Conservation Technology Information Center

Viridis View Methodology Details for DTN

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About DTN

DTN is a global data and technology company supporting operational decisions across agriculture, weather, and energy. Founded in 1984, DTN serves customers in more than 120 countries. Over the past five years its conservation offerings have expanded to include tracking of tillage, residue and cover crops, along with various other data and modeling capabilities used to evaluate the carbon intensity of farming practices at the field level.

The history and evolution of our **Tillage** estimation methodology

DTN's tillage and crop residue estimation capability was developed through a focused R&D effort. Rather than committing to a single approach at the outset, the team iteratively identified and evaluated several candidate methods, testing which produced the most reliable results before converging on the current methodology. The evaluation spanned a number of dimensions, including how best to translate the satellite-derived tillage index into a physically meaningful crop residue estimate; whether a single nationwide relationship was adequate or whether state-level tuning was needed; which residue cover cutoffs most cleanly separated the tillage classes; which seasonal time windows best captured the residue signal that distinguishes tillage practices; etc.

The history and evolution of our **Cover Crop** estimation methodology

DTN's earliest cover crop work followed the dominant method in the scientific literature: thresholding NDVI on one or more dates and classifying fields above the threshold as cover-cropped. However, DTN found that commonly reported skill statistics could be misleading, due in part to the large imbalance between cover-cropped and non-cover-cropped fields. Methods that performed well against one ground truth dataset or region also often performed poorly elsewhere.

DTN therefore pursued a machine-learning (ML) approach to cover crop identification, with the goal of developing a unified model that performs reasonably across varied conditions. DTN

acquired training data from multiple sources, ultimately compiling several million observations of cover-crop presence (or lack thereof) across multiple years. The ML approach also allows the model to be readily updated as new training data become available each year.

Row crop lands included in our estimates

Corn (maize), Soybeans, Cotton, Wheat, (many other crops, depending on the specific need)

Our imagery source(s), bands, filters, indices, and date ranges

DTN leverages Harmonized Landsat–Sentinel-2 (HLS) data, quality-controlled, cloud-screened, and reprocessed to daily resolution before use. For cover crops, DTN uses NDVI, GCVI, EVI, and LSWI indices in various models, sampled at dates in the fall through the following spring. For tillage/residue, NDTI is computed from HLS SWIR bands, with an NDVI-based mask applied to exclude green vegetation. Minimum residue is evaluated over the full season, pre-planting, and post-harvest.

How we classify the presence or absence of **Cover Crops**

DTN's current method uses an ensemble of ML models rather than a single model, vegetation index, threshold, or observation date. Ensemble members independently estimate cover crop likelihood using different vegetation indices and dates, ML methods (e.g., neural networks vs. random forests) and supporting data such as prior crop.

Each model assigns pixels a score from 0 (highly unlikely) to 1 (highly likely). Scores across models and pixels within a field are combined to assess field-level cover-crop likelihood. Where a yes/no classification is required, USDA Census of Agriculture county-level cover crop prevalence data help to identify appropriate classification thresholds.

Models vary geographically because relevant timeframes and cropping patterns differ across the country. Available training data limit further localization, so DTN currently employs southern, central, and northern versions of its models.

How we categorize **Tillage**

DTN makes assessments of crop residue using combinations of satellite data from different spectral bands, creating Normalized Difference Tillage Index (NDTI) values for each 30 meter pixel in the satellite data. To turn NDTI into a physically-meaningful percent residue cover, a simple linear transform is applied (residue % = $m \cdot (NDTI) + b$), with the slope m and intercept b set separately for each state. The methodology then estimates tillage practices indirectly through crop residue cover, classifying pixels into one of conventional tillage, conservational/reduced tillage, or no-till categories. The entire process is calibrated against historical USDA Census of Agriculture data, resulting in state-specific models.

Our efforts to quantify estimate accuracy

At the county level, DTN's cover crop and tillage/residue models are both calibrated against available Census of Agriculture (CoA) data, which is the definitive source for these data at that scale. This does not mean DTN's estimates will always match CoA data, however, as DTN purposely avoids overfitting during model development so as to preserve those models' ability to

generalize to county-year combinations where no CoA data are available. At pixel- to field-levels, model training/calibration and validation are accomplished by splitting available observations into two separate pools: one for building/refining the models, and a second one for evaluating the accuracy of those models.

Published references describing our estimation methodology

N/A

Other conservation-related datasets that we could potentially make available to interested parties

N/A

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