



## Quantifying Benefits from Adoption of Conserving Agricultural Practices

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**This publication was commissioned by AGree to inform and stimulate dialogue about policy reform; it does not represent official AGree positions. The views expressed here are those of the individual authors.**

## Foreword

AGree drives transformative change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. Through its work, AGree supports policy innovation and develops initiatives that address critical challenges in a comprehensive and integrated way. AGree envisions constructive roles for the private sector and civil society as well as for policymakers.

AGree's work addresses four interconnected challenges facing the global food and agriculture system:

- Meet future demand for food;
- Conserve and enhance water, soil, and habitat;
- Improve nutrition and public health; and
- Strengthen farms and communities to improve livelihoods.

We have taken a deliberative, inclusive approach to develop a policy framework and ongoing, complementary initiatives to meet these challenges. To overcome traditional obstacles to change, we engage a broad array of stakeholders whose insights and commitment contribute to meaningful solutions. AGree's work, building on our research to better understand problems and assess options, aims to stimulate creative ideas and encourage new perspectives while fostering the linkages key to catalyzing effective action.

This AGree backgrounder was prepared by Stephanie Mercier, former Chief Economist of the U.S. Senate Committee on Agriculture, Nutrition, & Forestry and currently with the Farm Journal Foundation, with support from AGree. The paper draws on the author's own research and extensive experience analyzing federally-collected agricultural and environmental data. Mercier argues for improved data analysis and integration across USDA agencies to inform a range of public policy and private-sector decisions. She suggests that better understanding the relationship among conservation practices, yield, and environmental conditions could drive broader adoption of conservation practices such as crop rotations and cover cropping.

This publication is intended to broaden discussion and complement AGree's consensus recommendations on policies and actions focused on food and agriculture. While the concepts presented in this paper have greatly enriched the deliberations of the AGree Co-Chairs and Advisors, the perspectives and positions do not represent consensus among them.

We hope you find this paper a helpful resource and source of ideas.



**Deborah M. Atwood**  
Executive Director

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## Introduction

In recent years, U.S. farmers have been remarkably effective in balancing the need to run profitable operations while conserving natural resources such as soil, water, and biodiversity. However, they face major challenges with a changing climate, shrinking water supplies, shifting dietary preferences, and a growing global population. Public policy has played a role in helping farmers achieve recent gains in their stewardship of the environment.

As part of its multi-year effort to formulate reform proposals for U.S. food and agricultural policy, the AGree initiative has focused on several priority areas. One component of that work includes an interest in improving the productivity, profitability, and environmental performance of agriculture. Toward that end, AGree is exploring a range of strategies for achieving that objective, including modification of existing public policy and programs and the potential for establishing market-based incentives, both aimed at encouraging wider adoption of conserving agricultural practices.

It is widely recognized that expanded use of conservation practices by farmers generates a range of benefits for the general public, including reduced soil erosion, improved water quality, and reduced net emissions of greenhouse gases, either by reducing energy consumption or increasing carbon sequestration. Some studies also indicate that farmers can capture private benefits from the use of such practices, such as improved yields, reduced yield variability, and reduced input costs.

During the course of AGree discussions about those public policy strategies, the issue of the availability of appropriate data to evaluate the relationship between agricultural productivity and use of conservation practices has arisen repeatedly. Data that would be key to a robust evaluation of these issues include farm-level measures of yield, yield variability, and soil health (or whatever proxy measures might be available), and how

those vary in response to adoption of conservation practices. This paper will explore various aspects of the process that would be needed to assemble that data and the implications if the effort were successful in establishing a strong relationship between productivity and conservation practices.

