Conservation Technology Information Center

Viridis View Methodology Details for TerraDiagnostics

Commercial & Technical Contact Andy Jacobson: andy.jacobson@terradiagnostics.com

About TerraDiagnostics

TerraDiagnostics is an environmental and agricultural research firm specializing in geospatial analysis, remote sensing, and environmental modeling. We develop scalable methods for identifying and monitoring agricultural conservation practices using satellite imagery, terrain analysis, and other geospatial data. Our field-scale inventories support conservation benchmarking, environmental risk assessment, and help prioritize future conservation efforts where they may provide the greatest benefit.

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

Tillage monitoring is a relatively recent addition to our agricultural conservation practice identification efforts. Our initial approach focused on evaluating satellite-derived crop residue indices, such as the Normalized Difference Tillage Index (NDTI), during key postharvest and preplanting periods to distinguish tillage practices. We have since developed a machine-learning approach that integrates a broader range of spectral indices, seasonal reflectance patterns, soil characteristics, and current and previous-year crop context. This approach is designed to better account for variability in residue conditions, cropping systems, and environmental conditions across agricultural regions.

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

Our initial cover crop identification methodology, developed through a research collaboration with Syngenta Crop Protection, relied on Sentinel-2 imagery and the Normalized Difference Vegetation Index (NDVI) to evaluate vegetation greenness during selected fall and spring periods. By comparing vegetation conditions following harvest, before planting, and during spring green-up, we identified agricultural fields exhibiting vegetation growth consistent with cover crop implementation. We have since developed a machine-learning approach that evaluates seasonal NDVI patterns, vegetation persistence, and growth timing throughout the postharvest-to-planting period. Regional and temporal adjustments help account for differences in cover crop timing and performance across growing conditions and cropping systems.

Row crop lands included in our estimates

Corn (maize), Soybeans, Cotton, Sorghum

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

We primarily use Sentinel-2 Level-2A surface reflectance imagery (visible, red-edge, NIR, and SWIR bands), filtered for clouds, shadows, and image quality. USDA Cropland Data Layer classifications and agricultural field boundaries define target crop areas. Cover crop features emphasize seasonal NDVI patterns, vegetation persistence, and growth timing, while tillage features include residue-sensitive indices such as NDTI and seasonal reflectance patterns, supplemented by soil characteristics and crop context. Imagery generally spans fall postharvest through spring planting (October–May/June).

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

Our current methodology uses a supervised machine-learning model trained on field-level ground-truth observations to classify the presence or absence of cover crops. The model evaluates seasonal NDVI patterns, vegetation persistence, and growth timing throughout the postharvest-to-planting period. Rather than relying on fixed vegetation thresholds during individual observation periods, the methodology combines seasonal vegetation evidence with regional and temporal adjustments to account for differences in growing conditions, background vegetation, and cover crop timing and performance. Predictions are generated at the agricultural field scale and aggregated using target crop acreage.

How we categorize **Tillage**

Our current methodology uses a supervised machine-learning model trained on field-level ground-truth observations to classify agricultural fields as tilled or no-till.. The model evaluates spectral and temporal characteristics associated with crop residue and exposed soil throughout the fall postharvest to spring preplanting period.. Key feature families include residue-sensitive spectral indices such as NDTI, seasonal reflectance patterns, soil characteristics, and current and previous-year crop context. The model integrates spectral evidence across the monitoring period rather than explicitly identifying individual tillage events or estimating percent residue cover. Field-level no-till probabilities are weighted by target crop acreage and aggregated to county estimates.

Our efforts to quantify estimate accuracy

Both methodologies have been developed and evaluated using field-level ground-truth observations representing different crops and growing conditions across the Midwest. Model development has included testing alternative feature combinations, evaluating classification performance across different crop types, and refining models to improve geographic transferability. Validation approaches include randomized field-level testing and spatially blocked cross-validation at multiple geographic scales. These evaluations help assess predictive performance when applying the models to agricultural areas outside the immediate vicinity of training observations. Additional ground-truth data spanning different geographies, years, and cropping systems would support continued validation and refinement.

Published references describing our estimation methodology

N/A

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

TerraDiagnostics also develops field-scale inventories of grassed waterways, terraces, water and sediment control basins (WASCOBs), and riparian buffers. These datasets combine satellite imagery, high-resolution elevation data, vegetation characteristics, and hydrologic analysis. Inventories can be summarized by county, watershed, or region. Similar geospatial methods could be adapted to identify additional conservation practices.

Conservation Technology Information Center

ctic@ctic.org | CTIC.org

P.O. Box 85 Lafayette, IN 47902 | (319)768-8348