*Weed Science*

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# Implications of weakening of the United States Geological Survey Pesticide National Synthesis Project for Weed Scientists

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## My View

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Weeds are a significant threat to the production of agronomic, horticultural, and ornamental crops, as direct competition for resources can result in substantial yield shortfalls (WSSA 2023). A review of research data generated across the United States and Canada indicated that unmanaged weeds have the potential to reduce corn (*Zea mays* L.) and soybean [*Glycine max* (L.) Merr.] production by approximately 50%, even when other best management practices are applied (Soltani et al. 2016, 2017). The associated economic losses, which were estimated at US $26.7 billion and US$17.2 billion for corn and soybeans, respectively, would be catastrophic. Weeds can also interfere with crops indirectly. For example, weeds may impede or delay harvest operations (Smith et al. 2000), reduce crop quality because of contamination (Moore et al. 2004), and serve as alternate hosts for pests and pathogens (Chen et al. 2011; Wisler and Norris 2005). Other habitats, such as rangelands, wetlands, and other natural and urban areas, are also affected by weedy and invasive plant species. Impacts of unwanted vegetation can include damage to infrastructure, damage to recreational space, altered water flow, degraded natural resources, reduced biodiversity and species displacement, and a loss of ecosystem services, among other effects (DiTomaso 2000; Jetter et al. 2021; Neal 2023; Vilà et al. 2011).

To manage weeds, growers can rely on a diverse set of strategies, including herbicides. The U.S. Department of Agriculture (USDA) regularly surveys U.S. growers with respect to on-farm chemical use; these data are then used to populate the information housed in the National Agricultural Statistical Service's (NASS) Agricultural Chemical Use Program (USDA-NASS 2023). Data are collected across a range of crop groups on a rotating basis with select commodities being assessed every 2 to 3 years. A review of the available statistics indicates that herbicides are a significant contributor to the total pesticide load across cropping systems, most importantly in the major U.S. agronomic commodities. For example, according to the 2020 to 2022 surveys, herbicides were applied to a greater percentage of planted soybean, cotton (*Gossypium hirsutum* L.), corn, and wheat (*Triticum aestivum* L.) acres (60% to 96%) than were fungicides (1% to 22%) and insecticides (14% to 39%) combined.

Another important source of agricultural pesticide use data is the National Pesticide Synthesis Project, which is supported by National Water Quality Program run by the U.S. Geological Survey (USGS 2023). The National Water Quality Program is a comprehensive initiative designed to monitor and assess the quality of the nation's surface and groundwater resources. Previously (1992 to 2018), the program compiled yearly estimated use data for more than 400 pesticides, which are presented in both table and map form. The information in the tables represents estimated county-level usage, which is derived from surveys of on-farm pesticide application and harvested crop acreage. The maps present the estimates in finer detail, as the data are purposefully allocated to specific agricultural areas within each county. Additionally, each individual pesticide map is accompanied by a graph illustrating the annual estimated use of the chemical, categorized by major crop or crop group, over time (e.g., Figure 1).

In 2019, the National Water Quality Program reevaluated its pesticide monitoring efforts, severely reducing the numbers of compounds assessed by the project; for 2019, data for approximately 70 pesticides have been released (USGS 2023). The frequency with which information is issued will also change. According to the website, the USGS will publish annual, county-level estimates of pesticide use for 2018 to 2022 in 2024. After this, annual pesticide use estimates will be published over a 5-year cycle to align with the USDA's Census of Agriculture. For example, estimated agricultural pesticide use for 2023 to 2027 will be released in 2029; as noted on the website, "preliminary estimates will no longer be published annually and later updated with final estimates."

In a recent article in *Science*, Gewin (2023) highlighted the value of these pesticide use estimates with respect to environmental toxicology and public health, mentioning that they have been used in more than 500 peer-reviewed studies. The scientists who were cited in the article described how the change in data-release patterns could hinder future efforts to detect trends

