

National Water-Quality Assessment Program

**Annual Agricultural Pesticide Use for Midwest
Stream-Quality Assessment, 2012–13**



Data Series 863

Annual Agricultural Pesticide Use for Midwest Stream-Quality Assessment, 2012–13

By Nancy T. Baker and Wesley W. Stone

National Water-Quality Assessment Program

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**U.S. Department of the Interior
U.S. Geological Survey**

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Conversion Factors

SI to Inch/Pound		
Multiply	By	To obtain
Length		
meter (m)	3.281	foot (ft)
Area		
square kilometer (km ²)	247.1	acre
square kilometer (km ²)	0.3861	square mile (mi ²)
Mass		
kilogram (kg)	2.205	pound avoirdupois (lb)

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Abstract

This report provides estimates of annual agricultural use of 190 pesticide compounds for counties and selected watersheds of Midwestern States for 2012 and 2013 compiled for subsequent analysis by the National Water-Quality Assessment Program, Midwest Stream-Quality Assessment (MSQA). One of the goals of MSQA is to characterize contaminants at perennial-stream sites throughout the Corn Belt. Evaluating pesticide inputs from agricultural sources will aid in that characterization.

Crop acres for selected Midwestern crops were obtained from the Cropland Data Layer of the U.S. Department of Agriculture's National Agricultural Statistics Service and used in conjunction with GfK Kynetec, Inc. proprietary Crop Reporting District-level pesticide-use data to estimate pesticide use for counties and watersheds. Estimated pesticide use (EPest) values were calculated by using both the "EPest-high" and "EPest-low" methods, the distinction being that there are more counties with estimated pesticide use for EPest-high compared to EPest-low, owing to differing assumptions about missing survey data.

County-level and watershed-level estimates of annual agricultural pesticide use are provided as downloadable, tab-delimited files for both EPest-high and EPest-low. Summary graphs of MSQA watershed-level pesticide use for selected crops are also provided.

Introduction

This report provides estimates of annual agricultural use of 190 pesticide compounds for counties and selected watersheds of Midwestern States for 2012 and 2013 compiled for subsequent analysis by the National Water-Quality Assessment Program, Midwest Stream-Quality Assessment (MSQA). One of the goals of MSQA is to characterize contaminants at perennial-stream sites throughout the Corn Belt. Evaluating pesticide inputs from agricultural sources will aid in that characterization.

Crop acres for selected Midwestern crops were obtained from the Cropland Data Layer (CDL) of the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) (USDA, 2013, 2014) and used in conjunction with GfK Kynetec, Inc. (GfK) proprietary Crop Reporting District (CRD)-level pesticide-use data to estimate pesticide use for counties and watersheds. Estimated pesticide use (EPest) values were calculated by using both the EPest-high and EPest-low methods described in Thelin and Stone (2013). The distinction between the EPest-high method and the EPest-low method is that there are more counties with estimated pesticide use for EPest-high compared to EPest-low, owing to differing assumptions about missing survey data (Thelin and Stone, 2013).

Pesticide-use estimates from this study are suitable for making national, regional, and watershed assessments of annual pesticide use; however, the reliability of estimates generally decreases with scale. For example, detailed interpretation of use intensity distribution within a county is not an appropriate use. Although county-level estimates were used to create the maps and are provided in the dataset, it is important to understand that surveyed pesticide-by-crop use was not available for all CRDs and, therefore, extrapolation methods were used to estimate pesticide use for some counties. Surveyed pesticide-by-crop use may not reflect all agricultural use on all crops grown. In addition, state-based restrictions on pesticide use were not incorporated into EPest-high or EPest-low estimates. EPest-low estimates are more likely to reflect these restrictions than EPest-high estimates. With these caveats in mind, including other details discussed in Thelin and Stone (2013), the maps, graphs, and associated county-level use data can be used to fill a critical data need for water-quality models and provide a comprehensive graphical overview of the geographic distribution and trends in agricultural use in the conterminous United States.

County-level and watershed-level estimates of annual agricultural pesticide use are provided as downloadable, tab-delimited files for both EPest-high and EPest-low. Summary graphs of MSQA watershed-level pesticide use for selected crops are also provided.

Estimation Methods

Estimation methods follow those described in Thelin and Stone (2013) except the manner for determining county and watershed crop acres. Thelin and Stone (2013) used USDA county-level data for harvested-crop acres in conjunction with GfK CRD-level pesticide-use data to estimate county-level pesticide use. For this report, crop acres were obtained from the 2012 and 2013 CDL (U.S. Department of Agriculture, 2013 and 2014) which were then used with the

GfK CRD-level pesticide use data to calculate estimates. The reason for changing the data source for crop acres is that USDA harvested-crop acre data were not available at the time use estimates were calculated for the MSQA. In order to provide timely estimates to the MSQA team, CDL acres were used. Use estimates were compiled for counties and watersheds in the Midwestern States that are part of the MSQA study area (fig. 1). MSQA watershed identification information is listed in table 1. GfK pesticide use data were available for the crops listed in table 2.

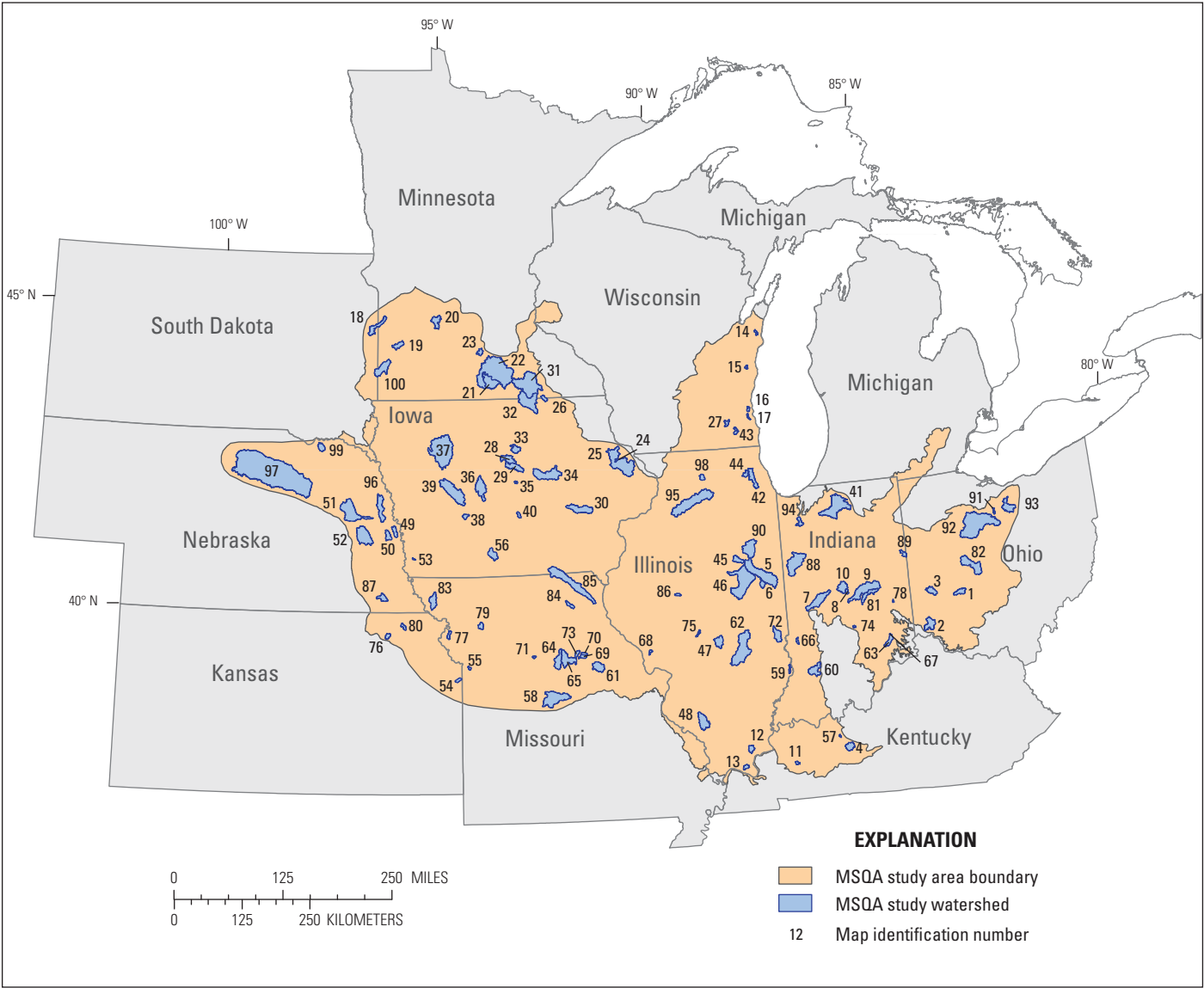


Figure 1. Location of Midwest Stream-Quality Assessment (MSQA) watersheds and associated map identification number. Site names are listed in table 1.