## Efforts to Quantify Benefits

In economic theory, the benefits generated by a specific good or service are often divided into two categories — those attributes which can be captured and realized by the individual involved in that activity, often called private goods, and those attributes which that individual cannot exclude others in society from enjoying and which can be consumed by additional people without added costs, known as public or social goods.<sup>1</sup>

## Measuring Social Benefits

The adoption of conserving agricultural practices by farmers, especially those actions taken as a result of participation in voluntary federal conservation programs, have long been seen as generating benefits that accrue to the general public, such as reduced soil erosion and agricultural chemical runoff, which both contribute to improved water quality. Because of the diffuse nature of runoff from cropland or livestock operations, usually referred to as nonpoint sources, the typical procedure has been to measure those benefits in aggregate, such as changes in pollution levels of certain chemicals or compounds associated with agricultural uses in river or lake systems. More recently, studies have also attempted to quantify the monetary value of public benefits of conservation programs. For example, a 2008 USDA report looked at the value of benefits stemming from reduced soil erosion across 12 different categories, which in aggregate amount to estimated benefits of up to \$26 per ton.<sup>2</sup>

## Aggregate Measurement of Environmental Indicators

In order to help formulate national policies in those areas, various agencies of the U.S. government collect aggregate data on changes in various environmental indicators over time. The U.S. Geological Survey (USGS) is a federal agency charged with providing impartial scientific information on the U.S. ecosystem and environment and the natural hazards that face this country. The agency, established in 1879 as part of the U.S. Department of the Interior, began to collect data on water quality on a systematic basis in 1991, focused on surface and ground water found within 51 major river systems or aquifers throughout the country.<sup>3</sup> The data includes measures of nutrient and pesticide concentration, as well as levels of sediment and aquatic organisms found in each study unit or basin, all measures that are relevant to U.S. agriculture. However, the dataset is not currently structured in such a way that it can be linked to behavior or practices at the farm level.

The U.S. Environmental Protection Agency (EPA), established in 1970, was given a mission to protect human health and the environment. The EPA has been collecting national data on U.S. annual emissions of various air pollutants, such as carbon monoxide and sulfur dioxide, since 1970, and a separate greenhouse gas emissions inventory was initiated in 1990, tracking emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) and three less important gases by source on an annual basis.<sup>4</sup> Various greenhouse gas-related activities in agriculture, such as soils management and manure management, as well as land use changes within the agricultural sector, are included. These data are useful in estimating aggregate relationships but not farm-level behavior.

## National Surveys

More specifically, the U.S. Department of Agriculture (USDA) collects national data on variables of particular interest to this process, called Soil Survey Geographic Database, or SSURGO. The National Cooperative Soil

Survey is a joint endeavor between USDA's Natural Resources Conservation Service (NRCS) and state agencies with jurisdiction over natural resources. Survey activities have been going on since 1899, with more precise information coming over time as a result of a systematic classification of soil types, emergence of first aerial photography and then remote sensing capability, and digitization of the data.<sup>5</sup> These data are now available on the Internet on the Web Soil Survey, and users are able to access data at the field level through an interactive map.

NRCS is also involved in collecting environmental data on a national basis under the National Resources Inventory (NRI). Data for the NRI was first collected in 1982 in response to the Soil and Water Resources Conservation Act (RCA) of 1977 that reinforced NRCS's inventory activities authorized by the 1972 Rural Development Act.<sup>6</sup> The NRI is a longitudinal database that includes 800,000 sampling points (See Table 1). From 1982 to 1997, the NRI data was collected every five years. Since 1997, the survey has been conducted annually, surveying a subset each year of the original sites sampled in the 1997 NRI.<sup>7</sup> The survey includes samples from non-Federal lands in the 48 contiguous states, and examines land uses, wetlands, and soil erosion. After 2007, the NRI survey added sites in Alaska, Puerto Rico, and Hawaii.

