

# Food for Thought

Environmental  
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American  
Farmland Trust

Center for Science  
in the Public Interest

Defenders  
of Wildlife

Environmental  
Working Group

Trout Unlimited

The Case for Reforming Farm Programs  
to Preserve the Environment and Help  
Family Farmers, Ranchers and Foresters



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# Executive Summary

America's farmers can provide far more than food—they can provide clean water and wildlife; they can serve as the frontline against sprawling development.

Farmland dominates the American landscape, occupying 55% of the land of the contiguous United States, or 1.1 billion acres.<sup>1</sup> Because of its scope, no single economic activity has as great an impact on the quality of our drinking water, the character of our landscape, and the future of imperiled wildlife as agriculture, and few have the same capacity to affect global warming and public health.

Federal spending on farm programs is growing, reaching a record \$32 billion last year in direct payments to farmers and export subsidies.<sup>2</sup> That tops the funds spent to run America's parks and refuges, clean up toxic waste sites, and build wastewater treatment plants—in fact, it was greater than the total budgets of the Environmental Protection Agency and the Department of Interior combined. These resources give farm programs great potential to protect the environment and enhance social goals.

Many farmers already follow practices to protect and enhance the environment. More than one-third of all farmers have changed the way they plow fields to reduce polluted runoff into nearby streams.<sup>3</sup> In the last 5 years, farmers have installed buffer strips of trees and plants along one million miles of streams to intercept runoff and filter out pollutants.<sup>4</sup> Farmers also are making increased use of a variety of farming methods to reduce fertilizer and pesticide use, increase the health of native grasslands, and reuse manure so that it does not pollute our air and water or contaminate food supplies.

But most farmers seeking federal help to meet public health and environmental challenges are turned away. According to the US Department of Agriculture, three out of four farmers seeking support to change farming practices or to restore wetlands are turned away.<sup>5</sup> Roughly half of all farmers seeking basic technical guidance to reduce polluted runoff are rejected.<sup>6</sup> The reason? In recent years, less than 10 cents out of each federal farm dollar has gone to help farmers implement better land use practices or protect sensitive lands.

A reformed farm policy can do a great deal to help the country meet a broad range of critical environmental challenges:

- Farmers can hold back sprawling development, which now consumes 2.1 million acres of land each year.<sup>7</sup>
- Farmers can keep polluted runoff from contaminating rivers and lakes. More than one-third of rivers and lakes monitored by states remain too polluted to allow fishing, swimming, or drinking.<sup>8</sup> Since more than half of the country's rain and snow falls on farmland, it is not surprising that polluted runoff from certain farming practices is the leading contributor. But a number of proven farming techniques can control this source of water pollution.
- Farmers can take practical steps to improve habitat for the one-third of the nation's imperiled wildlife species that are challenged by modern farming practices.<sup>9</sup> Such steps include enhancing woodlands and grasslands, planting trees to shade streams, controlling invasive weeds, reducing the drift of pesticides, and improving irrigation techniques to leave more water for fish.

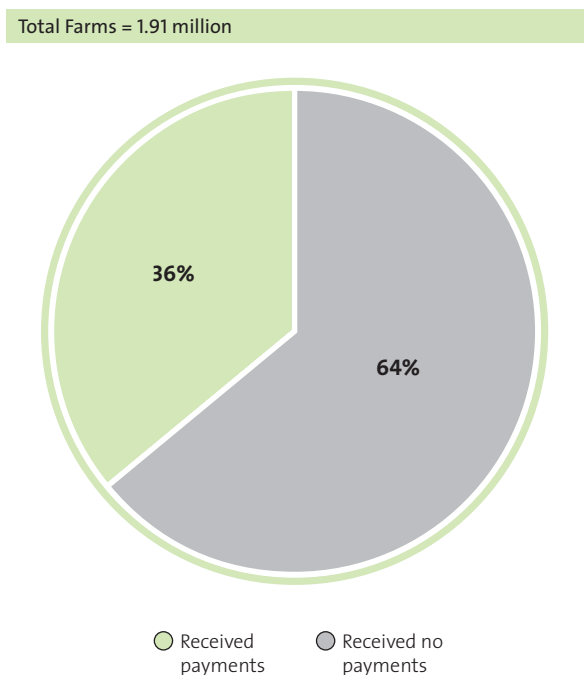
- Farmers can improve public health through better control of pesticides and livestock manure, which sicken thousands of Americans each year, and by reducing the overuse of antibiotics, which creates dangerous strains of bacteria that are resistant to modern drugs.
- Farmers can help curb global climate change by reducing emissions of greenhouse gases, increasing wind power and other renewable energy sources, and by increasing the amount of global warming gases absorbed by soils and forests.

Traditional support payment programs are failing most farmers because they focus almost entirely on one kind of farming—the growth of so-called “commodities”—animal feeds, grains, and cotton. A number of agricultural programs do focus on other farm products, but the programs that provide funds generally ignore four-fifths of the farm production in the United States—including cattle-raising, dairy, and production of fruits and vegetables.<sup>10</sup> The commodity programs stimulate crop surpluses which

leads to lower crop prices, hurting small farmers and increasing the need for federal aid. By ignoring the contribution of grass-based agriculture, despite its huge contribution to the food supply, these programs encourage farmers to replace grass fields with commodity crops that provide less habitat for wildlife, use more chemicals, and lead to more soil erosion.

As a result, traditional farm programs have largely failed to achieve their oft-claimed goal of preserving family farms. According to US Department of Agriculture statistics, the number of farms has declined from almost 7 million during the Depression when modern farm programs were formed to fewer than 2 million today.<sup>11</sup> Most government aid flows to only a few of these farmers, and primarily to those with the largest farms. From 1996 through 1998, a computer analysis of those who received money from the principal farm program showed that the top 10% collected an average \$96,000, while the bottom half collected an average \$1,200.<sup>12</sup> According to USDA, two-thirds of farmers receive no direct government funding at all.<sup>13</sup> (See Figure 1.)

**Figure 1: Farm Payment Programs Do Not Help Most Farmers**



Traditional agricultural programs have also failed to support rural America, another frequently stated goal. In farming-dependent counties, farm jobs declined by 6.4% between 1990 and 1997, and the number of farmers is expected to decline another 13% by 2008.<sup>14</sup> According to 1997 data, rural poverty rates now exceed those of urban communities, and are three times higher for rural minorities.<sup>15</sup> One-fifth of rural children—more than 3 million children—

*According to the most recent farm census in 1997, nearly two-thirds of all farmers do not receive government payments. Much of the reason is that most payment programs only support growing a few animal feed grains, wheat and cotton and do not support other kinds of agriculture, including grazing and fruits and vegetables.*

**Source:** USDA, National Agricultural Statistics Service, 1997 Census of Agriculture.

live in poverty.<sup>16</sup> Farm programs that encourage large-scale farms that employ fewer skilled workers probably undermine rural economic development goals. At a minimum, they are unlikely to address the real problems of rural communities.

Programs that reward farmers for conservation have enormous potential to work better than traditional programs for most farmers while contributing to significant environmental progress. Experience has shown that conservation programs achieve greater equity for small- and medium-sized farms and for regions that rely less on the few subsidized commodity crops,<sup>17</sup> and they can help farmers without inducing crop surpluses and low prices. What's more, the more than 90% of all farmers who control 70% of all farmland now produce only around one-third of the agricultural products by value.<sup>18</sup> For these farmers, compensation for conservation benefits can provide an important supplemental source of income.

The Congressional Budget Resolution adopted in 2001 contemplates spending more than \$20 billion per year on direct payments to farmers in the next Farm Bill, which will take effect in 2003—more than \$100 billion over 5 years. Congress should ensure that at least half of this funding (roughly \$10 billion per year) is directed at conservation incentives that meet key challenges:

- **Improve Water Quality:** Congress should create incentives to reduce excess application of fertilizer and encourage use of new manure management technologies like feed additives and digesters to help small dairy, hog, beef, and poultry farmers address problems of excess manure and generate new income.
- **Preserve Farmland and Forests from Sprawl:** Congress should boost funds to acquire development rights on a voluntary basis from farmers and forest owners on land in the path of sprawl or otherwise at risk of loss.
- **Protect Public Health:** Congress should help farmers reduce the use of pesticides and antibiotics and help interested farmers make the transition from conventional to organic farming while boosting markets.
- **Restore and Preserve Wildlife Habitat:** Congress should give incentives to farmers to restore and preserve wetlands and enhance their land's habitat value for rare species and other wildlife by removing exotic weeds, conducting controlled burns, and revitalizing streamside trees, shrubs, and grasses.
- **Protect and Enhance Pasture and Range Land:** Congress should aid farmers interested in shifting from crops to managed grazing, help farmers enhance the health of pasture and grazing lands, and fund easements to preserve valuable range and pasturelands.
- **Reduce the Threat of Climate Change:** Congress should provide incentives for farmers and rural communities to identify and utilize available renewable energy resources and help develop the market for real and verifiable reductions in greenhouse gases on farms.
- **Bolster Farm Income through Conservation:** Congress should provide income support through stewardship payments that reward farmers for practices designed to reduce polluted runoff and combat climate change.
- **Boost Rural Communities:** Congress should expand market opportunities for farmers using environmentally friendly farm techniques by investing in value-added enterprises, assisting small farmer marketing cooperatives, and expanding research into environmentally friendly farming methods.



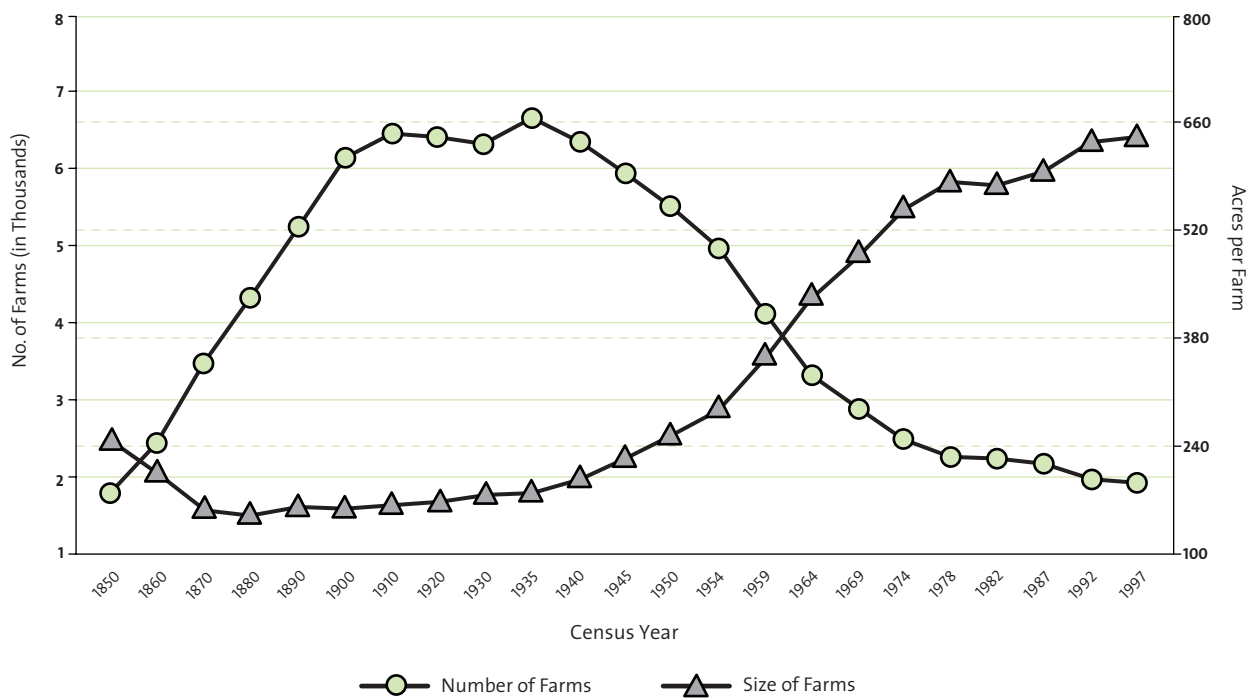
# 1 Why America's Farm Programs Have Failed to Meet the Challenge

Since the New Deal, the details of farm programs have changed, but the basic structure has remained the same. Traditional agriculture programs have targeted the overwhelming majority of funds at those farmers who grow a few basic farm commodities, primarily corn, soybeans, wheat, and cotton. Most programs have paid farmers when the prices of these basic feeds, grains, and cotton fall below a guaranteed level. In general, the more bushels of grain or pounds of cotton a farmer produces, the more money he or she receives from the federal government.

These programs have failed to meet their publicly stated goals.

■ **Family farms have declined.** Virtually every public official who speaks in support of farm programs claims to be saving the family farm.<sup>19</sup> But since farm programs came into existence during the New Deal, family farms have declined from almost 7 million to fewer than 2 million today.<sup>20</sup> (See Figure 2.) The rate of decline in total farms has leveled off in the last two decades, but the number

Figure 2: Farm Programs Have Not Stemmed the Decline of Family Farms



According to USDA data, the number of farmers has declined steadily while the average size of farm has increased over the

decades. Farm programs are not achieving their oft-stated goal to save family farmers and may accelerate their decline.

Source: USDA, Economic Research Service.

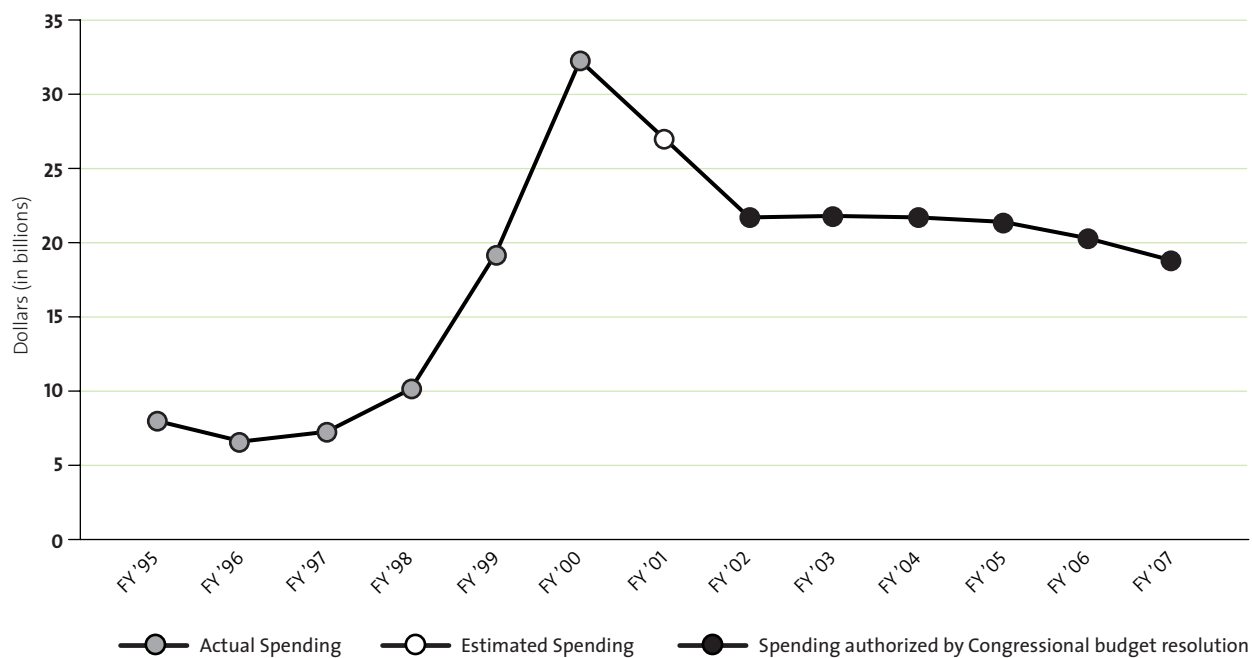
of farmers who make their primary income from the farm continues to decline rapidly.<sup>21</sup> Employment on farms fell by 667,000 jobs (27%) between 1975 and 1996 and is projected to continue to fall.<sup>22</sup> Of the 2 million remaining farmers, a mere 3% sell more than \$500,000 per year and produce more than half of all American farm products by value.<sup>23</sup> Farmers are leaving the land, and the counties that rely most heavily on farms are faring worse economically than other rural counties.<sup>24</sup>

■ **Environmental challenges have grown.** Even as the number of family farmers has declined, several key environmental challenges associated with farming have grown. Increased fertilizer and pesticide use stresses large numbers of rivers, lakes, bays, and drinking water wells.<sup>25</sup> Instead of playing a major role in saving endangered species, agriculture is a major source of their decline.<sup>26</sup>

■ **Federal farm spending has ballooned.** In fiscal years 1995 through 1997, farm programs spent roughly \$7.5 billion per year. Although reforms in 1996 were designed to reduce farm spending, commodity prices declined, and Congress responded with multi-billion dollar emergency payments. By 1999, farm program payments had grown to \$19 billion, and they climbed to a record \$32 billion in fiscal year 2000.<sup>27</sup> The Congressional Budget Resolution adopted in 2001 provides on average more than \$20 billion in farm income support programs for each year of the next Farm Bill. (See Figure 3.)

