Productivity and Risk Management

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FARM BILL LAW ENTERPRISE

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The Promise of a New Farm Bill

If it seems like everyone is talking about the farm bill, there are good reasons. New farm bills are proposed, debated, and passed once every five years, sometimes longer, and they shape virtually every aspect of our food and agricultural systems. Many programs authorized by the most recent farm bill, the Agricultural Act of 2014, will expire in September 2018. For this reason, and despite everything else competing for attention on Capitol Hill, Congress is working to pass a new farm bill this year.

The farm bill grew out of Depression-era policies designed to keep farmers out of bankruptcy, ensure a reliable food supply, and protect against soil loss in the wake of the Dust Bowl.

Today, farm bills continue to evolve the body of laws that authorize and fund a broad array of food and agriculture programs. The 2014 Farm Bill included twelve separate titles covering a wide variety of issues including Depression-era carryovers like commodities, conservation, and crop insurance programs, the country's largest nutrition safety net program, and new support for expanding local food and biofuel markets.

With all this and more combined into one piece of legislation, even the most passionate supporters of farmers, eaters, and the environment struggle to make sense of how the pieces fit together. Even though most Americans agree on basic goals such as a safe and nutritious food supply, an honest living for farmers, a healthy environment, and a guarantee against hunger, the legislation itself is so complex and specialized that it can be hard to know where to begin. For most Americans, there is a gulf between caring about these goals and understanding how to champion solutions through the farm bill.

TITLES OF THE 2014 FARM BILL

I. Commodities
II. Conservation
III. Trade
IV. Nutrition
V. Credit
VI. Rural Development
VII. Research and Extension
VIII. Forestry
IX. Energy
X. Horticulture and Specialty Crops
XI. Crop Insurance
XII. Miscellaneous

Click to learn more about each title in FBLE's background library.

The Farm Bill Law Enterprise

The Farm Bill Law Enterprise (FBLE) helps bridge this gulf. FBLE is a national partnership of law school programs working toward a better farm bill that reflects the long-term needs of our society. Our members' expertise in the laws and policies of food, agriculture, public health, and the environment make it possible to cut across special interest and partisan boundaries. Beyond our diverse research backgrounds, our work is driven by our shared beliefs that the farm bill should advance economic opportunity and stability, public health and nutrition, public resources stewardship, and principles of fair access and equal protection.

This publication belongs to a collection of reports based on the collaborative research of FBLE members.

- ***Diversified Agricultural Economies*** addresses the barriers facing small, medium-scale, diversified, beginning, female, and minority farmers and ranchers. It sets goals and makes recommendations to create opportunities for these producers by improving access to markets, insurance, credit, and land.
- ***Food Access, Nutrition, and Public Health*** focuses on the farm bill's nutrition safety net for low-income families, the elderly, people living with disabilities, and unemployed Americans. It sets goals and makes recommendations to improve food access, nutrition, public health, infrastructure, and economic development.
- ***Productivity and Risk Management*** focuses on the farm bill's commodities, conservation and crop insurance programs that govern the complex interactions between large-scale production agriculture, the risks presented by both weather and market volatility, and natural resources protection. It sets goals and makes recommendations to better align production with the stewardship of resources like water, the health and productive capacity of soils, and the vitality of rural communities.

Writing a new farm bill is a momentous opportunity, but much also depends on how the law gets implemented.

Implementation depends on the agency rulemaking, Congress's annual appropriations process, and the decisions and priorities made by USDA leadership. FBLE will monitor implementation of the new farm bill and keep readers informed on our website, FarmBillLaw.org. The website contains a wealth of resources, including background materials that go in depth on every title of the farm bill, tools for tracking the farm bill's progress through Congress, and information on getting involved in the legislative process. Finally, FBLE's blog is a great place to get timely and trenchant analysis from FBLE's members.

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EXECUTIVE SUMMARY

The commodities segment of the agricultural sector produces most of the nation's agricultural products. Commodity producers face thin margins and often look to government support to maintain profitability. At the same time, the capacious production of this sector can mask persistent challenges, including the short-term stewardship of natural resources like water, the long-term health and productive capacity of soils, and threats to the vitality of rural communities. Producers need help to tackle these challenges for the sake of their businesses and the nation's food security. Every five years, help arrives in the form of a new farm bill that updates existing commodities, conservation and crop insurance (CCCI) programs.

This report explores how CCCI policy can support broader notions of productivity and risk management that prioritize farmer livelihoods and natural resources health. Here, productivity sits at the nexus between the land's capacity to sustain crops and animals over the long term, and the livelihood of the producers who make their living off the land. Risk management, on the other hand, addresses the potential to invest in resilient agricultural systems that reduce both on-farm financial risk and broader natural resource concerns. By considering CCCI initiatives together, Congress can improve productivity and risk management for the benefit of producers and the public.

Today, the agricultural sector faces similar challenges as it did in the 1930's when the twin specters of the Great Depression and the Dust Bowl haunted rural areas and drove many producers to bankruptcy. In 2018, producers are again contending with the prospect of persistently low commodity prices. Soil remains a conservation priority even as new natural resource management challenges, such as water quality and climate change adaptation, are competing for scarce conservation dollars. The interactions between CCCI programs require producers to make agronomic and economic tradeoffs between programs, including which crops to plant, which agronomic practices to implement, and whether to put some of their acreage into retirement or under easement. The congressional budgeting process also links these programs. The sheer size of CCCI spending, accounting for 95 percent of 2014 Farm Bill spending outside of Nutrition, means that significant changes within

any one of those areas will likely require cuts to others.

By addressing CCCI together it is possible to renegotiate a better bargain for producers and the public. Achieving this deal requires a candid assessment of the issues confronting the agricultural sector. Traditional environmental laws inadequately protect air and water quality from agricultural sources of pollution. In their place, Congress relies on CCCI incentives and voluntary conservation measures to mitigate environmental harms. New policy can better align the short-term interests of producers and the long-term health of natural resources. At the same time, efforts to increase productivity and improve risk management must include attention to disparities in wealth and the inequitable payment of federal benefits. Aligning private incentives with the public good requires that benefits are spread evenly throughout the agricultural economy and across the broadest base of producers.

This report focuses on goals and recommendations, including specific legislative changes, tailored to advancing these objectives within the next farm bill. The full report is part of a series. When considered in total they offer a dynamic and wide-ranging suite of ideas for the future of American agriculture and American eating. Other reports in the series address *Diversified Agricultural Economies* and *Food Access, Nutrition, and Public Health*. Given its distinctive breadth, the farm bill offers a unique opportunity to address the myriad challenges facing agricultural producers and their communities. These challenges may seem diffuse, but are entwined through the complex workings of our food and agriculture system. This report, like the others in this series, demonstrates how this essential interconnectivity offers opportunities to seize the farm bill as a tool to improve the lives of all Americans.

Goal I

Increase fairness and invest in the future through commodity and crop insurance program reforms

Congress writes the farm bill according to strict budget rules that cap spending relative to previous farm bills. In order to put new funding where it is needed most, broadening economic opportunity and natural resources stewardship across all farms, requires identifying money-saving reforms elsewhere in the farm bill. Reforms that make the commodities and crop insurance programs fairer and more effective can simultaneously trim expenses and make additional funding available to higher priority areas.

Top Commodities and Crop Insurance Solution for the Next Farm Bill

Introduce means testing to the federal crop insurance program and place enforceable limits on who can collect commodities payments

Risk management as delivered through the commodities and crop insurance programs should provide a safety net in bad years rather than subsidize and concentrate profits. Unlike

other farm bill subsidy programs, however, the federal crop insurance program has no means test for premium subsidies. One result is that the largest 15 percent of farm operations receive as much as 90 percent of all crop insurance subsidies. Meanwhile, the "active personal management" standard is supposed to prevent high-income households from receiving commodity payments, but the Government Accountability Office has criticized the standard as overly broad, subjective, and difficult to enforce. Allowing nearly unlimited commodities payments and crop insurance subsidies is expensive for the public and unfair to most producers, and Congress should put reasonable and enforceable limits on both programs.

Additional Commodities and Crop Insurance Recommendations

- Decouple crop insurance subsidies from premiums
- Require fairness in public-private partnership
- Reform the Harvest Price Option to reduce overexposure and windfalls
- Reform Supplemental Coverage Option to eliminate windfall payments

Goal II

Advance conservation compliance and enforcement

The 1985 Farm Bill addressed natural resources in a new way by requiring farmers to comply with basic conservation measures in order to maintain eligibility for certain farm program payments, subsidies, and loans. Known as "conservation compliance," these federal requirements leverage benefit payments to encourage a basic level of environmental stewardship by farmers. Because federal environmental laws like the Clean Air Act and Clean Water Act largely exempt agricultural activities, the conservation compliance provisions are critically important in addressing environmental harms resulting from agricultural production. However, multiple factors undermine the efficacy of conservation compliance, including a lack of transparency, weak conservation standards, and a lack of enforcement resources. For example, NRCS does not report conservation compliance data, making it difficult to assess implementation. Further, even when farmers and ranchers are in compliance, the NRCS soil erosion tolerance rates still permit a net loss of soils. Moreover, millions of erodible cropland acres are excluded from conservation compliance altogether. Congress and USDA have an opportunity to reform the existing conservation compliance regime to address the challenges posed by inadequate transparency, standards and enforcement.

Top Conservation Compliance Solution for the Next Farm Bill

Bring transparency to conservation compliance

A prerequisite to effective enforcement of the conservation compliance requirements is the

gathering and reporting of data on compliance, enforcement and program efficacy. There is currently no legal mandate that the USDA report this information to Congress or otherwise make it publicly available. In particular, Congress does not require the Secretary to include data regarding conservation compliance enforcement. In addition, existing law requires that the Secretary submit to Congress an annual report on conservation program enrollment, but not on conservation practice efficacy. Understanding the relationship between voluntary conservation programs and conservation compliance is necessary to determine whether these programs are achieving their purpose and how they can be improved, in terms of environmental outcomes and cost-effectiveness. Congress should require that compliance and enforcement data are available to the public and reported in a timely manner to Congress, with a granularity comparable to the Agricultural Census.

Additional Conservation Compliance Recommendations

- Update conservation compliance standards to conserve more soil
- Fund robust enforcement and technical assistance of compliance standards

Goal III

Modernize conservation funding priorities, eligibility, and payment rates

Producers balance two essential but often countervailing aims: to supply food, feed, and fiber to the nation, and to steward the land and natural resources all depend on. Because many environmental laws and regulations exempt or otherwise differentiate agricultural activities from rules that apply to other industries, farm bill policy is critical in helping farmers manage and prioritize these two goals. Generally, farm bill conservation programs are popular with producers and efficient for taxpayers. However, the 2014 Farm Bill and subsequent sequestration reduced projected conservation spending by an estimated $6.1 billion, or 9.8 percent relative to pre-2014 levels. The farm bill conservation programs help promote soil health, protect community health, manage extreme weather risks, and ensure long-term agricultural productivity for generations to come. The Conservation Title also boosts rural development, providing an additional source of income for producers and creating natural amenities that can support rural economic growth. Congress should restore its prior funding of conservation programs with renewed focus on improving conservation outcomes. Conservation dollars should prioritize investments in agricultural practices that protect water quality and build soil health, and limit funding that subsidizes environmental risk-taking.

Top Voluntary Conservation Program Solution for the Next Farm Bill

Invest in long-term soil and water and quality

Reforms to voluntary conservation programs provide the best opportunity to move beyond simple conservation and begin to improve long-term soil and water quality. Working lands conservation programs pay producers to manage their acreage for environmental as well as production goals. For example, nutrient-rich runoff from agricultural fields impairs water

systems, causing both hypoxic "dead zones" and threatening drinking water supplies downstream, and conservation programs pay farmers to adopt practices that mitigate this pollution. Congress should encourage efforts to coordinate conservation priorities across state lines while boosting payments rates for the most effective conservation practices. On the other hand, some land is not fit for production, and the role of retirement programs like CRP is to enable producers to retire the most environmentally sensitive land for a period of years. Unfortunately, when this land re-enters production conservation benefits such as water quality and carbon sequestration are lost. CRP contracts should be extended, and eventually made permanent, on the most sensitive and marginal acres.

Additional Voluntary Conservation Program Recommendations

- Restore EQIP's focus on smaller farms performing voluntary conservation
- Prioritize innovation in conservation program spending

Goal IV

Invest in research and pilot programs

Research and pilot initiatives are investments in the future, building the knowledge and experience that allows for innovative policy to scale and adapt across time and geographies. In particular, targeted research and pilot programs can improve long-term productivity and risk management within agriculture, with a focus on investments in soil health, resilient agronomic systems and natural resources conservation. Research and pilot programs best address situations where there is evidence that certain farming practices further goals or lead to desired outcomes, but uncertainties remain about the nature or magnitude of these benefits. Congress should provide research funding when a lack of data hampers efforts to adequately assess the costs and benefits of certain farming practices, or when there is insufficient understanding of interactions between incentives to develop policy that promotes good practices. On the other hand, pilot projects work best when there is sufficient information to identify beneficial practices but barriers such as conflicting public or private incentives prevent farmers from achieving widespread adoption.

Top Research and Pilot Program Solution for the Next Farm Bill

Bolster links between insurance subsidies and soil health

A growing body of research suggests that many farming practices not in widespread use can significantly improve long-term productivity and conservation outcomes. Research connects these practices to significant increases in soil health, reductions in erosion, retention of soil moisture, better drought resistance, reductions in greenhouse gas emissions, and increased carbon sequestration. Of particular significance to the federal crop insurance program, there is evidence that these practices can reduce the frequency and magnitude of indemnity payments to farmers. Uncertainties remain about the magnitude of the impact of some of these practices; their transferability to different

regions, soil types, and crops; and their effects when used in combination. Other barriers remain to incorporating these practices into guarantee- and premium-setting processes. Congress should create pilot programs to gather data and analysis needed to develop actuarially sound methods for incentivizing these practices through the crop insurance program.

Additional Research and Pilot Program Recommendations

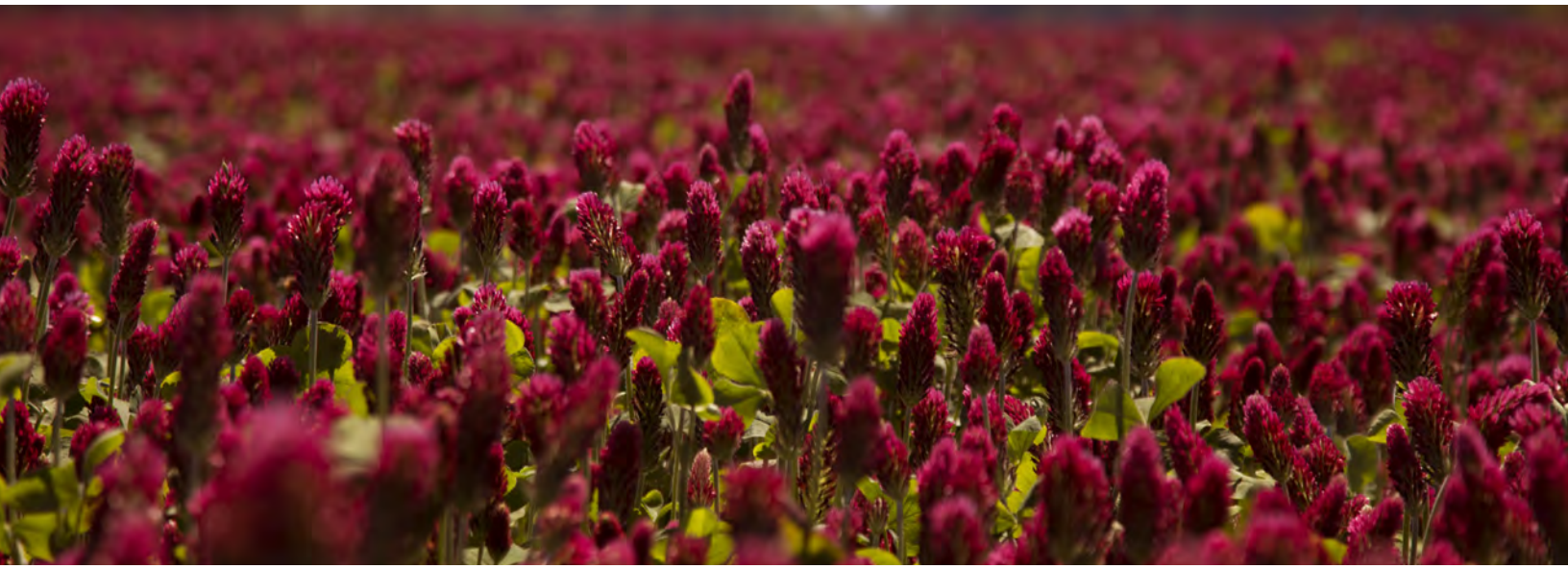
- Monitor and reduce harmful emissions
- Coordinate a robust USDA response to climate change
- Invest in opportunities for perennial agriculture systems
- Understand precision agriculture's risks and opportunities
- Preserve, expand, and improve the Livestock Indemnity Program

Farm Bill Titles Covered in This Report:

- Commodities (I)
- Conservation (II)
- Research (VII)
- Crop Insurance (XI)
- Miscellaneous (XII)

This report covers farm bill programs that support agricultural production, risk management, and conservation of the nation's natural resources. After outlining the major challenges of existing farm bill policy, this report recommends a variety of farm bill reforms that could improve farmland productivity and health while increasing the economic security of farmers who make their living off the land. Section I proposes changes to the commodities and crop insurance programs that will simultaneously increase economic fairness and reduce costs, freeing up funds necessary to enact many of the recommendations in the following sections. Section II recommends improvements in enforcement and compliance within the conservation compliance regime. Section III recommends changes to the largest voluntary conservation programs. Finally, Section IV proposes research and pilot programs to better align public values to future farm bill policy.

Introduction



Productivity & Risk Management in Context

The farm bill, under its expansive umbrella, has the potential to address challenges that seem diffuse but are entwined through the complex workings of our food and agriculture system. These challenges affect the daily lives of every individual. Food insecurity still plagues 41 million Americans almost a decade after the Great Recession.[1] Multiple diet-related diseases persist at epidemic proportions, driven at least in part by inaccessibility of health-promoting food options. These and similar challenges are addressed in FBLE's report, *Food Access, Nutrition, and Public Health*. Meanwhile, the average American farmer nears 60 years old, and the new generation who would take their place must first overcome capital constraints and access market channels to supply the fresh, affordable and sustainably raised products that customers demand. These and other challenges faced by small, beginning, and female and minority producers are addressed in FBLE's report, *Diversified Agricultural Economies*.

A distinct set of challenges emerge from the commodity segment of the agricultural sector, which produces most of our nation's agricultural products. Across these operations, producers can face thin margins and often look to government support to finance their operations and maintain solvency. Bountiful productivity within this sector can mask persistent challenges, including the short-term stewardship of natural resources like water, the long-term health and productive capacity of soils, and threats to the vitality of rural communities.

To tackle these challenges, this report looks to the farm bill's commodities, conservation and crop insurance (CCCI) policy. The farms that currently participate in CCCI programs also control most American farmland. Corn, soybeans, hay, and wheat alone account for over 90 percent of harvested cropland acres.[2] Thus, *Productivity and Risk Management* refers to the potential of CCCI policy to reverberate across a vast swatch of the United States landscape, promoting productivity in both the short and long term by facilitating more resilient agricultural systems.

In this report, *productivity* addresses the nexus between soil health, the ability of the land to sustain crops and animals over the long term, and the livelihoods of the producers who make their living by stewarding this balance between short-term extraction and long-term productivity. CCCI policy must begin to fully account for agriculture's true costs and benefits and compensate producers fairly for their investments in the future capacity of the landscape to supply vital food, fuel and fiber.

Similarly, *risk management* must address the nexus between natural resources health, choices among agronomic systems, and the risk that affects producers most acutely, namely the risk to their financial security. Existing CCCI policy that rewards producers financially for planting unsuitable crops or on marginal land is at loggerheads with sound risk management principles. An updated approach to risk management should instead find ways to reward producers for reducing risks, both in the current crop year and in years to come. This is no simple task. Producers face varied risks, from weather events that affect this year's harvest, to climatic changes that make current production systems riskier year over year, to market risks that expose the vulnerability of producers who rely on a single crop. Only by considering CCCI initiatives together can policymakers implement risk management strategies that protect producer livelihoods and the public's investment in resilient food production.

The Practical Links Among Commodities, Conservation and Crop Insurance

There have long been important connections between commodities programs that broadly support producer incomes, federal crop insurance that protects individual farms against yield or revenue losses, and conservation programs that share the private costs of stewarding natural resources. Recent farm bills include individual titles for Commodities (Title I), Conservation (Title II), and Crop Insurance (Title XI) policy. Given how these three program areas are practically and thoroughly linked, they must be addressed together.

