Union of Concerned Scientists

POLICY BRIEF

Safeguarding Soil

A Smart Way to Protect Farmers, Taxpayers, and the Future of Our Food

HIGHLIGHTS

Soil is at the foundation of our food system and is vital for our future. Healthy, living soil promotes healthy crops, holds water, prevents pollution, stores carbon, and helps ensure that farmers and their communities can thrive. Yet decades of short-sighted farm policies have incentivized practices—such as growing just one or two crops instead of more diverse rotations, and leaving soil bare after harvests—that have depleted and damaged this foundation. As a result, estimates have suggested that US farms lose more than 3 trillion pounds of soil to erosion each year. To rebuild this critical life-support system, we need science-based public policies that invest in farmers and soil.

Many people think of soil as "just dirt," but soil is at the foundation of our food system, and taking care of it is vital for our future. Healthy soil is full of life, including beneficial insects, fungi, and microbes that recycle leaves and other material into organic matter and nutrients for growing plants. For farmers, living soil promotes healthy crops, needs fewer chemical inputs, and acts as a sponge, protecting against floods and droughts and preventing water pollution caused by fertilizer runoff. In these ways, healthy soil reduces the risk of crop loss from extreme weather, lowers farmers' input costs, and stores more carbon in the ground. And when farmers profit from growing healthy food on healthy soils, everyone—in both rural and urban communities—benefits.

For decades, US farm policies have prioritized near-term production gains, leading to grave damage to soils in the form of depleted nutrients, increased vulnerability to erosion, and reduced resilience to floods and droughts. Such short-sighted policies have often led to overproduction, benefiting large food and agribusiness conglomerates but degrading soils and harming many farm families, rural areas, and communities downstream. Now, with intensifying weather disasters threatening soils, farms, rural communities, and the stability of our food supply, we need a new approach to agriculture and the policies that support it. Helping all farmers to build and maintain this vital foundation for the future should be a key objective of the nation's farm, food, and rural economic development policies.

Why Focus on Soil Health?

Soil erosion and degradation are costly, to farmers, rural communities, and taxpayers. Estimates suggest that US agricultural land loses more than 3 trillion pounds of soil to erosion each year (USDA 2018). These losses are devastating,

Zachary Haslick/Aerial Associates Photography, Inc.

In 2017, a toxic algal bloom overtook the Maumee River where it empties into Lake Erie in Toledo, Ohio. Rapid algae growth occurs when excess nutrients—such as fertilizers in farm runoff—enter the water upstream. In recent years, such blooms have temporarily poisoned the part of the lake that provides Toledo's drinking water.

robbing farmers of valuable natural resources and financial investments—the soil itself but also fertilizers that wash away with it—and polluting the nation's waterways. Nitrogen pollution from agriculture costs the nation some $157 billion per year, closing beaches and killing fish in many lakes and rivers, and contributing to a Gulf of Mexico "dead zone" that in summer 2019 was nearly the size of New Jersey (Sobota et al. 2015; NOAA 2019). Farming communities from California to the Corn Belt, along with downstream cities such as Des Moines, Iowa, and Toledo, Ohio, struggle to protect residents from agricultural nitrogen and phosphorus pollution of drinking water supplies (Greenaway 2012; Healy 2018; Mulik 2016).

Many current agricultural practices also harm the physical structure and microbial life of soil. Damaged soil is less able to absorb and drain water, leaving farmers, communities, and ecosystems more vulnerable to both floods and droughts, which are increasingly wreaking havoc on crops and livestock (Basche 2017; USGCRP 2018). Farm fields with damaged soils are more likely to flood under heavy rains, while crops and grazing lands with degraded soil dry up more quickly during droughts. Taxpayers shoulder a heavy burden for this damage. Between 2009 and 2018 the federal crop insurance program paid $52 billion for flood- and drought-related claims (RMA 2019).[1] Such insurance claims will likely increase as a result of climate change, costing taxpayers even more (OMB 2016).

Damage to farm soils also puts our food supply at risk. Without healthy soil as a buffer against increasingly frequent and severe weather disasters, ripple effects such as accelerating crop failures and reduced livestock productivity are likely. As a result of such losses, rural US households and communities with economies tied tightly to agriculture are likely to suffer the most (USGCRP 2018). Further, in many countries, climate variability and extremes have already increased prices of basic food commodities, triggering food crises and increased hunger, and such challenges are expected to get worse (IPCC 2019). In the United States as well, adapting to climate change will require significantly more resilience in our food system.

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Healthy soil practices are key to combatting climate change. Soil represents an important opportunity for agriculture to be part of the climate change solution, with farmers as key partners. The nation's agriculture sector directly accounts for roughly 9 percent of US heat-trapping emissions, but changing agricultural practices can help reduce these emissions (EPA 2019). In addition, because farms and ranches can capture and store substantial amounts of carbon through plants and soils, increasing on-farm sequestration rates can reduce the nation's net heat-trapping emissions (Harden et al. 2018; Vermeulen et al. 2019).

Recognizing the many benefits of soil health, a growing number of state and federal policymakers have put forward policy proposals to foster healthy soils. A recent legislative analysis by the Union of Concerned Scientists found that, between 2015 and 2018, policymakers introduced 166 soil-related bills in 27 state legislatures and 105 such bills in Congress. Many of those bills sought to promote soil health through mechanisms including research, technical assistance, and incentives such as grants, loans, and tax credits for farmers and ranchers who adopt soil-building practices (Eley, DeLonge, and Ferguson 2019).