In light of these vast sums of money, why have federal agriculture programs failed to meet their publicly stated goals? Traditional farm programs have certainly spurred American farmers to increase

**Figure 3: Farm Spending Has Risen Steeply and \$100 Billion is at Stake in the Next Farm Bill**



Direct farm payments and export subsidies have risen from around \$7.5 billion in the mid-1990's to more than \$20 billion

in recent years. The Congressional Budget Resolution allocates roughly \$20 billion for each year of the next five-year Farm Bill.

Sources: USDA, Office of the Chief Economist, Congressional Budget Resolution of 2001.



**Figure 4: How Well Do Farmers in Each State Do?**

State	Average farm marketing totals	Average government payouts	Government payout per marketing dollar
ND	\$ 2,881,371	\$ 776,714	\$ 0.27
MT	\$ 1,757,707	\$ 422,878	\$ 0.24
IL	\$ 7,249,885	\$ 1,322,539	\$ 0.18
LA	\$ 1,869,112	\$ 334,779	\$ 0.18
SD	\$ 3,523,553	\$ 587,895	\$ 0.17
KS	\$ 7,700,020	\$ 1,127,662	\$ 0.15
IA	\$ 10,355,353	\$ 1,510,786	\$ 0.15
IN	\$ 4,628,848	\$ 637,225	\$ 0.14
MN	\$ 7,370,344	\$ 1,009,270	\$ 0.14
MO	\$ 4,468,847	\$ 556,020	\$ 0.12
NE	\$ 8,701,526	\$ 1,059,737	\$ 0.12
AR	\$ 5,340,642	\$ 617,804	\$ 0.12
TX	\$ 13,128,892	\$ 1,456,298	\$ 0.11
MS	\$ 3,314,059	\$ 356,498	\$ 0.11
OK	\$ 3,945,391	\$ 414,319	\$ 0.11
OH	\$ 4,700,678	\$ 470,419	\$ 0.10
MI	\$ 3,475,221	\$ 298,588	\$ 0.09
TN	\$ 2,094,978	\$ 168,093	\$ 0.08
CO	\$ 4,331,556	\$ 312,946	\$ 0.07
SC	\$ 1,458,596	\$ 94,725	\$ 0.06
WI	\$ 5,894,536	\$ 368,461	\$ 0.06
ID	\$ 3,333,839	\$ 202,593	\$ 0.06
WA	\$ 5,043,966	\$ 263,309	\$ 0.05
GA	\$ 5,347,609	\$ 269,482	\$ 0.05
KY	\$ 3,688,179	\$ 184,605	\$ 0.05
AZ	\$ 2,273,055	\$ 93,509	\$ 0.04
AL	\$ 3,360,708	\$ 137,538	\$ 0.04
WY	\$ 850,984	\$ 34,319	\$ 0.04
NM	\$ 1,951,823	\$ 76,255	\$ 0.04
MD	\$ 1,500,608	\$ 52,698	\$ 0.04
AK	\$ 47,291	\$ 1,585	\$ 0.03
OR	\$ 3,072,223	\$ 102,726	\$ 0.03
VA	\$ 2,305,734	\$ 72,080	\$ 0.03
NC	\$ 6,925,911	\$ 207,050	\$ 0.03
NY	\$ 3,121,608	\$ 88,422	\$ 0.03
UT	\$ 973,725	\$ 27,535	\$ 0.03
WV	\$ 395,672	\$ 8,191	\$ 0.02
DE	\$ 746,025	\$ 15,193	\$ 0.02
CA	\$ 24,708,456	\$ 502,003	\$ 0.02
NH	\$ 152,141	\$ 2,902	\$ 0.02
ME	\$ 510,426	\$ 9,077	\$ 0.02
PA	\$ 4,122,467	\$ 69,817	\$ 0.02
VT	\$ 548,732	\$ 8,359	\$ 0.02
MA	\$ 451,735	\$ 5,940	\$ 0.01
CT	\$ 495,530	\$ 5,571	\$ 0.01
NJ	\$ 784,328	\$ 7,724	\$ 0.01
RI	\$ 56,236	\$ 522	\$ 0.01
NV	\$ 335,443	\$ 2,674	\$ 0.01
FL	\$ 6,913,800	\$ 50,916	\$ 0.01
HI	\$ 521,642	\$ 528	\$ 0.00
<b>USA</b>	<b>\$ 192,730,998</b>	<b>\$ 16,406,765</b>	<b>\$ 0.09</b>

The right hand column reveals how many cents farmers in each state received on average in 1998-99 in direct federal payments for each dollar of their farm production. Many major agricultural states, such as New York, Pennsylvania, California and Florida, receive little aid. Even in the states

that do well, most of the funds are directed at the largest farms, and farms that do not primarily produce “commodity crops” receive little if any money.

**Sources:** Data from USDA, Agriculture Income and Finance, Situation and Outlook Report (September 1999, and September 2000).

steadily the yields per acres of basic farm commodities. They also have buttressed the bad years for the country's larger farms. But traditional programs have important limitations and side effects. They are regionally inequitable; they favor large farms over small farms; they cause excess production that offsets some of their benefits by lowering prices; and they favor farming systems that have harsher environmental impacts over farming methods that are easier on the land.

Traditional programs are inequitable in part because they are limited to the production of wheat, feed grains and cotton, which actually generate only one-fifth of the value of the country's agriculture.<sup>28</sup> Dairy, fruit and vegetable, and livestock farmers are almost entirely excluded from direct financial support, although they derive some support from other programs. Farmers in whole regions receive little funding. Thus, USDA data shows that while farmers in North Dakota received from federal farm programs 27 cents for each dollar of product they generated in 1998 and 1999, farmers in such major agricultural states as New York, Florida, Pennsylvania, Oregon, North Carolina, and California received 3 cents or less. (See Figure 4.) A surprising fact is that according to the USDA Farm Census, two-thirds of the country's farmers receive no direct farm payments.<sup>29</sup>

Traditional programs are also highly skewed toward the largest farms. In 1995, according to a USDA report, the largest 2% of commodity producers on average received four times more funding than medium-sized commercial farms.<sup>30</sup> Since the "reforms" of 1996, payments have become even more skewed. From 1997 through 1999, 10% of those receiving payments in the principal farm program—so-called market transition payments—received 61% of all funds. Those recipients collected \$96,000 per year while the bottom half of recipients collected only an average of \$1,200.<sup>31</sup>

Traditional farm programs encourage farm consolidation and handicap smaller farms because they reward a kind of farming in which large farms are likely to dominate. Most basic crops today are grown on a massive scale, using expensive chemicals and machinery that must be amortized over a large land area. Thus, a farm growing 2,000 acres of corn, wheat, or cotton can generally produce each pound or bushel more cheaply than a farm growing only 200 acres (if environmental and social effects are ignored).<sup>32</sup> By continuing to base program payments on the amount of grain or cotton a farmer produces, farm programs will continue to favor larger-scale operations over smaller ones.

Farm programs can help smaller farmers only by supporting farm methods or products in which smaller farmers can compete. Government programs can help smaller and medium-sized farms that produce grains and cotton, but only if they reward achievements other than volume—such as environmental performance. Programs that support more diversified and specialized markets are also more helpful to average-sized farms because these markets reward the greater attention smaller farm operators can pay to more specialized products.

The narrow focus of traditional farm programs on large-scale production of a small number of crops encourages row crops at the expense of more environmentally beneficial fields of grass. Grass provides far more wildlife habitat, triggers far less soil erosion, and uses far less fertilizer and pesticides than do cotton and grain fields. Most of the country's corn and soybeans, and much of the wheat, is produced to feed beef and dairy cows, hogs, and chickens living in concentrated feedlots. Alternatively, these animals could gain more of their weight by eating hay or grazing in pastures, thereby eliminating the need to put as much land into crop production. Of the 460 million acres classified by USDA as potential cropland, roughly 120 to 130 million acres are actually

used from year to year to grow grass for haying or pasture, and tens of millions more could be planted in grass as part of paid conservation programs.<sup>33</sup> Although most grain and cotton land would still be cropped if government programs disappeared, government programs that reward only crops probably shift millions of acres of grasslands into cropland—perhaps more than 30 million acres according to some economists.<sup>34</sup>

Farm programs also stress the environment because they often encourage farmers to grow the same one or two crops year after year on the same land. This practice invites pests and requires more use of pesticides (and occasionally more use of fertilizer) than rotating a variety of crops.<sup>35</sup>

Even for the farmers who receive most of the government aid, traditional farm programs create some problems. By paying farmers more for growing more grain and cotton, farm programs encourage farmers to plant more of these crops, prolonging periods of surpluses and depressing prices. Lower average crop prices over the long term offset at least some of the benefits of government aid. Programs would benefit farmers more if they delivered the same dollars without spurring surpluses and lowering crop prices.<sup>36</sup>

The 1996 Farm Bill was designed to avoid this problem because its major payment program was based not on current crop size, but on how much grain or cotton a farmer had produced in the early 1990s. In theory, farmers were free to convert crop fields to pasture or to grow more diverse crops if that was what the market signaled. Although this program locked in prior inequities, this “Freedom to Farm” provision had the potential at least to reduce incentives to produce surpluses in the future. But since the 1996 Farm Bill, tens of billions of dollars in spending has continued to be tied directly to the amount of crops produced through loan deficiency payments and crop insurance. So long as farmers know that

most spending programs are ultimately tied to the basic commodities, they are understandably reluctant to experiment with alternatives.

The recent explosion of government payments highlights the problem. Prior to 1996, key federal farm programs included a brake to offset their accelerating effects on production. For example, some programs required farmers to idle some of their fields when crops were abundant. But since Congress abolished supply controls in 1996, federal payments have kept a foot on the accelerator without a foot on the brake. As crop prices plummeted in 1998 and 1999, only higher payments kept commodity farmers from losing money.<sup>37</sup> In the calendar year 2000, according to USDA, nearly all the net income of grain and cotton producers resulted from government payments.<sup>38</sup> Yet, because the government keeps paying farmers to grow surplus grains, the market never adjusts, and prolonged surpluses keep farm prices low. Today, only a major drought or flood in a grain-producing part of the world would break the cycle of growing surpluses and increasing government aid.

## 2 Meeting the Challenges Through The Next Farm Bill



There is no reason farm programs must follow the traditional path and pay farmers to produce more of a limited selection of commodities. The next Farm Bill, which is already under consideration, creates an opportunity to reform farm programs to boost farm income and give farmers, ranchers, and forest landowners incentives to provide clean water and habitat for rare wildlife, to combat climate change, and to save farmland and forests from urban sprawl. By aiding smaller and average-sized farms, farm programs can help rural communities stay vibrant.

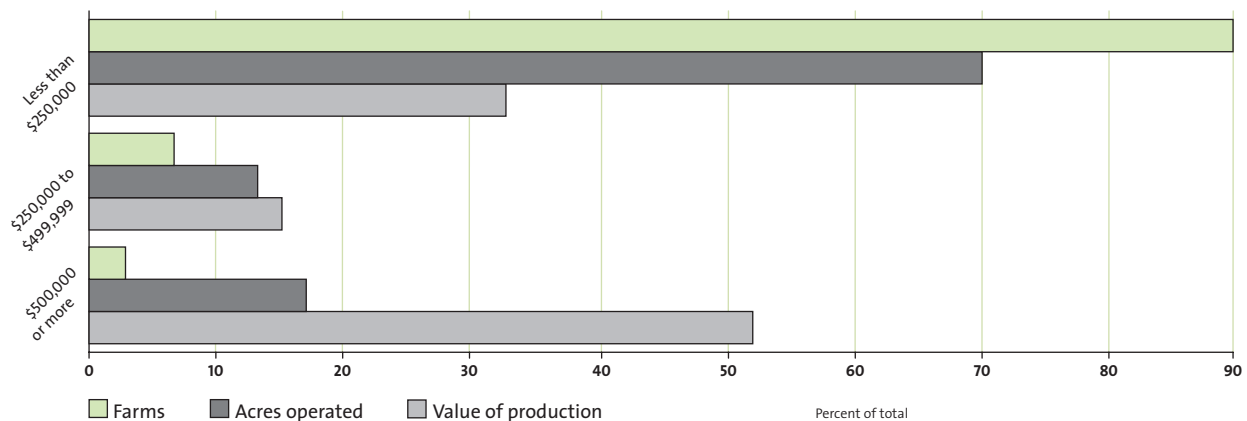
Carefully designed reforms can benefit both the environment and rural communities.

- Conservation programs can and should be part of the income support system and reward farmers for protecting the environment. Many traditional

conservation programs have only partially offset some of the costs of conservation practices, giving farmers little real incentive, except their own sense of stewardship, to protect the environment.

- Many farming methods that benefit the environment can also increase farm revenue or decrease farm costs. Agriculture conservation practices can produce energy by recapturing methane from manure, reduce the volume of animal feed and therefore volumes of manure, or increase the nutritional value of their grasses.
- Unlike many traditional commodity programs, conservation incentives should not spur increased production, and thus should not increase or prolong surpluses that decrease prices.

**Figure 5: Distribution—by Sales Class—of Farms, Acres Operated, and Value of Production, 1999**



The lowest column of this USDA chart shows that 3% of the farms, using 17% of the land, produce 52% of the value of all agricultural products. By contrast, 90% of all farmers manage 70% of the land but produce around one third of the

products. These facts suggest that programs that reward farmers based on the quality of their land stewardship could benefit more farmers than programs that base payments on the amount of crops produced.

Source: USDA, Economic Research Service.

- Conservation incentive programs can benefit all farmers in all regions, not only certain farmers growing select crops in limited geographic areas.
- Conservation incentive programs can help smaller farmers survive by rewarding the production of public goods, including clean water and wildlife habitat. In the arena of producing public goods, smaller farms can compete effectively against the largest. According to USDA, the 3% of all farmers who produce half of all agricultural products use only 17% of all agricultural land—and this percentage continues to decline steadily. (See Figure 5.) Stewardship of land resources represents one of the major growth opportunities for the 90% of farmers who manage 70% of the land but produce only one-third of the country’s agricultural products.
- In the long run, highly mechanized farms that require few workers cannot sustain rural communities. Funds to develop markets for a broad range of goods produced by smaller farms or support rural development in other ways can help rural communities diversify their economies.