A. Producers Trade Off Among CCCI Programs and Incentives

Farms that benefit from one type of CCCI program often participate in other CCCI programs. For instance, an operation that has significant acreage in a commodity program like Price Loss Coverage is much more likely—relative to non-participants—to enroll that acreage in the federal crop insurance program, and also more likely to operate at a scale that makes participation in a conservation program cost-effective. The interactions between CCCI programs require many producers to make management decisions taking into account the way these programs relate to one another. For example, the 2014 Farm Bill required producers to make a one-time

election between a Commodities Title program that makes payments based on farm revenue or a different program that makes payments based on market prices. Electing the revenue-based program made a producer ineligible for a new and generously-funded crop insurance program, while participation in the price-based program preserved the option to buy the new insurance product.

This overlap demands that policymakers view CCCI policy holistically because tugging on one strand is liable to rattle the entire web of federal supports. Producers constantly make agronomic and economic tradeoffs between programs, including choices amongst crops, agronomic practices, inputs, business structures and whether to put some of their acreage into retirement or under easement. For example, producers have long struggled to navigate conservation program incentives to plant cover crops—thereby enhancing soil health, among other benefits—with crop insurance contracts that restrict incorporation of cover crops into annual rotations.[3]

The farm bill's conservation compliance requirements make additional statutory links between CCCI by requiring that producers on certain land follow conservation procedures in order to maintain most federal farm program benefits. The Conservation Title sets conservation compliance requirements and dictates how these requirements interact with a producer's ability to participate in other CCCI programs. Accounting for changes made by the 2014 Farm Bill, producers must meet baseline conservation measures on highly erodible lands and wetlands in order to be eligible for most commodity payments, crop insurance subsidies, conservation programs and farm credit.

B. Congress Trades Off Among CCCI

The congressional budgeting process also links these programs. The current political climate and the budget rules in Congress ensure that the next farm bill will be written on a tight budget. Around the time of this publication, the Congressional Budget Office will release its estimate of what current farm bill provisions would cost if extended unchanged ten years into the future.[4] This sets the new farm bill's "baseline," or total amount of projected spending that can realistically make it into the new farm bill. Any new spending must be offset by cuts elsewhere in the bill. For example, if Congress wanted to increase spending on conservation, it would have to make cuts to other program areas.

This situation played out as Congress wrote the 2014 Farm Bill. A large expansion of the federal crop insurance program was offset with projected cuts within the Commodities Title. Although those savings never materialized in fact,[5] the technicalities of the budgeting process mean that new funding is nearly impossible to come by, and writing a new farm bill often resembles a zero-sum game wherein interest groups compete to increase their slice of an unchanging pie. The sheer size of CCCI spending, accounting for 95 percent of 2014 Farm Bill spending outside of Nutrition,[6] means that significant changes within any one of those areas will likely require compensatory adjustments to other programs within CCCI. FBLE's companion report *Diversified Agricultural Economies* recommends how modest net savings from CCCI could also fund high-impact programs elsewhere in the farm bill.

C. CCCI Share Deep Historical Roots

CCCI programs share a long history. The role of the federal government in commodities, conservation and crop insurance dates to the earliest farm bills. When Congress passed the first farm bill in 1933, it addressed the Depression-era farm crisis by curtailing agricultural overproduction and installing price supports.[7] A few years later, Congress added conservation programs as another tool in the effort to boost farm incomes. Begun in the Soil Conservation Act of 1935, which created the Soil Conservation Service, early conservation programs paid farmers to shift from soil-depleting and overproduced commodities to soil-conserving grasses, legumes and cover crops.[8] The Federal Crop Insurance Corporation was created soon thereafter, in 1938,

to administer federal crop insurance policies in response to widespread crop loss during the Dust Bowl.[9]

Today, the agricultural sector faces similar challenges as it did in the 1930's when the twin specters of the Great Depression and the Dust Bowl haunted rural areas and drove many producers to bankruptcy. In 2018, producers are again contending with the prospect of persistently low commodity prices, driven in part by oversupply. Soil remains a conservation priority but the focus has expanded from soil retention to include overall soil health. New natural resource management challenges, such as water quality and climate change adaptation, are competing for scarce conservation dollars.

Opportunities: "Productivity" and "Risk Management" in the 21st Century

Addressing CCCI together offers Congress an unparalleled opportunity to tackle complex issues in United States agriculture. The farm bill is an opportunity for American agricultural producers and the American public to renegotiate an age-old bargain that is better for both. In this deal, producers provide a reliable, safe, nutritious and sustainable food supply that meets the needs of both present and future generations. In return, the public recognizes and addresses the unique risks of agricultural production as well as the vital role that producers play in providing for the nation and stewarding its natural resources.

Reaching a mutually beneficial deal requires a candid assessment of the issues confronting the agricultural sector. Traditional environmental laws are inadequate to protect air and water quality from agricultural sources of pollution. In their place, Congress has relied on CCCI incentives and voluntary conservation measures to address environmental harms, but the current regime of CCCI programs can better meet the needs of both producers and the natural resources they steward and depend upon.

In practice, policy can better align the long-term needs of agricultural producers and natural resources toward public goals of productivity and risk management. The current design of CCCI programs ensures that large farms receive higher total payments on both an absolute and per-acre basis.[10] Efforts to increase productivity and improve risk management across United States agriculture must include attention to disparities in wealth and this inequitable flow of federal benefits toward fewer and larger producers. On the one hand, this is a matter of fairness. At the very least, farm policy should avoid further concentrating wealth in the farm sector or allowing individual actors to become too big to fail. On the other hand, a more equitable distribution of benefits is a practical necessity for building agricultural systems that grows more productive and resilient with each passing season. Benefits must be spread more evenly throughout the agricultural economy, across the broadest base of producers, in order to align private incentives with the production of public goods.

Progress to Build On

A number of programs in recent farm bills show that it is possible to pursue the mutualistic goals of productivity and risk management. For example, the Whole Farm Revenue Protection (WFRP) pilot program, a 2014 evolution of a 2008 program, increases premium subsidies for producers who build resilience into their agronomic system through crop diversification. WFRP is discussed in greater detail in *Diversified Agricultural Economies*. This program provides proof of concept, and can be scaled up such that much larger subsidies elsewhere in the crop insurance program could be tied to the use of practices that mitigate risk across longer timescales by building soil health and conserving natural resources.

The 2014 Farm Bill also streamlined conservation

programs in an effort to improve program delivery and align conservation goals. In a positive light, consolidating programs elevated earnest conversation about how to ensure that conservation dollars produced real and additional conservation outcomes. Getting the most out of each conservation dollar will be more important than ever as the next farm bill is written under tight fiscal constraints, and this report offers numerous suggestions for achieving that goal in the next farm bill.

Building on the progress of past farm bills, this report makes recommendations for the next farm bill to support the incremental process of aligning agricultural policy with the public's shared expectations. The recommendations fall into four categories. Section I proposes changes to the principle commodities and crop insurance programs in order to more fairly distribute economic supports among producers and free up funds to enact the recommendations in sections II, III and IV. Section II recommends improvements to enforcement and compliance with conservation requirements. Section III recommends changes to the largest voluntary conservation programs. Finally, Section IV proposes research and pilot programs to drive future innovations and policy.

Discretionary, Mandatory and Baseline: A Primer on Farm Bill Funding

Congress writes the farm bill according to established federal budget rules and procedures. Chief among these rules is the process for "capturing" budget baseline, wherein the Congressional Budget Office projects the costs of all existing farm bill programs as if they were extended for ten years. This becomes the "baseline" pool of money available to write the new farm bill. Adding to this baseline is possible, but unlikely.

All farm bill funding is not created equal. Some programs receive ***mandatory*** funding through the farm bill. Mandatory funding is not contingent on annual appropriations because the farm bill already says how much funding to provide each year. A subset of mandatory spending is ***baseline*** funding. *Baseline* means that a program already has built-in funding going forward and Congress does not have to find new funding to keep the program in a new farm bill. Many of the largest farm bill programs, like the Supplemental Nutrition Assistance Program, the federal crop insurance program, and the major conservation programs have baseline funding.

However, programs with mandatory spending but no baseline face an uphill battle as Congress writes a new farm bill because Congress must find "new" money to support them. At least 39 farm bill programs have mandatory funding but no baseline. These programs, which include the Food Insecurity Nutrition Incentives Program and the Senior Farmers' Market Nutrition Program, have received over $2.8 billion since 2014. Generally, the cutoff between mandatory and baseline funding is $50 million per year. Programs receiving $50 million in the last year of the current farm bill are considered part of the baseline and thereby achieve a more *permanent* status within the farm bill.

Finally, some programs receive authorization in the farm bill but depend on ***discretionary*** spending through the annual appropriations process. Authorization tells the agency what the program can and should do, but does not guarantee that there will be any money to carry out that mission. Initiatives like the Beginning Farmer and Rancher Individual Development Accounts and USDA's share of the Healthy Food Financing Initiative received authorization in the 2014 Farm Bill but have received little or no funding through the subsequent appropriations.

For more information about farm bill funding, including a list of programs with mandatory funding but no baseline, see Jim Monke, Cong. Research Serv., R44758, Farm Bill Programs Without a Budget Baseline Beyond FY2018 (2017).

GOAL I

Increase fairness and invest in the future through commodity and crop insurance program reforms

Congress writes the farm bill according to well-established federal budget rules and procedures. Chief among these rules is the process for "capturing" budget baseline, wherein the Congressional Budget Office (CBO) projects the costs of all existing farm bill programs as if they were extended for ten years,[11] which becomes the "baseline" pool of money available to write the new farm bill.[12] Adding to (or subtracting from) this baseline is possible, but extremely unlikely.[13] Thus, identifying program reforms that generate cost savings is critical to advancing a farm bill that adds new funding for programs that drive economic opportunity and natural resources stewardship. As the following recommendations address, some commodities and crop insurance funding could be reallocated toward fairer and more effective purposes.[14]

1. Reforms to Title XI: Crop Insurance

Congress has simultaneously broadened and deepened the federal government's role in providing crop insurance, particularly over the past thirty years. Reforms to the federal crop insurance program offer an opportunity to generate cost savings that can be applied to more pressing farm bill initiatives. This is especially true now that crop insurance has supplanted commodities program expenditures and receives greater funding than at any point in history.[15] Approximately 89 percent of the 252 million acres planted to principal commodity crops—barley, corn, cotton, grain sorghum, peanuts, potatoes, rice, soybeans, tobacco, and wheat—are insured,[16] reducing the chance that Congress will be called upon to offer costly and slow ad hoc disaster payments.[17] However, the program is expensive: the CBO originally estimated that the 2014 Farm Bill would increase federal spending for crop insurance by $5.7 billion between 2014 and 2023,[18] and recent updates suggest that the program's cost will exceed $8 billion annually in the absence of reform.[19]

The USDA's Risk Management Agency (RMA) oversees the Federal Crop Insurance Corporation (FCIC), which in turn runs the federal crop insurance program as authorized and funded by the farm bill.[20] RMA administers premium subsidies and works directly with private insurance companies to provide federal crop insurance to producers.[21] Through this public-private partnership, RMA provides reinsurance and pays overhead and administrative costs for companies that sell and service RMA policies.[22]

Producers contribute to the crop insurance program by paying a portion of crop insurance premiums, but large federal subsidies—averaging 62 percent of total premiums[23]—ensure that on average farmers will receive considerably more money in indemnities than they pay in premiums. Nationwide, producers receive an average of $2.22 in claim payments for each dollar they pay in premiums, a figure that declines to $1.56 for each dollar paid for producers in the lowest-risk states.[24] As a comparison, auto and homeowners insurance policies pay about $.60 in claims for each dollar in premiums.[25] If, as these numbers suggest, crop insurance is a form of income support for agricultural producers who can

access it, the design of the current system raises serious questions of who benefits and who is left out.

The largest operations not only receive the vast majority of crop insurance subsidies, they benefit disproportionately on a per-acre basis.[26] In some instances, these subsidies result in windfalls, where a decline in yield can result in farmers receiving substantially more money than they could have expected from a "good" year.[27] Furthermore, the private companies that partner with the federal government to sell insurance contracts and verify claims receive up to $1.4 billion in administrative and operating (A&O) subsidies[28] despite also receiving a disproportionate share of any underwriting gains.[29] A recent report from the Government Accountability Office (GAO) found that crop insurance companies receive above-market returns on their federal crop insurance portfolios. Returns averaged 16 percent between 2009-2015 compared to an average "reasonable" rate, calculated by GAO based on market conditions, of 9.6 percent.[30]

Proponents justify federal crop insurance subsidies and the public-private partnership on the basis of private market failure.[31] Acting on its own, it is argued, the private market would fail to provide risk coverage at sufficiently affordable rates to induce widespread coverage.[32] Without widespread coverage, Congress faces more pressure to step in and provide ad hoc disaster aid when uninsured producers experience losses. Agriculture more closely resembles the risks of flooding in coastal communities than the risk individuals face with respect to their health or their cars. Weather-related disasters affecting agriculture, like hurricanes flooding entire communities, can be both catastrophic and widespread. Farm revenues fall when some combination of yields and prices fall. Yield risk does have an idiosyncratic component reflecting inter-farm variability in production methods or land attributes, but also a systemic component primarily driven by weather:[33] droughts, hail, and floods occur at county, if not regional, scales. Price risk, on the other hand, is almost entirely systemic.[34] Individual producers are at the mercy of the market, and price swings affect every producer of a given commodity.[35]

The possibility that many farms will simultaneously experience large losses—either through a weather-related yield loss or through a drop in prices—makes insurance premiums more expensive than what many farmers are willing to pay in the absence of subsidies.[36] When too few producers buy policies it undermines the insurance market through adverse selection, where only the riskiest producers participate.[37] Further reducing the incentive to buy insurance, many agricultural producers have a breadth of alternative risk management tools at their disposal. For example, instead of purchasing insurance, producers can shift to more resilient varieties, diversify their crop mix, reduce production on marginal land, or self-insure.[38]

For all these reasons, government intervention is probably necessary to maintain extraordinarily high coverage levels for the largest commodities. Federally subsidized crop insurance insured 87 percent of corn, 88 percent of soybeans, 96 percent of cotton, and 84 percent of wheat acres in 2014.[39] However, as greater subsidies drive risks toward the public sector, *moral hazard* leads producers to take riskier bets. While crop insurance could aid the federal government in its efforts to conserve natural resources,[40] the program seems to discourage the adoption of ecologically desirable practices.[41] The next farm bill offers an opportunity to address each of these concerns.

The RMA and FCIC set the insurance premium subsidy rates and develop the specific policies used by private insurers.[42] RMA assesses and approves new policies for sale to producers on a yearly basis; in 2015, it managed more than $102 billion in total crop insurance liability.[43] Policies are currently provided for over 250 million eligible acres and 130 different crops, which include fruits and vegetables ("specialty crops") and commodity crops, such as corn, soy, wheat and cotton.[44] Over 1.2 million individual federal policies—with some producers purchasing

multiple policies—were issued in 2014 alone.[45] In contrast to the Title I commodities programs, there are currently no income caps barring receipt of federal crop insurance subsidies.[46]

The 2014 Farm Bill made important changes to the farm safety net, including creating two additional insurance programs to bolster the farm safety net for commodities producers. They are 1) Stacked Income Protection (STAX) for upland cotton and 2) the Supplemental Coverage Option (SCO).[47] Both programs are intended to cover *shallow losses* not covered by a typical crop insurance policy.[48] CBO estimated that STAX and SCO would add $5 billion to the 10-year cost of crop insurance, although they have not been as costly as predicted.[49]

Federally subsidized crop insurance is ripe for reform that saves money and better aligns incentives with public values of resilience and fairness. The recommendations that follow address specific issues identified above, including perverse incentives that encourage risky production choices, an imbalance between public risk assumption and private gains, and the regressive use of public funds that does not cap or otherwise limit public transfers to the wealthiest operations.

RECOMMENDATION

Decouple crop insurance subsidies from premiums

For most crop insurance products, the government pays a set percentage of the premiums that farmers owe on their policies.[50] As a result, and all other things being equal, producers with higher premiums—intended to reflect higher risks of drought or other natural causes of crop loss—receive more total federal dollars than do producers with lower risks and thus lower premiums.[51] If the "riskiest" quintile of producers received gross premium subsidies comparable to those received by the other 80 percent, costs to the government would have been reduced by over $600 million in 2013 alone.[52] As Congress searches for savings within the federal crop insurance program, it should begin by scaling back subsidies that enable the riskiest behavior by producers.

LEGISLATIVE OPPORTUNITY

Limit crop insurance premium subsidies per acre

Congress should decouple subsidy amounts from crop insurance premiums by offering producers a fixed dollar amount per acre to spend on crop insurance. Such an approach would be less likely than the current premium subsidy to affect farmer production choices because it would reduce the incentive for producers to make riskier decisions, such as planting on marginal land or choosing more profitable but less resilient crops.[53] Furthermore, a less complex crop insurance program would significantly reduce administrative costs associated with government management of the program.[54] Congress should implement this change by adding a provision in the Crop Insurance Title limiting the total per-acre subsidy that a producer can receive.

RECOMMENDATION

Require fairness in the public-private partnership

The Federal Crop Insurance Act of 1980 created the public-private partnership that delivered crop insurance through approved insurance providers.[55] While the partnership has successfully led to the enrollment of the majority of United States crop acreage in federal crop insurance,[56] private insurance companies capture a third of federal crop insurance expenditures.[57] Details of the partnership between USDA and approved insurance providers are determined in the Standard Reinsurance Agreement (SRA). The SRA is a contract that is renegotiated between the Federal Crop Insurance Corporation and approved insurance providers approximately every five years.[58] The farm bill can play an active role in setting guidelines for the terms of the SRA, as Congress did in the most recent

farm bill. Specifically, the 2014 Farm Bill required that the next SRA be "budget neutral," effectively neutralizing cuts to private insurers' administrative and overhead payments or underwriting gains,[59] although some minor cuts were made through sequestration.[60]

LEGISLATIVE OPPORTUNITY

Lower cap on administrative and overhead expenses

Congress should reduce the amount FCIC can spend on administrative and overhead expenses. Private insurance companies do not compete on the price of their policies because RMA sets premium rates.[61] Instead, companies compete for the business books of independent agents, leading to inefficient outcomes including outsized agent compensation costs.[62] A cap on administrative and overhead (A&O) costs in the 2011 SRA has reduced these expenses somewhat.[63] Congress should lower the cap in the next farm bill by amending Section 508(k)(4) of the Federal Crop Insurance Act,[64] as proposed in bi-partisan legislation recently introduced by Congressmen Ron Kind (D-WI) and Jim Sensenbrenner (R-WI).[65]

LEGISLATIVE OPPORTUNITY

Reduce private profits to reasonable market rates

Congress should heed recent recommendations made by the Government Accountability Office to reduce the target rate of return.[66] The private companies that partner with USDA to deliver crop insurance receive a portion of premiums in return for absorbing some risk.[67] However, between 1998 and 2016, insurance companies had net underwriting gains in all but two years, while the FCIC reported net underwriting losses in ten years.[68] In 2015, for example, insurance companies retained approximately 78 percent of the premiums paid into the crop insurance programs, including both the proportion paid by farmers and the government subsidy, but paid only 66 percent of the indemnities.[69] Reducing the target rate of return from the current 14.5 percent to the "average reasonable rate" from 2009-2015 of 9.6 percent would have saved $364 million in 2015 alone.[70] Congress should amend Section 508(k)(3) of the Federal Crop Insurance Act[71] to limit the average rate of return to the average reasonable rate and reinvest the baseline savings in other priorities identified in this report.

RECOMMENDATION

Introduce means testing to subsidized crop insurance

If crop insurance is to perform like a true risk management tool, it should insulate farmers from catastrophe in bad years rather than subsidize risky behavior and further concentrate profits. However, the federal crop insurance program has no means test for premium subsidy eligibility.[72] Large operations receive the largest federal premium subsidies.[73] Researchers estimate that 10 percent of farm operations receive 68 percent of all insurance subsidies.[74] This concentration is not simply the result of larger operations insuring more production: acre by acre, operations in the top 2 percent of crop sales average $50 per acre in premium subsidies, 4 times the average per-acre premium subsidy across all operations.[75] This is expensive for the public and unfair to most producers, and Congress should reform the crop insurance program to focus on protecting the livelihoods of producers who need help.