Useful Practices for Soil Health

A variety of methods build soil health, and these should be incentivized by public policies. Methods will differ in detail according to soil type, climate, and crop, but there are some consistent best practices. Soil is healthier when it is kept covered, contains living roots, and is left undisturbed. Incorporating these elements into farming systems can improve soil structure, fertility, and microbial diversity (Bowman, Wallander, and Lynch 2016). Soil health practices include:

- **Growing cover crops** in between main crops to keep soil in place and help it absorb rainfall and snow melt.
- **Diversifying crop rotations** to add fertility, disrupt pests' lifecycles, and keep living roots in the ground for more months of the year.
- **Planting perennial plants**, such as prairie grasses or trees within or at the edge of fields, to maintain deep living roots year-round that stabilize soil, draw carbon deeper underground, and capture excess fertilizer before it can become a pollutant.
- **Plowing less, or not at all**, with low- or no-till farming systems that minimize disturbance and keep moisture in the soil.
- **Regularly applying materials such as compost and mulch** to add nutrients along with soil-building organic matter.

Lynn Betts/NRCS/SWCS

Planting strips of perennial plants in and around farm fields can dramatically reduce soil erosion and water pollution. An Iowa State University study has shown that that replacing just 10 percent of cropland with prairie, like these newly established strips in Iowa, can cut fertilizer runoff by 85 to 90 percent.

- **Improving grazing management** to promote nutrient recycling, prevent soil compaction, increase sponginess, and establish deep-rooted plants that store more carbon.

Abundant research has shown that such practices can reduce erosion, enhance carbon storage, increase water-holding and draining capacity, boost plant health, and reduce the need for pesticide and fertilizer use (for example, Basche 2017; DeLonge and Basche 2017; Byrnes et al. 2018; Stanley et al. 2018; DeLonge and Stillerman 2019; Hunt, Hill, and Liebman 2019; Schulte et al. 2017; Paustian et al. 2019; Basche and DeLonge 2019). Importantly, some of these practices have been shown to lead to equal or greater profits for farmers (Mulik 2017; Myers, Weber, and Tellatin 2019).

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However, despite the benefits of these practices both on and off the farm, current US agricultural policies have not done enough to date to help farmers adopt them widely. For example, as of 2017, fewer than 4 percent of cropland acres nationwide incorporated cover crops (NASS 2019). New policies are desperately needed to accelerate the adoption of this and other proven practices.

Farmers and the Public Looking for New Solutions

Across the country, farmers are looking for new solutions as they increasingly struggle to adjust and survive in the face of a mounting climate crisis. In a 2018 poll of more than 2,800 farmers in seven states—Iowa, Illinois, Kansas, Michigan, Ohio, Pennsylvania, and Wisconsin—three-quarters of respondents expressed support for federal policy incentives to reduce farm runoff and soil loss, improve water quality, and increase resilience to floods and droughts (RABA 2018). Seven in 10 of these farmers—across party lines—said they would be more likely to vote for a political candidate who favors farm success through sustainable agriculture instead of business as usual.

The general public, too, consistently expresses concern about problems—including water pollution, drinking water

safety, and climate change—that could be addressed through attention to healthy soil (McCarthy 2017; Dennis, Mufson, and Clement 2019; Roper Center 2019).

Recommendations

In order to improve soil health and climate resilience and help ensure long-term sustainability for farmers' livelihoods and our food supply, policymakers should:

- **Support initiatives to gather information on the economic and environmental outcomes of healthy-soil practices.** We cannot manage what we do not measure. Therefore, to reach the goal of widespread, long-term adoption of healthy-soil practices, we need science and data to inform investments and policymaking. Ongoing efforts by the US Department of Agriculture (USDA) and others to collect information should remain a priority, and their funding and scope should be scaled up and coordinated where possible.

Lance Cheung/USDA

With financial and technical support from the USDA, Jim Chew applies compost annually and grows no-till grass cover crops between the rows of his California pistachio orchard to hold water in the soil and deliver nutrients to the trees. Financial incentives help farmers like Chew cover up-front costs that may come with such practices, which can increase yields and save on inputs over the long term.

- **Align financial incentives for farmers with healthy-soil practices.** More and better incentives are needed to enable farmers to make up-front investments and cover longer-term costs that are sometimes associated with implementing healthy-soil farming practices. This support for practices new to some farmers will help hasten a transition to healthier soils.
- **Increase investments in food and agriculture research.** Research is necessary to assess the effectiveness of new practices, and to refine them. However, inflation-adjusted public sector spending for food and agricultural research declined 20 percent between 2008 and 2013 (Clancy, Fuglie, and Heisey 2016), and very little funding has been directed at the types of ecological research that are urgently needed for advancing soil health (DeLonge, Miles, and Carlisle 2016). New, expanded research efforts should focus on climate change topics, strategies and outcomes that enable more farmers to adopt healthy-soil practices, and connections between healthy soil and human health.
- **Expand technical assistance and extension services supporting best practices for healthy soils**. Publicly funded technical assistance and knowledge-sharing—often through university-based agricultural extension services—is meant to serve the public good and is an ideal channel for knowledge and best practices aimed at ensuring long-term soil health. Extension enables two-way communication with farmers about new scientific research and can support them in implementing healthy-soil practices best suited to their regions.
- **Direct resources toward historically marginalized farmers and farmers most in need**. Policies should be designed to enable all farmers, especially historically marginalized farmers and farmers of color, to participate in and benefit from new healthy-soil investments.

To protect US farmers and the public in the face of an uncertain future of increasing flooding, drought, water pollution, pest problems, and an unstable food supply, there is an urgent need for new policies and investments that can facilitate a vast nationwide scale-up of healthy-soil practices nationwide. Food, farm, and rural policies must shift and maximize public investments to speed up this transition to healthier and more resilient food systems, farm economies, and farmland.

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ENDNOTE

1 *This value was calculated as the sum from all US locations reporting indemnity data to the Risk Management Agency for one of three causes of loss: flood, drought, or excess moisture/precipitation/rain.*

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