

sharing the cost



Creating a Working Land
Conservation Trust Fund
Through a Tax on
Agricultural Inputs?

The Soil and Water Conservation Society (SWCS) is a nonprofit scientific and educational organization that serves as an advocate for conservation professionals and for science-based conservation policy. SWCS seeks to advance the science and art of soil, water, and related natural resource conservation to achieve sustainability. Members practice and promote an ethic that recognizes the interdependence of people and their environment.

SWCS has about 10,000 members around the world. They include researchers, administrators, planners, policymakers, teachers, students, farmers, and ranchers. Nearly every academic discipline and many different conservation institutions are represented within the membership.

Member benefits include the widely respected *Journal of Soil and Water Conservation*; representation in policy circles; opportunities for leadership and networking; and discounts on books and conference registrations.

SWCS chapters throughout the United States, Canada, and the Caribbean Basin conduct a variety of activities at local, state, and provincial levels and on university campuses. These 75 chapters represent the grassroots element of the organization. Each chapter elects its own officers, organizes conservation forums, and formulates local recommendations on land and water conservation issues.

ABOUT SWCS



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4	Executive Summary
7	Introduction
7	Why A Working Land Conservation Trust Fund?
	Secure Funding
	New Approaches
	Landcare Australia
	Federal Examples
	State Examples
	A Working Model
16	Taxing Inputs: Potential Revenue
	Overview of the U.S. Agricultural Sector
	Tax Options
	Estimated Revenues
23	Taxing Inputs: Incidence and Economic Effects
	Incidence of a Tax on Agricultural Inputs
28	Taxing Inputs: Design and Administration
	Tax Equity
	Tax Efficiency
	Administrative Simplicity
	Exemptions
30	Conclusion
32	References
33	Appendix I: Agricultural Industry Groups
	Agriculture, Forestry, Fishing, and Hunting
	Detailed Listing of the Industries in the U.S. Agricultural Sector
38	Appendix II: Description of the Input-Output (I-O) Model

CONTENTS

EXECUTIVE SUMMARY

This report explores the desirability and feasibility of creating a federal working land conservation trust fund through revenue generated by a tax on agricultural inputs. Three concerns led us to undertake this exploration:

- How do we create a sustainable, secure source of funding for conservation on agricultural land in the United States given the troubling future most experts predict for the U.S. federal budget?
- How do we focus enough conservation assistance to working farms and ranches to meet agriculture's environmental agenda and thereby ensure agriculture's commercial viability?
- How do we effectively empower producers themselves to take the lead in directing collaborative conservation activities on their operations, with their neighbors, and in their communities.

We examined existing U.S. federal and state conservation-based trust funds as models for a working land conservation trust fund. We also explored the Australian Landcare movement as an alternative model for producer-driven conservation on their operations. We used these examples and our own analyses to develop a working model of a working land conservation trust fund for the United States.

We concluded that a working land conservation trust fund could make a significant contribution to our nation's capacity to address agriculture's environmental agenda through collaborative, incentive-based, producer-driven approaches. Such a trust fund could fill important gaps in our current capabilities if it included the following components:

- Return tax revenue to same localities from which it came and in the same proportions in which it was generated.
- Match trust fund revenues with general taxpayer revenues—perhaps through a matching grant program that recognizes the public benefits that will accrue from such an initiative.
- Allocate trust and matching funds to producer groups—analogue to Australian Landcare groups—to support collaborative work on their operations and in their communities to improve environmental quality and ensure the commercial viability and sustainability of agriculture.
- Empower producer groups to determine how to use grant funds based on their own project plan. For example, producers could use funds to secure technical help for their members, hire a coordinator or other staff to support their project, or provide financial assistance to work group members to adopt, install, or maintain conservation and pollution prevention systems on their operations.

- Producer groups would be responsible for ensuring accountability to themselves and the public for use of the grant funds.

We also explored the feasibility of taxing agricultural inputs to generate revenue for the trust fund. We did not evaluate the tax based on its effect on reducing use of agrochemicals or other changes in producer behavior. Our goal was to get an indication of whether a relatively small tax on inputs could generate substantial revenues with relatively small economic effects.

We used a detailed input/output (I/O) economic model of the U.S. agricultural sector to estimate the amount of revenue that could be generated through a tax on agricultural inputs and to simulate the economic effects of such a tax. We analyzed six options beginning with a narrow tax base—fertilizers and chemicals used in agricultural production only. We then analyzed the effect of broadening the tax base in two directions, first, by adding purchases of seeds and new machinery to the tax base and, second, by applying the tax to all users of the taxed commodity.

SUMMARY OF TAX OPTIONS EXPLORED

Option	Agricultural Sector			Non-Agricultural Sector (Including Household Use)		
	Fertilizers & Chemicals	Seeds	Machinery	Fertilizers & Chemicals	Seeds	Machinery
1	X					
2	X			X		
3	X	X				
4	X	X		X	X	
5	X	X	X			
6	X	X	X	X	X	X

We found that a relatively small tax on agricultural inputs could generate enough revenue to fund an effective working land conservation trust fund. The 5 percent tax we analyzed has the potential to generate between \$1 billion and \$2.7 billion annually over the next several years, depending upon the tax base employed and the industries subject to the tax. Grants flowing from such a trust fund could more than double the funding for working land conservation made available under the 2002 farm bill.

ESTIMATED ANNUAL REVENUES FROM A TAX ON AGRICULTURAL INPUTS

Option	Description	Annual Revenues (\$ Millions)
1	Fertilizers & chemicals only/agricultural use only	\$1,030
2	Same as option 1, but use by all industries	\$1,590
3	Fertilizers & chemicals, plus seeds/agricultural use only	\$1,250
4	Same as option 3, but use by all industries	\$1,930
5	Fertilizers & chemicals, seeds and machinery/agricultural use only	\$1,890
6	Same as option 5, but use by all industries	\$2,690

The economic effects of such a tax appear to be small—at the *industry* scale. Effective tax rates do not exceed 1 percent for any of the industries analyzed in our I/O model. For most industries, effective tax rates are well below 0.5 percent. We did not, however, estimate the economic effects of such a tax at the *farm* or *ranch* scale. Those effects could be larger and would surely be much more variable. Understanding those effects would be a critical next step in evaluating the feasibility and desirability of creating a working land conservation trust fund.

This report is exploratory. Our findings are, for the most part, preliminary. Our hope is that this report will lead to more discussion and more focused evaluation and analyses of the advantages and disadvantages of a federal working land conservation trust fund. Our analysis suggests to us, however, that more detailed and serious work is merited that could lead to the creation of a working land conservation trust fund. The uncertainties of federal conservation funding given current projections for the federal budget, coupled with the importance of making progress on agriculture’s environmental agenda, suggest that such work should be undertaken with some urgency.

This report explores the desirability and feasibility of creating a federal working land conservation trust fund through revenue generated by a tax on agricultural inputs. Three concerns led us to undertake this exploration:

- How do we create a sustainable, secure source of funding for conservation on agricultural land in the United States given the troubling future most experts predict for the U.S. federal budget?
- How do we focus enough conservation assistance on working farms and ranches to meet agriculture's environmental agenda and thereby ensure agriculture's commercial viability?
- How do we effectively empower producers themselves to take the lead in directing collaborative conservation activities on their operations, with their neighbors, and in their communities.

The Soil and Water Conservation Society (SWCS) undertakes activities related to public policy for two purposes. The first purpose is to bring conservation science and the professional judgment of conservationists to bear on pressing policy issues of the day. The second purpose is to stimulate discussion and debate on important issues that may shape conservation policy in the future.

This report is intended to serve the second purpose. Our objective is to explore one possible approach to addressing the three concerns outlined above. The report explores (1) the rationale and advantages of a working land conservation trust fund and (2) the revenue potential and likely economic impact of a tax on agricultural inputs to finance the conservation trust fund. This report is exploratory. Our findings are, for the most part, preliminary. Our hope is that this report will lead to more discussion and more focused evaluation and analyses of the advantages and disadvantages of a federal working land conservation trust fund.

Environmental performance today is a key determinant of the commercial viability of important sectors of agriculture. Producers operating animal feeding operations or irrigating cropland or pasture already are facing fundamental questions about the environmental and commercial sustainability of their operations. Most producers will face that same question in the near future. The reason agriculture's environmental agenda is so large is not because agriculture is bad, but rather because agriculture is so big and complex.

INTRODUCTION

WHY A WORKING LAND CONSERVATION TRUST FUND?

Consider the following:

- More than half of all the land in the United States is managed as cropland, pasture, or rangeland.
- Nearly 90 percent of all precipitation that falls on the contiguous United States falls on privately owned agricultural or forestland before it runs into our streams, lakes, or underground water.
- More than 60 percent of agricultural production, by value, is produced in metropolitan counties or counties adjacent to metropolitan counties.

It should be no surprise that agriculture has powerful effects on the environment given its scope and dominance over much of the U.S. landscape.

Clearly, the environmental agenda looms large in agriculture's future. Meeting that agenda has important implications for conservation efforts in the United States. A secure, long-term source of funding and new approaches to working with producers will be needed. A working land conservation trust fund could be designed to achieve both of these objectives. A stable source of funding and new approaches that put producers themselves in charge of conservation programming will be essential to meeting the environmental agenda—and are the rationale for exploring the feasibility of a working land conservation trust fund.

