Western Lake Erie Basin Conservation Dashboard

February 2025

A field with conventional tillage

Soybeans emerge after rye cover crop

This dashboard was prepared to describe the state of agricultural conservation practice adoption in Michigan's Western Lake Erie Basin (WLEB) using the best available datasets and other information, with an emphasis on remote sensing-based data products. The Nature Conservancy (TNC) has a partnership with Regrow Ag and the Conservation Technology Information Center (CTIC) to develop and apply the Operational Tillage Information System (OpTIS) for estimating certain agricultural management practices using remote sensing techniques. Regrow provided us with access to certain datasets, including cover crop usage and tillage practices, housed in its Sustainability Insights platform for the WLEB landscape at different spatial aggregation levels for the 2017-2022 period. To supplement the remote sensing-based data products, we also compiled and synthesized agricultural conservation adoption information from other sources. Included in the information that follows are various maps, charts, and tables with some commentary, and a discussion of the potential limitations of and future enhancements to agricultural conservation practice adoption tracking and reporting.

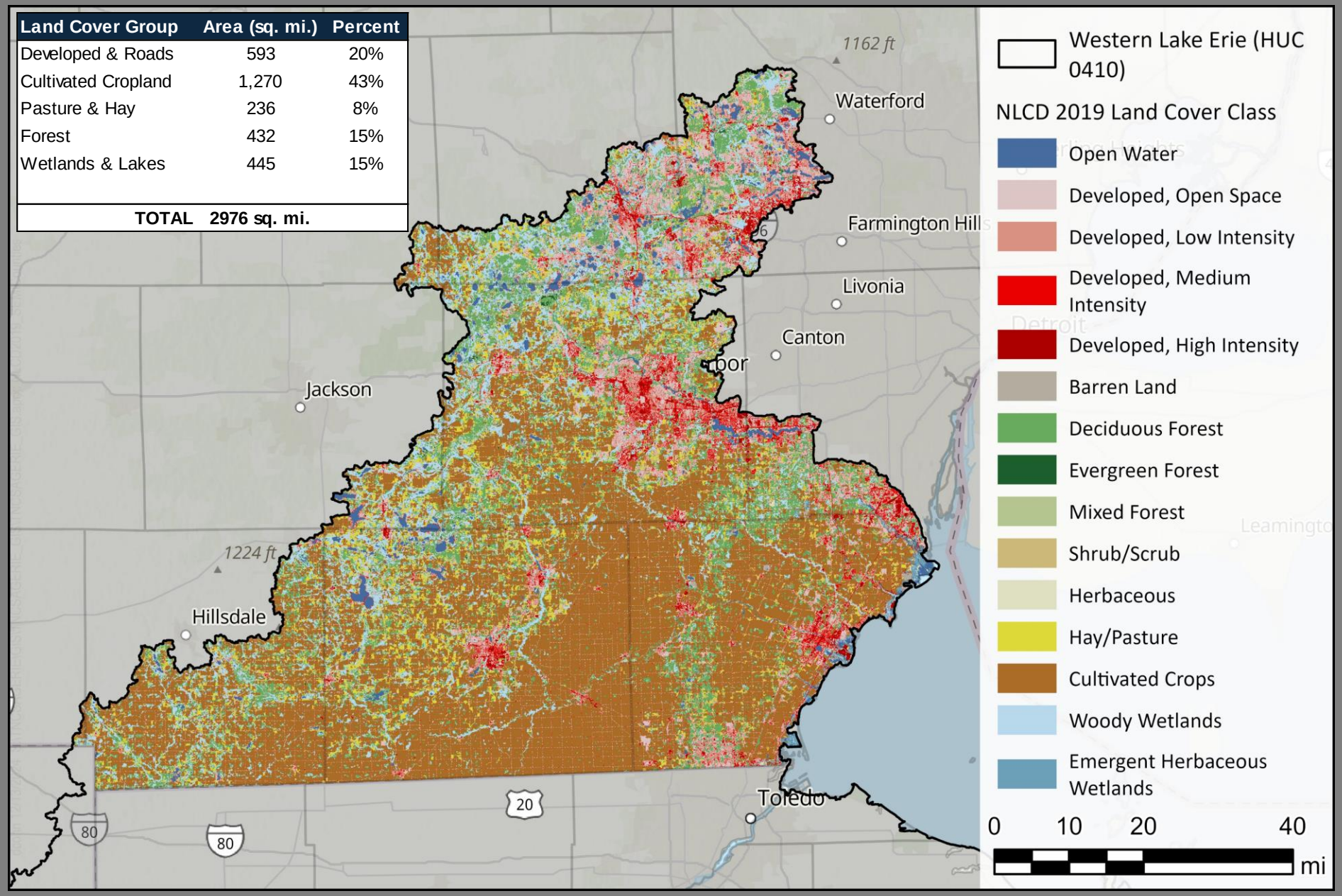
Harvesting a hay field

Corn residue on a no-tillage field

For the purposes of this analysis, the Huron River, River Raisin, Bean Creek (Tiffin River), St. Joseph River, and Ottawa-Stony drainages are considered in Michigan's WLEB drainage area. The Huron, Raisin, and Ottawa-Stony watersheds empty into Lake Erie along Michigan's shoreline, while the St. Joseph River and Bean Creek watersheds eventually flow into Lake Erie via the Maumee River at its mouth in Toledo, Ohio.

Michigan's WLEB landscape covers nearly 3,000 square miles and contains a mix of different land uses, with cultivated cropland representing the majority at 43%. Cultivated cropland in this part of the state is mostly used for corn and soybean production. Developed land use including residential, commercial, and industrial areas and various roads and highways can be found throughout the watershed, with relatively more development in the Huron River watershed compared to other areas. The largest communities include Ann Arbor, Ypsilanti, Brighton, Monroe, Adrian, and various other cities in the Detroit metro area. A meaningful portion of the watershed is classified as natural land use categories (30%) including different forest, wetland, and water classifications. Unlike other areas of the state, however, most of these natural areas are interspersed with rural residences or lake shoreline developments.

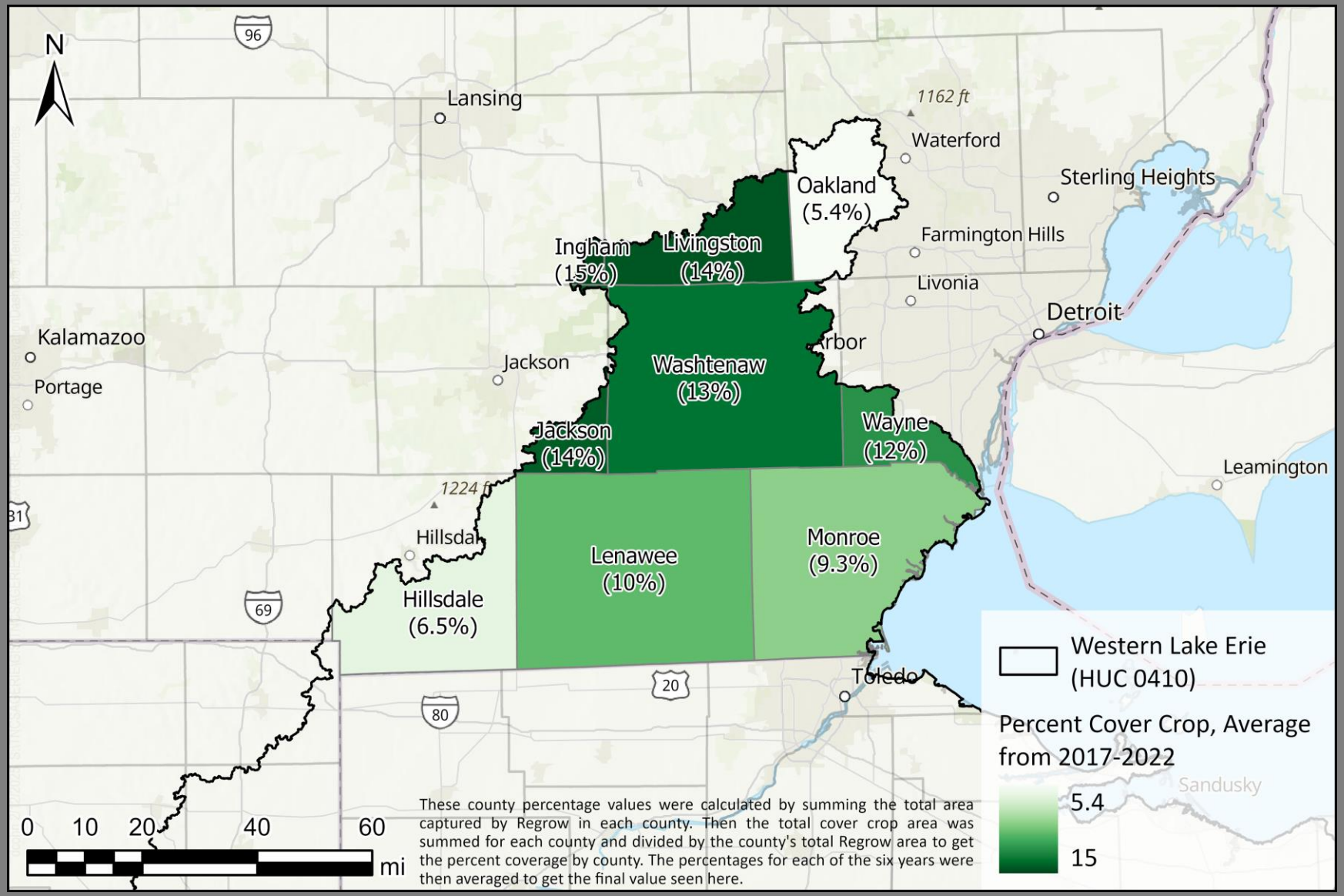
Land Cover Group	Area (sq. mi.)	Percent
Developed & Roads	593	20%
Cultivated Cropland	1,270	43%
Pasture & Hay	236	8%
Forest	432	15%
Wetlands & Lakes	445	15%
TOTAL	**2976 sq. mi.**	



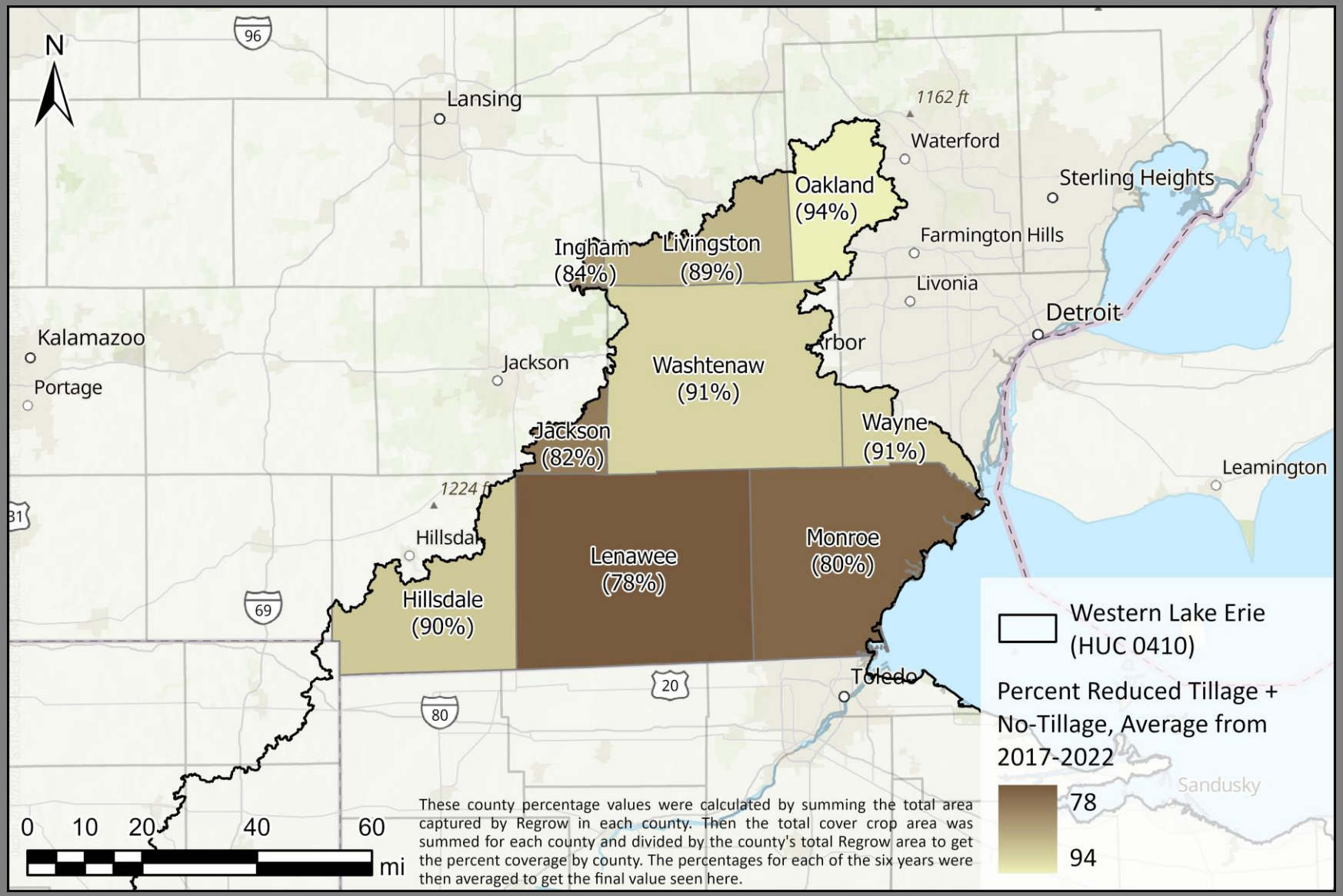
OpTIS Data

Through its partnership with Regrow Ag and the Conservation Technology Information Center (CTIC), TNC was able to obtain Operational Tillage Information System (OpTIS) data at two spatial resolutions; county scale and HUC-12 watershed scale. While the dataset included relatively novel estimates of certain carbon-related indicators, our analysis focused on cover crop and tillage practice usage by year. The dataset was complete for the 2017-2022 period. The maps and time series plots that follow are presented at the HUC-8 watershed scale, an aggregation of the HUC-12 watersheds, and at the county scale for Michigan's WLEB drainage area.