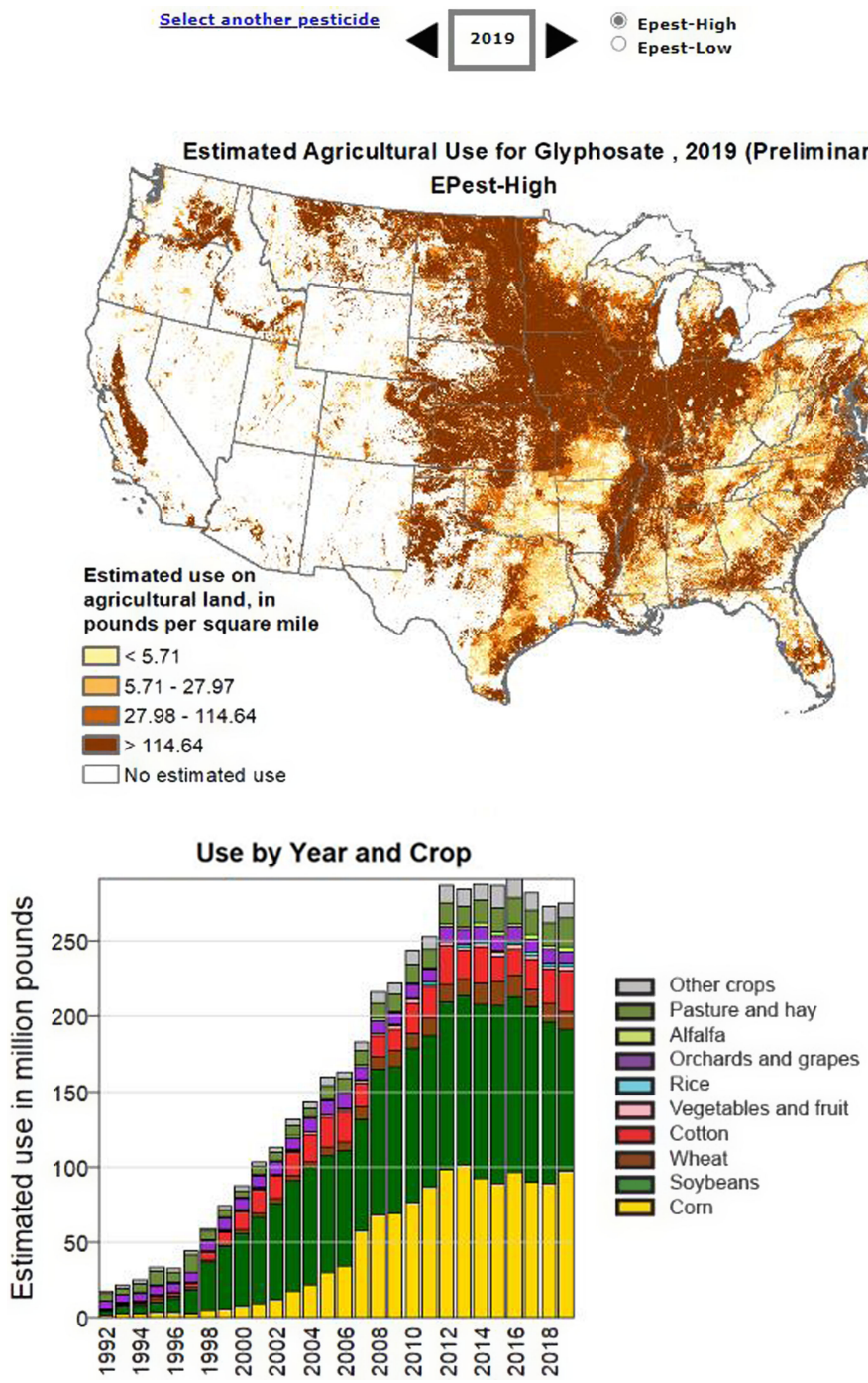


**Figure 1.** Example of USGS National Pesticide Synthesis Project estimated glyphosate use data, adjusted for agricultural land area at the county level, in the United States in 2019. Maps of pesticide use are accompanied by crop × year statistics presented in graph form.

and address concerns related to pesticide use in real time. Similar sentiments were expressed by Kolok et al. (2023) in *Environmental Toxicology and Chemistry*, where the authors cited two of their own publications to illustrate the value of the National Pesticide Synthesis Project to scientists. Kolok et al. (2023) suggested that the proposed adjustments by the USGS could limit the National Pesticide Synthesis Project's usefulness for evaluating the risks of pesticide exposure under changing climatic conditions that can differentially affect chemical accumulation and breakdown. They also noted that the USGS's pesticide use data can be critical for identifying disparities in health outcomes across demographic groups that could be related to pesticide use profiles (Kolok et al. 2023).

What is not mentioned in these articles is the potential value of these data to researchers focused on pressing agricultural concerns such as the evolution and spread of pesticide resistance in arthropods, plant pathogens, and weeds. The development of pesticide resistance is dynamic, as are accompanying changes to resistance management strategies. The yearly release of pesticide use data via the USGS database is invaluable to scientists who rely

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on information about temporal and geographic trends in pesticide applications to describe the intensity of chemical use in agricultural systems. USGS data have been important in weed management publications (e.g., Duke 2021; Gaines 2018) and in predicting evolution of resistance to insecticides (e.g., Major et al. 2022). We have seen widespread use of graphics and data from the USGS National Pesticide Synthesis Project website in presentations by weed scientists, environmental toxicologists, and scientists in other disciplines over the past decade. Frequent and detailed data about agricultural pesticide use will be critically important for monitoring shifts in chemical weed management strategies once the Environmental Protection Agency's (EPA) workplan to better protect endangered species is enacted (EPA 2023). Changes to the formal registration review process may result in amended label language regarding herbicide use rates, application timings, and allowable crops. Herbicide use across many cropping systems will also require the inclusion of multiple mitigation practices to prevent off-target movement and harm to threatened and endangered species. Collectively, these changes could reshape weed management practices throughout the United States. Thus, now more than ever, there is a strong need for the USGS Pesticide National Synthesis Project to provide yearly data on the use of all commercial pesticides.