The Managers Report of the 2002 Farm Bill instructed USDA to undertake additional assessments of the Farm Bill conservation programs, a process that came to be called the Conservation Effects Assessment Project, or CEAP.<sup>8</sup> Assessments in CEAP are carried out at national and watershed scales on cropland, grazing lands, wetlands, and wildlife.<sup>9</sup> The three principal components of CEAP — the national assessments, the watershed assessment studies, and the bibliographies and literature reviews — contribute to building the science base for conservation. The CEAP process includes research, modeling, assessment, monitoring and data collection, outreach, and extension education. Some of the CEAP watershed-level work is focused on the linkages between adoption of conserving practices and economic performance at the farm or field level.<sup>10</sup>

The first CEAP national cropland assessment, conducted from 2003 to 2006, interviewed about 42,000 farmers to gather detailed information on production and conservation practices. A second nation-wide survey of farmers is scheduled for 2015 and 2016 which will interview about 45,000 farmers. Each of the interviews is linked to one of the 800,000 NRI sample points.

The Census of Agriculture began as a separate survey in 1840 that was conducted in conjunction with the Decennial Census through 1950, although mid-decade Censuses of Agriculture were conducted in 1925, 1935, and 1945.<sup>11</sup> All operators of U.S. farms<sup>12</sup> are required by law to fill out a Census survey; oversight of the Census of Agriculture process was housed at the Census Bureau within the U.S. Department of Commerce until 1992, when it was moved to the National Agricultural Statistics Service (NASS) at USDA. In the 2012 Census of Agriculture, 2.1 million farms were surveyed. The 2012 Census included questions on use of certain conservation practices for the first time. Farm-level data as defined under the Census of Agriculture do not necessarily match up with farm data as reported to USDA program agencies (FSA, RMA, or NRCS) for purposes of program participation. In addition, all Census data are self-reported, so may contain some measurement error.

USDA's Economic Research Service (ERS) and NASS jointly conduct an Agricultural Resource Management Survey (ARMS) aimed at collecting data on financial conditions, production practices, and resource management on U.S. farms. The ARMS has been conducted since 1996 — a predecessor, the Farm Cost and Return Survey, was initiated in 1982. Data are collected on production of key crops on a rotating basis on 30,000 farms each year. Variables included in ARMS that are relevant to this discussion are farmers' participation in conservation programs and their use of select conservation practices, such as crop residue management, cropping practices, cover crops, conservation structures such as buffers and water control features, and conservation plans.

## Measuring Private Benefits

Various agronomic studies in recent decades have shown that in general, using no-till cultivation and other conservation tillage practices tends to lead to higher crop yields.<sup>13,14,15</sup> Similarly, an analysis of U.S. yield impacts from cover crops during the 2012 drought crop year found that corn planted after cover crops had yields on average 9.6 percent higher than corn planted in fields without, and 11.6 percent higher for soybeans following cover crops.<sup>16</sup> While a compelling result, this SARE-CTIC study does represent only one year of data. However, while supporting the notion that adopting certain conserving practices are beneficial with respect to crop yields, most such studies are not sufficiently rigorous to justify basing economic incentives, either through public programs or private markets, on their results. One exception was a 2005 article published in the *Journal of Soil and Water Conservation*, which described a study conducted through field-scale tests in 7 states on the impact on yield and profit of adopting conservation tillage in growing cotton between 1998 and 2002. That study found consistently higher profit for utilizing no-till cultivation rather than other systems (in part due to reduced input costs), but not higher yields in every instance.<sup>17</sup> A 2003 article from the *American Journal of Agricultural Economics* found that corn farmers who adopted crop residue management practices (including conservation tillage) had consistently lower production costs per unit of output than did non-adopters.<sup>18</sup>

## Availability of Appropriate Data

No publicly available database which catalogues farm-level characteristics of the U.S. crop production sector includes all the variables which would be needed for a quantitative evaluation of the relationship between adopting conserving agricultural practices and agricultural productivity measures, such as yield and yield variability. However, it appears that many if not all of the key variables are contained in different datasets maintained

by various USDA agencies, collected primarily for the purpose of managing farm, risk management, and conservation programs established under the federal legislative process.

As a result, the issue of data and data integration has surfaced repeatedly during AGree's discussions, especially regarding data about conservation practices, soil health, crop yield, and crop yield variability. The capacity to merge existing USDA databases to assemble an integrated database suitable for evaluating these types of relationships has become a central focus of AGree's activities in this area.