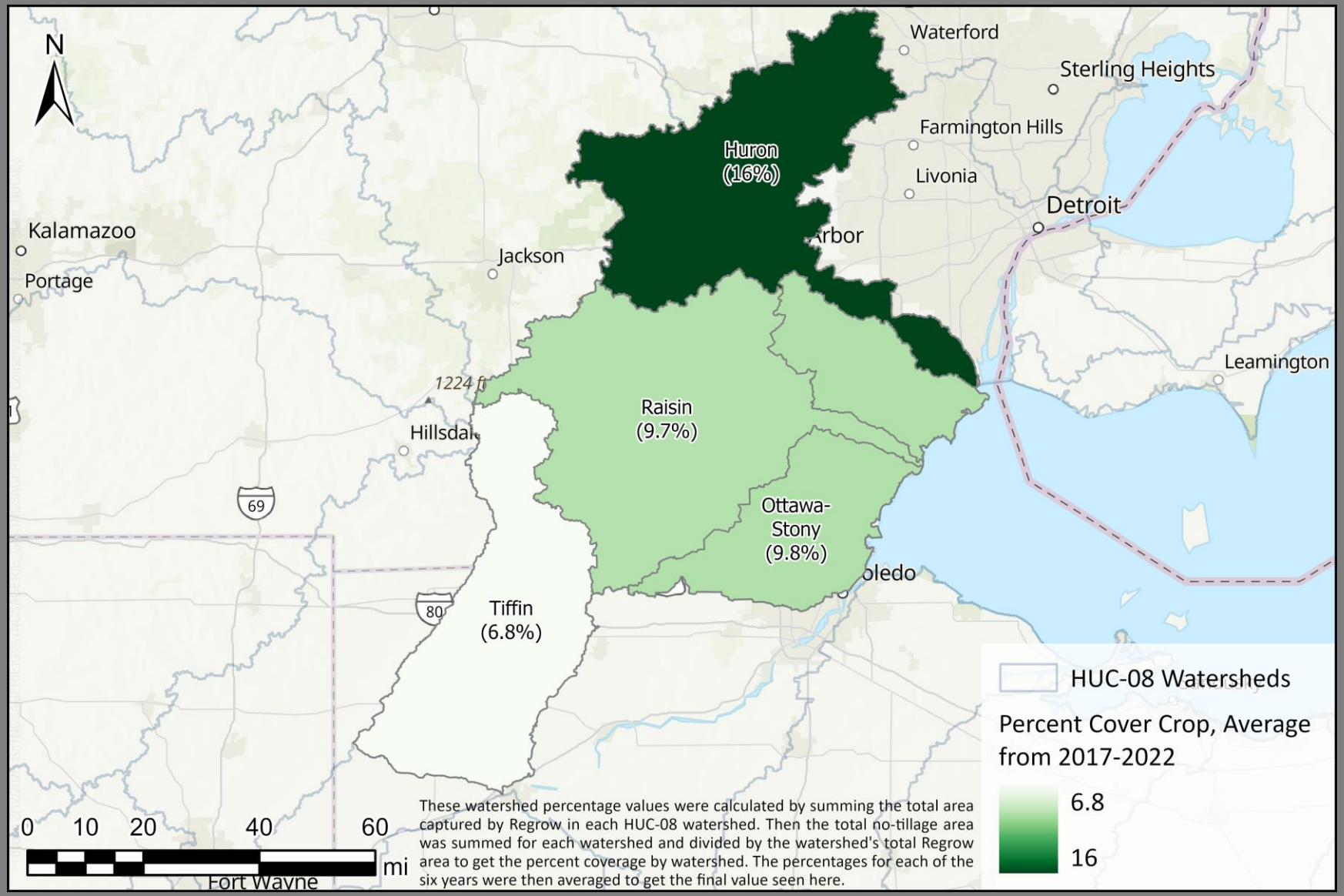
Average Percent Cover Crop by County for the 2017-2022 period



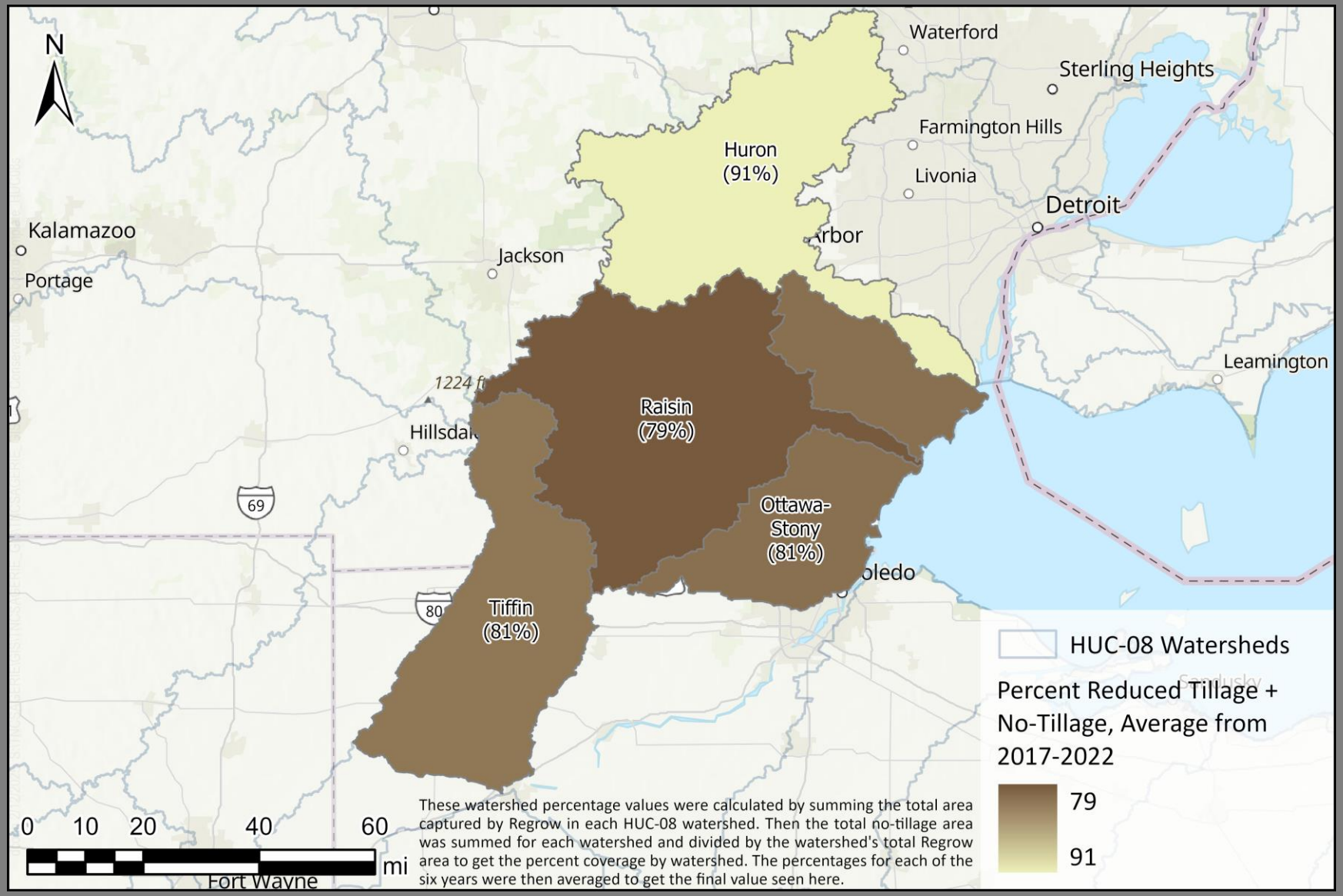
Average No-Tillage and Reduced Tillage by County for the 2017-2022 period



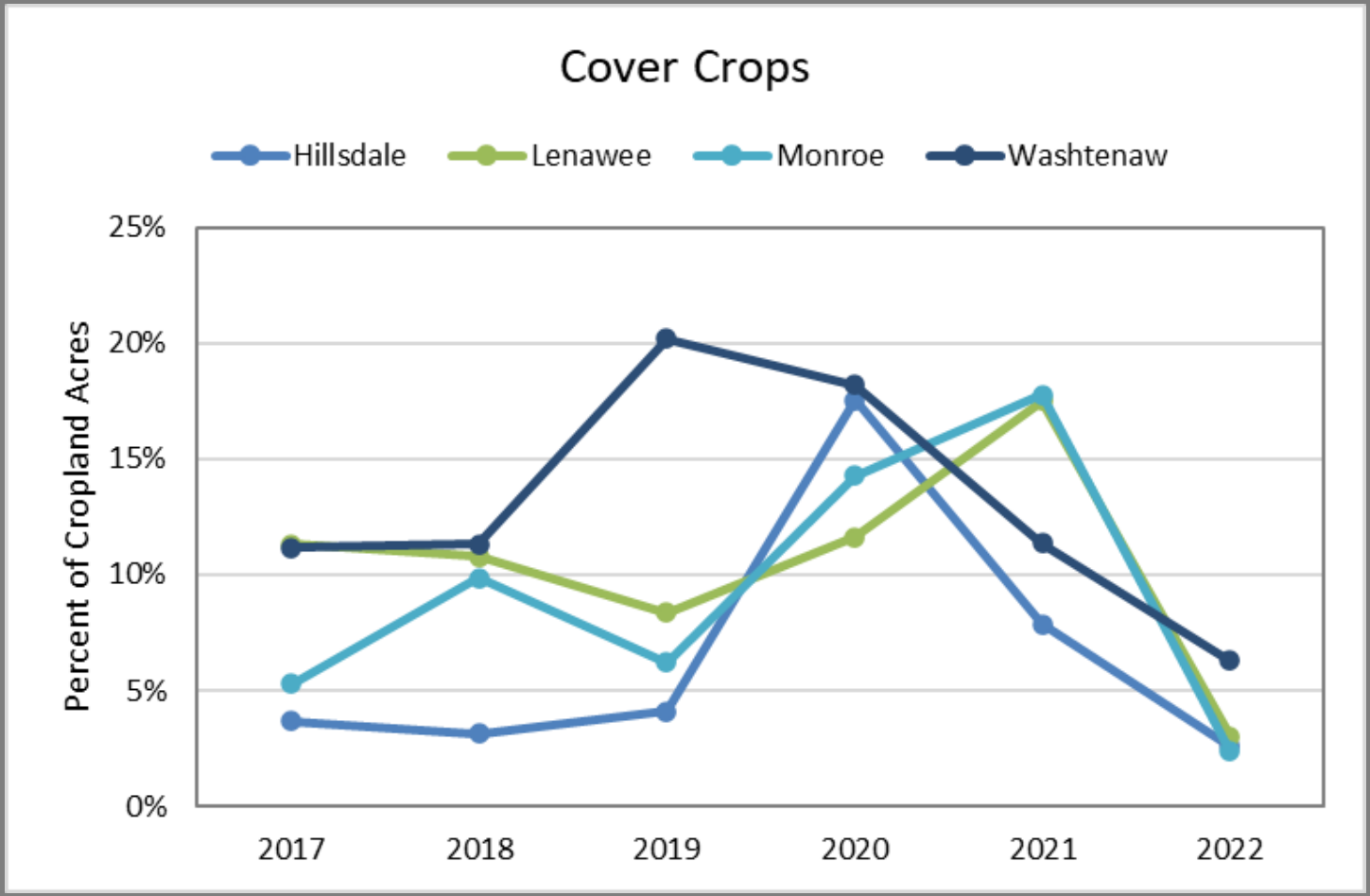
Average Percent Cover Crop by Watershed for the 2017-2022 period