One way to move toward a fairer crop insurance system is to begin means testing for crop insurance subsidies. In doing so, policymakers will have to contend with the tradeoff between keeping as many producers in the system as possible and spreading the subsidies across the producer pool in a more equitable manner. That challenge is largely technocratic, as more data is needed to set a subsidy reduction schedule based on income (see Administrative Opportunity, below) that meets both of these aims.

LEGISLATIVE OPPORTUNITY

Reduce premium subsidies for producers with high adjusted gross incomes

Congress should establish a tiered system that reduces premium subsidies according to adjusted gross income. A modest first step toward this goal was proposed during the last farm bill debate, and gained majority support in the Senate before ultimately failing in the House.[76] The Senate version would have reduced by 15 percentage points the crop insurance premium subsidy for producers with adjusted gross income over $750,000.[77] A more ambitious reform, proposed in an amendment to the House bill, would have ended premium subsidies to producers with adjusted gross incomes over $250,000 while setting a total crop insurance subsidy cap at $50,000.[78] These bills provide a good starting point as Congress considers means testing crop insurance, and Congress should include some version of means testing in the next farm bill.

ADMINISTRATIVE OPPORTUNITY

Conduct research needed to tailor premium subsidy means testing

Any recommendation for means testing in crop insurance must be accompanied by research to assess the impact on participation.[79] Means tests will lead some high-income producers to reduce their crop insurance coverage.[80] If only the riskiest producers remain in the program—a problem in insurance markets known as *adverse selection*—the program could become more expensive for those who remain. The crop insurance lobby points to this adverse selection problem as a reason to avoid implementing means tests or income caps,[81] but researchers do not have the data to compare loss ratios and thus to estimate the extent to which the program is reliant on the participation of the wealthiest farms. USDA should make granular data on premiums, indemnities and farm income available to researchers, because stronger evidence on the effects of program changes on the viability of the crop insurance program is critical to mitigate the likelihood that income caps could have negative unintended consequences.

RECOMMENDATION

Reform the Harvest Price Option to reduce overexposure and windfalls

The Harvest Price Option (HPO) has proven unjustifiably expensive for taxpayers. In simple terms, the HPO is an option that agricultural producers can purchase on top of their revenue protection policies.[82] It is a very popular option, with 87-92 percent of wheat, soy and corn policies carrying the HPO.[83] For these producers, HPO gives them the option to choose between two crop prices for the purpose of calculating their losses: the expected market price of their crop at planting time and the actual market price at harvest time.[84] This choice can greatly affect the indemnity payment that the producer receives, especially when the market price rises substantially between planting and harvest. As part of a sound risk management strategy, the HPO insulates producers who forward contract some of their expected harvest from the risk of having to make up yield shortfalls at high prices.[85]

However, HPO subsidization can also enable producers to take on too much risk through forward contracting. In the worst cases this risky behavior produces indemnity payments beyond those that could have been expected under normal market conditions with typical crop yields.[86] The 2012 drought provides one example, when a 24 percent drop in corn yield led to a 40 percent increase in harvest price.[87] The 2012 drought was not unique: on average, in the five years of largest percentage yield decline for corn and soybeans since 1974, revenue per planted acre at harvest was, respectively, equal to and greater than expected revenue at planting time.[88]

Government-subsidized HPO artificially decreases the risk associated with forward contracting by allowing farmers to receive

indemnity payments even if prices rise more than enough to compensate for yield losses.[89] This decreased risk incentivizes farmers to forward contract more than they would otherwise and more than would be financially prudent absent HPO subsidies.[90] Generally, experts believe that forward contracting more than a third of expected production is imprudent.[91] Thus existing HPO subsidies encourage overexposure to the futures market.

LEGISLATIVE OPPORTUNITY

End Harvest Price Option premium subsidies

Congress should eliminate direct subsidization of HPO premiums. By continuing to offer HPO through the federal crop insurance program, HPO would still be available below market prices as a result of A&O subsidies and reinsurance provisions. Bipartisan legislation introduced in both the House and Senate in 2015 would have eliminated the subsidy while still allowing producers to add HPO coverage to underlying subsidized policies.[92] Senators Jeff Flake (R-AZ) and Jeanne Shaheen (D-NH) introduced the Harvest Price Subsidy Prohibition Act in late 2017.[93] Congress should include this proposal, which amends section 508(e) of the Federal Crop Insurance Act,[94] in the Crop Insurance Title of the next farm bill. This change would open $13-15 billion in budget authority over ten years,[95] savings that could be reinvested in more pressing priorities.

RECOMMENDATION

Reform the Supplemental Coverage Option to eliminate windfall payments

In its current form, the Supplemental Coverage Option (SCO) generously subsidizes buy-up coverage that producers can stack on top of their more traditional crop insurance policies.[96] Because SCO policies trigger indemnity payments well before more traditional crop insurance, SCO is often referred to as a *shallow loss* program. Similar to HPO, SCO creates a considerable risk of windfalls. SCO was established in the 2014 Farm Bill, but had it been available in 2012 it would have paid out over $6.5 billion to corn and soybean farmers.[97] Critically, those payments would have been in addition to the $7.8 billion provided by other revenue protection policies.[98] Had SCO been in place, some farmers in areas suffering significantly from drought would have seen 15 to 30 percent more revenue than they would have anticipated from a normal growing season.[99]

LEGISLATIVE OPPORTUNITY

Limit Supplemental Coverage Option premium subsidies based on income, and do so more aggressively compared with other crop insurance subsidies.

While shallow loss programs like SCO may be appropriate for farms that do not have the resources to survive revenue volatility, larger well-capitalized farm businesses can rely on other tools, including savings, off-farm investment, leveraging land assets, and private crop insurance to survive the relatively minor revenue swings implicated in SCO.[100] Though a significant subsidy cut could reduce enrollment by low-risk farms, in turn increasing premiums across the board,[101] research indicates that reasonable subsidy cuts would be unlikely to impact enrollment.[102] This report identifies many programs and investments that are more worthy of support than SCO, and Congress should cut or eliminate SCO subsidies through amendments to the SCO section in the 2014 Farm Bill and through Section 508(c) of the Federal Crop Insurance Act.[103]

Cotton Policy

The cotton-specific STAX program has been much less popular than expected. One result is that many farmers have taken advantage of very high Price Loss Coverage (see below) reference prices and separate Title I payment limitations

for peanuts and planted their "generic" (formerly cotton) base acres to peanuts.[104] Cotton is treated uniquely because of its role in a WTO dispute over international market distortion caused by a previous farm bill's subsidy mechanism.[105] However, issues at the center of the cotton case are not unique to cotton and many of the programs in the current farm bill raise similar WTO compliance issues.[106] Thus, the next farm bill should not try to re-formulate a special program for cotton—which, as a sector, has been enjoying high prices and strong demand—but should instead work to address the broader concerns with commodity supports that led to the creation of STAX in the first place.

2. Title I: Commodities Program Reform

In contrast to the federal crop insurance program, the largest commodities programs generally do not require cost share by producers. Instead, program eligibility is based on producer characteristics like ownership of land with a history of commodity crop production.[107] In the 2014 Farm Bill, Congress eliminated direct payments, which wrote annual checks to certain producers based on their historical production.[108] In their place, the 2014 Farm Bill offered commodity producers a choice between two new programs: Price Loss Coverage (PLC) and Agriculture Risk Coverage (ARC).[109] These Subtitle A programs support producers with land historically planted to named commodity crops, specifically wheat, corn, grain sorghum, barley, oats, long grain rice, medium grain rice, soybeans, other oilseeds, peanuts, dry peas, lentils, small chickpeas, and large chickpeas.[110] During the 2015 crop year, 1.7 million farms that enrolled in Subtitle A programs received payments.[111]

PLC makes payments to eligible producers when the market price for a commodity falls below a statutory "reference price."[112] The payment amount is the payment rate *multiplied by* 85 percent of the producer's base acres in the commodity *multiplied by* the payment yield, which is calculated as 90 percent of the producer's own yield on acres planted with the commodity between 2008 and 2012.[113] Since "reference prices" act as the "triggering" prices for PLC payments, their statutory levels determine how often and how generously producers will receive payments under a PLC election. In the 2014 Farm Bill, commodity groups successfully lobbied for across-the-board increases in reference prices relative to analogous 2008 Farm Bill payment trigger levels (PLC did not exist in 2008, but a similar target price program did).[114] For example, payment trigger levels rose 51 percent for wheat, meaning that producers in the PLC program receive payments when prices fall below $5.50 per bushel compared with a trigger level of $3.65 per bushel under the 2008 Farm Bill.[115] Trigger prices rose 57 percent for corn, 51 percent for soybeans, 73 percent for sorghum and 107 percent for barley.[116]

ARC makes payments when producer revenue (price *multiplied by* yield) falls below 86 percent of historical levels.[117] ARC thus provides "shallow loss" protection for losses not otherwise covered under a producer's crop insurance policies. If a producer experiences a 20 percent revenue loss relative to historical benchmarks, and his or her crop insurance carries a 25 percent deductible, her crop insurance policy would pay nothing, but ARC would make a payment. ARC payments are capped at 10 percent of the benchmark revenue;[118] the overall effect is that producers bear the first 14 percent of revenue losses relative to the benchmark, ARC covers losses from 15-25 percent, and crop insurance (assuming producers buy sufficient coverage) and marketing assistance loans cover deeper losses.[119]

Together, PLC and ARC are expensive programs that favor large producers, exacerbate overproduction, and increase land prices to the disadvantage of smaller and beginning producers, leaving Congress many opportunities to improve commodities policy in the next farm bill.

RECOMMENDATION

Free up budget baseline through commonsense reforms to Title I Programs

Unlike the crop insurance program, the two largest Commodities Title programs do not require farmers to pay part of the cost. Since these programs rely exclusively on taxpayer dollars, there is the strongest possible policy rationale to ensure that these programs align with broader public policy goals.[120] Generally, there are two fundamental issues with ARC and PLC. First, they are far more expensive than expected when they were enacted in 2014.[121] Applying their baseline back into ARC and PLC would divert funds from other programs that would likely better contribute to a productive and sustainable agricultural sector. Second, ARC and PLC favor large, established producers over small and medium, diversified, and beginning farmers,[122] contributing to industry consolidation and concentration rather than supporting livelihoods across the farm sector. In the next farm bill, it may be difficult to achieve another broad reform of commodities programs in light of falling commodities prices.[123] Nonetheless, given the tight budget climate, Congress can better target Title I program payments to those producers who need them while investing savings elsewhere in the farm bill.

LEGISLATIVE OPPORTUNITY

Lower adjusted gross income cap for receipt of Title I subsidies

Producers with high incomes should not be subsidized through Title I because they face less financial stress,[124] are able to make more intensive use of their labor and capital resources,[125] and are generally more capable of managing risk independently.[126] In the last farm bill cycle, the Senate adopted a cap on receipt of Title I subsidies for farmers with average adjusted gross incomes (AGI) over $750,000 per year.[127] This limitation almost made it into the final bill, but was raised to $900,000 in conference committee.[128] Data from 2013—a year of very high farm income and the most recent year for which data is available—indicate that only about 0.7 percent of sole proprietors and share-rent landlords have more than $1 million in AGI, and only 2.2 percent have more than $500,000 in AGI.[129] For this reason, even a relatively low AGI cap is unlikely to impact all but the wealthiest operations. Congress should lower the AGI cap from $900,000 to $500,000 by amending Section 1001D(b) of the Food Security Act of 1985.[130]

RECOMMENDATION

Place enforceable limits on who can collect commodities payments

The "active personal management" standard, which is supposed to limit the persons who qualify for Title I subsidies, contains problematic loopholes.[131] Contrary to its aims, the standard allows individuals who are not closely involved in farm activities to receive subsidy payments, and thus incentivizes farms to structure their operations for the purpose of maximizing subsidies.[132] The Government Accountability Office has criticized the standard as overly broad, subjective, and difficult to enforce.[133] A 2015 USDA rule partly closed the loophole for non-family farms by limiting the number of eligible farm managers to three; farms must demonstrate that they are "large" to qualify for a second farm manager, and show that they are "complex" in order to qualify for a third.[134] Yet, these requirements likely mean that additional subsidies will flow only to the largest and most sophisticated operations. The USDA rule also exempted family farms from the limit on eligible farm managers, even though family farms make up approximately 97 percent of farms[135] and can be just as profitable as corporate farms.[136] While Title I payments could undoubtedly help small and medium sized farms survive, the current structure provides inconsistent and often-incoherent incentives that reward institutional complexity and unduly favor large farms.

LEGISLATIVE OPPORTUNITY

Close the "active personal management" loopholes that currently permit nearly unlimited Title I payments

Congress should, at a minimum, adopt the bipartisan provisions of the Farm Program Integrity Act, which would limit farm program payments to individuals who are indeed actively engaged in farming activities.[137] Introduced by Senator Chuck Grassley (R-IA) with multiple democratic cosponsors, the proposal was adopted by both the House and Senate in the last farm bill process, but was dropped in the conference process that produced the 2014 Farm Bill. For the provision to succeed, it should strictly define the activities that qualify as "active management," as well as those activities that do not. At the same time, it should impose recordkeeping requirements that will allow for meaningful auditing of payment recipients. It is critical that any limitations apply to family farms as well as non-family farms, given the number of family farms and the ease of structuring a farm as a family operation in order to avoid application of the new rules.[138]

Looking Ahead: Resilience eligibility for commodity programs

Unlike credit secured through FSA, loss protection purchased through federally subsidized crop insurance, or participation in voluntary conservation programs, ARC and PLC are pure entitlement programs. These commodity program payments are made based on ownership of land that qualifies as base acreage, and payments are conditioned only on observance of conservation compliance requirements that are insufficiently specified, narrowly applied, and poorly enforced (see next section).[139] Crop insurance has replaced commodity program payments as the primary source of federal income support.[140] One result is that maintaining eligibility for insurance premium subsidies now accounts for a significant share of the incentive to meet compliance requirements.[141]

As this share grows, the link between commodity program payments and conservation compliance weakens to the point where taxpayers might justifiably wonder what they are getting in return for their investment in ARC and PLC. Taxpayers should expect more from producers in exchange for commodity program payments, especially as these payments increasingly flow to farm operations with the highest household incomes.[142] As a first step in re-linking Title I to conservation outcomes, Congress could create a new set of *environmental eligibility* requirements specific to eligibility for commodity program support. For example, Congress could require that producers must follow an NRCS-approved nutrient management plan on the acres that qualify for Title I support.

RECOMMENDATION

Free budget baseline by making ARC and PLC less regressive

ARC and PLC have proven remarkably expensive. Though they were expected to produce significant savings in comparison to the programs they replaced, these savings have not materialized. As of March 2016, total projected cost estimates for ARC and PLC for 2014–2023 had increased above initial projections by 57 percent to $42.6 billion, and projected costs for the first five years of the program had increased by 71 percent to $30.6 billion.[143] The latter is $3.7 billion more than direct payments, ACRE, and CCP (the Title I programs that ARC and PLC replaced) were expected to cost combined.[144] While ARC and PLC do provide benefits to small farmers, 80 percent of their total subsidies are expected to go to farms in the top 15 percent in terms of farm size.[145] And in addition to disproportionately helping large farms and high-

income producers,[146] the subsidy actually harms small and beginning farms by increasing land values, thus raising barriers to entry and making competition more difficult.[147] This dynamic likely accelerates farm consolidation.[148] Congress should address inequalities in farm program payments while simultaneously creating budget savings that can be applied to other farm bill programs and initiatives.

LEGISLATIVE OPPORTUNITY

Reorient Agriculture Risk Coverage & Price Loss Coverage expenditures

Congress has many options if it is willing to reorient ARC and PLC to mitigate their regressive distribution of payments.[149] The most direct way for Congress to lower program costs and reverse benefit concentration would involve capping the number of base acres that producers could enroll in ARC and PLC.[150] Any effort to cap base acres must also include reforms to the *actively engaged* standard (discussed above) to avoid efforts to game the new limits by nominally splitting up farms and dividing acreage. If Congress does not adopt an acre limit, it should at least prevent double payments by offsetting crop insurance indemnities with reductions in commodity program payments so that producers are not paid twice for the same losses.[151]

GOAL II

Advance conservation compliance and enforcement

In the 1985 Farm Bill, Congress addressed natural resources in a new way by requiring farmers to comply with basic conservation measures in order to maintain eligibility for certain farm program payments, subsidies and loans.[152] Known as "conservation compliance," these federal requirements leverage the threat of losing benefits to ensure a basic level of environmental stewardship by farmers.

"Sodbuster" and Highly Erodible Land (HEL)[153] compliance apply to land designated by the Natural Resources Conservation Service (NRCS) as highly erodible, and require producers to follow an approved NRCS conservation plan or system designed to limit soil erosion when producing an agricultural commodity.[154] HEL compliance recognizes the continued problem of soil erosion on American farmland, and the need for conservation planning and related implementation of conservation practices to reduce erosion. "Swampbuster" or Wetland Conservation (WC) compliance prohibits producers from producing an agricultural commodity on a wetland converted after December 23, 1985, or converting a wetland after November 28, 1990 to make production of an agricultural commodity possible.[155] NRCS, in cooperation with the Farm Service Agency (FSA), implements the conservation compliance provisions.

Because federal environmental laws like the Clean Air Act and Clean Water Act largely exempt agricultural activities,[156] the conservation compliance provisions are critically important

in addressing environmental harms resulting from agricultural production. However, multiple factors undermine the efficacy of conservation compliance, including a lack of transparency, weak conservation standards, and a lack of enforcement resources. For example, NRCS does not report conservation compliance data, making it difficult to assess the robustness of implementation.[157] Further, even when farmers and ranchers are in compliance, the NRCS soil erosion tolerance rates are set so high that there is still a net loss of soils.[158] Moreover, millions of erodible cropland acres are not classified by NRCS as highly erodible, and, therefore, are not subject to conservation compliance requirements.[159]

The recommendations that follow are designed to better mitigate soil loss by strengthening conservation compliance. The public deserves a better conservation return on their significant investment in the farm safety net, farm credit, and conservation programs. In particular, Congress and USDA have an opportunity to reform the existing conservation compliance regime to address the challenges posed by inadequate transparency, standards and enforcement.

RECOMMENDATION

Bring transparency to conservation compliance

A prerequisite to effective enforcement of the conservation compliance requirements is the gathering and reporting of data on compliance, enforcement and program efficacy. There is currently no legal mandate that the USDA report this information to Congress or otherwise make it publicly available. Instead, the current farm bill requires the Secretary to annually submit a report to the House Committee on Agriculture and the Senate Committee on Agriculture, Nutrition, and Forestry[160] that reports the number of wetland and highly erodible determination requests received and completed by NRCS, and whether the requests are "addressed in a timely manner."[161] These determinations inform producers whether they have wetlands or highly erodible lands that are subject to compliance measures. However, Congress does not require the Secretary to include data regarding conservation compliance enforcement.[162]

In addition, existing law requires that the Secretary submit to Congress an annual report on conservation program enrollment, but not on conservation practice efficacy.[163] Understanding the relationship between voluntary conservation programs and conservation compliance is necessary to determine whether these programs are achieving their purpose and how they can be improved, in terms of environmental outcomes and cost-effectiveness.

LEGISLATIVE OPPORTUNITY

Require conservation compliance data reporting

Congress should require that compliance and enforcement data are available to the public and reported in a timely manner to Congress, with a granularity comparable to the Agricultural Census. The database with the relevant records on compliance and enforcement is maintained by FSA, but there are inadequate mechanisms requiring disclosure to Congress and the public. FSA oversees the database that records which land tracts receive farm bill benefits and are, therefore, subject to conservation compliance. The USDA Office of the Inspector General (OIG) has found that procedures for transferring this data to NRCS are inadequate.[164] This fragmented data tracking system hinders NRCS's ability to enforce compliance.[165] Thus, a legal requirement to make compliance and enforcement data available to the public and to report such data to Congress would create an incentive for NRCS and FSA to finally develop tracking and reporting procedures necessary to carry out conservation compliance. Reporting this data could also improve conservation compliance enforcement by the USDA. The next farm bill should therefore include mandatory disclosure of the relevant data to NRCS, to Congress and to the public.

This legislative amendment could be added in Title XII, Miscellaneous provisions or offered as an amendment to the reporting requirement for program payment reporting in Subtitle G of Title II.