In contrast to the problems associated with traditional farm programs, conservation programs have produced significant benefits. Spurred by the dust-bowls of the 1930’s, Congress began funding soil conservation programs to minimize soil erosion. Although soil erosion remains a significant problem today, soil erosion rates have declined significantly.<sup>39</sup> Since its enactment in 1985, the Conservation Reserve Program has restored grasslands throughout the central U.S., thereby helping bring many grassland bird species back from near extinction and boosting populations of many duck species.<sup>40</sup> The Wetlands Reserve Program, which has restored almost one million acres of wetlands, has been so popular that demand for its services far exceeds supply.

The next Farm Bill presents Congress with a great opportunity to build on these successes and address many challenges.

## Challenge

### Improve Water Quality

Nearly 88% of the rain and snow that falls on the United States each year falls on private land before it flows into our reservoirs, drinking water faucets, and coastal nursery grounds for fish.<sup>41</sup> This land can either cleanse or pollute this water before it flows into streams or ground water supplies. Because most of this precipitation falls on farmland, farm practices have a great impact on water quality.

Many farmers already implement some practices to keep sediment, fertilizers, and pesticides from running off their farms and into rivers and streams. But because farming occupies so much of the land, and frequently relies heavily on chemicals, it is not surprising that state reports to the Environmental Protection Agency list agricultural runoff as the most prevalent source of water quality problems.<sup>42</sup> As a whole, state water monitoring data indicate that one-third of river miles, 45% of lakes, and 44% of bays violate water quality standards.<sup>43</sup>

Increasing fertilizer use is a major water quality problem. Fertilizer use has tripled since 1960, rising from 7.5 million tons to more than 22 million tons, including a more than 6-fold increase in the use of nitrogen in the 42% of the United States that feeds runoff into the Mississippi River. (See Figure 6.) During this same period, the flow of nitrogen down the Mississippi River to Gulf of Mexico increased more than 3-fold.<sup>44</sup> Excess nitrogen triggers algae blooms and “dead zones” of low or no oxygen in 43 of the country’s coastal bays. In the Gulf of Mexico, the dead zone has recently reached 8,000 square miles, an area the size of New Jersey.<sup>45</sup>

Some of the nitrogen applied on farm fields percolates down into groundwater. Unsafe levels of nitrate, which can cause miscarriages and blue-baby syndrome, have been found in more than a quarter of rural wells in some coastal states and the northern plains, and in community water systems serving 3 million people.<sup>46</sup>

Agriculture contributes to water quality problems in a variety of ways.

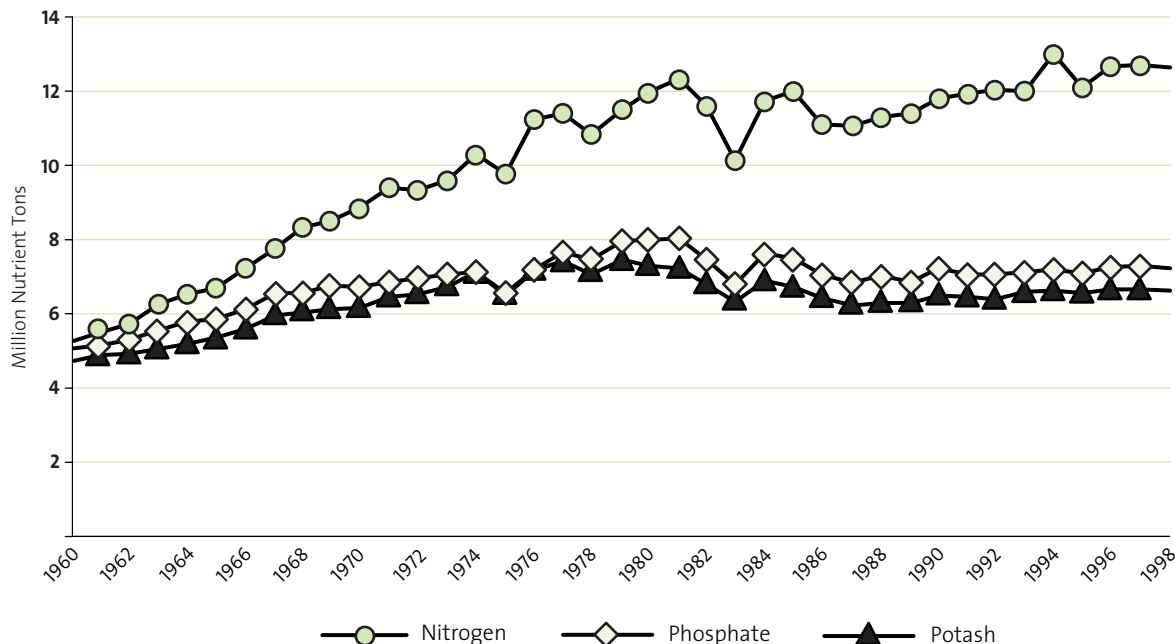
- Runoff water from crop fields carries pesticides and phosphates that are not absorbed by the crops.
- Runoff creates soil erosion, particularly on cropland that lies on steep slopes, is plowed in certain ways, or is left bare during winter months. Soil not only carries chemicals, but also is one of the principal sources of water pollution itself because it suffocates fish eggs and bottom-dwelling insects needed by fish and waterfowl. The costs of sediment damage have been estimated at \$2 to \$8 billion per year from increased water treatment costs and increased dredging of navigation channels.<sup>47</sup>

- Agricultural drainage eliminates wetlands that would otherwise filter water naturally. Drainage systems also move water through streams rapidly, which erodes banks and pollutes water with sediment.
- In some irrigated landscapes, water returned from irrigation fields can leach toxic metals or excess salts. Heavy irrigation withdrawals can also leave rivers with too little water for wildlife or to absorb normal pollution levels.

Fortunately, farmers themselves have proved that a variety of practices can reduce pollution loads greatly.

Simply by testing soil or plant tissue and calculating fertilizer needs accordingly, farmers can reduce fertilizer use and farm expenditures. But testing is

Figure 6: Fertilizer Usage



Runoff of excess fertilizer is a major reason 43 major coastal bays have algae blooms or dead zones. Proven techniques can reduce fertilizer use while maintaining yields.

Source: USDA, Economic Research Service.



FEDERAL INTERAGENCY STREAM RESTORATION WORKING GROUP

*Stream buffers can filter most of the sediment and fertilizer out of the water that passes through them. Programs from the last Farm Bill have helped farmers plant buffers on almost 4 million acres, but USDA experts estimate that at least 12 million acres are needed.*

implemented on no more than one-third of acres planted to corn, wheat, soybeans, or cotton.<sup>48</sup> Injecting fertilizer directly into soils instead of spraying it on fields can reduce losses by as much as 35% while increasing yields.<sup>49</sup> By splitting nitrogen fertilizer into separate applications during and after spring planting, farmers can reduce losses by as much as 40% without reducing crop yields.<sup>50</sup> Despite these opportunities, most corn, soybean, cotton, and potato fields are fertilized either before planting in the spring or even in the fall, when losses are sure to be high.<sup>51</sup>

Farmers can greatly reduce soil erosion by plowing lands less deeply, leaving corn stalks and other crop residues to cover the soil during the winter, and using “no till” techniques in which farmers plant seeds into the soil without turning it over. Although large numbers of farmers use these techniques, a majority of farmers still do not.<sup>52</sup>

Farmers can also install a wide variety of buffers—strips of trees or grasses—to intercept and filter runoff water. Buffers placed within fields, on field edges, or along streams usually remove more than half of the sediment, pesticides, nutrients, or bacteria in the water that moves through them.<sup>53</sup> Although farm drainage tiles and ditches can circumvent a normal buffer, restored wetlands can work like a buffer and filter the drainage water. In the right size and location, wetlands can also remove

most of the sediment, fertilizer, and pesticides in agricultural runoff. A team of scientists and economists studying the dead zone in the Gulf of Mexico has recommended the restoration of at least 5 million acres of wetlands within the Mississippi River watershed to help reduce the flow of nutrients into the river.<sup>54</sup>

Simple irrigation efficiency techniques can help solve problems in irrigated landscapes. Farmers can cut irrigation in half simply by lining earthen ditches or using pipes to drip irrigation water on the field rather than using nozzles to spray it through the air. Farmers can shift to crop varieties that use less water. Simple water management techniques that reduce water consumption can also greatly reduce leaching of toxic metals and other pollutants.

Many of these practices can save farmers money, but some also impose obvious or hidden costs—which explains why they are not more widely adopted. For example, farmers who fertilize in the fall must use more fertilizer, but they do so because fertilizer is cheaper in the fall and because they do not risk costly delays during the planting season in the case of bad weather. Irrigation improvements may require new equipment, and buffers often involve removing some land from production. If incentive programs compensate landowners for these risks, farmers and the environment can benefit accordingly.

Some existing farm programs fund water quality improvements and have produced significant benefits. The Conservation Reserve Program pays farmers to plant grassed or forested buffers on cropland, and it has provided farmers with funds to create almost 3 million acres of buffers. However, those working on the buffer program estimate the total need at 12 to 16 million acres.<sup>55</sup> The Wetlands Reserve Program pays farmers to restore wetlands. The Environmental Quality Incentives Program reimburses farmers for much or all of the costs of a broad range of water quality practices. Each of these programs can be improved in ways discussed in the next section, but all three programs share a common problem—inadequate funding.

# Challenge

## Safely Manage Manure

Livestock production causes special water quality problems. Pigs, poultry, and dairy and beef cows comprise half of the dollar volume of American agriculture,<sup>56</sup> but animal producers have received little assistance from traditional farm programs.

America's animal feedlots are increasing in size, and the vast amounts of manure they produce contribute heavily to many of the country's biggest water quality problems. Livestock produce 130 times more waste per year than do all the humans in the United States—5 tons per year for every American citizen,<sup>57</sup> and nearly all hogs and poultry and many cows produce this waste in large feedlots. (See Figure 7.) Pollution from this manure finds its way into drinking water wells, streams and coastal bays. Waste lagoons leach pollution into groundwater, and excess manure applied to farm fields washes off with the rain. Perhaps most significantly, pollution evaporates into the air producing noxious and unhealthful odors, as well as ammonia that falls back to earth and contaminates coastal bays.<sup>58</sup>

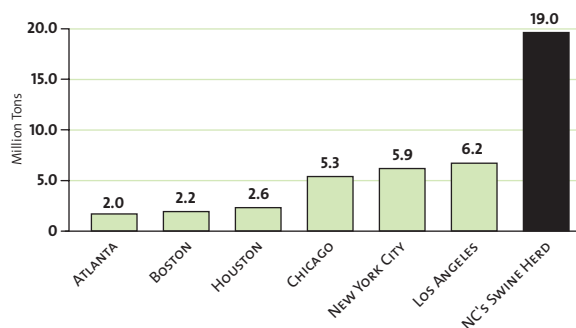
Roughly half the country's rivers have excessive levels of phosphorus, and feedlots are the largest source.<sup>59</sup> Feedlots are likely the primary source of the nitrogen that creates dead zone problems in many coastal waters.<sup>60</sup> Spills from feedlots also cause massive fish kills.

Manure is also a major public health concern because it contains bacteria, viruses, and protozoa that can contaminate swimming and drinking water,<sup>61</sup> as well as vegetables and fruits when applied to farm fields. In 1999, manure runoff from a dairy barn contaminated water supplies, which killed 2 and sickened over 1,000 people attending a New York county fair, and a similar problem killed 6 and sickened 2,000 people in Canada.<sup>62</sup> Public health experts have connected a number of disease outbreaks to vegetables that have been contaminated by manure.<sup>63</sup> Of 80

reported disease outbreaks in the United States tied to the consumption of domestically produced food and vegetables, more than 50 resulted from strains of *Salmonella*, *E.coli* or *Campylobacter*, which almost certainly came from animal manure.<sup>64</sup> And because of reporting gaps, the number of true manure-related food outbreaks is almost certainly much greater.

The largest feedlot operations are putting smaller producers out of business at a rapid pace. More than two-thirds of pork producers disappeared between 1982 and 1997, and a quarter of dairy producers went out of business in the 5-year period after 1992.<sup>65</sup> Three percent of pork producers and 2% of beef producers now control half of their respective markets.<sup>66</sup> These very large commercial operations require permits under the Clean Water Act, and in general, they can afford and should be responsible for their own costs of pollution control.

Figure 7: Hogs vs. Humans



*Massive hog feedlots in North Carolina alone produce more waste each year than the cities of Houston, Chicago, New York and Los Angeles combined, but they manage it with only the most primitive techniques and dump it all locally. Any real solution to the pollution problems from manure requires reprocessing it so that it can be moved and used as fertilizer where it is really needed.*

Source: K. Cochran, J. Rudek, D. Whittle, Dollars and Sense (Environmental Defense 2000)





USDA, AGRICULTURE RESEARCH SERVICE

*Many dairy farmers have discovered that rotating cows frequently among pastures provides the most economical business model. Feeding animals in pastures also uses far fewer chemicals and provides more wildlife habitat than growing corn and soybeans as a feed source and transporting them to feedlots. Today's farm programs tilt the field in favor of the grain/feedlot system, but alternative farm programs can at least provide equal opportunities for grazing.*

But smaller farms still produce three-quarters of the manure generated from dairy feedlots, and roughly half of the manure from poultry and hogs.<sup>67</sup> These smaller operators, already under great pressure from the largest factory farms, need help to address environmental and public health problems and to survive at all. Financial incentives can help them implement a variety of practices that will greatly reduce pollution and increase profits in the long run.

**Improved Storage and Land Application:** Many smaller operations can reduce excess runoff simply by storing waste more carefully, by measuring the nutrient content of manure and soil, and by applying

manure with better calibrated machines. One study found that farmers put twice the amount of manure needed on fields simply because of inaccurate field spreaders.<sup>68</sup> Farm plans can also direct application away from erosion-prone zones and zones near streams to decrease the likelihood of runoff.

**Changed Feeding Practices:** Many dairy farmers have found that they can reduce feed by following careful feeding regimens, and thereby reduce both costs and the volume of manure. Other farmers have found that by adding an enzyme to feed, they can reduce phosphorus excretions by 25 to 50%.<sup>69</sup>

**Decreased Confinement and Increased Grazing:** Many dairy farms can use rotational grazing to reduce reliance on grain and feeding in confined situations. Originally pioneered in New Zealand, rotational grazing rotates cows rapidly through small fenced areas (often using movable fences), generating more rapid and nutritious grass growth. Some analyses suggest that rotational grazing can be a more profitable system for many dairy farms, while reducing erosion and achieving a greater local nutrient balance.<sup>70</sup> Pig farmers can also forego massive centralized barns for hoop houses—steel hoops covered with a polyvinyl tarp—to house smaller numbers of pigs on a bed of dung and straw. After each group of pigs is sold, the bedding can be cleaned out and directly applied to crops or composted.<sup>71</sup>

Even more promising are innovative technologies to overcome the fundamental problem of too much manure in one location. Although raw manure is an ancient source of fertilizer, it is extremely bulky compared to commercial fertilizers. Few farmers transport manure more than a few miles from its source,<sup>72</sup> meaning that farmers frequently end up spreading more manure on adjacent farm fields than those fields can accommodate. According to USDA, feedlots in more than 100 counties generate more manure today than the farm fields in those counties could use even if manure replaced all commercial fertilizer.<sup>73</sup> New technologies can overcome this problem.