Table 1. Midwest Stream-Quality Assessment (MSQA) watershed station identification information.[ID, identification; STAID, station identification; USGS, U.S. Geological Survey; km², square kilometers]

Map ID (fig. 1)	STAID (Tables 6–7)	USGS station number	MSQA watershed station name	Area (km ²)
1	03241500	03241500	Massies Creek at Wilberforce, OH	167
2	03259000	03259000	Mill Creek at Carthage, OH	311
3	03271000	03271000	Wolf Creek at Dayton, OH	178
4	03318800	03318800	Caney Creek near Horse Branch, KY	185
5	03336645	03336645	Middle Fork Vermilion River above Oakwood, IL	1,120
6	03336890	03336890	Spoon River near St. Joseph, IL	108
7	03340900	03340900	Big Raccoon Creek at Ferndale, IN	559
8	03351072	03351072	Williams Creek at 96th Street, Indianapolis, IN	42
9	03352875	03352875	Fall Creek at 16th Street at Indianapolis, IN	831
10	03353200	03353200	Eagle Creek at Zionsville, IN	274
11	03383782	03383782	Richland Creek at Carbondale Rd near Richland, KY	31
12	03384450	03384450	Lusk Creek near Eddyville, IL	111
13	03611200	03611200	Massac Creek at Metropolis, IL	66
14	04085250	040852508	Tisch Mills Creek at Tisch Mills, WI	31
15	04085700	040857005	Otter Creek at Willow Road near Plymouth, WI	25
16	04086941	040869416	Lincoln Cr at Sherman Blvd at Milwaukee, WI	35
17	04087119	04087119	Honey Creek at Wauwatosa, WI	28
18	05299770	05299770	Florida Creek at 171st Ave near Marietta, MN	299
19	05315295	05315295	Threemile Creek at 210th Ave near Ghent, MN	162
20	05316562	0531656290	West Fork Beaver Creek at 320 St. near Bechyn, MN	247
21	05320410	05320410	Maple River at Hwy 30 near Mapleton, MN	504
22	05320500	05320500	Le Sueur River near Rapidan, MN	2,865
23	05325148	05325148	Sevenmile Ck blw Footbridge in Park nr Kasota, MN	94
21	05320410	05320410	Maple River at Hwy 30 near Mapleton, MN	504
22	05320500	05320500	Le Sueur River near Rapidan, MN	2,865
23	05325148	05325148	Sevenmile Ck blw Footbridge in Park nr Kasota, MN	94
24	05418180	05418180	Johns Creek near Worthington, IA	17
25	05418400	05418400	North Fork Maquoketa River near Fulton, IA	1,303
26	05420520	05420520	Wapsipinicon River at McIntire, IA	74
27	05426400	05426400	Scuppernong River near Palmyra, WI	68
28	05451112	05451112	South Fork Iowa River at H Avenue near Buckeye, IA	265
29	05451210	05451210	South Fork Iowa River near New Providence, IA	582
30	05455095	05455095	Old Mans Creek at Kansas Ave SW near Iowa City, IA	499
31	05457200	05457200	Cedar River at 100th St. near Lyle, MN	1,407
32	05457520	05457520	Cedar River at Lancer Avenue at Osage, IA	2,233
33	05458800	05458800	Maynes Creek near Hampton, IA	185
34	05464220	05464220	Wolf Creek near Dysart, IA	772
35	05471090	05471090	Unnamed Trib to East Br Indian Cr near Zearing, IA	20
36	05481820	05481820	Beaver Creek at Bouton, IA	526
37	05482300	05482300	North Raccoon River near Sac City, IA	1,809
38	05483341	05483341	Beaver Creek at Glendon, IA	73
39	05483450	05483450	Middle Raccoon River near Bayard, IA	989

¹ Also known as LEATHERWOOD CR AT W CORD 750N NR NAPOLEON, IN.

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Table 1. Midwest Stream-Quality Assessment (MSQA) watershed station identification information.—Continued

[ID, identification; STAID, station identification; USGS, U.S. Geological Survey; km², square kilometers]

Map ID (fig. 1)	STAID (Tables 6–7)	USGS station number	MSQA watershed station name	Area (km ²)
40	05487550	05487550	Walnut Creek near Vandalia, IA	52
41	05517000	05517000	Yellow River at Knox, IN	1,128
42	05531500	05531500	Salt Creek at Western Springs, IL	292
43	05544989	05544989	Honey Creek at Ct Highway DD Near Burlington, WI	63
44	05550500	05550500	Poplar Creek at Elgin, IL	92
45	05554300	05554300	Indian Creek near Fairbury, IL	174
46	05572000	05572000	Sangamon River at Monticello, IL	1,426
47	05592195	05592195	Beck Creek at Herrick, IL	254
48	05599100	05599100	Galum Creek near Pyatts, IL	426
49	06610765	06610765	Little Papillion Cr at Ak-Sar-Ben at Omaha, NE	130
50	06610785	06610785	West Papillion Creek at Millard, NE	152
51	06800000	06800000	Maple Creek near Nickerson, NE	955
52	06804000	06804000	Wahoo Creek at Ithaca, NE	699
53	06808495	06808495	Unnamed Trib to W Nishnabotna Riv nr Randolph, IA	12
54	06893350	06893350	Tomahawk C nr Overland Park, KS	56
55	06893620	06893620	Rock Creek at Kentucky Road in Independence, MO	24
56	06897937	06897937	Long Creek at 137th Street near Van Wert, IA	238
57	37351408	373514086371200	Pond Run at Highway 110 near Falls of Rough, KY	12
58	38315809	383158092192001	North Moreau Creek nr Jefferson City, MO	871
59	38422408	384224087353601	Allison Ditch near Vincennes, IN	37
60	38424008	384240087103901	Prairie Cr at Co Rd N100W nr Capehart, IN	319
61	38563809	385638091364601	Loutre River near Montgomery City, MO	303
62	38573008	385730088324401	Little Wabash River near Mason, IL	1,231
63	39003308	390033085300301	Otter Cr at N Cord 560E nr Butlerville, IN	159
64	39020009	390200092341701	Moniteau Creek near Rocheport, MO	327
65	39022709	390227092234101	Perche Creek near Columbia, MO	461
66	39111008	391110087194401	W Fk Busseron Cr at St Rt 48 nr Wilfred, IN	37
67	39111408	391114085205801	Otter Cr at W Cord 750N nr Napoleon, IN ¹	3
68	39113609	391136090341101	Cole Creek near Hardin, IL	29
69	39130809	391308091550901	Skull Lick Creek nr Mexico, MO	76
70	39144309	391443091534001	Fish Branch near Mexico, MO	45
71	39150409	391504093003301	Bear Creek nr Gilliam, MO	21
72	39160108	391601087414801	Mill Creek near Choctaw, IL	270
73	39181500	391815009203901	Goodwater Creek nr Centralia, MO	72
74	39215808	392158086035901	Nineveh Cr at Stone Arch Rd nr Nineveh, IN	17
75	39324708	393247089260701	Clear Creek near Jeisyville, IL	39
76	39335809	393358096130000	French C at Parallel Rd, Onaga, KS	72
77	39415109	394151094531501	Contrary Creek nr St. Joseph, MO	68
78	39425308	394253085111101	Lick Cr at N Cord 250W near Harrisburg, IN	9
79	39425409	394254094092301	Brushy Creek near Cameron, MO	93
80	39430609	394306095484300	Muddy C at 145h St nr Wetmore, KS	64
81	39434008	394340085524601	Sugar Creek at Co Rd 400S at New Palestine, IN	241

¹ Also known as LEATHERWOOD CR AT W CORD 750N NR NAPOLEON, IN.