RECOMMENDATION

Update conservation compliance standards to conserve more soil

The United States would still face a serious soil erosion problem even if conservation compliance requirements were followed to the letter by every producer. The HEL standards do not apply to all erosion-prone cropland and, where they do apply, often allow for unsustainable erosion rates. In particular, the standard that NRCS applies to measure a substantial reduction in soil erosion on HEL in general is 2T. The 2T standard essentially allows producers who farm on land that was cropped before 1985 to meet HEL compliance standards while depleting soil at twice the rate it is replenished.[166] NRCS formulated the "T" standard decades ago based on its statutory duty to take into consideration the economic burden of compliance on farmers and ranchers, cost-effectiveness, and available technology.[167]

Moreover, NRCS's data on soil erosion rates misrepresent the actual, national erosion rates for several reasons. First, NRCS data are related to HEL designated land,[168] not on all farmland that is actually eroding. HEL accounts for only 97 million of the 357 million acres of crop land in the United States.[169] Second, significant soil erosion occurs during heavy rain events through losses caused by the creation of ephemeral gullies, which NRCS traditional erosion models have failed to capture.[170] It is time for Congress and NRCS to recalibrate the standards, and their scope, to the magnitude of soil loss happening across United States cropland.

LEGISLATIVE OPPORTUNITY

Expand the reach of conservation compliance to protect more soils

Congress should require conservation compliance for soils on more cropland—not just land currently designated as HEL.[171] Extending even basic compliance requirements to more—and eventually all—acreage receiving farm program benefits would represent a significant shift in conservation policy. While expanding compliance coverage will likely prove too controversial for inclusion in the next farm bill, Congress should at least consider taking an initial step toward broader compliance. As a first step, Congress should issue a broader definition of HEL that more faithfully captures sensitive lands most in need of protection.

ADMINISTRATIVE OPPORTUNITY

Revise the 2T Standard Erosion Rate

NRCS already has authority to revise the allowable tolerance ("T") rates to achieve a zero-net loss of soils.[172] Much has changed since NRCS set the "tolerable" erosion level at twice the rate of replenishment, particularly technological advancements that include the development of precision agriculture and the analytical power of big data. In the absence of Congressional action, NRCS could do much administratively to implement a true healthy soils policy. For example, NRCS should update its erosion calculation methodologies to more accurately reflect real erosion rates and adjust its soil tolerance levels in order accelerate soil erosion reduction.

RECOMMENDATION

Fund robust enforcement and technical assistance of compliance standards

Even if conservation compliance standards were robust, enforcement has proven inadequate. Various federal audits as well as USDA data show a chronic lack of conservation compliance enforcement by NRCS.[173] For example, a 2003 General Accounting Office (now the Government Accountability Office) report found that nearly

half of NRCS field offices failed to implement required conservation compliance provisions due to a lack of staff, inadequate managerial emphasis on conservation compliance, or because NRCS agents were uncomfortable acting in the role of enforcer.[174] The same report also found that NRCS personnel did not consistently monitor for wetlands violations.[175]

In addition to the lack of reporting, statutory exemptions and flexible compliance mechanisms undermine conservation compliance effectiveness. For example, the law provides farmers with an abundance of flexible timelines and alternate methods for compliance based on their particular needs.[176] Moreover, USDA relies on self-certification[177] and producer good-faith. Guidance published by NRCS in conjunction with the FSA and Risk Management Agency states that "to comply with the HEL Conservation and Wetland Conservation provisions, producers and affiliated persons must fill-out and sign form AD-1026 certifying they will not" violate the compliance requirements.[178] While signing the form "gives representatives of USDA authorization to enter upon and inspect" the farm for HEL Conservation and Wetland Conservation compliance,[179] in reality, inspections to verify compliance are rare.

Further, when standards are enforced, it is often unclear what those standards are. A 2016 Office of Inspector General report found that NRCS state offices issue different guidance on interpreting compliance requirements.[180] A violation in one state may not count as noncompliance in a neighboring state, because "NRCS State offices have developed inadequate guidance for consistently applying standards for conducting compliance…reviews" which "resulted in inconsistent noncompliance determinations."[181] A few states with some of the highest erosion rates have failed to issue any guidance at all on ephemeral gully erosion identification or control, even though gully erosion is the leading cause of soil erosion.[182] Any initiative by NRCS to increase enforcement of compliance standards demands similar commitment to issuing guidance and providing technical assistance. Otherwise, even well-intentioned producers will persist in bad practices, without a clear understanding of what rules apply or how to comply with them.

The current enforcement regime of self-certification, minimal and inconsistent verification, and the USDA's reluctance and lack of resources to follow through with removal of benefits results in ineffectual environmental protection and a poor value for the taxpayer. Congress should require and fund effective conservation compliance implementation in order to achieve a decent return on the public investment and provide a down payment on a food-secure future.

LEGISLATIVE OPPORTUNITY

Fund USDA enforcement of conservation compliance standards

NRCS does not receive adequate funding to staff or conduct enforcement activities.[183] A 2012 Office of Inspector General report found that "NRCS must…design adequate compliance activities to ensure that program benefits are reaching those who are truly eligible and serving their intended purposes."[184] Even with haphazard enforcement, NRCS has documented conservation compliance violations over the past decade denying nearly $124 million in farm bill program payments.[185] However, the majority of benefits—$109 million—were ultimately reinstated for reasons that remain unclear given the lack of reporting requirements.[186] Congress should provide specific funding for conservation compliance enforcement in conjunction with the previously recommended reporting requirements as fundamental steps toward a legitimate national policy of soil and wetlands conservation.

LEGISLATIVE OPPORTUNITY

Rebuild a robust NRCS technical assistance capacity

Congress should enable NRCS to recommit to its mission as technical assistance provider in service to improving natural resource outcomes

on working lands. Even when producers are eager to comply with HELC and WC compliance standards, they are often left without guidance on how to do so.[187] This is only one consequence of a larger deficit within NRCS, which must be given the financial resources to rebuild its technical assistance capacity.[188] NRCS's ability to provide producers with the necessary technical assistance capacity has seriously eroded as the number of financial assistance programs it administers has ballooned and resources have shifted to meet program administration needs.[189] In FY2016 alone, NRCS administered over 36,000 Environmental Quality Incentive Program (EQIP) contracts[190] and over 12,000 active Conservation Stewardship Program (CSP) contracts,[191] discussed below. As administrative duties have risen, the government has not made a concurrent investment in NRCS technical staff, such as scientists, engineers, and planners. Congress should fund a rejuvenated technical assistance capacity within NRCS so that the agency is capable of providing the technical support required for universal compliance with conservation standards.

LEGISLATIVE OPPORTUNITY

Study third-party NRCS technical assistance

Until NRCS has restored adequate internal technical assistance staffing, Congress should ensure that contractors who perform NRCS technical assistance duties meet the same standards as in-house providers. As the administrative duties of NRCS have grown, significant technical assistance dollars have been outsourced to third party "technical service providers"—a legislative creation meant to address the shortfall of in-house technical assistance providers.[192] However, little is known about the efficacy or cost effectiveness of these third-party providers. Consequently, Congress should mandate independent review by a panel of experts of the provision of farm bill technical assistance, which should include recommendations to improve technical assistance capacity and efficacy in order to guide future policy and funding of technical assistance.

GOAL III

Modernize conservation funding priorities, eligibility, and payment rates

Farmers and ranchers must balance two important, and often countervailing, aims: to supply food, feed and fiber to the nation, while stewarding their land and the nation's natural resources. Because many environmental laws and regulations exempt or otherwise differentiate agricultural activities from rules that apply to other industries,[193] farm bill policy is critical in helping farmers manage and prioritize these two goals. In this vein, the Conservation Title serves as the first line of environmental protection in the United States agriculture sector.[194] The farm bill conservation programs help promote soil health, protect community health, manage extreme weather risks, and ensure long-term agricultural productivity for generations to come. The Conservation Title also boosts rural development, providing an additional source of income for producers and creating natural amenities that can support rural economic growth.[195]

Generally, farm bill conservation programs are popular with producers and efficient for taxpayers,[196] yet Congress can and should build upon these successes to help producers continue to be leaders on soil and community health. Through program reforms and increased funding, conservation programs could reach further and do more to encourage innovative conservation practices for the future, such as mitigating livestock methane emissions, protecting drinking water quality, and conserving and enhancing soil health.

In addition to the conservation compliance provisions discussed above, the farm bill's Conservation Title authorizes a suite of voluntary conservation programs.[197] Conservation easements, made through the Agricultural Conservation Easement Program (ACEP), are agreements between landowners and the government to permanently and voluntarily restrict land use practices to keep the land in agricultural use or to protect and enhance agricultural lands.[198] Land retirement programs, including the Conservation Reserve Program (CRP) and its suite of continuous-enrollment offshoots,[199] offer financial incentives to take land out of production for periods of 10-15 years while restoring environmentally sensitive land.[200]

General CRP signup takes place through an annual competitive process, while continuous enrollment can occur at any time so long as the producer meets threshold requirements for the specific sub-program.[201]

Working lands programs, in contrast, keep land in production and pay producers to adopt resource-conserving practices.[202] The two most significant working lands programs are the Conservation Stewardship Program (CSP)[203] and the Environmental Quality Incentives Program (EQIP).[204] Both CSP and EQIP provide financial and technical assistance in exchange for the implementation of a variety of conservation practices.[205] CSP focuses on the improvement of existing conservation activities and systems across the operation, with payments conditioned on performance throughout a five-year contract term.[206] EQIP incentivizes the

adoption of conservation practices and capital investments, carried out in accordance with a farmer-developed EQIP plan, through cost-share payments.[207]

CSP, CRP, and EQIP remain the cornerstone farm bill conservation programs, despite cuts in these programs in the 2014 Farm Bill relative to the 2008 Farm Bill. For example, the 2014 Farm Bill reduced the number of acres NRCS could annually enroll in CSP from 12.8 million to 10 million.[208] NRCS had to turn away approximately 73 percent of program applicants that met program eligibility criteria in 2015.[209] CRP received even larger cuts, with enrollment lowered to 24 million acres from 32 million between 2014 and 2018.[210] The reductions in program caps make little fiscal sense, hurt producers' bottom lines, and threaten established conservation gains.

Overall, the 2014 Farm Bill reduced projected Conservation Title spending by $3.97 billion relative to the 2008 Farm Bill.[211] However, as noted above, when the effects of sequestration are considered, projected conservation funding actually fell by an estimated $6.1 billion, or 9.8 percent relative to pre-2014 levels.[212]

Congress should restore its prior funding of conservation programs, and previous sections of this report have identified reforms to commodities and crop insurance programs that would free up funding to make that possible. However, simply ending sequestration and restoring conservation spending levels does not go far enough in improving conservation *outcomes*. Savings from other titles should be reinvested in aligning commodity, conservation and crop insurance policy toward better protecting and promoting the soil and water health that are the foundation of productivity and risk management. Realizing this vision requires that Congress target conservation dollars toward innovative programs that protect water quality and build soil health, while ending the use of conservation payments that enable the harmful practices to continue.

Each of the conservation programs discussed here serves a different, important role in agricultural conservation and should be preserved and, in some cases, expanded. But a recurring theme through each iteration of the farm bill is that programs are often added, modified, or split from existing programs haphazardly. Although there was some effort in the 2014 Farm Bill to rationalize conservation programs, there remains undesirable confusion, overlapping, as well as systemic underfunding as programs compete with one another for funds. The existing system has proven workable, as evidenced by ever-increasing industry participation across Title II programs, but continued rationalization must remain the long-term goal.

RECOMMENDATION

Invest in long-term soil and water quality

This report discusses the persistent and continuing crisis of soil loss in the previous section. It argues protecting soils requires more transparency, enforcement and technical assistance in administering the Title II conservation compliance requirements. While reforms to conservation compliance are necessary and important, they are not sufficient. Congress must enable proactive actions that reach beyond the status quo. Changes to Title II's voluntary programs provide the best opportunity to not only conserve, but begin to enhance, critical natural resources for both producers and the public. These resources must include not only soil but also water.

Agricultural runoff is a leading cause of water quality impairment, causing both hypoxic "dead zones" and threatening drinking water quality.[213] Indeed, it has the potential to be "one of the costliest, most difficult environmental problems we face in the 21st century."[214] Agricultural runoff includes nutrients like nitrate and phosphorous, manure, and sediment.[215] Federal environmental laws, as applied, have failed to sufficiently regulate agricultural water pollution.

For example, although the Clean Water Act does contemplate non-point source pollution, it primarily regulates point sources, but generally exempts farms from that definition.[216] At the same time, the Safe Drinking Water Act, which sets municipal drinking water standards, is powerless to address the upstream sources of agricultural water pollution.[217] As Congress considers how to proactively enhance both soil and water quality, it should focus on providing robust support to proven programs that make payments in exchange for environmental services.

Working lands conservation programs such as CSP begin to fill the gap in federal environmental law. Working lands programs succeed because producers are paid for providing additional public benefits while building their own soil health and producing a marketable crop. CSP is used on over 70 million farmed acres to provide technical and financial assistance in order to maintain existing conservation practices and implement new conservation techniques.[218] Within CSP, the 2008 Farm Bill first authorized—and the 2014 Farm Bill extended—supplemental payment rates for producers who adopt resource-conserving crop rotations.[219] Congress should focus CSP's attention toward resource-conserving crop rotations that, by statute, must reduce erosion, improve soil fertility and tilth, and interrupt pest cycles.[220]

However, some land should not be planted at all, and the role of retirement programs like CRP is to enable producers to keep the most environmentally sensitive land out of production for a period of years. Unfortunately, when CRP contracts expire and land re-enters production, conservation benefits such as water quality and carbon sequestration are lost.[221] Between 2006 and 2014, fourteen million acres re-entered production after their CRP contracts ended.[222] This number will continue to rise as the 2014 Farm Bill's acreage limits take full effect.[223] CRP reform should prioritize enrollment of the most environmentally sensitive land while addressing how the benefits of CRP, especially on those acres most critical to soil and water conservation, can be preserved by transitioning some land into permanent easement once contracts expire.

The shift toward permanent easements is necessary because many of the benefits of land retirement are lost once the acres re-enter production. The shift toward easements is also timely. If commodity prices remain persistently low in the years to come, as forecasters predict, the cost of purchasing easements will also fall as producers face the prospect of successive seasons where prices hover or dip beneath the costs of production. In other words, the public investment in permanent easements will go further, covering more acres for the same amount of money. A similar dynamic is observed in CRP enrollment, where weak commodity markets spike producer applications and lower the per-acre cost of the program, which is tied to market rental rates.[224]

LEGISLATIVE OPPORTUNITY

Remove limits on supplemental payments for resource-conserving crop rotations

Congress should require NRCS to raise CSP's supplemental payments for resource-conserving crop rotations, and should provide the funding necessary to ensure that this change does not reduce total enrolled acres.[225] The value of resource-conserving crop rotations is difficult to overstate. Such rotations contribute to soil health, increase biomass in the soil, and reduce soil erosion.[226] Because they conserve resources and build soils, crop rotations also improve producers' long-term productivity and risk management outlook. Finally, as CRP contracts expire and marginal acres re-enter production,[227] resource-conserving crop rotations can provide a reliable source of income to producers in exchange for ensuring the conservation benefits of the CRP are not lost. However, NRCS has capped supplemental payments at $15 per acre.[228] This cap does not reflect the importance of resource-conserving crop rotations or the cost of implementing them on the farm. Congress should ensure that CSP pays a fair cost for implementing resource-conserving crop rotations by requiring minimum per-acre

payments by amending the 2014 Farm Bill's Subtitle B, Section 1238g of Title II.[229]

LEGISLATIVE OPPORTUNITY

Expand continuous enrollment of CRP acres

Congress should expand the number of acres entering CRP through continuous enrollment, which focuses on high-impact practices. Continuous CRP now accounts for approximately 25 percent of total CRP acres,[230] including through the Conservation Reserve Enhancement Program and the Farmable Wetlands Program, special initiatives within CRP.[231] In contrast to general CRP signup, continuous enrollees are not subject to a competitive process but instead must meet eligibility requirements tied to priority natural resource concerns and the sensitivity of the land.[232] Because participation is contingent on implementing practices chosen through an adaptive management approach, continuous enrollment programs can help maximize the impact of CRP spending.[233] Congress should reward the success of continuous enrollment options in employing a more targeted and less invasive approach to conserving both farm and wild lands by setting aside up to half of CRP acres for continuous enrollment.

LEGISLATIVE OPPORTUNITY

Transition the most marginal CRP acres to permanent easements

The next farm bill should reform CRP to encourage longer-term participation. Currently, most conservation benefits are lost at the end of the contract's 10-15 year duration because farmers are free to put their land back into production.[234] If crop prices rise, farmers have less economic incentive to re-enroll their land in the program at the expiration of their contract.[235] The next farm bill provides an opportunity to transition away from 10-15 year CRP contracts toward permanent conservation easements on the most environmentally sensitive and marginal acres. Congress could implement this recommendation by creating a separate acreage cap and providing mandatory funding, either within or separate from CRP. Instead of restoring CRP acreage caps to their pre-2014 levels, now is the time to invest in making the benefits of land retirement permanent.

LEGISLATIVE OPPORTUNITY

Prioritize drinking water quality within the Regional Conservation Partnership Program

In light of the paramount importance of safe drinking water, Congress should invest more in protecting drinking water quality by expanding targeted cost-share efforts through the Regional Conservation Partnership Program (RCPP).[236] Over its first three years RCPP invested $590 million in nearly 200 projects that leverage almost a billion dollars of in-kind assistance across 2,000 conservation partners.[237] Across the farm bill's conservation programs, RCPP is uniquely suited to address water quality concerns because it is designed to operate at a regional scale, bringing together nonprofit organizations, state and local governments, producers, water districts, and other entities. Congress should amend RCPP's statutory purpose to include drinking water source protection and provide separate mandatory funding for partnerships that address drinking water issues.[238]

LEGISLATIVE OPPORTUNITY

Fully fund the Agricultural Conservation Easement Program

Congress should restore full mandatory funding to ACEP to carry out its purpose. The ACEP is a consolidation of three older programs—the Wetlands Reserve Program, the Grassland Reserve Program, and the Farm and Ranch Land Protection Program.[239] In part as a result of this consolidation, the new ACEP was allotted fewer funds than all of its predecessor programs combined.[240] Since 2014, appropriations for this program has continued to decline. The program will only be allotted $250 million in 2018—down from $400 million in 2014.[241] ACEP funding helps to protect critical natural and agricultural

resources from conversion to other uses that impose greater environmental harms,[242] and plays an integral role in ensuring the nation's cultivatable land remains useful and available to agricultural operations. Congress should provide reliable funding at least matching pre-2014 levels by amending Section 2301 of the 2014 Farm Bill.[243]

RECOMMENDATION

Restore EQIP's focus on smaller operations performing voluntary conservation

The Environmental Quality Incentives Program (EQIP) originated in the 1996 Farm Bill to help producers implement conservation initiatives through technical and financial assistance.[244] EQIP provides cost-share funds through contracts with producers who "plan and install structural, vegetative, and land management practices… to alleviate natural resource problems."[245] EQIP contracts run as long as ten years[246] and, after changes in the 2014 Farm Bill, no longer have a minimum term.[247] Overall, EQIP remains among the largest farm bill conservation programs, with $1.75 billion in mandatory funding for fiscal year 2018.[248]

Although EQIP commands considerable funding, the program's target audience has shifted since its inception. When the program began, it limited total cost-share and incentive payments to $50,000 per operation and no more than $10,000 per year.[249] However, Congress increased that payment limit over the course of successive farm bills, and by the 2014 Farm Bill the contract limit had reached $450,000.[250] Since 1996, USDA also gained case-by-case authority to waive the adjusted gross income cap that applies to most conservation and commodities programs, including EQIP, and no limitations were set as to how often they could do so.[251] Allowing the highest-grossing operations to receive EQIP cost-share funding reduces available funding and undermines the ability of smaller producers with less capital to access the program. In FY 2016 only 27 percent of EQIP applications received funding.[252]

In another significant change, EQIP now subsidizes large concentrated animal feeding operations (CAFOs).[253] Congress sets aside 60 percent of EQIP funding for livestock operations.[254] However, large CAFOs were initially ineligible.[255] Beginning in 2002, CAFOs became eligible to receive EQIP funding to support construction of manure management facilities.[256] In 2016, 11 percent of EQIP funding funded CAFOs.[257] Waste management, including waste storage facilities, waste facility covers, animal mortality facilities, and manure transfer received the most funding, meaning that EQIP funding functions as a subsidy to help large polluting agribusiness meet existing regulatory requirements under the Clean Water Act.

Raising contract limits and making CAFOs eligible has created a pattern of concentrating resources toward the largest operations. The top 20 percent of EQIP funding recipients now account for 70 percent of its spending and the top one percent alone accounts for 15 percent of spending.[258] Prior to 2002, the value of EQIP contracts averaged about $7,800; since 2002, that average has reached over $16,000.[259] Even though swine CAFOs make up just 10.7 percent of hog farms in the United States, they obtain approximately 37 percent of EQIP contracts given to hog farms.[260] Industrial dairies comprise 3.9 percent of United States dairy farms, but they receive 54 percent of the dairy industry's EQIP contracts.[261] It is time for Congress to restore EQIP's integrity as a leading conservation program within the farm bill.