SECURE FUNDING

Thankfully, the Farm Security and Rural Investment Act of 2002 (FSRI 2002)—popularly known as the 2002 farm bill—increased funding for conservation programs by an estimated \$17.1 billion over 10 years. As important, most of that 80 percent increase in conservation funding is scheduled to go to programs that support conservation and environmental management on working land. Two conservation programs in particular—the Environmental Quality Incentives Program (EQIP) and the Conservation Security Program (CSP)—could boost efforts to help producers implement management-intensive conservation and pollution prevention systems on their farms and ranches.

The funding provided by FSRI 2002 for conservation programs is a major step forward, but there are reasons for concern.

The Congressional Budget Office (CBO) is projecting deficits in the federal budget through 2007. Federal budget pressure could easily prevent the funding provided by FSRI 2002 from being fully realized. Funding for CSP already has been cut to fund farm disaster payments, and EQIP funds have been diverted to support implementation of other

conservation programs. Conservation programs are on the cutting board now. The pressure to cut more will be intense in the coming years.

Implementation of management-intensive conservation and pollution prevention systems on working land is only one of a multiplicity of objectives for farm bill conservation programs. Even with full funding, the funds available to support these efforts could be small. About 20 percent of EQIP funds, for example, were used to support management practices from fiscal year 1997 through the first quarter of fiscal year 2002 (USDA/NRCS Personal Communication).

Finally, FSRI 2002 does little to encourage the collaborative, project-based work that will be essential to meeting agriculture's environmental agenda.

In short, FSRI 2002 is a good first step toward meeting agriculture's environmental agenda. FSRI 2002 alone, however, will not be enough.

Our nation's approach to incentive-based conservation efforts will need to change to meet agriculture's environmental agenda. Conservation efforts will need a much greater emphasis on (1) intensive management of our most productive land rather than retiring marginal land from production, (2) collective action among producers operating farms and ranches in hydrologically or environmentally sensitive locations, and (3) putting producers themselves in charge of project-based, collaborative efforts.

Intensive Management of Working Land

Most of agriculture's environmental challenges and opportunities are linked to the way our best and most productive land is managed. When soil erosion was the major concern, we could make progress by retiring marginal or highly erodible land from production. Air and water pollution and often wildlife habitat, however, are closely associated with our best agricultural land—land we want to keep in production rather than retire.

Sophisticated nutrient management, tillage by prescription, intensive rotational grazing, managing water in the soil profile, and taking full advantage of the soil as a partner in production and pollution prevention—rather than taking marginal land out of production—will be the most important answers to agriculture's environmental agenda. These solutions demand more management attention, better tools to inform and facilitate the adjustment

NEW APPROACHES

of production systems in real-time, and far greater understanding of the interactions of soil, water, and agricultural production systems. In most cases, successful implementation of these systems can reduce costs of production and input use. In some cases, however, such systems increase risk because they depend upon an ability to recognize the need to take action at critical points in the growing season. In nearly all cases, they demand more management time and attention from producers.

Building producers' capacity to manage the opportunities and risk of such management-intensive systems could be a primary purpose of a working land conservation trust fund. Specifically, the trust funds could be used to supply producers with the education, technical assistance, information systems, and risk management tools they will need to meet the environmental agenda they face.

Collective Action in Key Locations

Tangible improvement in environmental quality can only be achieved if a critical mass of producers within a particular geographic area implement and maintain the key conservation practices and systems that will, in the aggregate, produce clean air and water, more wildlife, and a better quality of life. The environmental agenda will put a premium, then, on focusing effort and money to achieve a critical mass of conservation in key locations and on intensively treating key components of the landscape.

The trust fund could support projects based on collaborative efforts among groups of producers who, working together, can produce major gains in environmental quality and ensure the commercial viability of their operations.

Putting Producers in Charge

Producers' knowledge, commitment, and willingness to work together are the keys to meeting agriculture's environmental agenda. Putting producers directly in charge of how trust fund resources are used in their local area would seem to be an effective way to ensure the knowledge, commitment, and willingness to work together.

Government programs usually seek input from producers on program design and priorities. But public program-driven conservation—funded with taxpayer dollars—brings with it an appropriate concern for public accountability for how taxpayer dollars are spent. The demand for accountability leads to a larger role for government in decision-making in

publicly funded conservation programs. Producers also find it difficult to compete effectively in leadership with paid staff from agencies and organizations in committees and other venues used to solicit ideas from stakeholders. As a result, producers tend to react to program opportunities, rules, and regulations. If those rules and regulations are a good match with the producer's operation, then he or she participates.

The Australian Landcare movement is an example of a different model for conservation on agricultural land. Landcare began in Australia as a locally led community movement that brought individuals, interest groups, and governments together in an attempt to solve important natural resource management problems at the local level. At the outset, handfuls of farmers organized themselves to solve a conservation problem in their local watershed or community and, in the process, achieve greater economic and environmental sustainability. Today, more than 4,500 landcare and related community groups have been formed across Australia. About 40 percent of all farmers in the country participate in a local landcare group (see sidebar for more details on Landcare in Australia).

LANDCARE AUSTRALIA

Agricultural and conservation interests in Australia have created an interesting model for a working land conservation trust fund in the United States. In response to expanding land degradation problems, the National Farmers Federation and the Australian Conservation Foundation in 1989 lobbied the Australian government to support an emerging community movement called landcare. The federal government subsequently declared the 1990s as the "Decade of Landcare" and committed funds to landcare projects.

Landcare began in Australia as an autonomous community movement. The purpose of the movement was to bring individuals, interest groups, and governments together in an attempt to solve important natural resource management problems at the local level. At the outset, the movement was almost exclusively agricultural based. Handfuls of farmers here and there throughout the country organized to solve a conservation problem in their local watershed or community and, in the process, achieve greater economic and environmental sustainability.

Landcare has since evolved into a much broader range of activities involving rural and urban interests alike. City landcare groups work to protect remaining areas of natural vegetation. Schools have introduced landcare as a way to educate young people about environmental protection. Rural landcare groups seek to adopt better farming practices and protect natural areas. Coastal landcare groups seek to protect dunes and estuaries. Businesses support landcare by funding on-the-ground projects and public education activities.

Today, more than 4,500 landcare and related community groups have been formed across Australia. About 40 percent of all farmers in the country participate in a local landcare group. A recent trend among the groups is the creation of regional networks, which increasingly are spawning activities on larger watershed or river basin scales.

Over the years, a public and private infrastructure has been put in place to support landcare. The Australian Landcare Council is the government's key advisory body on natural resource management issues. A national landcare

facilitator, regional facilitators, community facilitators, and local landcare coordinators, all of whom are trained appropriately, support the activities of local landcare groups nationwide. This support encompasses organization, funding, and the acquisition of technical assistance. Grants typically are made to landcare groups, not individual group members. The group then decides how the funds are distributed among individual members to address a particular conservation problem.

The Australian government's initial commitment of funds for landcare received a substantial boost in 1996 with creation of the Natural Heritage Trust. Proceeds from the sale of a government-owned telephone company were placed in the trust that was dedicated to conservation efforts that would achieve restoration, protection, and sustainable use of the country's natural resources.

The Natural Heritage Trust is administered by the Natural Heritage Board, with advice and counsel from a Natural Heritage Trust Advisory Committee. Partnership agreements with the states and territories identify what activities are funded by the trust and who is responsible for doing what in administration of the granting process. Trust funds are used to address five environmental themes: land, vegetation, rivers, coasts and marine, and biodiversity.

The trust began in 1997 with a commitment of \$1.25 billion (\$1.00 Australian equals 50-65 cents in U.S. currency) over five years. In 2001, the government pledged an additional \$1 billion to extend the trust over a further five-year period, \$350 million of which is earmarked for water quality improvement activities.

Grants are made from the trust to state or territory and regional institutions for regional projects and through a small grants program (Envirofund) to local landcare groups. The grants to local landcare groups typically range from \$500 to \$30,000, but networks and other larger bodies might receive amounts of \$50,000 to \$200,000, sometimes for more than one year, depending upon the quality and scale of the project. This often requires enhanced management skills.

Some funding for landcare group projects also is available from Landcare Australia, a nonprofit corporation that was created in 1989, about the time the Australian government made its "decade of landcare" declaration. Landcare Australia's mission is to create greater public awareness in the country of the need for sustainable use of natural resources.

The organization, which maintains a close relationship with the Australian Landcare Council and the National Landcare Facilitator Program, works largely with corporate interests in support of the landcare movement. A substantial portion of its multimillion-dollar annual budget is used for public media activities, National Landcare Week, National Landcare Awards, and special promotions.

Such a model would have advantages for driving efforts to meet the environmental challenge on working land. A working land trust fund could provide grants directly to groups of producers who have organized themselves to solve a particular environmental problem in their local area. Those producer groups could use the grant funds to acquire the right mix of technical assistance from public or private sources, provide financial assistance for members of the group to make the changes in their production and conservation systems needed to enhance the environment, or for any other purpose the group thinks will help solve the problem. Producer groups would have full flexibility to develop their own program because

they would be using “their own money,” not taxpayers’ money, if the trust fund revenue were generated from a tax on agricultural inputs. Producers organized around a project they design to solve a particular problem would spark the collective action so essential to addressing successfully agriculture’s environmental agenda.