Table 1. Midwest Stream-Quality Assessment (MSQA) watershed station identification information.—Continued[ID, identification; STAID, station identification; USGS, U.S. Geological Survey; km², square kilometers]

Map ID (fig. 1)	STAID (Tables 6–7)	USGS station number	MSQA watershed station name	Area (km ²)
82	39594208	395942083151401	Big Darby Creek at Prairie Oaks nr Lake Darby, OH	594
83	40022709	400227095151501	Squaw Creek Ditch near Squaw Creek Wildlife Area, MO	285
84	40024009	400240092081201	Little Fabius River nr Fabius, MO	90
85	40050209	400502091403401	North Fabius River nr Monticello, MO	1,173
86	40085608	400856089562001	Herget Drainage Ditch near Kilbourne, IL	40
87	40114309	401143096134301	Turkey Creek near Steinauer, NE	159
88	40184908	401849087161401	Big Pine Cr at Co Rd N125E nr Williamsport, IN	838
89	40324208	403242084553201	Limberlost Creek at Cord N 250 E near Bryant, IN	83
90	40491708	404917088222701	North Fork Vermilion River near Wing, IL	571
91	41013308	410133082465301	Unnamed Trib to Honey Creek near Willard, OH	27
92	41015008	410150083125701	Sandusky River at CR6 near McClutchenville, OH	1,999
93	41114608	411146082244001	Vermilion River at SR18 near Clarksfield, OH	336
94	41143908	411439087065601	Hodge Ditch Stream at Cord N400W nr Wheatfield, IN	116
95	41291108	412911089540101	Green River near Hooppole, IL	1,348
96	41301209	413012096210001	Bell Creek near Arlington, NE	432
97	42044409	420444097543301	Elkhorn River near Oakdale, NE	6,348
98	42062608	420626089101201	Stillman Creek at Stillman Valley, IL	81
99	42404809	424048097483601	Howe Creek near Lindy, NE	145
100	43542009	435420096290500	Pipestone Creek nr SD/MN State Line	445

¹ Also known as LEATHERWOOD CR AT W CORD 750N NR NAPOLEON, IN.**Table 2.** Selected crops for which pesticide-use data were available for 2012 and 2013.

Selected crops	
Alfalfa	Rice
Barley	Sorghum
Canola	Soybeans
Corn	Spring wheat
Dry beans	Sugarbeets
Fallow/Idle cropland	Sunflower
Pasture/Hay	Tobacco
Peanuts	Winter wheat

The CDL is a raster, georeferenced, crop-specific land cover data layer. Both 2012 and 2013 CDLs have a ground resolution of 30 meters (U.S. Department of Agriculture, 2013 and 2014). To obtain crop acres, the Midwestern States were extracted from the National CDL raster. A raster of county boundaries was combined with the CDL raster to produce a new raster (CDL-CO) with all the unique combinations of counties and crop-specific land cover. There are 128 unique land cover classes in each of the 2012 and 2013 CDL data layers, with slight differences between the two years (table 3). Because the GfK pesticide use data was for selected crops, the CDL was reclassified to match GfK crops (table 3). All other crop categories and non-agricultural land were classified as “Other Land” and were not used to determine crop acres.

Reclassification also provides consistent land cover codes between the two CDL data layers, especially for the Pasture/Hay and Grassland categories. The CDL is produced by using satellite imagery; and because grassland, pasture, and hay have similar spectral signatures, they are difficult to distinguish with imagery. For 2012, CDL codes 37 (Other Hay/Non Alfalfa), 62 (Pasture/Grass), 171 (Grassland Herbaceous), and 181 (Pasture/Hay) were used to designate pasture, hay, and grassland (table 3). For 2013, CDL codes 37 (Other Hay/Non Alfalfa) and 176 (Grassland/Pasture) were used to designate pasture, hay, and grassland (table 3). In order to make these categories consistent between the two years, the above CDL categories were reclassified as 176 (Pasture/Hay). Because combining grassland, pasture, and hay categories overestimates pasture and hay acres, it spreads the estimated use over a larger geographic area for those pesticides applied to pasture and hay. Although this approach does not change the total estimated county use for these compounds, it may underestimate the watershed use of some compounds, particularly if the county area outside of an adjacent watershed has a large amount of grassland. Pesticides are usually not applied to non-pasture and non-hay grassland.

As mentioned previously, two different methods, EPest-low and EPest-high, were used to estimate a range of pesticide use. Both methods incorporate a combination of surveyed and extrapolated rates to estimate pesticide use for counties and watersheds, but EPest-low and EPest-high estimation procedures differ in how they treated situations when a CRD was surveyed and pesticide use was not reported for a particular pesticide-by-crop combination. If use of a pesticide

on a crop was not reported in a surveyed CRD, EPest-low reports zero use in the CRD for that pesticide-by-crop combination. EPest-high, however, treats the unreported use for that pesticide-by-crop combination in the CRD as unsurveyed, and pesticide-by-crop use rates from neighboring CRDs—or, in some cases, regional rates from CRDs within the same USDA Farm Resource Region—are used to calculate the pesticide-by-crop EPest-high rate for the CRD, as described in detail by Thelin and Stone (2013). Several USDA Farm Resource Regions extend beyond the MSQA states, resulting in EPest-high use for 17 additional pesticide compounds in these “unsurveyed” areas that were not calculated for EPest-low use. Use estimates were calculated for 173 compounds for EPest-low and 190 compounds for EPest-high.

Watershed boundary geospatial data for 100 MSQA stream sites (Naomi Nakagaki and Sharon Qi, U.S. Geological Survey, written commun., 2014) were used to estimate pesticide use, by compound, for each watershed. Pesticide-by-crop EPest-high and EPest-low county use was joined, by crop and county code, to the CDL-CO raster layer for 2012 and 2013. To obtain the use rate for each raster cell in the CDL-CO, the crop-county rate was divided by the number of cells within each county for each unique county and crop combination. MSQA watershed boundaries were then used to extract the portion of the CDL-CO raster within each watershed boundary. For each compound, the CDL-CO cells within each watershed were simply summed to obtain the total pesticide use for that compound in that watershed.

Estimates of annual agricultural pesticide use, by county and watershed, are provided via this report as downloadable, tab-delimited files. County-level estimates are organized by compound (COMPOUND), year (YEAR), state (STATE), state Federal Information Processing Standard (FIPS) code (STATE_FIPS), county FIPS code (COUNTY_FIPS_CODE), estimated amount of pesticide used in kilograms (KG), county area in square kilometers (COUNTYKM2), and total county agricultural land in square kilometers (AGLANDKM2) (tables 4 and 5). Watershed-level estimates are organized by watershed identification number (STAID), compound (COMPOUND), year (YEAR), estimated amount of pesticide used in kilograms (KGS), watershed area in square kilometers (KM2), and estimated amount of pesticide used per square kilometer (KGSKM2) (tables 6 and 7). Tables 4–7 are available for downloading at <http://pubs.usgs.gov/ds/0863/>.

Table 3. Cropland Data Layer crop class and code reclassification used to compile Midwest Stream-Quality Assessment (MSQA) pesticide-use estimates, 2012 and 2013.

