

Supplementary Document

Improved Change Detection with Trajectory-Based Approach: Application to Quantify Cropland Expansion in South Dakota

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Table S1. Fitted parameter coefficients, derived metrics from the Convex Quadratic (CxQ) model for land surface phenology [1].

Parameters	Meaning
α, β, γ	Fitted parameter coefficients of CxQ model (Equation 1)
TTP	Thermal time to peak (AGDD at the max fitted EVI) ($TTP = -\beta/2\gamma$)
PH	Peak height EVI (max fitted EVI) ($PH = \alpha - \beta^2/4\gamma$)
HTV	Value of EVI at half-TTP ($HTV = \alpha + \beta \times TTP/2 + \gamma \times TTP^2/4$)
y _{max}	Highest observed EVIs
r ²	Coefficient of determination of the fitted model
l _{pos} , r _{pos}	Observation index of start and end of the fitting window
o _{fit}	Number of observations used to fit the CxQ model
o _{per}	Ratio of "o _{fit} " to the total number of observations
minx, maxx	AGDD at left and right ends of the fitted curve in the first quadrant
peaks	Number of high EVI values ($\geq 0.8 \times y_{max}$) outside the fitting window
jumps	Number of times that $\Delta EVI \geq 0.2$

Table S2. Pixel-wise comparison between predicted land cover maps (RFC) and the reclassified CDL for (a) 2006 and (b) 2012. PA is producer's accuracy, UA is user's accuracy. Overall accuracy appears in **bold**.

(a)		CDL (km ²)				
	2006	Cropland	Grassland	Others	Total	UA
RFC (km ²)	Cropland	42,265	5,053	4,236	51,554	82.0%
	Grassland	7,388	103,232	13,775	124,395	83.0%
	Others	1,503	4,613	17,662	23,778	74.3%
	Total	51,156	112,898	35,673	199,727	
	PA	82.6%	91.4%	49.5%		81.7%
(b)		CDL (km ²)				
	2012	Cropland	Grassland	Others	Total	UA
RFC (km ²)	Cropland	52,258	5,018	2,940	60,216	86.8%
	Grassland	6,587	108,440	7,577	122,604	88.4%
	Others	906	3,066	12,935	16,907	76.5%

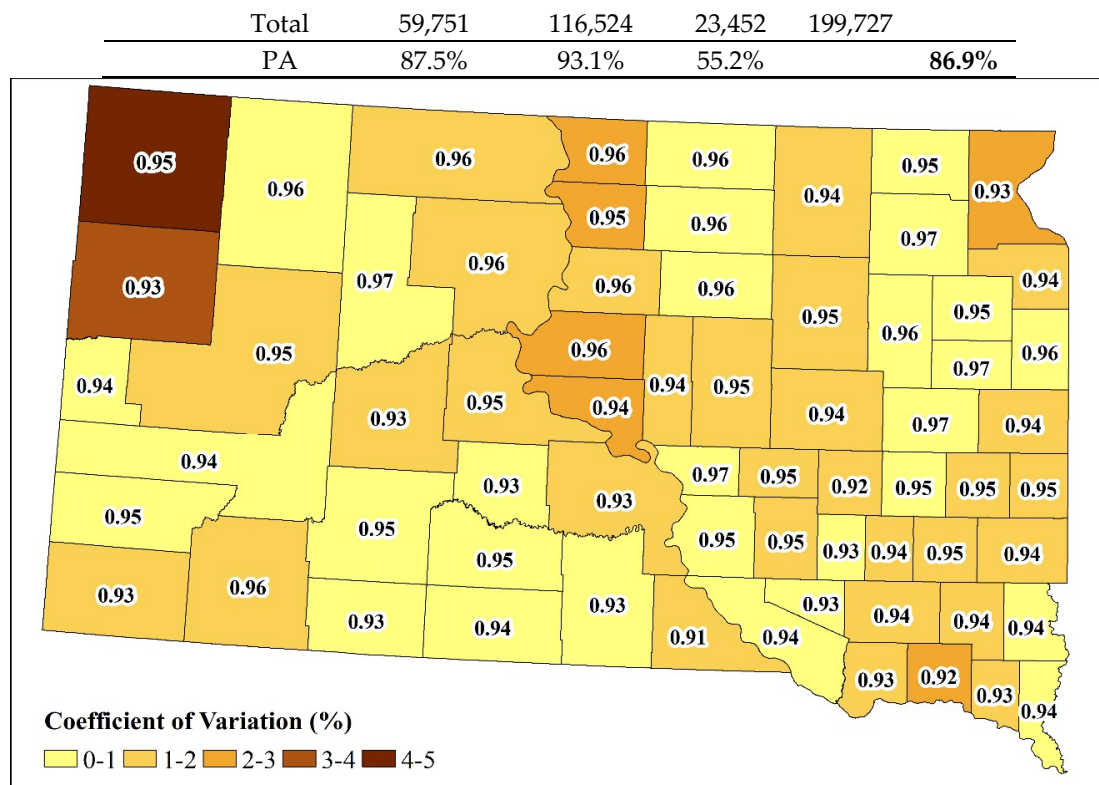


Figure S1. Accuracy of county-level Random Forest models. Numbers are mean overall accuracies of 11 years, and color-coded background shows temporal coefficient of variation.

