Initial indications that conservation practices can mitigate farmland susceptibility to flooding

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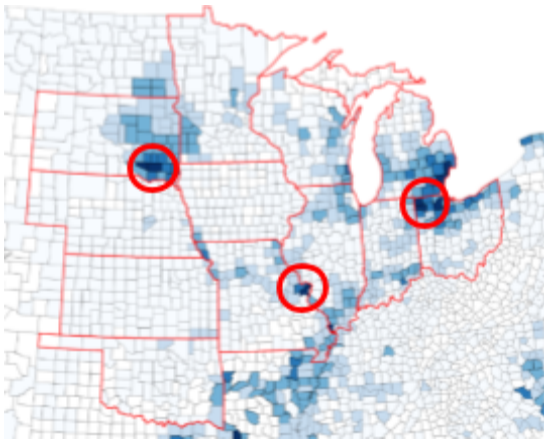
Dagan, Inc and Applied Geosolutions have mapped conservation agriculture management practices and the associated soil health and environmental outcomes across the Midwest Corn Belt between 2005 and 2018. Products by OpTIS in conjunction with DNDC offer a solution to the difficult process of tracking the use of conservation agriculture practices, such as implementing cover crops and conservation tillage, without having to employ a patchwork of methods to obtain baseline documentation of conservation agriculture acreage data. We provide reliable maps of historical adoption of conservation practices at a variety of scales, from farm-segments level to county, watershed, crop reporting district, or state scales.

Insights on conservation practice outcomes

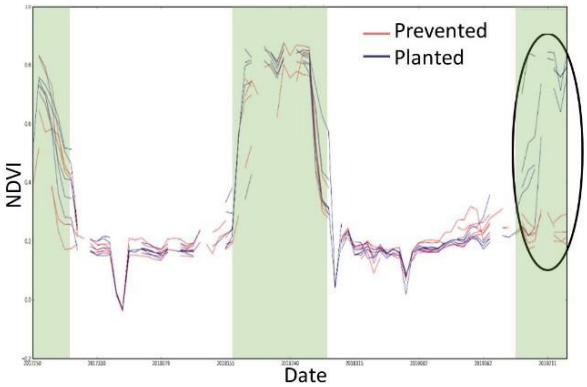
Analytics from this database can offer insight into farmland susceptibility to flooding. During the 2018-2019 winter and spring season, millions of acres were prevented from planting across the Midwest. According to producer reports, as much as 11.2 million acres of corn and 4.4 million acres of soy went unplanted (1, 2). We explored how implementation of soil health practices like cover cropping and conservation tillage impacted the ability of agricultural fields to withstand flooding. Mapping was constrained to farmland with corn, soy, and wheat crop rotations. We used recently released county data by USDA-RMA on prevented planting to select counties with substantial prevented planting acres. For this study we selected the following counties for more in depth analysis: Hutchinson County, South Dakota, Wood County, Ohio, and Lincoln County, Missouri.



Corn Belt region of the United States showing counties with higher prevented planting acres in darker blue.

Mapping acres of successful and prevented planting

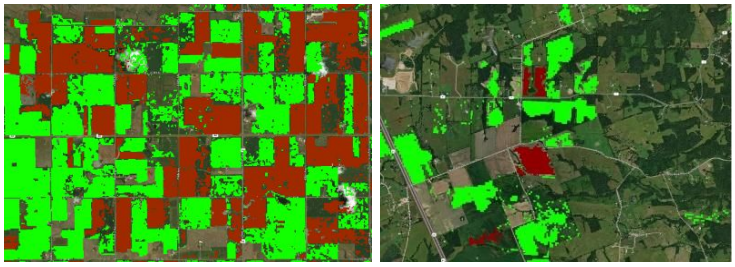
To identify successful and prevented planting, we used vegetation index values from the peak growing season. We isolated fields that were successfully planted in the summer of 2018 according to the cropland data layer, and had either (a) robust green signal in the summer of 2019 (i.e. successfully planted) or (b) very weak green signal in the summer of 2019 (i.e. prevented plant). Equipped with this information, we then looked at the conservation tillage and cover crop adoption histories at the farm-segment level.