[CDL, Cropland Data Layer; Dbl, double; Orn, ornamental; WinWht, winter wheat;]

CDL code, 2012–13	CDL crop class, 2012	MSQA crop reclassification, 2012	CDL crop class, 2013	MSQA crop reclassification, 2013	MSQA code, 2012–13
1	Corn	Corn	Corn	Corn	1
2	Cotton	Other Land	Cotton	Other Land	0
3	Rice	Rice	Rice	Rice	3
4	Sorghum	Sorghum	Sorghum	Sorghum	4
5	Soybeans	Soybeans	Soybeans	Soybeans	5
6	Sunflower	Sunflower	Sunflower	Sunflower	6
10	Peanuts	Peanuts	Peanuts	Peanuts	10
11	Tobacco	Tobacco	Tobacco	Tobacco	11
12	Sweet Corn	Other Land	Sweet Corn	Other Land	0
13	Pop or Orn Corn	Other Land	Pop or Orn Corn	Other Land	0
14	Mint	Other Land	Mint	Other Land	0
21	Barley	Barley	Barley	Barley	21
22	Durum Wheat	Spring Wheat	Durum Wheat	Spring Wheat	23
23	Spring Wheat	Spring Wheat	Spring Wheat	Spring Wheat	23
24	Winter Wheat	Winter Wheat	Winter Wheat	Winter Wheat	24
25	Other Small Grains	Other Land	Other Small Grains	Other Land	0
26	Dbl Crop WinWht/Soybeans	Dbl Crop WinWht/Soybeans	Dbl Crop WinWht/Soybeans	Dbl Crop WinWht/Soybeans	26
27	Rye	Other Land	Rye	Other Land	0
28	Oats	Other Land	Oats	Other Land	0
29	Millet	Other Land	Millet	Other Land	0
30	Speltz	Other Land	Speltz	Other Land	0
31	Canola	Canola	Canola	Canola	31
32	Flaxseed	Other Land	Flaxseed	Other Land	0
33	Safflower	Other Land	Safflower	Other Land	0
34	Rape Seed	Other Land	Rape Seed	Other Land	0
35	Mustard	Other Land	Mustard	Other Land	0
36	Alfalfa	Alfalfa	Alfalfa	Alfalfa	36
37	Other Hay/Non Alfalfa	Pasture/Hay	Other Hay/Non Alfalfa	Pasture/Hay	176
38	Camelina	Other Land	Camelina	Other Land	0
39	Buckwheat	Other Land	Buckwheat	Other Land	0
41	Sugarbeets	Sugarbeets	Sugarbeets	Sugarbeets	41
42	Dry Beans	Dry Beans	Dry Beans	Dry Beans	42
43	Potatoes	Other Land	Potatoes	Other Land	0
44	Other Crops	Other Land	Other Crops	Other Land	0
45	Sugarcane	Other Land	Sugarcane	Other Land	0
46	Sweet Potatoes	Other Land	Sweet Potatoes	Other Land	0
47	Misc Veggies & Fruits	Other Land	Misc Veggies & Fruits	Other Land	0
48	Watermelons	Other Land	Watermelons	Other Land	0
49	Onions	Other Land	Onions	Other Land	0
50	Cucumbers	Other Land	Cucumbers	Other Land	0

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Table 3. Cropland Data Layer crop class and code reclassification used to compile Midwest Stream-Quality Assessment (MSQA) pesticide-use estimates, 2012 and 2013.—Continued

[CDL, Cropland Data Layer; Dbl, double; Orn, ornamental; WinWht, winter wheat;]

CDL code, 2012–13	CDL crop class, 2012	MSQA crop reclassification, 2012	CDL crop class, 2013	MSQA crop reclassification, 2013	MSQA code, 2012–13
51	Chick Peas	Other Land	DoNotUse	Other Land	0
52	Lentils	Other Land	Lentils	Other Land	0
53	Peas	Other Land	Peas	Other Land	0
54	Tomatoes	Other Land	Tomatoes	Other Land	0
55	Caneberries	Other Land	Caneberries	Other Land	0
56	Hops	Other Land	Hops	Other Land	0
57	Herbs	Other Land	Herbs	Other Land	0
58	Clover/Wildflowers	Other Land	Clover/Wildflowers	Other Land	0
59	Sod/Grass Seed	Other Land	Sod/Grass Seed	Other Land	0
60	Switchgrass	Other Land	Switchgrass	Other Land	0
61	Fallow/Idle Cropland	Fallow/Idle Cropland	Fallow/Idle Cropland	Fallow/Idle Cropland	61
62	Pasture/Grass	Pasture/Hay	NA	NA	176
66	Cherries	Other Land	Cherries	Other Land	0
67	Peaches	Other Land	Peaches	Other Land	0
68	Apples	Other Land	Apples	Other Land	0
69	Grapes	Other Land	Grapes	Other Land	0
70	Christmas Trees	Other Land	Christmas Trees	Other Land	0
71	Other Tree Crops	Other Land	Other Tree Crops	Other Land	0
72	Citrus	Other Land	Citrus	Other Land	0
72	Citrus	Other Land	Citrus	Other Land	0
74	Pecans	Other Land	Pecans	Other Land	0
75	Almonds	Other Land	Almonds	Other Land	0
76	Walnuts	Other Land	Walnuts	Other Land	0
77	Pears	Other Land	Pears	Other Land	0
92	Aquaculture	Other Land	Aquaculture	Other Land	0
111	Open Water	Other Land	Open Water	Other Land	0
112	Perennial Ice/Snow	Other Land	Perennial Ice/Snow	Other Land	0
121	Developed/Open Space	Other Land	Developed/Open Space	Other Land	0
122	Developed/Low Intensity	Other Land	Developed/Low Intensity	Other Land	0
123	Developed/Med Intensity	Other Land	Developed/Med Intensity	Other Land	0
124	Developed/High Intensity	Other Land	Developed/High Intensity	Other Land	0
131	Barren	Other Land	Barren	Other Land	0
141	Deciduous Forest	Other Land	Deciduous Forest	Other Land	0
142	Evergreen Forest	Other Land	Evergreen Forest	Other Land	0
143	Mixed Forest	Other Land	Mixed Forest	Other Land	0
152	Shrubland	Other Land	Shrubland	Other Land	0
171	Grassland Herbaceous	Pasture/Hay	NA	NA	176
176	NA	NA	Grassland/Pasture	Pasture/Hay	176
181	Pasture/Hay	Pasture/Hay	NA	NA	176
190	Woody Wetlands	Other Land	Woody Wetlands	Other Land	0
195	Herbaceous Wetlands	Other Land	Herbaceous Wetlands	Other Land	0

Table 3. Cropland Data Layer crop class and code reclassification used to compile Midwest Stream-Quality Assessment (MSQA) pesticide-use estimates, 2012 and 2013.—Continued

[CDL, Cropland Data Layer; Dbl, double; Orn, ornamental; WinWht, winter wheat;]