One solution to excess manure is digesters that serve one or more farms by decomposing manure in an enclosed vessel and capturing methane, which then can be burned for heat and electricity. Because they capture the evaporating pollutants from manure piles and kill most disease germs, digesters have great environmental advantages. Some farm engineers are growing high-value vegetables or special animal feeds directly in manure slurry in greenhouses or lined trenches. Some systems concentrate manure so that it can be transported more cheaply to where it is needed.<sup>74</sup>

In general, these practices can help address public health concerns. Keeping animals in pasture reduces the amount of manure that must be disposed of elsewhere. Perhaps more significantly, composting and digesters can reduce bacteria and viruses found in manure, making it safer to use for fruits and vegetables. While many fruit and vegetable farmers now shy away from manure because of its safety concerns, these efforts to resolve health concerns should open up new markets for manure.

A variety of additional good housekeeping measures, from rodent control to screening of diseases in young animals and finished products, can greatly reduce contamination levels. A sample program for egg production in Pennsylvania reduced the presence of salmonella from 23% to 3% in just 3 years.<sup>75</sup>

Farm programs can help farmers shift to these improved systems for generating and handling manure. The Environmental Quality Incentives Program funds some of these efforts today, but available dollars have been too limited and used too infrequently to promote innovative methods that truly can address the challenges associated with manure.

## Challenge

### Ensure Public Health

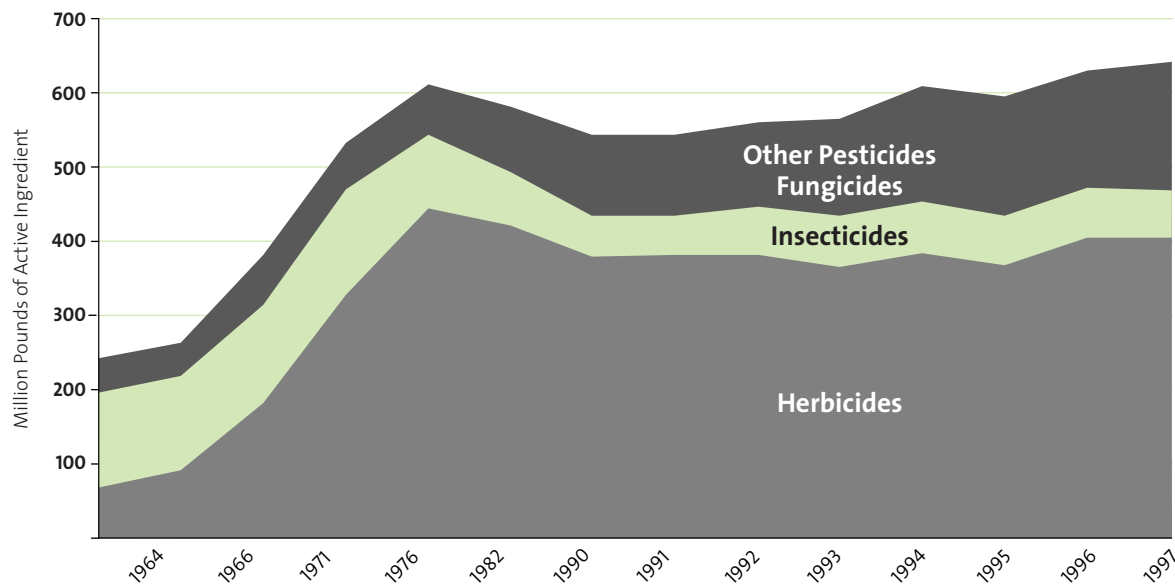
For the most part, America's food supply is safe. But the nation's food production system does create a number of serious challenges to public health. In addition to the disease concerns associated with manure management discussed earlier, such challenges include pesticides and threats to the integrity of the nation's antibiotics.

Since 1964, the use of pesticides has grown three and a half times even as they have become more powerful. (See Figure 8.) Adjusted for potency, pesticide use continues to increase each year (although there has been some shift toward pesticides that present fewer risks to the public).<sup>76</sup> Americans use more than 500 different types of pesticides and more than half a million tons of active pesticide ingredients a year,<sup>77</sup> and these pesticides have been estimated to reduce crop losses due to pests by 10%.<sup>78</sup> But less than 1% of these pesticides actually reach the target pests: the remainder enters the environment at least temporarily.<sup>79</sup> Many widely used pesticides are known or suspected to cause brain and nervous system damage, cancer, and disruption of immune systems.

A 1994 review of more than 20,000 drinking water tests in the Corn Belt and the Chesapeake Bay area found that more than 14 million Americans drink public water that routinely contains pesticides.<sup>80</sup> It also found that 4 million Americans in more than 200 communities are exposed to levels of herbicides in drinking water that exceed federal safety benchmarks more than 10 times. Water supply treatment costs also increase substantially when pesticides are present.

Pesticides pose special concerns to children because of their high metabolisms and low body weights. More than 1 million children between the ages of 1 and 5 ingest at least 15 pesticides every day from fruits and vegetables. More than 600,000 of these children eat a dose of organophosphate insecticides

**Figure 8: Pesticide Usage**



*Pesticide use remains high in the United States. Sweden has shown that it is feasible to reduce pesticide use by 50%.*

Source: USDA

that the federal government considers unsafe, and 61,000 eat doses that exceed benchmark levels by a factor of 10 or more.<sup>81</sup>

Controversy surrounds the issue of children's exposure to pesticides because of the issue's great importance to parents, some inevitable scientific uncertainty, and farm group concerns about market loss. But there are many other important reasons to reduce pesticide use. According to the General Accounting Office, 300,000 direct cases of pesticide poisoning are reported each year in the United States, with approximately 20 fatalities, most of which are children.<sup>82</sup> Epidemiological evidence shows that farmers and farm workers have a significantly higher rate of cancer than do non-farmers. Some studies suggest that pesticides may be linked to Parkinsons disease and Lou Gehrig's disease. As urban areas encroach upon farmland, the likely exposure of non-farm residents to harmful levels of pesticides increases.<sup>83</sup>

Pesticides also threaten wildlife. Large-scale die-offs of various species of birds, fish, and even alligators have been documented.<sup>84</sup> The EPA estimates that a single pesticide kills 1 to 2 million birds in a single year.<sup>85</sup> Most recently, scientists have linked pesticides to widespread deformities and disappearing populations of frogs—a problem that may be large enough to endanger the survival of many species.<sup>86</sup> Tests show that shellfish, beneficial insects, shrimp, and fish are particularly susceptible to pesticides, although the magnitude of effects in the wild is hard to document.<sup>87</sup>

Another important recent concern is the ability of pesticides to mimic the female hormone estrogen and disrupt normal hormone functions in humans. There is evidence that these kinds of effects are probably contributing to global declines in human sperm counts, cancer, birth defects, and possibly female sterility, as well as causing similar problems for wildlife.<sup>88</sup> Policy implications are significant

because these problems probably result from the combined exposure to multiple pesticides: 40% of the weight of active ingredients are known to disrupt hormone systems.<sup>89</sup> Reducing these risks probably requires a general reduction in the use of pesticides, rather than strict regulatory controls on only a few.

Excessive pesticide use also creates problems for farming. Because pesticides kill many natural predators that keep pests under control, their use ironically has been linked to many large outbreaks of pests. Pesticides hurt commercial honeybees and other wild pollinators of fruits and vegetables, threatening the one-third of U.S. agricultural production derived from insect-pollinated plants.<sup>90</sup> According to one estimate, pesticides cost \$4 billion per year in lost agricultural production and increased costs.<sup>91</sup> And over time, heavy pesticide use triggers resistance among the pests, so 10% to 25% of today's pesticide cost is probably attributable to the increased resistance from past use of pesticides.<sup>92</sup>

Fortunately, farmers can adopt a wide variety of practices to reduce pesticide use. Simply by rotating crops, farmers can curb the amount of pesticides used. Many pests attack only a specific crop and decline significantly when a different crop is planted for a year or two. Farmers can also change the timing of planting and harvesting to avoid pest infestations, and remove crops or plants that provide winter pest habitat. Farmers are also using other living organisms—such as pest predators, parasites, and weed-feeding invertebrates—to control crop pests and weeds, and some are providing habitat for the natural enemies of crop pests. In many cases, farmers can simply increase their inspection of crops and then wait to spray crops until pests are present. Some farmers plant a small plot of a crop earlier than the rest of the crop in order to attract and kill a particular pest. Farmers can change their method of spraying pesticides. While most farmers broadcast pesticides across the field, and some spray pesticides from airplanes, other farmers have employed an alternative technique—banding applications—which can dramatically lower herbicide application

rates. Farmers are also using drip pans to catch “overspray” from equipment.<sup>93</sup> Federal programs can assist farmers in these efforts.

An increasing number of farmers are avoiding synthetic pesticides altogether and choosing organic farming methods. Sales of organic foods more than doubled in the 1990's, and annual growth rates are estimated at 20-30%.<sup>94</sup> Foreign markets are growing comparatively, and organic food sales in 1997 represented 1% to 2% of all sales in the U.S. and major developed markets. Because consumers are willing to pay significant premiums for organic products, the growth of this sector has the potential to benefit farmers as well as the environment. In the dairy and livestock sector, organic farmers rely more on grass and less on grain feeding than do conventional farmers. In grain, fruit, and vegetable production, organic farmers employ a range of crop rotations and natural pest controls to control insects and weeds.

Recent USDA rules that establish labeling standards for use of the term organic are expected to spur even greater growth in this industry. But making the transition to organic food production raises financial challenges because farmers must generally avoid application of agricultural chemicals for 3 years before they can call their products organic, and because it is common for farmers to experience reduced yields during this transition. Farmers also incur costs going through the organic certification process. Financial assistance to ease this transition period, along with marketing assistance for existing organic farmers, could help spur further growth in this sector. Most experts also believe that changes in loan programs and shifts in the research budget would encourage organic production.

Another growing public health concern is the heavy use of antibiotics in animal feedlots. Overall, the increasing ability of deadly bacteria to resist the antibiotics prescribed by doctors is an emerging public health challenge of great magnitude. Resistant bacteria are already responsible for many deaths, and the problem grows as strains of disease become resistant to more and more antibiotics, leaving fewer or no antibiotics that work. Meanwhile,

medical expenses increase as patients go through many rounds of different and increasingly expensive antibiotic treatment and remain hospitalized far longer to deal with antibiotic-resistant infections.

Animal agriculture, according to the best available independent assessment by the Union of Concerned Scientists, may use 84% of all the antibiotics sold in the United States, including many antibiotics of importance to human health. Most of this use is to promote animal growth, not to treat illness. This so-called “sub-therapeutic” use probably amounts to 70% of the total antibiotics used in the country.<sup>95</sup> Because this treatment is not designed to kill all bacteria, it is especially likely to generate resistant bacteria. One strain of *Salmonella* resistant to 5 antibiotics grew from 0.6% of all *Salmonella* in 1979-1980 to 34% in 1996.<sup>96</sup> Animal agriculture has also been linked to antibiotic-resistant *Enterococcus*, *E.coli*, *Streptococcus*, and *Pneumonia* bacteria.

The problem extends beyond simply the evolution of resistant diseases in the animals themselves. Scientists believe that antibiotic resistant bacteria in animals that pose no direct risks to humans can still transfer their resistance to bacteria that do cause human disease. Antibiotic resistance can move from animal operations to humans not merely through the meat supply, but through infection of farm families and workers. Both antibiotics themselves and antibiotic-resistant bacteria can enter the environment through manure and contaminate rivers, lakes, and groundwater, where they can further trigger resistant bacteria.

Both the World Health Organization and the American Medical Association have called for phasing out the non-veterinary use on animals of the antibiotics that are important to human health. Farmers also can reduce the medical use of antibiotics by taking measures that improve animal health. Reduced confinement systems, such as hoop houses and rotational grazing, provide useful options. Incentive programs can encourage these efforts.

## Challenge

### Save Endangered Species and Other Wildlife

Nearly 70% of the land in the contiguous United States is privately owned farms and forests.<sup>97</sup> Not surprisingly, a number of scientific studies have shown that this land is critical to imperiled wildlife species. Of all known populations of threatened and endangered animals, two-thirds do not occur on federal lands.<sup>98</sup> Of animals protected by the Endangered Species Act, about half rely on private and state land for at least 80% of their habitat.<sup>99</sup> Wildlife is not only at risk from the potential conversion of this habitat to other uses, including agricultural expansion,<sup>100</sup> but in many cases, habitat for rare species will disappear unless landowners actively manage it, for example, by controlling foreign weeds or reproducing natural fire patterns. The survival of many rare species depends on the *active* stewardship of private landowners, and farm owners in particular.

The good news is that farmers can often engage in a wide variety of practices to enhance habitat for imperiled native wildlife, and in nearly all cases, other wildlife as well.

*Prairie dogs were once ubiquitous on most of America's rangelands, but they have been so reduced that all 4 species are at some risk of extinction, hurting many other species that rely on them. Ranchers and conservationists are working together to increase federal incentives to preserve and restore them.*



US FISH & WILDLIFE SERVICE

Many rare species rely on healthy range lands in the West. The range and shrub lands of southern California, for example, support a special ecosystem. Its decline as a result of sprawling development has made southern California a hot spot for endangered species where the San Joaquin kit fox, the arroyo toad, the California gnatcatcher, the quino checkerspot butterfly, and other imperiled species struggle to survive.<sup>101</sup> Their survival largely depends on the preservation of range lands and on the control of invasive species. Elsewhere in the West, 4 species of prairie dogs, which once numbered in the hundreds of millions, are now rare or even highly endangered. Prairie scientists consider them a keystone species of range land ecosystems because they create habitat and provide a food source for other animals, including the black-footed ferret, swift fox, mountain plover, sage grouse, and burrowing owl, all of which are declining. Landowners can restore habitat for all these species even while continuing to use their land for cattle. They can replant native grasses where they have eroded, control invasive foreign weeds, curb excess livestock use, and in some places reintroduce the natural patterns of small fires critical to native grasses and flowers.<sup>102</sup>

Grasslands in the central and northern plains have also declined in quality and quantity, leading to steep, consistent, and geographically widespread declines of many grassland bird species. According to the National Biological Service, the number of lark bunting and grassland sparrows declined by 50% between 1963 and 1993.<sup>103</sup> In some cases, farmers can help restore these species by postponing haying and grazing until later in the summer when nesting ends, by combining patches of remaining pasture into larger units, and by curbing excess pesticide use in neighboring croplands.

The press has focused significant attention on the many rivers on both the Pacific and Atlantic coasts where salmon have become endangered. According to all the government studies, a major cause is the decline of streamside forest that provide shade and cools water temperatures, keep sediment out of the water, stabilize river banks, and contribute woody



ANN COOK

*Many bird species that nest in grass fields, like this Meadowlark, are declining seriously. With incentives, farmers can postpone haying their fields until after birds fledge and give grassland birds a chance to rebound.*

habitat at the base of the food chain. Another factor is small stream blockages like pipes under roads that keep salmon from moving upstream but that can be easily reconfigured. Farmers can enhance salmon habitat by reestablishing woody buffers and removing blockages. Similar streamside efforts can improve habitat for rare species in much of the country, such as rare shellfish in Kentucky, Tennessee, and Georgia.

Farmers can enhance habitat by restoring wetlands for many rare species, from salmon in the Pacific Northwest to wood storks and panthers in southern Florida. At least one-third of all endangered species rely heavily on wetlands. Because farms dominate private landscapes, it is not surprise that farming has caused 80% of the country's wetland loss since colonial times.<sup>104</sup> Many of these former wetlands are highly productive, but some are marginal because they continue to flood frequently, making these fields particularly appropriate for restoration.

