

Agriculture Practice

How the Iowa derecho has affected 2020 crops

An estimated 3.1 million to 3.8 million acres of corn and soybeans have been damaged.

by Nicolas Bellemans, David Fiocco, Jude LaRenzie, and Ryan McCullough



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On August 10, 2020, a derecho swept through Iowa, bringing severe winds and significant precipitation across many parts of the state. Nearly 12 million acres of cropland in total were affected in some way, representing about 50 percent of the 24.7 million acres planted in Iowa in 2020.

Many sources have published estimates of total exposure but there has been less focus on an end-to-end assessment of the actual damage sustained to crops. There are challenges to doing so given the extensive acreage involved, but satellite-based analytics are offering new ways to rapidly unlock these insights. More specifically, changes in satellite-derived vegetation indices, such as the normalized difference vegetation index, can be employed to assess damage to crop health from the storm.

Analyzing satellite imagery, we estimate that 3.1 million to 3.8 million acres sustained physical crop damage (Exhibits 1 and 2). Of these acres, corn was most adversely affected, making up 80 to 90 percent of the total damage. Damage intensity varies among fields; satellite analysis allows us to segment the fields into two categories:

- *Production partially lost.* In these fields, crops had some deleafing or were bent, but production is likely only partially lost. About 2.6 million to 3.4 million acres (or 85 to 90 percent of damaged acres) fall into this category.

- *Production completely lost.* In these fields, crops were completely stripped or broken by the storm. We estimate that about 0.3 to 0.6 million acres (or 10 to 15 percent of damaged acres) fall into this category.

The full impact on crop yield from the derecho is difficult to predict and depends on several factors, including:

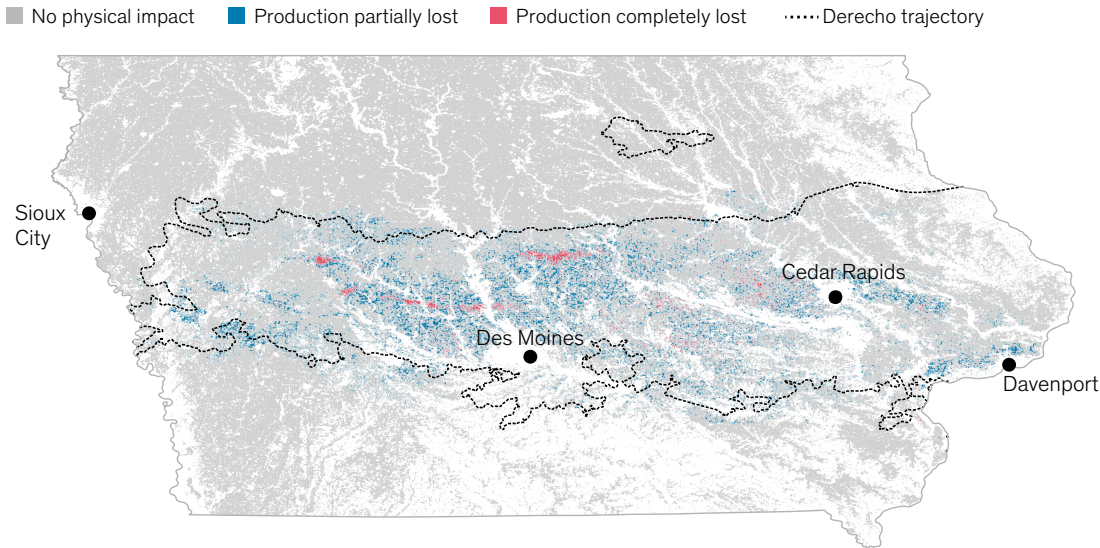
- *How bent or flattened the corn is and whether a combine can harvest it.* There are ways to harvest flattened corn but it can be tedious and tends to have higher bushel loss.
- *Where and if breakage occurred.* If breakage happened at the bottom of the stalk, then yield is likely fully lost. Breakage closer to the ear development area will have some impact on yield but not likely full loss.
- *How growing conditions play out in the coming weeks.* The severity of crop stress will directly dictate how much of the damaged crop recovers or degenerates in the coming weeks.