CDL code, 2012–13	CDL crop class, 2012	MSQA crop reclassification, 2012	CDL crop class, 2013	MSQA crop reclassification, 2013	MSQA code, 2012–13
204	Pistachios	Other Land	Pistachios	Other Land	0
205	Triticale	Other Land	Triticale	Other Land	0
206	Carrots	Other Land	Carrots	Other Land	0
207	Asparagus	Other Land	Asparagus	Other Land	0
208	Garlic	Other Land	Garlic	Other Land	0
209	Cantaloupes	Other Land	Cantaloupes	Other Land	0
210	DoNotUse	NA	Plums/Prunes	Other Land	0
211	Olives	Other Land	Olives	Other Land	0
212	Oranges	Other Land	Oranges	Other Land	0
213	Honeydew Melons	Other Land	Honeydew Melons	Other Land	0
214	Broccoli	Other Land	Broccoli	Other Land	0
216	Peppers	Other Land	Peppers	Other Land	0
217	Pomegranates	Other Land	Pomegranates	Other Land	0
218	Nectarines	Other Land	Nectarines	Other Land	0
219	Greens	Other Land	Greens	Other Land	0
220	Plums	Other Land	Plums	Other Land	0
221	Strawberries	Other Land	Strawberries	Other Land	0
222	Squash	Other Land	Squash	Other Land	0
223	Apricots	Other Land	Apricots	Other Land	0
224	Vetch	Other Land	Vetch	Other Land	0
225	Dbl Crop WinWht/Corn	Dbl Crop WinWht/Corn	Dbl Crop WinWht/Corn	Dbl Crop WinWht/Corn	225
226	Dbl Crop Oats/Corn	Other Land	Dbl Crop Oats/Corn	Other Land	0
227	Lettuce	Other Land	Lettuce	Other Land	0
229	Pumpkins	Other Land	Pumpkins	Other Land	0
230	Dbl Crop Lettuce/Durum Wht	Other Land	Dbl Crop Lettuce/Durum Wht	Other Land	0
231	Dbl Crop Lettuce/Cantaloupe	Other Land	Dbl Crop Lettuce/Cantaloupe	Other Land	0
232	Dbl Crop Lettuce/Cotton	Other Land	Dbl Crop Lettuce/Cotton	Other Land	0
233	NA	NA	Dbl Crop Lettuce/Barley	Other Land	0
234	Dbl Crop Durum Wht/Sorghum	Dbl Crop Durum Wht/Sorghum	Dbl Crop Durum Wht/Sorghum	Dbl Crop Durum Wht/Sorghum	234
235	Dbl Crop Barley/Sorghum	Dbl Crop Barley/Sorghum	Dbl Crop Barley/Sorghum	Dbl Crop Barley/Sorghum	235
236	Dbl Crop WinWht/Sorghum	Dbl Crop WinWht/Sorghum	Dbl Crop WinWht/Sorghum	Dbl Crop WinWht/Sorghum	236
237	Dbl Crop Barley/Corn	Dbl Crop Barley/Corn	Dbl Crop Barley/Corn	Dbl Crop Barley/Corn	237
238	Dbl Crop WinWht/Cotton	Other Land	Dbl Crop WinWht/Cotton	Other Land	0
239	Dbl Crop Soybeans/Cotton	Other Land	Dbl Crop Soybeans/Cotton	Other Land	0
240	Dbl Crop Soybeans/Oats	Other Land	Dbl Crop Soybeans/Oats	Other Land	0
241	Dbl Crop Corn/Soybeans	Dbl Crop Corn/Soybeans	Dbl Crop Corn/Soybeans	Dbl Crop Corn/Soybeans	241
242	Blueberries	Other Land	Blueberries	Other Land	0
243	Cabbage	Other Land	Cabbage	Other Land	0

Table 3. Cropland Data Layer crop class and code reclassification used to compile Midwest Stream-Quality Assessment (MSQA) pesticide-use estimates, 2012 and 2013.—Continued

[CDL, Cropland Data Layer; Dbl, double; Orn, ornamental; WinWht, winter wheat;]

CDL code, 2012–13	CDL crop class, 2012	MSQA crop reclassification, 2012	CDL crop class, 2013	MSQA crop reclassification, 2013	MSQA code, 2012–13
245	Celery	Other Land	Celery	Other Land	0
247	Turnips	Other Land	Turnips	Other Land	0
249	Gourds	Other Land	Gourds	Other Land	0
254	Dbl Crop Barley/Soybeans	Dbl Crop Barley/Soybeans	Dbl Crop Barley/Soybeans	Dbl Crop Barley/Soybeans	254

Midwest Stream-Quality Assessment Watershed Pesticide Use

The following figures and graphs are intended to provide a better understanding of pesticide use in individual MSQA watersheds. All MSQA watershed sampling took place during 2013; therefore, the graphs show use for 2013. For simplicity, only EPest-low estimates were used to generate the graphics. The combination of agricultural pesticide compounds used is largely determined by the types of crops grown within a watershed. Figure 2 shows crop cover for each MSQA watershed. The total mass of product applied to all watersheds combined, for those compounds where the total use is greater than 100 kilograms, is given in figure 3. The total mass of pesticide compounds applied to individual crops for all watersheds combined are given in figure 4. Figure 5 shows the mass of pesticide compound used per square kilometer for the top 14 compounds used, in kilograms per square kilometer, on each MSQA watershed.

References Cited

- Thelin, G.P., and Stone, W.W., 2013, Estimation of annual agricultural pesticide use for counties of the conterminous United States, 1992–2009: U.S. Geological Survey Scientific Investigations Report 2013–5009, 54 p.
- U.S. Department of Agriculture, 2013, Cropland Data Layer, 2012: National Agricultural Statistics Service, geospatial data, accessed February 2013 at <http://www.nass.usda.gov/research/Cropland/SARSIa.htm>.
- U.S. Department of Agriculture, 2014, Cropland Data Layer, 2013: National Agricultural Statistics Service, geospatial data, accessed February 2014 at <http://www.nass.usda.gov/research/Cropland/SARSIa.htm>.

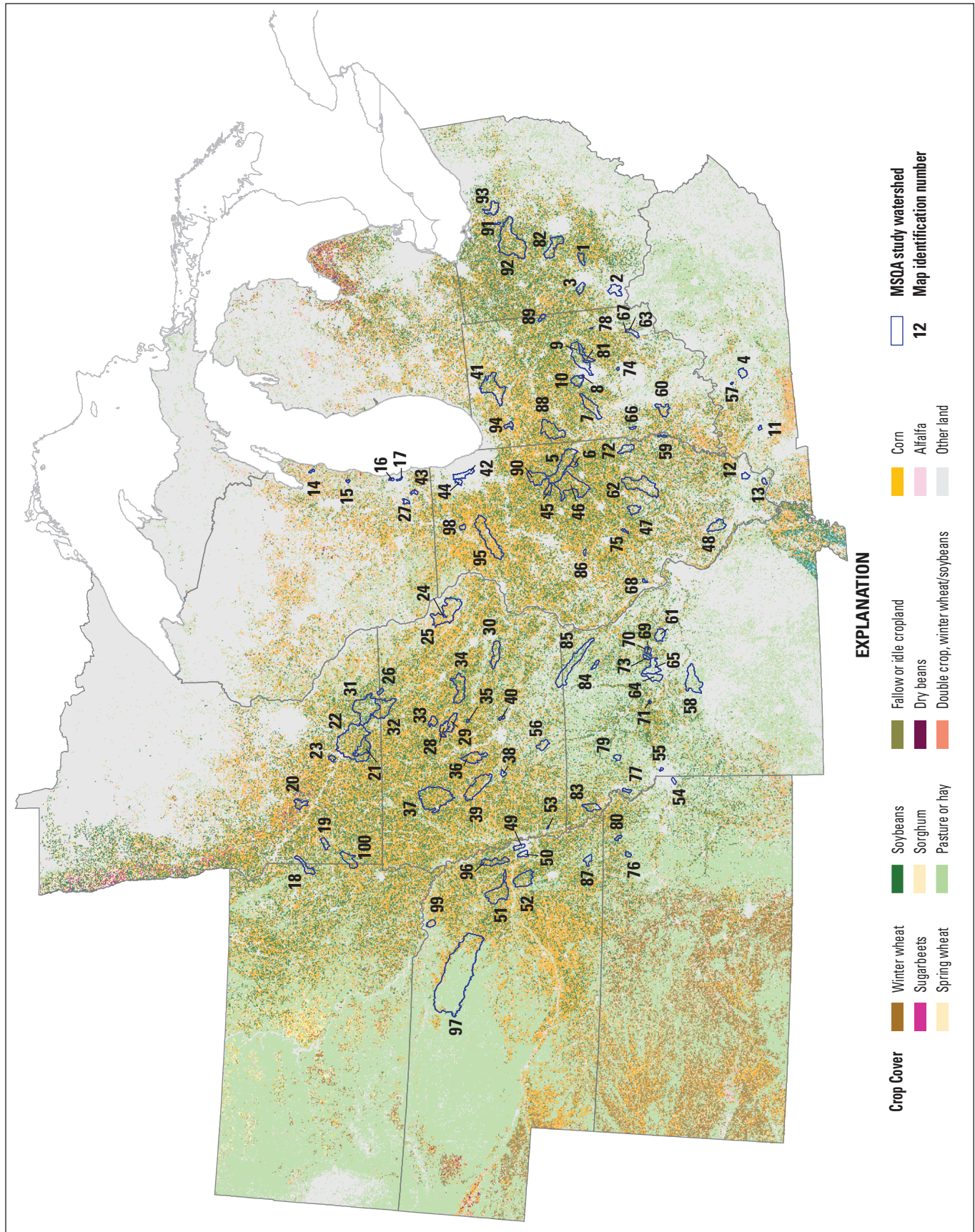


Figure 2 part 1. Location and crop cover for Midwest Stream-Quality Assessment (MSQA) watersheds, 2013. Site names are listed in table 1.