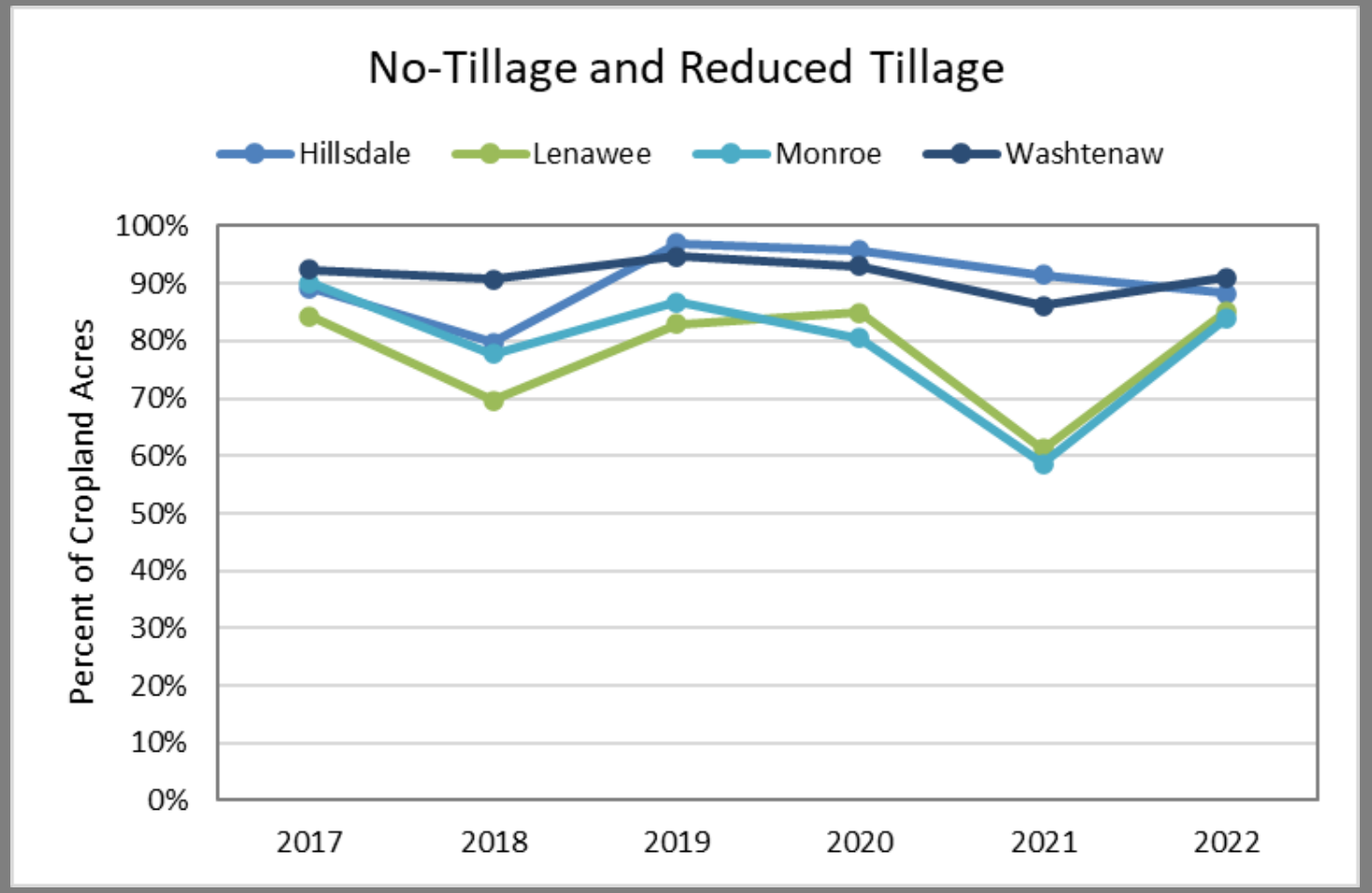
Average No-Tillage and Reduced Tillage by Watershed for the 2017-2022 period



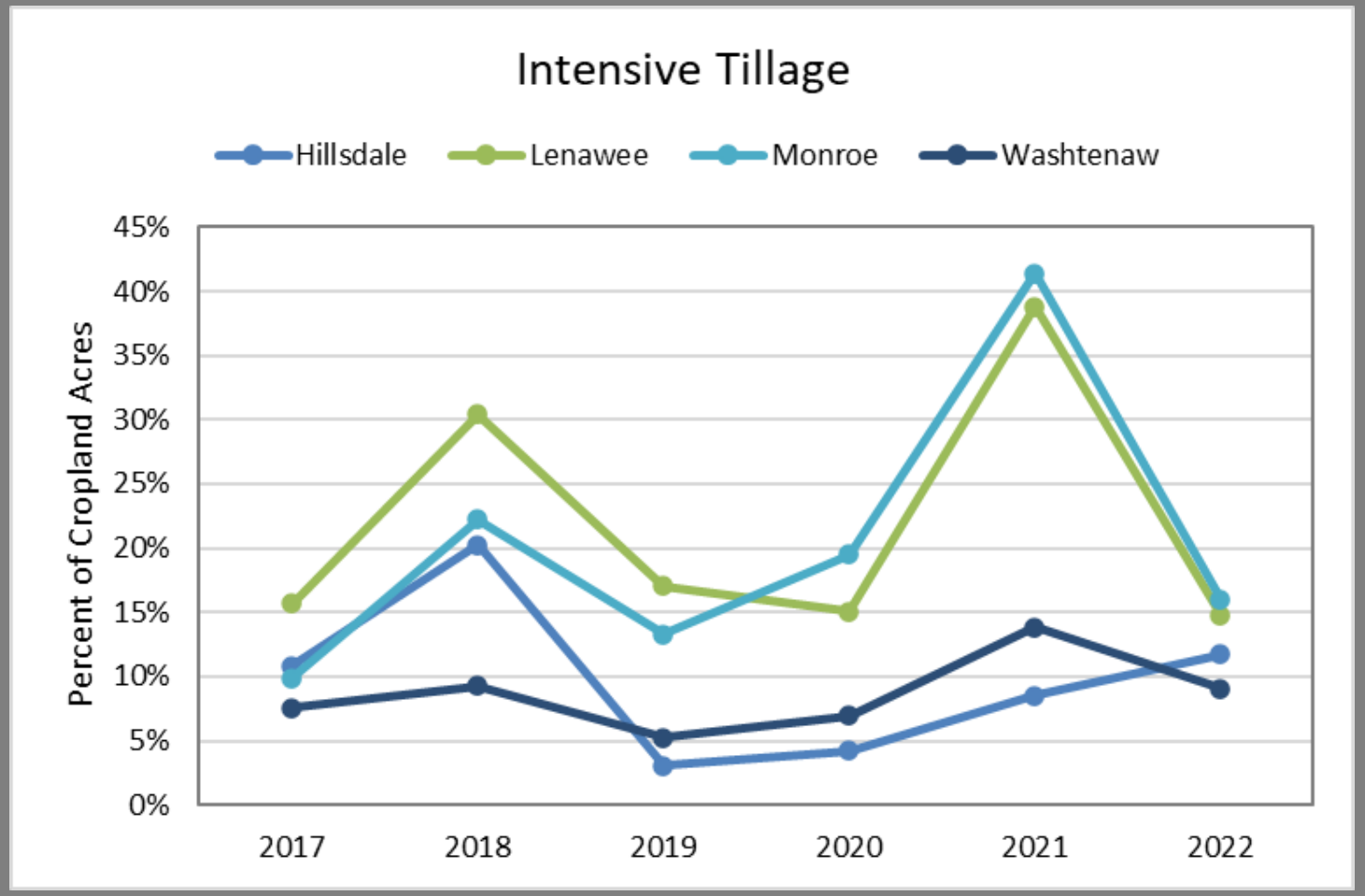
Cover Crops by County for the 2017-2022 period



No-Tillage and Reduced by County for the 2017-2022 period



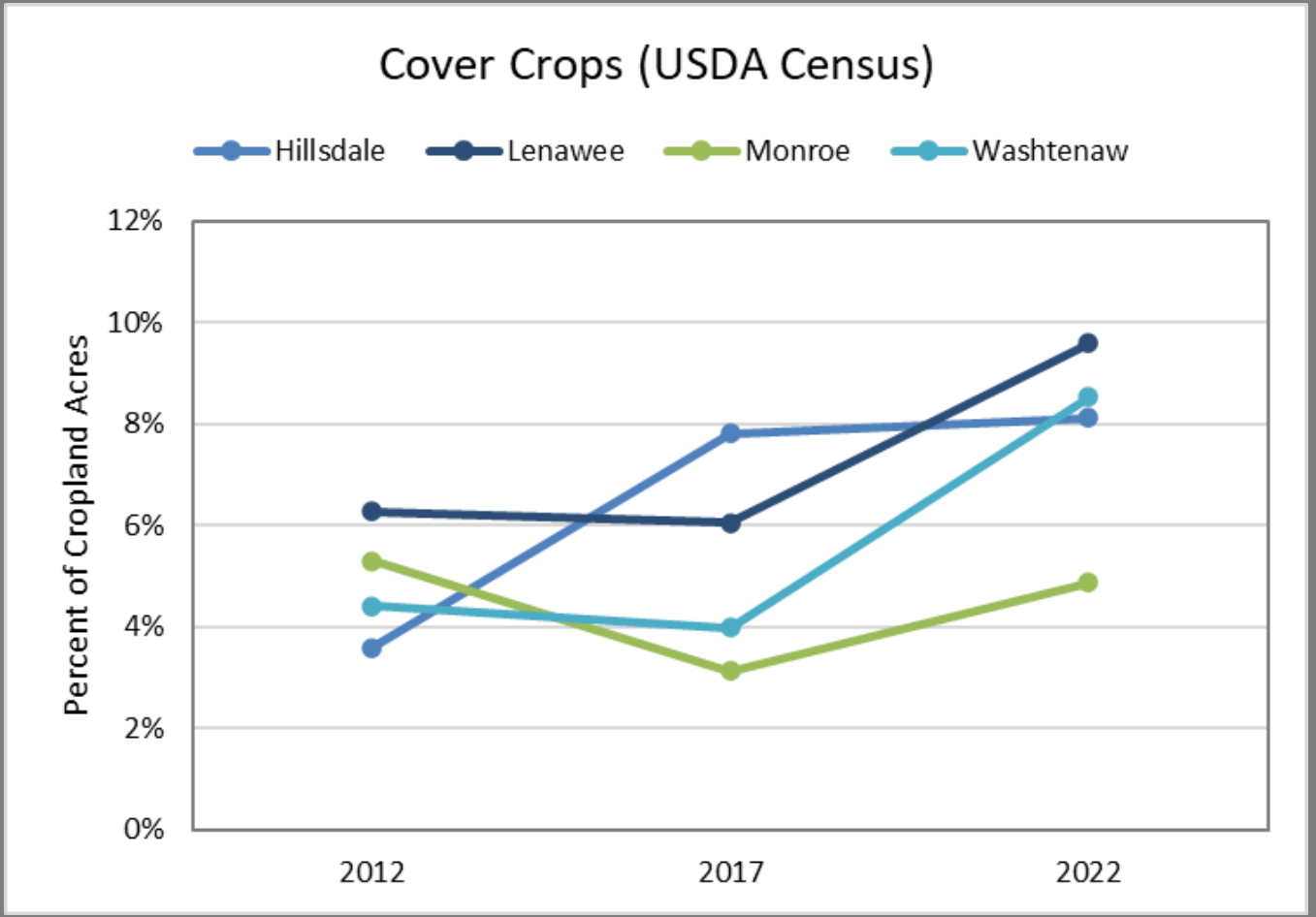
Intensive Tillage by County for the 2017-2022 period



USDA Census and CRP Data

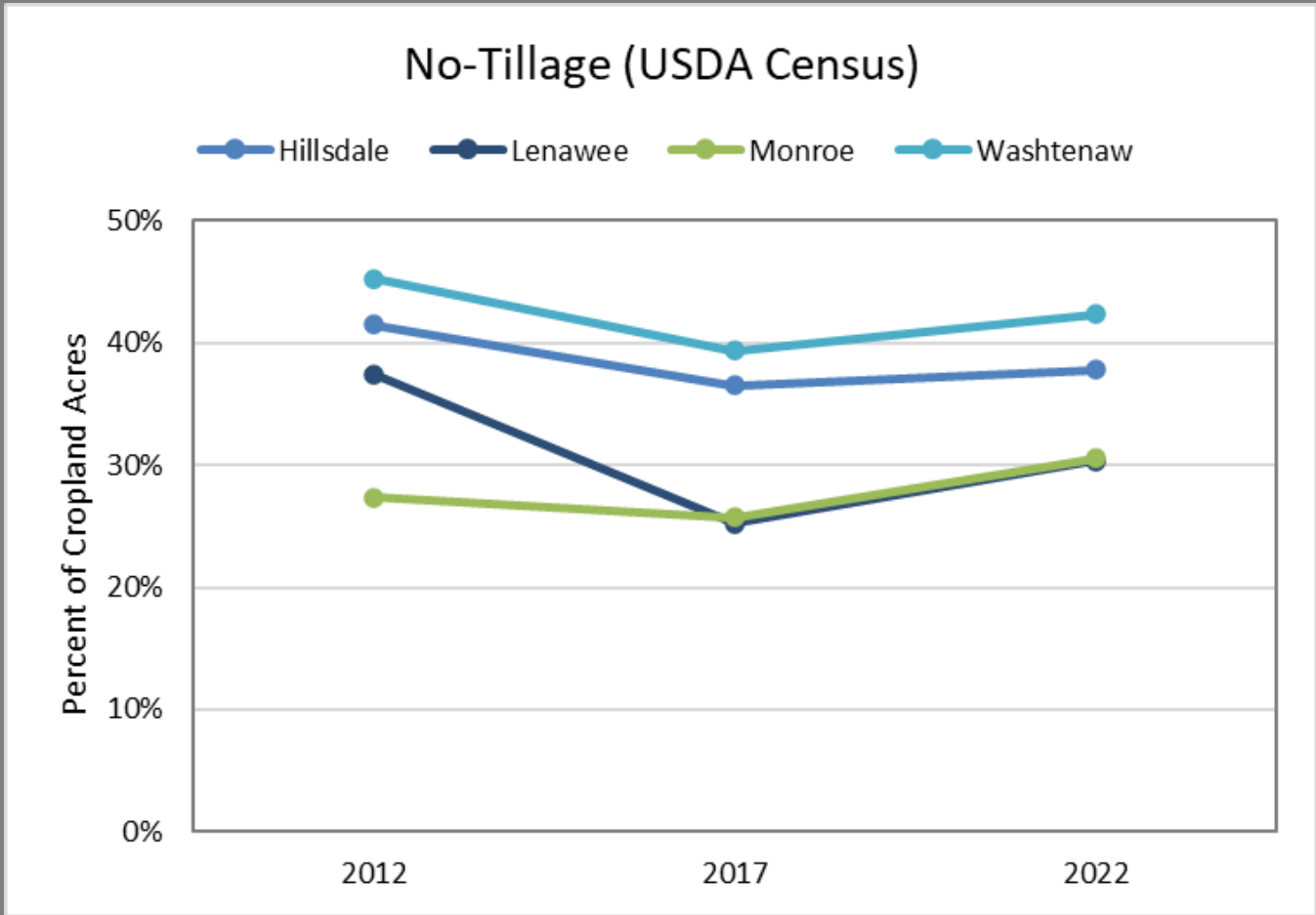
The following analyses were completed using county level data reported in the 2017 and 2022 Census of Agriculture, Geographic Area Series for the State of Michigan, which includes estimates reported for the 2012, 2017, and 2022 census years. Results are summarized for Hillsdale, Lenawee, Monroe, and Washtenaw counties, the four counties with most or all their land area in the Lake Erie watershed and relatively higher proportions of cultivated cropland compared to other WLEB counties. Like the analysis of OpTIS data, focus is on use of cover crops and tillage practices. Following the analysis of census data is a presentation of Conservation Reserve Program (CRP) data for Lenawee, Monroe, and Washtenaw counties, emphasizing two structural BMPs for improving water quality: filter strips and riparian buffers.

