Spatial Data in Geographic Information System Format on Agricultural Chemical Use, Land Use, and Cropping Practices in the United States

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS

Multiply	By	To obtain
foot (ft)	0.3048	meter
acre	0.4047	hectare
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
pound	0.4536	kilogram
ton	0.9078	metric ton
pound per square mile	0.1751	kilogram per square kilometer
ton per square mile	0.3505	metric ton per square kilometer

Degree Celsius (°C) may be converted to degree Fahrenheit (°F) by using the following equation:
$$°F = 9/5 \ (°C) + 32.$$

Degree Fahrenheit (°F) may be converted to degree Celsius (°C) by using the following equation:
$$°C = 5/9 \ (°F\text{-}32).$$

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Abstract

The spatial data in geographic information system format described in this report consist of estimates for all counties in the conterminous United States of the annual use of 96 herbicides in 1989; annual sales of nitrogen fertilizer, in tons, for 1985-91; and agricultural expenses, land use, chemical use, livestock holdings, and cropping practices in 1987. The source information, originally in tabular form, is summarized as digital polygon attribute data in the 18 geographic information system spatial data layers (coverages) provided. The information in these coverages can be used in estimating regional agricultural-chemical use or agricultural practices and in producing visual displays and mapping relative rates of agricultural-chemical use or agricultural practices across broad regions of the United States.

INTRODUCTION

Agricultural chemicals (herbicides, insecticides, and fertilizers) are used extensively in the United States to increase yields of agricultural crops. Many agricultural chemicals are partially water soluble and can leach to ground water or run off to surface water (Thurman and others, 1992). The presence of agricultural chemicals in ground water and surface water has been documented in many recent reports (Madison and Brunett, 1985; Goolsby and others, 1991a; Goolsby and others, 1991b; Goolsby and Battaglin, 1993; Spalding and Exner, 1991; Thurman and others, 1991; Thurman and others, 1992; U.S. Environmental Protection Agency, 1992; Battaglin and others, 1993; Scribner and others, 1993; Kolpin and others, 1993; and Burkart and Kolpin, 1993). Analysis of relations among the presence and distribution of agricultural chemicals in the environment, estimates of agricultural-chemical use, estimates of agricultural land use, and descriptions of hydrologic conditions is greatly facilitated by the application of geographic-information-system (GIS) technology (Battaglin and others, 1994; Battaglin and others, 1993; Goolsby and Battaglin, 1993; Kolpin and others, 1993; Rains and Latham, 1993; and He and others, 1993).

This report describes the data sources and methods used to construct spatial data layers in GIS format (coverages) on agricultural-chemical use and agricultural practices that may help in future research concerning the presence and distribution of agricultural chemicals in water resources of the United States. The coverages contain information at the county scale for the conterminous United States. The 3,111 counties of the conterminous United States constitute the study area for this report.

SCOPE

The report contains: (1) 18 ARC/INFO (GIS software produced and distributed by Environmental Systems Research Institute) GIS coverages summarizing the annual use of 96 herbicides in 1989; annual sales of nitrogen fertilizer, in tons, for 1985-91; and agricultural expenses, land use, chemical use, livestock holdings, and cropping practices in 1987, for counties in the conterminous United States; (2) complete on-line documentation of the 18 coverages and a self-installing version the U.S. Geological Survey's documentation AML (ARC Macro Language) (Nebert, 1994); and (3) 12 page-sized color maps summarizing selected attribute data from the 18 coverages (see figs. 1-12). These products were prepared by the U.S. Geological Survey in cooperation with the U.S. Environmental Protection Agency under Interagency Agreement DW14934820-01-1.

Information from four primary sources is summarized as polygon attribute data in the 18 coverages provided. Five coverages summarizing the use of 96 herbicides were constructed from estimates reported in Gianessi and Puffer (1991). Seven coverages summarizing annual nitrogen fertilizer sales, in tons, for the years 1985-91 were constructed from estimates reported by the U. S. Environmental

Protection Agency (1990) and by Jerald Fletcher (West Virginia University, written commun., 1992). Six coverages summarizing agricultural expenses, land use, chemical use, livestock holdings, and cropping practices were constructed from estimates reported by the U. S. Department of Commerce (1989a, 1989b) in the 1987 Census of Agriculture. The 18 coverages contain a total of 521 attributes that were derived from the four cited data sources. All coverages described in this report were created and documented, and are stored on-line, in accordance with the guidelines given by Nebert (1994).

METHODS USED TO PROCESS SOURCE DATA INTO GEOGRAPHIC INFORMATION SYSTEM PRODUCTS

A polygon coverage representing county boundaries in the conterminous United States, as well as lakes, estuaries, and other nonland-area features, is used as the base for the coverages described in this report. The base county coverage was derived from the Digital Line Graph (DLG) files representing the 1:2,000,000-scale map in the National Atlas of the United States (U.S. Geological Survey, 1970; Domeratz and others, 1983). Polygon coverages in general are used to represent area features. Polygons are defined by a series of arcs that form a many-sided, closed figure. A label point inside each polygon is used to assign attributes to the polygon. Attributes can contain any information that pertains to the area represented by the polygon. For example, every polygon in the base coverage contains an attribute called PLYTYPE which is a numeric code that indicates whether the polygon represents land, a lake, or an estuary. Each county land polygon is identified by a five-digit Federal Information Processing Standard (FIPS) code. Some counties are represented by more than one polygon.

A missing value code of -99.0 is used when no attribute data are given for a county land polygon and also is used for all nonland-area polygons. Attribute values in counties represented by one polygon are equal to county totals. For counties described by more than one polygon, attribute values are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of each county polygon to the total area of the county. For example, if county A is represented by two polygons of equal area, and 1,000 pounds of atrazine are reported to have been used in county A, then the value of the attribute for pounds of atrazine used for each of the two polygons representing county A would be 500 pounds.

Construction of Geographic Information System Coverages

Automated procedures were developed for processing the raw herbicide-use, nitrogen-fertilizer-sales, and 1987 Census of Agriculture data into ARC/INFO coverage attributes. Procedures generally were coded in AML (Environmental Systems Research Institute, 1992); however, some Fortran codes and awk programs (Aho and others, 1988) also were used. The procedure was to copy the ARC/INFO county base coverage to a new coverage and then execute an attribute addition AML program to transfer attribute values from the raw data files to the new coverage. Other automated procedures were developed to calculate summary statistics of attribute values, and to produce maps (color postscript files) that represent attribute values across the United States (figs. 1-12). The on-line documentation file that accompanies each coverage was generated by using the program document.aml, which is available from the U.S. Geological Survey (Nebert, 1994). An example of the hard copy of an on-line documentation data set, as created by document.aml, is given in appendix 1.

All products were inspected visually for obvious errors. County-level herbicide-use estimates were sometimes absent as a result of withheld census data. County herbicide-use data cannot be totaled to obtain the State use totals reported in Gianessi and Puffer (1991) because of differences between statewide crop-acreage estimates (which include all counties) and county-level crop-acreage estimates (some of which are withheld because of census disclosure rules). Estimates of nitrogen-fertilizer use in Utah in 1985 are missing. Estimates from the 1987 Census of Agriculture were compared visually with maps published in U. S. Department of Commerce (1990). Most missing data in unexpected areas results from withholding of Census of Agriculture data as a result of census disclosure rules. Additional details concerning the processing of coverage and ancillary information are given in the Data Sources For Geographic Information System Coverages section of this report.

Construction of Color Maps

Color maps summarizing 24 selected attributes from the 18 coverages were constructed in ARC/INFO by use of a consistent methodology (see figs. 1-12). The maps were developed to show locations and relative rates of agricultural-chemical use or agricultural practices across broad regions of the

United States. A statistical distribution was used to select six class intervals for the graphic display of agricultural-chemical use, land use, and cropping-practice data. The empty (white) class (see figs. 1-12) represents counties in which attribute values are missing or zero. The first shaded class (light blue) represents attribute values that are reported (not missing or zero) and as large as the 25th percentile of the data. The second shaded class (green) represents attribute values that are greater than the 25th percentile and as large as the 50th percentile (median) of the data. The third shaded class (yellow) represents attribute values that are greater than the median and as large as the 75th percentile of the data. The fourth shaded class (orange) represents attribute values that are greater than the 75th percentile and as large as the 75th percentile plus two standard deviations of the data. The fifth shaded class (red) represents attribute values that are greater than the 75th percentile plus two standard deviations.

DATA SOURCES FOR GEOGRAPHIC INFORMATION SYSTEM COVERAGES

Herbicide-Use Data

Five coverages summarizing the use of 96 herbicides were constructed from estimates reported in Gianessi and Puffer (1991). A ranking of national herbicide-use amounts (Gianessi and Puffer, 1991, Table A-6) was used to divide herbicide-use attribute data into five coverages. The tabular estimates of herbicide use by county and by crop were constructed by Gianessi and Puffer (1991) by:

(1) compiling statistics, by State and by crop, on the percentage of acres treated with a given herbicide and the average annual application rate of the herbicide from responses to surveys sent to U.S. Department of Agricultural Cooperative Extension Service weed scientists in 1987 and 1989;

(2) augmenting survey data with published surveys and reports from individual States (U.S. Department of Agriculture, 1989a; U.S. Department of Agriculture, 1989b; Rinehold and Witt, 1989)

(3) establishing herbicide-use profiles, by State and by crop, that

contain the percentage of acres treated and average annual application rates;

(4) multiplying county-level crop-acreage estimates from the 1987 Census of Agriculture (U.S. Department of Commerce, 1989a) by the percentage of acres treated and the average annual application rates to obtain herbicide-use estimates; and

(5) tabulating herbicide-use amounts and acres treated by crop and by county.

Eighty-four crops were profiled, resulting in usage estimates for 96 herbicide active ingredients. Although crop acreages are from 1987 data, the herbicide-use estimates generally reflect 1989 usage amounts (Gianessi and Puffer, 1991). Estimates of herbicide use by county were generated from a combination of data collected from surveys of weed scientists and from surveys of farmers. Herbicide-use profile data were generated by using ancillary data sources or were calculated from profiles for neighboring States when no responses to surveys or published reports were available (Gianessi and Puffer, 1991). Sampling and statistics were used to account for crop acreages from nonresponding farm operations. Thus, the information describing crop acreages is subject to sampling variability as well as reporting and coverage errors (U.S. Department of Commerce, 1989b). Census disclosure rules also prevent the publication of information that would reveal the operation of individual farms.

Herbicide-use attributes by crop and by county were extracted from the tabular data files provided by Gianessi and Puffer (1991). The total use of each herbicide on all crops was calculated for all counties with herbicide use. Three attributes were added to an ARC/INFO coverage for each of the 96 herbicides. Attributes with names ending in .ACR are estimates of the number of acres treated with a given herbicide. Attributes with names ending in .LBS are estimates of the total number of pounds of active ingredient of a given herbicide applied on all crops. Attributes ending in .USE are estimates of a county-level herbicide-use rate in pounds per square mile. Attribute names are keyed to four-digit herbicide code numbers provided in table 1. For example, estimates of the number of pounds of atrazine applied are contained in the attribute named H1980.LBS. Herbicide-coverage names, attribute names, and the crops on which the

largest amount of active ingredient of each herbicide was used are listed in table 2.

Herbicide-use estimates for counties represented by one polygon are equal to county totals. For counties described by more than one polygon, herbicide-use estimates are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of the county polygon divided by the total area of the county. A missing-value code of -99.0 is used when no herbicide-use estimates are available for a county and for all nonland-area polygons. A missing-value code in a county land polygon can indicate any of the following conditions:

-- herbicide not used in the county (for example, no alachlor used in county),
-- crop data withheld because of census disclosure rules,
-- crop data not available to the census, or
-- crop data not published because county contains fewer than 10 farms.

Nitrogen-Fertilizer Sales Data

Seven coverages summarizing annual nitrogen-fertilizer sales, in tons, for the fertilizer years 1985-91 (for example, the 1987 fertilizer year is the period from July 1, 1986, to June 30, 1987), were constructed from estimates reported by the U.S Environmental Protection Agency (1990). Estimates for 1990 and 1991 were provided to the U.S. Geological Survey by Jerald Fletcher (West Virginia University, written commun., 1992) in cooperation with the National Fertilizer and Environmental Research Center, Tennessee Valley Authority (TVA). Estimates of fertilizer sales estimates were generated and are reported as tons of actual nutrient (inorganic nitrogen, phosphate, and potash). The fertilizer-sales estimates do not account for the use of manure.

The method used to construct fertilizer sales estimates is similar to that used by Alexander and Smith (1990). The data are summarized for fertilizer years . The county-level nitrogen-fertilizer sales estimates (U.S. Environmental Protection Agency, 1990) were constructed by:

(1) compiling annual State fertilizer-sales data reported as tonnages to the National Fertilizer and Environmental Research Center of the TVA;

(2) calculating the ratio of expenditures for commercial fertilizers by county to expenditures for commercial fertilizers by State from the 1987 Census of Agriculture (U.S. Department of Commerce, 1989a); and

(3) computing annual county-level fertilizer sales, in tons, by multiplying estimates of annual State sales by the ratio of county expenditures to State expenditures.

Nitrogen-fertilizer sales estimates by county were constructed from estimates reported by the U.S. Environmental Protection Agency (1990) for 1985-89 and by Jerald Fletcher (West Virginia University, written commun., 1992) for 1990-91. The estimates of nitrogen-fertilizer sales in tons of actual nutrient were entered directly into the GIS. Nitrogen-fertilizer sales estimates are provided for each year (1985-91); however, the 1987 Census of Agriculture data on fertilizer expenditures used to disaggregate State sales totals represent only 1987 sales. Fertilizer-sales data submitted annually to State regulatory agencies by fertilizer dealers were compiled by the National Fertilizer and Environmental Research Center, TVA (U.S. Environmental Protection Agency, 1990). These data reflect total sales of fertilizer without regard to the land use for which it was bought, or the State (or county) in which the fertilizer was actually used.

Estimates of fertilizer sales by county were constructed from a combination of data reported to

Census of Agriculture. In the Census of Agriculture, sampling and statistics are used to account for nonresponding farm operations (U.S. Department of Commerce, 1989b). Thus, the information that describes county-level fertilizer sales is subject to sampling variability as well as reporting and coverage errors. Census disclosure rules also prevent the publication of information that would reveal the operation of individual farms.

Eleven attributes were added to an ARC/INFO coverage for each year of fertilizer-sales data. All attribute names contain a number that represents the year of the data. For example, NTOT86 is the attribute name for total nitrogen-fertilizer sales in 1986. Sales estimates are provided for total nitrogen, potash, and phosphate, and for nitrogen sold as ammonium nitrate, anhydrous ammonia, miscellaneous forms, nitrogen solutions, and urea. Nitrogen-fertilizer sales coverage names, attribute names, and short attribute descriptions are listed in table 3.

Fertilizer-use estimates for counties represented by one polygon are equal to county totals. For counties described by more than one polygon, fertilizer-use estimates are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of the county polygon divided by the total area of the county. A missing-value code of -99.0 is used when no fertilizer-use estimate is available for a county and in all nonland-area polygons. A missing-value code in a county land polygon can indicate any of the following conditions:

-- fertilizer not sold in the county,
-- crop data withheld because of census disclosure rules,
-- crop data not available to the census, or
-- crop data not published because county contains fewer than 10 farms.

Census of Agriculture Data

Six coverages summarizing agricultural expenses, land use, chemical use, livestock holdings, and cropping practices were constructed from estimates reported by the U. S. Department of Commerce (1989a, 1989b) in the 1987 Census of Agriculture. A total of 123 data fields from the Census of Agriculture are summarized by 156 attributes in the 6 coverages. Most of the attributes summarized represent 1987 data, but some information from the 1982 Census of Agriculture also was included.

The estimates were constructed from surveys of all farms where $1,000 or more of agricultural products were sold, or normally would have been sold, during the census year. Sampling and statistics were used to account for nonresponding farm operations. Thus, the information in the Census of Agriculture is subject to sampling variability as well as reporting and coverage errors. Census disclosure rules prevent publication of information that would disclose the operation of individual farms. Thus, for example, one or two sod farms may be reported in a county, but no acreage of sod grown is reported, because release of that information might disclose information about a particular farmer's operation.

All census attributes were extracted from tabular data files provided by the U. S. Department of Commerce (1989a). Data are reported in either thousands of dollars, number, tons, acres, or percent of county. Attribute names are keyed to field names found in the technical documentation of the Census of Agriculture (U.S. Department of Commerce, 1989b).

Specifically, the four-digit number at the end of the ARC/INFO item names matches the field-name numbers in the technical-documentation reference. Complete definitions of attributes and terms used in the census can be found in U. S. Department of Commerce (1989b; 1990). Census of Agriculture coverages and attribute names and short descriptions are listed in table 4. Attribute names beginning with CA represent data fields transferred directly from the census tabular data files. Attribute names beginning with PCT are percent-of-county attributes and represent relative intensities of an agricultural practice. Attributes reported as percent of county were calculated as the attribute value (in acres) divided by the county polygon area (in acres) multiplied by 100.

Census estimates for counties represented by one polygon are equal to county totals. For counties described by more than one polygon, attribute values are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of each county polygon divided by the total area of the county. A missing-value code of -99 is used when no census-attribute data are given for a county and for all nonland-area polygons. A missing-value code in a county land polygon could indicate any of the following conditions:

-- agricultural practice not present in county (for example, no corn grown in county),
-- data withheld because of census disclosure rules,
-- data not available to census, or
-- data not published because county contains fewer than 10 farms.

OBTAINING AND USING THE GEOGRAPHIC INFORMATION SYSTEM COVERAGES

Obtaining the Coverages

The GIS coverages described in this report were prepared in compliance with the guidelines presented by Nebert (1994) for National-scope thematic data layers. These coverages are available through the U.S. Geological Survey Distributed Spatial Data Library (DSDL) (Nebert, 1994). DSDL is a distributed repository, and custody of specific data sets is assigned to individuals or groups within the organization. Complete documentation (metadata) and review of spatial and attribute information are required for all data sets prior to their inclusion in DSDL. Information in DSDL is accessible to the wide-area

network and can be retrieved by using information-discovery programs such as the Wide Area Information Server (WAIS), gopher, or mosaic. The GIS coverages described in this report currently (1994) also can be made available on 1/4-inch tape or in DLG-O format upon special request to the Regional Hydrologist at the address on page iii.

The coverages are retrievable as individual themes. The compressed ARC/INFO coverage export files range in size from 4.1 to 4.9 megabytes (MB). Uncompressed, these files range in size from 8.5 to 10.9 MB. All 18 uncompressed ARC/INFO coverage export files occupy about 170 MB of disk space. All 18 imported ARC/INFO coverages occupy about 100 MB of disk space. Generally, about 200 to 300 MB of disk space is required to work with data sets of this size. Additional information on data retrieval, coverage import, and a suggested data directory structure are given in appendix 2.