A successful data integration effort along these lines could facilitate the following types of efforts:

1. Help make the business case to producers that adopting conservation practices is good for both the environment and their own farm's profitability;
2. Drive changes in the crop insurance program by better integrating the risk management benefits of conservation practices into ratings AND supporting an incentive-based approach through the development of new crop insurance policies or a better risk rating system through procedures established under Section 508(h) of the Federal Crop Insurance Act;
3. Inform the development or improvement of corporate sustainability standards; and
4. Support the development of nascent markets for carbon and ecosystem services.

## Existing USDA Program Databases

As part of administering various commodity support programs established in Title I of recent Farm Bills, USDA's Farm Service Agency (FSA) requires program crop farmers<sup>19</sup> receiving payments under the programs to submit an annual report detailing what crops are planted by area for each farm they operate to help the

agency determine payment eligibility and amount.<sup>20</sup>

This requirement was suspended after the passage of the Federal Agriculture Improvement and Reform (FAIR) Act of 1996 because no program payments were linked to current acres under that Farm Bill, and was reinstated by Congress in the Food Security and Rural Investment Act of 2002. The Census of Agriculture reports that 811,387 farms received federal commodity payments in 2012 (Table 1). This group accounts for about 40 percent of all farms tallied for the Census, but includes most of the commercial-sized operations, especially in the crop sector.

USDA's Risk Management Agency (RMA) provides oversight over the Federal Crop Insurance Program (FCIP), although the program's services are provided to farmers by private crop insurance companies operating under a Standard Reinsurance Agreement (SRA) with USDA that governs the program's delivery and the financial terms with the private companies, known as Approved Insurance Providers (or AIPs). In order to obtain insurance under the FCIP for their crops, farmers must provide multiple years of crop yield data for the various fields or units to be covered to their insurance company, which uses that data to calculate the farmer's Average Production History (APH) that determines the insured value (or guarantee) of the farmer's crop.<sup>21</sup> Those farm-level reports on crop acreage and crop production are transmitted by the AIPs to RMA for program management and policy verification purposes.<sup>22</sup> RMA maintains up to 10 years of data for each insured unit under the FCIP.

Over the last few years, RMA, FSA, and NRCS have made a concerted effort to develop a system to allow farmers who participate in both the commodity support and crop insurance programs to submit a single annual report to both USDA agencies addressing both their planted acres of crops and accompanying crop yields, simplifying the data submission process for farmers and establishing a common database across the two agencies. This process will require farmers to obtain a unique identification number (called a Data Universal Numbering System number, or DUNS number) to be assigned to their farm business from the commercial data firm Dun and Bradstreet to simplify data submission



to USDA agencies.<sup>23</sup> USDA may wish to expand that requirement to any survey data that farmers provide to federal agencies, such as to NASS for the Census of Agriculture or ARMS. Beginning in 2016, farmers will be required to file the new unified acreage and production report with data all specified to the Common Land Unit (CLU) level.

NRCS provides oversight for conservation programs intended to assist farmers in adopting conservation structures and practices for their working farmland. One of these programs, the Environmental Quality Incentives Program, or EQIP, was established as a modest-sized program (funded at about \$200 million annually) under the 1996 Farm Bill, and expanded significantly in the 2002 Farm Bill. As currently configured under the 2014 Farm Bill, the program receives \$1.35 billion annually, 60 percent of which is required to go to livestock producers for help with manure management and other aspects of their operations. With the remaining funds, NRCS provides cost-share and technical assistance to crop farmers who install conservation structures such as terraces or buffer strips on their cropland or adopt conserving practices such as conservation tillage or establishing fish or wildlife habitat. The agency maintains a record of those practices, established on 58 million acres of crop or pastureland between 2009 and 2012, in a database at the CLU level. Analyses of the data from about a decade ago raised questions about whether all practices contracted under EQIP had actually been installed or maintained, casting some doubt about the accuracy of the records,<sup>24</sup> but improvements have been made in the survey procedure since then.<sup>25</sup>