LEGISLATIVE OPPORTUNITY

Study EQIP practices to maximize environmental benefits

Congress should direct NRCS to conduct an environmental review of the 219 funded conservation practices and defund the practices that do not *further* environmental objectives. EQIP dollars are scarce—approximately 75 percent of eligible participants are turned away

from the program,[262] and there is evidence that the current allocation of funds fails to optimize environmental benefits.[263] For instance, EQIP cost-share payments contribute to the expansion of concentrated animal feeding operations by reducing the cost of certain infrastructure.[264] In 2016, EQIP allocated over $51 million to waste storage facilities, $33.5 million to waste facility covers, and over $8 million to animal mortality facilities.[265] These subsidies offset conservation gains and environmental benefits while diverting funds from smaller operations that seek to implement sustainable management practices.[266]

To maximize EQIP's environmental benefits, Congress should direct NRCS to conduct an in-depth environmental review of each of the 219 conservation practices and defund certain practices based on these findings. A comprehensive study will supply NRCS with the information necessary to restructure the program to maximize the public benefit by funding the most cost-efficient conservation practices. This would increase the impact of EQIP funds by limiting public subsidies to projects that do not further environmental objectives, improving additionality of the program overall.

LEGISLATIVE OPPORTUNITY

Lower the cap on individual EQIP contracts

Congress should lower the per-project funding cap back to its original level for most types of EQIP contracts. Adjusted for inflation, the cap would be set at $77,000.[267] Given that the average EQIP contract under the 2014 Farm Bill is roughly a quarter of the original $50,000 cap,[268] this is a reasonable limit that would help return EQIP's focus to smaller operations. It will also shift subsidies away from well-capitalized operations, restoring a more level playing field instead of sending public assistance to the largest operations to help meet their preexisting environmental obligations. For example, EQIP payments for irrigation expansion often go to projects that are more expensive and less effective than knowledge-based and vegetative practices, such as conservation tilling, filter strips, nutrient management, and cover cropping that are preferred by smaller producers.[269] A gradual implementation schedule would give time to plan for compliance and flexibility to prioritize voluntary over mandatory projects. Congress can implement this cap by amending the 2014 Farm Bill's § 2206.[270]

RECOMMENDATION

Prioritize innovation in conservation program spending

The Conservation Title supports research into, and implementation of, innovative conservation practices and technologies through the Conservation Innovation Grants (CIG) program, which is authorized and funded through the much larger EQIP.[271] CIG advances and leverages state-of-the-art conservation techniques by building partnerships across a variety of stakeholders. Importantly, CIG funds projects that both develop new approaches through on-farm pilots and work to transfer successful ideas to other producers through on-farm demonstrations. Development of cutting-edge conservation practices are integral to ensuring agriculture can continue to improve sustainability outcomes into the future. USDA provided $22.6 million in CIG funding to 33 projects in 2017,[272] a decrease of approximately $15 million from 2008 Farm Bill authorizations.[273] Additionally, it is apparent that further cuts have been made for FY 2018, after the NRCS announced in December of 2017 that up to $10 million would be available for the national component of the program.[274] Congress should recognize the potential of producer-driven conservation innovations by increasing expenditures on conservation programs that allow farmers to develop new conservation practices.

LEGISLATIVE OPPORTUNITY

Increase funding for Conservation Innovation Grants

Congress should authorize CIG funding at or above 2008 levels in order to spur new and effective conservation measures. This change requires amendment to Section 1240H of the Food Security Act of 1985,[275] as amended by the 2014 Farm Bill, to restore the authorized funding level from $25 million annually to $37.5 million. Additionally, Congress should consider de-tethering CIG from EQIP by creating a separate mandatory funding stream for CIG.

GOAL IV

Invest in research and pilot programs

Research and pilot initiatives are investments in the future, building the knowledge and experience that allows for innovative policy to scale and adapt across time and geographies. In particular, this section recommends how the farm bill can authorize research and pilot programs to improve long-term productivity and risk management within United States agriculture, with a focus on investments in soil health, resilient agronomic systems and natural resources conservation.

Research and pilot programs best address situations where there is evidence that certain farming practices further goals or lead to desired outcomes, but uncertainties remain about the nature or magnitude of these benefits. This section recommends research funding when a lack of data hampers efforts to adequately assess the costs and benefits of certain farming practices, or when there is insufficient understanding of interactions between incentives to develop policy that promotes good practices. On the other hand, the section recommends pilot projects when there is sufficient information to identify beneficial practices but barriers such as conflicting public or private incentives prevent farmers from achieving widespread adoption. Pilot programs are also called for when more work is required to identify the best policy mechanism to promote those practices.

RECOMMENDATION

Bolster links between insurance subsidies and soil health

A growing body of research suggests that many farming practices that are not in widespread use can significantly improve long-term productivity and conservation outcomes. These practices include no-tillage or conservation tillage, cover cropping, diversified crop rotations, the use of riparian buffers, and agroforestry (collectively "soil health-enhancing practices"). Research connects these practices to significant increases in soil health, reductions in erosion, retention

of soil moisture, better drought resistance, reductions in greenhouse gas emissions, and increased carbon sequestration.[276] Of particular significance to the federal crop insurance program, there is evidence that these practices can, at least in the long run, reduce the frequency and magnitude of indemnity payments to farmers.[277]

Uncertainties remain, however, about the magnitude of the impact of some of these practices; their transferability to different regions, soil types, and crops; and their effects when used in combination.[278] Furthermore, although many of these practices can improve the long-term productivity and drought-resistance of farms, barriers remain to incorporating these practices into the guarantee- and premium-setting processes. It is also possible that some practices, such as cover cropping, could make a crop riskier in the first year but less risky than conventional practices in the long run.[279] More data are needed—and more analysis is needed of information that has already been gathered—to develop actuarially sound methods for incentivizing these practices through the crop insurance program. The opportunities outlined below present necessary steps that Congress can take to fill the gaps in basic and applied research to better align productivity, risk management and conservation.

LEGISLATIVE OPPORTUNITY

Require RMA to pilot a program linking soil type data to crop insurance rates

Congress should require RMA to begin incorporating available information on variations in soil quality into premium rates. Recent research has demonstrated on a small scale that it is feasible to incorporate soil quality information into crop insurance premiums,[280] but the federal crop insurance program currently does not explicitly take into account soil health. Instead, rates are set at the county level and then subject to a minor adjustment based average historical yields, called the "Actual Production History" (APH).[281]

However, research demonstrates there is a strong relationship between yield risk and soil quality that is not captured in the Risk Management Agency's (RMA's) current methodology.[282] Such an uninformed method potentially results in an insurance pool concentrated with higher-risk producers and makes the program less attractive to lower-risk producers (who then require higher subsidies to participate).[283] This makes farms more risk-prone and the federal crop insurance program more expensive for taxpayers.[284] By contrast, incorporating soil quality data into rate calculations arguably represents a significant improvement over APH in meeting the RMA's duty to set actuarially sound rates.

While some soil quality data is publicly available,[285] incorporating it into crop insurance rates is a complicated task. For one thing, there are serious data processing requirements if the RMA is to do it on a nationwide scale. In addition, changes to crop insurance premiums must be considered in concert with other aspects of the crop insurance program, such as the level of premium subsidies provided to producers, as well as the other shallow loss provisions in the farm bill. A unilateral change in one program may not produce the desired effects if its interaction with other programs is not analyzed. Therefore, Congress should create a new pilot program within the Crop Insurance Title that requires RMA to integrate soil type data into crop insurance rates for one crop in one region. If successful, this program could then be scaled across other geographic regions and crops. It would also lay the groundwork for later incorporating soil health-enhancing practices into the federal crop insurance program.

LEGISLATIVE OPPORTUNITY

Implement a pilot program that adjusts insurance premiums to reflect a broader portfolio of risk management activities

The next farm bill should support conservation practices by tying insurance premiums to actual planting risk, based in part on farmer planting practices and soil conditions. Producers who

plant on the most fragile soils should pay the highest premiums. Adjustments in the premium would reward best management practices that increase soil resilience. Under this system, premiums would reflect the balance between actual risk and risk management strategies. A successful pilot program would create tiered payment rates that adjust premiums and provide a more equitable return on the public's investment.

The FCIC's complex administrative requirements and incentives can slow adoption of ecologically desirable practices.[286] Program changes that reward producers for developing and adopting innovative practices are critical to the long-term viability of both the food supply and the federal budget.[287] To this end, Congress should direct USDA to create a pilot program that links premiums to risk-mitigating practices. Such a system could be tested through section 1523(d) of the Federal Crop Insurance Act, which allows the FCIC to pilot premium rate reductions.[288] Existing data limitations have slowed the empirical identification of practices that reduce risk,[289] so USDA should partner with insurers and agricultural researchers to identify farming practices that protect against yield loss. The results could then be used to develop a pilot program that increases premium subsidies or discounts premiums for producers who implement evidence-based risk-reducing practices. Rewarding risk management practices with reduced premiums would pay for itself via fewer indemnity payouts, as farms are incentivized to become generally less risk-prone.[290]

LEGISLATIVE OPPORTUNITY

Create a centralized data warehouse for RMA's field-level yield data

Additional improvements in the crop insurance program can be achieved if USDA does more to share existing data sets with researchers. Data play a crucial role in achieving policy goals by improving accuracy, efficiency, and transparency. Furthermore, the gathering and disclosure of data regarding the relevant practices of individuals who receive taxpayer funding is especially important, as the government should ensure that its programs are properly utilized and taxpayers have a right to know their funds are not being wasted. However, there are a number of farm bill programs that fail to share the data that USDA collects with constituencies who can make productive use of them. For example, RMA has been collecting insurance policy records and field-specific crop yield data under the federal crop insurance program since 2009.[291] But despite the important role these data could play in tying soil health to crop yields at a field-specific level, RMA does not make them available to researchers or the public.[292]

The farm bill should fund the creation of a centralized data warehouse containing RMA's field-level yield data,[293] nationwide soil indexes, and other datasets relating to soil type which may be relevant,[294] and make it accessible to researchers and insurers[295] who can perform the data analytics necessary to improve the federal crop insurance program's pricing methods. The program would fund the research, design, and implementation of the facility, including whatever standardization of different datasets may be necessary. The design aspect should be undertaken in consultation with stakeholders, including scientists, and should include a consideration of the best ways to address privacy concerns through data anonymization measures *(e.g.* encryption, removing personally identifiable information) and restricting access to bona fide users (*e.g.* researchers, insurance company employees). The system could be hosted by a land grant university.

Insurance companies would then be able to propose pilot programs that consider soil data in setting premiums, and reduce rates below those set by the current RMA formula as permitted by the law governing the federal crop insurance program.[296] This would boost the federal crop insurance program's rating efficiency, resulting in taxpayer savings, fairer premiums for lower-risk farmers, and less risky underwriting exposure.[297]

LEGISLATIVE OPPORTUNITY

Create a National Soil Monitoring System and a Farming Practice Survey

Currently, the National Agricultural Statistics Service ("NASS") collects some data on planting decisions, yields and inventories. For example, the crop estimating program collects data "on farmers' planting intentions, estimates of acreage actually planted and expected to be harvested, and forecasts of yield and production during the growing season. After the crops have been harvested, estimates of harvested acreage, yield, and production are made."[298] However, there is no mechanism in place to monitor soil quality. Congress should direct USDA to create a national soil monitoring system, which would track a set of sites that will conduct periodic and holistic assessments of soil attributes and monitor changes over time.[299] This system can be incorporated into NRCS's existing National Resources Inventory, which has monitored land use and cropping system change since 1982.[300]

In combination with soil monitoring, an understanding of the impacts of different farming practices requires knowing which practices farmers are actually using. There are currently, or have been in the past, some efforts that track certain aspects of farming practice. For example, the Conservation Effects Assessment Project tracks the use and impacts of conservation practices.[301] The National Crop Residue Management Survey measured at the county level the type of tillage used by crop from 1989 to 2004, with limited data available through 2008.[302] Some other information is collected only at the regional or state level, such as surveys in the Chesapeake Bay Watershed, Des Moines River (Iowa) and Western Lake Erie Basins (2012), and California Bay-Delta Watershed Area (2013).[303]

None of these initiatives, however, provides a current and statistically representative sample of all farming practices. A national farming practices survey, when linked with a soil health survey, would provide the information needed to assess the effects of different farming practices on soil health as a precursor to modifying the crop insurance and commodities programs to create incentives for farmers to engage in practices that result in better long-term productivity and conservation outcomes.

RECOMMENDATION

Monitor and reduce harmful emissions

Nitrous oxide (N_2O) is a powerful greenhouse gas, with a global warming potential 300 times that of carbon dioxide (CO_2). The agriculture sector is the largest source of N_2O emissions in the United States and is responsible for about 80 percent of total United States N_2O emissions.[304] The primary agricultural sources of N_2O emissions are soil management—particularly the addition of nitrogen fertilizers (75 percent)—and manure management, which produces N_2O emissions occurring from the breakdown of nitrogen in livestock manure and urine, in addition to the potent greenhouse gas, methane.[305] Yet, soil management-related emissions can be difficult to track. For one thing, N_2O emissions tend to be episodic rather than steady; periodic air sampling can therefore miss pulses of emissions.[306] For example, one study found that emissions were two orders of magnitude greater in the weeks immediately after the application of fertilizer than in the rest of the year.[307] In addition, atmospheric concentrations of N_2O are very low compared to CO_2, making them difficult to detect through many common analytical techniques.[308] However, given the warming potential of N_2O relative to CO_2, even "low" concentrations make significant contributions to climate change.

Anaerobic digestion—the generation of renewable energy (biogas) from organic waste—is a productive and efficient way to dispose of manure and thereby reduce certain harmful emissions of methane and other air and water pollutants. Digestion also produces useful products like biogas and nutrient-filled digestate.[309] Direct benefits to producers and

the community include energy production for onsite uses like heat, electricity, and farm operations; profits from selling excess electricity; avoidance of manure spills from storage lagoons nearing capacity; and reduced odor.[310] However, the anaerobic digesters needed to produce biogas are expensive,[311] and often can only be afforded by the largest farms.[312] This obstacle prevents smaller producers from reaping the many benefits of anaerobic digestion.

The next farm bill should provide the funding and authorizations necessary to adequately monitor greenhouse gas emissions sources and provide support for innovative partnerships that can turn emissions into economically viable sources of energy.

LEGISLATIVE OPPORTUNITY

Fund continuous monitoring technology for N_2O emissions

A variety of technologies are being developed that could allow the continuous monitoring of N_2O emissions on farms.[313] Congress should provide funding for the study of continuous monitoring technologies to identify best practices that can be used to incorporate N_2O monitoring from farms into the nationwide monitoring system for emissions.

LEGISLATIVE OPPORTUNITY

Pilot cooperative biogas production

Congress should direct USDA to adopt a pilot project that will help small- and mid-size producers realize the potential for biogas generation by pooling resources through cooperative ownership structures. Such an approach would help producers overcome capital barriers by spreading installation, operating, and maintenance costs across many operators, increasing their bargaining power when negotiating with utilities, increasing energy and by-product sales, and allowing them to remain focused on agricultural production.[314]

Cooperative models for biogas generation have proven effective both domestically[315] and abroad.[316] This program should provide funding, in the form of grants or loan guarantees to producers who apply to participate, to support the construction of a limited number of plants. Because the farm bill is key to rural economic development, funding priority should be given to rural communities that face challenges in accessing the power grid. The purpose of the pilot program would be to assess the feasibility of such an approach, with a focus on identifying ways to overcome potential barriers such as how best to transport manure to a central location,[317] determining the best legal structure for plant ownership, and standardizing terms for power purchase agreements with electrical utilities. To enact this pilot, Congress should amend the Farm Security and Rural Investment Act of 2002 to add cooperative biogas production to the list of "Eligible Technology" for biorefinery, renewable chemical and biobased product manufacturing assistance,[318] and set aside funding within the program to fund the pilot.

RECOMMENDATION

Coordinate a robust USDA response to climate change

The USDA Climate Hubs, a collaboration of USDA sub-agencies established in 2014, play a vital role in the federal government's broad effort to support producers and other stakeholders in making climate-informed decisions.[319] Climate Hubs provide numerous services in pursuit of their mission, which is strengthening agricultural production, natural resource management, and rural economic development under increasing climate variability.[320] Among their key activities is facilitating coordination between stakeholders and government institutions, acting as a principal point of contact between agency services and the constituencies they are meant to serve.[321] This coordination also extends to other entities including land grant universities, the private sector, non-profits, and regional climate experts.[322] This role helps ensure that producers can connect to the appropriate network to find

the science and technical support they need to adapt to climate-related challenges.

Additionally, the Hubs themselves provide a host of informational services that can be used to manage climate-related risks and opportunities. They translate climate projections into impacts on the agriculture sector, conduct regional vulnerability assessments, sift through and maintain a database of peer-reviewed journal articles, and provide newsletters and workshops.[323]

They also provide a variety of land management tools, including special calculators, maps, models, and datasets that are used to estimate anything from crop production to seasonal drought outlooks.[324] In the coming years, the Climate Hubs can provide important assistance to farmers by disseminating information on drought-resistant crops and more generally on the crops and livestock breeds appropriate to the changing climate in a particular region. The disruptive potential of climate change requires that Congress preserve existing programs and strengthen ongoing efforts to both adapt to and mitigate climate change within the agricultural sector.

LEGISLATIVE OPPORTUNITY

Expand and rename the Climate Hubs program

Given the crucial role of Climate Hubs, Congress should ensure their continued operation. Mandatory funding guarantees that the critical functions of the Hubs can continue. Additional funding will help achieve the Hubs' full potential, much of which is still left to be seen, given that its first years were mostly devoted to coordination and laying groundwork.[325] At the moment, the Hubs are not explicitly authorized in the farm bill and instead rely exclusively on discretionary and therefore unpredictable funding. There is increasing resistance in Congress to appropriated funds for ongoing programs that are not included in authorizing legislation;[326] therefore, Congress should include explicit authorization for the Climate Hubs, in combination with mandatory funding. Because the Hubs' name may provoke unnecessary resistance, such authorization could be combined with providing them with a new name, such as Resiliency Centers.

RECOMMENDATION

Invest in opportunities for perennial agriculture systems

Congress should make a long-term investment in the development and adoption of perennial agriculture. The main commodity crops grown by farmers in the United States today are annuals. Annual crops must be replanted every year, which requires regular soil disturbance and means that farmers must continually purchase new seeds. In addition, farmers must suppress or kill weeds that compete with crop seedlings. Whether carried out by mechanical tillage or chemical herbicides, such suppression can result in a variety of adverse environmental effects.

Perennial crops offer a variety of potential benefits compared to the annual plants that dominate agriculture today.[327] These crops are alive year-round and are harvested multiple times before dying. They can have deeper roots and longer growing seasons and therefore capture and retain more rainfall, are more productive, reduce erosion, maintain more soil carbon, demand less fertilizer and herbicide, and require less tillage.[328] For example, one study found significant differences in soil moisture, nitrate leaching, and soil labile carbon (carbon that easily volatizes into the atmosphere) in fields planted with the perennial grain Kernza compared to fields planted with winter wheat.[329]

A leading example of perennial development comes from the Land Institute in Salina, Kansas, which has bred a perennial grain crop called Kernza that is designed to replace conventional wheat. Kernza is currently in the early stages of commercialization,[330] as Kernza seeds are still only about a quarter the size of wheat seeds.[331]

LEGISLATIVE OPPORTUNITY

Fund extramural research to support perennial crop development

Perennial grains and oilseeds face an uphill battle for development and commercialization. Specifically, the yields per acre and grain sizes of perennial crops are currently lower and smaller than those of annual crops. Increasing seed size is key to increasing the overall yield of the plant. The challenges of breeding perennial crops that can compete with their higher-yielding annual cousins are not insurmountable. The yields and grain sizes of perennial crops are similar to those of some wild progenitors of annual crops,[332] and it is estimated that with sufficient support commercially viable perennial grain crops could be available within 20 years.[333] Congress should seize the opportunity to accelerate the development of new perennial crops by providing extramural funding to support plant breeders and geneticists, as well as agricultural scientists to develop agricultural systems that rely on perennial crops.

RECOMMENDATION

Understand precision agriculture's risks and opportunities

Precision agriculture "plays an increasing role in farm production."[334] Definitions of precision agriculture tend to track the equipment or technology that is currently available.[335] The NRCS defines it as "a management system that is information and technology based, is site specific" and uses field-level data "for optimum profitability, sustainability, and protection of the environment."[336] Precision agriculture can be as simple as the spot application of pesticides. It can also be a complex production system that relies on GPS technology and very granular field data to vary agricultural inputs within the field and over time.[337] Precision agriculture may also involve producers using research about weather patterns, soil temperature and humidity, growth, and other factors to inform their practices.