Use of the Coverages

The information on agricultural-chemical use, land use, and cropping practices presented in this report are intended for use directly in a geographic information system. Several aspects of the processing of this information into GIS coverage format are important when working with the data. First, census disclosure rules affect the content of all of the coverages. In some cases the absence of a reported value for a particular attribute in a particular county is the result of census disclosure rules rather than a true zero value for the attribute in that county. Second, for counties described by more than one polygon, attribute values are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of each county polygon to the total area of the county. This operation makes the coverage easier to work with in the GIS but also means that care must be used when the information in the coverages is used to estimate total attribute values for counties described by more than one polygon. Most of the counties in the coverages are represented by only one polygon, however. Third, additional details on coverage preparation, item definitions, and coverage projection are given in the on-line coverage documentation files (see example in appendix 1). Not all of the documentation files were printed in this report because of their length (about 35 pages each). The GIS coverage attributes that are accessible to users are listed in tables 1-4.

The information summarized in the coverages provided is intended for use in estimating regional agricultural-chemical use, land use, or cropping practices, and in producing visual displays and mapping relative rates of agricultural-chemical use, land use, or cropping practices across broad regions of the United States (Battaglin and Goolsby, 1994; Battaglin and others, 1993; Goolsby and others, 1993; Goolsby and Battaglin, 1993; Mueller and others, 1993). The estimates provided can not be used appropriately to determine rates of agricultural-chemical use or the presence or absence of a particular agricultural practice in small areas (less than 20 square miles) or at specific locations.

SUMMARY

Eighteen geographic information systems spatial data layers (coverages) summarizing for all counties in the conterminous United States the use of 96 herbicides in 1989; the annual sales of nitrogen fertilizer, for 1985-91; and agricultural expenses, land use, chemical use, livestock holdings, and cropping practices in 1987 are discussed in this report and are available through the U.S. Geological Survey Distributed Spatial Data Library (DSDL). Information in DSDL is accessible to the wide-area network. The information in these coverages is intended for use in estimating regional agricultural-chemical use, land use, or cropping practices, and in producing visual displays and mapping relative rates of agricultural-chemical use, land use, or cropping practices across broad regions of the United States.

The 18 coverages were constructed by relating tabular source materials to a polygon coverage representing county boundaries, lakes, estuaries, and other nonland-area features in the conterminous United States at a scale of 1:2,000,000.

SELECTED REFERENCES

Aho, Alfred V., Kernighan, Brian W., and Weinberger, Peter J., 1988, The AWK programming language: New York, Addison-Wesley Publishing Company, 210 p.

Alexander, Richard B., and Smith, Richard A., 1990, County-level estimates of nitrogen and phosphorus fertilizer use in the United States, 1945 to 1985: U.S. Geological Survey Open-File Report 90-130, 12 p.

Battaglin, W.A., Goolsby, D.A., and Mueller, D.K., 1994, Relations between use, concentration, and transport of agricultural chemicals in the Mississippi River basin, in Marston, R.A., and Hasfurther, V.R., eds., Effects of human-induced changes on hydgrologic systems, proceedings of the American Water Resources Association Summer Symposium, Jackson Hole, Wyoming, June 26-29, 1994, p. 1073-1086.

Battaglin, W.A., Goolsby, D.A., and Coupe, R.H., 1993, Annual use and transport of agricultural chemicals in the Mississippi River, 1991-92, in Goolsby, D.A., and others, eds., Selected papers on agricultural chemicals in water resources of the Midcontinental United States: U.S. Geological Survey Open-File Report 93-418, p. 26-40.

Battaglin, W.A., and Goolsby, D.A., 1994, Relations between herbicide use and annual transport of herbicides in Midwestern rivers, 1991-92, in Weigmann, D. L., ed., New directions in pesticide research, development, management, and policy, Proceedings of the Fourth National Conference on Pesticides, November 1-3, 1993, p. 711-723.

Burkart, M.R., and Kolpin, D.W., 1993, Hydrologic and land-use factors associated with herbicides and nitrate in near-surface aquifers: Journal of Environmental Quality, v. 22, no. 4, p. 646-656.

Domeratz, M.A., Hallam, C.A., Schmidt, W.E., and Calkins, H.W., 1983, USGS digital cartographic data standards--Digital line graphics from 1:2,000,000-scale maps: U.S. Geological Survey Circular 895-D, 38 p.

Environmental Systems Research Institute, 1992, AML user's guide: Redlands, Calif., Environmental Systems Research Institute, Inc., various pagination.

Gianessi, Leonard P., and Puffer, Cynthia, 1991, Herbicide use in the United States: Washington, D.C., Resources for the Future, December 1990 (revised April 1991), 128 p.

Goolsby, D.A., and Battaglin, W.A., 1993, Occurrence, distribution and transport of agricultural chemicals in surface waters of the midwestern United States, in Goolsby, D.A., and others, eds., Selected papers on agricultural chemicals in water resources of the Midcontinental United States: U.S. Geological Survey Open-File Report 93-418, p. 1-25.

Goolsby, D.A., Battaglin, W.A., and Thurman, E.M., 1993, Occurrence and transport of agricultural chemicals in the Mississippi River Basin, July through August 1993: U.S. Geological Survey Circular 1120-C, 22 p.

Goolsby, D. A., Coupe, R.H., and Markovchick, D. J., 1991b, Distribution of selected herbicides and nitrate in the Mississippi River and its major tributaries, April through June 1991: U.S. Geological Survey Water-Resources Investigations Report 91-4163, 35 p.
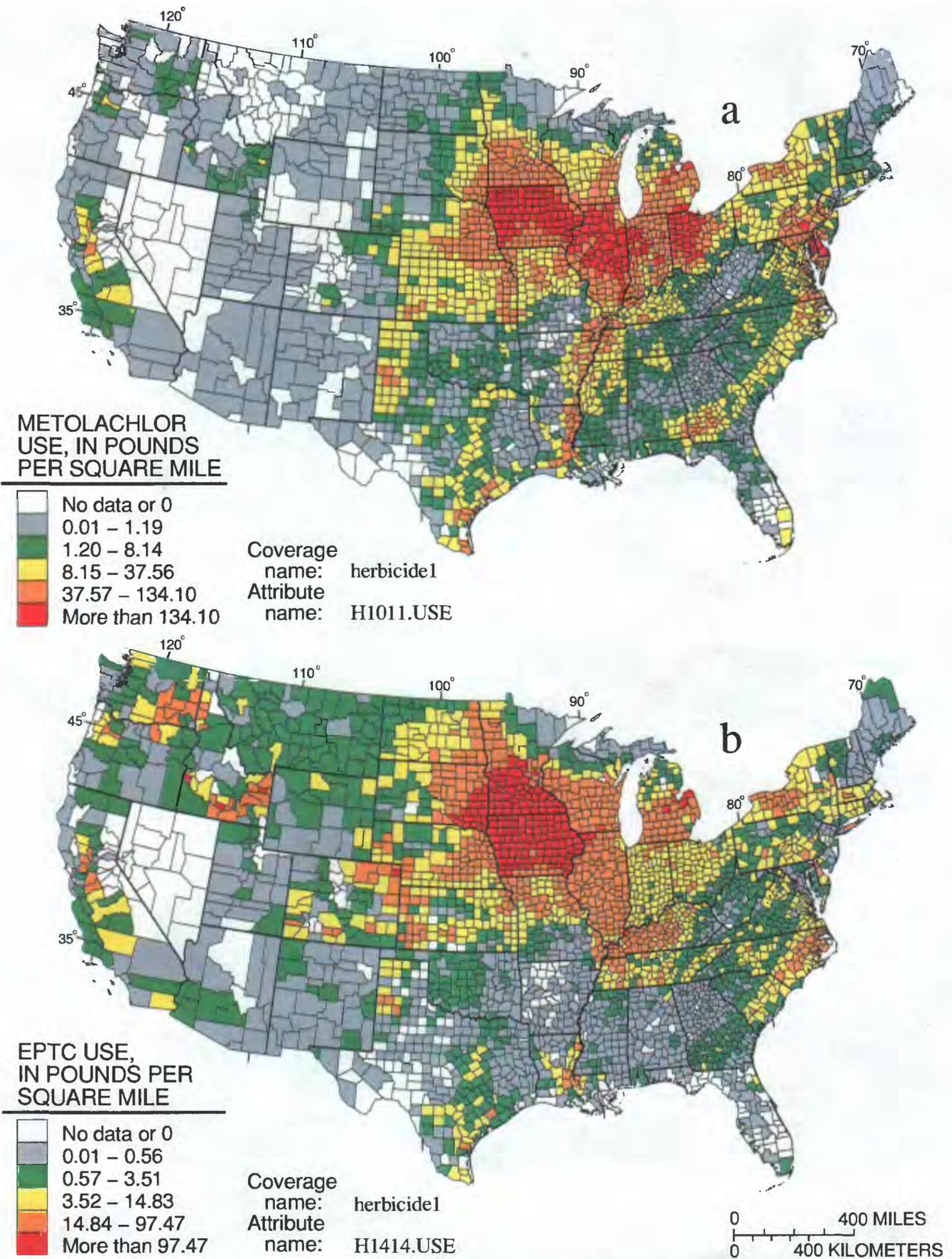
Goolsby, D.A., Thurman, E.M., and Kolpin, D.W., 1991a, Herbicides in streams--Midwestern United States, in Irrigation and drainage, Proceedings of the 1991 American Society of Civil Engineers Conference, Honolulu, Hawaii, July 22-26, 1991, p. 17-23.

He, Chansheng, Riggs, James F., and Kang, Yung-Tsung, 1993, Integration of geographic information systems and a computer model to evaluate impacts of agricultural runoff on water quality, in Harlin, J.M., and Lanfear, K.J., eds., Proceedings of the Symposium on Geographic Information Systems and Water Resources: American Water Resources Association Technical Publication Series TPS-93-1, Mobile, Ala., March 14-17, 1993, p. 61-70.

Kolpin, D.W., Goolsby, D.A., Aga, D.S., Iverson, J.L., and Thurman, E.M., 1993, Pesticides in near-surface aquifers--Results of the Midcontinental United States ground-water reconnaissance, 1991-92, in Goolsby, D.A., and others, eds., Selected papers on agricultural chemicals in water resources of the Midcontinental United States: U.S. Geological Survey Open-File Report 93-418, p. 64-74.

Madison, R.J., and Brunett, J.O., 1985, Overview of the occurrence of nitrate in ground water of the United States, in National Water Summary 1984--Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, p. 93-105.

Mueller, D.K., Ruddy, B.C., and Battaglin, W.A., 1993, Relation of nitrate concentrations in surface water to land use in the upper-midwestern United States, 1989-90, in Goolsby, D.A., and others, eds., Selected papers on agricultural chemicals in water resources of the Midcontinental United States: U.S. Geological Survey Open-File Report 93-418, p. 41-50.

Nebert, Douglas D., 1994, Design of the distributed spatial data library for the Water Resources Division, U.S. Geological Survey: U.S. Geological Survey Open-File Report 94-327, 30 p.

Rains, L., and Latham, P., 1993, GIS modelling of land use and associated nonpoint source pollution, in Harlin, J.M., and Lanfear, K.J., eds., Proceedings of the Symposium on Geographic Information Systems and Water Resources: American Water Resources Association Technical Publication Series TPS-93-1, Mobile, Ala., March 14-17, 1993, p. 35-44.

Rinehold, J.W., and Witt, J.M., 1989, Oregon pesticide use estimates for 1987: Corvallis Oregon State University Extension Service, various pagination.

Scribner, E.A., Thurman, E.M., Goolsby, D.A., Meyer, M.T., Mills, M.S., and Pomes, M.L., 1993, Reconnaissance data for selected herbicides, two atrazine metabolites, and nitrate in surface water of the midwestern United States, 1989-90: U.S. Geological Survey Open-File Report 93-457, 77 p.

Spalding, R.F., and Exner, M.E., 1991, Nitrate contamination in the contiguous United States, in Bogardi, I., and Kuzelka, R.D., eds., Nitrate contamination--Exposure, consequence, and control: Berlin, Springer-Verlag, North Atlantic Treaty Organization Advanced Science Institutes Series, v. G 30, p. 13-48.

Thurman, E.M., Goolsby, D.A., Meyer, M.T., and Kolpin, D.W., 1991, Herbicides in surface water of the midwestern United States--The effect of the spring flush: Journal of Environmental Science and Technology, v. 25, no. 10, p. 1794-96.

Thurman, E.M., Goolsby, D.A., Meyer, M.T., Mills, M.S., Pomes, M.L., and Kolpin, D.W., 1992, A reconnaissance study of herbicides and their metabolites in surface water of the midwestern United States using immunoassay and gas chromatography/mass spectrometry: Journal of Environmental Science and Technology, v. 26, no. 12, p. 2440-2447.

U.S. Department of Agriculture, 1989a, Agricultural resources--Situation and outlook report: U.S. Department of Agriculture, Economic Research Service, February, Washington, D.C.

U.S. Department of Agriculture, 1989b, Agricultural resources--Situation and outlook report: U.S. Department of Agriculture, Economic Research Service, August, Washington, D.C.

U.S. Department of Commerce, 1989a, Census of agriculture, 1987--Final county file: U.S. Department of Commerce, Bureau of the Census [machine-readable data file].

_____ 1989b, Census of agriculture, 1987-- Final county file technical documentation: U.S. Department of Commerce, Bureau of the Census, Data User Services Division, various pagination.

_____ 1990, Census of agriculture, 1987-- Agricultural atlas of the United States, volume 2: U.S. Department of Commerce, Bureau of the Census, Agriculture Division, AC87-S-1, 210 p.

U.S. Environmental Protection Agency, 1990, County-level fertilizer sales data: U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, PM-221.

_____ 1992, Another look--National pesticide survey phase II report, Washington, D.C., 174 p.

U.S. Geological Survey, 1970, National atlas of the United States of America: Washington, D.C., U.S. Geological Survey, 417 p.

ATRAZINE USE,
IN POUNDS PER
SQUARE MILE

- No data or 0
- 0.01 – 2.32
- 2.33 – 13.46
- 13.47 – 52.35
- 52.36 – 163.73
- More than 163.73

Coverage
name: herbicide1
Attribute
name: H1980.USE

ALACHLOR USE,
IN POUNDS PER
SQUARE MILE

- No data or 0
- 0.01 – 1.31
- 1.32 – 8.70
- 8.71 – 42.07
- 42.08 – 152.89
- More than 152.89

Coverage
name: herbicide1
Attribute
name: H1863.USE

0   400 MILES

0   400 KILOMETERS
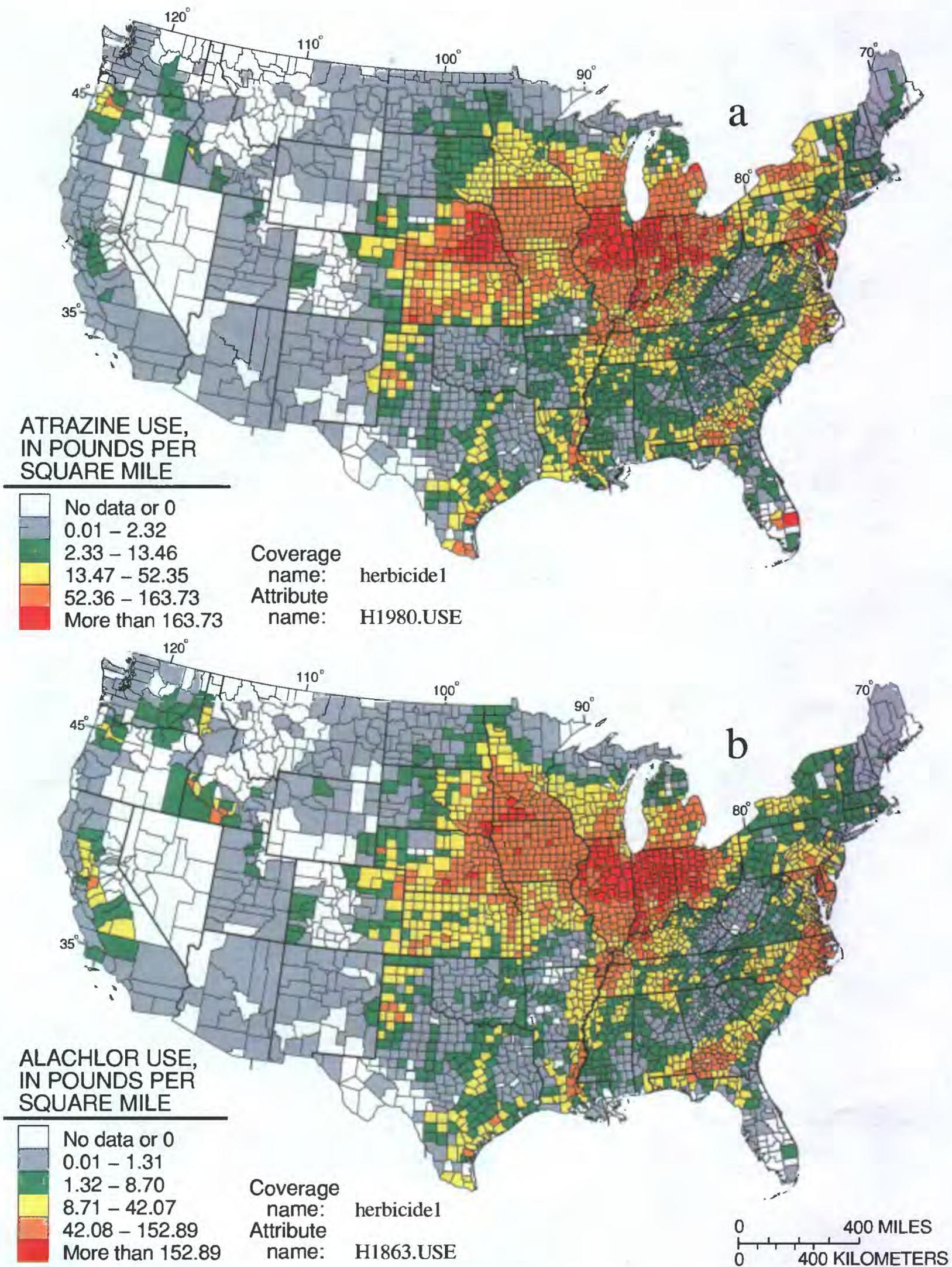
Figure 1. Estimated annual county-level herbicide use, 1989: (a) atrazine; (b) alachlor.