The federal wildlife and fisheries restoration funds are the best existing examples of using federal excise taxes to raise funds for conservation purposes. The Pittman-Robertson Act (1937) and the Dingell-Johnson Act (1950) created federal programs that provide funds to state agencies for conservation and education purposes. Each is funded by means of an excise tax on hunting and fishing equipment. Funds are disbursed in such a way as to ensure that those who pay the tax are the chief beneficiaries of the programs the revenues are intended to support.

Pittman-Robertson Act (1937)

Known officially as the *Wildlife Restoration Projects Fund*, the Pittman-Robertson Act was signed by President Franklin Roosevelt in 1937 to encourage conservation through land and water management. Revenues are collected from a tax on sporting arms and ammunition and deposited in a trust fund. Under current law, firearms, ammunitions, and archery equipment are subject to a tax of between 10 and 11 percent, depending upon the type of equipment. Revenues generated from the tax total about \$250 million per year and fund wildlife restoration projects and programs in all 50 states.

One-half of the tax is dedicated to wildlife restoration and one-half is for hunter education and safety programs. The tax is collected by retail establishments on the purchase of the taxed items and administered by agencies of the United States Treasury: the Division of Alcohol, Tobacco and Firearms (ATF) and the Internal Revenue Service (IRS). Amendments to the original act in 1970 further defined and extended the definition of “wildlife restoration” to cover maintenance and management of wildlife areas and acquisition or rehabilitation of new areas. Revenues from the tax are disbursed to states using a formula based on:

- The land area in the state (one-half of the allocation).
- The number of hunting and fishing licenses issued in the state (one-half of the allocation).

In addition, the formula mandates that no state will receive more than 5 percent of the revenues and no state will receive less than 0.5 percent. State funding for hunter safety and education programs is determined under a separate allotment formula that is based on

FEDERAL EXAMPLES

population, with no state receiving more than 3 percent or less than 1 percent of the funds.

Dingell-Johnson Act (1950)

The Sportfish Restoration Act of 1950 created a new federal program modeled after the Pittman-Robertson Act, but directed at the conservation, management, and restoration of fishery and aquatic resources. As originally implemented, the act imposes a tax on fishing equipment. The tax is collected at the point of sale and administered by IRS. Subsequent amendments to the act in 1984 broadened the items covered by the tax and created the Aquatic Resources Trust Fund—a separate funding mechanism for water-use management and restoration activities. Outlays for the program were about \$330 million in the most recent fiscal year.

The fund reimburses qualified state programs for 75 percent of the cost of conservation projects. Only state agencies are eligible for cost-sharing, and those agencies must apply to the program to receive those funds. The allocation formula used to disburse funds to states is based on:

- The number of fishing licenses issued in the state (60 percent of the allocation).
- The land area of the state (40 percent of the allocation).

The apportionment formula stipulates that no state is to receive more than 5 percent of available funds or less than 1 percent.

Taken together, Pittman-Robertson and Dingell-Johnson provide a secure funding base for conservation, land and water management, education, and restoration. What is remarkable about these two programs is their almost universal acceptance among the taxed community, their effectiveness in providing local solutions to environmental problems, and their broad public support.

STATE EXAMPLES

Many states have created programs that use fees or taxes to generate revenue used for conservation and environmental protection purposes. Many states also use tax credits to encourage similar activities. Programs in Iowa and Nebraska are particularly interesting examples for purposes of this report.

Nebraska uses pesticide registration fees to fund conservation programs, including installation of conservation buffers, control of noxious weeds, and water quality improvement

projects. Fees are collected on about 8,500 products registered in the state each year. Manufacturers of specialty products, such as flea and tick collars and household products, pay a fee of \$135 annually. Manufacturers of nonspecialty products, such as the bulk pesticides used on farms and ranches, pay a fee of \$200 annually. Sixty dollars of each registration fee is allocated to the buffer program. Another \$30 of each fee funds the state noxious weed program. The balance of the fees paid to register nonspecialty products ($\$200 - \$60 - \$30 = \110) is allocated to natural resource districts for water quality improvement projects. The balance of the fees paid on specialty products ($\$135 - \$60 - \$30 = \45) is used by the State Department of Agriculture for program administration. Interestingly, these conservation activities were initially funded through a tax on fertilizers. Authority for the excise tax, levied per ton of fertilizer, recently expired. Rather than reauthorizing the excise tax, Nebraska increased its pesticide registration fees to compensate for the lost fertilizer tax revenue. In fact, pesticide registration fees have been raised twice in the past four years to fund conservation-related programs. Currently, those registration fees generate about \$1.3 million annually for conservation activities.

The Iowa program combines an excise tax on nitrogen fertilizer with pesticide registration fees to create a fund used to support conservation activities in the state. The fertilizer tax is 75 cents per ton, which equates to .00046 cents per pound of nitrogen, assuming a ton of fertilizer contains about 82 percent nitrogen. The fertilizer tax and pesticide registration fees have generated between \$3.4 million and \$4.0 million annually for conservation activities. In 2001 the fertilizer tax generated \$913,000, while pesticide registrations generated \$2.7 million, for a total of \$3.6 million. The Leopold Center for Sustainable Agriculture receives 35 percent of the pooled fund to support research, education, and assistance programs for farmers and ranchers in Iowa. The remainder of the fund supports a solid waste program at Northern Iowa University and the agricultural health program at the University of Iowa.

Insights from model programs in the United States and Australia, coupled with our understanding of the components needed for an effective working land conservation initiative, suggest that a working model of a conservation trust fund could include the following provisions:

- Return tax revenue to the same localities from which it came and in the same proportions in which it was generated.
- Match trust fund revenues with general taxpayer revenues—perhaps through a matching grant program that recognizes the public benefits that will accrue from such an initiative.

A WORKING MODEL

TAXING INPUTS: POTENTIAL REVENUE

- Allocate trust and matching funds to producer groups—analogue to Australian Landcare groups—to support collaborative work on their operations and in their communities to improve environmental quality and ensure the commercial viability and sustainability of agriculture.
- Empower producer groups to determine how to use grant funds based on their own project plan. For example, producers could use funds to secure technical help for their members, hire a coordinator or other staff to support their project, or provide financial assistance to work group members to adopt, install, or maintain conservation and pollution prevention systems on their operations.
- Producer groups would be responsible for ensuring accountability to themselves and the public for use of the grant funds.

Economists and environmentalists have recently focused more attention on the role that targeted taxes might play in environmental policy. In most cases, such targeted taxes are proposed to compensate for the failure of traditional markets to properly account for the full social costs of activities and processes that harm the environment. For example, a manufacturing plant may use a pollution-producing production process because the plant does not have to pay for the environmental damage caused by disposing of its waste air or water. Economists refer to this dynamic as an “externality.” The true cost of production—including the cost of pollution—is not reflected in the final price of the product. Imposing a tax on the inputs that cause the pollution or on the quantity of pollution itself is a way to bring the market price of the goods produced in line with the full social costs of producing those goods. The primary goal of such taxes is to change behavior, and taxes should be high enough and targeted enough to produce the change in production processes needed to reduce pollution.

In our case, however, the primary purpose of the tax is to raise sufficient revenue for an effective trust fund rather than to affect directly the way producers use the taxed inputs. The goal is to raise sufficient revenue with as little economic effects as possible. Our analysis focused on preliminary estimates of the revenue potential, incidence, and economic effects of such a tax. We did not evaluate the tax based on its effect on reducing use of agrochemicals or other changes in producer behavior. Our goal was to get an indication of whether a relatively small tax on inputs could generate substantial revenues with relatively small economic effects.

Agriculture in the United States involves a diverse mix of industries. The U.S. Bureau of Economic Analysis (BEA) breaks down the agricultural sector into 21 industry groups. Table 1 lists those groups and their contribution to total economic output in the agricultural sector. Total output in 1996 was almost \$300 billion. Two industries—meat animals and feed grains—accounted for more than 35 percent of that total output. Industries in the agricultural sector are interrelated. Much of the output from the feed grain industry, for example, is used in producing meat animals for consumption. These interrelations mean that a tax on agricultural production inputs is likely to affect indirectly all agricultural sectors. These effects may not be immediately apparent in an analysis of aggregate statistics. An input/output model of the U.S. agricultural sector was used to simulate these interactions while estimating the revenue that could be generated by a tax on agricultural inputs.

OVERVIEW OF THE U.S. AGRICULTURAL SECTOR

TABLE 1: STRUCTURE OF THE U.S. AGRICULTURE SECTOR, BY INDUSTRY.