The Conservation Stewardship Program (or CSP), is another working lands conservation program conducted by NRCS, with more than 60 million acres enrolled in the program as of the passage of the 2014 Farm Bill.<sup>26</sup> Originally established as the Conservation Security Program under the 2002 Farm Bill, CSP provides cost-share and incentive payments to encourage farmers to adopt a suite of conservation practices on their farms. In part because of the whole farm multi-practice approach under CSP, NRCS has not developed a system to collect farm or field-level data about the practices adopted under CSP.

## Potential Approaches to Integrating Existing Databases

There are probably a couple of hundred thousand U.S. farmers who participate in commodity support, crop insurance, and the EQIP program and thus have farm or field-level data on their farms included in the separate FSA, RMA, and NRCS databases described above. If the relevant variables (crop yield, conservation practices, etc.) can be drawn together using data-mining applications or through a meta-analysis, that could be the core of a dataset that would serve the analytical needs of evaluating these relationships. It would also be helpful to include farmers in the database who have not incorporated or maintained conservation practices in their operations, to have some basis for comparing the yield effects of adoption versus non-adoption.

If there were a desire to expand the size of the dataset, it would be possible to identify an additional group of farmers who participate in farm and crop insurance programs and who have adopted conservation practices through participation in other federal programs, such as CSP, the Conservation Reserve Program (CRP), or the Conservation Reserve Enhancement Program (CREP), or who have adopted practices without participating in such programs but have received technical assistance for those new practices from one of the USDA program agencies. That pool of non-EQIP conservation adopters might be identified through their responses about use of conservation practices in the 2012 Census of Agriculture or the ARMS database. Then, USDA could undertake — directly through NASS or through a contract with an outside party — a supplemental survey of this pool of farmers to gather farm or field-level data about their use of such practices that would be comparable to that found in the EQIP database. Information from the supplemental conservation/risk management survey could then be combined with the constructed database described above.

In addition, either the smaller constructed database with EQIP participants or a survey-augmented database could be enriched by overlaying the observations onto

geo-positioned soil maps from SSURGO, allowing an analysis to incorporate the relationship between yield (and yield variability) and soil type as well as conservation practices in place. Similar steps might be taken with geo-referenced data from recent NRI surveys to incorporate soil erosion variables. Consideration should also be given to augmenting the constructed database with information from non-government sources, such as the survey data on tillage or use of cover crops collected by the Conservation Technology Information Center at Purdue University, or the extensive databases on farm-level weather and other characteristics maintained by companies such as The Climate Corporation or the alliance of diverse groups collecting information on sustainable agriculture under the Field to Market effort.<sup>27</sup>

For the future, USDA might be able to reconfigure the questions in the ARMS survey to query farmers more specifically about uses of some of these conservation practices, and rely upon the new standardized annual report being developed by the USDA program agencies to collect data on crop acreage and yield. Ideally, the agencies should collect the ARMS data in such a way as to be linkable with the USDA program dataset through a common farm identifying number, like the DUNS number, or for CLUs included in the farming operation.

## Analytical Issues and Constraints

With RMA limited to maintaining 10 years of yield data for the purpose of calculating an insured unit's Average Production History for crop insurance purposes, it is important to utilize as wide a pool of producers as possible in the constructed database so as to capture any variation in yield response resulting from the adoption of conserving agricultural practices.

Initial efforts should likely focus on a few conservation practices that are utilized across multiple regions of the country to generate more robust results from the analysis. To the extent possible, the conservation practices evaluated should be those whose effectiveness

does not vary greatly depending on the knowledge and/or skill of the practitioner.