METOLACHLOR USE, IN POUNDS PER SQUARE MILE

	No data or 0
	0.01 – 1.19
	1.20 – 8.14
	8.15 – 37.56
	37.57 – 134.10
	More than 134.10

Coverage name: herbicide1
Attribute name: H1011.USE

EPTC USE, IN POUNDS PER SQUARE MILE

	No data or 0
	0.01 – 0.56
	0.57 – 3.51
	3.52 – 14.83
	14.84 – 97.47
	More than 97.47

Coverage name: herbicide1
Attribute name: H1414.USE

0   400 MILES
0   400 KILOMETERS

Figure 2. Estimated annual county-level herbicide use, 1989: (a) metolachlor; (b) EPTC.

2,4–D USE, IN POUNDS PER SQUARE MILE

- No data or 0
- 0.01 – 4.72
- 4.73 – 10.96
- 10.97 – 17.48
- 17.49 – 34.84
- More than 34.84

Coverage name: herbicide1
Attribute name: H1302.USE

CYANAZINE USE, IN POUNDS PER SQUARE MILE

- No data or 0
- 0.01 – 0.34
- 0.35 – 2.41
- 2.42 – 18.77
- 18.78 – 66.07
- More than 66.07

Coverage name: herbicide1
Attribute name: H1369.USE

0   400 MILES
0   400 KILOMETERS
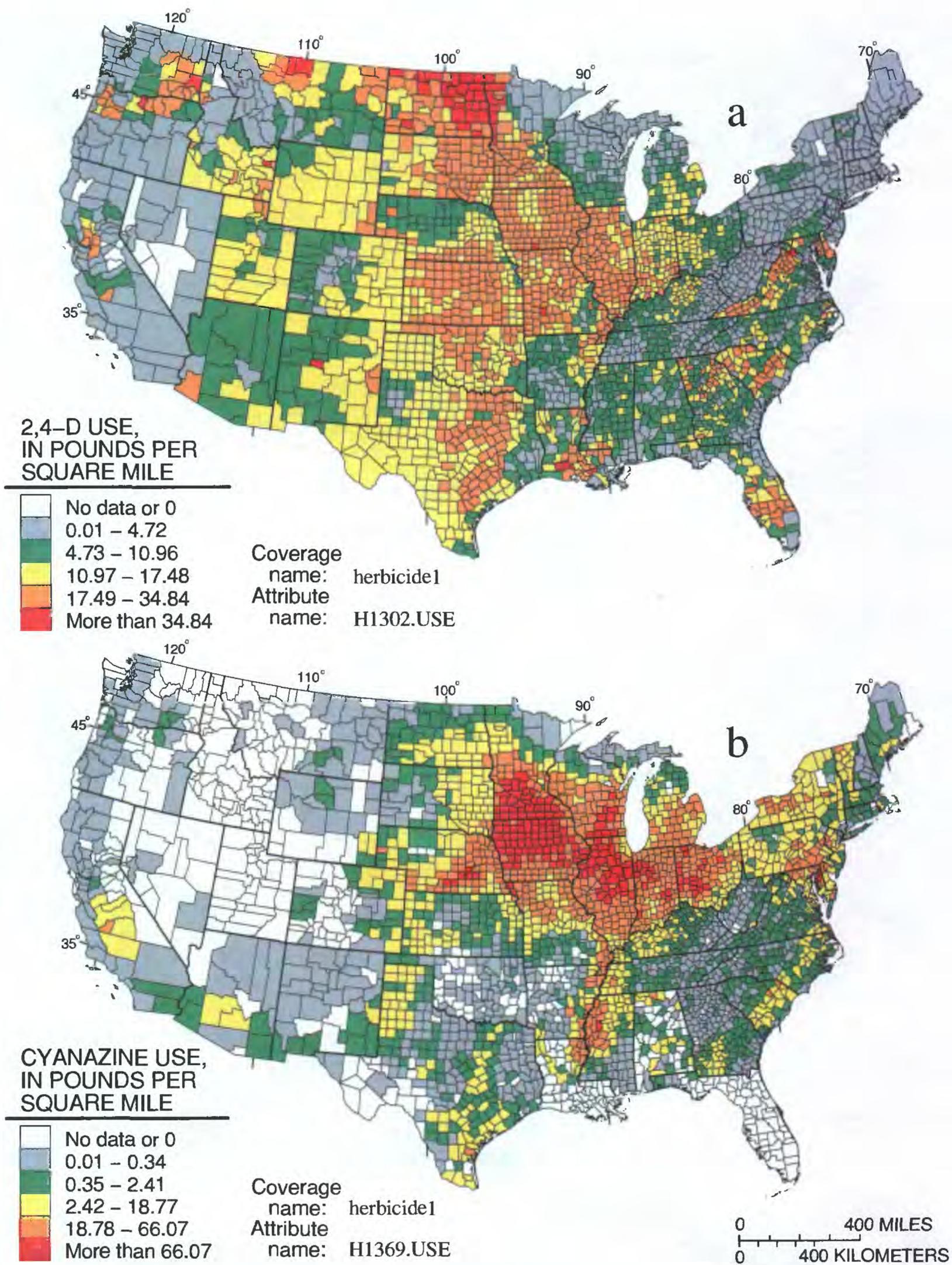
Figure 3. Estimated annual county-level herbicide use, 1989: (a) 2,4-D; (b) cyanazine.

METRIBUZIN USE, IN POUNDS PER SQUARE MILE

- No data or 0
- 0.01 – 0.11
- 0.12 – 0.70
- 0.71 – 3.42
- 3.43 – 15.46
- More than 15.46

Coverage name: herbicide1
Attribute name: H1975.USE

SIMAZINE USE, IN POUNDS PER SQUARE MILE

- No data or 0
- 0.01 – 0.08
- 0.09 – 0.50
- 0.51 – 2.22
- 2.23 – 15.14
- More than 15.14

Coverage name: herbicide1
Attribute name: H1981.USE

0   400 MILES
0   400 KILOMETERS
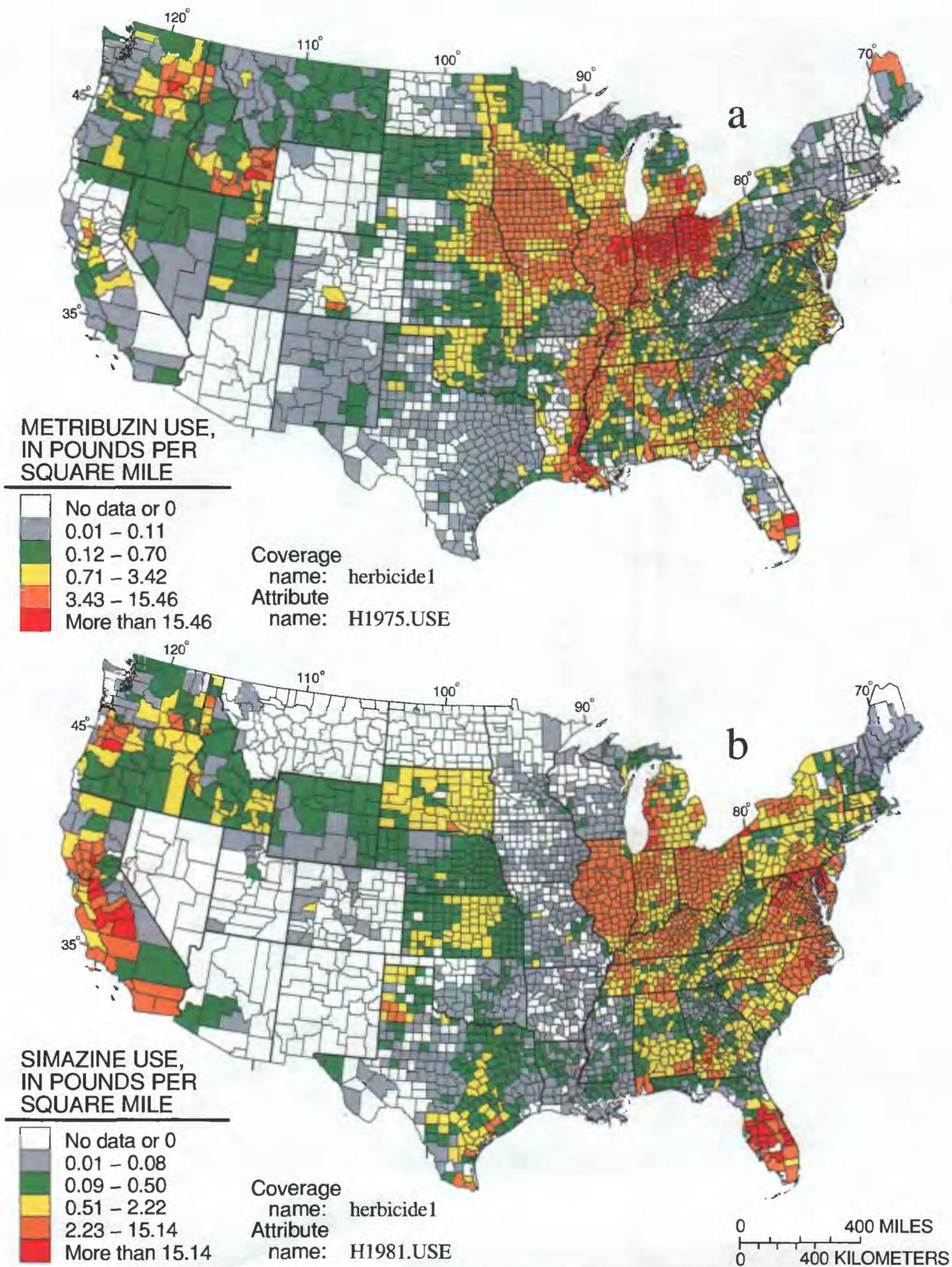
Figure 4. Estimated annual county-level herbicide use, 1989: (a) metribuzin; (b) simazine.

NITROGEN-FERTILIZER USE, IN TONS PER SQUARE MILE

☐	No data or 0
☐	0.01 – 0.94
☐	0.95 – 3.08
☐	3.09 – 7.38
☐	7.39 – 18.36
☐	More than 18.36

Coverage name: nit87
Attribute name: NTOT87.USE

PHOSPHATE USE, IN TONS PER SQUARE MILE

☐	No data or 0
☐	0.01 – 0.40
☐	0.41 – 1.23
☐	1.24 – 2.93
☐	2.94 – 7.51
☐	More than 7.51

Coverage name: nit87
Attribute name: P2O587.USE
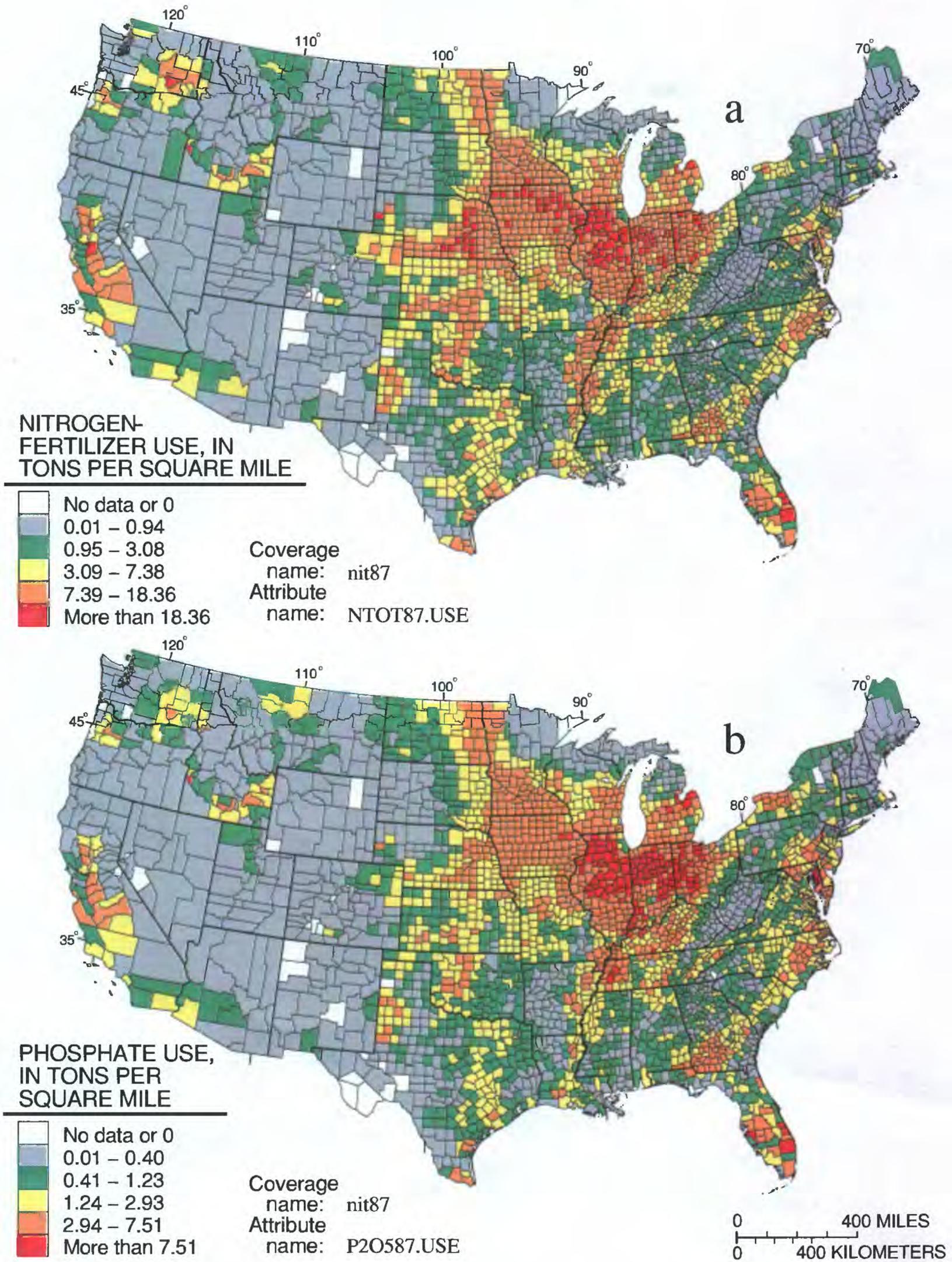
Figure 5. Estimated annual county-level (a) nitrogen-fertilizer use and (b) phosphate use, July 1, 1986, to June 30, 1987.
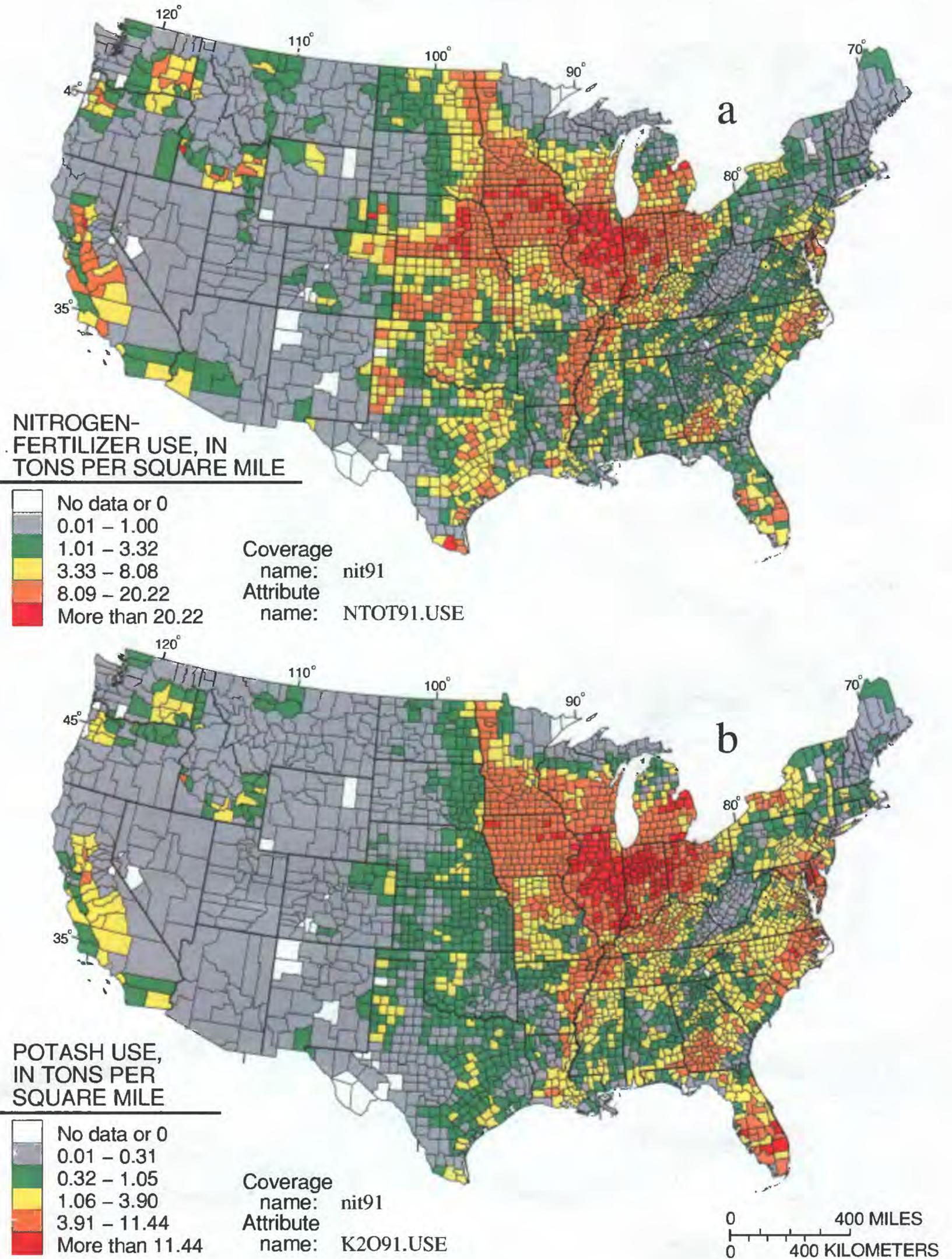
Figure 6. Estimated annual county-level (a) nitrogen-fertilizer use and (b) potash use, July 1, 1990, to June 30, 1991.