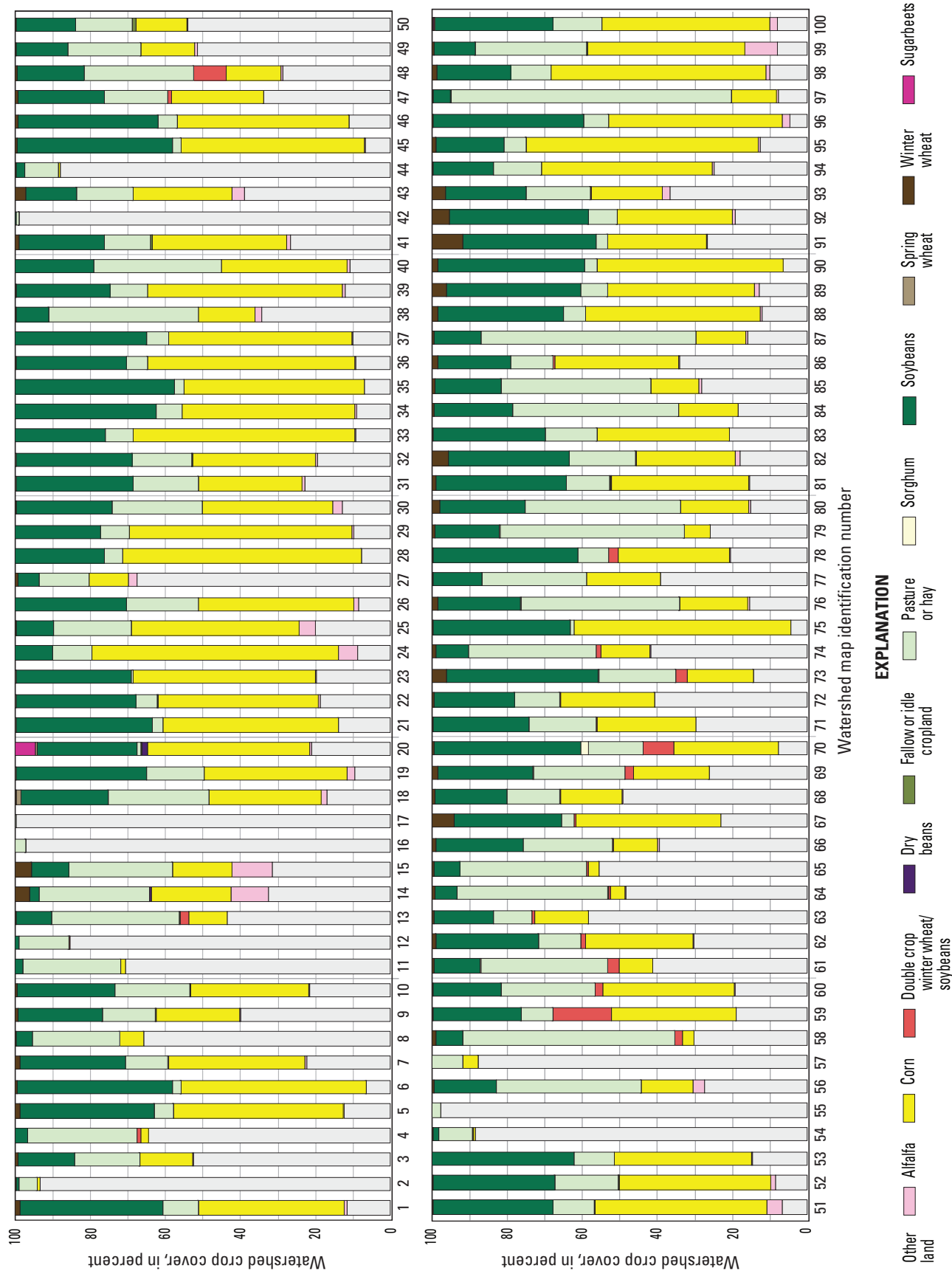


Figure 2 part 2. Location and crop cover for Midwest Stream-Quality Assessment (MSQA) watersheds, 2013. Site names are listed in table 1.

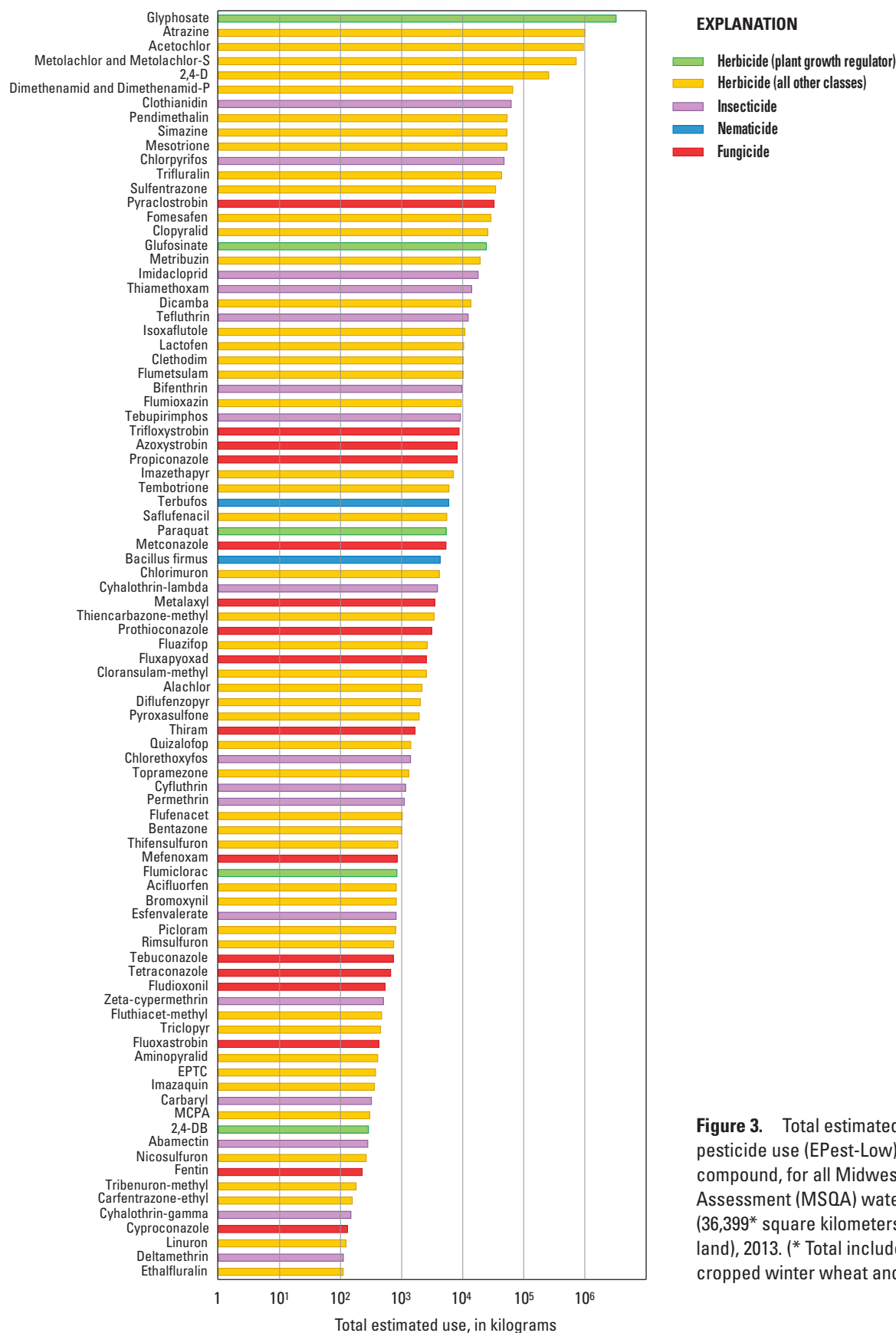


Figure 3. Total estimated agricultural pesticide use (EPest-Low) for all crops, by compound, for all Midwest Stream-Quality Assessment (MSQA) watersheds combined (36,399* square kilometers [km²] of agricultural land), 2013. (* Total includes 120 km² of double-cropped winter wheat and soybeans.)

