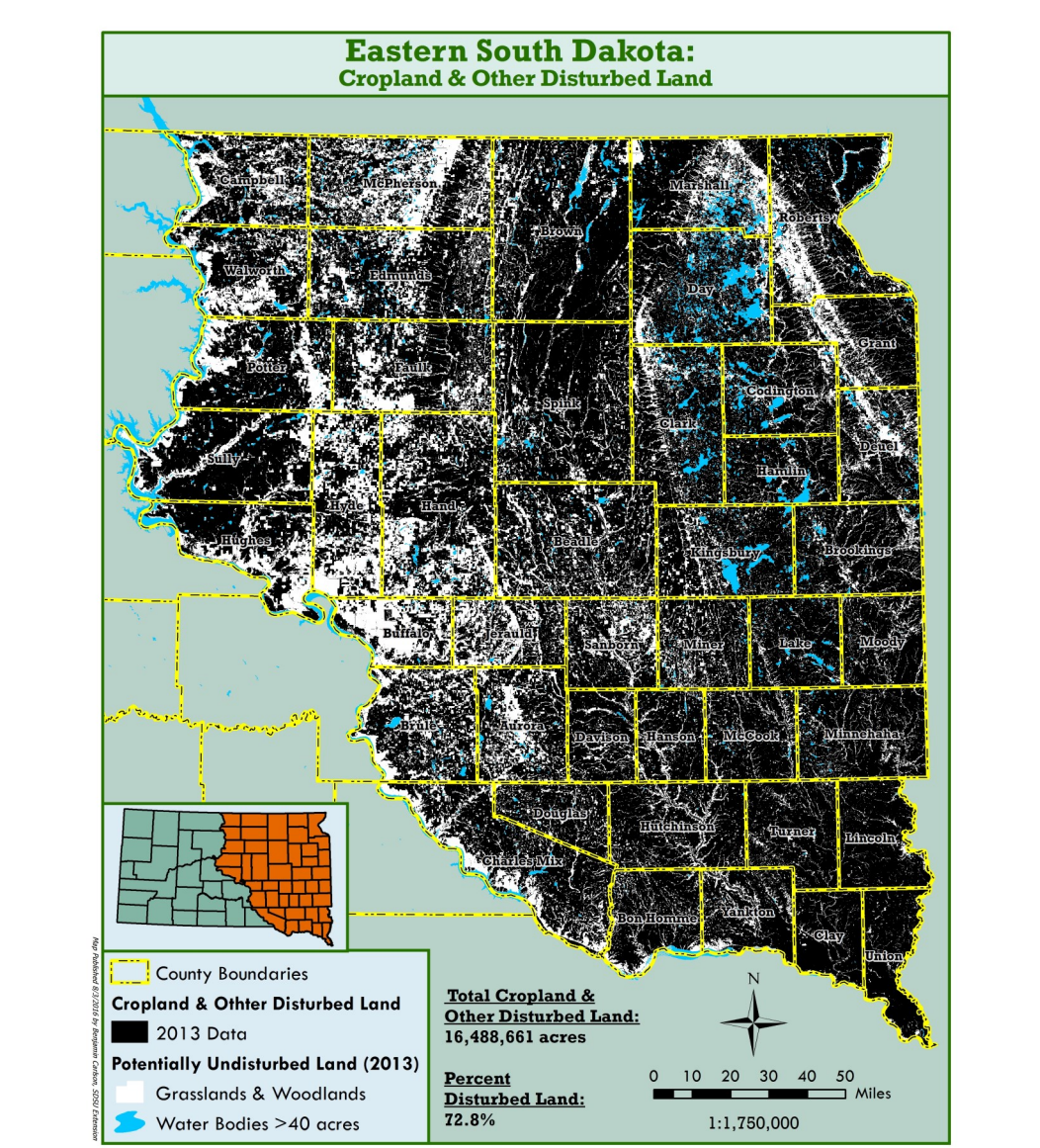
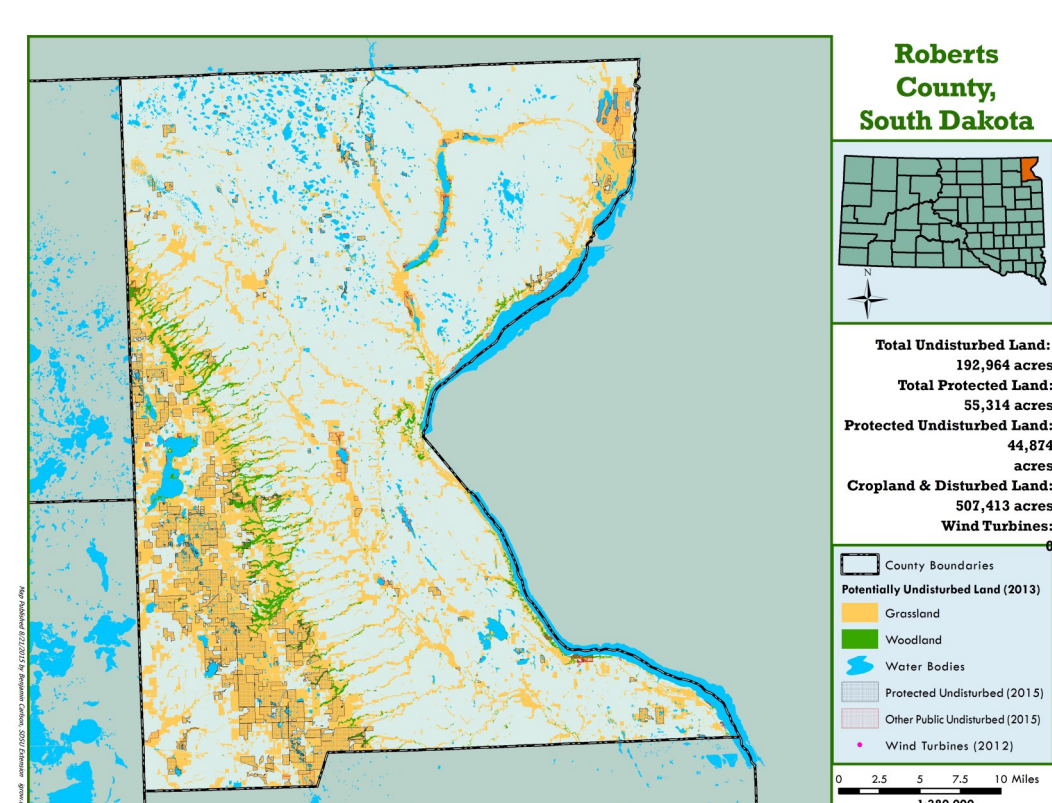