Although this constructed dataset would consist largely of data submitted by farmers for USDA surveys or for participation in USDA programs, many of the potential applications for its use lie within the private sector. USDA agencies operate under very tight confidentiality rules for such farm-level data, so protocols would have to be developed if this constructed database is to be made available for analysis outside the Department in order to avoid disclosing confidential or proprietary features of farmers' operations.

In recent years, farmers have become much more sensitive about access to information they provide to the federal government through their program participation or responses to USDA surveys, especially after organizations critical of the sector gained access to farm-level program participation data through use of authority available under the Freedom of Information Act or through accidental disclosure by federal agencies. Farmers' concerns about safeguarding their privacy would have to be addressed in order for this project to move forward.

## Potential Applications for an Integrated Conservation/Yield Dataset

Discussions in the AGree process described above have largely focused on the potential use of this integrated dataset in developing a crop insurance product aimed at providing incentives for farmers to adopt conserving agricultural practices through various mechanisms available for private sector submission under the Federal Crop Insurance Act. If this dataset could be constructed and made accessible to outside groups, an analysis could be conducted which could quantitatively demonstrate a positive relationship between adoption of certain conservation practices and either increased yield or reduced yield variability. If

realized, a new crop insurance product or a modification to an existing product could be developed and submitted for consideration by the Board of the Federal Crop Insurance Corporation through one of three mechanisms.

The first option, laid out under Section 508(h) of the Federal Crop Insurance Act, allows submission by an outside party of a fully developed product to the Board. The Board, assisted by extensive reviews of the proposed product by external experts, can approve the proposal, thus making the new product available on the crop insurance market as a federally reinsured product, and making farmers who purchase the product eligible for premium subsidies. If approved, the submitting party would then be reimbursed for their expenses in developing the product. Alternatively, Section 522(b) of the Federal Crop Insurance Act also allows outside parties to develop a concept proposal for a new product for consideration by the Board. If the Board approves the concept proposal, that party can then receive payment in advance for at least half of the estimated cost of fully developing the product, the remainder to be reimbursed if the full product is eventually approved. The third option, available under Section 523(d) of the Act, allows a proposal to be submitted to the Board to provide an additional premium subsidy discount for farmers utilizing a specific practice or input, if the proposer can demonstrate that such practice or input lowers the risk of incurring an indemnifiable loss under their policy.

The first two avenues have been used quite frequently for submissions since they were first made available — through August 2014, 132 concept proposals had been submitted to the Board, and 50 full-blown crop insurance product proposals, some of which had started through the approval pipeline as concept proposals.<sup>28</sup> The Section 523(d) authority has been utilized only a few times successfully, most recently with the approval by the Board of an additional premium subsidy for farmers planting specific varieties of GMO corn seed, initially called the Biotech Yield Endorsement, or BYE, for the 2008 crop year for select pilot states. In 2009-11, the program was expanded to include farmers in all states

growing GMO corn seed, and then terminated for 2012, based on the widespread adoption of the technology.<sup>29</sup> This endorsement provided an additional premium discount for existing policies, rather than offering an entirely new product and is viewed by many analysts as the best model for providing an incentive for conservation practices under the federal crop insurance program. One such example might be continuous no-till cultivation — while the 2008 CTIC survey estimated that there were nearly 65 million acres under no-till cultivation, only about 6 percent of U.S. cropland is in continuous no-till.<sup>30</sup>

There are other potential uses for this dataset within the public sphere. For example, EPA oversees a federal procurement program that is designed to give priority to acquisition of goods and services that are ‘environmentally preferable’. For the purposes of this program, products or services that are environmentally preferable are defined as those that “have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.”<sup>31</sup> This program was established by President Clinton under Executive Order 12873 in 1993. Under the program, federal purchasers are supposed to calculate the costs and benefits of various ‘green’ products and services; if this constructed database were to be made available, it would be easier to quantify the benefits of purchasing food and agricultural products produced using conservation practices on the ground.