	Total Industry Output, 1996	
	Millions of Dollars	Percent
Dairy farm products	23,327	7.9%
Poultry and eggs	17,328	5.8%
Meat animals	54,627	18.4%
Miscellaneous livestock	3,451	1.2%
Cotton	6,299	2.1%
Food grains	12,756	4.3%
Feed grains	50,458	17.0%
Grass seeds	722	0.2%
Tobacco	4,062	1.4%
Fruits	11,474	3.9%
Tree nuts	2,086	0.7%
Vegetables	16,047	5.4%
Sugar crops	2,952	1.0%
Miscellaneous crops	1,031	0.3%
Oil bearing crops	18,494	6.2%
Forest products	3,022	1.0%
Greenhouse and nursery products	13,672	4.6%
Forestry products	8,540	2.9%
Commercial fishing	8,908	3.0%
Agricultural, forestry, and fishery services	16,911	5.7%
Landscape and horticultural services	20,465	6.9%
Total, All Agriculture	296,633	100%

TAX OPTIONS

Determining the appropriate base on which to levy a tax would be among the most fundamental issues confronting policymakers who might consider creating a working land conservation trust fund. The experience and theory behind environmental taxes would suggest that the tax be applied to those inputs that have the most direct effect on environmental quality. Fertilizers, pesticides, and other agrichemicals are obvious candidates for inclusion in the tax base because their use and management is closely tied to air and water quality. Effective management of these inputs also is critical to sustaining the productivity of working land. Including seeds and machinery used in agricultural production are obvious choices if the goal is to expand the tax base and potential stream of revenue to a working land conservation trust fund.

In this study, we analyzed six options to estimate the potential for generating revenue from a small tax on agricultural inputs. Those six options enabled us to estimate potential revenue beginning with a narrow tax base—fertilizers and chemicals used in agricultural production. We then analyzed the effect of broadening the tax base in two directions, first, by adding purchases of seeds and new machinery to the tax base and, second, by applying the tax to all users of the taxed commodity. The six options we analyzed are outlined in Table 2.

TABLE 2: SUMMARY OF TAX OPTIONS

Option	Agricultural Sector			Non-Agricultural Sector (Including Household Use)		
	Fertilizers & Chemicals	Seeds	Machinery	Fertilizers & Chemicals	Seeds	Machinery
1	X					
2	X			X		
3	X	X				
4	X	X		X	X	
5	X	X	X			
6	X	X	X	X	X	X

There are two kinds of taxes on commodities—taxes that are proportional to the price paid (ad valorem taxes) and taxes that relate to the quantity purchased (excise taxes). Most consumption taxes are ad valorem taxes. The most common ad valorem taxes are the general sales taxes levied by most states. Excise taxes, however, are also important

sources of state revenue, and most federal consumption taxes are excise taxes. The most significant federal excise taxes are those on gasoline (per gallon), cigarettes (per pack), and alcohol (per gallon, usually).

Prudent tax administration may favor one type of tax over another. Revenues from ad valorem taxes will tend to rise with the overall increase in the price level, insuring a revenue stream that is constant in real terms. Revenue from excise taxes, on the other hand, will only increase if use of the taxed good increases. Excise taxes seem to be a more popular choice for environmental taxes where the objective is to discourage the level of consumption of the taxed good.

Effective tax administration also seeks to ensure that commodities (or income) are only taxed once. This is difficult to accomplish in practice. General sales taxes, for example, are normally levied only at the retail level. Purchases made by businesses as part of their production processes are normally exempt. Most states explicitly exempt agricultural production inputs from the general sales tax base, lowering the effective tax rate for the agricultural sector.

We chose to explore the effects of a 5 percent ad valorem tax in this report. A 5 percent tax seems roughly in line with most state sales taxes, and it is somewhat lower than the tax rates imposed under the Wildlife Restoration Act.

Given the exploratory nature of this analysis, we estimated revenues for a single, representative year in the near future. This approach allowed us to compare results from different options in a common framework. We ignored differences in timing that would result as alternative assumptions are made regarding when the tax may be imposed. Additionally, we assumed that farmers have sufficient time to plan for the tax and make adjustments in their production plans. This “fully phased-in” convention is typical in tax policy analysis.

We constructed a detailed input/output model (I-O) of the U.S. economy to simulate the revenue effects of the tax. An I-O model is useful because it describes the structure of production and the interconnections that exist among industries. In addition, the I-O model allows for the calculation of the feedback effects of a tax as it is passed along in the form of higher prices across all industries using the taxed commodity directly, as well as the indirect effects that show up as the tax affects the prices of other goods in the system. We describe our I-O model in more detail in Appendix II.

ESTIMATED REVENUES

TABLE 3: ESTIMATED ANNUAL REVENUES FROM A TAX ON AGRICULTURAL INPUTS

Option	Description	Annual Revenues (\$ Millions)
1	Fertilizers & chemicals only/agricultural use only	\$1,030
2	Same as option 1, but use by all industries	\$1,590
3	Fertilizers & chemicals, plus seeds/agricultural use only	\$1,250
4	Same as option 3, but use by all industries	\$1,930
5	Fertilizers & chemicals, seeds and machinery/agricultural use only	\$1,890
6	Same as option 5, but use by all industries	\$2,690

The I/O model estimates of revenue from a 5 percent tax are presented in Table 3 for each of our six tax options. These estimates indicate that a 5 percent tax on agricultural inputs has the potential to raise between \$1 billion and \$2.7 billion *annually over the next several years*, depending upon the tax base employed and the industries subject to the tax.¹

Revenue estimates are sensitive to assumptions made regarding the effect of the tax on reducing use of the taxed good. Economists use a factor called the price elasticity of demand to estimate the magnitude of this effect. We assumed a price elasticity of -2.0 for agricultural inputs. An elasticity of -2.0 means that a 5 percent increase in the price of an agricultural input caused by a 5 percent tax will cause a 10 percent reduction in use of the taxed input. This assumption is on the high end of the consensus view among industry specialists. Assuming larger elasticities results in lower estimates of revenue generated because less of the taxed input is purchased after the tax goes into effect. For example, assuming an elasticity of -5.0 produced estimates of annual revenue about 17 percent lower than reported in Table 3.

The amount of revenue generated varies considerably among states because the amount of taxed commodities used varies among states. The funding allocated to states from the working model of the trust fund described earlier also would vary considerably. A gross estimate of the distribution of trust fund revenues among states is given in Table 4. Funding flowing to states each year ranges from less than \$1 million to two states under option 1 to \$122 million for one state under option 3.

¹ These figures represent revenues flowing into the trust fund. For federal budget score-keeping purposes, the increase in federal tax receipts would be somewhat lower to account for the fact that taxes are deductible from income. Generally speaking, the net change in receipts would be reduced by about 25 percent.

We relied on state-level estimates of inputs into the agricultural production process from the 1997 *Census of Agriculture* to generate Table 4. We had to confine our analysis to options 1 and 3 because state-by-state data for all U.S. industries were not available. We simply allocated the revenues collected from the tax according to the percentage of total production costs accounted for by each of the taxed commodities. For example, the fraction of each state's usage of agricultural fertilizer and chemicals in agricultural production in relation to the U.S. total was used to allocate the revenues under option 1.

TABLE 4: ESTIMATED ANNUAL ALLOCATIONS FROM THE TRUST FUND, BY STATE, COMPARED TO FISCAL YEAR 2003 EQIP ALLOCATIONS

State	Estimated Annual Trust fund Allocation (\$ millions)		EQIP Annual Allocation— Fiscal Year 2003 (\$ millions)
	Option 1	Option 3	
ALABAMA	11	12	11
ALASKA	*	*	1
ARIZONA	9	10	14
ARKANSAS	27	31	13
CALIFORNIA	102	122	49
COLORADO	12	16	26
CONNECTICUT	1	2	2
DELAWARE	2	3	3
FLORIDA	42	50	16
GEORGIA	25	28	12
HAWAII	3	3	2
IDAHO	22	25	18
ILLINOIS	76	94	12
INDIANA	69	90	8
IOWA	69	90	14
KANSAS	36	42	20
KENTUCKY	16	19	9
LOUISIANA	18	20	11
MAINE	2	3	4
MARYLAND	6	7	5
MASSACHUSETTS	1	2	3
MICHIGAN	26	33	18
MINNESOTA	54	69	19
MISSISSIPPI	19	21	12
MISSOURI	35	41	15
MONTANA	12	13	19
NEBRASKA	43	55	20
NEVADA	1	1	4

State	Estimated Annual Trust fund Allocation (\$ millions)		EQIP Annual Allocation— Fiscal Year 2003 (\$ millions)
	Option 1	Option 3	
NEW HAMPSHIRE	*	1	2
NEW JERSEY	3	5	3
NEW MEXICO	3	4	16
NEW YORK	10	14	10
NORTH CAROLINA	26	31	13
NORTH DAKOTA	31	37	14
OHIO	34	44	10
OKLAHOMA	14	15	14
OREGON	16	19	18
PENNSYLVANIA	11	16	9
RHODE ISLAND	*	*	1
SOUTH CAROLINA	10	11	7
SOUTH DAKOTA	22	28	14
TENNESSEE	15	18	9
TEXAS	52	60	58
UTAH	2	3	15
VERMONT	1	1	3
VIRGINIA	11	13	9
WASHINGTON	26	30	13
WEST VIRGINIA	1	1	5
WISCONSIN	26	33	13
WYOMING	2	3	11

* Less than \$1 million

Revenues of the magnitude estimated in Tables 3 and 4 would double or triple the amount of conservation funding for working land that FSRI 2002 authorized. EQIP, for example, is scheduled to reach its peak annual funding of \$1.3 billion in 2007—about the same amount of annual revenue projected for Option 3. Revenue projected under Option 6 would be about twice the peak annual funding levels authorized for EQIP. The percentage increase in funding available for management-intensive pollution prevention systems would be much larger.