EXPENSES FOR COMMERCIAL FERTILIZER, 1987 ($1,000)

☐	No data or 0
☐	1 – 457
☐	458 – 1,306
☐	1,307 – 3,016
☐	3,017 – 8,832
☐	More than 8,832

Coverage name: ag_expn
Attribute name: CA0295

EXPENSES FOR AGRICULTURAL CHEMICALS, 1987 ($1,000)

☐	No data or 0
☐	1 – 208
☐	209 – 760
☐	761 – 2,009
☐	2,010 – 8,229
☐	More than 8,229

Coverage name: ag_expn
Attribute name: CA0299
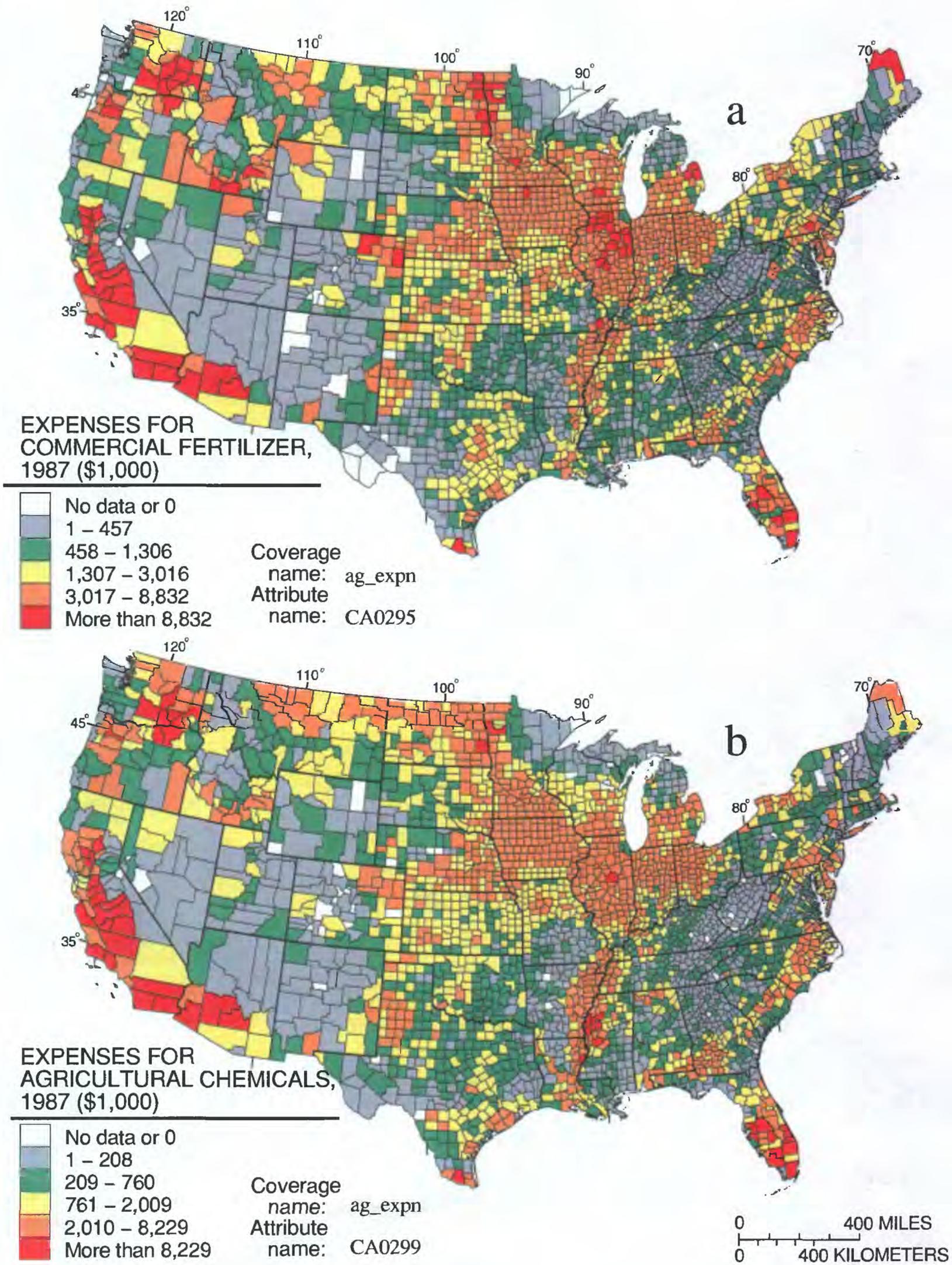
Figure 7. Estimated annual county-level farm expenses for (a) commercial fertilizer and (b) agricultural chemicals, 1987.
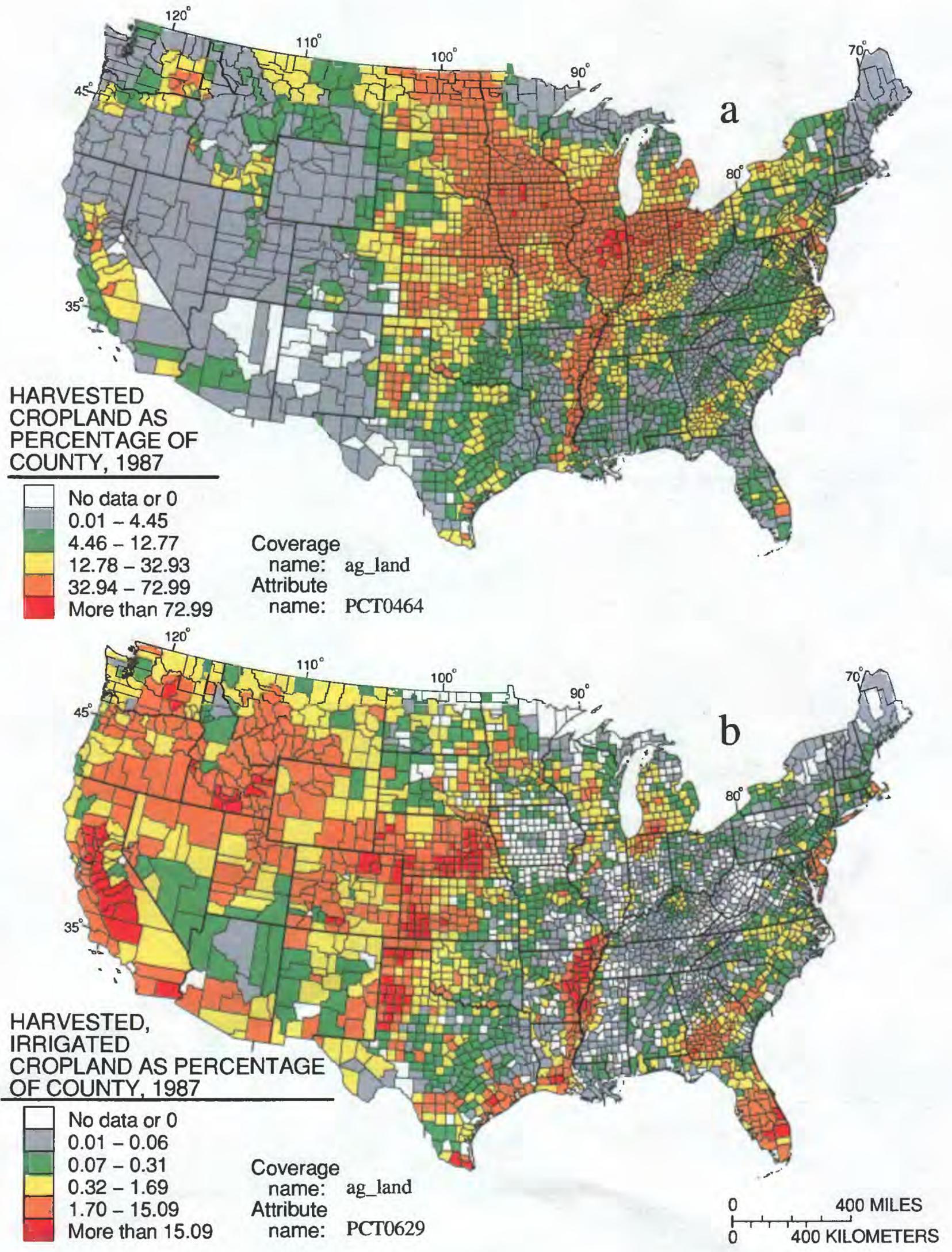
Figure 8. Estimated (a) harvested cropland, 1987, and (b) harvested, irrigated cropland, 1987, expressed as a percentage of the total area of each county.

**PERCENTAGE OF
COUNTY TREATED WITH
COMMERCIAL FERTILIZER, 1987**

No data or 0
0.01 – 3.31
3.32 – 10.24
10.25 – 24.55
24.56 – 54.53
More than 54.53

Coverage
name: ag_chem
Attribute
name: PCT0772

a

**PERCENTAGE OF
COUNTY TREATED WITH
HERBICIDES, 1987**

No data or 0
0.01 – 1.61
1.62 – 6.24
6.25 – 18.50
18.51 – 48.56
More than 48.56

Coverage
name: ag_chem
Attribute
name: PCT0802

b

0   400 MILES
0   400 KILOMETERS
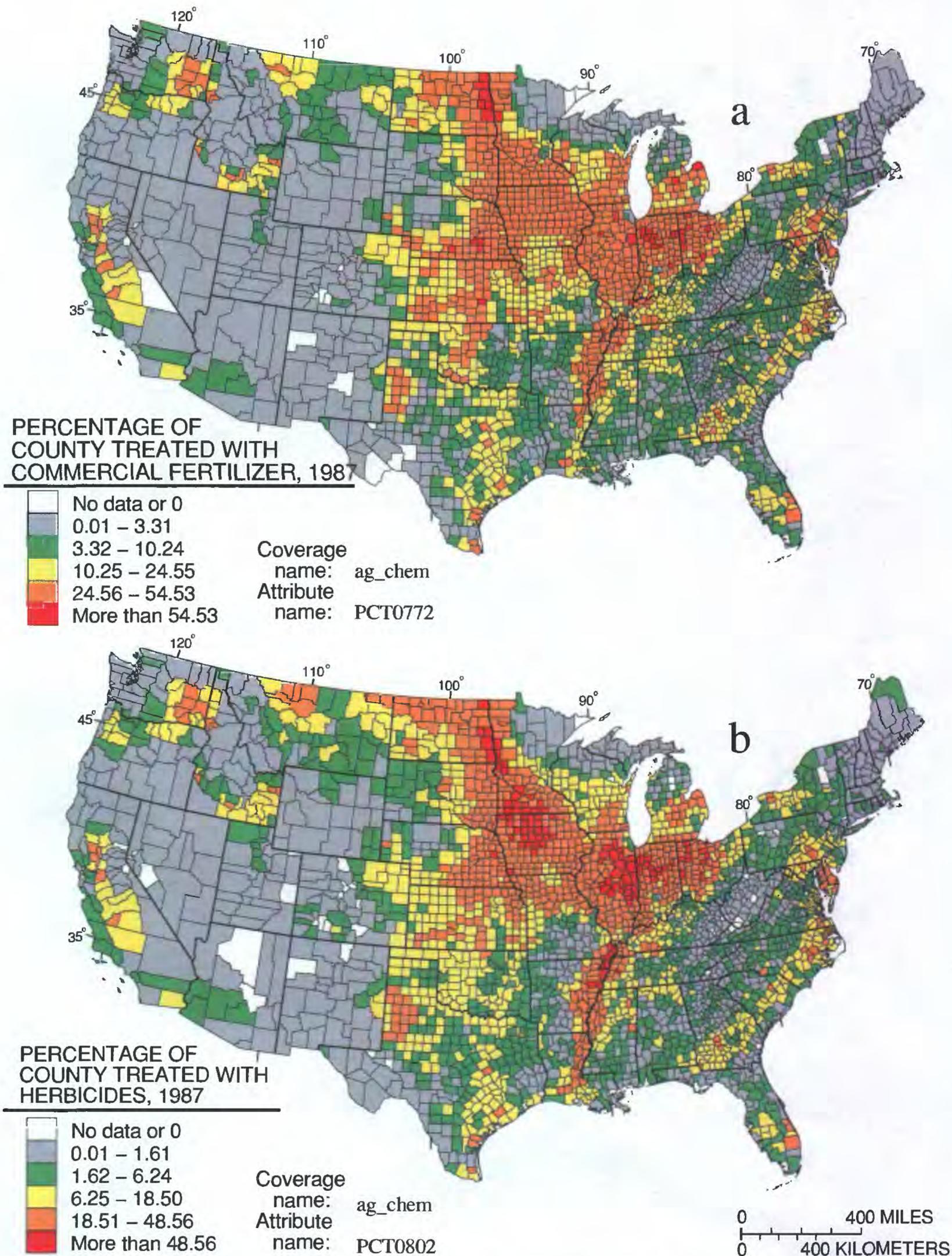
Figure 9. Estimated area treated with (a) commercial fertilizer, 1987, and (b) products used to
control weeds, grass, or brush in crops and pasture, 1987, expressed as a percentage of
the total area of each county.

NUMBER OF CATTLE AND CALVES, 1987

No data or 0	
1 – 9,027	
9,028 – 21,292	Coverage
21,293 – 42,660	name: ag_stock
42,661 – 115,820	Attribute
More than 115,820	name: CA0930

NUMBER OF BROILERS AND OTHER MEAT–TYPE CHICKENS, 1987

No data or 0	
1 – 141	
142 – 450	Coverage
451 – 2,135	name: ag_stock
2,136 – 3,093,447	Attribute
More than 3,093,447	name: CA1247
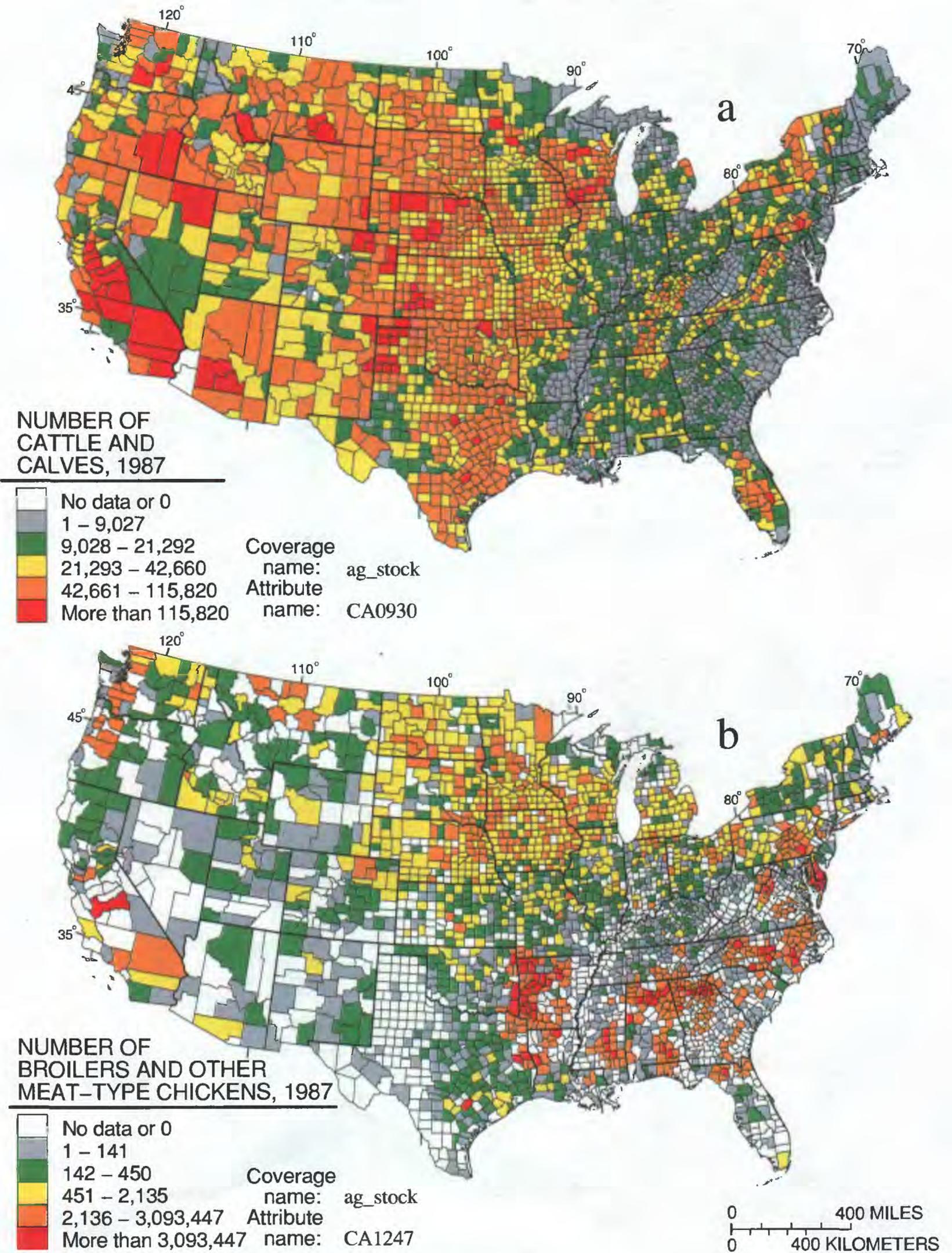
Figure 10. Estimated number of (a) cattle and calves, 1987, and (b) broilers and other meat-type chickens, 1987, by county.