Similarly, USDA’s Agricultural Marketing Service (AMS) runs numerous programs certifying voluntary food labels that provide additional information to the consuming public, such as the breed of the animal from which the meat is sourced (Angus Beef Cattle), state of origin (Famous Idaho Potatoes), or animal production practice used (Free Range Chicken). A new program could be established certifying to the public that the grain sourced for a given product was produced through conserving agricultural practices.

More broadly, this dataset can help federal agencies with jurisdiction over environmental policy and programs document the impacts of a wide range of conservation practices on farm viability and/or environmental outcomes at the watershed level. This effort would help

provide concrete justification for existing federal or state programs, and also help set the stage for better functioning environmental markets that operate on the border between the public and private sectors.

## Environmental Markets

There have been markets for environmental goods or services in the United States in the past, although most of the successful uses of such mechanisms within the agricultural sector have been relatively narrow in scope. The first environmental market was a cap and trade system designed to reduce U.S. emissions of sulfur dioxide (SO<sub>2</sub>) from coal-fired power plants to reduce the incidence of acid rain, as authorized under the Clean Air Act Amendments of 1990. The SO<sub>2</sub> market was spectacularly successful — trading of SO<sub>2</sub> allowances helped to reduce annual emissions of that compound from 15.9 million tons in 1990 to 5.1 million tons in 2010.<sup>32</sup>

Another successful example of environmental markets has been efforts to offset destructions of existing wetlands in construction projects by creating, restoring, or preserving other wetland sites as an offset, allowed under wetland rules established by the U.S. Army Corps of Engineers in 2008. It is estimated that this market has annual activity valued between \$1.3 and \$2.2 billion, protecting about 24,000 acres per year.<sup>33</sup>

Within U.S. agriculture, potential environmental markets generally fall into one of three categories:

- Efforts to improve water quality, quantity, or temperature;
- Efforts to reduce CO<sub>2</sub> or other greenhouse gas (GHG) emissions; and
- Efforts to boost biodiversity and/or fish and wildlife habitat.

Such projects are typically based on a system under which certain entities are restricted by federal or state laws or regulations with respect to their pollution levels

(water, air, or GHG emissions), and those entities are allowed to ‘offset’ some portion of their pollution by paying other non-regulated entities to reduce their pollution levels instead. One such regional effort in the Northeastern United States, the Regional Greenhouse Gas Initiative (RGGI), was established in 2007. RGGI’s list of allowed offsets includes only manure management efforts to reduce methane emissions among its offset categories that are applicable to farming.<sup>34</sup> The California state government has also established a cap and trade system for greenhouse gas emissions which began in 2012. Owners of California farms or private forests are not considered covered entities under the system, but can generate offsets through methane capture or burning in livestock operations or through reforestation projects or improved forest management on their lands.<sup>35</sup>

The constructed database described in this paper could bolster environmental markets by helping participating entities with improved transparency in the market, if the underlying regulatory regime is appropriately configured.

## Bilateral Payment for Environmental Services

As part of the AGree discussions on these issues, information was solicited from organizations involved in bilateral transactions. For example, The Nature Conservancy partnered with local conservation districts in southwest Michigan in 2012 to develop a tool that calculates the groundwater recharge achieved by farmers’ adoption of new conservation practices. The calculator helps the Coca-Cola Company establish incentive payment levels for farmers undertaking the new practices.<sup>36</sup> The company will benefit by having cleaner water to source for its bottling facilities in the area.

A number of big corporations have undertaken similar efforts in encouraging sustainable practices on the part of their suppliers. As part of its Global Responsibility undertaking, the Walmart Corporation has established three aspirational goals in this area:

- Be supplied 100 percent by renewable energy;
- Create zero waste; and
- Sell products that sustain people and the environment.<sup>37</sup>