PROCESS EXAMPLE ON 1 SQUARE MILE, MCPHERSON COUNTY, SD: AT LEFT, BLACK INDICATES A CLU 'CROP' CODE, LEAVING ALL CROSS-HASH AREAS TO BE ANALYZED. ULTIMATELY, BASED ON ALL KNOWN FACTORS, FINAL POTENTIALLY UNDISTURBED LAND TRACTS ARE IDENTIFIED AND CATALOGED IN THE DATABASE AS SEEN IN THE IMAGE AT RIGHT (GRASSLANDS [BEIGE]).



Results

Potentially Undisturbed Land: Landscape Statistics								
Landscape	Landscape Area (Acres)	CLU Cropland (Acres)	Other Disturbed (Acres)	Potentially Undisturbed Grasslands (Acres)	Potentially Undisturbed Woodlands (Acres)	Total Potentially Undisturbed (Grasslands and Woodlands) (Acres)	Total Protected (Acres)	Total Undisturbed and Protected (Acres)
Southwest MN	5,055,319	4,051,457 (80.0%)	491,634 (12.0%)	348,304	53,949	402,253 (8.0%)	290,412	104,169 (2.1%)
Eastern SD	22,646,780	14,922,173 (65.9%)	1,566,487 (6.9%)	5,370,928	117,097	5,488,025 (24.2%)	1,384,982	962,734 (4.3%)
Northwest SD	7,347,812	1,397,499 (19.0%)	193,570 (2.6%)	5,686,795	56,342	5,743,137 (78.2%)	12,315	10,835 (0.1%)



Discussion

Our methodology yields exceptional accuracy at any scale because it is mapped data utilizing GIS polygons, thus avoiding interpretation and accuracy concerns associated with grass-like habitats identified using satellite-based land use assessments, such as National Agricultural Statistics Service (NASS) data.

Management Implications

Our work provides a new methodology in determining the extent and quality of remaining habitats and is being utilized extensively by agencies, NGOs, and private industry in South Dakota. Reports, methods, maps, tables, GIS and geodatabase files are publicly available on SDSU's *Open Prairie* public data repository. After completion of western South Dakota, we intend to incorporate Light Detection and Ranging (LiDAR) technology to assess areas where historic land manipulation was suspected, but where definitive proof was lacking (i.e. go-back areas). Other studies have indicated a high degree of accuracy when applying LiDAR to an extended area (Ryan Fisher, Pers. Comm.). When complete, the SD Potentially Undisturbed Land layer will serve resource managers of all types.

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