Summary and Overview 1

In the past few decades, the U.S. agricultural sector has become integrally and irrevocably linked to international markets and environmental interests. Once the dominant supplier, U.S. agricultural producers now must compete with numerous other international traders to fill the demands of global agricultural markets. At the same time, the effects of agricultural activity on the U.S. environment, and of environmental programs on agricultural production and trade, have become subjects of national importance. Within this new, multifaceted framework, international markets increasingly dictate domestic production and marketing decisions, and new priorities for environmental programs emerge. Also emerging, however, are questions about the efficacy and appropriateness of current government farm and conservation programs, many of which were instituted to cope with the exigencies of another time. In 1995, and into the next century, the key challenge for U.S. agricultural, trade, and environmental interests is to ensure that the nation's policies and programs are oriented toward the future, not shackled to the past.

This report assesses the current status of, and the diverse connections among agriculture, trade, and the environment. It delivers four major messages based on the overarching goal of promoting complementarity among them:

1. Global forces increasingly dictate the economic framework within which the U.S. agricultural sector operates, as well as the legislative framework for U.S. agricultural policy. As a result, current agricultural programs are more of a problem than a solution. Dismantling them would help the U.S. agricultural sector to respond better to the demands of global markets, and improve U.S. competitiveness abroad.

2. Current conservation programs focus too narrowly on old problems rather than on newer issues such as water quality, wildlife habitat, soil quality, and the environmental systems that join them together. Scientific knowledge of these newer issues is lacking.
3. Expanding agricultural trade does not pose significant short-run environmental risks, and environmental regulation overall does not impair the United States' ability to compete effectively in overseas markets. However, some isolated environmental damage related to trade and some cases of trade impairment will occur.
4. Federally funded research programs remain tied to an old agenda of producing more agricultural output, while research on international trade and environmental issues is dramatically underfunded. Opportunities for developing technologies that help the United States to meet its agricultural production, trade, and environmental objectives are being missed.

The United States is not alone in facing these problems. Other countries too are striving to liberalize trade while enhancing environmental protection and bringing their agricultural production sectors in line with market realities. Achieving some of these global goals may require multilateral action. Nonetheless, there is much that the United States can do on a unilateral basis to reorient its policies and programs to complement global forces while working toward national goals related to agricultural production, trade, and the environment. This report offers a range of forward-looking policy options (chapter 7) designed to benefit the three areas both individually and collectively.

GLOBAL INTEGRATION NOW IMPACTS THE UNITED STATES

In recent decades, global events and trends have had an ever-greater impact on the United States. On the economic front, the United States has switched from fixed exchange rates, which were controlled by the government, to flexible exchange rates, which are controlled by dynamic and volatile forces around the world. The country has also moved from a relatively closed economy to a more open economy, in which trade is a major force behind the restructuring of the nation's industries, including agriculture. As part of its more open policy, the United States has entered into a number of agreements that liberalize international trade. The most notable are the North American Free Trade Agreement (NAFTA) and the Uruguay Round Agreements (URA) of the General Agreement on Tariffs and Trade (GATT) (now the World Trade Organization, or WTO). On the environmental front, the United States has joined other countries in structuring more multilateral accords, such as the North American Agreement on Environmental Cooperation and the Montreal Protocol on Substances that Deplete the Ozone Layer, to protect transboundary resources and the global environment.

Poised to take advantage of more liberalized trade are multinational companies (MNCs) that control a substantial portion of the world (and the U.S.) economy. Their origins, sources for materials, communications, production facilities, and outlooks are increasingly global. Intrafirm trade—that is, goods and services exchanged among parent companies and their foreign subsidiaries—may account for 40 percent of U.S. imports and 35 percent of exports.

Facilitating the long reach of MNCs is global communications technology. Fifty plus years ago, when technologies such as radio and television first appeared, only a few wealthy countries felt its impact. Today, these and other global communications technologies allow hundreds of millions of people around the world to hear and see how others do things differently. With advanced computer systems, firms as well as individuals have instant access to global information, and trading goes on 24 hours a day. At the same time, the increasing exchange of scientific data and discoveries through communications technology has fostered an improved understanding of transboundary and global environmental systems. The result of these changes is that countries are much more interdependent. It is more difficult for a country to

impede the flow of information or to prevent or even slow the transfer of technology. All of these massive forces of change mean actions taken by one country have major implications for others.