Precision agriculture can have many benefits. For example, "[s]oil and water quality benefits can result from reduced or targeted application of inputs such as nutrients, pesticides, and irrigation water. When used to precisely control where equipment travels in a field, precision agriculture can also reduce soil compaction and erosion."[338]

However, there is still uncertainty about whether or to what degree precision agriculture provides long-term net environmental benefits. According to one NRCS report, "to achieve a positive impact on the environment, the use of precision agriculture needs to be part of a system that is developed specifically to address a resource concern. To be effective, the entire system needs to be implemented, not just a few random precision agriculture techniques."[339]

LEGISLATIVE OPPORTUNITY

Research the long-term effects of precision agriculture

Congress should provide funding for robust research into the effects of precision agriculture on ambient pollutant concentrations. Given the uncertainties about the true costs and benefits of various precision agriculture technologies, and given the support that NRCS already provides for precision agriculture through conservation programs, Congress should fund robust research on the long-term environmental impacts of precision agriculture. Such research will help determine whether NRCS should continue supporting these practices—and, if so, which ones and at what payment rates—or instead should focus its efforts on other measures. Congress should provide authority and set-aside funding in the Research, Extension and Related Matters Title to accelerate coordinated extramural research into the costs and opportunities of precision agriculture technologies.

RECOMMENDATION

Preserve, expand, and improve the Livestock Indemnity Program

The Livestock Indemnity Program (LIP) provides payments to ranchers for animals lost due to "attacks by animals reintroduced into the wild by the Federal Government or protected by Federal law, including wolves and avian predators."[340] Compensation schemes like the LIP are intended to ensure that ranchers do not bear a disproportionate share of the burden of species protection, reduce ranchers' hostility to reintroduced or protected predators, and promote the conservation of these species.[341] When predators eat livestock, ranchers may kill the predators in retaliation. As a result, "livestock depredation is considered one of the driving forces behind the worldwide decline of large carnivores."[342]

Moreover, recent research has linked the conservation or re-establishment of top predators to much broader benefits than the protection of a single species. When top predators are absent from an ecosystem, herbivore populations can explode, leading to degradation and simplification of plant and animal communities.[343] Conversely, when predators are reintroduced, reductions in herbivore numbers and changes in behavior can increase plant and animal diversity, reduce stream bank erosion, improve water quality, and increase carbon sequestration in plants.[344] Large carnivores can even reduce disease in domestic livestock by consuming sick wild prey, which in turn reduces disease transmission from wild herbivores to livestock.[345]

Payment schemes like the LIP play an important role in the conservation of large predators. Around the world, compensation schemes have been credited with helping to ensure the success of species reintroductions,[346] although their overall effectiveness has proven difficult to establish.[347]

The LIP systematically undercompensates ranchers for losses they suffer. The program compensates only 75 percent of the lost animal's market value,[348] calculates market value without accounting for interruptions in the production system overall,[349] and pays ranchers only when they lose an animal. This creates a moral hazard problem where ranchers may be less likely to take proactive measures to avoid predation knowing that losses will be compensated, if incompletely.[350] It is not clear how much real support compensation payments generate among ranchers for rising predator populations.[351]

Thus, even as the LIP is maintained, Congress should experiment with other models to compensate producers for positive ecological outcomes. Better programs would not simply compensate farmers for the loss of their individual animals. Rather, they would incentivize management practices and behaviors that limit conflict and increase the health of target populations.

LEGISLATIVE OPPORTUNITY

Pilot livestock indemnity payments tied to conservation outcomes

The next farm bill should pilot a modified version of the LIP based on performance payments. Under such an approach, ranchers receive payments that are tied to the achievement of conservation goals rather than confirmed livestock losses. For example, the payments could be based on the number of offspring born to the carnivore species in a given area, while the compensation level could be tied to expected future harm caused by these animals.[352] This approach avoids the moral hazard problems identified above. In Sweden, a performance payment scheme involving reindeer herders has led to a doubling of the wolverine population in a decade.[353] Congress should require USDA to pilot this approach for one predatory species in a single region, and to use this pilot to determine the appropriate level of compensation, track population trends, and assess changes in ranchers' perceptions of the predator and actions taken to reduce predator-livestock conflict.

ENDNOTES

1 *Food Security Status of U.S. Households in 2016*, U.S. Dep't of Agric. Econ. Res. Serv., https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics.aspx (last updated Oct. 4, 2017).

2 U.S. Dep't of Agric., Econ. Res. Serv., Major Uses of Land in the United States 24 (2012), https://www.ers.usda.gov/webdocs/publications/84880/eib-178.pdf?v=42972.

3 Gabrielle Roesch-McNally et al., *The trouble with cover crops: Farmers' experiences with overcoming barriers to adoption*, Renewable Agric. and Food Systems 9 (2017), https://www.cambridge.org/core/journals/renewable-agriculture-and-food-systems/article/div-classtitlethe-trouble-with-cover-crops-farmers-experiences-with-overcoming-barriers-to-adoptiondiv/732DAC57E92E1C9EFC5A451F7EAF454A.

4 Catherine Boudreau, *The Ghost of Farm Bills Past: 2014 Saving No Help to Struggling Farmers*, Politico (May 17, 2017), http://www.politico.com/story/2017/05/17/the-ghost-of-farm-bills-past-2014-savings-no-help-to-struggling-farmers-238499.

5 *See* Renee Johnson & Jim Monke, Cong. Research Serv., RS22131, What Is the Farm Bill? 5 (2017), https://fas.org/sgp/crs/misc/RS22131.pdf.

6 *Id.* At the time of enactment, the Congressional Budget Office (CBO) estimated that the Commodities Title would spend $23.6 billion, the Conservation Title $28.2 billion, and Crop Insurance $41.4 billion—a total of $93.14 billion for FY2014-18. Memorandum from Douglas W. Elmendorf, Cong. Budget Off., CBO cost estimate of the Agricultural Act of 2014, to the Honorable Frank D. Lucas, Chairman, U.S. House of Representatives, Committee on Agriculture 3 (Jan. 28, 2014), https://www.cbo.gov/publication/45049. After three years of expenditures, CBO now estimates that the Commodities Title will cost about $12.4 billion more while the Crop Insurance Title will spend about $11.2 billion less than expected over five years. *See CBO Budget and Economic Outlook, "10-Year Budget Projections,"* Cong. Budget Off., https://www.cbo.gov/about/products/budget-economic-data#3 (last visited Mar. 18, 2018). Conservation spending is about $4.6 billion below original projections. *See CBO Budget and Economic Outlook, "10-Year Budget Projections,"* Cong. Budget Off., https://www.cbo.gov/about/products/budget-economic-data#3 (last visited Mar. 18, 2018). Conservation has been the victim of automatic sequestration cuts and discretionary "changes in mandatory program spending," whereby Congress uses funding otherwise "guaranteed" in the last farm bill in order to fill gaps elsewhere in the federal budget. *See* Jonathan Coppess et. al, *Tax Legislation and the Specter of Sequestration*, FarmDoc Daily (November 22, 2017), http://farmdocdaily.illinois.edu/2017/11/tax-legislation-and-the-specter-of-sequestration.html.

7 Renee Johnson & Jim Monke, *supra* note 5, at 5.

8 Zachary Cain & Stephen Lovejoy, *History and Outlook for Farm Bill Conservation Practices,* Choices, (4th Quarter 2004) at 37.

9 Dennis A. Shields, Cong. Research Serv., R40532, Federal Crop Insurance: Background 1 (2015), https://fas.org/sgp/crs/misc/R40532.pdf [hereinafter Shields, Federal Crop Insurance: Background].

10 Anton Bekkerman et al., *supra* note 10, at 1.

11 Carl Zulauf et al., *Baseline for Next Farm Bill's Crop Commodity Programs: An Early Perspective*, farmdoc daily (Nov. 3, 2016), http://farmdocdaily.illinois.edu/2016/11/baseline-next-farm-bill-crop-commodity-programs.html.

12 *Id.*

13 *Id.*

14 *See Projected Spending Under the 2014 Farm Bill*, U.S. Dep't of Agric., Econ. Res. Serv., https://www.ers.usda.gov/topics/farm-economy/farm-commodity-policy/projected-spending-under-the-2014-farm-bill/ (last visited Mar. 17, 2018) (indicating the share of total farm bill spending that crop insurance and Commodities Title spending were projected to comprise at the time of the 2014 legislation's passage). Note, however, that although the majority of farm bill funding goes to the Nutrition title, that funding is necessary to maintain programs on which many of our most vulnerable citizens rely, and our goals support expansion, rather than reallocation, of those funds.

15 *See generally* U.S. Senate Committee on Agriculture, Nutrition, & Forestry, *Farm Bill Ends Direct Payment Subsidies*, Minority News, (Jan. 28, 2014), https://www.agriculture.senate.gov/newsroom/press/release/farm-bill-ends-direct-payment-subsidies; Farm Credit Services of America, Crop Insurance in America: A Public-Private Partnership for U.S. Agricultural Security 1 (2016), https://www.cropinsurancespecialists.com/docs/default-source/pdfs/fcsamerica_cropinsur_whitepaper.pdf (asserting that "[c]rop insurance has become the primary risk management tool of U.S. agriculture, replacing direct crop subsidies.").

16 U.S. Dep't of Agric., Risk Mgmt. Agency, The Risk Management Safety Net: Market Penetration and Market Potential 15 (2017), https://www.rma.usda.gov/pubs/2017/portfolio/portfolio.pdf.

17 *See* Shields, Federal Crop Insurance: Background, *supra* note 9, at 13.

18 Memorandum from Douglas W. Elmendorf, *supra* note 6, at 3.

[19] Jonathan Coppess, et al., *Reviewing CBO Baseline for Farm Bill Program Spending*, FARMDOC DAILY (March 2, 2017), http://farmdocdaily.illinois.edu/2017/03/reviewing-cbo-baseline-for-farm-bill-spending.html. Projections are detailed in Figure 2.

[20] *History of the Crop Insurance Program*, U.S. DEPT. OF AGRIC., RISK MGMT. AGENCY, http://www.rma.usda.gov/aboutrma/what/history.html (last visited Mar. 18, 2018).

[21] DENNIS A. SHIELDS, CONG. RESEARCH SERV., R43494, CROP INSURANCE PROVISIONS IN THE 2014 FARM BILL (P.L. 113-79) 3 (2014) http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43494.pdf [hereinafter SHIELDS, CROP INSURANCE PROVISIONS IN THE 2014 FARM BILL].

[22] *Id.*

[23] *See* SHIELDS, FEDERAL CROP INSURANCE: BACKGROUND, *supra* note 9, at 2.

[24] CONG. BUDGET OFF., OPTIONS TO REDUCE THE BUDGETARY COSTS OF THE FEDERAL CROP INSURANCE PROGRAM 13 (2017), https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/53375-federalcropinsuranceprogram.pdf.

[25] *Id.*

[26] ANTON BEKKERMAN ET AL., supra note 10, at 1.f.

[27] *See* BRUCE BABCOCK, ENVTL. WORKING GRP., CUTTING WASTE IN THE CROP INSURANCE PROGRAM 7 (2013), http://cdn.ewg.org/sites/default/files/u118/2013%20Cutting%20Crop%20Insurance%20Waste_.pdf; *see also* Eric Pianin, *Aggie Bill Cuts = $24 Billion Windfall for Farmers*, FISCAL TIMES (Mar. 16, 2015), http://www.thefiscaltimes.com/2015/03/16/Aggie-Bill-Cuts-24-Billion-Windfall-Farmers.

[28] JOSEPH W. GLAUBER, TAXPAYERS FOR COMMON SENSE, CROP INSURANCE AND PRIVATE SECTOR DELIVERY: REASSESSING THE PUBLIC-PRIVATE PARTNERSHIP 5–8 (2016), http://www.taxpayer.net/images/uploads/downloads/Crop_Insurance_and_Private_Sector_Delivery_1.pdf [hereinafter JOSEPH W. GLAUBER, CROP INSURANCE AND PRIVATE SECTOR DELIVERY].

[29] *See Reinsurance Reports*, U.S. DEP'T OF AGRIC., RISK MGMT. AGENCY, https://prodwebnlb.rma.usda.gov/apps/ReinsuranceReports.

[30] *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO-17-501, CROP INSURANCE: OPPORTUNITIES EXIST TO IMPROVE PROGRAM DELIVERY AND REDUCE COSTS 25 (2017), https://www.gao.gov/assets/690/686145.pdf [hereinafter U.S. GOV'T ACCOUNTABILITY OFF., CROP INSURANCE: OPPORTUNITIES EXIST TO IMPROVE PROGRAM DELIVERY AND REDUCE COSTS] (indicating that the average rate of return was 18.0 percent between 1996 and 2015—including 24.8 percent in 2015—compared to a "reasonable" rate of 8.8 percent in 2015 or 9.6 percent when averaged from 2009-2015).

[31] *See* SHIELDS, CROP INSURANCE PROVISIONS IN THE 2014 FARM BILL, *supra* note 21, at 1.

[32] *See id.*

[33] *See* Mario J. Miranda, *Area-Yield Insurance Reconsidered*, 73(2) AM. J. OF AGRIC. ECON. 233, 242 (1991).

[34] *See* Mario J. Miranda & Joseph W. Glauber, *Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets*, 79(1) AM. J. OF AGRIC. ECON. 206, 215 (1997).

[35] *See* ERIK J. O'DONOGHUE ET AL., U.S. DEP'T OF AGRIC., ECON. RESEARCH SERV., THE 2014 FARM ACT AGRICULTURE RISK COVERAGE, PRICE LOSS COVERAGE, AND SUPPLEMENTAL COVERAGE OPTION PROGRAMS' EFFECTS ON CROP REVENUE 1 (2016), https://www.ers.usda.gov/webdocs/publications/45512/56418_err-204.pdf?v=42381.

[36] Barry K. Goodwin & Vincent H. Smith, *What Harm Is Done By Subsidizing Crop Insurance?* 95(2) AM. J. OF AGRIC. ECON. 492–94 (2013).

[37] Vincent H. Smith & Barry K. Goodwin. *Private and Public Roles in Providing Agricultural Insurance in the United States*, in PRIVATE AND PUBLIC ROLES IN INSURANCE 173, 173 (Jeffrey Brown ed., 2010).

[38] *Id.*

[39] *See* DENNIS A. SHIELDS, FEDERAL CROP INSURANCE: BACKGROUND, *supra* note 9, at 2.

[40] *See* MEGAN STUBBS, CONG. RESEARCH SERV., R42459, CONSERVATION COMPLIANCE AND U.S. FARM POLICY 6-8 (2014). https://fas.org/sgp/crs/misc/R42459.pdf [hereinafter MEGAN STUBBS, CONSERVATION COMPLIANCE AND U.S. FARM POLICY]; *To Protect Native Grassland, Sodsaver Provision Must be Strengthened*, NAT'L SUSTAINABLE AGRIC. COAL., NSAC'S BLOG (Jul. 15. 2016), http://sustainableagriculture.net/blog/sodsaver-nsac-comments/.

[41] *See* Francis Annan & Wolfram Schlenker, *Federal Crop Insurance and the Disincentive to Adapt to Extreme Heat*, AM. ECON. REV.: PAPERS & PROC. 264-266 (2015); Joshua D. Woodard et al., *Government Insurance Program Design, Incentive Effects, and Technology Adoption: The Case of Skip-Row Crop Insurance*, AM. J. AGRIC. ECON. 823-837 (2012).

[42] *See History of the Crop Insurance Program*, *supra* note 20.

[43] *Id.*

[44] *See* SHIELDS, CROP INSURANCE PROVISIONS IN THE 2014 FARM BILL, *supra* note 21, at 2.

[45] *Id.* at 3.

[46] *Id.* at 4.

[47] SCO insurance policies can be stacked on both yield-based and revenue-based insurance policies for certain crops and are triggered once a producer reaches losses totaling 14 percent of their expected revenue; thus, SCO covers losses between 14-

30 percent of expected yield or revenue, depending on the underlying policy. *See* U.S. Dep't of Agric., Risk Mgmt. Agency, Supplemental Coverage Option for Federal Crop Insurance (2016), http://www.rma.usda.gov/pubs/rme/2017sco.pdf.

48 *See* Shields, Crop Insurance Provisions in the 2014 Farm Bill, *supra* note 21, at 6-7.

49 *Id.* at 12.

50 *See Government Programs and Risk: Major Risk Management Programs,* U.S. Dep't of Agric., Econ. Research Serv., https://www.ers.usda.gov/topics/farm-practices-management/risk-management/government-programs-risk/ (last visited Mar. 18, 2018).

51 *See* U.S. Gov't Accountability Off., Crop Insurance: In Areas with Higher Crop Production Risks, Costs are Great, and Premiums May not Cover Expected Losses 2–3 (2015), https://www.gao.gov/assets/670/668358.pdf.

52 *See Id.* at 21 (assuming that farmers in the highest quintile for weighted average county target premiums had received 4 cents rather than 11 cents for every $1 of expected crop value).

53 *See* Paul C. Westcott & C. Edwin Young, U.S. Dep't of Agric., Econ. Research Serv., Farm Program Effects on Agricultural Programs: Coupled and Uncoupled Programs, AER-838 8, 11 (2004), https://www.ers.usda.gov/webdocs/publications/41708/30381_aer838b_002.pdf?v=41271; Bruce A. Babcock, Envtl. Working Grp., Crop Insurance: A Lottery That's A Sure Bet 12 (2016), https://static.ewg.org/reports/2016/federal_crop_insurance_lottery/EWG_CropInsuranceLottery.pdf?_ga=2.1672819.3307486.1521398842-586990933.1521398842.

54 Babcock, Envtl. Working Grp., Crop Insurance: A Lottery That's A Sure Bet, *supra* note 53, at 13.

55 Glauber, Crop Insurance and Private Sector Delivery, *supra* note 28, at 1.

56 Press Release No. 16-075, U.S. Dep't of Agric., Risk Mgmt. Agency, USDA Builds on Record of Crop Insurance Success for America's Farmers and Ranchers 2 (Jul. 7, 2016), https://www.rma.usda.gov/news/2016/07/cropinsurance.pdf.

57 *See* Glauber, Crop Insurance and Private Sector Delivery, *supra* note 28, at 1.

58 *See* Shields, Federal Crop Insurance: Background, *supra* note 9, at 18.

59 *Id.*

60 *See* Coppess et al., *Tax Legislation and the Specter of Sequestration, supra* note 6.

61 *See* Glauber, Crop Insurance and Private Sector Delivery, *supra* note 28, at 4.

62 *See Id.,* at 1, 7.

63 *See* Shields, Federal Crop Insurance: Background, *supra* note 9, at 18. Note that the cap is adjusted for inflation.

64 7 U.S.C.A. 1508(k)(4) (West 2017).

65 Assisting Family Farmers Through Insurance Reforms Act, H.R.2332, 115th Cong. (2017). The bill would cap A&O reimbursements at $900 million, allowing for annual inflation. *See also,* Nicholas D. Paulson et al., *The Potential for Crop Insurance Reform*, Agric. Fin. Rev. 467-468 (2014).

66 *See* U.S. Gov't Accountability Off., Crop Insurance: Opportunities Exist to Improve Program Delivery and Reduce Costs, *supra* note 30, at 27.

67 *See* Shields, Federal Crop Insurance: Background, *supra* note 9, at 20–21.

68 *See Reinsurance Reports*, U.S. Dep't of Agric., Risk Mgmt. Agency, http://prodwebnlb.rma.usda.gov/apps/ReinsuranceReports (last visited Mar. 18, 2018) (providing links to download data that illustrate the claim).

69 *See Id.* Note that the claim relies on a calculation of the ratio of retained premiums to gross premiums and the ratio of retained indemnities to gross indemnities.

70 U.S. Gov't Accountability Off., Crop Insurance: Opportunities Exist to Improve Program Delivery and Reduce Costs, *supra* note 30, at 28.

71 7 U.S.C.A. 1508(k)(3) (West 2017).

72 *See* Shields, Crop Insurance Provisions in the 2014 Farm Bill, *supra* note 21, at 11.

73 Shields, Federal Crop Insurance: Background, *supra* note 9, at 13–14. In 2013, for example, farms with $5 million or more in sales received an average of $115,000 in subsidies even though farms overall were receiving an average subsidy of just $19,000.