HARVESTED CORN AS PERCENTAGE OF COUNTY, 1987

No data or 0
0.01 – 0.23
0.24 – 1.41
1.42 – 8.17
8.18 – 27.47
More than 27.47

Coverage name: ag_crop1
Attribute name: PCT2107

HARVESTED SOYBEANS AS PERCENTAGE OF COUNTY, 1987

No data or 0
0.01 – 0.64
0.65 – 3.12
3.13 – 14.34
14.35 – 35.92
More than 35.92

Coverage name: ag_crop1
Attribute name: PCT2307

0   400 MILES
0   400 KILOMETERS
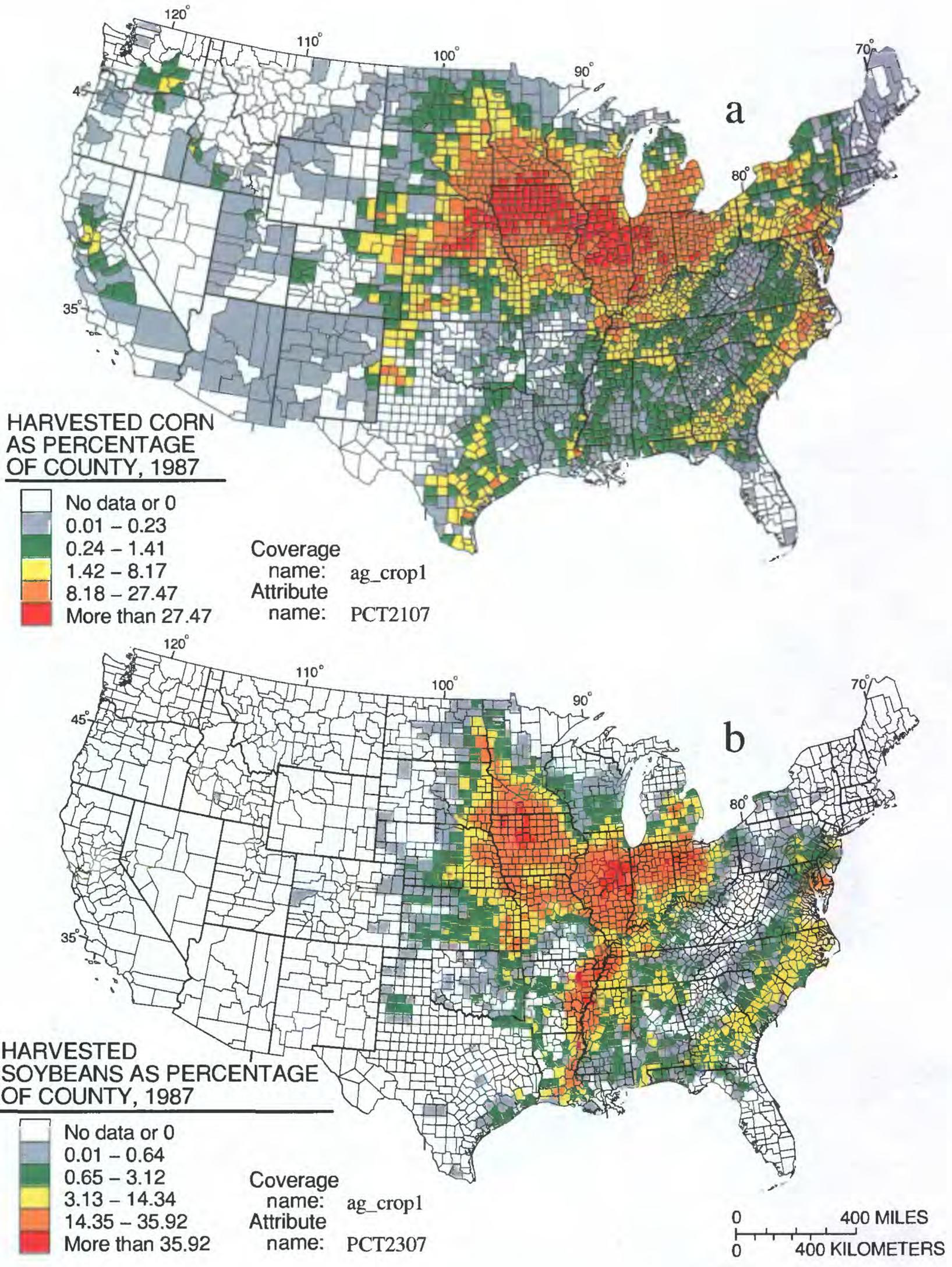
Figure 11. Estimated harvested (a) corn for grain or seed, 1987, and (b) soybeans for beans, 1987, expressed as a percentage of the total area of each county.

HARVESTED
SORGHUM AS PERCENTAGE
OF COUNTY, 1987

	No data or 0
	0.01 – 0.08
	0.09 – 0.29
	0.30 – 1.45
	1.46 – 7.91
	More than 7.91

Coverage
name: ag_crop1
Attribute
name: PCT2117

HARVESTED
WHEAT AS PERCENTAGE
OF COUNTY, 1987

	No data or 0
	0.01 – 0.23
	0.24 – 0.94
	0.95 – 3.44
	3.45 – 15.78
	More than 15.78

Coverage
name: ag_crop1
Attribute
name: PCT2127

0   400 MILES
0   400 KILOMETERS
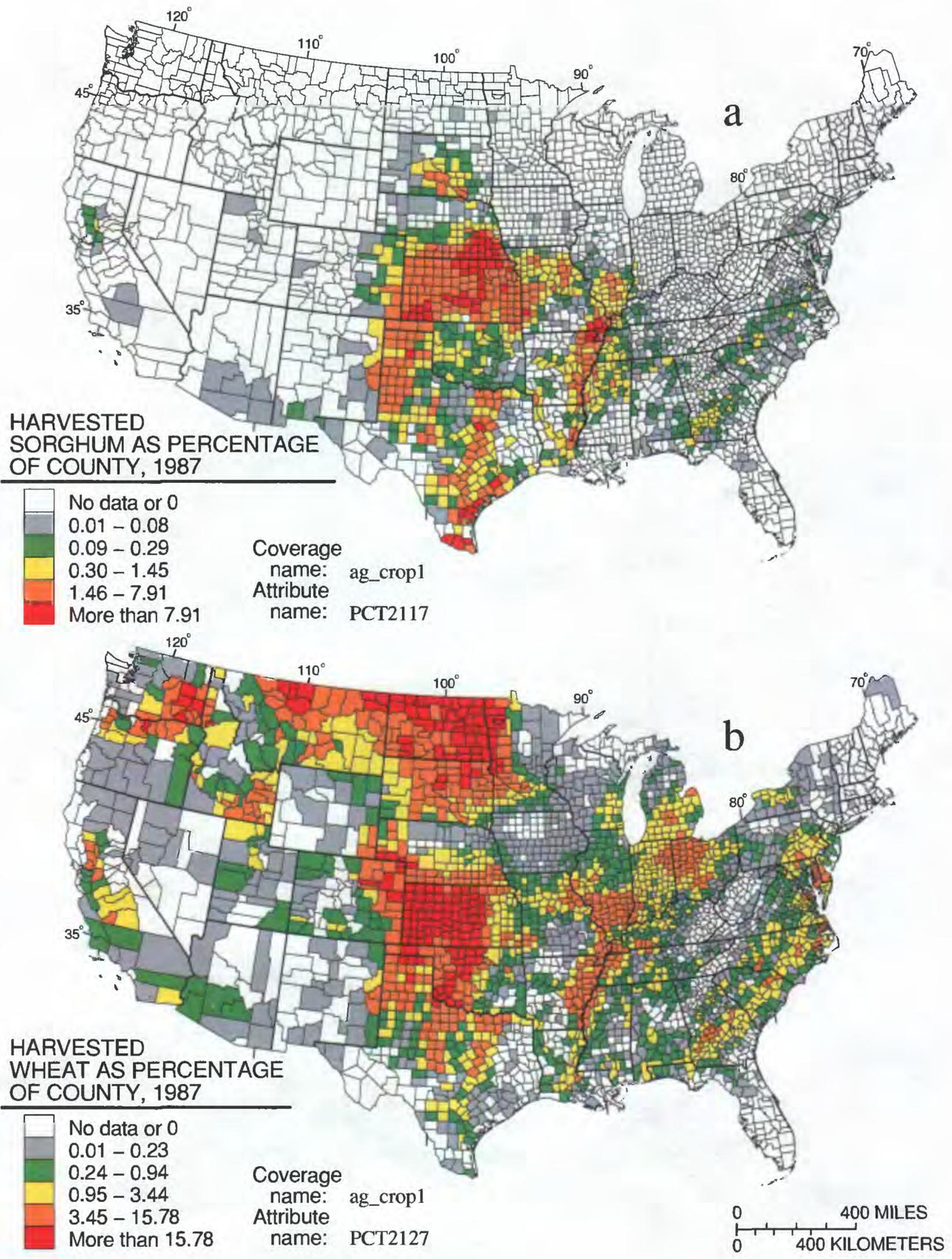
Figure 12. Estimated harvested (a) sorghum for grain or seed, 1987, and (b) wheat for grain, 1987, expressed as a percentage of the total area of each county.

Table 1. Herbicide codes

{Herbicides listed alphabetically}

Herbicide code number	Herbicide name	Herbicide code number	Herbicide name	Herbicide code number	Herbicide name
1302	2,4-D	1005	Diclofop	1417	Molinate
1308	2,4-DB	9015	Diethatyl-ethyl	1900	Napropamide
1002	Acifluorfen	1374	Difenzoquat	1307	Naptalam
1863	Alachlor	1375	Dinoseb	1018	Norflurazon
1982	Ametryn	1366	Diphenamid	1873	Oryzalin
9048	Asulam	1974	Dipropetryn	4000	Oxyfluorfen
1980	Atrazine	1950	Diquat	1616	Paraquat
1176	Barban	1991	Diuron	1419	Pebulate
1362	Benefin	1414	EPTC	1629	Pendimethalin
1098	Bensulide	1948	Endothall	2220	Phenmedipham
1287	Bentazon	9009	Ethalfluralin	1051	Picloram
1309	Bifenox	9012	Ethofumesate	1396	Profluralin
1809	Bromacil	5003	Fenoxaprop	1987	Prometryn
1116	Bromoxynil	9007	Fluazifop	1888	Pronamide
1839	Butylate	1397	Fluchloralin	1191	Propachlor
1885	CDAA	1998	Fluometuron	1282	Propanil
1299	Chloramben	4010	Fomesafen	1979	Propazine
4008	Chlorimuron	1099	Glyphosate	2158	Propham
2053	Chloroxuron	2070	Hexazinone	2250	Pyrazon
1183	Chlorpropham	9000	Imazethapyr	1910	Sethoxydim
1913	Chlorsulfuron	4005	Imazaquin	1984	Siduron
5000	Clomazone	1867	Isopropalin	1981	Simazine
4002	Clopyralid	4009	Lactofen	1963	Tebuthiuron
1369	Cyanazine	1993	Linuron	1109	Terbacil
2069	Cycloate	1305	MCPA	1977	Terbutryn
1872	DCPA	1889	MCPB	4004	Thiameturon
4001	DSMA	1477	MCPP	1903	Thiobencarb
1289	Dalapon	1124	MSMA	1790	Triallate
9014	Desmedipham	9096	Methazole	1988	Triclopyr
9016	Diallate	1011	Metolachlor	4007	Tridiphane
1298	Dicamba	1975	Metribuzin	1361	Trifluralin
1865	Dichlobenil	4003	Metsulfuron	1432	Vernolate

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest weight of active ingredient was used, 1989

[Attribute names: those ending in .ACR are estimates of acres treated, .LBS are estimates of total pounds of active ingredient applied, and .USE are estimates of county-level herbicide-use rate; treated crops: the crops on which the largest weights of active ingredients were estimated to have been used in the United States, 1989; percentage treated: percentage of the crop treated; treated crops and percentage treated are as reported in Gianessi and Puffer (1991, Tables B-1 through B-96); <, less than]

HERBICIDE1--Coverage of use estimates for the 20 most-used herbicides in the conterminous United States

Herbicide name	Attribute names	Treated crops	Percentage treated
Atrazine	H1980.ACR, H1980.LBS, and H1980.USE	corn	65
		sorghum	52
		sugarcane	59
		pasture	<1
		sweet corn	49
Alachlor	H1863.ACR, H1863.LBS, and H1863.USE	corn	31
		soybeans	19
		sorghum	13
		peanuts	42
		dry beans	16
		sweet corn	33
Metolachlor	H1011.ACR, H1011.LBS, and H1011.USE	corn	26
		soybeans	11
		sorghum	19
		peanuts	29
		dry beans	14
		potatoes	18
		cotton	3
EPTC	H1414.ACR, H1414.LBS, and H1414.USE	corn	10
		alfalfa	5
		dry beans	38
		potatoes	27
		sugarbeets	10
		green beans	38
		sweet corn	8

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE1--Coverage of use estimates for the 20 most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
2,4-D	H1302.ACR, H1302.LBS, and H1302.USE	pasture	5
		wheat	29
		corn	12
		other hay	16
		barley	33
		sorghum	9
		rice	23
		oats	14
Trifluralin	H1361.ACR, H1361.LBS, and H1361.USE	soybeans	41
		cotton	65
		wheat	4
		sunflowers	68
		alfalfa	1
		dry beans	38
Cyanazine	H1369.ACR, H1369.LBS, and H1369.USE	corn	19
		cotton	22
		sorghum	2
		sweet corn	16
Butylate	H1839.ACR, H1839.LBS, and H1839.USE	corn	6
		sweet corn	8
Pendimethalin	H1629.ACR, H1629.LBS, and H1629.USE	soybeans	15
		cotton	30
		corn	3
		peanuts	31
		tobacco	46
		sorghum	2

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE1--Coverage of use estimates for the 20 most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Glyphosate	H1099.ACR, H1099.LBS, and H1099.USE	soybeans	6
		cotton	21
		corn	3
		pasture	<1
		wheat	4
		grapes	38
		sorghum	8
Dicamba	H1298.ACR, H1298.LBS, and H1298.USE	pasture	3
		corn	11
		wheat	11
		other hay	5
		sorghum	4
Bentazon	H1287.ACR, H1287.LBS, and H1287.USE	soybeans	22
		rice	14
		dry beans	10
		corn	<1
		peanuts	12
Propanil	H1282.ACR, H1282.LBS, and H1282.USE	rice	76
MSMA	H1124.ACR, H1124.LBS, and H1124.USE	cotton	28
		sod	6
		citrus	2
Metribuzin	H1975.ACR, H1975.LBS, and H1975.USE	soybeans	21
		potatoes	57
		alfalfa	2
		sugarcane	27
		wheat	<1
		tomatoes	40
Molinate	H1417.ACR, H1417.LBS, and H1417.USE	rice	40

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE1--Coverage of use estimates for the 20 most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
MCPA	H1305.ACR, H1305.LBS, and H1305.USE	wheat	10
		barley	21
		oats	15
		rice	12
Propazine	H1979.ACR, H1979.LBS, and H1979.USE	sorghum	26
Propachlor	H1191.ACR, H1191.LBS, and H1191.USE	sorghum	12
		corn	1
		green peas	7
Simazine	H1981.ACR, H1981.LBS, and H1981.USE	corn	2
		citrus	45
		alfalfa	2
		grapes	56
		seed crops	8
		apples	34
		asparagus	40

HERBICIDE2--Coverage of use estimates for the twenty-first through the fortieth most-used herbicides in the conterminous United States

Herbicide name	Attribute names	Treated crops	Percentage treated
Ethalfluralin	H9009.ACR, H9009.LBS, and H9099.USE	soybeans	5
		dry beans	25
		sunflowers	22
		peanuts	21
Triallate	H1790.ACR, H1790.LBS, and H1790.USE	wheat	3
		barley	15
		dry peas	14

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE2--coverage of use estimates for the twenty-first through the fortieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Paraquat	H1616.ACR, H1616.LBS, and H1616.USE	soybeans	5
		corn	3
		cotton	10
		alfalfa	1
		citrus	36
		peanuts	53
		grapes	20
Chloramben	H1299.ACR, H1299.LBS, and H1299.USE	soybeans	4
		dry beans	21
		sweet potatoes	30
		sunflowers	2
		tomatoes	5
		peanuts	7
Picloram	H1051.ACR, H1051.LBS, and H1051.USE	pasture	1
		other hay	1
Clomazone	H5000.ACR, H5000.LBS, and H5000.USE	soybeans	7
		pumpkins	5
Bromoxynil	H1116.ACR, H1116.LBS, and H1116.USE	corn	5
		wheat	5
		barley	10
		oats	3
		rice	9
		alfalfa	<1
		garlic	99
Linuron	H1993.ACR, H1993.LBS, and H1993.USE	soybeans	7
		cotton	3
		carrots	95
		potatoes	8
		asparagus	29

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE2--coverage of use estimates for the twenty-first through the fortieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Fluometuron	H1998.ACR, H1995.LBS, and H1998.USE	cotton	31
DCPA	H1872.ACR, H1872.LBS, and H1872.USE	onions	53
		broccoli	42
		cauliflower	56
		seed crops	1
		cabbage	19
		garlic	89
Diuron	H1991.ACR, H1991.LBS, and H1991.USE	cotton	6
		citrus	68
		seed crops	10
		wheat	<1
		grapes	31
		alfalfa	<1
Prometryn	H1987.ACR, H1987.LBS, and H1987.USE	cotton	13
		celery	78
		parsley	100
Norflurazon	H1018.ACR, H1018.LBS, and H1018.USE	cotton	20
		citrus	20
		grapes	18
		almonds	20
		apples	9
DSMA	H4001.ACR, H4001.LBS, and H4001.USE	cotton	11
		sod	2
Acifluorfen	H1002.ACR, H1002.LBS, and H1002.USE	soybeans	10
		peanuts	14
		rice	6
Diclofop	H1005.ACR, H1005.LBS, and H1005.USE	wheat	3
		barley	3

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE2--coverage of use estimates for the twenty-first through the fortieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Oryzalin	H1873.ACR, H1873.LBS, and H1873.USE	grapes	46
		soybeans	1
		almonds	50
		apples	21
2,4-DB	H1308.ACR, H1308.LBS, and H1308.USE	alfalfa	3
		soybeans	3
		peanuts	67
		seed crops	8
Thiobencarb	H1903.ACR, H1903.LBS, and H1903.USE	rice	21
Cycloate	H2069.ACR, H2069.LBS, and H2069.USE	sugar beets	29
		beets	79
		spinach	38

HERBICIDE3--Coverage of use estimates for the forty-first through the sixtieth most-used herbicides in the conterminous United States

Herbicide name	Attribute names	Treated crops	Percentage treated
Benefin	H1362.ACR, H1362.LBS, and H1362.USE	peanuts	35
		alfalfa	1
		tobacco	5
		seed crops	1
		lettuce	44
Bromacil	H1809.ACR, H1809.LBS, and H1809.USE	citrus	76
Terbutryn	H1977.ACR, H1977.LBS, and H1977.USE	sorghum	3
		wheat	1
Asulam	H9048.ACR, H9048.LBS, and H9048.USE	sugarcane	50
		sod	10

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE3--Coverage of use estimates for the forty-first through the sixtieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Imazaquin	H4005.ACR, H4005.LBS, and H4005.USE	soybeans	20
Diphenamid	H1366.ACR, H1366.LBS, and H1366.USE	tobacco	16
		tomatoes	20
		sweet potatoes	37
		sweet peppers	24
Vernolate	H1432.ACR, H1432.LBS, and H1432.USE	peanuts	17
		soybeans	<1
		corn	<1
Sethoxydim	H1910.ACR, H1910.LBS, and H1910.USE	soybeans	4
		cotton	9
		sugar beets	34
		alfalfa	1
		peanuts	16
Fluazifop	H9007.ACR, H9007.LBS, and H9007.USE	soybeans	4
		cotton	14
		grapes	4
		onions	24
Napropamide	H1900.ACR, H1900.LBS, and H1900.USE	tomatoes	34
		tobacco	9
		strawberries	41
		sweet peppers	49
Naptalam	H1307.ACR, H1307.LBS, and H1307.USE	soybeans	1
		cucumbers	13
		watermelons	26
		peanuts	4
Pebulate	H1419.ACR, H1419.LBS, and H1419.USE	tobacco	15
		tomatoes	18
		sugar beets	<1