Fiscal year 2003 allocations of EQIP funds to states are shown in Table 4 for comparison with our gross estimates of allocations to states from a trust fund. Allocations from the trust fund would double funding going to most states through EQIP. Several states would experience very large increases in funding.

In sum, a small tax on agricultural inputs appears to have the potential to generate a substantial amount of funding for a working land conservation trust fund.

Our preliminary estimates indicate that a tax on agricultural inputs could effectively fund a working land conservation trust fund. The incidence and economic effects of such a tax, however, would need to be well understood before decisions could be made on the wisdom of proceeding with an input tax. Although a full analysis of these effects was beyond the scope of this exploratory project, we did undertake a preliminary assessment of the potential incidence and economic effects of such a tax.

Economists use the term tax incidence to describe who bears the burden of a tax. Tax analysts have long recognized that there can be important differences between the statutory and economic incidence of a tax. For example, if businesses can add the cost of the tax to the price of their products, then buyers of the product ultimately bear the burden of the tax even though legally the tax is collected from the business producing and selling the product. Further, the economic burden of a tax is not necessarily the same as the amount of revenue collected from the tax. When the price of a good rises—in this case, because of a tax imposed on that good—use of the taxed good may well decrease. Such a reduction in demand for the taxed commodity is considered part of the full economic burden of a tax.

The ultimate incidence and economic effects of a tax will depend upon the ability of each user of the taxed commodity to pass along the cost of the tax to someone else. The ability to pass along the cost of a tax depends upon market conditions that are specific to the affected industries. Economists summarize these specific conditions by referring to the relative *elasticity* of supply and demand of the taxed good. If an increase in price of a good results in a large decrease in use of the good, then demand for the good is described as elastic. Conversely, if an increase in price results in little or no decrease in use, then demand is described as inelastic. In general, industries or businesses whose demand for the taxed good is inelastic will bear the largest tax burden.

Estimating elasticity of supply and demand is key to realistic analyses of tax incidence. A useful discussion of tax incidence and how it relates to economic burden is that by the Joint Committee on Taxation (1993). Another discussion by Summers and Kotlikoff (1985) is far more technical, but also more complete.

At least four industries or groups would be affected by a new tax on agricultural inputs: (1) industries producing fertilizer, agricultural chemicals, seed, or machinery; (2) farmers or ranchers using the taxed inputs to produce food or fiber; (3) food and fiber processors;

TAXING INPUTS: INCIDENCE AND ECONOMIC EFFECTS

INCIDENCE OF A TAX ON AGRICULTURAL INPUTS

and (4) consumers purchasing food, fiber, or inputs for household use. Interactions among these groups will be complex and will likely vary across industries, regions of the country, and over time. Standard tax incidence analysis will usually make assumptions about the degree of competition in the affected industries as well as the existence of an international market for the commodities.

Most tax-incidence analysis ignores the general equilibrium effects of a tax. These are effects that filter through the economy to other sectors and to the demand and supply of other goods and services. For example, if fertilizer producers are unable to pass along the tax to farmers, then net profits in the fertilizer industry will go down. This could cause a reduction in the demand for the factors of production—labor and capital, for example—in the fertilizer industry. Labor and capital would then flow from the fertilizer industry to other sectors of the economy and affect the supply and demand in those industries. Tax-incidence analyses routinely ignore these general equilibrium effects because reliable estimates of the elasticity of supply and demand for labor and capital in each industry are almost always unavailable.

Who Will Ultimately Bear the Burden of the Tax?

From the point of view of farmers, a tax on agricultural inputs can be analyzed in much the same way as an increase in the price of the taxed commodities: the tax will raise the cost of production. Initially, when faced with higher costs for materials used in the production of final goods, most businesses will attempt to pass these additional costs along to consumers in the form of higher prices. This is a fundamental assumption in tax-incidence analysis.

Alternatively, if businesses are unable to raise the prices they charge to their customers, they will use less of the higher cost input, substitute other inputs for the now higher priced input, or a combination of both. If none of these options is possible, the business will bear the full burden of the tax.

In this report, we make two important assumptions about the ability of the U.S. agricultural sector to respond to an increase in the price of certain inputs. First, we assume that farmers are *price-takers* on both the demand side (e.g., their use of the taxed input) and on the supply side with respect to the prices they can get for their product. Second, we assume that agricultural production technology is such that farmers can adjust the mix of inputs (the “production set”) to allow for *substitution* of the newly taxed input with lesser cost alternatives.

Our first assumption—that farmers are price-takers—seems the correct one and is the assumption most often used in this type of analysis. This assumption is justified by recognizing the highly competitive nature of the U.S. agricultural industry. In addition, the existence of a large international market for agricultural products will affect the ability of farmers to influence prices. To the extent U.S. farmers compete with agricultural producers in other countries, their ability to raise prices will be limited.

Our second assumption relating to the substitutability of other inputs for fertilizer and pesticides, for example, also seems borne out by our own anecdotal evidence as well as some recent empirical studies. There are good reasons to think that most producers could, in fact, reduce their use of these inputs by adopting more intensive management systems without any great yield penalty. Basically, they would be substituting management time and attention for the input in most cases. In fact, getting farmers to adopt such systems would be a primary goal of using revenues generated by the tax.

For purposes of our analysis, these assumptions imply that (1) farmers will bear the full burden of any taxes paid on the inputs they purchase and (2) farmers will likely respond to the higher prices by reducing their use of the taxed commodities.

Which Industries Will Be Most Affected?

Effective tax rates are used as the estimates of tax incidence for each of the six tax options we evaluated. Effective tax rates compare the total amount of taxes collected from each industry (before offsets and reductions in demand) to the total output of each industry. The effective tax rate of 0.53 percent shown in Table 5 for the feed grains industry under Option 1, for example, means that the amount of tax collected from the feed grains industry amounts to 0.53 percent of the total output of the feed grains industry.

Effective tax rates were calculated as total taxes collected, *before allowing for any reduction in demand for the taxed inputs*. This approach is used to assess the burden of most taxes because it captures the notion that a behavioral change induced by a tax is itself a form of burden. In our case, the added burden of adjusting to the tax is captured by assuming that producers cannot pay less tax by using less of the taxed input through substitution.

The estimates of effective tax rates in Table 5 for a 5 percent tax on agricultural inputs are quite small. This is because the taxed commodities—fertilizers, agrochemicals, seed, and

machinery—are a small fraction of the total output in the affected industries. No industry has an effective tax rate more than 1 percent. The largest effective tax burden is 0.87 percent in the agricultural, forestry, and fisheries services industry under the broadest tax base. Other industries with relatively large tax burdens are feed grains, oil-bearing crops, and cotton. Industries that invest heavily in agricultural machinery and equipment

TABLE 5: EFFECTIVE TAX RATES, BY INDUSTRY

Industry	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Dairy farm products	0.00%	0.00%	0.00%	0.00%	0.13%	0.13%
Poultry and eggs	0.02%	0.02%	0.02%	0.02%	0.14%	0.14%
Meat animals	0.01%	0.01%	0.01%	0.01%	0.15%	0.15%
Miscellaneous livestock	0.01%	0.01%	0.01%	0.01%	0.15%	0.15%
Cotton	0.44%	0.44%	0.57%	0.57%	0.71%	0.71%
Food grains	0.26%	0.26%	0.42%	0.42%	0.55%	0.55%
Feed grains	0.53%	0.53%	0.59%	0.59%	0.72%	0.72%
Grass seeds	0.18%	0.18%	0.26%	0.26%	0.40%	0.40%
Tobacco	0.19%	0.19%	0.20%	0.20%	0.34%	0.34%
Fruits	0.32%	0.32%	0.32%	0.32%	0.46%	0.46%
Tree nuts	0.12%	0.12%	0.12%	0.12%	0.26%	0.26%
Vegetables	0.13%	0.13%	0.17%	0.17%	0.30%	0.30%
Sugar crops	0.24%	0.24%	0.36%	0.36%	0.49%	0.49%
Miscellaneous crops	0.18%	0.18%	0.25%	0.25%	0.38%	0.38%
Oil bearing crops	0.30%	0.30%	0.64%	0.64%	0.77%	0.77%
Forest products	0.06%	0.06%	0.06%	0.06%	0.19%	0.19%
Greenhouse and nursery products	0.03%	0.03%	0.03%	0.03%	0.16%	0.16%
Forestry products	0.02%	0.02%	0.02%	0.02%	0.12%	0.12%
Commercial fishing	0.00%	0.00%	0.00%	0.00%	0.06%	0.06%
Agricultural, forestry, and fishery services	0.72%	0.72%	0.72%	0.72%	0.87%	0.87%
Landscape & horticultural services	0.08%	0.08%	0.08%	0.08%	0.22%	0.22%
Mining and minerals	–	0.00%	–	0.00%	–	0.00%
Construction	–	0.00%	–	0.00%	–	0.00%
Manufacturing: Food and Kindred Products	–	0.00%	–	0.00%	–	0.00%
Manufacturing: Industrial and Other Chemicals	–	0.04%	–	0.04%	–	0.04%
Manufacturing: Agricultural Fertilizers and Chemicals	–	0.53%	–	0.53%	–	0.53%
Manufacturing: Plastics and Synthetic Materials	–	0.02%	–	0.02%	–	0.02%
Manufacturing: Other Manufacturing	–	0.00%	–	0.00%	–	0.00%
Transportation, Communications and Utilities	–	0.00%	–	0.00%	–	0.00%
Wholesale and Retail Trade	–	0.00%	–	0.00%	–	0.00%
Finance, Insurance and Real Estate	–	0.00%	–	0.00%	–	0.00%
Services: Amusements	–	0.01%	–	0.01%	–	0.01%
Services: Other Services	–	0.00%	–	0.00%	–	0.00%
Owner-Occupied Dwellings	–	0.00%	–	0.00%	–	0.00%
Other Industries	–	0.00%	–	0.00%	–	0.00%
Total, All Industries	0.21%	0.01%	0.25%	0.01%	0.38%	0.01%

experience a large increase in their effective tax rate under options 5 and 6. The data presented in Table 6 are another way of looking at tax incidence. Instead of using effective tax rates as a measure of tax incidence, Table 6 shows the share of total revenue generated by the tax that is contributed by each industry group under each of the six options. That is, the percentages in Table 6 show how much of the total revenues collected from the tax