Cover Crops by County for 2012, 2017, and 2022



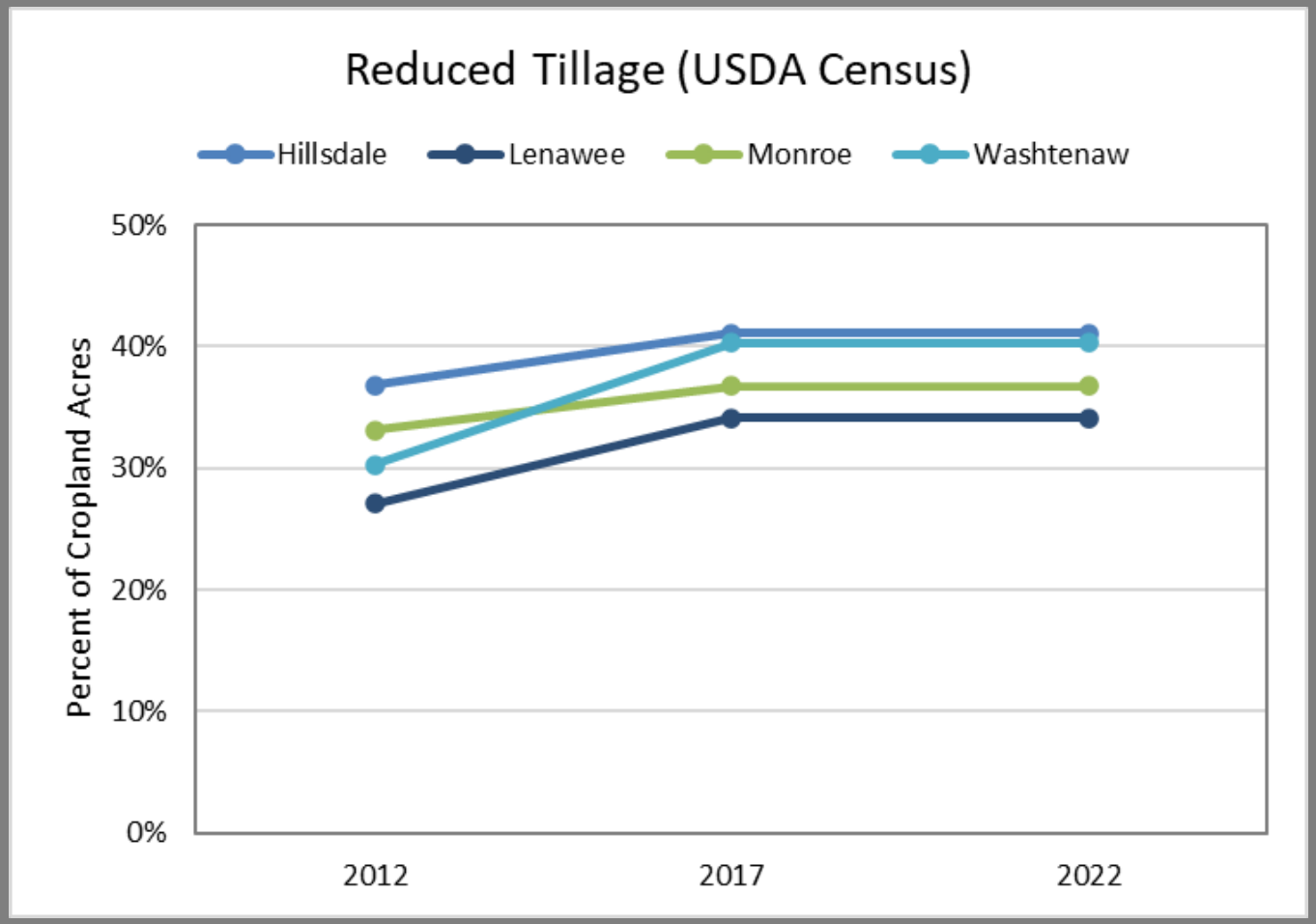
Source: USDA NASS (2019 and 2024)

No-Tillage by County for 2012, 2017, and 2022



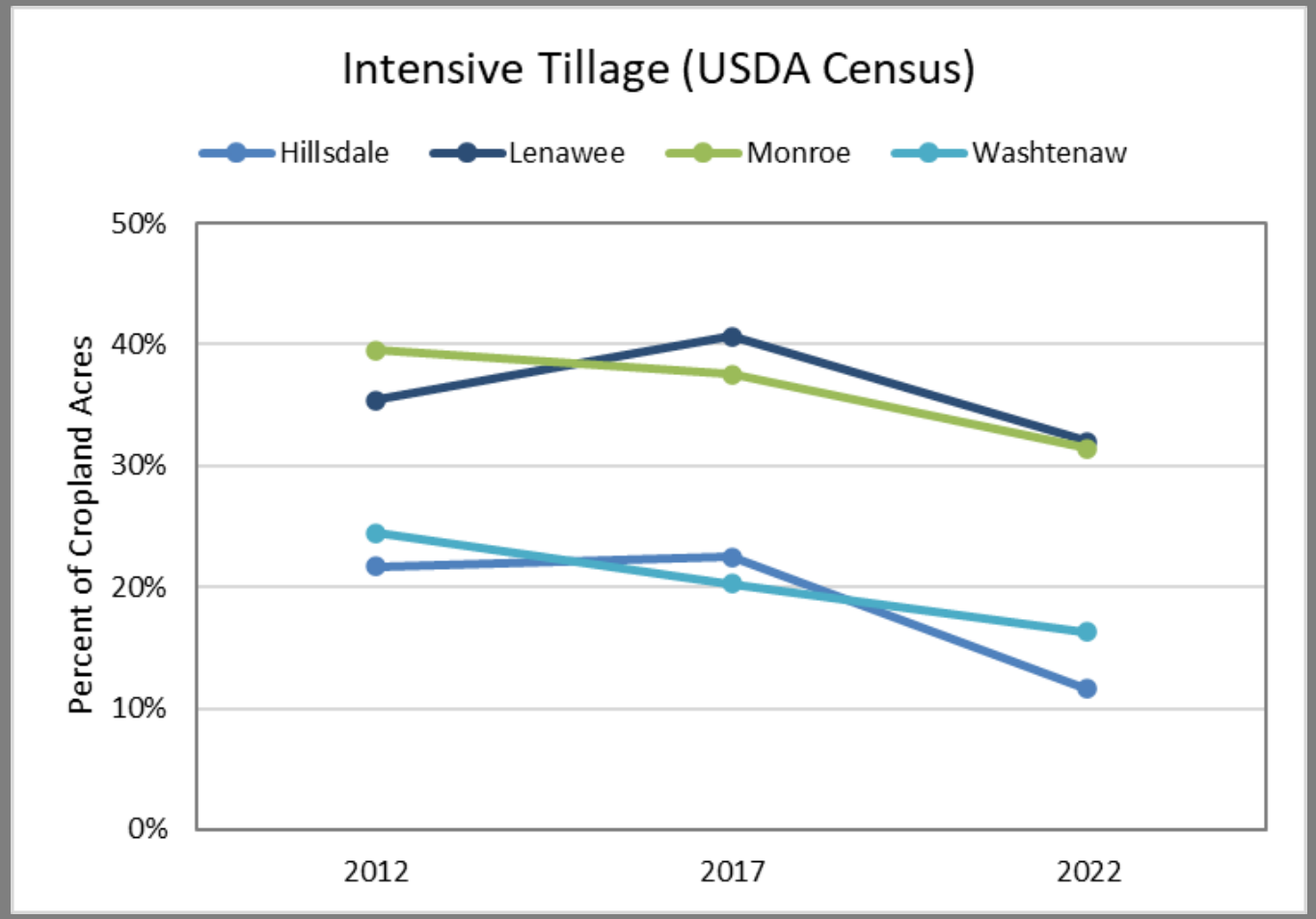
Source: USDA NASS (2019 and 2024)

Reduced Tillage by County for 2012, 2017, and 2022

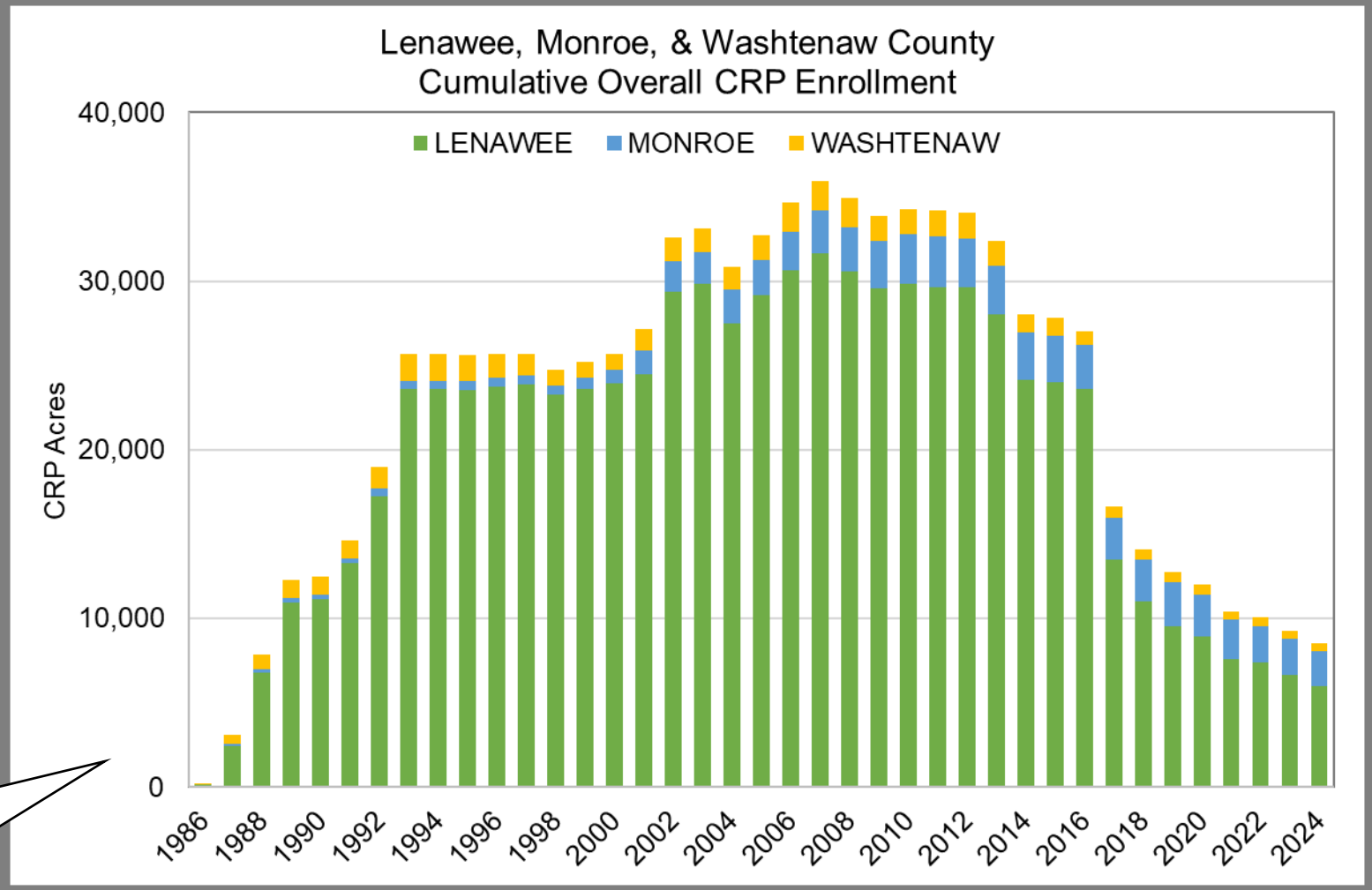


Source: USDA NASS (2019 and 2024)