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE3--Coverage of use estimates for the forty-first through the sixtieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Bensulide	H1098.ACR, H1098.LBS, and H1098.USE	watermelons	29
		cantaloupes	43
		cucumbers	30
		sod	8
Profluralin	H1396.ACR, H1396.LBS, and H1396.USE	soybeans	1
		cotton	2
Tebuthiuron	H1963.ACR, H1963.LBS, and H1963.USE	pasture	<1
Oxyfluorfen	H4000.ACR, H4000.LBS, and H4000.USE	grapes	35
		almonds	30
		cotton	3
Diethatyl-ethyl	H9015.ACR, H9015.LBS, and H9015.USE	sugar beets	21
		spinach	53
Dipropetryn	H1974.ACR, H1974.LBS, and H1974.USE	cotton	3
Dalapon	H1289.ACR, H1289.LBS, and H1289.USE	sugarcane	6
		cotton	<1
		citrus	7
		seed crops	<1
Dinoseb	H1375.ACR, H1375.LBS, and H1375.USE	dry peas	24
		green peas	
		dry beans	
		green beans	3
		sweet corn	2
		potatoes	1

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE4--Coverage of use estimates for the sixty-first through the eightieth most-used herbicides in the conterminous United States

Herbicide name	Attribute names	Treated crops	Percentage treated
Terbacil	H1109.ACR, H1109.LBS, and H1109.USE	alfalfa	1
		mint	80
		sugarcane	16
Hexazinone	H2070.ACR, H2070.LBS, and H2070.USE	alfalfa	2
		seed crops	3
		blueberries	22
Imazethapyr	H9000.ACR, H9000.LBS, and H9000.USE	soybeans	5
		green beans	6
Ethofumesate	H9012.ACR, H9012.LBS, and H9012.USE	sugar beets	19
		seed crops	3
Pyrazon	H2250.ACR, H2250.LBS, and H2250.USE	sugar beets	15
		beets	68
Propham	H2158.ACR, H2158.LBS, and H2158.USE	alfalfa	<1
		seed crops	2
		sugar beets	1
		lettuce	3
Methazole	H9096.ACR, H9096.LBS, and H9096.USE	cotton	5
Chlorimuron	H4008.ACR, H4008.LBS, and H4008.USE	soybeans	8
		peanuts	22
Difenzoquat	H1374.ACR, H1374.LBS, and H1374.USE	barley	2
		wheat	<1
Chlorpropham	H1183.ACR, H1183.LBS, and H1183.USE	alfalfa	<1
		onions	18
		seed crops	<1
		carrots	2

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE4--Coverage of use estimates for the sixty-first through the eightieth most-used herbicides in the conterminous United States--continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Pronamide	H1888.ACR, H1888.LBS, and H1888.USE	alfalfa	1
		lettuce	44
		seed crops	1
		artichokes	28
Fomesafen	H4010.ACR, H4010.LBS, and H4010.USE	soybeans	1
Tridiphane	H4007.ACR, H4007.LBS, and H4007.USE	corn	<1
Endothall	H1948.ACR, H1948.LBS, and H1948.USE	sugar beets	17
		cotton	7
		potatoes	2
Ametryn	H1982.ACR, H1982.LBS, and H1982.USE	corn	<1
		sugarcane	23
		citrus	20
Phenmedipham	H2220.ACR, H2220.LBS, and H2220.USE	sugar beets	66
		spinach	12
		beets	11
Diquat	H1950.ACR, H1950.LBS, and H1950.USE	potatoes	21
		alfalfa	<1
		seed crop	4
Desmedipham	H9014.ACR, H9014.LBS, and H9014.USE	sugar beets	68
Bifenox	H1309.ACR, H1309.LBS, and H1309.USE	rice	3
Diallate	H9016.ACR, H9016.LBS, and H9016.USE	sugar beets	5
		potatoes	1
		soybeans	<1
		flax	1

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE5--Coverage of use estimates for the eighty-first through the ninety-sixth most-used herbicides in the conterminous United States

Herbicide name	Attribute names	Treated crops	Percentage treated
Lactofen	H4009.ACR, H4009.LBS, and H4009.USE	soybeans	1
Isopropalin	H1867.ACR, H4009.LBS, and H4009.USE	tobacco	13
Chlorsulfuron	H1913.ACR, H1913.LBS, and H1913.USE	wheat barley oats	12 2 1
Triclopyr	H1988.ACR, H1988.LBS, and H1988.USE	other hay pasture	<1 <1
Chloroxuron	H2053.ACR, H2053.LBS, and H2053.USE	strawberries celery carrots	29 28 4
Dichlobenil	H1865.ACR, H1865.LBS, and H1865.USE	apples cranberries grapes	3 26 1
Thiameturon	H4004.ACR, H4004.LBS, and H4004.USE	wheat barley	4 6
Barban	H1176.ACR, H1176.LBS, and H1176.USE	wheat barley	<1 <1
MCPB	H1889.ACR, H1889.LBS, and H1889.USE	green peas dry peas	23 2
Metsulfuron	H4003.ACR, H4003.LBS, and H4003.USE	wheat barley	7 4
MCPP	H1477.ACR, H1477.LBS, and H1477.USE H1477.LBS	sod seed crops	22 <1
Fenoxaprop	H5003.ACR, H5003.LBS, and H5003.USE	rice	4

Table 2. Herbicide-use coverage names, attribute names, and crops on which the largest amount of active ingredient was used, 1989 -- continued

HERBICIDE5--Coverage of use estimates for the eighty-first through the ninety-sixth most-used herbicides in the conterminous United States-continued

Herbicide name	Attribute names	Treated crops	Percentage treated
Cylopyralid	H4002.ACR, H4002.LBS, and H4002.USE	wheat	<1
		sugar beets	3
CDAA	H1885.ACR, H1885.LBS, and H1885.USE	onions	4
Fluchloralin	H1397.ACR, H1397.LBS, and H1397.USE	cotton	1
Siduron	H1984.ACR, H1984.LBS, and H1984.USE	sod	1

Table 3. Nitrogen-fertilizer sales coverage names, attribute names, and short attribute descriptions
        [Attribute descriptions and values from U.S. Environmental Protection Agency, 1990]

NIT85--Coverage of nitrogen-fertilizer sales estimates, 1985

Attribute name	Description
NTOT85	Total estimated nitrogen-fertilizer sales, 1991 (tons)
NTOT85.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O85	Estimated potash (K_2O) sales, 1985 (tons)
K2O85.USE	Rate of potash use in county polygon (tons per square mile)
P2O585	Estimated phosphate (P_2O_5) sales, 1985 (tons)
P2O585.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI85	Fertilizer sold as ammonium nitrate, 1985 (tons)
ANHY85	Fertilizer sold as anhydrous ammonia, 1985 (tons)
NMIS85	Fertilizer sold as miscellaneous forms, 1985 (tons)
NSOL85	Fertilizer sold as nitrogen solutions, 1985 (tons)
UREA85	Fertilizer sold as urea, 1985 (tons)

NIT86--Coverage of nitrogen-fertilizer sales estimates, 1986

Attribute name	Description
NTOT86	Total estimated nitrogen-fertilizer sales, 1986 (tons)
NTOT86.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O86	Estimated potash (K_2O) sales, 1986 (tons)
K2O86.USE	Rate of potash use in county polygon (tons per square mile)
P2O586	Estimated phosphate (P_2O_5) sales, 1986 (tons)
P2O586.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI86	Fertilizer sold as ammonium nitrate, 1986 (tons)
ANHY86	Fertilizer sold as anhydrous ammonia, 1986 (tons)
NMIS86	Fertilizer sold as miscellaneous forms, 1986 (tons)
NSOL86	Fertilizer sold as nitrogen solutions, 1986 (tons)
UREA86	Fertilizer sold as urea, 1986 (tons)

Table 3. Nitrogen-fertilizer sales coverage names, attribute names, and short attribute descriptions -- continued

NIT87--Coverage of nitrogen-fertilizer sales estimates, 1987

Attribute name	Description
NTOT87	Total estimated nitrogen-fertilizer sales, 1987 (tons)
NTOT87.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O87	Estimated potash (K_2O) sales, 1987 (tons)
K2O87.USE	Rate of potash use in county polygon (tons per square mile)
P2O587	Estimated phosphate (P_2O_5) sales, 1987 (tons)
P2O587.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI87	Fertilizer sold as ammonium nitrate, 1987 (tons)
ANHY87	Fertilizer sold as anhydrous ammonia, 1987 (tons)
NMIS87	Fertilizer sold as miscellaneous forms, 1987 (tons)
NSOL87	Fertilizer sold as nitrogen solutions, 1987 (tons)
UREA87	Fertilizer sold as urea, 1987 (tons)

NIT88--Coverage of nitrogen-fertilizer sales estimates, 1988

Attribute name	Description
NTOT88	Total estimated nitrogen-fertilizer sales, 1988 (tons)
NTOT88.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O88	Estimated potash (K_2O) sales, 1988 (tons)
K2O88.USE	Rate of potash use in county polygon (tons per square mile)
P2O588	Estimated phosphate (P_2O_5) sales, 1988 (tons)
P2O588.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI88	Fertilizer sold as ammonium nitrate, 1988 (tons)
ANHY88	Fertilizer sold as anhydrous ammonia, 1988 (tons)
NMIS88	Fertilizer sold as miscellaneous forms, 1988 (tons)
NSOL88	Fertilizer sold as nitrogen solutions, 1988 (tons)
UREA88	Fertilizer sold as urea, 1988 (tons)

Table 3. Nitrogen-fertilizer sales coverage names, attribute names, and short attribute descriptions -- continued

NIT89--Coverage of nitrogen-fertilizer sales estimates, 1989

Attribute name	Description
NTOT89	Total estimated nitrogen-fertilizer sales, 1989 (tons)
NTOT89.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O89	Estimated potash (K_2O) sales, 1989 (tons)
K2O89.USE	Rate of potash use in county polygon (tons per square mile)
P2O589	Estimated phosphate (P_2O_5) sales, 1989 (tons)
P2O589.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI89	Fertilizer sold as ammonium nitrate, 1989 (tons)
ANHY89	Fertilizer sold as anhydrous ammonia, 1989 (tons)
NMIS89	Fertilizer sold as miscellaneous forms, 1989 (tons)
NSOL89	Fertilizer sold as nitrogen solutions, 1989 (tons)
UREA89	Fertilizer sold as urea, 1989 (tons)

NIT90--Coverage of nitrogen-fertilizer sales estimates, 1990

Attribute name	Description
NTOT90	Total estimated nitrogen-fertilizer sales, 1990 (tons)
NTOT90.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O90	Estimated potash (K_2O) sales, 1990 (tons)
K2O90.USE	Rate of potash use in county polygon (tons per square mile)
P2O590	Estimated phosphate (P_2O_5) sales, 1990 (tons)
P2O590.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI90	Fertilizer sold as ammonium nitrate, 1990 (tons)
ANHY90	Fertilizer sold as anhydrous ammonia, 1990 (tons)
NMIS90	Fertilizer sold as miscellaneous forms, 1990 (tons)
NSOL90	Fertilizer sold as nitrogen solutions, 1990 (tons)
UREA90	Fertilizer sold as urea, 1990 (tons)

Table 3. Nitrogen-fertilizer sales coverage names, attribute names, and short attribute descriptions -- continued

NIT91--Coverage of nitrogen-fertilizer sales estimates, 1991

Attribute name	Description
NTOT91	Total estimated nitrogen-fertilizer sales, 1991 (tons)
NTOT91.USE	Rate of nitrogen-fertilizer use in county polygon (tons per square mile)
K2O91	Estimated potash (K_2O) sales, 1991 (tons)
K2O91.USE	Rate of potash use in county polygon (tons per square mile)
P2O591	Estimated phosphate (P_2O_5) sales, 1991 (tons)
P2O591.USE	Rate of phosphate use in county polygon (tons per square mile)
AMNI91	Fertilizer sold as ammonium nitrate, 1991 (tons)
ANHY91	Fertilizer sold as anhydrous ammonia, 1991 (tons)
NMIS91	Fertilizer sold as miscellaneous forms, 1991 (tons)
NSOL91	Fertilizer sold as nitrogen solutions, 1991 (tons)
UREA91	Fertilizer sold as urea, 1991 (tons)

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions
[Descriptions of coverage attributes from U.S. Department of Commerce, 1989b]

AG_EXPN--Coverage of agricultural expenses estimates from the 1987 Census of Agriculture

Attribute name	Description
CA0275	Total farm production expenses, 1987 ($1,000)
	Expenses for--
CA0279	Livestock and poultry purchased, 1987 ($1,000)
CA0283	Feed for livestock and poultry, 1987 ($1,000)
CA0291	Seeds, bulbs, plants, and trees, 1987 ($1,000)
CA0295	Commercial fertilizer, 1987 ($1,000)
CA0299	Agricultural chemicals, 1987 ($1,000)
CA0303	Petroleum products, 1987 ($1,000)
CA0323	Electricity, 1987 ($1,000)
CA0327	Hired farm labor, 1987 ($1,000)
CA0331	Contract labor, 1987 ($1,000)
CA0341	Interest paid, 1987 ($1,000)
CA0350	Property taxes paid, 1987 ($1,000)

AG_LAND--Coverage of agricultural-land estimates from the 1987 Census of Agriculture

Attribute name	Description
CA0398	Farms, 1987 (number)
CA0400	Land in farms, 1987 (acres)
PCT0400	Percent of county as land in farms, 1987
CA0401	Land in farms, 1982 (acres)
PCT0401	Percent of county as land in farms, 1982
CA0402	Average size of farm, 1987 (acres)
CA0460	Total cropland, 1987 (acres)
PCT0460	Percent of county as total cropland, 1987
CA0461	Total cropland, 1982 (acres)
PCT0461	Percent of county as total cropland, 1982

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions --
continued

AG_LAND--Coverage of land in agriculture estimates from the 1987 Census of Agriculture--
continued

Attribute name	Description
CA0464	Harvested cropland, 1987 (acres)
PCT0464	Percent of county as harvested cropland, 1987
CA0468	Cropland used only for pasture or grazing, 1987 (acres)
CA0476	Cropland in cover crops, legumes, and soil-improvement grasses, not harvested and not pastured, 1987 (acres)
CA0477	Cropland in cover crops, legumes, and soil-improvement grasses, not harvested and not pastured, 1982 (acres)
CA0492	Total woodland, 1987 (acres)
PCT0492	Percent of county as total woodland, 1987
CA0496	Woodland pastured, 1987 (acres)
CA0500	Woodland not pastured, 1987 (acres)
CA0516	Pastureland, all types, 1987 (acres)
PCT0516	Percent of county as pastureland, all types, 1987
CA0523	Cropland placed under the conservation reserve program, 1987 (acres)
CA0612	Farms with irrigation, 1987 (number)
CA0613	Farms with irrigation, 1982 (number)
CA0614	Land in irrigated farms, 1987 (acres)
PCT0614	Percent of county as land in irrigated farms, 1987
CA0615	Land in irrigated farms, 1982 (acres)
CA0618	Harvested cropland, irrigated, 1987 (acres)
CA0619	Harvested cropland, irrigated, 1982 (acres)
CA0622	Other cropland, excluding cropland pastured, irrigated, 1987 (acres)
CA0623	Other cropland, excluding cropland pastured, irrigated, 1982 (acres)
CA0629	Irrigated land, 1987 (acres)
PCT0629	Percent of county as irrigated land, 1987
CA0632	Harvested cropland, irrigated, 1987 (acres)
CA0636	Pastureland and other land, irrigated 1987 (acres)
CA3223	Land in orchards, total, 1987 (acres)
PCT3223	Percent of county as land in orchards, total, 1987

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions --
continued

AG_CHEM--Coverage of agricultural-chemical use estimates from the 1987 Census of Agriculture

Attribute name	Description
CA0772	Commercial fertilizer, 1987 (acres on which used)
PCT0772	Percent of county treated with commercial fertilizer, 1987
CA0773	Commercial fertilizer, 1982 (acres on which used)
PCT0773	Percent of county treated with commercial fertilizer, 1982
CA0776	Cropland fertilized, 1987 (acres on which used)
PCT0776	Percent of county as cropland fertilized, 1987
CA0777	Cropland fertilized, 1982 (acres on which used)
PCT0777	Percent of county as cropland fertilized, 1982
CA0780	Pastureland and rangeland fertilized, 1987 (acres on which used)
PCT0780	Percent of county as pastureland and rangeland fertilized, 1987
CA0784	Lime, 1987 (acres on which used)
PCT0784	Percent of county treated with lime, 1987
CA0786	Lime, 1987 (tons)
	Sprays, dusts, granules, fumigants, and other compounds use to control --
CA0790	Insects on hay and other crops, 1987 (acres on which used)
PCT0790	Percent of county treated for insects on hay and other crops, 1987
CA0791	Insects on hay and other crops, 1982 (acres on which used)
PCT0791	Percent of county treated for insects on hay and other crops, 1982
CA0794	Nematodes in crops, 1987 (acres on which used)
PCT0794	Percent of county treated for nematodes in crops, 1987
CA0795	Nematodes in crops, 1982 (acres on which used)
PCT0795	Percent of county treated for nematodes in crops, 1982
CA0798	Diseases in crops and orchards, 1987 (acres on which used)
PCT0798	Percent of county treated for diseases in crops and orchards, 1987
CA0799	Diseases in crops and orchards, 1982 (acres on which used)
PCT0799	Percent of county treated for diseases in crops and orchards, 1982
CA0802	Weeds, grass, or brush in crops and pasture, 1987 (acres on which used)
PCT0802	Percent of county treated for weeds, grass, or brush in crops and pasture, 1987
CA0803	Weeds, grass, or brush in crops and pasture, 1982 (acres on which used)

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions --
continued

AG_CHEM--Coverage of agricultural-chemical use estimates from the 1987 Census of Agriculture--continued

Attribute name	Description
PCT0803	Percent of county treated for weeds, grass, or brush in crops and pasture, 1982
CA0806	Chemicals used for defoliation or for growth control of crops or thinning of fruit, 1987 (acres on which used)
PCT0806	Percent of county treated with chemicals used for defoliation or for growth control of crops or thinning of fruit, 1987
CA0807	Chemicals used for defoliation or for growth control of crops or thinning of fruit, 1982 (acres on which used)
PCT0807	Percent of county treated with chemicals used for defoliation or for growth control of crops or thinning of fruit, 1982

AG_STOCK--Coverage of livestock holdings estimates from the 1987 Census of Agriculture

Attribute name	Description
CA0930	Cattle and calves, 1987 (number)
CA0966	Beef cows, 1987 (number)
CA0984	Milk cows, 1987 (number)
CA1006	Steers, steer calves, bulls, and bull calves, 1987 (number)
CA1094	Hogs and pigs, 1987 (number)
CA1183	Sheep and lambs inventory, 1987 (number)
CA1210	Horses and ponies inventory, 1987 (number)
CA1218	Any poultry, 1987 (farms)
CA1222	Chickens 3 months old or older, 1987 (number)
CA1226	Hens and pullets of laying age, 1987 (number)
CA1247	Broilers and other meat-type chickens, 1987 (number)
CA1251	Turkeys, 1987 (number)
CA1261	Any poultry sold, 1987 ($1,000)