TABLE 6: PERCENT OF REVENUES, BY INDUSTRY

Industry	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Dairy farm products	0.11%	0.08%	0.09%	0.07%	2.75%	2.18%
Poultry and eggs	0.59%	0.41%	0.49%	0.35%	2.16%	1.71%
Meat animals	1.27%	0.87%	1.05%	0.76%	7.12%	5.63%
Miscellaneous livestock	0.05%	0.03%	0.04%	0.03%	0.45%	0.36%
Cotton	4.43%	3.04%	4.80%	3.49%	3.90%	3.09%
Food grains	5.41%	3.71%	7.08%	5.14%	6.16%	4.87%
Feed grains	43.04%	29.53%	39.50%	28.69%	31.95%	25.28%
Grass seeds	0.21%	0.14%	0.25%	0.18%	0.25%	0.20%
Tobacco	1.25%	0.86%	1.10%	0.80%	1.20%	0.95%
Fruits	5.95%	4.08%	4.89%	3.56%	4.58%	3.63%
Tree nuts	0.42%	0.28%	0.34%	0.25%	0.47%	0.37%
Vegetables	3.42%	2.35%	3.66%	2.66%	4.27%	3.37%
Sugar crops	1.16%	0.80%	1.41%	1.02%	1.27%	1.00%
Miscellaneous crops	0.31%	0.21%	0.34%	0.25%	0.35%	0.27%
Oil bearing crops	8.89%	6.10%	15.62%	11.34%	12.45%	9.85%
Forest products	0.28%	0.19%	0.23%	0.17%	0.49%	0.39%
Greenhouse and nursery products	0.66%	0.45%	0.54%	0.39%	1.90%	1.50%
Forestry products	0.28%	0.19%	0.23%	0.17%	0.93%	0.73%
Commercial fishing	0.00%	0.00%	0.00%	0.00%	0.51%	0.40%
Agricultural, forestry, and fishery services	19.72%	13.52%	16.23%	11.79%	12.88%	10.20%
Landscape & horticultural services	2.56%	1.75%	2.11%	1.53%	3.98%	3.15%
Mining and minerals	–	0.01%	–	0.01%	–	0.02%
Construction	–	0.01%	–	0.01%	–	0.08%
Manufacturing: Food and Kindred Products	–	0.01%	–	0.01%	–	0.04%
Manufacturing: Industrial and Other Chemicals	–	5.72%	–	4.98%	–	3.60%
Manufacturing: Agricultural Fertilizers and Chemicals	–	13.13%	–	11.44%	–	8.24%
Manufacturing: Plastics and Synthetic Materials	–	1.44%	–	1.25%	–	0.91%
Manufacturing: Other Manufacturing	–	1.19%	–	1.04%	–	1.01%
Transportation, Communications and Utilities	–	0.00%	–	0.00%	–	0.10%
Wholesale and Retail Trade	–	3.01%	–	2.63%	–	2.02%
Finance, Insurance and Real Estate	–	0.99%	–	0.86%	–	0.76%
Services: Amusements	–	1.05%	–	0.91%	–	0.67%
Services: Other Services	–	1.33%	–	1.16%	–	1.08%
Owner-Occupied Dwellings	–	2.53%	–	2.20%	–	1.63%
Other Industries	–	0.98%	–	0.86%	–	0.71%
Total, All Industries	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

TAXING INPUTS: DESIGN AND ADMINISTRATION

TAX EQUITY

(after reduction in demand and federal tax offset) are paid by each industry. The percentages directly reflect the relative size of each industry and its use of the taxed commodity.

Just how a tax on inputs will affect the agricultural industry will depend, as we discussed earlier, on the ability of the industry to pass along the tax to end use consumers. Our underlying assumption in this report is that the farmers are limited in their ability to shift the tax and will, therefore, bear the burden of the entire levy. Even in this extreme case, our analysis shows the likely effect will be small at the industry level: the effective rate of tax is never more than a fraction of a percent of total output in any industry, even under the most expansive tax base. The effective rate can be further reduced in the agricultural sector by extending the tax to all purchasers of the taxed commodity.

Although economic effects at the industry level are quite small, effects at the individual farm or ranch level could be larger. The I/O approach does not produce estimates at the individual firm level. Analysis of economic effects at the farm or ranch scale was beyond the scope of this project. Such analysis would be a critical next step in exploring the feasibility or desirability of constructing a conservation trust fund from a tax on agricultural inputs.

Three criteria are generally used to assess or evaluate a proposed tax: equity, efficiency, and administrative simplicity.

Tax equity relates to the fairness of a tax. Economists generally identify two separate but related concepts of tax equity. Horizontal equity refers to the like treatment of taxpayers in similar circumstances. A horizontally equitable tax treats all industries or people subject to the tax in the same way—no particular group of taxpayers incurs a disproportionate share of burden. For example, we would expect that individuals with the same income would pay about the same in income taxes.

Vertical equity relates to how taxpayers of different means may be affected by the tax. Vertical equity is a measure of how tax liability changes as ability to pay changes. Under a vertically equitable tax, no individual or business should incur a liability that is high relative to the resources they have available to meet their obligations.

A horizontally equitable tax on agricultural inputs would be one in which businesses that use the same amount and kind of taxed inputs in the production process should pay about the same in taxes. Vertical equity means that larger farms that use more of the taxed good also should pay more.

A flat 5 percent ad valorem tax would meet both of these criteria.

By nature, any tax will almost always change the allocation of resources as producers and consumers alter their activities in the presence of the tax. An income tax that exempts the interest earned on bonds, for example, will cause investors to demand more bonds in their portfolio because they will have a higher after-tax rate of return than a similar, taxable asset. Similarly, if certain types of machinery are given preferential treatment with respect to how depreciation deductions are calculated, then manufacturers will likely employ more of the tax-favored input.

In both of these cases, the tax causes individuals (or businesses) to make decisions about how to allocate resources that are different than they would be in the absence of the tax. Tax efficiency is concerned with minimizing these effects in order to have minimal impact on economic activity.

Applying an agricultural input tax to the broadest base and at the lowest rate needed to generate sufficient revenue would be the best way to increase tax efficiency.

A tax that is equitable and efficient may require a complex collection mechanism or administrative procedures. Often, this is due to complex rules or regulations that limit the application of the tax to certain types of taxpayers or determine eligibility for targeted exclusions or exemptions. A tax that imposes a high degree of compliance burden—measured in both time and money spent meeting one’s tax obligations—in addition to the amount of the tax collected is likely to meet with strong resistance from the affected taxpayers.

The way taxes are collected and remitted to the tax agency can have important effects on both compliance and burden. For example, retailers are required to collect sales taxes even though it is the consumer who actually pays the tax. It would be administratively burdensome to require everyone who purchases a taxed commodity to keep track of all their purchases and send a check to the appropriate revenue department every month. It is far more efficient

TAX EFFICIENCY

ADMINISTRATIVE SIMPLICITY

and simple for the tax to be collected at the point of sale, effectively making the retailer an agent of the tax agency.

EXEMPTIONS

Sound principles of tax design are often modified to accommodate certain groups in the economy or to accomplish specific purposes. For example, our present income tax system relies on numerous exemptions and credits designed to provide incentives to save, account for the added costs of raising children, provide financial help to low income working families, and help with educational costs, to name just a few.

Exemptions could be considered for small purchases of the taxed commodity, for example, or for small farmers or ranchers whose total sales are under some threshold level. Finally, farmers or ranchers who implement comprehensive conservation or pollution prevention plans could be exempted from the tax on agricultural inputs. Such an exemption would encourage environmentally sound use of taxed inputs and help meet some of the objectives of the trust fund. Assessing the impact of this type of exemption on revenues is difficult and will depend on the practices and activities that would be required to become eligible for the exemption.