Intensive Tillage by County for 2012, 2017, and 2022



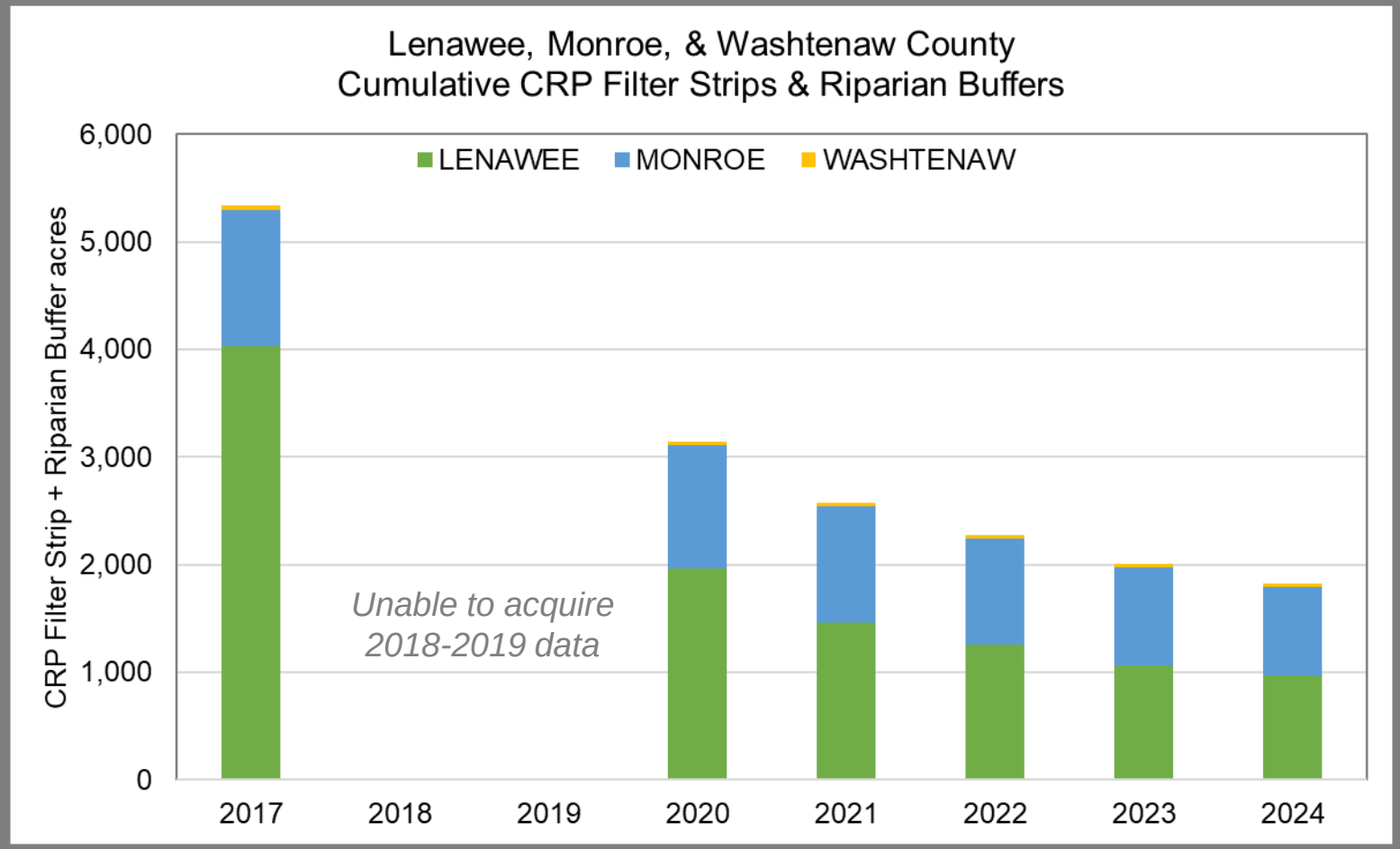
Source: USDA NASS (2019 and 2024)



This analysis extends a similar evaluation illustrated in Michigan's 2021 Adaptive Management Plan for Lake Erie, which showed the sharp decline in annual CRP enrollment first beginning in 2014 and continuing through 2024.

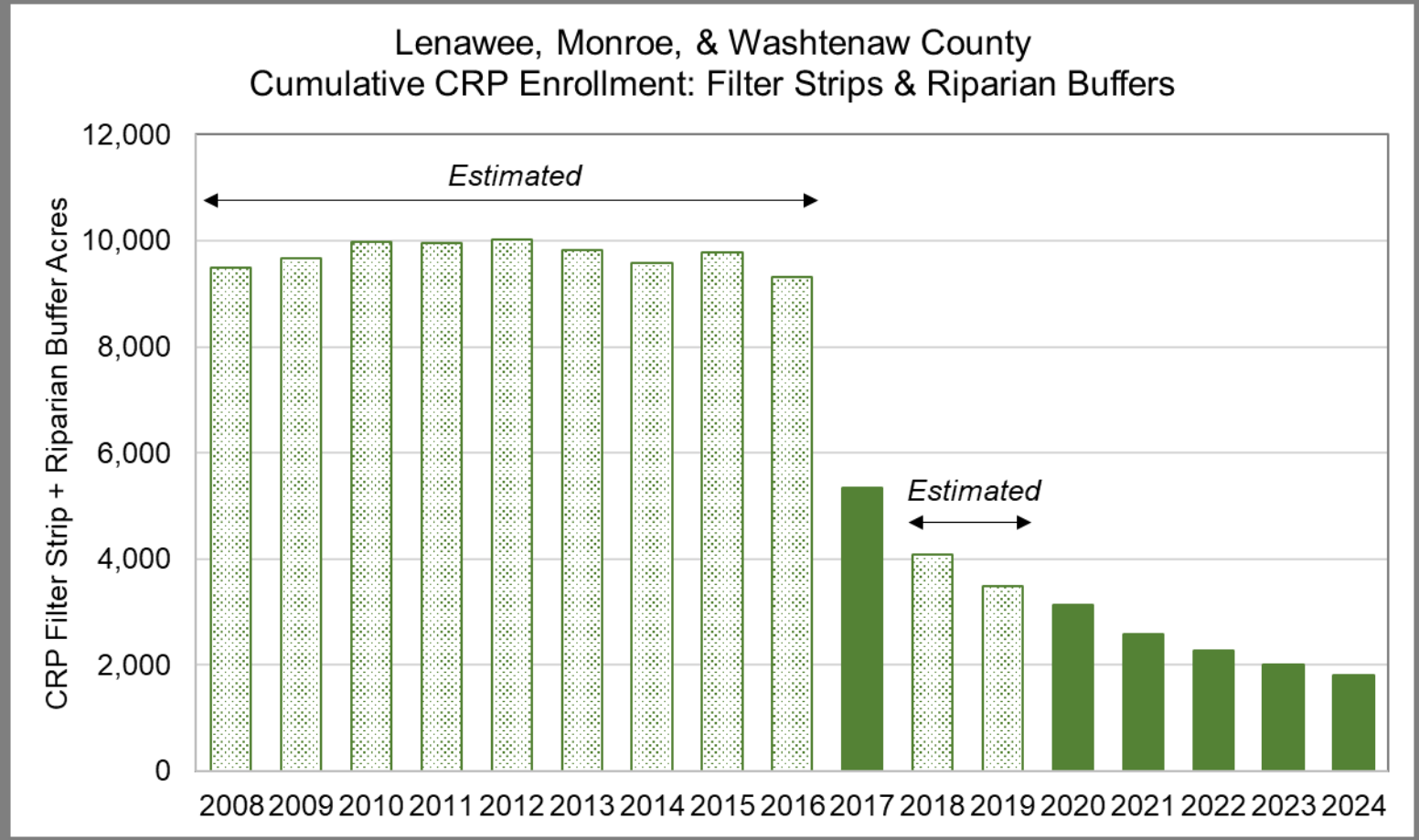
In the late 1990s, Lenawee County had approximately 15 times more Conservation Reserve Program (CRP) enrollment than Monroe and Washtenaw counties combined.

Source: USDA FSA CRP Statistics (2024)



Inspection of this CRP filter strip and riparian buffer enrollment for the 2017-2024 period suggests that the greatest decline in enrollment has been in Lenawee County, which started with much higher overall levels than Monroe and Washtenaw counties for these two practices.

Source: USDA FSA CRP Statistics (2024)



This analysis projected backward in time the proportion of CRP enrollment acres that was attributable to filter strips or riparian buffers. It shows that for the three counties listed, there has been a decline of more than 80% since peak enrollment years (2008-2012) relative to the present (2024).

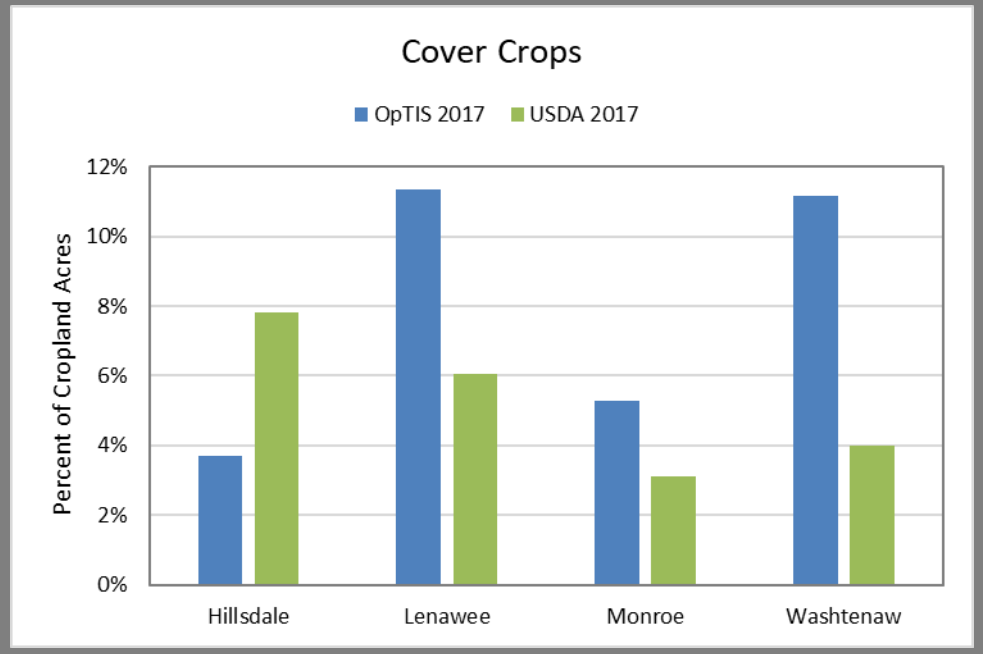
Values indicated as "Estimated" were computed by multiplying the total CRP acres for each year (which was available in the dataset) by the estimated percentage of filter strips and riparian buffers. The estimated percentage of these two BMPs used a correlation for the three counties and the statewide percentage in filter strips in riparian buffers for 2017 and 2020-2024, the period with both county-level and statewide reporting of individual CRP practice types.

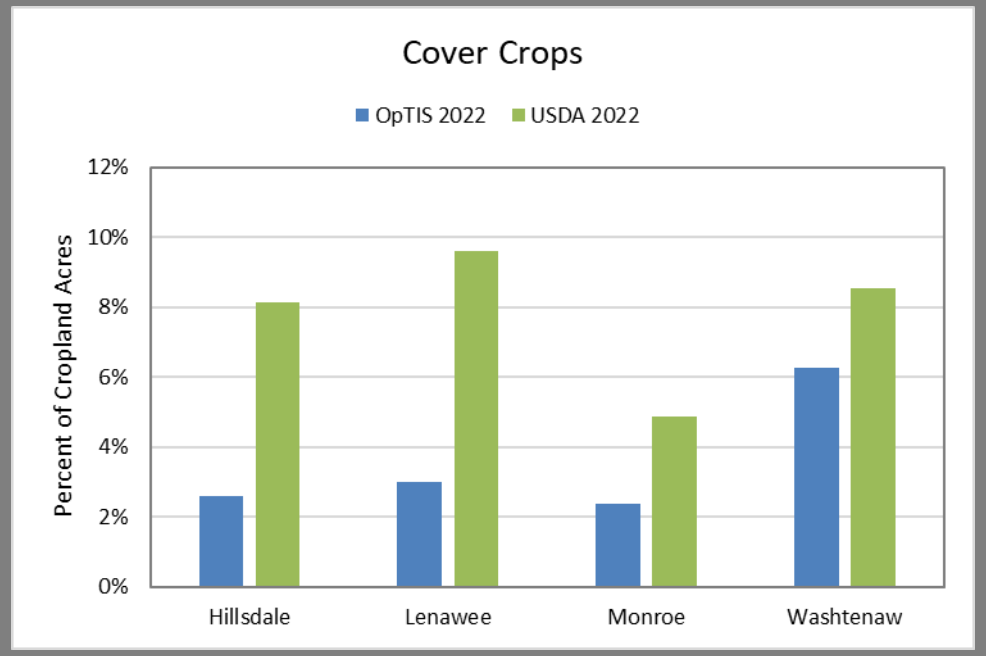
Source: USDA FSA CRP Statistics (2024)

Comparison of OpTIS and USDA

The following analyses were completed using county level data reported in the 2017 and 2022 Census of Agriculture and OpTIS data provided for 2017 and 2022. The focus of the comparisons is on cover crops and tillage practices.