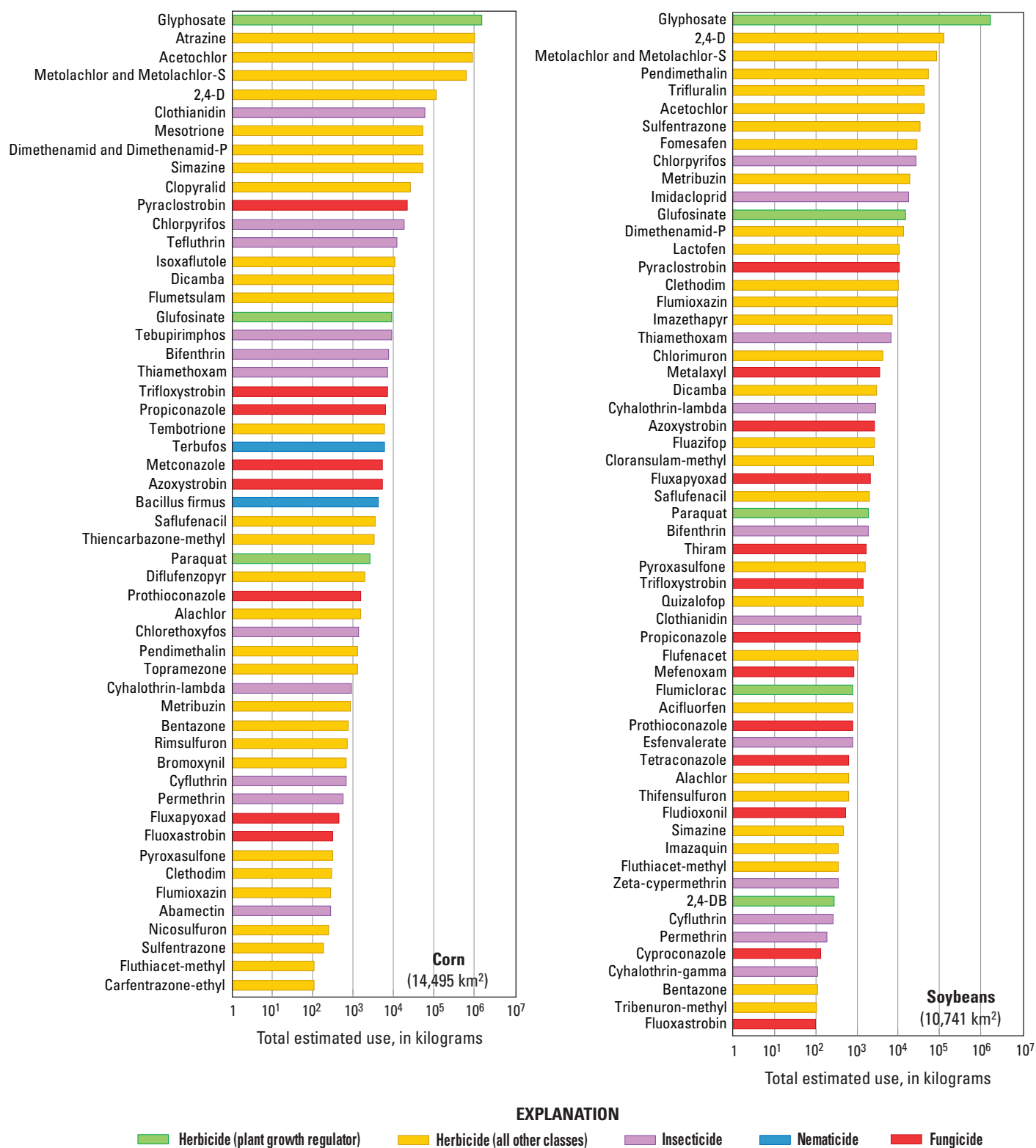


Figure 4 part 1. Total estimated agricultural pesticide use (E Pest-Low) by crop and compound and total land area for each crop grown for all Midwest Stream-Quality Assessment (MSQA) watersheds combined (36,399* square kilometers [km²] of agricultural land**), 2013. (* Total includes 120 km² of double-cropped winter wheat and soybeans. ** 4 km² of miscellaneous crops not shown on this figure.)

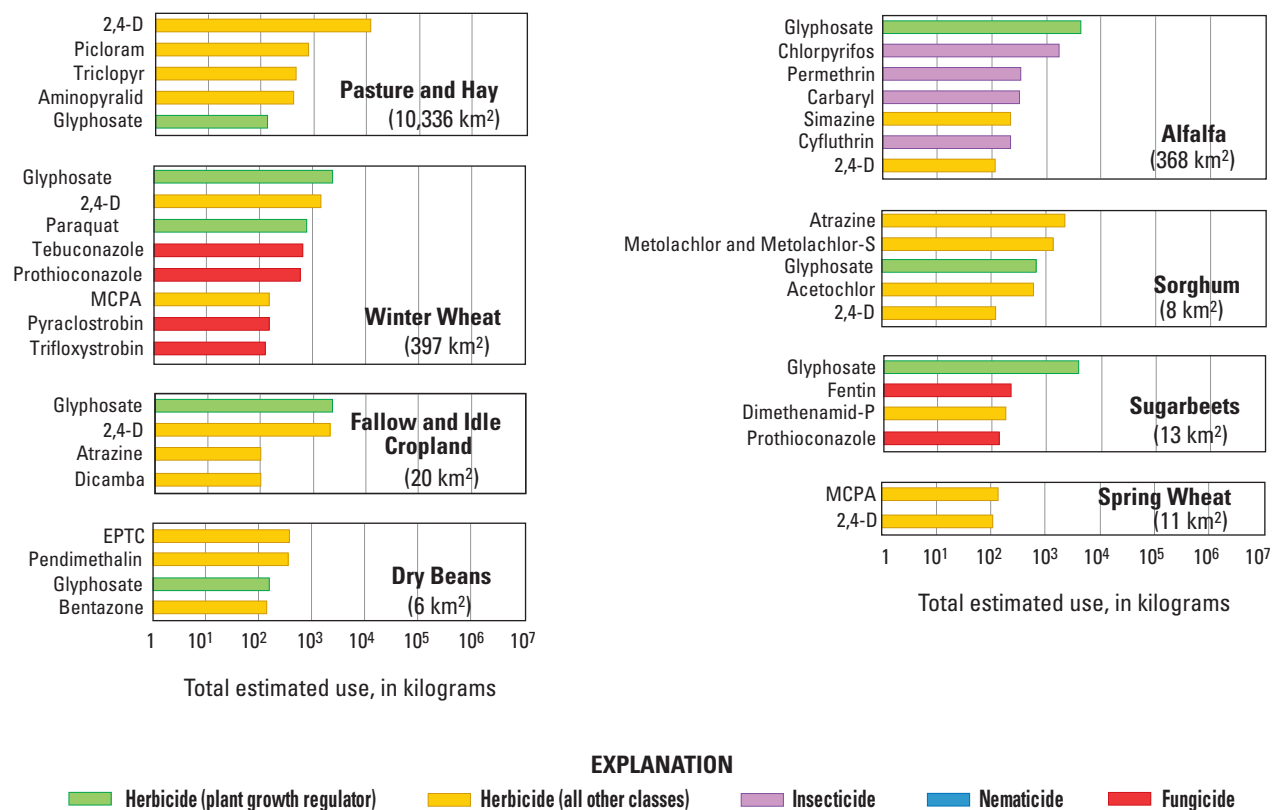


Figure 4 part 2. Total estimated agricultural pesticide use (EPest-Low) by crop and compound and total land area for each crop grown for all Midwest Stream-Quality Assessment (MSQA) watersheds combined (36,399* square kilometers [km²] of agricultural land**), 2013. (* Total includes 120 km² of double-cropped winter wheat and soybeans. ** 4 km² of miscellaneous crops not shown on this figure.)