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions -- continued

AG_CROP1--Coverage of cropping-practices estimates from the 1987 Census of Agriculture-- part 1

Attribute name	Description
CA2107	Corn for grain or seed, harvested, 1987 (acres)
PCT2107	Percent of county as corn for grain or seed, harvested, 1987
CA2110	Corn for grain or seed, irrigated, 1987 (acres)
CA2117	Sorghum for grain or seed, harvested, 1987 (acres)
PCT2117	Percent of county as sorghum for grain or seed, harvested, 1987
CA2120	Sorghum for grain or seed, irrigated, 1987 (acres)
CA2127	Wheat for grain, harvested, 1987 (acres)
PCT2127	Percent of county as wheat for grain, harvested, 1987
CA2130	Wheat for grain, irrigated, 1987 (acres)
CA2137	Barley for grain, harvested, 1987 (acres)
CA2140	Barley for grain, irrigated, 1987 (acres)
CA2197	Oats for grain, harvested, 1987 (acres)
CA2200	Oats for grain, irrigated, 1987 (acres)
CA2227	Rice, harvested, 1987 (acres)
CA2230	Rice, irrigated, 1987 (acres)
CA2237	Rye for grain, harvested, 1987 (acres)
CA2240	Rye for grain, irrigated, 1987 (acres)
CA2287	Cotton, harvested, 1987 (acres)
CA2290	Cotton, irrigated, 1987 (acres)
CA2297	Tobacco, harvested, 1987 (acres)
CA2300	Tobacco, irrigated, 1987 (acres)
CA2307	Soybeans for beans, harvested, 1987 (acres)
PCT2307	Percent of county as soybeans for beans, harvested, 1987
CA2310	Soybeans for beans, irrigated, 1987 (acres)
CA2317	Dry edible beans, excluding limas, harvested, 1987 (acres)
CA2320	Dry edible beans, excluding limas, irrigated, 1987 (acres)
CA2367	Irish potatoes, harvested, 1987 (acres)
CA2370	Irish potatoes, irrigated, 1987 (acres)
CA2397	Sugar beets for sugar, harvested, 1987 (acres)
CA2340	Sugar beets for sugar, irrigated, 1987 (acres)

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions --
continued

AG_CROP1--Coverage of cropping practices estimates from the 1987 Census of Agriculture--part 1--continued

Attribute name	Description
CA2427	Sugarcane for sugar, harvested, 1987 (acres)
CA2430	Sugarcane for sugar, irrigated, 1987 (acres)

AG_CROP2--Coverage of cropping practices estimates from the 1987 Census of Agriculture--part 2

Attribute name	Description
CA2447	Peanuts for nuts, harvested, 1987 (acres)
CA2450	Peanuts for nuts, irrigated, 1987 (acres)
CA2717	Hay--all, harvested, 1987 (acres)
PCT2717	Percent of county as hay-all, harvested, 1987
CA2720	Hay--all, irrigated, 1987 (acres)
CA2727	Alfalfa Hay, harvested, 1987 (acres)
CA2730	Alfalfa Hay, irrigated, 1987 (acres)
CA2777	Corn for silage or green chop, harvested, 1987 (acres)
CA2780	Corn for silage or green chop, irrigated, 1987 (acres)
CA2807	Land used for vegetables, harvested, 1987 (acres)
PCT2807	Percent of county as land used for vegetables, harvested, 1987
CA2809	Land used for vegetables, irrigated, 1987 (acres)
CA3007	Garlic harvested, 1987 (acres)
CA3087	Hot peppers harvested, 1987 (acres)
CA3159	Sweet corn, harvested, 1987 (acres)
CA3167	Tomatoes harvested, 1987 (acres)
CA3169	Tomatoes irrigated, 1987 (acres)
CA3232	Apples, total, 1987 (acres)
CA3331	Grapes, total, 1987 (acres)
CA3367	Nectarines, total, 1987 (acres)

Table 4. 1987 Census of Agriculture coverage names, attribute names, and short attribute descriptions --
continued

AG_CROP2--Coverage of cropping practices estimates from the 1987 Census of Agriculture--part 2--continued

Attribute name	Description
CA3403	Peaches, total, 1987 (acres)
CA3457	All citrus fruit, total, 1987 (acres)
PCT3457	Percent of county as all citrus fruit, total, 1987
CA3484	Lemons, total, 1987 (acres)
CA3493	Limes, total, 1987 (acres)
CA3502	Oranges, total, 1987 (acres)
CA3619	Berries, harvested, 1987 (acres)
CA3810	Sod, harvested, 1987 (acres in the open)
CA3814	Sod, harvested, 1982 (acres in the open)

APPENDIX 1

Sample Coverage Documentation

Documentation-file contents for coverage HERBICIDE1

METADATA FOR HERBICIDE1

/* Identification Information */
Data_Set_Identity: HERBICIDE1 -- Herbicide use estimates for counties in the United States
Identification_Code: N/A
Theme_Keyword: Herbicide Use--part 1
Thematic_Accuracy: See Attribute Descriptions
Thematic_Accuracy_Explanation: See Attribute Descriptions
Logical_Consistency: Polygon topology present
Completeness: See Data_Set_Description
Data_Set_Citation:
   Battaglin, W.A., and Goolsby, D.A., 1994, Spatial data in geographic information
   system format on agricultural chemical use, land use, and cropping practices
   in the United States: U.S. Geological Survey Water-Resources
   Investigations Report 94-4176.

Native_Data_Set_Environment: UNIX
Use_Restrictions: See Data_Set_Description
Access_Restrictions: Available to public upon request.
Security_Classification: UNCLASSIFIED

/* Spatial Reference */
Native_Data_Set_Structure: ARC/INFO COVER
Horizontal_Coordinate_System: Planar
Map_Projection_Name: ALBERS
Map_Projection_Coordinate Units: METERS
Horizontal_Datum_Name: NAD27
Ellipsoid_Name: CLARKE1866
Vertical_Datum_Name: NGVD29
Longitude_of_Central_Meridian: -96 0 0.000
Latitude_of_Projection_Origin: 23 0 0.000
Latitude_of_First_Standard_Parallel: 29 30 0.000
Latitude_of_Second_Standard_Parallel: 45 30 0.000
False_Easting: 0.00000

False_Northing: 0.00000
X-Shift: 0.0000000000
Y-Shift: 0.0000000000
Point/Vector_Object_Information:
  Number of points: 4787
  Number of lines: 11926
  Number of line segments: 270213
  Number of polygons: 4788
Point_Object_Information:
  Number of control points: 197
Horizontal_Positional_Accuracy: N/A
Horizontal_Positional_Accuracy_Explanation: N/A
Vertical_Positional_Accuracy: N/A
Vertical_Positional_Accuracy_Explanation: N/A
West_Bounding_Coordinate: -118.8170
East_Bounding_Coordinate: -65.2570
North_Bounding_Coordinate: 48.2619
South_Bounding_Coordinate: 22.6777
Data_Set_G-Polygon_Outer_G-Ring: N/A
Data_Set_G-Polygon_Exclusion_G-Ring: N/A
Geographic_Keyword_Name: Conterminous United States
Geographic_Keyword_Type: Location

/* Status Information */
Data_Set_Status:
  Available to public upon request.
Release_Date: N/A
Maintenance_and_Update_Frequency: N/A

/* Metadata Reference Section */
Metadata_Date: 941215.142217
Metadata_Review_Date: N/A
Metadata_Future_Review_Date: N/A
Metadata_Contact: wbattagl

/* Source Information */
Source_Identity:
  Battaglin, W.A., and Goolsby, D.A., 1994, Spatial data in geographic information
  system format on agricultural chemical use, land use, and cropping practices in the
  United States: U.S. Geological Survey Water-Resources Investigations Report 94-4176.

/* Processing History Information */

/* Per Process Step */

Process_Description: RESELECT COUNTY2M COUNTY.NEW POLY

Process_Date: 11/12/1991 (MDY)

Process_Time: 15:28

Process_Description: LABELERRORS COUNTY.NEW

Process_Date: 11/12/1991 (MDY)

Process_Time: 15:29

Process_Description: LABELERRORS COUNTY.NEW

Process_Date: 11/12/1991 (MDY)

Process_Time: 15:56

Process_Description: EXTERNALALL

Process_Date: 11/12/1991 (MDY)

Process_Time: 17:21

Process_Description: RENAME COUNTY.NEW COUNTY2M

Process_Date: 11/13/1991 (MDY)

Process_Time: 12:49

Process_Description: CREATELABELS COUNTY2M 5000

Process_Date: 11/15/1991 (MDY)

Process_Time: 16:56

Process_Description: EXTERNALALL

Process_Date: 12/04/1991 (MDY)

Process_Time: 14:10

Process_Description: COPY COUNTY2M /ARC3/WORK/LIB/COUNTY2M

Process_Date: 01/02/1992 (MDY)

Process_Time: 8:33

Process_Description: COPY /ARC3/WORK/LIB/COUNTY2M COUNTY.AG

Process_Date: 01/02/1992 (MDY)

Process_Time: 15:27

Process_Description: RENAME COUNTY.AG CNTY.AG

Process_Date: 01/02/1992 (MDY)

Process_Time: 15:27

Process_Description: COPY /ARC3/WORK/CNTY.AG COUNTY2M

Process_Date: 01/07/1992 (MDY)

Process_Time: 14:23

Process_Description: EXPORT COVER COUNTY2M COUNTY2M

Process_Date: 01/17/1992 (MDY)

Process_Time: 13:50

Process_Description: COPY /ARC3/WORK/LIB/COUNTY2M COUNTY2M

Process_Date: 01/21/1992 (MDY)

Process_Time: 15:49

Process_Description: BUILD COUNTY2M POLY

Process_Date: 01/21/1992 (MDY)

Process_Time: 16:15

Process_Description: ARCEDIT /ARC3/WORK/COUNTY2M

Process_Date: 01/22/1992 (MDY)

Process_Time: 9:48

Process_Description: BUILD COUNTY2M POLY

Process_Date: 01/22/1992 (MDY)

Process_Time: 9:56

Process_Description: IDEDIT COUNTY2M POLY

Process_Date: 01/22/1992 (MDY)

Process_Time: 11:01

Process_Description: COPY COUNTY2M /ARC3/WORK/LIB/COUNTY2M

Process_Date: 01/22/1992 (MDY)

Process_Time: 11:02

Process_Description: IDEDIT COUNTY2M POLY

Process_Date: 03/30/1992 (MDY)

Process_Time: 15:37

Process_Description: EXPORT COVER COUNTY2M COUNTY2M

Process_Date: 06/08/1992 (MDY)

Process_Time: 11:03

Process_Description: ARCEDIT /ARC3/WORK/LIB/COUNTY2M

Process_Date: 08/03/1992 (MDY)

Process_Time: 17:48

Process_Description: BUILD COUNTY2M POLY

Process_Date: 08/03/1992 (MDY)

Process_Time: 17:58

Process_Description: CLEAN COUNTY2M # 2 2 POLY

Process_Date: 08/03/1992 (MDY)

Process_Time: 18:46

Process_Description: COPY COUNTY2M /WB2/DB/USA/COUNTY2M

Process_Date: 08/04/1992 (MDY)

Process_Time: 9:19

Process_Description: COPY /WB2/DB/USA/COUNTY2M HERBICIDE1

Process_Date: 12/28/1992 (MDY)

Process_Time: 15:41

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 03/30/1993 (MDY)

Process_Time: 16:50

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 03/31/1993 (MDY)

Process_Time: 11:54

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 03/31/1993 (MDY)

Process_Time: 13:17

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 04/03/1993 (MDY)

Process_Time: 11:49

Process_Description: EXPORT COVER HERBICIDE1 HERBICIDE1

Process_Date: 04/13/1993 (MDY)

Process_Time: 16:34

Process_Description: COPY HERBICIDE1 /AG/WORK/HERBICIDE1

Process_Date: 07/18/1994 (MDY)

Process_Time: 12:06

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 07/26/1994 (MDY)

Process_Time: 14:22

Process_Description: PROJECTDEFINE COVER HERBICIDE1

Process_Date: 07/26/1994 (MDY)

Process_Time: 14:27

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 07/26/1994 (MDY)

Process_Time: 16:37

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 07/27/1994 (MDY)

Process_Time: 10:23

Process_Description: COPY /AG/WORK/HERBICIDE1 HERBICIDE1

Process_Date: 08/18/1994 (MDY)

Process_Time: 9:02

Process_Description: EXPORT COVER HERBICIDE1 HERBICIDE1

Process_Date: 08/18/1994 (MDY)

Process_Time: 9:07

Process_Description: COPY /ARC3/EPA1/RFF/HERBICIDE1 HERBICIDE1

Process_Date: 12/15/1994 (MDY)

Process_Time: 9:06

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL

Process_Date: 12/15/1994 (MDY)

Process_Time: 11:41

Process_Description: DOCUMENT HERBICIDE1 UPDATE WBATTAGL
Process_Date: 12/15/1994 (MDY)
Process_Time: 14:22

/* Distribution Information */
Distribution_Contact: William A. Battaglin, U.S. Geological Survey
Distribution_Liability: N/A
Transfer_Options: N/A
Transfer_Instructions: N/A
Fees: N/A
Turnaround: N/A

/* Contact Information */
Contact_Organization: U.S. Geological Survey
Contact_Person: William A. Battaglin
Contact_Position: N/A
Contact_Mailing Address: N/A
Contact_Physical Location: N/A
Contact_Voice_Telephone: N/A
Contact_Facsimile_Telephone: N/A
Contact_Electronic_Mail_Address: N/A
Contact_Instructions: EMAIL: wbattagl@wrdmail.er.usgs.gov

/* Entity/Attribute Information */

Data_Base_Identity: HERBICIDE1
Partition_Identity: N/A

Entity_Type_label: HERBICIDE1.PAT

Entity_Type_Definition: Polygon attribute table
Entity_Type_Definition_Source: ARC/INFO file
Number_of_Attributes_in_Entity: 72

Attribute_Label: AREA
Attribute_Definition: Area of polygon in square coverage units (meters)
Attribute_Definition_Source: Computed
EA_Domain_Values: Positive real numbers
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: PERIMETER
Attribute_Definition: Perimeter of polygon in coverage units (meters)
Attribute_Definition_Source: Computed
EA_Domain_Values: Positive real numbers
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: HERBICIDE1#
Attribute_Definition: Internal feature number
Attribute_Definition_Source: Computed
EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: HERBICIDE1-ID
Attribute_Definition: User-assigned feature number
Attribute_Definition_Source: User-defined
EA_Domain_Values: Integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: FIPS
Attribute_Definition: 5-digit County FIPS code
Attribute_Definition_Source: Federal Information Processing Standard
EA_Domain_Values: 01001 - 56998, none = 0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: ST
Attribute_Definition: two-character state abbreviation
Attribute_Definition_Source: U.S. Postal Service
EA_Domain_Values: AL - WY, none = blank
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: CNTYNAME
Attribute_Definition: County name
Attribute_Definition_Source: U.S. Geological Survey files
EA_Domain_Values: upper-case alphanumeric, none = blank
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: PLYTYPE
Attribute_Definition: polygon type: 0=county land, others are lakes, estuaries, etc.

Attribute_Definition_Source: see narrative

EA_Domain_Values: 0-4,9

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: WORKB

Attribute_Definition: variable used for data processing

Attribute_Definition_Source: n/a

EA_Domain_Values: any integer

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: AREA.ACRES

Attribute_Definition: total county land area (all polygons) in acres

Attribute_Definition_Source: calculated from area of polygons with like FIPS code and PLYTYPE=0

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1980.ACR

Attribute_Definition: Acres treated with atrazine

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1980.LBS

Attribute_Definition: pounds of atrazine used

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1980.USE

Attribute_Definition: rate of atrazine use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1863.ACR

Attribute_Definition: acres treated with alachlor

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1863.LBS
Attribute_Definition: pounds of alachlor used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1863.USE
Attribute_Definition: rate of alachlor use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1011.ACR
Attribute_Definition: acres treated with metolachlor
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1011.LBS

Attribute_Definition: pounds of metolachlor used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1011.USE
Attribute_Definition: rate of metolachlor use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1414.ACR
Attribute_Definition: acres treated with EPTC
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1414.LBS
Attribute_Definition: pounds of EPTC used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1414.USE

Attribute_Definition: rate of EPTC use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1302.ACR

Attribute_Definition: acres treated with 2,4-D

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1302.LBS

Attribute_Definition: pounds of 2,4-D used

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1302.USE
Attribute_Definition: rate of 2,4-D use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1361.ACR
Attribute_Definition: acres treated with trifluralin
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1361.LBS
Attribute_Definition: pounds of trifluralin used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1361.USE

Attribute_Definition: rate of trifluralin use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1369.ACR

Attribute_Definition: acres treated with cyanazine

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1369.LBS

Attribute_Definition: pounds of cyanazine used

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1369.USE

Attribute_Definition: rate of cyanazine use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1839.ACR

Attribute_Definition: acres treated with butylate

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1839.LBS

Attribute_Definition: pounds of butylate used

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1839.USE

Attribute_Definition: rate of butylate use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1629.ACR
Attribute_Definition: acres treated with pendimethalin
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1629.LBS
Attribute_Definition: pounds of pendimethalin used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1629.USE
Attribute_Definition: rate of pendimethalin use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1099.ACR

Attribute_Definition: acres treated with glyphosate
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1099.LBS
Attribute_Definition: pounds of glyphosate used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1099.USE
Attribute_Definition: rate of glyphosate use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1298.ACR
Attribute_Definition: acres treated with dicamba
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1298.LBS
Attribute_Definition: pounds of dicamba used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1298.USE
Attribute_Definition: rate of dicamba use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1287.ACR
Attribute_Definition: acres treated with bentazon
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1287.LBS
Attribute_Definition: pounds of bentazon used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1287.USE
Attribute_Definition: rate of bentazon use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1282.ACR
Attribute_Definition: acres treated with propanil
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1282.LBS

Attribute_Definition: pounds of propanil used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1282.USE
Attribute_Definition: rate of propanil use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1124.ACR
Attribute_Definition: acres treated with MSMA
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1124.LBS
Attribute_Definition: pounds of MSMA used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1124.USE

Attribute_Definition: rate of MSMA use in county polygon in pounds per square mile

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.000

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1975.ACR

Attribute_Definition: acres treated with metribuzin

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A

EA_Measurement_Frequency: N/A

Attribute_Label: H1975.LBS

Attribute_Definition: pounds of metribuzin used

Attribute_Definition_Source: Gianessi and Puffer, 1991

EA_Domain_Values: numeric values greater than 0, missing = -99.0

EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A

EA_Beginning_Date: N/A

EA_Ending_Date: N/A

EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1975.USE
Attribute_Definition: rate of metribuzin use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1417.ACR
Attribute_Definition: acres treated with molinate
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1417.LBS
Attribute_Definition: pounds of molinate used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1417.USE