All of these activities to enhance habitat for rare species will also benefit other wildlife, including many coveted by sportsmen. Restoring grasslands and longleaf pine forests regenerates pheasants and deer. Streamside buffers are needed for the trout sought by anglers. Restoring wetlands greatly benefits duck populations. Targeting wildlife efforts on protecting rare species makes sense because many other species also benefit, while the reverse is often not true.



*Endangered salmon along both northern Pacific and Atlantic coasts need reinvigoration of streamside forests on farms*

*to make streams usable for spawning. A variety of farm programs can help farmers restore these buffers.*

Typically, activities to enhance wildlife habitat come at some financial cost, so most farmers need incentive programs to take advantage of these opportunities. When government has offered incentives, farmers have been willing participants, with documented benefits to wildlife. In regions with large enrollments of land in the Conservation Reserve Program (CRP), declining bird populations have rebounded dramatically. Minnesota, Iowa, Illinois, and Nebraska have all reported increased populations not only of uncommon species, such as northern bobwhite, but also of pheasant, a common game bird. The Colorado population of greater prairie chicken has increased from 2,000 birds to nearly 20,000 birds—an increase directly linked to habitat provided by CRP easements. And while populations of many important duck species like mallards and pintails declined by 40% to 70% during the 1980's, duck populations rebounded in the 1990's in significant part because of wetlands restored through CRP and the Wetlands Reserve Program.<sup>105</sup>

Farm programs can offer even more wildlife benefits, particularly for rare species, if land retirement programs are not only expanded but also focused more on restoring rare habitats. Farmer interest in the Wetlands Reserve Program, which buys permanent

and 30-year restoration easements, has exceeded available funding by a 3-to-1 margin—more than 500,000 acres of wetlands are currently available for enrollment if the program were adequately funded.<sup>106</sup> Great opportunities also exist to enhance habitat on working lands through means other than land retirement. A small program created in the 1996 Farm Bill, the Wildlife Habitat Incentives Program, provides grants to landowners to enhance habitat for wildlife, and it has received far more applications than it can fund.

For such programs to work, landowners must be reassured that efforts to attract endangered species will not result in new restrictions under the Endangered Species Act. The US Fish & Wildlife Service has created a mechanism to do so, called Safe Harbor agreements, which assure landowners they will not be responsible for any obligations for additional endangered species they attract. It does have some costs, for landowners need to engage a wildlife biologist to assess whether endangered species already rely on the property. Part of any federal initiative should include provisions to expedite these agreements and to reimburse landowners for these costs.

# Challenge

## Combat Sprawl

An accelerating environmental challenge facing the United States is the increasing rate of sprawl. Since 1992, urban and suburban growth has claimed farm, ranch, and forest lands at a rate of 2.1 million acres per year.<sup>107</sup> This sprawl uses land more inefficiently than before, eating up land at twice the rate of population growth.<sup>108</sup> From 1960 to 1990, urban and suburban areas almost tripled, while average population density fell by more than one-third.<sup>109</sup> If present trends continue, some experts predict suburban land use will grow by 8 to 12 times the rate of employment and population growth.<sup>110</sup>

Sprawl imposes a wide variety of environmental and social costs. Pavement generates 16 times more runoff than the average farmland, and in many cases, more pollution.<sup>111</sup> One study found that after 12% of an area is developed, rapid drainage of rainwater into local streams quickly deprives them of their ability to support aquatic life.<sup>112</sup> Even after Maryland and Virginia made expensive investments in sewage treatment to protect the Chesapeake Bay, a 1992 study found that growing runoff pollution from sprawl in these states had offset these reductions for many pollutants.<sup>113</sup>

Sprawl increases air pollution. The number of miles Americans drive doubled between 1960 and 1990, even as population increased only 40%.<sup>114</sup> This growth rate of more than 3% each year has offset most of the pollution-reduction benefits of new technologies and reformulated gasoline. It also means great increases in congestion—57% in the 3-year period between 1985 and 1988—which carry costs estimated by the Office of Technology Assessment in the tens of billions of dollars.<sup>115</sup>

Sprawl harms wildlife—not just by paving over habitat, but also by fragmenting it. That helps explain the decline of more than a dozen migratory birds that need forest interiors only to roost or nest successfully.

Sprawl also costs taxpayers more dollars for new infrastructure, even while it exacerbates poverty and crime in urban areas. The public costs of roads, schools, and sewers for a typical development 10 miles from central facilities is more than double that for closer, denser development.<sup>116</sup> Meanwhile, sprawl can depopulate cities and lead to concentrated populations of urban poor.

Farms serve on the frontline against urban sprawl. Those located near urban centers serve as the primary source of fresh, locally grown food—79% of our fruit, 69% of our vegetables, and 52% of our dairy goods are produced on high-quality farmland threatened by urban growth. One-third of America's agricultural production occurs on farms near cities. Unlike their growing urban and suburban neighbors, farms pay more for municipal services than they require.<sup>117</sup>

Combating sprawl is not easy. Successful initiatives probably require a combination of transportation, tax, school, and land use policies to attract and support less sprawling development. But farmland and forest preservation programs can help significantly. These programs buy development rights from farmers and forest landowners facing escalating land prices and pressure to sell their land to developers. Over the last 20 years, state and local efforts have protected more than 1 million acres of farmland in this way.<sup>118</sup> If states use these funds strategically, they can help create greenbelts that focus development inward. Farm programs can also help sustain farms on the urban periphery by promoting local, high-value marketing opportunities, such as farmer's markets and school purchases of local products.



Since 1990, Congress has funded one small Farmland Protection Program and the Forest Legacy Program, which have matched state and local funds and helped protect thousands of acres of farms and forests. But these programs have been too small to be truly effective. Farmland protection has been oversubscribed by 600%. If funds were available, more than 4000 farmers would sell development rights on their land today.<sup>119</sup> A more vigorous initiative could recognize state and local priorities, leverage private funding, and encourage creative policy changes to ensure protection of valuable forests and a critical mass of agricultural land that remains actively farmed with good stewardship.

## Challenge

### Preserve and Enhance Private Forests

Private forest lands occupy more than 20% of the United States,<sup>120</sup> and individual landowners own two-thirds of these forests.<sup>121</sup> These forests not only produce 60% of the annual timber harvest, but also serve as critical areas for protecting reservoirs or recharging major drinking water aquifers. Private forests represent a particularly high portion of the country's remaining lowland forests, which have distinct ecological values. Despite their importance, the nation's private forests are at serious risk of loss to development, fragmentation, or excessive harvest.

Private forests are at particular risk in the southeastern United States. Southeastern forests are centers of great plant and animal diversity—they harbor more tree species than all of Europe. Today, two-thirds of US timber harvests occur in the southeast. Harvest levels have increased by 50% in the region, and an estimated 1.2 million acres of southeastern forests are being cleared each year to feed 140 pulp mills, more than 80% of which have been constructed since 1985.<sup>122</sup> In North Carolina for example, a recent study found that forestry losses were unsustainable and would adversely impact two-thirds of all species of state concern on private lands both in the coastal and Piedmont portions of the state.<sup>123</sup> Many southeastern forests are wetlands, and the US Fish and Wildlife Service recently found that 90% of the country's forested wetland loss was occurring in the region. Indeed, the Service found that nationwide, forestry had matched agriculture as a leading source of wetland loss.<sup>124</sup>

Beyond forest clear-cutting, unprecedented population growth<sup>125</sup> and sprawling land use patterns in the Southeast also contribute to forest loss. In one recent nationwide study, Georgia, North Carolina, Tennessee, and South Carolina all ranked in the top

10 states for the highest conversion of land to sprawl,<sup>126</sup> and from 1992 to 1997, forests were the land use type most commonly converted for development.<sup>127</sup>

Indeed, preservation efforts are too late for some southeastern forest ecosystems, which now depend on active restoration efforts. For example, longleaf pine forests that once covered 74 to 92 million acres of the Southeast have shrunk to less than 3 million acres, much of which is highly degraded.<sup>128</sup> The bottomland hardwood forests of the lower Mississippi River floodplain, which once covered roughly 25 million acres, have declined by more than 80%.<sup>129</sup> With these losses have come huge impacts on wildlife and water quality, including a host of endangered species from red-cockaded woodpeckers to black bears.

Forests are also at high risk in the northeastern United States. The 26-million-acre Northern Forest of Maine, New Hampshire, Vermont, and New York is the nation's largest stretch of undeveloped forestland east of the Mississippi River. Large expanses of contiguous forest are critical to many declining species of mammals and birds, and indeed, the Northern Forest is essential for rejuvenating populations of many interior forest birds that decline in more fragmented forests because of animal predators that thrive near human development. Yet, sale and subdivision, random development, and poor forest management threaten this great wilderness. In a span of just 2 years, nearly 20% of the region—more than 5 million acres—changed hands.<sup>130</sup>

Even in less expansive forests, deforestation causes a range of problems. In the Baltimore-Washington region, one analysis found that runoff due to the past quarter-century's tree loss has increased nearly 20%, leading to increased flood risk, stream erosion, and more than \$1 billion in water treatment costs for local governments.<sup>131</sup>

Fortunately, management measures to preserve and enhance private forests are well known and appeal to private landowners if they receive some support. Economic analyses of longleaf pine forests have shown that, with modest support, it makes sense for landowners to replant longleaf pine forests for long-term growth rather than other kinds of pine trees grown with short rotations and significantly less environmental value.<sup>132</sup> Similar analyses have shown that reforestation efforts make economic as well as environmental sense for frequently flooded lands in the lower Mississippi Valley.<sup>133</sup> A major effort to preserve the great Northern Forest has broad support because of its importance to the region's economy and ecology, and conservation easements are already playing a critical role.

The US Department of Agriculture oversees not just agriculture, but also US private and public forests. The Wetlands Reserve and Conservation Reserve Programs have supported replanting of hundreds of thousands of acres of wetland and longleaf pine forests, and, with sufficient support, could do much more. The Department also has cost-share programs to help private foresters—the Stewardship Incentive Program and the Forestry Incentive Program—but funding in recent years has either been non-existent or available to only a handful of landowners (and has not always supported forestry efforts with environmental benefits). A Forest Legacy Program to purchase easements to preserve forests from development received record funding in 2001 at \$60 million, but this figure remains woefully short of the country's need. A dedicated effort to preserve and enhance private forests requires a coordinated effort to restore critical forest types, purchase easements on threatened forests, and help private forest owners manage their forests to meet environmental goals.

# Challenge

## Combat Climate Change

According to a broad scientific consensus, the earth will warm by 2.5 to 10.4 degrees Fahrenheit over 1990 temperatures during the next 50 years unless humans cut back significantly on their emissions of gases that warm the atmosphere.<sup>134</sup> In turn, the official international science panel on climate change warns that this warming will likely cause sea level rise and coastal flooding, harm many ecosystems, increase droughts and floods in unpredictable ways and areas, spur disease, and generally impose hundreds of billions of dollars in economic costs.<sup>135</sup> For these reasons, an international agreement in 1997 pledged many nations to the goal of reducing emissions of these gases by 7% from 1990 levels by 2008 through 2012.

Agriculture has a great deal at stake in climate change. Modern farming techniques use fuel freely, and some farm groups have feared that policies limiting carbon dioxide emissions, the largest source of global warming and a product of fuel combustion, could increase their costs significantly. The US Department of Agriculture has estimated that meeting the 7% reduction target could cost agriculture \$350 to \$700 million, or 0.5 to 1% of net profits.<sup>136</sup> On the other hand, many scientists claim that climate change will have negative impacts on American agriculture, including increased drought in the Corn Belt and growing problems with pest and disease. So farmers have an important stake in solving the problem. Perhaps most significant for farm policy, farmers can help combat global warming. Programs that preserve farms and control sprawl reduce travel needs and the burning of fossil fuels. And more directly, farmers can reduce their own emissions of global warming gases and even remove carbon dioxide from the atmosphere.

Agriculture generates roughly one-tenth of this country's global warming emissions.<sup>137</sup> Nationally and internationally, carbon dioxide generated by deforestation and by burning coal, oil, and gas is the major contributor to global warming. More than half of the global warming contribution from American agriculture is nitrous oxide, and methane contributes another third.<sup>138</sup> Both are emitted in relatively small amounts, but have extremely potent effects in the atmosphere. As a result, agriculture has promising opportunities to reduce concentrations of these gases. Because soils and plant growth can remove carbon dioxide from the atmosphere, agriculture may also help limit global warming through sequestration if a means can be developed to ensure that this removal is permanent.

Many of the practices that benefit water quality can also reduce emissions of nitrous oxide, methane, and carbon dioxide. Agriculture produces nitrous oxide through the interaction of soils with nitrogen fertilizer. Reduced use of fertilizer will also cut emissions of nitrous oxides. A significant part of methane released into the atmosphere originates in manure piles. Systems that digest manure and capture and burn methane emissions will also benefit the climate. And practices that reforest marginal cropland and those that permanently shift cropland to techniques that do not turn over the soil will not only reduce emissions of carbon dioxide from soils—a major source—but may allow soils to capture more carbon dioxide than they emit. By some estimates, agriculture could become a net sink instead of a net source of global warming gases. Farm programs that help farmers reduce nitrogen fertilizer use, capture methane, convert crops to grasslands and forests, or use renewable energy sources like wind and solar power can help farmers curb global warming.

International agreements propose a system in which different sources and possibly sinks of global warming gases are traded to achieve the reductions in global warming gases. Some electric utilities have pledged already to reduce their net effect on climate change by paying farmers to achieve reductions. To make such a system work, monitoring and verification systems are critical. The federal government can help spur creative solutions for American agriculture by supporting efforts to develop such systems and perhaps by creating a start-up fund to purchase reductions in global warming emissions below existing baselines.

## Challenge

### Save Family Farms

As long as farms continue to get larger in size, and increased mechanization continues to reduce labor demands, the number of farmers will continue to decline. USDA's Commission on small farms wrote in 1998:

*Agricultural technologies have emerged that use ever greater levels of capital to enable fewer people to produce the Nation's food. As a result, income and opportunities have shifted from farms to the companies that produce and sell inputs to farmers. As farmers focused on producing undifferentiated raw commodities, food system profit and opportunities were shifted to the companies that process, package, and market food. Consequently, from 1910 to 1990 the share of the agricultural economy received by farmers dropped from 21 to 5 percent.<sup>139</sup>*

Federal farm policy and traditional farm programs have contributed to that decline. For example, the present system of federal "transition" payments rewards the one-third of farmers who participate in federal farm programs, and payments are derived from historic production levels, favoring large farmers. Revenue insurance programs perpetuate a large-farm bias by providing coverage for a handful of commodities, and federal tax policy provides disproportionate benefits to large farms through tax incentives for capital purchases to expand operations.

Minority farmers have been hit particularly hard. In 1920, there were approximately 925,000 African-American-owned farms in the United States, but fewer than 18,000 remain today. In 1996, USDA admitted in federal court that part of the problem lay in intentional discrimination against minority farmers in the administration of its programs. Minority farmers were unable to get basic technical assistance from USDA and were discriminated against in all

phases of the loan process. USDA took no action on any discrimination complaints from 1983 to 1996. The settlement agreements reached in 1999 require the federal government to pay \$50,000 to every farmer who can provide substantial evidence of discrimination, but vigorous action is needed to help minority farmers overcome this legacy and thrive in the future.

Small- and medium-sized farms do not lack success stories. The small farm branch of USDA has described many of these stories.<sup>140</sup> A common theme is the production of a broader range of products than traditional commodities, the use of environmentally friendly farming practices, and the ability to market directly to local markets that recognize the merits of special, local, or environmentally produced farm products. Many farmers have developed cooperative marketing efforts that range from farmers' markets to special collaborations with local grocery stores. Some farmers supplement their income with activities that bring consumers and those seeking weekend recreation to the farm.