Through pilot programs, the company is working with major food suppliers in North America to contract with farmers to utilize conserving agricultural practices to grow their corn and soybeans, reducing fertilizer use and GHG emissions. If the constructed database becomes available and the resulting analysis supports the hypothesis of a positive relationship between conserving practices and yield, this program could enroll more farmers by being able to assure them that their new practices not only reduce fertilizer use and GHG emissions, but also improve their yields and reduce their yield variability. Since Walmart is the world’s largest grocery retail company, with grocery products accounting for 55 percent of the company’s nearly \$470 billion global sales in 2012, their role in encouraging these types of practices could be significant.<sup>38</sup>

***The potential benefits from this effort would extend into the private sector as well, by making it easier to accurately value the private benefits generated by such practices and open up new opportunities for additional revenue for farmers from environmental markets and markets for environmental services.***

## Concluding Remarks

Over the short term, it appears that the only way to assemble the type of dataset needed to rigorously evaluate the relationship between use of conservation practices and productivity measures, such as crop yield and crop yield variability, is to integrate and analyze data from existing agency sources. Over the longer term, steps are being taken to harmonize existing data collection by USDA program agencies, and more could be done to strengthen the focus on these matters within the regular surveys conducted by USDA. While such a project would require a considerable investment by several USDA agencies to complete, a successful effort would generate a substantial payoff in terms of an enhanced capability on the part of USDA and other federal departments to encourage adoption of conserving agricultural practices within the existing array of public policies and programs, an important asset in an era of

declining federal budgets. Privacy concerns of farmers whose data are collected as a result of their participation in USDA programs would have to be addressed.

The potential benefits from this effort would extend into the private sector as well, by making it easier to accurately value the private benefits generated by such practices and open up new opportunities for additional revenue for farmers from environmental markets and markets for environmental services.

If realized, the availability of this integrated database would represent a significant contribution to a key goal of the AGree process, by helping farmers and other stakeholder groups to improve the productivity, profitability, and environmental performance of agriculture.

**Table 1 | Relevant USDA Datasets**

Dataset	Agency	Dataset Collection Period	Frequency	Observations	Relevant Variables	Notes
National Resources Inventory (NRI)	Natural Resources Conservation Service (NRCS)	Started in 1977	Conducted at five-year intervals through 1997; now collected annually	800,000 sites when collected every five years; now cycle through 200,000 sites, 40,000 each year	Land use, wetlands area, irrigated area, rate of soil erosion (water and wind)	Farm-level survey data collected for NRI-CEAP projects in certain regions
Soil Survey Geographic Database (SSURGO)	NRCS	Data collected under the National Cooperative Soil Survey over the last 115 years	Frequency of updates varies by state	Data available at county or multi-county level; 3200 discrete surveys included	Soil type, slope, land suitability rating	Data can be accessed at field level in online Web Soil Survey (interactive map)
Crop acreage reports	Farm Service Agency (FSA)	Reporting requirement reinstated in 2002 Farm Bill	Program data collected annually	811,387 farms received government payments in 2012	Planted, prevented acreage by crop	All commodity program participants must submit report
Federal crop insurance program records	Risk Management Agency (RMA)	Farm level records up to 10 years	Policy information collected annually	3.58 million insured units in 2013	Yield history, size of insured units, crop insurance coverage levels	296.1 million acres insured in 2013 (54 million in pasture and rangeland)
Environmental Quality Incentives Program (EQIP) data	NRCS	Program established in 1996, expanded in 2002	Annual enrollment for up to ten-year contracts	151,589 contracts on 58.1 million acres; 2009-12	Conserving practices implemented	60 percent of funds reserved for livestock operations
Census of Agriculture	National Agricultural Statistics Service (NASS)	Census started in 1840	Conducted every five years; most recent in 2012	2012 Census tallied data for 2.1 million farms	2012 Census questions included select land use practices and fertilizer use by farm	Moved to NASS in 1992; previously housed at Census Bureau
Agricultural Resource Management Survey (ARMS)	Economic Research Service (ERS) and NASS	ARMS started in 1996	Collects data annually	5,000 fields, 30,000 farms each year	Conservation program participation, use of certain conservation practices	Survey rotates which crops are targeted each year

## Endnotes

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AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

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