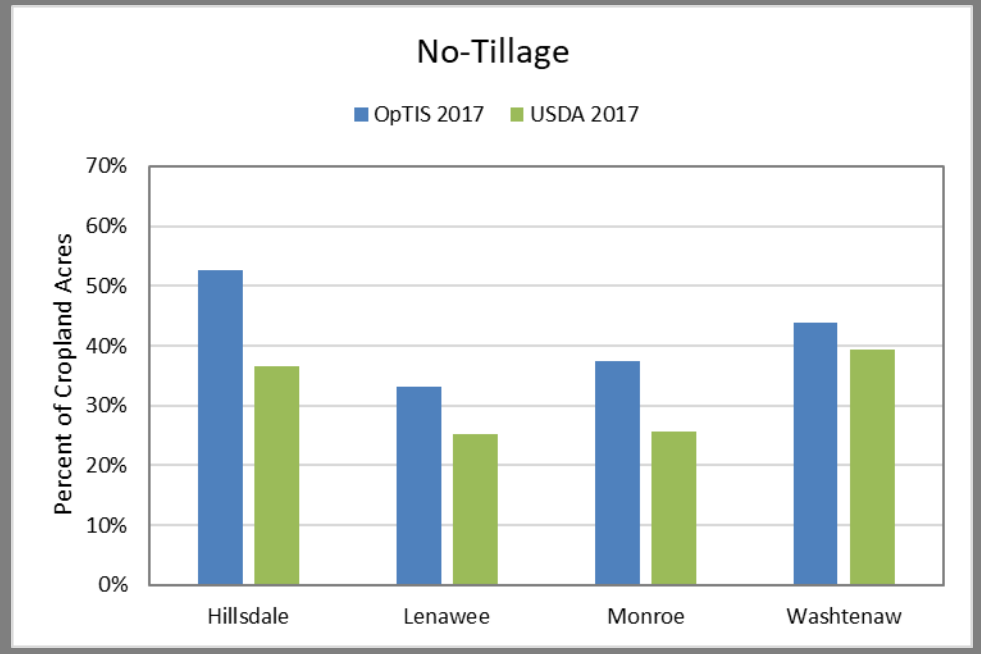
OpTIS vs. USDA 2017 and 2022 Census of Agriculture

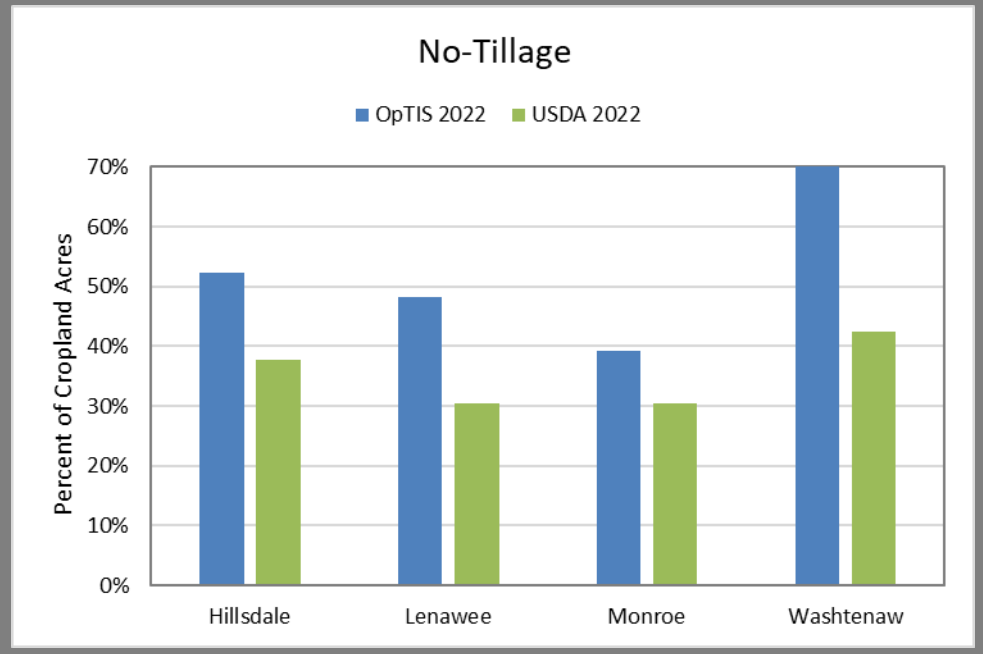




OpTIS and USDA Census data for cover crop use for these counties were generally not well correlated with each other. Overall, however, both datasets suggest that cover crop adoption is relatively low, in the 4-10% range, relative to total cropland acres.

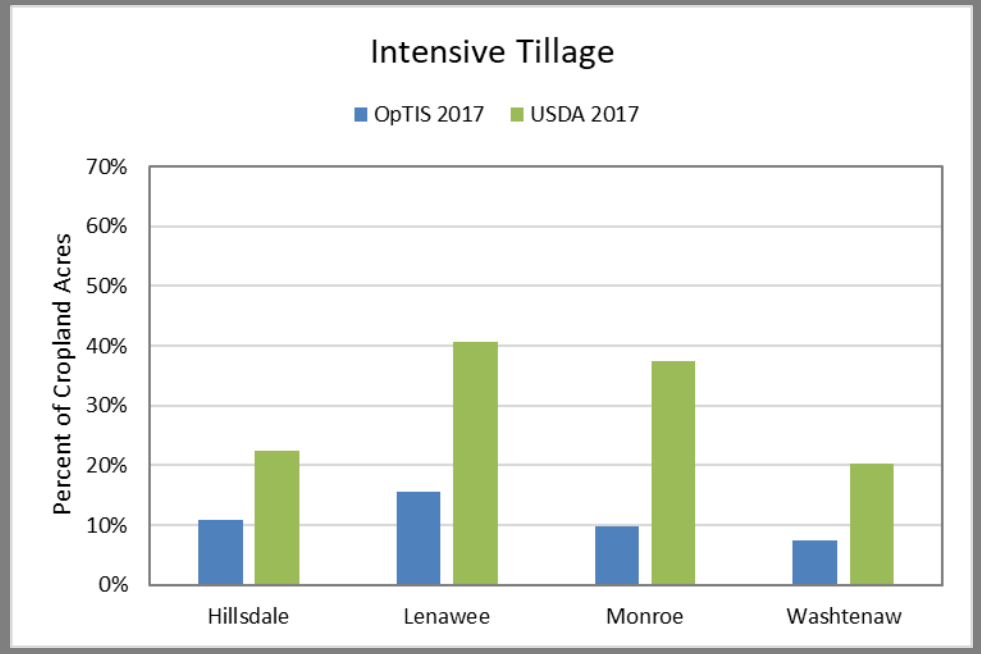
OpTIS vs. USDA 2017 and 2022 Census of Agriculture

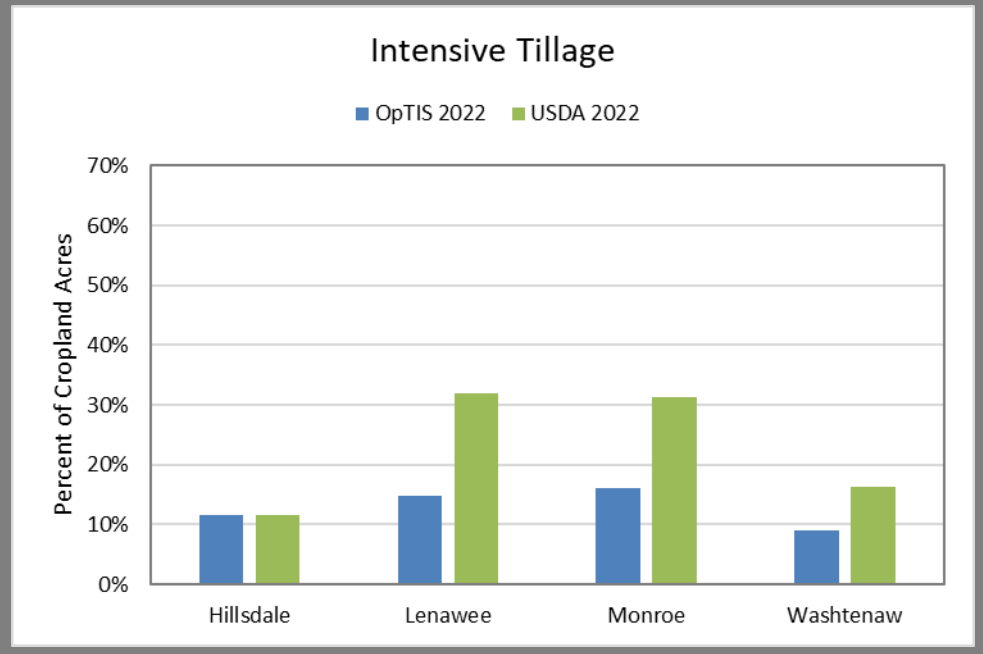




OpTIS and USDA Census data for no-tillage for these counties were relatively similar for 2017 and 2022, in terms of approximate magnitude and variability by county, though the OpTIS data consistently suggested higher no-tillage than the USDA Census data. The pattern in no-tillage adoption by county was generally similar between the two datasets, with Lenawee and Monroe counties having lower adoption levels.