Conservation-oriented farm programs provide smaller and medium-sized farms a better chance to compete with their largest brethren. Unlike traditional programs, these programs would target farmers who produce a broader diversity of products. There is no reason to believe that small farmers are at a disadvantage when competing to provide conservation benefits that such programs can reward. By encouraging and assisting the adoption of farming techniques that reduce chemical use or create more pasture for livestock, such programs support the strategies that small farmers have used to stay in business.

In addition, federal programs can aid small farmers by supporting cooperative farmer efforts to process their farm products in ways that increase their value. They can also support cooperative marketing efforts to offer consumers access to more locally grown

agricultural products. By increasing farmer and rancher share of the food profit system, investing in value-adding enterprises, creating alternative marketing channels for crops, and offering consumers access to more locally-grown agricultural products, federal programs can make a significant contribution to the preservation of smaller farms.

Federal programs can also support small farmers through better research efforts, like the Sustainable Agriculture Research and Education program. Developing new production techniques and the specialty crops that are the mainstay of smaller farms requires research and development.

Lastly, Congress should create a program to bring new farmers into the fold by helping eliminate the significant financial barriers new farmers face, including high capital costs. One-fourth of America's farmers are 65 or older. USDA predicts that while 500,000 farmers will retire between 1992 and 2002, they will be replaced by only 250,000 farmers.<sup>141</sup>

# Challenge

## Help Rural Communities

While most of America has prospered in recent years, small farms and rural communities have struggled to keep pace. According to a USDA analysis, the poverty rate in rural communities remains higher than the poverty rate in urban communities, and it is 3 times higher for rural minorities.<sup>142</sup> More than 3 million rural children live in poverty—1 in 5 of all children living in rural communities—and the poverty rate among the rural elderly is significantly higher than the poverty rate among the urban elderly.<sup>143</sup>

In those rural counties most heavily dependent on farms, farm jobs declined by 6.4% between 1990 and 1997 and the number of farms declined by 12.5% between 1987 and 1997.<sup>144</sup> The impact of lost farming jobs was most severe in Great Plains states like North Dakota, South Dakota, where new jobs are not being created as quickly as farm-related jobs are being lost. In these states, farm-dependent communities are losing population, report poverty levels 60% greater than their urban neighbors, and receive per capita earnings about two-third that of their urban neighbors. The long-term prognosis for farm-dependent rural counties is not promising—the Bureau of Labor Statistics predict a 3% decline in the employment of farm workers between 1998 and 2008, the largest decline of any occupation.<sup>145</sup>

Where farming is less dominant, rural counties have been doing better. In counties only somewhat dependent on farming, employment grew by 13.6% during the 1980s—or twice as fast as growth in rural counties more dependent on farming. An important factor affecting rural communities may be the availability of natural amenities. The expansion of row crops has replaced much of the wetlands, healthy

streams and rivers, grasslands, and wildlife that once co-existed with agriculture. Yet several economic studies have shown that these natural amenities are a major influence on which rural areas gain population and which do not.<sup>146</sup>

In general, economists focusing on the needs of rural America recommend efforts to add value to agricultural products, improve local marketing techniques, and make the communities attractive for a telecommuting age. Some rural communities desperately need basic water infrastructure. Traditional commodity programs are not sufficient to sustain rural communities.



### 3 Meeting the Challenge — The Principles and Potential Shape of a Conservation Farm Bill

New farm policies can help the environment and family farms without the wholesale creation of new farm agencies or many new programs. An established network of county soil and water conservation districts, buttressed by field staff of the Natural Resources Conservation Service, today delivers assistance to farmers throughout the country. Existing conservation programs, although modest, provide the basic infrastructure of programs to help farmers help the environment.

Meeting the key challenges does require a new focus for the Farm Bill. This focus should make conservation programs central. At least half of the \$20 billion per year planned in direct payments to farms in Congress's budget blueprint should be directed at conservation. At the same time, as discussed below, Congress should restructure remaining commodity programs so that they do not encourage increased production and should strengthen provisions designed to reduce incentives to drain wetlands or to plow up native prairies and highly erodible land.

The next generation of conservation programs should be crafted with a few basic principles.

1. Where feasible, programs should both improve the environment and boost farm income. Helping farmers convert manure into energy can produce new revenue. Helping farmers reduce fertilizer and pesticide use or irrigation demands can reduce costs. Helping farmers produce organically can tap into new markets.
2. In general, programs should be particularly attentive to the needs of smaller farms and should not be designed in a manner that disproportionately aids large farms.

3. Programs should be designed to enable state and local governments to develop innovative ways of combining different USDA programs. For example, it may make sense to target farmland protection and water quality funds on the same farms.

4. There must be adequate funding to allow federal and local staff to realize the potential of conservation programs. Where feasible, programs should enlist nonprofit organizations to help in the delivery. Active marketing is also essential, because the success of these voluntary programs is highly dependent on farmer knowledge of their existence and benefits.

5. Offer conservation programs in which all farmers can participate and direct special funds at the highest conservation priorities. Make some funds available to reward those good actors who are already implementing high-value conservation practices on their own.

6. Support proven conservation practices, but also emphasize innovation. In the long run, the key to achieving environmentally safer and more profitable farming is continually developing farming practices that accomplish both goals.

7. Provide a full package of programs that will benefit farmers across all parts of the country and all types of farming.

8. Provide market development assistance to smaller, conserving farmers through a range of programs. These programs must consider where the next generation of farmers will come from and recognize that specialized markets offer small farmers many opportunities.

# Meet the Challenge

## Improve Water Quality

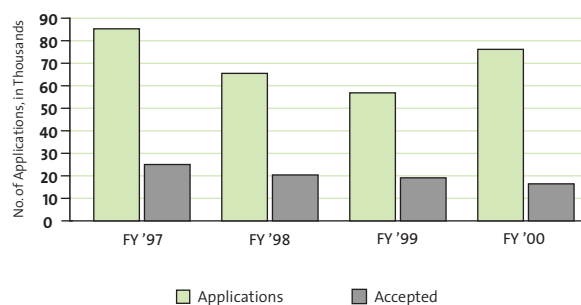
Congress should enact legislation that goes much further to reward farmers, ranchers, and forest landowners for general environmental stewardship. Senators Tom Harkin and Gordon Smith have introduced one such bill, the Conservation Security Act (CSA), that would provide farmers incentive payments for 3 different tiers of conservation practices based on their environmental value and implementation costs. The CSA would reward not just farmers who implement new conservation practices, but also those who have already done so. Water quality is paramount among the many conservation challenges addressed in the bill. It offers incentives for proven conservation practices, ranging from conservation tillage, to more tailored fertilizer application, to the preservation of buffer zones. These management actions also help reduce greenhouse gases by sequestering carbon in soils and by reducing losses of nitrous oxides.

Farmers also need support for structural improvements and innovative land management practices that are not appropriate for a general stewardship bill. In the 1996 Farm Bill, Congress created the Environmental Quality Incentives Program (EQIP) with a funding level of \$200 million a year to address water quality problems nationwide. EQIP provides funds to farmers to enter into contracts with USDA for implementation of a broad range of practices, with a particular focus on those addressing water quality. Although the program funded significant improvements, its inadequate funding has frustrated many farmers. (See Figure 9.) EQIP should be expanded to between \$1.5 and \$2 billion per year with funds reserved to address some of the most critical problems.

**Livestock and Manure Management:** Congress should allocate substantial funds to improve livestock and manure management on small- and medium-sized dairy, poultry, and hog farms. In particular, funds should be directed at innovative manure management technologies that have the potential to make manure reuse profitable, such as farm-level and regional digesters, as well as systems that reduce or eliminate confinement, such as managed grazing systems and hoop houses for pigs.

**Irrigation Efficiency and Water Management:** Congress should reserve funds to support efforts that reduce irrigation water demands and thereby alleviate increasing water shortage problems in much of the country. At least half of any saved water should be devoted to maintaining flows for rivers, springs, and other water bodies.

Figure 9: Farmers Turned Away



*Polluted runoff from farmland is the leading source of America's water pollution. The major federal program to help farmers improve water quality is the Environmental Quality Incentives Program, but three out of four farmers who want to participate are turned away because of insufficient funds.*

Source: USDA, Natural Resources Conservation Service.





USDA, TIM MCCABE

*Farmers have greatly reduced soil erosion on one-third of cropland by changing how they plow, such as this farm that includes in-field buffers and leaves crop residue to protect the soil.*

Congress should also expand the Wetlands Reserve Program (WRP) from around 150,000 to 400,000 acres per year. The program should prioritize wetlands that would intercept large volumes of farm runoff and thereby help filter out pollutants. To address limits on the protection of “isolated wetlands” by the Clean Water Act because of a Supreme Court decision last year, Congress should also provide funds to preserve at least one million acres of isolated wetlands. This effort should place a special emphasis on isolated wetlands in areas with a high potential for development.

## Meet the Challenge

### Ensure Public Health

The Environmental Quality Incentives Program can also serve as a tool for addressing public health challenges. To further public health goals, the program should fund only those manure management technologies that also reduce bacteria and viruses (and thereby also enhance the potential markets for processed manure). Congress should also give a funding priority to those livestock operations that use antibiotics only to treat sick animals, instead of the more prevalent use of antibiotics to promote animal growth, which breeds antibiotic-resistant bacteria.

Congress should also target EQIP and associated research funds for farmers interested in adopting new approaches to reducing the volume and toxicity of pesticides. Building on successful efforts in Sweden and Denmark, Congress should direct the Secretary of Agriculture to establish a national goal of reducing pesticide use by 50%. Coordinated demonstration projects for promising approaches to pesticide reduction can help advance this goal.

In addition, Congress should establish a program to help farmers interested in making the transition to organic farming. Such a program should cover part of the cost of organic certification, technical assistance, and the normal losses in production during a transition period. Existing small- and medium-sized organic producers should receive comparable assistance to expand their markets and implement the challenging practices needed to produce goods organically.

## Meet the Challenge

### Save Endangered Species and Other Wildlife

Congress now spends almost \$1.75 billion per year on programs to restore grasses and trees on environmentally sensitive lands. But nearly all these funds offer farmers only 10-year contracts through the Conservation Reserve Program (CRP). Not only is the restoration work potentially lost after the 10-year contract expires, but the time frame often discourages the more expensive and ambitious efforts at habitat restoration necessary to address many of the country's urgent conservation needs, such as habitat restoration for endangered species. In addition, too little of this funding is focused on the most critical conservation needs, such as buffer zones for streams, wetlands, and various rare and declining habitats.

In addition to expanding the Conservation Reserve Program from its present 36.4 million acres by at least 5 million acres, Congress should reserve at least 9 million acres of the program for priority, high-value enrollments. These include buffers, wetland restoration, rare native habitat, and other lands identified by states through Conservation Reserve Enhancement Programs. Farmers enrolling land in these high-value practices should be offered the option of a permanent easement instead of just a 10- to 15-year contract. Up to 5 million acres should be eligible for enrollment as permanent easements (or 30-year easements in those states that prohibit permanent easements), with a focus on those habitats otherwise at greatest risk of loss. Congress should also change policies that have limited the program's utility in many states. For example, CRP should allow farmers to enroll riparian pasture lands not only in trees, but also in wetlands or shrubs where that is more consistent with the natural vegetation of the area and would achieve water quality goals. Farmers should be able to receive

bonus payments not only for buffer zones around streams, but also for in-field buffer strips, so-called contour buffer strips, wind-breaks, and other "strip" practices.

Congress should allow CRP funding to be used for haying and grazing lands where conservation measures such as the cessation of haying and grazing can create essential habitat for rare species.

Congress should also create a new program to enroll 5 million acres of grass and ranchlands in permanent preservation easements. Such efforts should be targeted at lands with predominantly native vegetation of critical importance to wildlife. Such grasslands are imperiled in many areas, from Florida, through the central United States, to California. The easements should allow grazing in a manner consistent with preservation of native wildlife. This program should also set aside funds to manage these lands for wildlife.

Congress should expand programs for practices that enhance habitat for rare species and other wildlife on private lands, such as control of invasive species, improvement of riparian areas, controlled burns of grasslands and forests, and removal of stream obstructions. By increasing funding for the Wildlife Habitat Incentives Program (WHIP) to \$500 million a year, the program could provide incentives to landowners that cover some of the foregone benefits from using the land for other purposes. Today, the program covers only up to three-quarters of the costs of actual enhancement measures. One-third of funds should be available to private and non-profit entities for easements. Priority should be placed on WHIP projects that benefit imperiled species because, in the vast majority of cases, these projects also benefit game species and non-imperiled wildlife.

## Meet the Challenge

### Control Sprawl

In many parts of the country, from Florida to California, the Farmland Protection Program provides a critical supplement to existing programs to help communities limit sprawling development by acquiring development rights on lands in the path of sprawl. Congress should increase funding of this program to \$500 million per year. Priority should be given to states that integrate farmland protection programs into other comprehensive efforts to control sprawl. Distribution of other conservation funds should also be targeted at these farms preserved for future generations.

## Meet the Challenge

### Combat Climate Change

Programs that encourage forest and grasslands restoration and help farmers capture methane and reduce use of nitrogen fertilizer can reduce emissions of greenhouse gases from the agricultural sector. Congress should also fund a monitoring system that allows farmers to sell credits for verified removal of carbon dioxide from the atmosphere by sequestering it in soils and plants. Many corporations trying to meet self-imposed limits on global warming gases have demonstrated their willingness to purchase such credits, if verified. Congress should also assist farmers interested in developing renewable energy resources on their land, including wind and solar energy.

## Meet the Challenge

### Preserve and Enhance America's Forests

Expanding the Wetlands Reserve Program and focusing more of the Conservation Reserve Program on rare native habitat restoration will help to restore critical American forests. To further address the threats to private forests, Congress should create a new consolidated program to preserve and enhance the natural resource values of private forests through easements and other conservation measures. Such a program should give priority to forests of the highest conservation value, as well as efforts to link forest fragments and combat sprawl.

# Meet the Challenge

## Save Family Farms

Stewardship incentives can bolster the income of family farmers without spurring excess production that lowers the prices of farm products. By capping such programs and addressing loopholes for evading caps, Congress can partially direct these funds to the farmers who need them.

Congress can help family farmers help the environment by assisting in the development of local markets for products that are high-value and grown in environmentally sensitive ways. A good start would be to boost research funding for such efforts through the Sustainable Agriculture Research and Education Program, which now offers a paltry \$10 million per year. Congress should also create a grants program, funded at \$250 million per year, to boost local marketing opportunities for farmers who use environmentally friendly farming practices and produce high-value products.

*Farmers markets provide a major income opportunity for farmers around urban areas, but farm programs provide minimal help either to these kinds of farmers or these kinds of marketing opportunities.*

Congress should help redress the federal government's history of intentional discrimination against minority farmers by boosting funds for the socially disadvantaged farmer program.

Congress should expand the modest efforts made in the last Farm Bill to help farmers market their products directly to local schools. Farmers doing so provide a fresher product, but need to be reimbursed at a higher price. Experience shows that students presented with fresher local produce will consume more of it, and therefore less junk food. But schools receive much of their food budgets from federal assistance, and often believe the guidelines of these programs prohibit them from paying more for local products. Congress should amend the law to permit schools to pay a premium for locally grown, directly marketed produce.

Finally, Congress should create a new program to facilitate credit and technical assistance to the next generation of farmers.



CINDY BARENJON

## Meet the Challenge

### Help Rural Communities

Congress can best aid rural communities by eliminating its single-minded focus on large-scale farms that rely on expensive machinery and instead prioritize smaller-scale farms that rely on people and judgement. Emphasizing conservation in the Farm Bill can enhance the appeal of rural communities, such as aesthetics and other natural amenities, thereby inviting the related employment needed for rural communities to thrive in the long run. Massive, polluting feedlots producing offensive odors are not what rural communities need.