Exemptions to the tax may be desirable for economic, environmental, or political reasons. However, exemptions will come at a cost, including:

- Increasing the administrative burden of the tax.
- Unequal treatment of producers.
- A higher tax rate to make up for exempted purchases.
- Too many exemptions may give the impression that the tax is either unfair or easy to avoid and result in an erosion of confidence in the objectives of the tax.

CONCLUSION

A working land conservation trust fund could make a significant contribution to our capacity to address agriculture's environmental agenda through collaborative, incentive-based, producer-driven approaches. Such a trust fund could fill important gaps in our current capabilities if it included the following components:

- Return tax revenue to the same localities from which it came and in the same proportions in which it was generated.
- Match trust fund revenues with general taxpayer revenues—perhaps through a matching grant program that recognizes the public benefits that will accrue from such an initiative.

- Allocate trust and matching funds to producer groups—analogueous to Australian Landcare groups—to support collaborative work on their operations and in their communities to improve environmental quality and ensure the commercial viability and sustainability of agriculture.
- Empower producer groups to determine how to use grant funds based on their own project plan. For example, producers could use funds to secure technical help for their members, hire a coordinator or other staff to support their project, or provide financial assistance to work group members to adopt, install, or maintain conservation and pollution prevention systems on their operations.
- Producer groups would be responsible for ensuring accountability to themselves and the public for use of the grant funds.

A relatively small tax (5 percent in our estimates) on agricultural inputs could generate enough revenue to fund an effective working land conservation trust fund. Grants flowing from such a trust fund could more than double the funding for working land conservation made available recently under the 2002 farm bill.

The economic effects of such a tax appear to be small—at the *industry* scale. Effective tax rates for do not exceed 1 percent for any of the industries analyzed in our I/O model. For most industries, effective tax rates are well below 0.5 percent.

We did not estimate the economic effects of such a tax at the *farm* or *ranch* scale. Those effects could be larger and would surely be much more variable. Understanding those effects would be a critical next step in evaluation the feasibility and desirability of creating a working land conservation trust fund.

Our exploratory analysis suggests that much more detailed and serious work is merited that could lead to the creation of a working land conservation trust fund. The uncertainties of federal conservation funding given current projections for the federal budget, coupled with the importance of making progress on agriculture’s environmental agenda, suggest that such work should be undertaken with some urgency.

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APPENDIX I AGRICULTURAL INDUSTRY GROUPS¹

Until very recently, when U.S. government agencies compiled data and statistics on business and economic activities, the information was frequently displayed by industry groupings according to the Standard Industrial Classification (SIC) system. The SIC was developed for use in the classification of establishments by the type of principal activity in which they are engaged. Recognizing that the world economies were becoming more integrated, a new look at the system was undertaken in the early 1990s and recommendations were made and subsequently adopted that replaced the SIC system with the North American Industry Classification System (NAICS) to allow for more comparability among the economies of the U.S., Canada and Mexico.

In a similar manner, NAICS is an industry classification system that groups establishments into industries based on the activities in which they are primarily engaged. The purpose of the groupings is to “...facilitate the collection, tabulation, presentation, and analysis of data relating to establishments; and to provide uniformity and comparability in the presentation of statistical data describing the U.S. economy” (p16). While much of the analytical work in this report relied on the older SIC designation, the two approaches are consistent, and this appendix provides a description of what constitutes the “U.S. Agricultural Sector” under both systems.

NAICS represents a *production-oriented* industry classification system and groups establishments into industries according to the similarity in the processes used to produce goods and services. In economic jargon, producers in a particular industry will share the same “production function” or technology set. The structure of the NAICS is hierarchical, and the first two digits of the structure classify all economic activity into 20 sectors. For our immediate purpose, the first two-digit code is “11” and represents “Agriculture, Forestry, Fishing and Hunting.” Activities of this sector are defined as (1) growing crops, (2) raising animals, (3) harvesting timber, and (4) harvesting fish and other animals from farms, ranches, or the animals’ natural habitat.

NAICS then uses a six-digit classification system to identify particular industries within this hierarchical structure. A brief summary of the NAICS description of the U.S. Agricultural Sector follows.

The establishments in this sector are often described as farms, ranches, dairies, greenhouses, nurseries, orchards, or hatcheries. A farm may consist of a single tract of land or a

¹ Most of the information in this appendix is drawn from *North American Industry Classification System: United States, 2002*, Executive Office of the President, Office of Management and Budget (2002).

AGRICULTURE, FORESTRY, FISHING, AND HUNTING

number of separate tracts that may be held under different tenures. For example, one tract may be owned by the farm operator and another rented. The operator may operate it alone or with the assistance of members of the household or hired employees, or a partnership, corporation, or other type of organization may operate it. When a landowner has one or more tenants, renters, croppers, or managers, the land operated by each is considered a farm.

The sector distinguishes two basic activities: agricultural production and agricultural support activities. Agricultural production includes establishments performing the complete farm or ranch operation, such as farm owner-operators, tenant farm operators, and sharecroppers. Agricultural support activities include establishments that perform one or more activities associated with farm operations, such as soil preparation, planting, harvesting, and management, on a contract or fee basis.

Excluded from the Agriculture, Forestry, Fishing and Hunting sector are establishments primarily engaged in agricultural research and establishments primarily engaged in administering programs for regulating and conserving land, mineral, wildlife, and forest use.

Crop Production

Industries in the Crop Production sub-sector grow crops mainly for food and fiber. The sub-sector comprises establishments, such as farms, orchards, groves, greenhouses, and nurseries, primarily engaged in growing crops, plants, vines, or trees and their seeds.

The industries in this sub-sector are grouped by similarity of production activity, including biological and physiological characteristics and economic requirements, the length of growing season, degree of crop rotation, extent of input specialization, labor requirements, and capital demands. The production process is typically completed when the raw product or commodity reaches the “farm gate” for market, that is, at the point of first sale of price determination.

Establishments are classified to the crop production sub-sector when crop production (i.e., value of crops for market) accounts for one-half or more of the establishment’s total agricultural production. Within the sub-sector, establishments are classified to a specific industry when a product or industry family of products (i.e., oilseed and grain farming, vegetable and melon farming, fruit and tree nut farming) account for one-half or more of the establishment’s agricultural production. Establishments with one-half or more crop production with no one product or family of products of an industry accounting for one-half

of the establishment's agricultural production are treated as general combination crop farming and are classified as All Other Crop Farming.

Animal Production

Industries in the Animal Production sub-sector raise or fatten animals for the sale of animals or animal products. The sub-sector comprises establishments, such as ranches, farms, and feedlots primarily engaged in keeping, grazing, breeding, or feeding animals. These animals are kept for the products they produce or for eventual sale. The animals are generally raised in various environments, from total confinement or captivity to feeding on an open range pasture.

The industries in this sub-sector are grouped by important factors, such as suitable grazing or pasture land, specialized buildings, type of equipment, and the amount and types of labor required. Establishments are classified to the Animal Production sub-sector when animal production (i.e., the value of animals for market) accounts for one-half or more of the establishment's total agricultural production. Establishments with one-half or more animal production with no one animal product or family of animal products of an industry accounting for one-half of the establishment's agricultural production are treated as combination animal farming classified as All Other Animal Production.

Forestry and Logging

Industries in the Forestry and Logging sub-sector grow and harvest timber on a long production cycle (i.e., of 10 years or more). Long production cycles use different production processes than short production cycles, which require more horticultural interventions prior to harvest, resulting in processes more similar to those found in the Crop Production sub-sector. Consequently, Christmas tree production and other production involving production cycles of less than 10 years, are classified in the Crop Production sub-sector.

Industries in this sub-sector specialize in different stages of the production cycle. Reforestation requires production of seedlings in specialized nurseries. Timber production requires natural forest or suitable areas of land that are available for a long duration. The maturation time for timber depends upon the species of tree, the climatic conditions of the region, and the intended purpose of the timber. The harvesting of timber (except when done on an extremely small scale) requires specialized machinery unique to the industry. Establishments gathering forest products, such as gums, barks, balsam needles,

rhizomes, fibers, Spanish moss, and ginseng and truffles, are also included in this sub-sector.

Fishing, Hunting and Trapping

Industries in the Fishing, Hunting and Trapping sub-sector harvest fish and other wild animals from their natural habitats and are dependent upon a continued supply of natural resource. The harvesting of fish is the predominant economic activity of this sub-sector, and it usually requires specialized vessels that, by the nature of their size, configuration and equipment, are not suitable for any other type of production, such as transportation.

Hunting and trapping activities utilize a wide variety of production processes and are classified in the same sub-sector as fishing because the availability of resources and the constraints imposed, such as conservation requirements and proper habitat maintenance, are similar.

Support Activities for Agriculture and Forestry

Industries in the Support Activities for Agricultural and Forestry sub-sector provide support services that are an essential part of agricultural and forestry production. These support activities may be performed by the agriculture or forestry producing establishment or conducted independently as an alternative source of inputs required for the production process for a given crop, animal, or forestry industry. Establishments that primarily perform these activities independent of the agriculture or forestry production establishment are in this sub-sector.