In May 2023, more than 250 researchers petitioned the USGS to reconsider its proposed changes to pesticide data acquisition and release. While we were not party to this endeavor, we individually informed the USGS of the value of its data to the discipline of weed science. We agree with our fellow scientists that yearly updates to the database are vitally important and support calls for the USGS to revise its course regarding the National Pesticide Synthesis Project. At the same time, we urge our colleagues to investigate and utilize this data resource in their research and extension efforts.

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## References

Chen M, Shelton AM, Hallett RH, Hoepting CA, Kikkert JR (2011) Swede midge (Diptera: Cecidomyiidae), ten years of invasion of crucifer crops in North America. J Econ Entomol 104:709–716

DiTomaso JM (2000) Invasive weeds in rangelands: species, impacts, and management. Weed Sci 48:255–265

Duke SO (2021) Glyphosate: uses other than in glyphosate-resistant crops, mode of action, degradation in plants, and effects on non-target plants and agricultural microbes. Rev Environ Contam Toxicol 255:1–65

[EPA] Environmental Protection Agency (2023) EPA's Workplan and Progress toward Better Protections for Endangered Species. https://www.epa.gov/endangered-species/epas-workplan-and-progress-toward-better-protections-endangered-species. Accessed: October 10, 2023

Gaines TA (2018) The importance of glyphosate in non-GM settings. Outlooks Pest Manag 29:255–257

Gewin V (2023) Move to change how US tracks pesticide use sparks protest. Science 380:880–881

Jetter KM, Madsen JO, Bubenheim DA, Dong JU (2021) Bioeconomic modeling of floating aquatic weeds in the Sacramento–San Joaquin River Delta. J Aquat Plant Manag 30:98–106

Kolok AS, Joseph N, Propper CR (2023) The US Geological Survey plans to severely curtail the National Pesticide Synthesis Project. Environ Toxicol Chem 42:1647–1648

Major KM, Weston DP, Wellborn GA, Lydy MJ, Poynton HC (2022) Predicting resistance: quantifying the relationship between urban development, agricultural pesticide use, and pesticide resistance in a nontarget amphipod. Environ Sci Technol 56:14649–14659

Moore JW, Murray DS, Westerman RB (2004) Palmer amaranth (*Amaranthus palmeri*) effects on the harvest and yield of grain sorghum (*Sorghum bicolor*). Weed Technol 18:23–29

Neal JC (2023) Biological control of weeds in turfgrass: opportunities and misconceptions. Pest Manag Sci. https://doi.org/10.1002/ps.7436

Smith D, Baker R, Steele G (2000) Palmer amaranth (*Amaranthus palmeri*) impacts on yield, harvesting, and ginning in dryland cotton (*Gossypium hirsutum*). Weed Technol 14:122–126

Soltani N, Dille JA, Burke IC, Everman WJ, VanGessel MJ, Davis VM, Sikkema PH (2016) Potential corn yield losses from weeds in North America. Weed Technol 30:979–984

Soltani N, Dille JA, Burke IC, Everman WJ, VanGessel MJ, Davis VM, Sikkema PH (2017) Perspectives on potential soybean yield losses from weeds in North America. Weed Technol 31:148–154

[USDA-NASS] U.S. Department of Agriculture–National Agricultural Statistics Service (2023) Agricultural Chemical Use Program. https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Chemical_Use. Accessed: October 10, 2023

[USGS] U.S. Geological Survey (2023) Pesticide National Synthesis Project. https://water.usgs.gov/nawqa/pnsp/usage/maps. Accessed: October 10, 2023

[WSSA] Weed Science Society of America (2023) Crop Loss Website. https://wssa.net/wssa/weed/croploss-2. Accessed: October 10, 2023

Vilà M, Espinar JL, Hejda M, Hulme PE, Jarošík V, Maron JL, Pergl J, Schaffner U, Sun Y, Pyšek P (2011) Ecological impacts of invasive alien plants: a meta-analysis of their effects on species, communities, and ecosystems. Ecol Lett 14:702–708

Wisler GC, Norris RF (2005) Interactions between weeds and cultivated plants as related to management of plant pathogens. Weed Sci 53:914–917