Congress can help farmers and rural communities by creating a marketing grants program directed not at individual farmers but at cooperatives and loose confederations of farmers developing new markets for farm products.

## Meet the Challenge

### Improve the Effectiveness of Conservation Programs, Provide Adequate Technical Assistance, and Allow State and Local Governments to Coordinate and Guide Programs

While boosting conservation programs, Congress should also improve the effectiveness of conservation programs in two ways. First, Farm Bill programs need to include adequate technical assistance. In recent years, resources for technical support have declined markedly even as demands have grown. By assigning a reasonable percentage of the funds for each conservation program for technical assistance and restoring base conservation funding to historic levels, Congress could help narrow the gap. Congress should allow non-profit organizations and Soil and Water Conservation Districts to participate in programs and manage projects in a manner that meets or exceeds federal standards.

State and local governments need a mechanism to submit comprehensive plans for addressing critical natural resource problems in a manner that combines the different conservation programs with state and local funds. Such a mechanism should build on the Conservation Reserve Enhancement Program projects that have effectively allowed USDA to tailor the CRP program to high-profile needs. These plans permit the Agriculture Secretary to adapt policies and regulations to the needs of a particular resource. They also should allow simplified and comprehensive delivery of the different programs to farmers.

## Meet the Challenge

### Reduce the Perverse Incentives of Commodity Programs and Crop Insurance

Commodity programs almost certainly will survive in the next Farm Bill, so Congress needs to reduce the perverse incentives these programs now created. Congress can address this challenge in 3 ways.

First, strengthen the so-called “Conservation Compliance” mechanisms. These mechanisms, adopted in the 1985 Farm Bill, deny most federal funds to landowners who drain wetlands or plow highly erodible land without taking conservation measures. Unfortunately, conservation compliance no longer applies to all key funding programs, particularly the large federal crop insurance subsidies that cost taxpayers more than \$3 billion per year. In addition, loopholes have emerged in the wetland protection “Swampbuster” program. For example, efforts to map wetlands accurately were suspended in 1995, even though reports by USDA personnel from nearly all states reveal that existing maps greatly understate the extent of wetlands.<sup>147</sup> And the Swampbuster program no longer applies to all wetlands, including wetlands that were once farmed but have been abandoned and reverted to wetlands. Congress should strengthen these programs by making Swampbuster applicable to all farm programs again, restarting accurate mapping efforts, and closing loopholes.

Second, craft a “flexibility” provision to limit farm program discrimination against grass-based agriculture. Cropland farmers who want to shift to grass-based agriculture should receive the same level of support they would receive if they kept their fields in cropland. This provision is particularly necessary for drought- and flood-prone lands, which now receive the bulk of crop insurance subsidies. According to one analysis, these subsidies increase commodity cropland by more than 30 million acres per year, while another study concludes that crop insurance may cost farmers money by lowering crop prices more than farm crop insurance subsidies help them.<sup>148</sup>

Third, structure commodity programs to minimize the extent to which they encourage production beyond market capacity. Several mechanisms could help meet this goal. For example, income supports could be limited to a maximum amount of commodity production per farmer. Any cropland not already in regular crop production could be denied payments. A range of farm products could be eligible for payments, enabling farmers to experiment with crop rotations or grass-based agriculture.

## 4 Conclusion

America's farm, range, and forest lands are far more than food and fiber factories. They impact the air we breathe, the water we drink and use for recreation, and the habitat upon which wildlife depends. While commodity prices continue to decline, the value Americans place on the environment is growing, making stewardship of agricultural lands and related natural resources a growth opportunity for America's landowners. With fewer farmers producing a greater

percentage of agricultural products on less land, environmental stewardship may be one of the best opportunities available to the rest of the country's farmers. In the next Farm Bill, America has an historic chance to recognize these multiple functions of the land by helping farmers, ranchers, and forest landowners improve their farm products, their livelihood, their communities, and the environment.



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*The Peregrine Falcon, like other raptors, would benefit greatly from reduced use of pesticides.*

## Endnotes

**1** *Agricultural Resources and Environmental Indicators*, 2000 (USDA, Economic Research Service, September 2000), pp. 1, 3. The figure of 55% is the combined percentage of land identified in this report as cropland, grassland pasture and range of the contiguous 48 states, based apparently on a combined analysis of private land and public land. Arguably, another 8% of the land, which is grazed forest land, should be included in a total figure for agriculture, bringing the agricultural total to 63%. *Ibid.* p. 3 (Table 1.1.2). If all the land in Alaska and Hawaii are included, cropland and grassland pasture and range comprise 46%. USDA's Natural Resource Conservation Service conducts the primary analysis of private land. Of the 1.5 billion acres of non-federal land alone (which is 73% of the total land in the contiguous US), the 1997 NRI indicates that 60% of the land is cropland, pastureland or rangeland and another 27% is forest land. Natural Resources Inventory. See Natural Resources Inventory, *Highlights* (USDA, Natural Resources Conservation Service, January 2001). (<http://www.nhq.nrcs.usda.gov/land/pubs/97highlights.pdf>) (Hereinafter NRI).

**2** Chart, Farm Program Outlays by Fiscal Year, Presentation of Larry Salathe, USDA Office of the Chief Economist, at Seminar at Environmental Defense (December, 2000)

**3** According to USDA, roughly 37% of planted acreage in 1997 met standards for conservation tillage (no-till, ridge-till, and much-till). Conservation tillage means practices that either leave much of the soil undisturbed or leave 30% or more of the soil covered with crop residues, such as corn stalks, to limit erosion. Another 26% of farmers leave 15% to 30% cover. But 37% of farmers continue to plow in conventional ways. M. Padgett, D. Newton, R. Penn & C. Sandretto, *Production Practices for Major Crops in U.S. Agriculture, 1990-1997* (USDA, Economic Research Service Statistical Bulletin Number 969, 2000), p. 67.

**4** Personal Email Communication with Max Schnepf, Coordinator of the USDA Buffer Initiative (May 24, 2001) (providing summary data on USDA's buffer initiative).

**5** Data from USDA, Natural Resources Conservation Service summarized in Scott Faber, *Losing Ground: Failing to Meet Farmer Demand for Conservation Assistance* (Environmental Defense 2001).

**6** *Ibid.*

**7** NRI, *op. cit.*

**8** *The Quality of Our Nation's Waters* (EPA Office of Water, June 2000), p. 64.

**9** According to the most comprehensive analysis, of those species identified by state Natural Heritage Programs as imperiled, the best available sources identify agricultural practices as a major threat to roughly one third. D.S. Wilcove, D. Rothstein, J. Dubow, A. Phillips & E. Losos. "Quantifying Threats to Imperiled Species in the United States: Assessing the relative importance of habitat destruction, alien species, pollution, overexploitation and disease," *BioScience* Vol. 48, No. 8 (August 1998), pp. 607-15.

**10** P.C. Westcott & C.E. Young, "U.S. Farm Program Benefits: Links to Planting Decisions & Agricultural Markets," *Agricultural Outlook* (USDA Economic Research Service, October 2000), p. 14 (hereinafter *Agricultural Markets*) ("Major field crops account for only one fifth of total cash receipts in 2000, but are associated with nearly all direct government payments.") In addition to direct government payments, the federal government also funds a variety of programs to boost agricultural prices through product purchases or export subsidies. Some of these funds do support products like dairy, but the bulk of these programs also mainly support major field crops.

**11** *Agricultural Resources and Environmental Indicators*, 1996-97, (USDA, Economic Research Service, July 1999) *Agricultural Handbook* No. 712, p. 32 (statistics on farm concentration); *Agricultural Markets*, *op. cit.*, p. 14 (statistics on farm income breakdown).

**12** C. Williams-Derry, K. Cook, *Green Acres: How Taxpayers are Subsidizing the Demise of the Family Farm* (Environmental Working Group, 2000), p. 4.

**13** *Agricultural Markets*, *op. cit.*

**14** USDA, *Rural Conditions and Trends*, Vol. 10, No. 2, p. 4.

**15** *Ibid.* pp. 81-82.

**16** *Ibid.* p. 83.

**17** USDA data shows that conservation programs are much more equitably spread by farm size and by crop type than commodity payments. See charts set forth in *Seeking Common Ground for Conservation: A Farm Bill Proposal Responding to the Grassroots* (Soil and Water Conservation Society 2001), pp. 44-45.

**18** USDA Economic Research Service chart presented at <http://www.ers.usda.gov/briefing/FarmStructure/Gallery/Struct2.gif>.

**19** A typical recent example was provided by Congressman Thune in support of a recent boost in farm spending: "Mr. Speaker, this is a very, very desperate time for American agriculture. We are seeing people leave the farm. We are seeing outmigration from rural areas. We are seeing the family farm structure which, in my mind, is the backbone of America, start to disintegrate partly because farmers and ranchers cannot make a living on their farms and ranches. As a consequence, we have seen prices fall; we have seen costs go up; we have seen the bottom line get squeezed to where producers are either forced to sell out, go out of business." Congressional Record p. H3505 (June 25, 2001).

**20** *Agricultural Resources and Environmental Indicators*, 1996-97, *op. cit.* p. 32 (Figure 1.2.4); J.E. Sommer, R. A. Hoppe, R.C. Green, P.J. Korb, *Structural and Financial Characteristics of U.S. Farms, 1995: 20th Annual Family Farm Report to the Congress* (USDA, Economic Research Service 1998), p. 7.

**21** *Rural Conditions and Trends*, *op. cit.* p. 5.

**22** *Ibid.* pp. 4, 22.

**23** USDA, Economic Research Service data on farm concentration. <http://www.ers.usda.gov/briefing/FarmStructure/Questions/Struct.htm>, see in particular the graphic set forth at <http://www.ers.usda.gov/briefing/FarmStructure/Gallery/Struct2.gif>



**24** “Economic Growth in Farming Areas Lags the Rest of Rural America,” *Rural Conditions and Trends*, Vol. 10, No. 2, pp. 10-16.

**25** National Research Council, *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution* (National Academy of Sciences Press, 2000), p. 115 (20% runs off); *Agricultural Resources and Environmental Indicators*, *op.cit.*, p. 100.

**26** Wilcove et al., *op. cit.* (agriculture is most frequently identified cause of the decline of endangered species).

**27** Salathe *op. cit.*

**28** *Agricultural Markets*, *op. cit.*, p. 14.

**29** *Agricultural Markets*, *op. cit.*, p. 14 (the precise figure for the year 2000 is 63%).

**30** J.E. Sommer et al., *op. cit.*, p. 20, Table 5. According to this source, in 1995, of the 682,000 farmers receiving government payments, the 18,543 farmers producing from \$500,000 to \$1 million in products received on average \$28,466 in government payments, and the 6,218 farms producing more than \$1 million received on average \$35,716 in government payments. Meanwhile, the 100,426 farms producing between \$50,000 and \$100,000 received on average \$6,484.

**31** C. Williams-Derry et al., *op. cit.*, p. 4.

**32** M. Morehart, B. Kuhn, S. Offutt, “A Fair Income for Farmers,” *Agricultural Outlook* (USDA, Economic Research Service, May, 2000), p. 24 (showing larger wheat farms have generally lower costs than smaller wheat farms). As the article concludes: “Neither direct government payments nor government intervention to raise market prices encourages cost reduction by farmers, and the mid-cost group [of farms] may suffer when the payments are used by their lower cost neighbors to expand output and put downward pressure on prices.” *Ibid.* p. 25.

**33** *Agricultural Resources and Environmental Indicators, 2000 op. cit.*, p. 3, 7. Table 1.1.2 shows potential cropland, acreage idled either voluntarily or in government programs and cropland used for pasture as reported in agricultural censuses once every five years from 1945 through 1992. In 1992, 66.8 acres of cropland were used for pasture, and another 55.5 acres were idled. As indicated on page 7, another 61 million acres were used for hay in 1996.

**34** It is extremely difficult to estimate the extent to which farm programs increase the acres of land in crops, as opposed to pasture or more natural wildlife habitat. USDA’s Economic Research Service has long estimated how changes in average crop prices and income from crops from year to year are reflected by changes in the amount of acreage planted. Using this analysis, its models indicated that various subsidies in 2000 probably increased the acreage of crops from 5.5 to 6.5 million acres. *Agricultural Markets*, *op. cit.* These estimates probably underestimate the impacts of support programs for two reasons. First, they are based on short-term responses to price and income supports. A farmer committed to corn and soybean rotations is less likely to address changes in prices by adjusting farming practices from year to year than he is likely to adjust them over a longer term. Second, in the case of the crop insurance and disaster relief estimates, these estimates assume that all farm fields for a given crop receive the same average support from the programs. But crop insurance and disaster relief payments disproportionately go to those farm fields that suffer weather-related damages most frequently. These disaster-prone fields are relatively more likely not to be cropped without financial support and because they receive the highest payments, they are likely to be affected

the most. One effort to estimate the effect of crop insurance, even at earlier, less-subsidized levels than crop insurance provides today, estimated an effect of 30 million acres or more. K. Keeton, J. Skees & J. Long, *The Potential Influence of Risk Management Programs on Cropping Decisions at the Extensive Margin* (Paper presented at the American Agricultural Economics Meeting, Nashville, TN) (August 8, 1999).

**35** D.J. Horn, “IPM Pesticides for Reducing Pesticide Use in U.S. Field Crops,” in D. Pimental, (ed.), *Techniques for Reducing Pesticide Use* (John Wiley & Sons 1997), p. 286.

**36** B. Babcock & C. Hart, “Can Subsidies Hurt Iowa Agriculture?” *Iowa Ag Review* (Iowa State Center for Agricultural and Rural Development, Fall 1999), pp. 7-8 (estimating that crop insurance subsidies in Iowa cost Iowa farmers more money in lower prices than they received in benefits).

**37** According to USDA estimates, corn, soybean, wheat and cotton farmers also lost significant amounts of money on each planted acre in 1998 and 1999 if government payments are excluded. See USDA tables set forth <http://www.ers.usda.gov/data/costsandreturns/>

**38** Salathe, *op. cit.*

**39** According to Economic Research Service, soil erosion declined by 40% between 1982 and 1997, but soil continues to erode at 1.9 billion tons per year. *Agro-Environmental Policy at the Crossroads* (USDA Economic Research Service 2001), p. iv. The lack of dustbowl is due in part to these improvements but may also be due to weather, which has never replicated the extent of the droughts of the 1930’s.

**40** Wildlife Habitat Management Institute, *A Comprehensive Review of Farm Bill Contributions to Wildlife Conservation, 1985-2000* (USDA, Natural Resources Conservation Service, 2000) pp. 19-41.

**41** *A Geography of Hope: America’s Private Land* (USDA, Natural Resources Conservation Service, Dec. 1996, revised 1997), p. 8.

**42** *The Quality of Our Nation’s Waters* (EPA, Office of Water, June, 2000), pp. 64, 87, 107

**43** *Ibid.*

**44** *Integrated Assessment, Hypoxia in the Northern Gulf of Mexico* (U.S. National Science and Technology Council, Committee on Environment and Natural Resources, May 2000), p. 17.

**45** R. Howarth, D. Anderson, J. Cloern, C. Elfring, C. Hopkinson, B. Lapointe, T. Malone, N. Marcus, K. McGlathery, A. Sharpley, and D. Walker, “Nutrient Pollution of Coastal Rivers, Bays, and Seas,” *Issues in Ecology*, No. 7 (Ecological Society of America, Fall 2000).