Measure of green cover intensity over time (NDVI), showing 5 prevented planting fields (red) and 5 planted fields (blue). Prevented planting fields have much lower green cover in 2019 summer peak growing season, compared to the previous years

We obtained OpTIS-based management information, which extends from 2005 through 2018, for farm-segments to calculate the average number of years with no-till and conservation tillage. In addition, we obtained the average elevation of fields from a digital elevation model. Acreage, conservation practice history, and elevation of farm fields that were planted or had prevented planting are summarized below..

In Wood County, OH, 741 field segments were analyzed, of which 514 segments (18,640 acres) were prevented from planting and 227 (6,609 acres) were planted.



Example aerial photos and mapping results of successful planting (green) and prevented planting (maroon) in **A)** Hutchinson County, SD and **B)** Lincoln County, MS

In Hutchinson County, SD county we analyzed 652 farm-segments for this report, of which 300 were prevent planted, and 352 were planted.

In Lincoln County, MO, we analyzed 251 fields, 231 of which were planted, and 20 prevented from planting.

Can adoption of conservation practices help control flooding?

Across all three counties, fields that were successfully planted in spring of 2019 showed higher average number of years with conservation tillage and no-till practices, and higher average number of years with winter green cover (see table below). Successfully planted fields, on average, have higher mean elevation than fields that were prevented from planting.

***Table**. Area and number of fields with planting classes in three regions of interest; Wood, OH, Hutchinson, SD, and Lincoln, MO.*

Location	Planting Status	No-till	SD.	Conservation tillage	SD.	Winter green cover	SD.	Mean elevation	SD.	Area	Number of segments
		avg. # years		*avg. # years*		*avg. # years*		*meters*		acres	
Wood county, OH	Successful	1.71	1.7	5	2.75	0.67	1.02	211	8.27	6,609	227
	Prevented	1.31	1.31	4.87	2.12	0.55	0.87	205	8.56	18,640	514
Hutchinson county, SD	Successful	0.63	1.27	3.58	2.91	0.82	1.45	434	30.76	16,428	352
	Prevented	0.33	0.73	2.96	2.48	0.78	1.37	430	23.55	14,566	300
Lincoln county, MO	Successful	1.48	1.8	5.76	3.19	2.86	1.78	201	32.79	7,490	231
	Prevented	1	0.77	4.4	1.96	0.1	0.3	134	0.22	248	10

Floodplain hydrology studies have demonstrated the adoption of conservation practice, in particular the use of cover crops, help reduce flooding as well as help control flooding (4). Use of conservation practices provide numerous soil health benefits such as preventing soil erosion and increasing soil organic matter, both of which improve water storage capacity, thus reducing flooding (4). Whereas, factors like infiltration and presence of

vegetation were critical in controlling flooding during short rain periods, while factors like evapotranspiration were important over longer periods to reduce overall runoff (4). While more analysis needs to be conducted, this limited study provides additional indications that conservation practices can increase resilience to flooding.

Outlook for OpTIS and DNDC products

Never has a historical practices database of this magnitude been available to stakeholders working directly or indirectly with producers. As shown in the initial analysis here, use of the OpTIS and DNDC products can answer important questions about the outcomes of implementing conservation management, such as determining the effect of agriculture management decisions on the ability to plant given wet conditions like the Midwest experienced in the spring of 2019. The scale and scope of research shown here can be extended to benefit growers and agriculture stakeholders in other impacted areas, taking an array of additional factors into account. The use of this database can facilitate decision-making with the benefit of insight regarding crop management.

References

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(2) Burger, B., and Caruso, D. The Columbus Dispatch/GateHouse Media Posted Aug 17, 2019 https://www.pratttribune.com/news/20190817/planting-season-hits-record-lows

(3) USDA National Agricultural Statistics Service. 2017 Census of Agriculture— County Data.

(4) Murtada, S. Can Cover Crops Reduce Flooding? North Fork Crow River Watershed District July 1, 2019. https://www.nfcrwd.org/index.asp?SEC=C39CBC78-448C-488B-A67E-7FB8E383FFD8&DE=3F871E12-A9F3-4709-A80E-4C9F9D6663DC