Satellite-based analytics are offering new ways to rapidly unlock crop health insights over large areas.

Exhibit 1

The August 2020 derecho physically impacted crop health on 3.1–3.8 million acres of corn and soybeans in Iowa.

Soybean and corn crop health impact¹



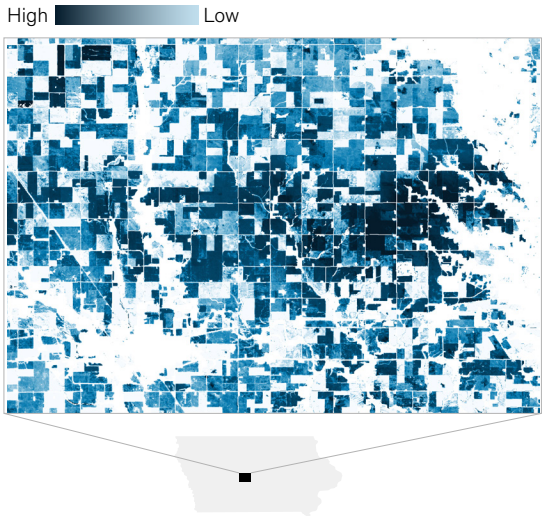
¹Crop damage was assessed using changes in crop health indices from optical (normalized difference vegetation index) and synthetic-aperture radar satellite (VH/VV ratio) composites 10 days before and 10 days after August 10th, 2020. The derecho trajectory has been defined using a maximum reflectivity composite, derived from data recorded by the NOAA-NEXRAD weather radar system on the August 10th, 2020. The reflectivity, measured in dBZ, is the amount of transmitted power returned to the radar receiver after hitting precipitations. All areas within the highlighted derecho trajectory had a reflectivity higher than 45 dBZ at least once during that day.

Source: Contains modified Copernicus Sentinel-1 and Sentinel-2 data 2020, NASA-MODIS data 2020 processed on Descartes Labs platform, NOAA-SPC NEXRAD

Exhibit 2

Satellite imagery can help assess the damage of the August 10, 2020, derecho that swept through Iowa.

Decrease in crop health index from satellite
Boone County, Iowa, August 7–19, 2020



Picture from a corn field with high crop health decrease
Boone County, Iowa, August 19, 2020



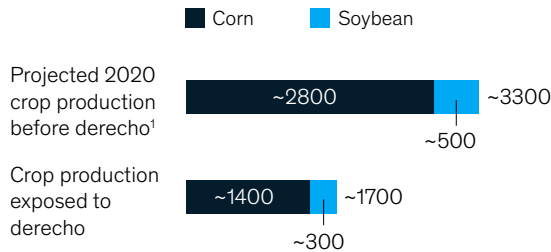
Source: McKinsey In-Field Survey

Source: Descartes Labs (incl. Copernicus Sentinel-2, 2020); McKinsey In-field Survey

Exhibit 3

Potential crop production impact from derecho in Iowa.

Crop production exposed to derecho, millions of bushels



Potential production loss,^{1,2} millions of bushels



¹Assumes average corn yield of 200 bushels per acre and average soybean yield of 55 bushels per acre.

²Assumes 25%, 50%, and 75% production loss on acres with partial damage and constant 100% production loss on acres with complete damage.

Source: USDA NASS, McKinsey satellite analysis

Despite the many questions that will define yield impact, we have developed three potential scenarios (Exhibit 3) that vary by the extent of production loss on damaged fields: 25 percent, 50 percent, and 75 percent.

At the low end, scenario one could cost growers \$600 million to \$700 million in revenue loss at current corn and soybean commodity prices (not accounting for crop insurance). At the high end, scenario three could cost farmers \$1.5 billion to \$1.8 billion. While none of the scenarios spell total loss for Iowa, the derecho will clearly have a meaningful financial impact on farmers and the economy.

All estimates were generated in collaboration with Descartes Labs, a geospatial analytics platform provider, through analysis of satellite imagery (MODIS, Sentinel-2, and Sentinel-1) and tracking major drops in crop health indices. Results were validated by select field walk-throughs.

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