Conservation Technology Information Center

Viridis View Methodology Details for Regrow

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About Regrow

Regrow is a climate tech company that helps Food & Beverage companies, agribusinesses, and sustainability organizations measure and reduce the environmental impact of their agricultural supply chains. Its MRV and Sustainability Insights platforms run carbon programs and Scope 3 reporting at scale, powered by a Monitoring platform that combines satellite remote sensing, machine learning, and biogeochemical modeling to turn field-level observations into scalable insights and outcome data.

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

Regrow's remote-sensing tillage algorithm reports field-level tillage activity, using residue cover as a proxy for soil disturbance. It evolved from OpTIS (the Operational Tillage Information System), developed with TNC and CTIC to measure conservation practice adoption across the US Corn Belt. OpTIS used the USDA Cropland Data Layer to define agricultural land and satellite data to detect residue, evaluated in 12-week seasonal windows and combined with the cropping system to estimate tillage impact.

Since then, the method has been refined for accuracy and specificity. Today, agricultural land is identified with Regrow's in-house field delineation model, and tillage observation windows are set dynamically from each field's crop emergence and senescence. Soil-moisture effects on the residue signal are better accounted for, so wet or dry conditions don't bias estimates, and residue thresholds now reflect crop-specific fragility. Monitor's models cover all of CONUS.

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

Regrow's cover crop algorithm reports field-level cover crop practices by detecting cover crop activity from satellite-measured vegetation greenness (NDVI) outside commodity cropping periods. Like the tillage algorithm, it evolved from the original OpTIS algorithms. OpTIS originally evaluated NDVI over the fall–spring cover crop period and reported a binary cover / no-cover result, excluding fields with winter commodities (per CDL).

Today the algorithm evaluates fields during dynamic, field-specific windows when commodity crops are absent, using regionally calibrated greenness thresholds. It now better distinguishes established cover crops from potential or poorly established ones; the dataset available via CTIC includes only acres classified as an established cover crop. As with tillage, cover crop adoption acreage is based on Regrow's in-house field delineation of agricultural land and is now available for all of CONUS.

Row crop lands included in our estimates

Corn (maize), Soybeans, Cotton, Wheat, alfalfa, dry bean, barley, canola, chickpea, clover, durum wheat, fallow, flax, perennial grass, pasture, hay, lentil, millet, oat, pea, peanut, potato, rice, ryegrass, rye, sorghum, spring wheat, sugar beet, sunflower, triticale, winter wheat, radish, beet, pumpkin, onion, sugarcane

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

Cover crop (per-pixel max NDVI, monthly composites):

- 2014–mid-2015: Landsat 7 ETM+, Landsat 8 OLI (surface reflectance)
- Mid-2015: adds Sentinel-2 L1C (top-of-atmosphere)
- 2016–2018: Landsat 8, Sentinel-2 L1C
- 2019–mid-2021: Landsat 8, Sentinel-2 L2A
- 2021+: Landsat 8, Landsat 9, Sentinel-2 L2A

Tillage/residue (NDTI from SWIR1/SWIR2 and a SWIR1/SWIR2 water index over pre-plant and post-harvest; NDVI as a mask):

- 2014–2018: Landsat 8
- 2019+: Sentinel-2 L2A

Cover crop and conservation tillage adoption may read higher in 2015–2017 due to sparser satellite coverage and sensors prior to Sentinel-2 availability.

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

For each field, mean monthly NDVI over the dynamic non-commodity window is compared to a regionally calibrated NDVI threshold (derived from surrounding natural vegetation, per year). By signal strength and persistence, a field is classed as Cover Crop (established), Potential Cover Crop (e.g. a cover crop that may not have established, weak greenness assoc. with weeds), or No Cover Crop.

Field acres are summed into Cover Crop (established only) and No Cover Crop. No Cover Crop includes no-cover and potential-cover fields and fields lacking enough time for a cover crop to establish between commodities (e.g. double-crops, select winter rotations - per CropID). Unobservable fields are excluded from the dataset. Cover crops are reported in the year the following commodity is harvested (e.g. a cover crop seeded fall 2023-spring 2024 prior to the 2024 corn, is reported in 2024). Only fields with annual row-crop acres are included; counties with under 1,000 row-crop acres are not reported.

How we categorize **Tillage**

For each pre-plant and post-harvest window (8–12 weeks, from CropID dates), the algorithm estimates weekly residue from moisture-adjusted NDTI (NDVI mask) and assigns a tillage class from the lowest-residue week. Residue is a proxy for tillage intensity, with thresholds that differ by crop fragility, since fragile residue decomposes faster:

Fragile (soybean, wheat, canola, cotton, etc.): conventional 0–15%, reduced 16–30%, no-till >30% residue.

Non-fragile (corn, sorghum, hay/alfalfa, etc.): conventional 0–30%, reduced 31–60%, no-till >60%.

Operations that remove residue or disturb soil (silage harvest, manure incorporation, residue/potato harvest) increase apparent tillage intensity.

Acres are summed to county by calendar year. For each field-year the reported class is the most intense across that year's pre-plant and post-harvest windows (e.g. conventional spring, no-till fall →conventional). For 2025, only spring (pre-plant) tillage is reported. Unobservable fields are excluded.

Our efforts to quantify estimate accuracy

Regrow validates practice estimates against independent ground-truth and reference datasets, using standard classification metrics (precision, recall, F1, confusion matrices). The published Monitor validation (Jones et al. 2024) used ~35,000 ground-truth observations across 19 U.S. states (2017–2022), drawn from the Maryland Department of Agriculture, internal MRV programs, OpTIS roadside surveys, and a Regrow field transect survey, and benchmarked results against the USDA NASS Census of Agriculture at the state level.

Validation is ongoing, with datasets and metrics refreshed if/when new ground-truth becomes available and as models are updated. The validation approach described in the 2024 publication remains current, though specific model versions have advanced since.

Published references describing our estimation methodology

Jones, M.O.; Figueiredo, G.; Howson, S.; Toro, A.; Rundquist, S.; Garner, G.; Della Nave, F.; Delgado, G.; Yi, Z.-F.; Ahn, P.; Barrett, S.J.; Bader, M.; Rollend, D.; Bendixen, T.; Albrecht, J.; Sogomo, K.; Musse, Z.Z.; Shriver, J. "Monitoring and Mapping a Decade of Regenerative Agricultural Practices Across the Contiguous United States." Land 2024, 13(12), 2246. https://doi.org/10.3390/land13122246

Note - the methodologies in the current dataset have undergone minor updates (some indices used and algorithmic improvements) since this publication was released. The general approach and validation methods are still applicable.

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

Beyond tillage and cover crops, Regrow's Monitoring platform includes crop type / crop identification, planting and harvest timing (crop emergence and senescence) datasets, crop

rotation, and land use change monitoring. Tillage and cover crop adoption rates can also be provided at field-level, and/or per crop.

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