Attribute_Definition: rate of molinate use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1305.ACR
Attribute_Definition: acres treated with MCPA
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1305.LBS
Attribute_Definition: pounds of MCPA used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1305.USE
Attribute_Definition: rate of MCPA use in county polygon in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1979.ACR
Attribute_Definition: acres treated with propazine
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1979.LBS
Attribute_Definition: pounds of propazine used
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1979.USE
Attribute_Definition: rate of propazine use in county polygons in pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A

EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1191.ACR
Attribute_Definition: acres treated with propachlor
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1191.LBS
Attribute_Definition: pounds of propachlor use
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1191.USE
Attribute_Definition: rate of propachlor use in county polygons pounds per square mile
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1981.ACR

Attribute_Definition: acres treated with simazine
Attribute_Definition_Source: Gianessi and Puffer, 1991
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1981.LBS
Attribute_Definition: pounds of simazine used
Attribute_Definition_Source: Gianessi and Puffer, 1990
EA_Domain_Values: numeric values greater than 0, missing = -99.0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: H1981.USE
Attribute_Definition: rate of simazine use in county polygon (pounds per square mile)
Attribute_Definition_Source: Gianessi and Puffer, 1990
EA_Domain_Values: numeric values greater than 0, missing = -99.000
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: FIPSST
Attribute_Definition: two-digit state FIPS code
Attribute_Definition_Source: Federal Information Processing Standard
EA_Domain_Values: 01 - 56, none = 0
EA_Units_of_Measure: N/A

EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: FIPSCNTY
Attribute_Definition: three-digit county FIPS code
Attribute_Definition_Source: Federal Information Processing Standard
EA_Domain_Values: 001 - 998, none = 0
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Entity_Type_label: HERBICIDE1.AAT

Entity_Type_Definition: Line attribute table
Entity_Type_Definition_Source: ARC/INFO file
Number_of_Attributes_in_Entity: 8

Attribute_Label: FNODE#
Attribute_Definition: Internal number of from-node
Attribute_Definition_Source: Computed
EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: TNODE#
Attribute_Definition: Internal number of to-node
Attribute_Definition_Source: Computed

EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: LPOLY#
Attribute_Definition: Internal number of polygon to left of arc
Attribute_Definition_Source: Computed
EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: RPOLY#
Attribute_Definition: Internal number of polygon to right of arc
Attribute_Definition_Source: Computed
EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: LENGTH
Attribute_Definition: Length of arc in coverage units
Attribute_Definition_Source: Computed
EA_Domain_Values: Positive real numbers
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A

EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: HERBICIDE1#
Attribute_Definition: Internal feature number
Attribute_Definition_Source: Computed
EA_Domain_Values: Sequential unique positive integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: HERBICIDE1-ID
Attribute_Definition: User-assigned feature number
Attribute_Definition_Source: User-defined
EA_Domain_Values: Integer
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Attribute_Label: BNDTYPE
Attribute_Definition: boundary type
Attribute_Definition_Source: see narrative
EA_Domain_Values: 0-8
EA_Units_of_Measure: N/A
EA_Measurement_Precision: N/A
EA_Beginning_Date: N/A
EA_Ending_Date: N/A
EA_Accuracy: N/A
EA_Accuracy_Explanation: N/A
EA_Measurement_Frequency: N/A

Data_Set_Description:
1. Abstract

This coverage contains estimates of herbicide use for the 20 most-used
herbicides in the conterminous United States as reported in Gianessi
and Puffer (1991). Herbicide-use estimates in this coverage are reported
for each county polygon as acres treated, pounds of active ingredient
used, and pounds used per square mile.

The herbicide-use estimates provided by Gianessi and Puffer (1991) list
acres treated and pounds of active ingredient applied for a given crop
in each county for which use has been estimated. Cropping data are from the
1987 Census of Agriculture, and are subject to occasional suppressions of
acreage estimates at the county level due to problems of confidentiality
and census disclosure rules. The herbicide-use estimates included in
this coverage are totals of use on all crops treated in a given county.

The polygons representing county boundaries in the conterminous United
States, as well as lakes, estuaries, and other nonland-area features
were derived from the Digital Line Graph (DLG) files representing the
1:2,000,000-scale map in the National Atlas of the United States (1970).

1.1 Keywords:

Herbicides
Herbicide use
Counties
United States

1.2 Descriptors:

Herbicides
Counties
Boundaries
United States

2. Applications of these data

2.1 Intended use of data

The herbicide-use estimates in this coverage are intended for use as a means for estimating regional herbicide use, and for producing maps showing relative rates of herbicide use across broad regions of the United States.

2.2 Limitations of data

HERBICIDE-USE DATA

Estimates of herbicide use by county were generated by Gianessi and Puffer (1991) by using the following procedure:

(1) collect statistics by State, by crop, on percentage of acres treated with a given herbicide, and average annual application rate of the herbicide from surveys sent to Extension Service weed scientists in 1987 and 1989;

(2) augment survey data with published information from some States;

(3) establish herbicide-use profiles, by State, by crop, containing the percentage of acres treated, and average annual application rates;

(4) apply data in herbicide-use profiles to county-level crop-acreage estimates from the 1987 Census of Agriculture (U.S. Department of Commerce, 1989a); and

(5) tabulate pounds of active ingredient of herbicides used by crop, by county.

Eighty-four crops were profiled, resulting in usage estimates for 96 herbicide active ingredients. This coverage contains estimates of use for the 20 most-used herbicides in the conterminous United States.

Although crop-acreage data represent the 1987 growing year, the herbicide-use estimates generally reflect 1989 usage amounts (Gianessi and Puffer, 1991).

Estimates of herbicide use by county were generated from a combination of data collected from surveys of weed scientists and from surveys of farmers. Herbicide-use profile data were generated from ancillary data

sources or were calculated from profiles in neighboring states when no responses to surveys or published reports were available (Gianessi and Puffer, 1991). Sampling and statistics were used to account for nonresponding farm operations. Thus, the information describing crop acreages is subject to sampling variability as well as reporting and coverage errors (U.S. Department of Commerce, 1989b). Census disclosure rules also prevent the publication of information that would disclose the operation of individual farms.

Before herbicide-use estimates entered into this coverage, the total use of individual herbicides on all crops for each county was calculated.

COUNTY BOUNDARIES

The original files for this map were provided in 15 sections. Boundaries near the edges of sections have been adjusted in edgematching.

Polygons that extend into the water (an ocean or the Great Lakes) should be considered arbitrary.

3. Attribute discussion

HERBICIDE-USE ATTRIBUTES

Herbicide-use attributes are from tabular data files provided by Gianessi and Puffer (1991). Three attributes are added to an ARC/INFO coverage for each of the 96 herbicides. Attributes with names ending in .ACR are estimates of the number of acres treated with a given herbicide. Attributes with names ending in .LBS are estimates of the number of pounds of active ingredient applied of a given herbicide. Attributes ending in .USE are estimates of a county-level herbicide-use rate in pounds per square mile.

Attribute names are keyed to four-digit herbicide code numbers provided in the table below. A ranking of national herbicide-use amounts (Gianessi and Puffer, 1991) was used to divide herbicide-use data into five coverages (herbicide1, herbicide2, herbicide3, herbicide4, and herbicide5).

Table 1. Herbicide codes for herbicide1 coverage

Code Herbicide

1980 Atrazine
1863 Alachlor
1011 Metolachlor
1414 EPTC
1302 2,4-D

1361 Trifluralin
1369 Cyanazine
1839 Butylate
1629 Pendimethalin
1099 Glyphosate

1298 Dicamba
1287 Bentazon
1282 Propanil
1124 MSMA
1975 Metribuzin

1417 Molinate
1305 MCPA
1979 Propazine
1191 Propachlor
1981 Simazine

Herbicide-use estimates in counties represented by one polygon are equal to county totals. For counties described by more than one polygon, attribute values are provided for each polygon and are calculated as the county total multiplied by the ratio of the area of each county polygon divided by total area of the county.

A missing-value code of -99.0 is used when no herbicide-attribute data are given for a county and for all nonland-area polygons. The missing-value code can indicate any of the following conditions:

-- herbicide use not present in county (for example, no atrazine used

in county)

-- crop data withheld because of census disclosure rules

-- crop data not available to the census

-- crop data not published because county contains fewer than 10 farms.

COUNTY POLYGON ATTRIBUTES

Each county is identified by a five-digit Federal Information Processing Standard (FIPS) code. The first two digits represent the State and the three remaining represent the county within the State. County names (in upper case) and the two-character State abbreviation also are included.

All polygons are coded by polygon type (PLYTYPE) as follows:
    0 = U.S. land.
    1 = Extensions of counties into the ocean and estuaries. Some
        boundaries may be arbitrary.
    2 = U.S. Great Lakes. Some boundaries between counties may
        be arbitrary.
    3 = Canadian Great Lakes.
    4 = Canadian islands in Great Lakes, included for visual
        cartographic purposes.
    9 = External polygon.

All arcs are coded by boundary type (BNDTYPE) as follows:
    0 = Coastline of United States.
    1 = State-State border located on land.
    2 = County-county border, within State, located on land.
    3 = State-State border located on the ocean, an estuary, or a
        Great Lake. Some of these borders are arbitrary.
    4 = County-county border, with State, but located on an ocean, an
        estuary, or a Great Lake. Some of these borders are arbitrary.
    5 = International border located on land.
    6 = International border located on water.
    7 = Canadian shoreline of the Great Lakes.
    8 = Arbitrary separation line between the Canadian portions of the
        Great Lakes.
    9 = Closure line with the external polygon. This is arbitrary.

All BNDTYPE values are determined from the adjoining polygons by the

routine INDEX_COUNTY.AML. The coverage is indexed (ARC: INDEXITEM) on FIPS code, State FIPS code, State abbreviation, county name, polygon type, and boundary type.

4. Procedures used to create or automate data

HERBICIDE-USE DATA

An automated procedure was developed to process the raw herbicide-use data into ARC/INFO coverage attributes. The procedure is summarized below:

(1) copy county2m coverage to coverage called herbicide%#%, and
(2) run the AML herbadd.aml for each herbicide to be added.

The herbadd.aml program runs a fortran program to total estimates of herbicide use on all crops by county, then processes these data, finally adding them as three columns of attribute data to the county coverage. Other programs were developed to calculate summary statistics of the herbicide-attribute data and to produce maps that show attribute values across the United States.

COUNTY BOUNDARIES

This series of maps was published as part of the National Atlas of the United States (U.S.Geological Survey, 1970). The maps for the conterminous United States were digitized in 15 sheets and published in the Digital Line Graph (DLG) format as described by Domeratz and others (1983).

Each sheet was prepared by reading the DLG files of the political and water-bodies layers, converting them to ARC/INFO; extracting the county boundaries and the coastline, respectively; and joining the two layers. FIPS codes were assigned to all polygons by using available sources and were checked manually.

Boundaries with adjacent sheets of the 15-sheet set were edgematched manually; one of the sheets was chosen arbitrarily as the "correct" border. Edgematching operations were used to adjust the linework as far as was necessary so that the coverages would fit to a tolerance of 100 meters (328.1 feet). The coverage (referred to herein as Version 1.0) was stored as 49 separate coverages (48 States and the District of Columbia) because

the ARC/INFO software in use at the time could not process the entire coverage. Individual States could be joined by specifying a tolerance of 100 meters.

From time to time, adjustments were made to the State coverages to reflect changes in counties. The accuracy of these adjustments is believed to be comparable to that of the original linework.

For Version 2.0, all State coverages were rejoined and manually edited to produce a perfect edgematch between all States. For States on the original map-sheet boundaries, this adjustment averaged less than 20 meters and in no case was more than 100 meters. The whole coverage was CLEANed to a tolerance of 20 meters (65.6 feet), which resulted in few, if any, effects on small offshore islands. The coverage also was checked to ensure that it represented current counties or county equivalents.

The coverage in Version 1.0 ended at the coastline. No attempt was made to depict offshore areas. This created problems when the coverage was used to assign county codes to sampling stations located near the coast. To help in this matter, Version 2.0 includes offshore extensions of the county polygons. The (water) boundaries of many of these polygons are arbitrary.

The Canadian Great Lakes features are another new addition to Version 2.0 They were added to improve the utility of the coverage for visual displays. Although the Canadian Great Lakes are represented logically by a single polygon, practical considerations--the inability of some software to plot polygons with a large number of vertices--made it necessary to separate them into four polygons. The dividing lines are located in narrow channels to minimize interference with plotting patterns. Canadian islands within the Great Lakes also were included.

All tick marks were relocated to places that are easily visible on maps of the United States, to help in registering maps that otherwise may not have adequate registration information.

To expedite accessing parts of the coverage, certain items have been indexed with the procedure INDEX_COUNTY.AML. See Section 3 above. A spatial index also was created.

When this coverage is used to clip or intersect other coverages, a

tolerance as low as 2 meters (6.6 feet) can be used.

The processing used to derive this coverage moved boundaries from their positions on the original maps. In cases of conflicting lines, preference was given to forming the correct topology. Strictly speaking, this coverage is not identical to the source materials. These changes were unavoidable in producing a continuous coverage of the conterminous United States.

5. Revisions made to data (revision number, date, description)

COUNTY POLYGON DATA

Revision 1.0, 12/17/90. This revision represents many corrections and minor modifications made to this set of coverages from its construction in 1985 through the revision date.

Revision 2.0, 3/18/91. Major reworking of the coverage, combining all State coverages.

6. Reviews applied to data (review type, date, person, description)

The herbicide-use data-processing procedure and attribute data have been peer reviewed in 1993 by Leonard Orzol and Barbara Ruddy, U.S. Geological Survey hydrologists.

The herbicide-use estimates prepared by Gianessi and Puffer (1991) were compared with National estimates provided by the Office of Pesticide Programs of the U.S. Environmental Protection Agency, and were reviewed by more than 20 individuals from the companies that registered the chemicals.

The county boundaries in this coverage were not reviewed formally. They have, however, been used in numerous applications where serious errors would have been obvious. Some State coverages were corrected following such use. The offshore polygon extensions and the Canadian Great Lakes polygons have not been reviewed.

7. Related spatial and tabular data sets

This coverage is part of series of 1:2,000,000-scale base maps that cover the United States. Also available are:

COUNTY--County boundaries.
STATE--State boundaries (formed from COUNTY).
WATERBOD--Water Bodies.
STREAM--Streams.
HUC--Hydrologic cataloging units (basins).

8. References cited

Domeratz, M. A., Hallam, C. A., Schmidt, W. E., and Calkins, H. W., 1983, USGS digital cartographic data standards--Digital line graphs from 1:2,000,000-scale maps: U.S. Geological Survey Circular 895-D, 38 p.

Gianessi, Leonard P. and Puffer, Cynthia, 1991, Herbicide use in the United States: Washington, D.C., Resources for the Future, December 1990 (revised April 1991), 128 p.

Nebert, Douglas D.,1994, Design of the distributed spatial data library for the Water Resources Division, U.S. Geological Survey: U.S. Geological Survey Open-File Report, 94-327, 30 p.

U.S. Department of Commerce, 1989a, Census of agriculture, 1987--Final county file: U.S. Department of Commerce, Bureau of the Census, [machine-readable data file]

U.S. Department of Commerce, 1989b, Census of agriculture, 1987--Final county file technical documentation: U.S. Department of Commerce, Bureau of the Census, Data User Services Division.

U.S. Geological Survey, 1970, National atlas of the United States of America: Washington, D.C., U. S. Geological Survey, 417 p.

9. Notes

DOCUMENTATION

The documentation for this coverage was generated by using the ARC macro language (AML) program document.aml available from the U.S. Geological Survey (Nebert, 1994).

APPENDIX 2

Data Specifications and Retrieval Documentation

Files

Currently available through the U.S. Geological Survey's Distributed Spatial Data Library (DSDL) or upon special request on 1/4-inch tape are 18 compressed ARC/INFO (GIS software produced and distributed by Environmental Systems Research Institute) coverage export files. The file names are listed below:

ag_chem.e00.Z	herbicide1.e00.Z	nit85.e00.Z
ag_crop1.e00.Z	herbicide2.e00.Z	nit86.e00.Z
ag_crop2.e00.Z	herbicide3.e00.Z	nit87.e00.Z
ag_expn.e00.Z	herbicide4.e00.Z	nit88.e00.Z
ag_land.e00.Z	herbicide5.e00.Z	nit89.e00.Z
ag_stock.e00.Z		nit90.e00.Z
		nit91.e00.Z

Storage Requirements

The 18 files represent about 80 megabytes (MB) of raw binary data. The compressed ARC/INFO coverage export files range in size from 4.1 to 4.9 MB. Uncompressed, these files range in size from 8.5 to 10.9 MB. The 18 uncompressed ARC/INFO coverage export files will occupy about 170 MB of disk space. The 18 imported ARC/INFO coverages will occupy about 100 MB of disk space. In general, about 200 to 300 MB of disk space will be required to work with data sets of this magnitude.

Format and Retrieval

The geographic information system coverages are available through the DSDL. Information in the DSDL is accessible to the wide-area network and can be retrieved by using information-discovery programs such as the Wide Area Information Server (WAIS), gopher, or mosaic. If a tape of the data is used, the tape contains binary data written to a 1/4-inch tape by using the UNIX command:

tar cv ag

This command writes all the files in the directory "ag" to the tape.

To retrieve the data on the tape, go to the point in your directory structure in which you wish to copy the data and issue the command:

tar xvfo (device name if not default)

This command will write the data onto your disk. The files will be in a directory called "ag". Once copied from the tape, the compressed files can be uncompressed by using the command:

uncompress (file name)

for example,

uncompress herbicide1.e00.Z

This command will uncompress the file and erase the compressed file. The ARC/INFO coverage export file can then be copied to its desired location in a UNIX directory structure.

The ARC/INFO coverage export file is imported with the following command issued from the ARC prompt:

Arc: **import cover <export file name> <coverage name>**

for example,

import cover herbicide1 herbicide1

This command will make the ARC/INFO coverage from the export file, but does not erase the export file.

Recommended Directory Structure

All of the coverages can be stored under one directory, or separate directories can be made for the Census of Agriculture, herbicide-use, nitrogen-fertilizer sales, and other National extent and scale coverages. To prevent corruption or unwanted modification of the coverages provided, create a large work space for manipulation and processing involving the coverages. Copy coverages to the work space before executing any ARC, ARCEDIT, ARCPLOT, or GRID commands that may affect coverage topology or attributes. Failure to make working copies of the coverages could result in the corruption of the original data or in the loss of the metadata describing coverage construction and attributes.

The graphic below is a schematic illustration of one possible directory structure.