74 Bekkerman et al., *supra* note 10, at 1.

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[147] Kari Hamerschlag, *Fairness for Small Farmers: A Missing Ingredient in the U.S. Farm Bill*, Fair World Proj. (2013), https://fairworldproject.org/voices-of-fair-trade/fairness-for-small-farmers-a-missing-ingredient-in-the-u-s-farm-bill/.

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[151] *See generally* Anne Weir Schechinger & Craig Cox, Envtl. Working Grp., Double Dipping: How Taxpayers Subsidize Farmers Twice for Crop Losses (2017), https://www.ewg.org/research/subsidy-layer-cake#.WiBrvLQ-fwc; ARC can overlap with crop insurance if a farmer elects revenue protection insurance that covers above 76%. Keith Collins & Harun Bulut, *How Will the Farm Bill's Supplemental Revenue Programs Affect Crop Insurance?*, Choices, (3d Quarter 2013), at 2, http://www.choicesmagazine.org/choices-magazine/theme-articles/current-issues-in-risk-management-and-us-agricultural-policy/how-will-the-farm-bills-supplemental-revenue-programs-affect-crop-insurance. This coverage is only available in certain areas. Rain & Hail Ins. Soc'y, 2016 Crop Insurance Update: Securing America's Farmers 12 (2016), https://www.rainhail.com/pdf_files/MKTG/MKTG_0123.pdf. Such overlap can actually incentivize lower yield in scenarios where a farmer would anticipate a double payout for a loss in revenue. *See* Jim Wiesemeyer, *A Look at the Proposed ARC Re: Farm Bill*, AgWeb (Jan. 5, 2012), http://www.agweb.com/mobile/article/a_look_at_the_proposed_arc_re_farm_bill/.

[152] 16 U.S.C.A. §§ 3801, 3811-12, 3821-23.

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[159] *Id.*

[160] Agricultural Act of 2014 §2602(2)(4) (codified at 16 U.S.C. §3841(c)(4)(2012) "Not later than November 1 of each year, the Secretary shall submit. . .a report that includes: (A) a description of the extent to which the requests for highly erodible land conservation and wetland compliance determinations are being addressed in a timely manner; (B) the total number of requests completed in the previous fiscal year; (C) the incomplete determinations on record; and (D) the number of requests that are still outstanding more than 1 year since the date on which the requests were received from the producer.")).

[161] Agricultural Act of 2014 § 2602 (codified at 16 U.S.C.A. §3841(c)(4) (2017)).

[162] Agricultural Act of 2014 § 2602(2)(4) (codified at 16 U.S.C.A. §3841(c)(4) (2017)).

[163] Agricultural Act of 2014 §2605 (codified at 16 U.S.C.A. §3841(i) (2017) ("Beginning in calendar year 2009, and each year thereafter, the Secretary shall submit to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate a semiannual report containing statistics by State related to enrollments in conservation programs.")).

[164] U.S. Dep't of Agric., Office of Inspector General, Audit Report 10601-0001-22, Nat. Res. Conservation Service's Oversight and Compliance Activities 3 (2013) https://www.usda.gov/oig/webdocs/10601-0001-22.pdf [hereinafter U.S. Dep't of Agric., Natural Resources Conservation Service's Oversight and Compliance Activities].

[165] *Id.* at 5.

[166] 7 C.F.R. §12.20-.23(2016).

[167] 16 U.S.C.A. §3812a (a) (West 2017) (stating the system should be one that: (1) "is technically and economically feasible"; (2) is based on "local resource conditions and available conservation technology; (3) is cost-effective; and (4) does not cause undue economic hardship on the person applying the conservation system under the person's conservation plan.").

[168] Laurie Ristino & Gabriela Steier, *Losing Ground: A Clarion Call for Farm Bill Reform to Ensure a Food Secure Future*, 42 COLUM. J. ENVTL. L. 1, 59, 66-68 (2016).

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[170] *Iowa State Project Aims to Reduce Major Cause of Soil Erosion on Iowa Farm Fields*, IOWA STATE UNIV., (Jan. 15, 2014) https://www.cals.iastate.edu/news/releases/iowa-state-project-aims-reduce-major-cause-soil-erosion-iowa-farm-fields.

[171] This recommendation may also be linked to the crop insurance section as a means for providing a baseline with which all producers must comply regardless of the type of soil on which they farm in order to be eligible to receive crop insurance benefits.

[172] *Erosion*, NAT. RES. CONSERVATION SERV., *supra* note 158.

[173] For a fuller treatment of conservation compliance enforcement issues *see*, Laurie Ristino & Gabriela Steier, *supra* note 168, at 94-96, 113-114.

[174] *See* U.S. GEN. ACCOUNTING OFF., GAO-03-418, AGRICULTURE CONSERVATION: NEEDS TO BETTER ENSURE PROTECTION OF HIGHLY ERODIBLE CROPLAND AND WETLANDS 42 (2003), https://www.gao.gov/assets/240/237878.pdf.

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[176] 16 U.S.C.A. §3812 (West 2017).

[177] *Id.* §3812a (d).

[178] Producers certify they will not: "Plant or produce an agricultural commodity on highly erodible land without following an NRCS approved conservation plan or system; Plant or produce an agricultural commodity on a converted wetland; or Convert a wetland which makes the production of an agricultural commodity possible." U.S. DEP'T OF AGRIC., CONSERVATION FACT SHEET: CONSERVATION COMPLIANCE AND CROP INSURANCE, 1 (2015), https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2015/conserve_compli_insure_apr2015.pdf.

[179] U.S. DEP'T OF AGRIC., FARM SERV. AGENCY, APPENDIX TO FORM FOR AD-1026 HIGHLY ERODIBLE LAND CONSERVATION (HELC) AND WETLAND CONSERVATION (WC) CERTIFICATION, https://forms.sc.egov.usda.gov/efcommon/eFileServices/eForms/AD1026.pdf (last visited Mar. 18, 2018).

[180] U.S. DEP'T OF AGRIC., OFFICE OF INSPECTOR GENERAL, USDA MONITORING OF HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION VIOLATIONS 6 (2016), https://www.usda.gov/oig/webdocs/50601-0005-31.pdf [hereinafter USDA MONITORING OF HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION VIOLATIONS].

[181] *Id.*

[182] *Id.*

[183] SOIL & WATER CONSERVATION SOC'Y & ENVTL. DEFENSE, AN ASSESSMENT OF TECHNICAL ASSISTANCE FOR FARM BILL CONSERVATION PROGRAMS (2007).

[184] U.S. DEP'T OF AGRIC., NATURAL RESOURCES CONSERVATION SERVICE'S OVERSIGHT AND COMPLIANCE ACTIVITIES, *supra* note 164, at 3.

[185] Laurie Ristino & Gabriela Steier, *supra* note 168, at 98.

[186] *Id.*

[187] USDA MONITORING OF HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION VIOLATIONS, *supra* note 180, at 5-10.

[188] *See* SOIL & WATER CONSERVATION SOC'Y & ENVTL. DEFENSE, *supra* note 183 at 1.

[189] Ristino & Steier, *supra* note 168, at 109-110.

[190] *NRCS Conservation Programs: Environmental Quality Incentives Program (EQIP)*, U.S. DEP'T OF AGRIC., NAT. RES. CONSERVATION SERV., https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/fb08_cp_eqip.html (last visited Mar. 18, 2018) (Table: EQIP Contract Data by State and Fiscal Year).

[191] *NRCS Conservation Programs: Conservation Stewardship Program (CSP),* U.S. DEP'T OF AGRIC., NAT. RES. CONSERVATION SERV., https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/fb08_cp_cstp.html#total (last visited Mar. 18, 2018) (Table: CSP Contract Data by State and Fiscal Year).

[192] SOIL & WATER CONSERVATION SOC'Y & ENVTL. DEFENSE, *supra* note 183.

[193] *See* J.B. Ruhl, *supra* note 156, at 263, 293–316.

[194] The farm bill mainly accomplishes this by creating a variety of cost-sharing and technical assistance programs that encourage and assist farmers to adopt resource-conserving practices in lands currently in use, such the Conservation Stewardship Program (CSP) and the Environmental Quality Incentives Program (EQIP) or incentivize farmers to remove marginal lands from production temporarily, such as the Conservation Reserve Program (CRP). MEGAN STUBBS, CONG. RESEARCH SERV., CONSERVATION PROGRAMS IN THE 2014 FARM BILL (P.L. 113-79), R43504 6 (2014), http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43504.pdf [hereinafter MEGAN STUBBS, CONSERVATION PROGRAMS IN THE 2014 FARM BILL].

[195] *See* DOUGLAS JACKSON-SMITH ET AL., AGREE, ASSESSING THE IMPACTS OF FEDERAL FARM BILL PROGRAMS ON RURAL COMMUNITIES 12–13 (2013), http://scholars.unh.edu/cgi/viewcontent.cgi?article=1106&context=soc_facpub.

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period contemplated by the current farm bill. Megan Stubbs, Conservation Programs in the 2014 Farm Bill, *supra* note 194, at 4; Ralph M. Chite, Cong. Research Serv., R43076, The 2014 Farm Bill (P.L. 113-79): Summary and Side-By-Side 8 (2014), http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43076.pdf.

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198 Daniel Imhoff, Food Fight: The Citizen's Guide to the Next Food and Farm Bill 58 (2012); *see* 16 U.S.C.A. § 3839aa (West 2017); *see also Environmental Quality Incentives Program*, Nat'l Sustainable Ag. Coal., http://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/environmental-quality-incentives-program/ (last updated Oct. 2016).

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201 Megan Stubbs, Cong. Research Serv., R42783, Conservation Reserve Program: Status and Issues 2 (2014), http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R42783.pdf [hereinafter Megan Stubbs, Conservation Reserve Program: Status and Issues].

202 Stubbs, Conservation Programs in the 2014 Farm Bill, *supra* note 194, at 3.

203 16 U.S.C.A. § 3838e (West 2017).

204 *Id.* § 3838.

205 Stubbs, Conservation Programs in the 2014 Farm Bill, *supra* note 194, at 8.

206 *Id.*

207 *Id.*; *Environmental Quality Incentives Program*, U.S. Dep't of Agric., Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/ (last visited Mar. 18, 2018).

208 *See* 16 U.S.C.A. § 3838g(c)(1) (West 2017).

209 *Low Acceptance Rates Reflect Continued Conservation Cuts*, Nat'l Sustainable Ag. Coal., NSAC's Blog, (Dec. 2, 2015), http://sustainableagriculture.net/blog/fy15-csp-eqip-acceptance-rates/.

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212 *2014 Farm Bill Drill Down: The Bill by the Numbers*, Nat'l Sustainable Ag. Coal., NSAC's Blog, (Feb. 4, 2014), http://sustainableagriculture.net/blog/2014-farm-bill-by-numbers/.

213 *See* Kelly Kennedy, Comment, 19th Century Farming and 21st Century Technology: The Path to Cleaner Water, 47 Ariz. St. L.J. 1385, 1391–92 (2015); Jonathan Coppess, *The Next Farm Bill May Present Opportunities for Hybrid Farm-Conservation Policies*, Choices (3d quarter 2016), http://www.choicesmagazine.org/choices-magazine/theme-articles/looking-ahead-to-the-next-farm-bill/the-next-farm-bill-may-present-opportunities-for-hybrid-farm-conservation-policies.

214 An Urgent Call to Action: Report of the State-EPA Nutrient Innovations Task Group, State-EPA Nutrient Innovations Task Grp. 1 (2009), http://www.epa.gov/sites/production/files/documents/nitgreport.pdf.

215 Kennedy, *supra* note 213, at 1391–92.

216 *See* Clean Water Act §§ 301, 502(14), 33 U.S.C.A. §§ 1311, 1362(14) (West 2017).

217 *See generally* Margot J. Pollans, *Drinking Water Protection and Agricultural Exceptionalism*, 77 Ohio State L.J. 1195 (2016), http://moritzlaw.osu.edu/students/groups/oslj/files/2017/03/Pollans.pdf.

218 U.S. Dep't of Agric., Nat. Res. Conservation Serv., Conservation Stewardship Program 1 (2016), https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1288534&ext=pdf.

219 16 U.S.C.A. § 3838g(e) (West 2017).

220 *Id.* § 3838g(e)(4) (West 2017).

221 Peter Lehner & Nathan A. Rosenberg, *Legal Pathways to Carbon-Neutral Agriculture*, 47 Envtl. L. Rep. News & Analysis 10845, 10864 (2017), *citing* Soren Rundquist & Craig Cox, Envtl. Working Grp., Fooling Ourselves: Executive Summary (2016). Tyler Lark et al., *Cropland Expansion Outpaces Agricultural and Biofuel Policies in the United States*, 10 Envtl. Res. Letters 9 (2015) (finding that up to 42% of all land converted to cropland came from land exiting the CRP).

222 Craig Cox et al., Envtl. Working Grp., Paradise Lost: Conservation Programs Falter as Agricultural Economy Booms 4 (2013), https://static.ewg.org/reports/2013/conservation_reserve_program/CRP_2013_report.pdf?_ga=2.66444459.463801663.1521557513-1926875882.1521557513.

223 *See* 16 U.S.C.A. § 3831(d) (West 2017).

224 *See generally* Daniel Hellerstein & Scott Malcolm, U.S. Dep't of Agric., Econ. Research Serv., ERR-110, The Influence of Rising Commodity Prices on the Conservation Reserve Program (2011), https://www.ers.usda.gov/webdocs/publications/44802/7770_err110.pdf?v=41056.

225 John Sisser, Izaak Walton League of America, *The Conservation Stewardship Program is Great. Here Are Five Ways to Make It*

Better, Izaak Walton League of America: Blog (Aug. 28, 2015), http://www.iwla.org/blog/blog/2015/08/28/the-conservation-stewardship-program-is-great.

226 *See* Daniel Kane, Nat'l Sustainable Ag. Coal., Carbon Sequestration Potential on Agricultural Lands: A Review of Current Science and Available Practices 14–15 (2015), http://sustainableagriculture.net/wp-content/uploads/2015/12/Soil_C_review_Kane_Dec_4-final-v4.pdf.

227 *Path to the 2018 Farm Bill: Conservation*, Nat'l Sustainable Ag. Coal., NSAC's Blog, (Mar. 14, 2017), http://sustainableagriculture.net/blog/path-to-2018-farm-bill-conservation/; *see also* Nat'l Sustainable Ag. Coal., Analysis of CCRP's Record Breaking Enrollment (2017), http://sustainableagriculture.net/wp-content/uploads/2017/03/CCRP-SPECIAL-REPORT.pdf.

228 U.S. Dep't of Agric., Nat. Res. Conservation Serv., Payment Schedule Handbook, Part C § 600.13(F) (2016), https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=40186.wba.

229 16 U.S.C.A. § 3838g(e) (West 2017).

230 Daniel M. Hellerstein, *The US Conservation Reserve Program: The evolution of an enrollment mechanism*, 63 Land Use Pol'y 608 (2017).

231 Stubbs, Conservation Reserve Program: Status and Issues, *supra* note 201, at 15.

232 *Id.* at 2.

233 Hellerstein, *supra* note 230, at 608.

234 Anne Weir Schechinger & Craig Cox, Envtl. Working Grp., 'Retired' Sensitive Cropland: Here Today, Gone Tomorrow?, 3 (2017), https://cdn3.ewg.org/sites/default/files/u352/EWG_ParadiseLostReport_C03.pdf?_ga=2.50975019.347754171.1516926949-371085394.1516926948.

235 *Id.* at 3.

236 16 U.S.C.A. § 3871 (West 2017).

237 U.S. Dep't of Agric., Nat. Res. Conservation Serv., RCPP: Partner-Led Solutions 1 (2016), https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download/?cid=nrcseprd1309909&ext=pdf.

238 16 U.S.C.A. § 3871(c) (West 2017).

239 Agricultural Act of 2014 § 1265(a)(1); Brian Wood, *Does the 2014 Farm Bill's New Acep Program Really Benefit America, or Does A Lack of Funding Stymie Any Good Works?*, 7 Ky. J. Equine, Agric. & Nat. Res. L. 537, 538 (2015).

240 Wood, *supra* note 239, at 537, 548; Bradley Lubben et al., *Conservation and the Agricultural Act of 2014*, Choices (2d quarter 2014).

241 Nat'l Sustainable Ag. Coal., Agricultural Appropriations Chart Fiscal Year 2019, http://sustainableagriculture.net/wp-content/uploads/2018/02/FY2019-Appropriations-Chart-Trump-Budget-1.pdf (last visited Mar. 18, 2018).

242 Agricultural Act of 2014 § 1261(b)(2)-(4).

243 16 U.S.C.A. § 3865 (West 2017).

244 Federal Agriculture Improvement and Reform Act of 1996 § 334 (codified at 16 U.S.C.A. § 3830 et seq. (West 2017)); Elanor Starmer, Campaign for Family Farms and the Env't, Industrial Livestock at the Taxpayer Trough: How Large Hog and Dairy Operations are Subsidized by the Environmental Quality Incentives Program 1-22 (2008), http://inmotionmagazine.com/ra08/EQIP_report_1208.pdf.

245 Stubbs, Conservation Programs in the 2014 Farm Bill, *supra* note 194, at 12.

246 16 U.S.C.A. § 3839aa-2(a-b) (West 2017).

247 Agricultural Act of 2014 § 2203(1-2).

248 16 U.S.C.A. § 3841(a)(5) (West 2017).

249 Federal Agriculture Improvement and Reform Act of 1996 § 1240G(a)(2) (codified at 16 U.S.C.A. § 3839aa–7 (West 2017)).

250 16 U.S.C.A. § 3839aa-7 (West 2017).

251 Megan Stubbs, Cong. Research Serv., R40197, Environmental Quality Incentives Program (EQIP): Status and Issues 8–9 (2010), http://www.nationalaglawcenter.org/wp-content/uploads/assets/crs/R40197.pdf [hereinafter Stubbs, Environmental Quality Incentives Program (EQIP): Status and Issues].

252 Cong. Research Serv., Farm Bill Primer: The Conservation Title 2 (2017), http://nationalaglawcenter.org/wp-content/uploads//assets/crs/IF10679.pdf.

253 Large CAFOs are animal production facilities that confine and feed, for at least 45 days a year, over 1,000 "animal units" (e.g. 1,000 veal calves or 125,000 broiler chickens) in a space that does not support "crops, vegetation or forage growth." 40 C.F.R. § 122.23.

254 16 U.S.C.A. § 3839aa-2(f)(1) (West 2017).

255 Federal Agriculture Improvement and Reform Act of 1996 § 1240B(e)(1)(b) (codified at 16 U.S.C.A. § 3839aa–2 (West 2017)).

256 Farm Security and Rural Investment Act of 2002 § 2301.

[257] *Cover Crops and CAFOs: An Analysis of 2016 EQIP Spending*, Nat'l Sustainable Agric. Coal.: NSAC's Blog, (Jan. 12, 2017), http://sustainableagriculture.net/blog/eqip-fy2016-analysis/.

[258] *See Environmental Quality Incentives Program: Concentration 1995-2016,* Envtl. Working Grp., https://farm.ewg.org/progdetail.php?fips=00000&progcode=totaleqip&page=conc&regionname=theUnitedStates (accessed Mar. 21, 2018).

[259] Megan Stubbs, Environmental Quality Incentives Program (EQIP): Status and Issues, *supra* note 251, at 8.

[260] Elanor Starmer *supra* note 244, at 3.

[261] *Id.*

[262] *Final Environmental Cost-Share Rule Fails to Incorporate Sustainability Recommendations*, Nat'l Sustainable Agric. Coal., NSAC's Blog, (May 12, 2016), http://sustainableagriculture.net/blog/eqip-final-rule/.

[263] *See* U.S. Gov't Accountability Off., GAO-17-225, USDA's Environmental Quality Incentives Program Could Be Improved to Optimize Benefits (2017), https://www.gao.gov/assets/690/684073.pdf.

[264] Tara Ritter, *Conservation, Climate, and CAFOs*, Inst. for Agric. & Trade Pol'y, (Feb. 12, 2015) https://www.iatp.org/blog/201502/conservation-climate-and-cafos.

[265] *Cover Crops and CAFOs: An Analysis of 2016 EQIP Spending*, Nat'l Sustainable Agric. Coal.: NSAC's Blog, (Jan. 12, 2017), http://sustainableagriculture.net/blog/eqip-fy2016-analysis/.

[266] *See* Danielle Wolfson, Note, *Come Hell or No Water: The Need to Reform the Farm Bill's Water Conservation Subsidies*, 45 Tex. Envtl. L.J. 245, 249–51 (2015); Erik Lichtenberg, *Conservation, the Farm Bill, and U.S. Agri-Environmental Policy*, Choices (3d quarter 2014).

[267] Inflation Calculator, Value of $50,000 in Today's Dollars, by Year. Retrieved from http://www.saving.org/inflation/inflation.php?amount=50%2C000.