**46** M. Ribaldo, R. Horan & M. Smith, *Economics of Water Quality Protection from Nonpoint Sources*, Agricultural Economic Report # 782 (USDA, ERS 1999), p. 8.

**47** Ribaldo et al., *op. cit.*, p. 7.

**48** *Environmental Indicators*, *op. cit.*, pp. 204-24 (see table 4.5.4).

**49** *Ibid.* p. 216.

**50** *Ibid.*

**51** *Ibid.*

**52** *Geography of Hope*, *op. cit.*, p. 38 (roughly 38% of farmers use conservation tillage).

- 53** R. Lawrence, L.S. Altier, J.D. Newbold, R.R. Schnabel, P.M. Groffman, J.M. Denver, D.L. Correll, J.W. Gilliam, J. Robinson, R. Brinsfield, K. Staver, W. Lucas & A. Todd. "Water Quality Function of Riparian Forest Buffers in Chesapeake Bay Watersheds," *Environmental Management*, Vol. 21, pp. 687-712. (1997).
- 54** W. J. Mitsch, J.W. Day, Jr., J. Wendell Gilliam, P. Groffman, D.L. Hey, G.W. Randall & N. Wang, *Reducing Nutrient Loads, Especially Nitrate-Nitrogen, to Surface Water, Groundwater and the Gulf of Mexico, Topic 5 Report of the Integrated Assessment on Hypoxia in the Gulf of Mexico* (NOAA Coastal Ocean Program Decision Analysis Series No. 19, May 1999). p. 95.
- 55** As of May 1, 2001, NRCS estimates that 1.2 million acres of buffers have been enrolled through general CRP, another 1.5 million acres through continuous CRP, and another 1.1 million acres have been restored as buffers with at least the partial assistance of other conservation programs, including mere technical assistance. Schepff, *op. cit.*, A rough estimate by NRCS regional offices estimated that 8.6 million acres of frequent cropland and 3.2 million acres of non-cropland needed to be restored for buffers. More recent estimates by SWCS place the figure as high as 22 million acres. *Ibid.*
- 56** Commission on 21st Century Production Agriculture, *The Status of U.S. Agriculture* (USDA, 1998), p. 13.
- 57** General Accounting Office, *Animal Agriculture: Waste Management Practices. Report to the Honorable Tom Harkin, Ranking Minority Member, Committee on Agriculture, Nutrition and Forestry, U.S. Senate.* (GAO/RCED-99-205., July, 1999), p. 1.
- 58** K. Cochran, J. Rudek & D. Whittle, *Dollars and Sense: An Economic Analysis of Alternative Hog Waste Management Technologies* (Environmental Defense 2000) p. 11; NRC, *op. cit.*, p. 134-35.
- 59** NRC, *op. cit.* p. 147.
- 60** NRC, *op. cit.*, p. 117 box 5-1.
- 61** *Microbiological Pollutants in Our Nation's Water. Environmental and Public Health Issues.* (American Society for Microbiology, 1999, Washington, D.C).
- 62** *E. coli Update—Case Numbers as of September 17, 1999*, (State of New York Department of Public Health, Capital District, September 17, 1999); "More Than 1,000 Sickened in Deadly E. coli Outbreak," *The Orlando Sentinel* (Sept. 18, 1999) p. A.16.
- 63** C.S. DeWaal, *Consumer Perspectives of Food Safety Controls at the Animal Production Level*, presented at Beltsville Symposium XXIV: Healthy animals 2000 (September 10, 2000) pp. 4-5 and accompanying notes.
- 64** *Outbreak Alert! Closing the Gaps in Our Federal Food-Safety Net*, (Center for Science in the Public Interest, 2000) pp. 28-31.
- 65** Environmental Protection Agency, Preamble to Proposed rule, National Pollutant Discharge Elimination System Permit Regulations and Effluent Goals and Strategy for CAFO's, Federal Register Vol 66, p. 2987 (January 12 2001).
- 66** *Ibid.* p. 2984, Table 6-1
- 67** *Ibid.* p. 2984, Table 6-3.
- 68** NRC p. 278.
- 69** *Dollars and Sense, op. cit.*, pp. 46-48.
- 70** Natural Resources Conservation Service, *Grazing Lands Institute, Dairy Farming Profitability Using Intensive Rotational Grazing* (USDA, 1996).
- 71** *Dollars and Sense, op. cit.*, pp. 39-42.
- 72** NRC, *op. cit.*, p. 279; *Dollars and Sense* pp. 8-11.
- 73** *Ibid.* p. 128.
- 74** *Dollars and Sense* pp. 25-36.
- 75** C.S. DeWaal, *op. cit.* pp. 8-10.
- 76** M., Padgitt, D. Newton, R. Penn, C. Sandretto, *Production Practices for Major Crops in U.S. Agriculture, 1990-97* (Economic Research Service, Statistical Bulletin Number 1969 (2000), pp. 2-3.
- 77** *Ibid.* See also J. Fernandez-Cornejo, S. Jans, *Pest Management in U.S. Agriculture* (Economic Research Service 1999) p. 5, Table 3. One report found that pesticide use in California had increased from 129 pounds to 195 million pounds in seven years. S. Kegley, S. Orme, L. Neumeister, *Hooked on Poison: Pesticide Use in California 1991-1998* (Californians for Pesticide Reform 2000) (<http://www.panna.org/resources/documents/hookedAvail.dv.html>).
- 78** D. Pimental, A. Greiner & T. Bashore, "Economic and Environmental Costs of Pesticide Use," in D. Pimental & H. Lehman (eds), *The Pesticide Question: Environment, Economics and Ethics* (Chapman and Hall 1993), p. 121.
- 79** *Ibid.*
- 80** R. Wiles, B. Cohen, C. Campbell, S. Elderkin, *Tap Water Blues: Herbicides in Drinking Water* (Environmental Working Group Physicians for Social Responsibility 1994).
- 81** Information in this paragraph summarized from Richard Wiles, Kert Davies, Christopher Campbell, Overexposed: Organophosphate Insecticides in Children's Food (Environmental Working Group 1998) pp. 1-3.
- 82** U.S. General Accounting Office, *Hired Farmworkers: Health and Well-Being at Risk* (U.S. General Accounting Office, 1992) p. 3. A more recent General Accounting Office report concluded that available data were so sketchy and so likely to underestimate both acute and chronic pesticide poisoning that no sound quantitative estimate could be made. U.S. General Accounting Office, *Pesticides: Improvements Needed to Ensure the Safety of Farmworkers and Their Children* (U.S. General Accounting Office, 2000).
- 83** Information from this paragraph taken from Pimental, Greiner & Bashore, *op. cit.*, p. 122.
- 84** *Ibid.* pp. 136-40.
- 85** C.M. Benbrock, *Pest Management at the Crossroads* (Consumers Union, New York 1996), p. 64.
- 86** Frog populations have been disappearing rapidly, and there have been many reports of frog deformities. See <http://www.im.nbs.gov/naamp3/papers/59df.html> providing summary of a workshop on central North American amphibian deformities September 25, 26th in Duluth Minnesota. Some studies showed that some frog deformities were caused by a virus. However, other studies have shown frog deformities and deaths caused by agricultural pesticides. M. Cone, "A Wind-Borne Threat to Sierra Frogs," *Los Angeles Times* (Dec. 6 2000) (scientists at USGS and USDA show wind-borne

pesticides harming frogs in Yosemite National Park); T. Meersman, "Studies Link Frog Deformities to Pesticides," *Minneapolis Star Tribune* (October 25, 1999) (reporting on study linking frog deformities in Minnesota ponds to agricultural pesticides).

**87** *Pesticides at the Crossroads, op. cit.*, pp. 60-64.

**88** T. Coburn, D. Dumonowski, J.P. Myers, *Our Stolen Future* (1996). For links to a range of relevant publications, see <http://www.osf-facts.org/>; <http://www.pmac.net/endodisr.htm> and <http://www.som.tulane.edu/ecme/eehome/>.

**89** *Pesticides at the Crossroads, op. cit.*, p. 74.

**90** Pimental, Bashore & Greiner, *op. cit.*, p. 130.

**91** *Ibid.* p. 131.; check also *Agricultural Resources and Environmental Indicators, 2000* (USDA Economic Research Service 2000) Chapter 4.3 (available only on the internet)

**92** Pimental, Bashore & Greiner, *op. cit.*, p. 130.

**93** See generally *Pest Management in U.S. Agriculture, op. cit.*

**94** "U.S. Organic Agriculture Gaining Ground," *Agricultural Outlook* (April 2000), p. 9. In California, Idaho, North Dakota and Washington, certified organic cropland grew 38-150% just from 1997 to 1999. Organic production is particularly significant for leading fruits and vegetables.

**95** Both the 84% and 70% figures are taken from M. Mellon, C. Benbrook, K. Lutz Benbrook, *Hogging It: Estimates of Antimicrobial Use in Livestock* (Union of Concerned Scientists 2001). A good summary of the issues discussed in this paragraph along with extensive citations can be found in A. Sayers, *Agricultural Use of Antibiotics and Antibiotic Resistance in Human Pathogens: Is There a Link?*—available at [www.healthsci.tufts.edu](http://www.healthsci.tufts.edu).

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**97** *Natural Resources Inventory, op. cit.*

**98** C.L. Groves, L.S. Kutner, D.M. Stoms, M.P. Murphy, J.M. Scott, M. Schafale, A.S. Weakley and R.L. Pressey, "Owning Up to Our Responsibilities: Who Owns Land Important for Biodiversity," in B.A. Stein, L.S. Kutner & J.S. Adams (eds.), *Precious Heritage: The Status of Biodiversity in the United States* (Oxford University Press 2000), pp. 275-300.

**99** Environmental Defense, *Progress on the Back Forty: An Analysis of Endangered Species Conservation in Private Land* (Environmental Defense, January 2000) p. 9 (compiling Fish & Wildlife Service data). Another broader list of endangered species is compiled by the Natural Heritage Program of the Nature Conservancy. Its data also indicate that agricultural development directly affected 38% of endangered species. Wilcove et al., *op. cit.*, p. 610.

**100** Of plant and animal species protected by the Endangered Species Act, 41% are endangered at least in significant part because of agricultural development, 17% are endangered by fertilizer and/or pesticide use, and 26% are endangered by grazing. J. Lewandrowski, J. & K. Ingram. "Policy Considerations for Increasing Compatibilities Between Agriculture and Wildlife." *Natural Resources Journal* Vol. 39, pp. 229-269.

**101** National Wildlife Federation, *Paving Paradise: Sprawl's Impact on Wildlife and Wild Places in California* (2001).

**102** See R. Bonnie, M. McMillan & D. Wilcove, *A Home on the Range: How Economic Incentives Can Save the Threatened Utah Prairie Dog* (Environmental Defense 2001).

**103** "Agricultural Practices, Farm Policy, and the Conservation of Biological Diversity," (US Department of the Interior National Biological Service, 1995), p. 14.

**104** T.E. Dahl, *Wetland Loss in the United States: Status and Trends* (U.S. Department of Interior 1990)

**105** Wildlife Habitat Management Institute, p.16

**106** Personal communication with Bob Misso, U.S. Department of Agriculture, Natural Resources Conservation Service (December 2000).

**107** NRI, *op. cit.*

**108** U.S. Department of Housing and Urban Development, *American Housing Survey* (1997).

**109** R.H. Platt, *Land Use and Society: Geography, Law and Public Policy* (1996), pp. 22-23. Measured by metropolitan areas, the percentage of urban/suburban land use from 6% to 19% between 1950 and 1992, while average density of urban areas declined from 4,090 to 2,589 between 1960 and 1980.

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**111** State of the Cities 2000 (US Department of Housing and Urban Development, 1997)

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**113** R.G. Cohn-Lee & D.M. Cameron, "Urban Stormwater Runoff Contamination of the Chesapeake Bay: Sources and Mitigation," *Environmental Professional* Vol. 14, pp. 10-27 (1992).

**114** E.W. Johnson, *Avoiding the Collision of Cities and Cars: Urban Transportation Policy for the Twenty-First Century, Report of a Study Project Sponsored by the American Academy of Sciences in Cooperation with the Aspen Institute* (September 1993).

**115** U.S. General Accounting Office, *Traffic Congestion: Trends, Measures and Effects* (U.S. General Accounting Office 1988); Office of Technology Assessment, U.S. Congress, *Saving Energy in U.S. Transportation* (U.S. Office of Technology Assessment 1994), p. 112.

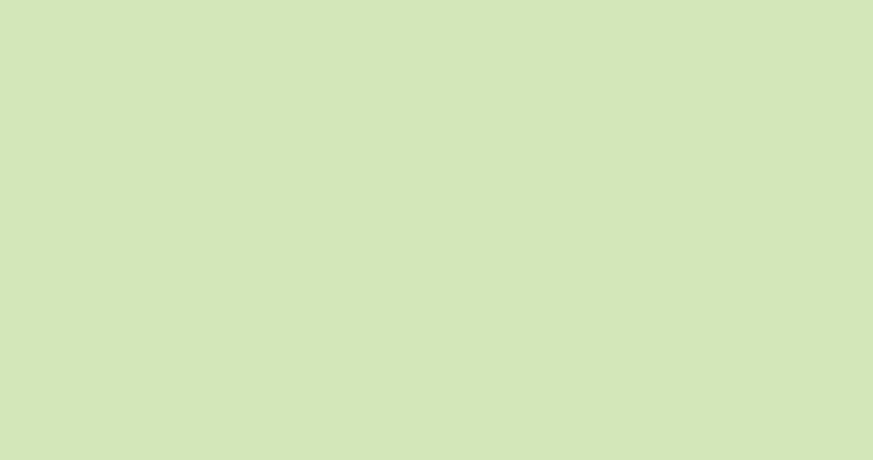
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**117** Facts in this paragraph taken from American Farmland Trust, *Farming on the Edge* (1996).

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- 121** *Working Landscapes: Cultivating Conservation in the 2002 Farm Bill* (National Wildlife Federation, 2001), p.14.
- 122** Testimony of Lark Hayes, Southern Environmental Law Center, Before the Committee on Agriculture, Subcommittee on Department Operations, Oversight, Nutrition, and Forestry, US House of Representatives, June 12, 2001
- 123** Economic And Ecologic Impacts Associated With Wood Chip Production In North Carolina." A Cooperative Research Proposal to the North Carolina Department of Environment and Natural Resources. Frederick W. Cabbage and Daniel D. Richter, Co-Principal Investigators, July 2000; Hess, George, et al. "Trends in Forest Composition and Size Class Distribution: Implications for Wildlife Habitat." Working Paper #61 in *Economic and Ecological Impacts Associated with Wood Chip Production in North Carolina*. Table 26. August 2000.
- 124** *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997* (U.S. Fish & Wildlife Service December 2000).
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- 127** NRI 'Highlights," *op cit*.
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- 131** *Watershed Forestry Initiative*, National Association of State Foresters, 2000, [www.stateforesters.org/S&PF/watershed.pdf](http://www.stateforesters.org/S&PF/watershed.pdf).
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- 133** L. Shabman & L. Zepp, *An Approach to Evaluating Nonstructural Actions with Application to Yazoo River Backwater Area* (Virginia Polytechnic Institute, February 7, 2000) (prepared for U.S. Environmental Protection Agency); G. Amacher, J. Sullivan, L. Shabman & L. Zepp, *Restoration of the Lower Mississippi Delta Bottomland Hardwood Forest: Economic and Policy Considerations* (Virginia Water Resources Research Center, Virginia Tech University 1997).
- 134** International Panel on Climate Change Summary for Policymakers: The Scientific Basis (2001).
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- 139** U.S. Department of Agriculture National Commission on Small Farmers, *A Time to Act* (U.S.D.A. January 1998), p. 4.
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