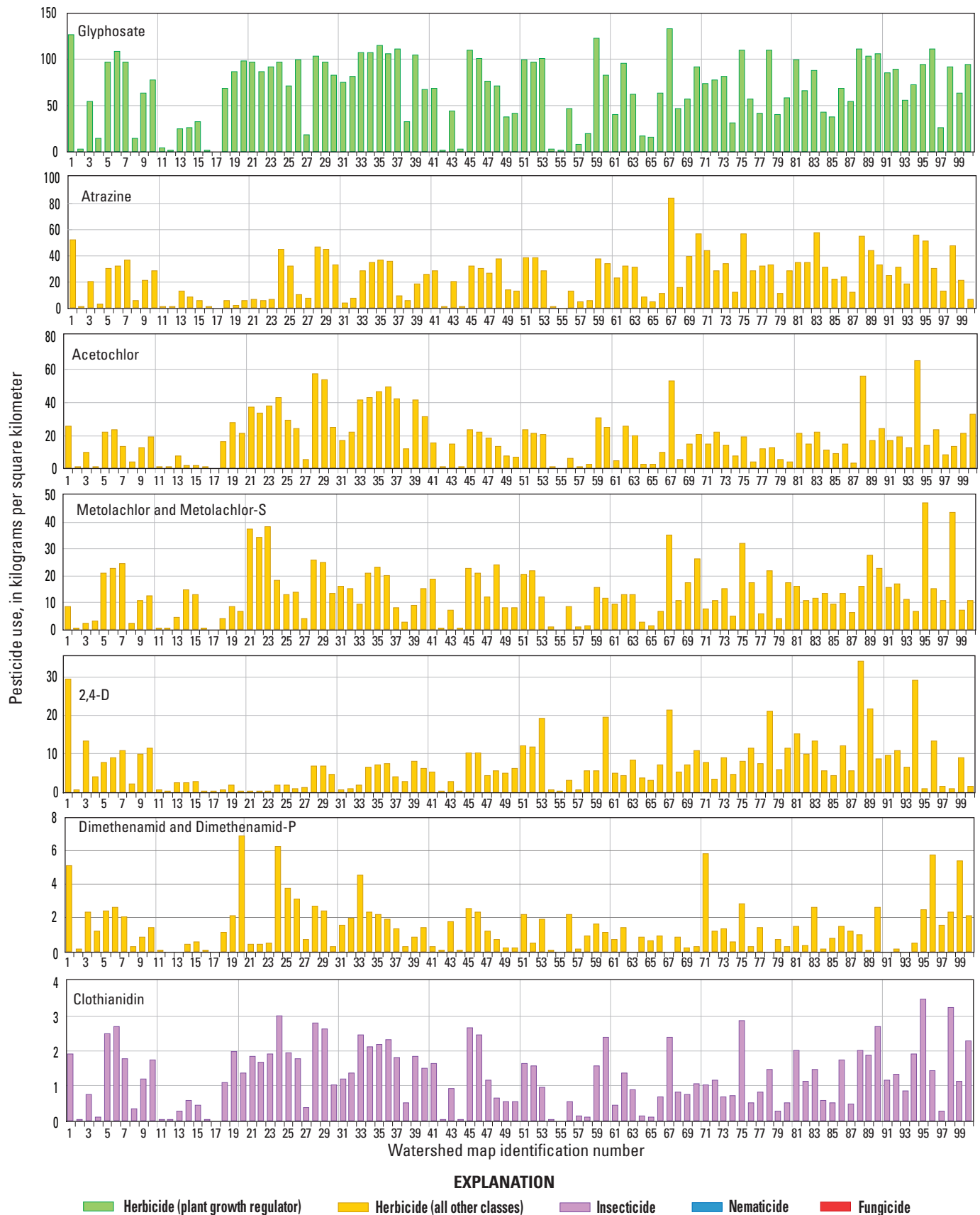


Figure 5 part 1. Estimated agricultural pesticide use (Epest-Low) intensity, by Midwest Stream-Quality Assessment (MSQA) watershed, for selected compounds, 2013.

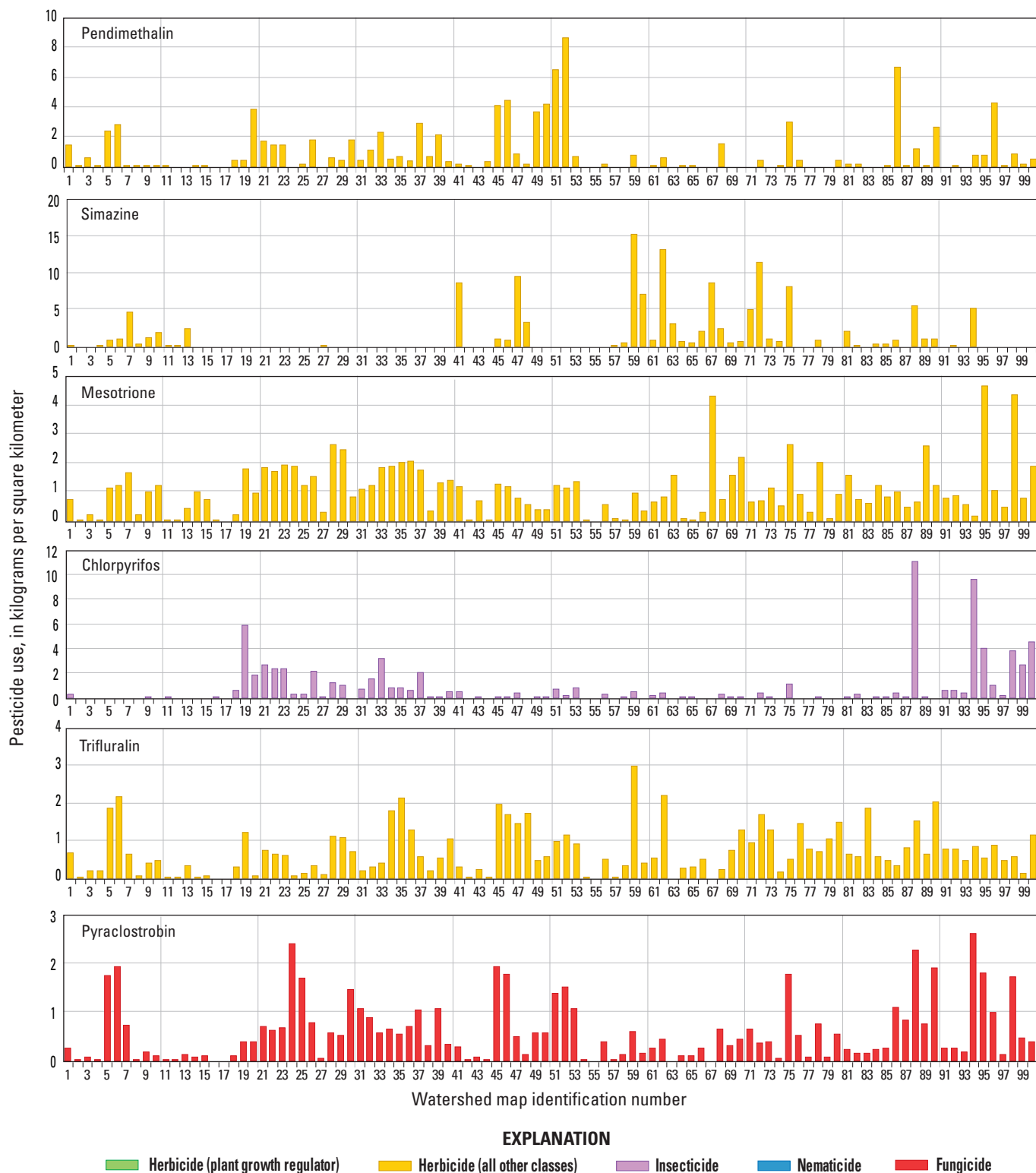


Figure 5 part 2. Estimated agricultural pesticide use (Epest-Low) intensity, by Midwest Stream-Quality Assessment (MSQA) watershed, for selected compounds, 2013.