[268] Stubbs, Environmental Quality Incentives Program (EQIP): Status and Issues, *supra* note 251, at 8.

[269] Untapped: How Farm Bill Conservation Programs Can Do More to Clean Up California's Water Envtl. Working Grp., 14 (2013), http://static.ewg.org/pdf/2013_California_EQIP_Report.pdf?_ga=1.211168855.312412521.1490898211.

[270] 16 U.S.C.A. § 3839aa-7 (West 2017).

[271] 16 U.S.C.A. § 3939aa-8 (West 2017); 7 C.F.R. § 1466.27. With the exception of air quality funding (for which Congress specifically authorizes separate funds), the overall level of CIG funding is within the discretion of the USDA.

[272] *2017 CIG National Funding Awards*, U.S. Dep't of Agric., Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/cig/?cid=nrcseprd1332220 (last visited Mar. 18, 2018).

[273] *See* 16 U.S.C.A. § 3839aa-8(b)(2) (West 2017); Megan Stubbs, Conservation Programs in the 2014 Farm Bill, *supra* note 194, at 13.

[274] *Conservation Innovation Grants*, U.S. Dep't of Agric., Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/ (last visited Mar. 18, 2018).

[275] 16 U.S.C.A. § 3939aa-8 (West 2017).

[276] *See, e.g.*, Kane, *supra* note 226, at 11.

[277] For example, "in 2010, corn farmers who used no-till were 30 percent less likely than their conventional-tilling peers to receive an indemnity payment under the federal crop insurance program" and in the 2012 drought, corn farmers who used cover crops harvested on average 79 percent of typical yields, compared to 68 percent for farmers who did not have cover crops. Claire O'Connor, Nat. Res. Def. Council, Soil Matters 10 (2013), https://www.nrdc.org/sites/default/files/soil-matters-IP.pdf; *see also* Mahdi M. Al-Kaisi et al., *Drought Impact on Crop Production and the Soil Environment: 2012 Experiences from Iowa*, 68 J. Soil & Water Conservation 19A, 20A (2013).

[278] *See* Joshua D. Woodard & Leslie Chiu, *Soil Data Not Considered in Cornerstone U.S. Agricultural Policy* (Ag-Analytics.Org, Working Draft, Feb. 2016), http://www.foodandagpolicy.org/sites/default/files/Woodard%20Verteramo_WorkingPaper_SoilData%28Feb2016%29.pdf.

[279] Joshua D. Woodard & Scott Marlow, AGree, Crop Insurance, Credit, and Conservation 7 (2017), http://www.foodandagpolicy.org/sites/default/files/Crop%20Insurance%20Credit%20and%20Conservation.pdf.

[280] Joshua D. Woodard, *Integrating High Resolution Soil Data into Federal Crop Insurance Policy*, 66 Envtl. Sci. & Policy 93, 94 (2016).

[281] Joshua D. Woodard, *Soil, Conservation, and Federal Crop Insurance*, *in* AGree, Four Papers on the U.S. Federal Crop Insurance Program, 1-1, 6 (2016).

[282] *See Id.* at 1-1.

[283] *Id.* at 98.

[284] The federal crop insurance program paid a record $10.8b in indemnities in 2011, then another record $17.3b in 2012. Currently, the program costs more than $14b per year. O'Connor, *supra* note 277, at 4, 6.

[285] For example, Joshua D. Woodard has relied on the NRCS SURRGO soil quality database as well FSA Common Land Unit (CLU) field

boundary maps. *See* Woodard, *Integrating High Resolution Soil Data into Federal Crop Insurance Policy*, *supra* note 280, at 93.

286 Kristin Ohlson, *This Kansas Farmer Fought a Government Program to Keep His Farm Sustainable*, Ensia (2016) https://ensia.com/features/sustainable-farm-crop-insurance/; Annan & Schlenker, *supra* note 41, at 264-266; Woodard, *supra* note 41, at 823-837.

287 Paul Janda, *Fire, Flood, Famine and Pestilence: Climate Change and Federal Crop Insurance*, Am Colo. Nat. Res., Energy & Envtl. L. Rev. 107 (2015).

288 7 U.S.C.A. §1523(d) (West 2017).

289 Jacqui Fatka, *Making crop insurance conservation-friendly: Part two in a series*, Farm Futures (2016) http://www.farmfutures.com/story-making-crop-insurance-conservation-friendly-part-two-series-17-139131.

290 In 2010, corn farmers practicing no-till farming were 30% less likely to receive federal crop insurance program indemnities. If all farmers had done so, around $224 million in indemnities could have been avoided. O'Connor, *supra* note 277, at 10, n.74, 75.

291 Woodard, *Integrating High Resolution Soil Data into Federal Crop Insurance Policy*, *supra* note 280, at 93, 98. The collection effort reached 100 percent target reporting by 2016. *Id.* at 94.

292 *See* Woodard & Chiu, *supra* note 278, at 15.

293 This assumes, of course, that the RMA data was sufficiently managed and does not involve such inconsistent standards of data collection across different factors so as to make it unusable. *See* Woodard, *Integrating High Resolution Soil Data into Federal Crop Insurance Policy*, *supra* note 280, at 93, 98.

294 Other relevant datasets include the NRCS's National Commodity Crop Productivity Index (crop yield data), the NRCS's SURRGO soil dataset (maps and tables of soil types and crop productivity index ratings), and Common Land Unit field boundary maps maintained by the Farm Service Agency. The system may also incorporate or link to relevant state datasets, e.g. the Illinois Farm Business Farm Management data on farm-specific crop yields, and the Iowa ISPAID Crop Yield Data. For how such data can be used to produce soil-aware insurance rates, *see generally* Woodard, *Integrating High Resolution Soil Data into Federal Crop Insurance Policy*, *supra* note 280, at 93.

295 Insurers have a strong incentive to know all risk factors, including those based on soil health, because they help them achieve their main competitive advantage of optimally assigning policies to different pools.

296 7 U.S.C.A. § 1523(a) (West 2017).

297 Woodard & Chiu, *supra* note 278, at 5.

298 *Education and Outreach: Understanding Statistics*, U.S. Dep't of Agric., Nat'l Agric. Statistics Serv., https://www.nass.usda.gov/Education_and_Outreach/Understanding_Statistics/Estimating_Programs/Crops/index.php (last visited Mar. 18, 2018).

299 Shannon Spencer et al*., Designing a National Soil Carbon Monitoring Network to Support Climate Change Policy: A Case Example for US Agricultural Lands*, 1 Greenhouse Gas Measurement & Mgmt. 167–178, 168 (2011).

300 Max Schnepf, Soil & Water Conservation Soc'y, *A History of Natural Resource Inventories Conducted by the USDA's Soil Conservation Service and Natural Resources Conservation Service* 1 (2016), https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1212208.pdf.

301 *Conservation Effects Assessment Project (CEAP)*, U.S. Dep't of Agric., Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=nrcs143_014131 (last visited Mar. 18, 2018).

302 *National Crop Residue Management Survey*, Conservation Tech. Info. Ctr., http://www.ctic.purdue.edu/CRM/ (last visited Mar. 18, 2018).

303 *CEAP Cropland Farmer Surveys*, U.S. Dep't of Agric., Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/?cid=nrcs143_014163 (last visited Mar. 18, 2018).

304 *Overview of Greenhouse Gases: Nitrous Oxide Emissions*, U.S. Envtl. Prot. Agency, https://www.epa.gov/ghgemissions/overview-greenhouse-gases#nitrous-oxide (last visited Mar. 18, 2018).

305 *Id.*

306 Trevor D. Rapson & Helen Dacres, *Analytical Techniques for Measuring Nitrous Oxide*, 54 TrAC Trends in Analytical Chemistry 64–74 (2014).

307 Ü. Rannik, et al., *Intercomparison of Fast Response Commercial Gas Analysers for Nitrous Oxide Flux Measurements Under Field Conditions*, 12 Biogeosciences 415 (2015).

308 Rapson & Dacres, *supra* note 306, at 64–74.

309 *See Environmental Benefits of Anaerobic Digestion (AD)*, U.S. Envtl. Prot. Agency, https://www.epa.gov/anaerobic-digestion/environmental-benefits-anaerobic-digestion-ad (last visited Mar. 18, 2018); *The Benefits of Biogas Recovery*, U.S Envtl. Prot. Agency, AgSTAR, https://www.epa.gov/agstar/benefits-biogas-recovery (last visited Mar. 18, 2018); U.S. Dep't of Agric., U.S. Envtl. Prot. Agency, U.S. Dep't of Energy, Biogas Opportunities Roadmap 9–15 (2014), https://www.usda.gov/oce/reports/energy/Biogas_Opportunities_Roadmap_8-1-14.pdf; Carolyn B. Liebrand & Charles Ling, U.S. Dep't of Agric., Rural Dev., Research Report 217, Cooperative Approaches for Implementation of Dairy Manure Digesters 6–10 (2009), http://large.stanford.edu/publications/coal/references/docs/RR217.pdf.

[310] *See Environmental Benefits of Anaerobic Digestion (AD)*, *supra* note 309; *The Benefits of Biogas Recovery*, *supra* note 309; U.S. Dep't of Agric., U.S. EPA, U.S. Dep't of Energy, Biogas Opportunities Roadmap *supra* note 309, at 9–15; Carolyn B. Liebrand & Charles Ling, *supra* note 309, at 5, 8, 13.

[311] *See* Liebrand & Ling, *supra* note 309, at 6 ("The capital cost of plug flow digesters on 10 U.S. dairy operations averaged $285,404 for the digester alone … The [per-cow] capital cost ranged from $194 to $1,557 and averaged $536 per cow").

[312] *See Id.* at v, 10 (noting that barriers to using anaerobic digesters include high costs, difficulties in obtaining financing, and the additional time and skill required to manage them).

[313] See, e.g., Araceli D. Larios, et al., *Challenges in the Measurement of Emissions of Nitrous Oxide and Methane from Livestock Sector*, 15 Reviews in Envtl. Sci. & Bio/Technology 285 (2016); Shu Kee Lam, et al., *Measurement and Mitigation of Nitrous Oxide Emissions from a High Nitrogen Input Vegetable System*, 5 Scientific Reports, Article number: 8208 (2015); Ü. Rannik, et al., *supra* note 307, at 415; Trevor D. Rapson & Helen Dacres, *supra* note 306, at 64–74; Joel J. Fassbender, et al., *Automated, Low-Power Chamber System for Measuring Nitrous Oxide Emissions*, 42 J. Envtl. Quality 606 (2013).

[314] Carolyn B. Liebrand & Charles Ling, *supra* note 309, at 12.

[315] *See Agricultural Uses for Anaerobic Digestion*, Mass Exec. Office of Energy & Envtl. Affairs, http://www.mass.gov/eea/agencies/massdep/climate-energy/energy/program/agricultural-uses-for-anaerobic-digestion.html (last visited Mar. 18, 2018) (five farms in Massachusetts with anaerobic digester technology with combined heat and power conversion units, whose feedstock includes organic waste trucked in from elsewhere in the state); Linda Tufano, *CR&R to build new $100M anaerobic digestion plant in California*, IndustryDive, (Aug. 31, 2015), http://www.wastedive.com/news/crr-to-build-new-100m-anaerobic-digestion-plant-in-california/404806/ ($100 million anaerobic digester complex that will take in organic waste from numerous California cities); Karen Lee, *Digester meets the needs of a community*, Progressive Dairyman, (May 20, 2013), http://www.progressivedairy.com/topics/manure/digester-meets-the-needs-of-a-community (a public-private partnership between three farms and Clear Horizons, LLC, made possible by pooling available resources to help finance it and spread the risk); *Haverhill, Mass. Farm Powered Anaerobic Digester*, Vanguard Renewables, http://vanguardrenewables.com/haverhillmassfarmpoweredanaerbobicdigester/ (last visited Mar. 18, 2018) (a "cooperative farm venture" between two farms in Massachusetts).

[316] For example, this approach has been used successfully in Denmark. *See* Rob Raven & K. H. Gregersen, *Biogas Plants in Denmark: Successes and Setbacks*, Renewable & Sustainable Energy Revs., 1–18 (2005); *see also* Global Methane Initiative, Successful Applications of Anaerobic Digestion from Across the World (2013), https://www.globalmethane.org/documents/GMI%20Benefits%20Report.pdf (describing successful applications in Brazil, Beijing, and Peru).

[317] Farms within a cooperative may be strategically located in order to efficiently transport biogas between them and a central gas conditioning and compressing plant, *see* Global Methane Initiative, supra note 316, at 12, an idea which may be applied to the transportation of feedstock (manure and other organic waste) between farms.

[318] 7 U.S.C.A. § 8103 (West 2017).

[319] Climate Hubs are a part of a broader federal effort to address climate variability. Counterpart programs in other agencies include Regional Climate Centers (National Oceanic and Atmospheric Administration), Climate Science Centers and Landscape Conservation Cooperatives (Department of the Interior), the Climate and Environmental Sciences Division (Department of Energy), and the Air, Climate and Energy Research Program (EPA).

[320] U.S. Dep't of Agric., USDA Regional Climate Hubs Factsheet (2016), https://www.climatehubs.oce.usda.gov/sites/default/files/USDA%20Regional%20Climate%20Hubs%20Factsheet%202016.pdf.

[321] *Id.*

[322] *Id.*

[323] *See* U.S. Dep't of Agric., USDA Climate Hubs Quarterly Report FY 2017, https://www.climatehubs.oce.usda.gov/sites/default/files/Climate%20Hubs%20Update%20-%20April%202015.pdf (last visited Mar. 18, 2018).

[324] These tools include the Climate Tool Shed, which allows users to search over 100 web tools; the Climate Resilience Toolkit, which includes various climate data and tools, adaption guidelines, and references to other resources; and AgroClimate.org, which includes tools and data on climate and crops.

[325] *See* U.S. Dep't of Agric., USDA Climate Hubs Quarterly Report FY 2017, supra note 323. Such potential may include its capacity to function as a central point of collaboration for the various climate and weather risk management programs across the federal government.

[326] *See, e.g.*, Christine Harbin, *Congress Should Rein in Unauthorized Appropriations*, Wash. Examiner, (Jun.15, 2016), http://www.washingtonexaminer.com/congress-should-rein-in-unauthorized-appropriations/article/2593912.

[327] Some common crops, such as "fruit trees, alfalfa, grapes, asparagus, and olive trees," are perennials. *Perennial Crops: New Hardware for Agriculture*, The Land Inst., https://landinstitute.org/our-work/perennial-crops/ (last visited Mar. 18, 2018). Grains, legumes, and oilseeds, however, are virtually all annuals.

[328] J.D. Glover, et al., *Increased Food and Ecosystem Security via Perennial Grains*, 328 SCIENCE 1638, 1638 (2010); *see also* Thomas S. Cox, et al., *Prospects for Developing Perennial Grain Crops*, 56 BIOSCIENCE 649, 649 (2006).

[329] Steve W. Culman, et al., *Soil and Water Quality Rapidly Responds to the Perennial Grain Kernza Wheatgrass*, 105 AGRONOMY J. 735 (2013).

[330] *Kernza® Grain: Toward a Perennial Agriculture*, THE LAND INST., https://landinstitute.org/our-work/perennial-crops/kernza/ (last visited Mar. 18, 2018).

[331] Jane Black, *Perennial Wheat is an Ecologist's Dream. Soon it May be what's for Dinner*, WASH. POST, (Oct. 2, 2016), https://www.washingtonpost.com/lifestyle/food/perennial-wheat-is-an-ecologists-dream-soon-it-may-be-whats-for-dinner/2016/10/02/0533bb7e-84f3-11e6-92c2-14b64f3d453f_story.html?utm_term=.4c97da96d9a4.

[332] Thomas S. Cox, et al., *supra* note 328, at 649, 650-51.

[333] J.D. Glover, et al., *supra* note 328, at 1638, 1639.

[334] *See generally* U.S. DEP'T OF AGRIC. ECON. RES. SERV., ERR-217, FARM PROFITS AND ADOPTION OF PRECISION AGRICULTURE (2016), https://www.ers.usda.gov/webdocs/publications/80326/err-217.pdf?v=42661.

[335] PHILIP R. MCLOUD & RON GRONWALD, U.S. DEP'T OF AGRIC., NAT. RES. CONSERVATION SERV., PRECISION AGRICULTURE: NRCS SUPPORT FOR EMERGING TECHNOLOGIES 1 (2007), https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043474.pdf.

[336] *Id.*

[337] *Id.*

[338] *Id.*

[339] *Id.,* at 7.

[340] 7 U.S.C.A. § 9081(b)(1)(A) (West 2017). LIP also provides payments for "livestock death losses in excess of the normal mortality" from "adverse weather…, including losses due to hurricanes, floods, blizzards, disease, wildfires, extreme heat, and extreme cold." § 9081(b)(1)(B). Our recommendation relates only to LIP payments in connection with predation.

[341] Philip J. Nyhus, et al., *Bearing the Costs of Human-Wildlife Conflict: the Challenges of Compensation Schemes*, *in* PEOPLE AND WILDLIFE: CONFLICT OR COEXISTENCE? (Rosie Woodroffe et al., eds. 2005), at 107, 107.

[342] Caitlin E. Jacobs & Martin B. Main, *A Conservation-Based Approach to Compensation for Livestock Depredation: The Florida Panther Case Study*, PLOS ONE, DOI:10.1371/journal.pone.0139203 (Sept. 30, 2015), at 2; *see also* Simon Thirgood, et al., *The Impact of Human-Wildlife Conflict on Human Lives and Livelihoods*, *in* PEOPLE AND WILDLIFE: CONFLICT OR COEXISTENCE? (Rosie Woodroffe et al., eds. 2005), at 12, 17 ("Livestock depredation, particularly by large carnivores, is probably the most common cause of human-wildlife conflict on a global basis."); Claudio Sillero-Zubiri & M. Karen Laurenson, *Interactions Between Carnivores and Local Communities: Conflict or Co-existence?*, *in* CARNIVORE CONSERVATION (John L. Gittleman, et al. eds. 2001), at 282, 286 ("Predation by carnivores on livestock is the root of a deeply ingrained hatred for carnivores throughout the world, with every domestic species from chickens to cattle being affected.").

[343] James A. Estes et al., *Trophic Downgrading of Planet Earth*, 333 SCIENCE 301 (2011).

[344] William J. Ripple et al., *Status and Ecological Effects of the World's Largest Carnivores*, 343 SCIENCE 1241484, 1241484-5 (2014).

[345] *Id.* at 1241484, 1241484-5; *see also* Craig Packer, et al., *Keeping the Herds Healthy and Alert: Implications of Predator Control for Infectious Disease*, 6 ECOLOGY LETTERS 797 (2003).

[346] *See, e.g.*, Jens Persson et al., *Paying for an Endangered Predator Leads to Population Recovery*, 8 CONSERVATION LETTERS 345 (2015); Hank Fischer, *Defenders of Wildlife Wolf Compensation Program*, CONSERVATION IN PRACTICE, Spring 2003, at 39.

[347] Philip J. Nyhus, et al., *supra* note 341, at 107, 117 ("[D]espite many attempts to implement compensation schemes of different kinds, little empirical evidence of their success or failure is available."). For example, one study in Wisconsin found that people who received compensation for losses to wolves were not more tolerant of wolves than people who had not received such compensation. Lisa Naughton-Treves, Rebecca Grossberg & Adrian Treves, *Paying for Tolerance: Rural Citizens' Attitudes Toward Wolf Depredation and Compensation*, 17 CONSERVATION BIOLOGY 1500, 1509 (2003).

[348] 7 U.S.C.A. § 9081(b)(2) (West 2017).

[349] Aaron Anderson, et al., *Economic Analysis of Indemnity Payments for Wolf Depredation on Cattle in a Wolf Reintroduction Area*, *in* PROCEEDINGS OF THE 26TH VERTEBRATE PEST CONFERENCE (R.M. Timm & J.M. O'Brien eds. 2014), at 413, 414.

[350] Philip J. Nyhus, et al., *supra* note 341, at 107, 114.

[351] One paper suggests that "[p]artial payments may be more frustrating to farmers and ranchers than no payments because they may perceive the establishment of payment programs to be an acceptance of responsibility for wildlife damage. Why then should an agency accept only partial responsibility?" Kimberly K. Wagner, et al., *Compensation Programs for Wildlife Damage in North America*, 25 WILDLIFE SOC'Y BULL. 312, 318 (1997).

[352] Astrid Zabel & Karin Holm-Müller, *Conservation Performance Payments for Carnivore Conservation in Sweden*, 22 CONSERVATION BIOLOGY 247, 247-48 (2008).

[353] Persson et al., *supra* note 346, at 345.