SIC Description

Agriculture, forestry, and fishing

DETAILED LISTING OF THE INDUSTRIES INCLUDED IN THE U.S AGRICULTURAL SECTOR

1 Agricultural production- crops

- 111 Wheat
- 112 Rice
- 115 Corn
- 116 Soybeans
- 119 Cash Grains, NEC
 - Dry Pea and Bean Farms
 - Oilseed, Except Soybean, Farms
 - Popcorn Farms
 - Combination Oilseed and Grain Farms
 - Other Farms
- 131 Cotton
- 132 Tobacco
- 133 Sugarcane and Sugar Beets
 - Sugar Beets
 - Sugarcane
- 134 Irish Potatoes
- 139 Field Crops, Except Cash Grains, NEC
 - Hay Farms
 - Peanut Farming
 - Sweet Potatoes and Yam Farms
 - Other Field Crop Farms
- 161 Vegetables and Melons
- 171 Berry Crops
 - Strawberry Farms
 - Other Berry Farms
- 172 Grapes
- 173 Tree Nuts
- 174 Citrus Fruits
 - Orange Groves and Farms
 - Other Citrus Groves and Farms
- 175 Deciduous Tree Fruits
 - Apple Orchards and Farms
 - Other Farms
- 179 Fruits and Tree Nuts, NEC
 - Combination Fruit and Tree Nut Farms
 - Other Farms
- 181 Ornamental Floriculture and Nursery Products
 - Floriculture Farming
 - Nursery Farming
- 182 Food Crops Grown Under Cover
 - Mushrooms, Growing Of
 - Other Food Crops Grown Under Cover
- 191 General Farms, Primarily Crop

2 Agricultural production- livestock

- 211 Beef Cattle Feedlots
- 212 Beef Cattle, Except Feedlots
- 213 Hogs
- 214 Sheep and Goats
 - Sheep Farms
 - Goat Farms
- 219 General Livestock, Except Dairy and Poultry
- 241 Dairy Farms
 - Dairy Heifer Replacement Farms
 - Dairy Farms
- 251 Broiler, Fryes, and Roaster Chickens
- 252 Chicken Eggs

- 253 Turkey and Turkey Eggs
 - 254 Poultry Hatcheries
 - 259 Poultry and Eggs, NEC
 - 271 Fur-Bearing Animals and Rabbits
 - 272 Horses and Other Equines
 - 273 Animal Aquaculture
 - Finfish Farms
 - Shellfish Farms
 - Other Animal Aquaculture
 - 279 Animal Specialties, NEC
 - Alligator and Frog Production
 - Beef Farms
 - Other
 - 291 General Farms, Primarily Livestock and Animal Specialties
- 7 Agricultural services**
- 711 Soil Preparation Services
 - 721 Crop Planting, Cultivating, and Protecting
 - 722 Crop Harvesting, Primarily by Machine
 - 723 Crop Preparation Services For Market, except Cotton Ginning
 - Other
 - Custom Grain Grinding
 - 724 Cotton Ginning
 - 741 Veterinary Services For Livestock
 - 742 Veterinary Services for Animal Specialties
 - 751 Livestock Services, Except Veterinary
 - Custom Slaughtering
 - Other Livestock Service, Except Veterinary
 - 752 Animal Specialty Service, Except Veterinary
 - Horses and Equines Services and Animal Production Breeding
 - Pet Care Services
 - 761 Farm Labor Contractors and Crew Leaders
 - 762 Farm Management Services
 - 781 Landscape Counseling and Planning
 - Horticulture Consulting
 - Landscape Architectural Services
 - 782 Lawn and Garden Services
 - 783 Ornamental Shrub and Tree Services
- 8 Forestry**
- 811 Timber Tracts
 - Short Rotation Woody Crops
 - Long Term Timber Farming
 - 831 Forest Nurseries and Gathering of Forest Products
 - Maple Sap
 - Other Forest Products
 - 851 Forestry Services
- 9 Fishing, hunting, and trapping**
- 912 Finfish
 - 913 Shellfish
 - 919 Miscellaneous Marine Products
 - Except Plant Aquaculture
 - Plant Aquaculture
 - 921 Fish Hatcheries and Preserves
 - Finfish Hatcheries
 - Shellfish Hatcheries
 - 971 Hunting and Trapping, and Game Propagation

APPENDIX II: DESCRIPTION OF THE INPUT-OUTPUT (I-O) MODEL

Input-Output (I-O) analysis is a natural way to begin to model the first-order effects of a tax on inputs to the production process. An I-O model is a description of the interrelationships between industries in a national or regional economy. It can also be thought of as representing a set of national income accounts, tracing out the dependencies among different sectors of the economy. I-O models are frequently used in environmental studies to estimate the impact of taxing certain pollutants (e.g., carbon) at the source. Fullerton (1995) and Metcalf (1999) are two recent studies that rely on I-O models to trace out the effects of certain environmental taxes.

Let X_i represent the total output of industry i in a national economy. In producing its output for final use by consumers, industry i will require certain inputs from other industries in the economy. Let x_{ij} denote the amount of industry i 's output that is required as input into industry j . This output from industry i is used both for intermediate use by other industries (the x_{ij} 's) as well as for final demand by consumers (consumption) and producers (investment). Similarly, when producing its output, industry j requires the use of inputs from industry i (the x_{ij} 's) along with labor and other value added (V_j) to produce its total output X_j . Figure 1 shows these relationships schematically.

FIGURE 1: STRUCTURE OF AN INPUT-OUTPUT SYSTEM OF ACCOUNTS

		Industry 1	Industry 2	—	—	—	Industry N	Personal Consumption Expenditures	Investment	Total Industry Output
INDUSTRY	Industry 1									X_1
	Industry 2									X_2
	—									—
	—									—
	—									—
	—									—
	—									—
	—									—
	—									—
Value Added	Industry N									X_N
	Compensation									
	Indirect Business Taxes									
	Other Value Added									
Total Industry Output		X_1	X_2	—	—	—	X_N			X

Each row of the table in Figure 1 shows the amount of industry i 's output used in the production of industry j 's output. Reading across each row, we see the total disposition of industry i 's output among intermediate use and final uses (consumption (C) and investment (I)). Reading down the columns of Figure 1 the input to industry j 's total output, X_j , is broken down by intermediate inputs and value added (V).

Mathematically, we can represent the rows in Figure 1 by the following system of equations where p_i represents the price of industry i 's output⁴:

$$x_{11}p_1 + x_{12}p_1 + \dots + C_1p_1 = X_1p_1$$

$$x_{21}p_2 + x_{22}p_2 + \dots + C_2p_2 = X_2p_2$$

$$x_{N1}p_N + x_{N2}p_N + \dots + C_Np_N = X_Np_N \quad (1)$$

In a similar manner, reading down the columns of Figure 1 results in a second system of equations:

$$x_{11}p_1 + x_{21}p_2 + \dots + V_1 = X_1p_1$$

$$x_{12}p_1 + x_{22}p_2 + \dots + V_2 = X_2p_2$$

$$x_{1N}p_1 + x_{2N}p_2 + \dots + V_N = X_Np_N \quad (2)$$

Define the *technical input coefficients* as $a_{ij} = x_{ij} / X_j$ and rearrange the system (2) to obtain:

$$(1-a_{11})p_1 - a_{21}p_2 - \dots = V_1/X_1$$

$$a_{12}p_1 + (1-a_{22})p_2 - \dots = V_2/X_2$$

$$a_{1N}p_1 - a_{2N}p_2 - \dots = V_N/X_N \quad (3)$$

Matrix algebra can be used to rewrite (3) in a more compact notation:

$$(I - A')P = V \text{ or } P = (I - A')^{-1}V \quad (4)$$

where I is the identity matrix, P is a vector of prices, A is the matrix of a_{ij} , and V is a vector where the i th element is V_i/X_i . Equation (4) is a basic result in I-O analysis and shows how prices will have to adjust to ensure that all output requirements are met. Taxes can be introduced in a straightforward manner along the lines of Fullerton (1995).

The I-O framework is a simple and elegant way to examine how changes in demand can have repercussions throughout the economy. But the assumptions behind the I-O model are quite restrictive and implications drawn from the model need to be interpreted with care. First, the model assumes *perfect competition* and requires that there are many producers who cannot affect the price of output. Second, the model assumes that the input coefficients are *fixed*,

⁴All the final uses have been collapsed into a single category representing consumption.

requiring that each industry produce its output with a predetermined “recipe.” Third, the model assumes that the economy is *closed* in that there is no foreign competition. Fourth, the I-O model is not a true *general equilibrium* (GE) model in that other factor prices (e.g., wages) are not allowed to adjust.

Because of these restrictive assumptions, in what follows we will use equation (3) to allocate the increased costs of imposing a tax on agricultural inputs. This is because (1) our revenue model assumes that producers will demand less of the taxed good (not allowed in the I-O framework) and (2) our uncertainty over the ability of the agricultural sector to pass along the increased costs associated with the tax. In Appendix A, we use equation (4) to trace out how each industry is affected, assuming the increased costs are passed along in the form of higher prices on consumer goods.

In the body of the report, we calculated effective tax rates by assuming that the additional costs incurred were borne by the industries directly purchasing the agricultural inputs. This assumption is appropriate if we believe that the affected industries are unable to pass this increased cost of doing business along to other intermediate purchasers of their product or to end-use consumers.



sharing the cost

at Inputs?



Creating a Working Land Conservation Trust Fund Through a Tax on Agri-inputs

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