OpTIS vs. USDA 2017 and 2022 Census of Agriculture

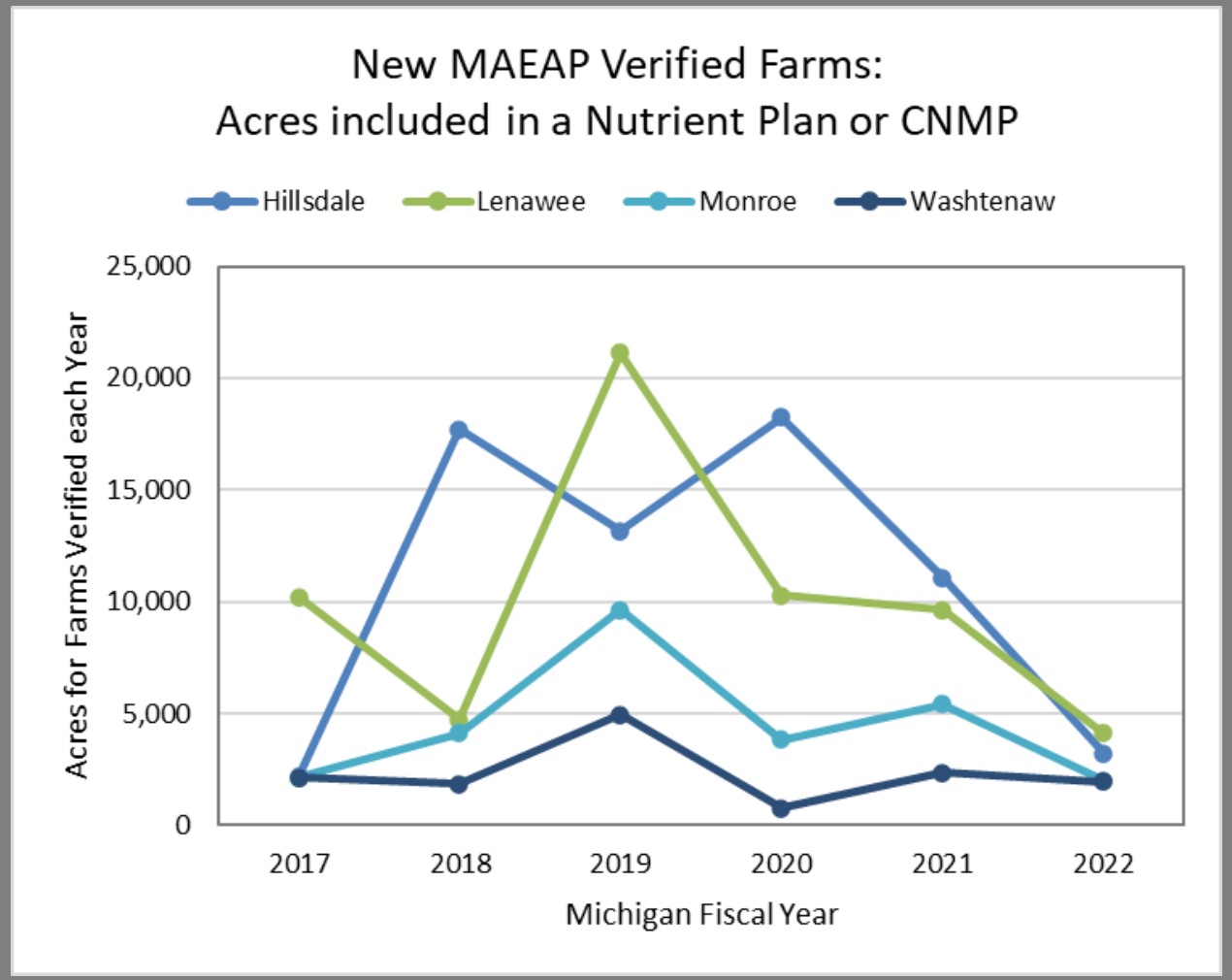




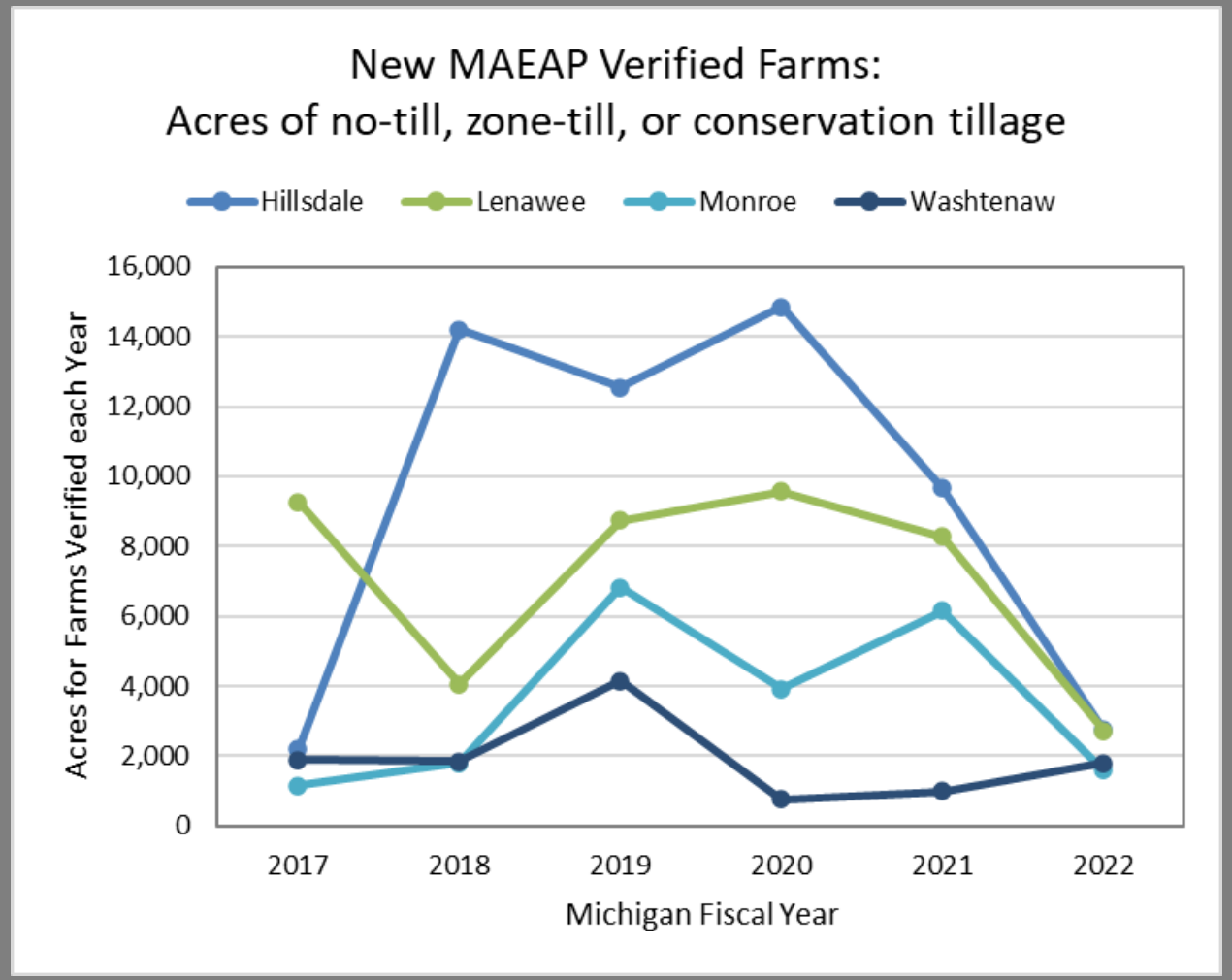
OpTIS and USDA Census data for intensive tillage for these counties were generally not well correlated with each other. Except for Hillsdale County in 2022, the USDA Census data suggested higher intensive tillage compared to the OpTIS.

MAEAP Data

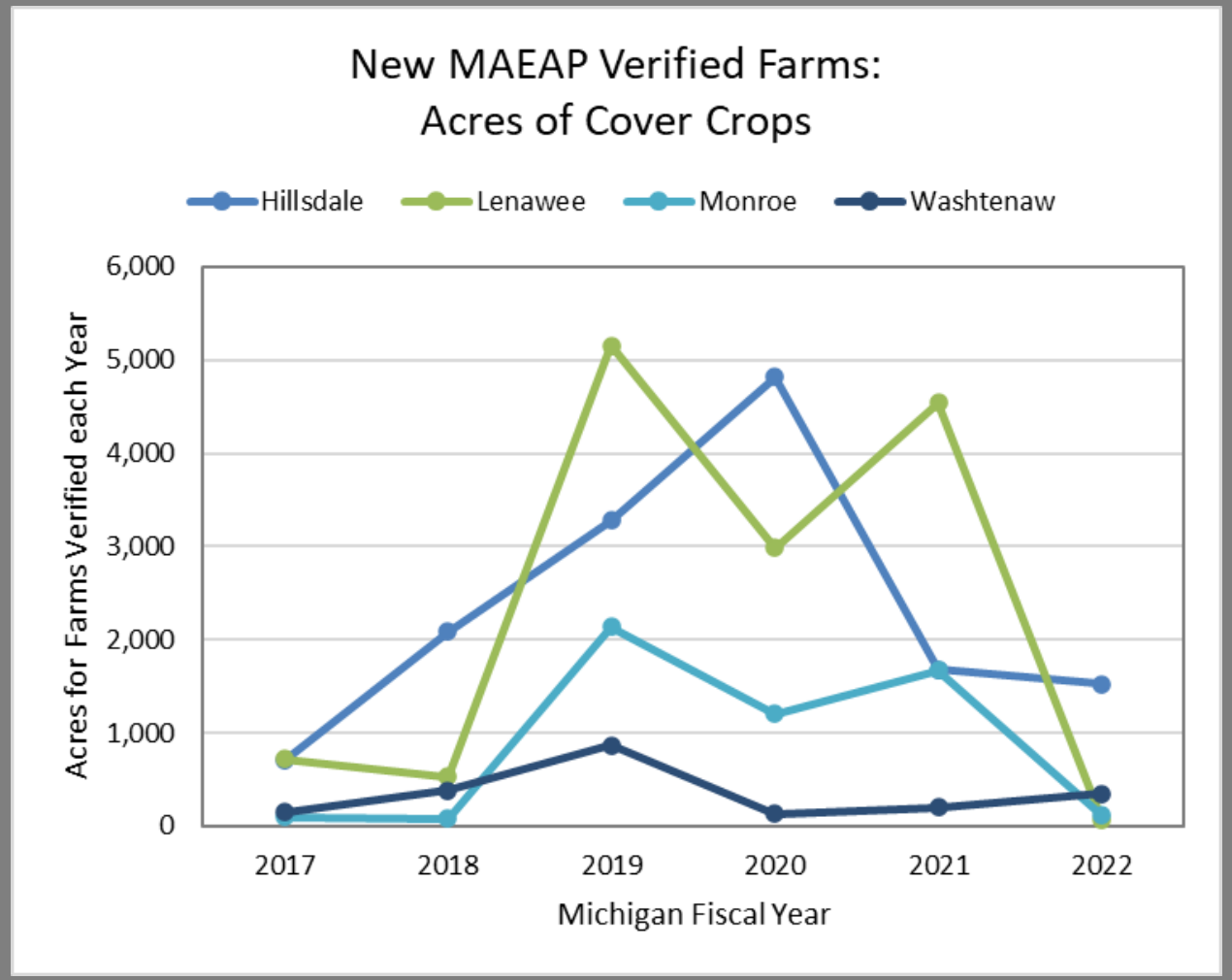
The following analyses were completed using county level data reported in annual legislative reports filed on behalf of MDARD to fulfill requirements of the Michigan Agriculture Environmental Assurance Program (MAEAP). Results were compiled for state fiscal years 2017 through 2022. Results are summarized for Hillsdale, Lenawee, Monroe, and Washtenaw counties, as described above as the four primary WLEB counties of interest. The graphical results by county focus on nutrient management, cover crops, and tillage. Tabular results are also provided as the four-county total for all nine practice categories and sediment and nutrient load reduction estimates for the 2017-2022 period. The MAEAP reporting strictly represents the annual accounting of operations and BMPs that have gone through the verification process or renewal process. It is not meant to be an indicator of temporal or spatial trends agricultural conservation practice adoption across the state or individual counties.



Source: MAEAP Annual Legislative Reports (2017-2022)



Source: MAEAP Annual Legislative Reports (2017-2022)



Source: MAEAP Annual Legislative Reports (2017-2022)

MAEAP Four-County Totals (Hillsdale, Lenawee, Monroe, & Washtenaw) for the 2017-2022 period

Environmental Outcome	2017	2018	2019	2020	2021	2022
Acres included in a nutrient plan or CNMP	16,692	28,410	48,888	33,108	28,499	11,310
Acres or linear feet of buffer/filter strips	295 acres	187,441 feet	656 acres	519 acres	202,547 feet	129,161 feet
Acres of cover crops	1,673	3,077	11,440	9,146	8,083	2,044
Acres of conservation tillage	6,023	13,553	14,345	11,646	10,557	6,322
Acres of no-till, zone till, or grass cover	8,405	10,419	19,170	16,848	13,034	2,922
Number of gullies stabilized	38	213	63	142	60	14
Feet of livestock exclusion	3,600	8,220	250	23,400	1,700	0
Size of silage pad (acres)	0	10	0.6	1.0	10	0
Acres of Pest Management Plans	16,465	26,859	48,206	32,478	27,301	11,202
Sediment reduced (tons)	24,328	41,409	72,193	49,011	42,210	16,911
Phosphorus reduced (pounds)	38,924	66,255	116,133	79,378	68,521	27,097
Nitrogen reduced (pounds)	77,849	132,510	234,655	162,762	138,210	53,554
BOD-5 reduced (pounds) from sileage leachate	0	588,902	35,334	58,889	61,245	0

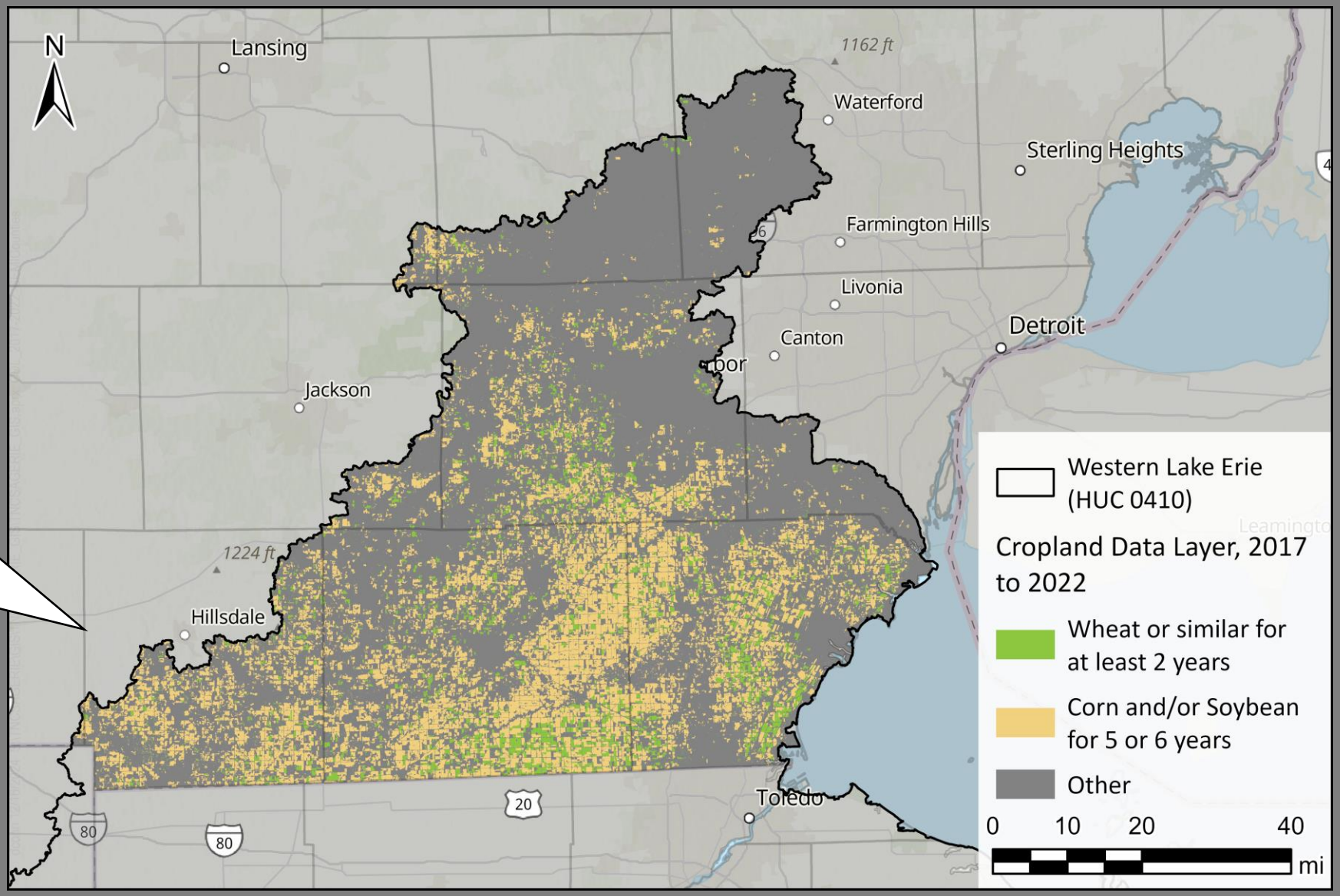
Source: MAEAP Annual Legislative Reports (2017-2022)

Other Recent Analyses

The following analyses demonstrate additional methods for evaluating the status of agricultural conservation practice adoption, specifically with recent applications that have been completed for certain subwatersheds within the WLEB or for the entire WLEB (Cropland Data Layer, CDL). The CDL evaluation shows cultivated cropland areas that used winter wheat in two years out of the six-year period 2017-2022 compared to those fields that used corn or soybeans in five or six years during that same period. Following the CDL analysis is an evaluation that quantified the presence of riparian filters, grassed waterways, and WASCOBs in Michigan's five priority HUC-12 subwatersheds via manual inspection of satellite imagery. A similar evaluation of filter strips was conducted for fields in the Ottawa-Stony North HUC-10 watershed via manual inspection techniques. Finally, results from windshield inventories of fall tillage, spring residue, and cover crops conducted during 2021 and 2022 in the Ottawa-Stony North watershed is presented.