Table S3. Correlation between estimated crop areas by this study (RFC), the reclassified CDL and the NASS statistics. Indication of significance: *, **, and *** for p-values less than 0.05, 0.01, and 0.001, respectively.

	Pearson's r	Spearman's r
CDL ~ NASS_Planted	0.74**	0.62*
CDL ~ NASS_Harvested	0.73*	0.76**
RFC ~ NASS_Planted	0.79**	0.65*
RFC ~ NASS_Harvested	0.78**	0.76**

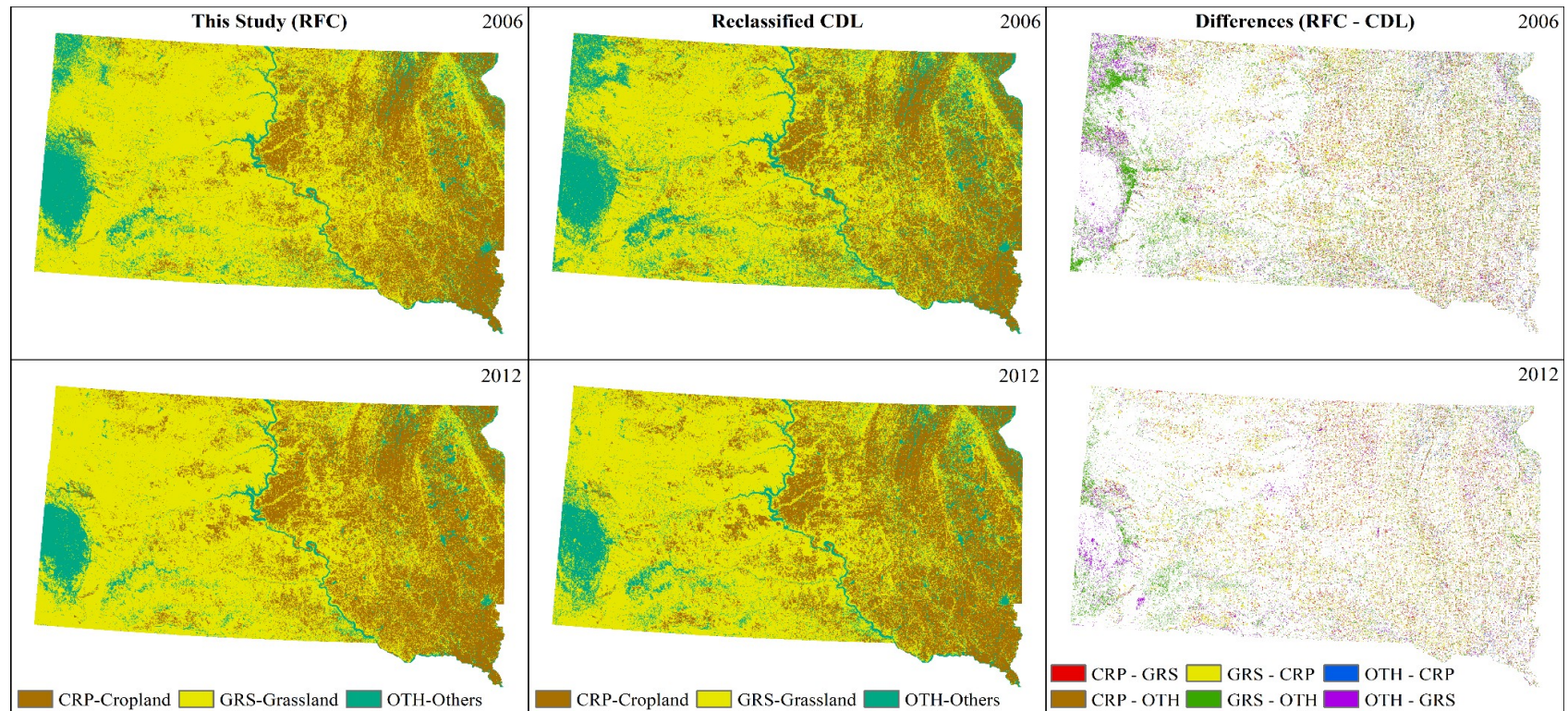


Figure S2. Comparison between our land cover maps and the reclassified CDL.

References

1. Nguyen, L.H.; Joshi, D.R.; Clay, D.E; Henebry, G.M. Characterizing land cover/land use from multiple years of Landsat and MODIS time series: a novel approach using land surface phenology modeling and random forest classifiers. *Remote Sens. Environ.* **2018**. (Articles in press) <https://doi.org/10.1016/j.rse.2018.12.016>