Crop Rotation Information for the 2017-2022 period

This evaluation of CDL data provides insights into which areas of Michigan's WLEB use a relatively more intense crop rotation compared to a more diverse or conservation crop rotation.



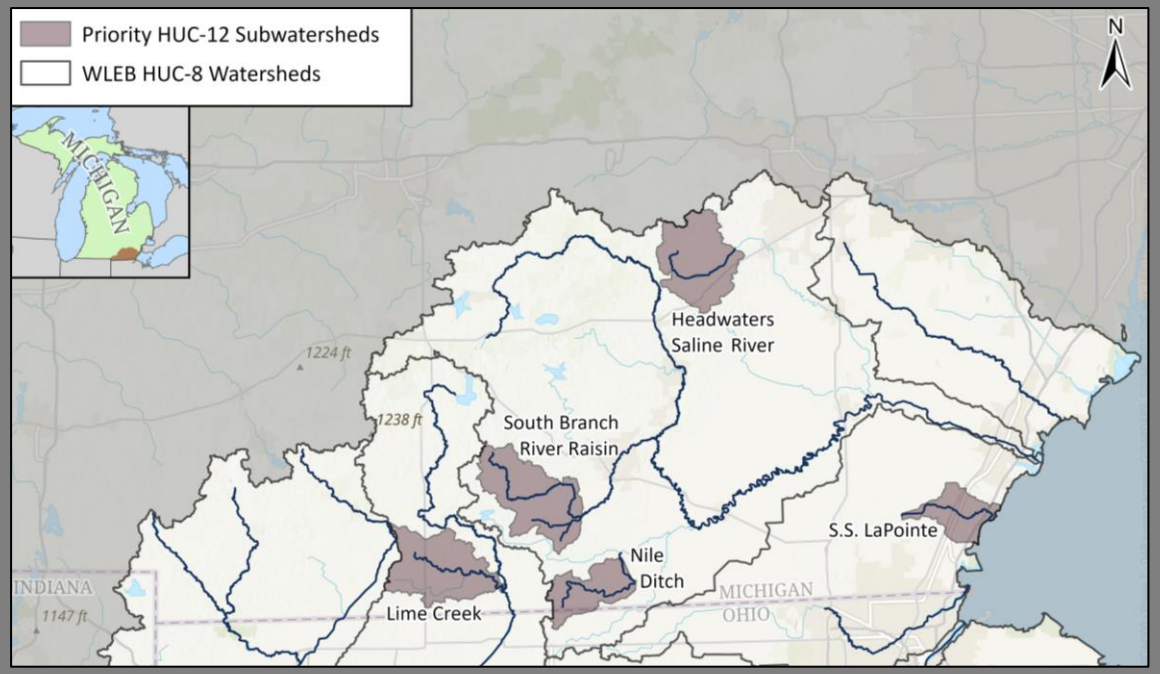
Source: Analysis of Cropland Data Layer completed by LimnoTech

Adoption of certain structural practices in Michigan's five priority HUC-12 subwatersheds

HUC-12 Subwatershed	Sufficient Riparian Filters	Implemented Grassed Waterways	Implemented WASCOBs
Nile Ditch	28%	1%	33%
South Branch River Raisin	35%	16%	52%
Lime Creek	37%	47%	49%
S.S. LaPointe Drain	10%	1%	0%
Headwaters Saline River	9%	10%	0%

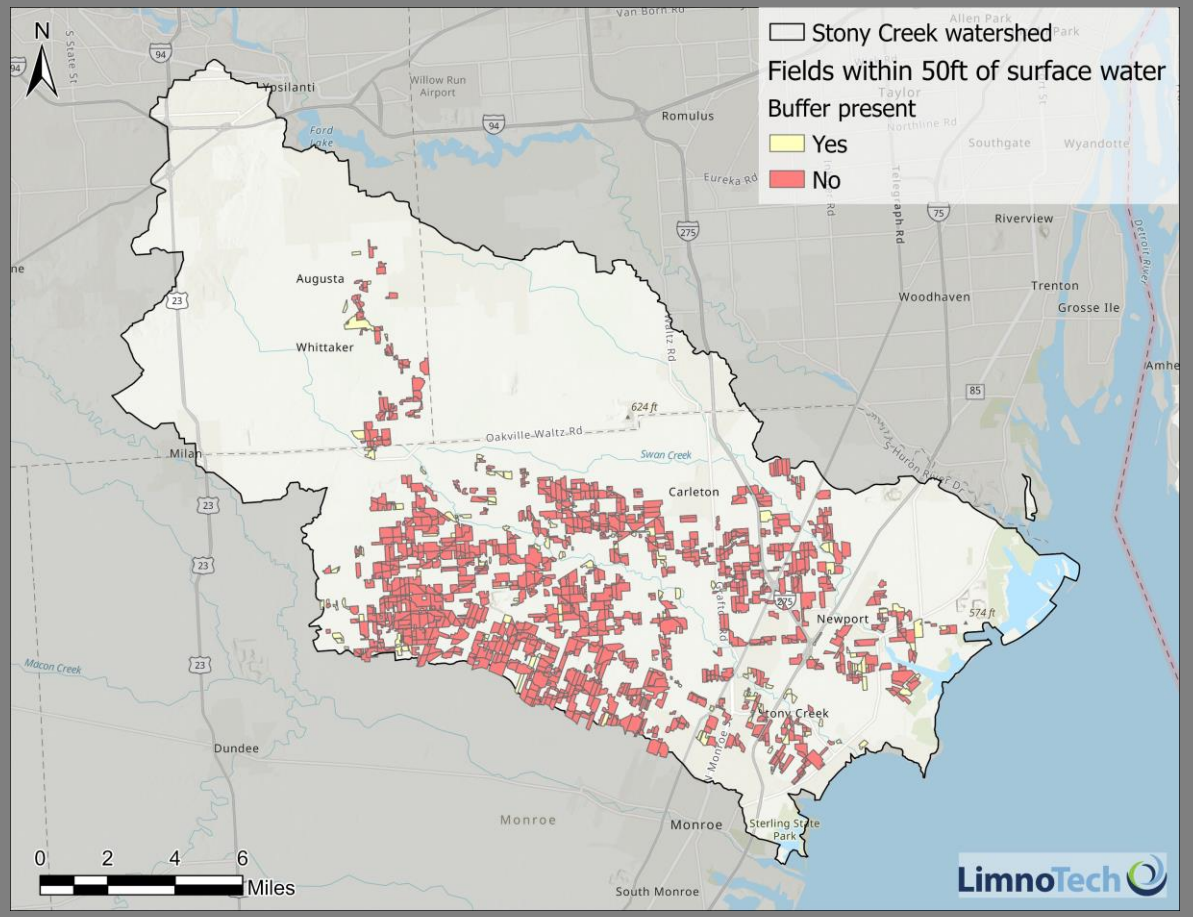
This evaluation found that the Lime Creek had the overall highest adoption rates of these three structural practices compared to the other four priority subwatersheds.

The relatively higher percentages in Nile Ditch, South Branch Raisin, and Lime Creek, which are mostly or entirely in Lenawee County, is consistent with the CRP data which showed Lenawee County having much greater CRP enrollment than Monroe or Washtenaw counties.



Source: Schlea & Zimnicki (2024)

Filter strip analysis results for the Ottawa-Stony North HUC-10 watershed



“Of the fields bordering streamlines, only about one of every ten had an adequate buffer.”

Source: LimnoTech, Monroe Conservation District, and Washtenaw County Conservation District (2024)

Windshield inventory results for the Ottawa-Stony North HUC-10 watershed

Tillage Practice (acres)		
Category	2021	2022
Chisel Plowed	1,435	7,323
Mulch Till	2,296	5,497
Planted	2,946	6,333
NA	2,636	2,787
None (No-Till)	28,024	14,555
Skipped	3,292	3,967
Not Summarized	8.5	516

Spring Residue (acres)		
Category	2021	2022
> 30%	6,643	5,355
< 30%	4,582	3,513
0%	9,604	13,774
Planted	3,138	4,086
Not Planted	4,552	978
NA	4,609	7,516
Skipped	7,683	6,038

Cover Crop (acres)		
Category	2021	2022
Yes	3,621	3,056
No (or not summarized)	37,638	38,204

Windshield inventory results suggested 8-10% of fields adopted cover crops in these two years, which is consistent with percentages in the earlier analyses of OpTIS and USDA Census datasets.

Source: LimnoTech, Monroe Conservation District, and Washtenaw County Conservation District (2024)

Discussion

This WLEB Conservation Dashboard sought information from multiple sources to provide insights regarding the adoption of different agricultural conservation practices in Michigan's WLEB. Each data source was limited in which practices it covered and/or which geographies it covered, and each data source has certain caveats that should be considered when interpreting results. Additionally, publicly available information regarding adoption of certain practices like fertilizer and manure management practices was lacking or not compiled.

Though there were some differences between the datasets for certain practices, counties, and years evaluated, certain observations were consistent, including the following findings:

- Cover crop adoption relative to all cultivated cropland acres is approximately in the 4% to 10% range.
- The use of no-tillage or reduced tillage was lowest in Lenawee and Monroe counties compared to Hillsdale and Washtenaw counties but was practiced on approximately 80% or more of cropland acres in any given year.
- A relatively low percentage of overall farm acres in four WLEB counties has underwent the MAEAP verification or renewal process in recent years.
- Total enrollment in CRP practices in three WLEB counties has decreased significantly (>5x) over the last 15 years.
- The greatest decrease in CRP filter strips and riparian buffers occurred in Lenawee County.
- Significant variability was found in adoption of filter strips, grassed waterways, and WASCBs across five subwatersheds.
- The Lime Creek subwatershed in southern Lenawee and Hillsdale counties was determined to have relatively higher adoption rates of all three structural practices evaluated, while the subwatersheds in Monroe and Washtenaw had the lowest adoption rates of these practices.

Additional information and considerations for methods used to collect information on agricultural conservation practice adoption

Remote Sensing

Remote sensing techniques like those used to produce the OpTIS dataset have been illustrated in this dashboard as a means for generating estimates of crops grown, use of cover crops, and use of different tillage practices at large spatial scales and potentially fine scale spatial resolution. Remote sensing has its limitations, including the inability to provide information on fertilizer and manure management practices, and although it has the potential, it has not yet been demonstrated to provide large spatial scale estimates of certain structural practices like grassed waterways, terraces, and WASCOBs. The quality of information produced by remote sensing techniques continues to improve with the advancement of this technology.

USDA Census of Agriculture and CRP Reporting

Reporting by USDA via 5-year census of agriculture and annual reporting such as CRP enrollment, available by county, provides relatively comprehensive estimates of certain agricultural conservation practice adoption rates. The last three census of agriculture provided estimates of cover crop adoption rates and different tillage practices, like the OpTIS dataset. Because CRP is a primary funding source for certain structural conservation practices, its annual enrollment reporting provides important insights into spatial and temporal trends in practices such as filter strips and riparian buffers.

MAEAP Reporting

Annual reporting of the MAEAP verification numbers is required by Michigan state legislature, and it represents a good example of tracking the year-to-year impact of the relatively high-profile state sponsored program. The MAEAP reporting should not be taken out of context, however, as it strictly represents the annual or cumulative accounting of operations and BMPs that have gone through the verification process or renewal process. It is not meant to be an indicator of temporal or spatial trends agricultural conservation practice adoption across the state or individual counties, as many farms that do not go through the MAEAP process also practice conservation adoption, and farms that do go through the MAEAP process may have been using conservation practice for a long period of time prior to verification.

Windshield Inventories

Windshield inventories of agricultural practices involve driving a defined geography and recording field management practices based on visual observations. Typically, one driver is needed and one or two recorders of the information collected, which may include photographs to capture field conditions. Michigan has implemented windshield surveys for several years to record fall tillage and spring residue conditions, among other information (e.g., crops grown, presence of large livestock operations). While this approach is generally quite accurate, it has certain drawbacks such as being relatively labor intensive, the use of subjective evaluations that may vary depending on the person judging field conditions (e.g., the percentage of residue on each field), the inability to see fields far from the road or behind tree lines, and the possibility that field conditions may change shortly after the inventory is completed (e.g., if tillage operations occur afterwards).

Manual Inspection of Satellite Imagery

This approach involves manually reviewing recent satellite imagery of an agricultural landscape to look for the presence of certain structural BMPs such as grassed waterways, WASCOBs, and filter strips, which are generally easy to identify. Although it can be a time-consuming process and may introduce errors or bias depending on the experience of the person conducting the work, this approach is much faster than driving a subwatershed to look for these BMPs from the roadways. It is important to determine the year of the satellite imagery used, as the presence or absence of structural BMPs may have changed relative to the present day. Certain GIS software or programming tools presumably have been used in certain limited areas or pilot applications, to execute this process in a more automated manner.

Farmer Surveys

Though not used in this dashboard, special surveys of farmers can be an effective means of gathering representative information about a variety of conservation practices that otherwise are not tracked through other methods, including the adoption of best fertilizer and manure management practices. Surveys can be designed to be comprehensive, polling respondents about cover crops, tillage, cropping system, use of structural practices, tile drainage system characteristics, and much more.

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