Although global integration has made the United States more dependent on other nations, it has also brought new and rewarding opportunities for the public and private sectors. U.S. industries can not only avail themselves of frontier science and state-of-the-art technology more readily and at reduced cost; they can also diversify production and marketing risks with overseas operations. The U.S. government can share science and data with other national governments to construct more accurate appraisals of transboundary or regional environmental issues, and private industry can export or import technologies to solve them. To take full advantage of the benefits of global integration, however, it is crucial for the United States to move toward new, far-sighted policies based on emerging conditions in the nation and the world. Implementing policies that promote mutually beneficial developments in agriculture, trade, and the environment is a policy objective consistent with the new forces.

AGRICULTURAL PROGRAMS NO LONGER REFLECT MARKET REALITIES

Global integration has had a profound impact on the U.S. agricultural system. No longer do national borders define the markets available to U.S. farmers and processors. Rather, the U.S. agricultural sector is using new organizational arrangements and marketing strategies to enter and compete in global markets. Farm inputs, new farm technologies, farm output, and new food products are all exchanged in this global agricultural system, of which the U.S. agricultural system is an important and interdependent part.

MNCs are responsible for most international business in food and agricultural products, handling farm inputs, food processing, food distribution, and fast-food restaurants. They draw on the entire world to supply their operations. If a drought or flood decreases grain supplies in the United States, for example, MNCs can obtain grain from Argentina, Brazil, Australia, or another country. MNCs in food processing are creating global sourcing networks for ingredients, food-processing equipment, and packaging systems. These developments and others have made for a global agricultural system that is extremely dynamic. Response time to marketing opportunities is shorter, resources are more mobile, and the level of competition is more intense in nearly all markets.

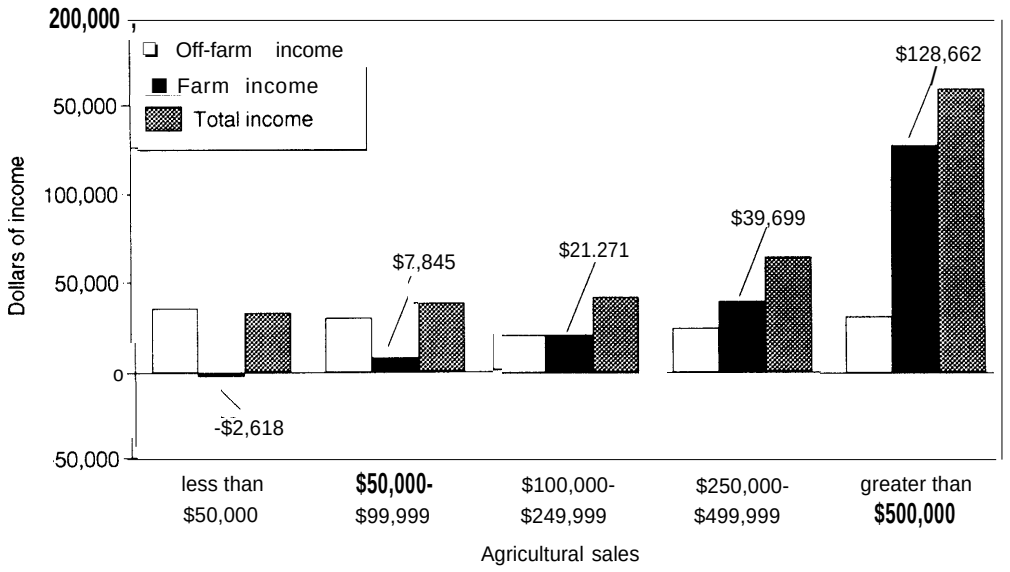
Unfortunately, current U.S. farm commodity programs do not provide the U.S. agricultural sector with the flexibility it needs to compete effectively in such a dynamic global agricultural system. These programs may have enhanced farm prices and farm incomes in earlier years, but now, they impose limits on land use and depress agricultural growth and competitiveness. The United States must seriously consider dispensing with these programs if it wishes to remain competitive in global agricultural markets.

Increased Market Orientation

As the previous sections explain, agricultural output, marketing decisions, and farmers' incomes are increasingly tied to global markets—which means that the traditional domestic demand and government program incentives that farmers looked to for guidance on what to plant, how to market, and what to export are steadily being replaced by market signals. Farm structure has changed as well. Six million farms produced the nation's food and fiber during World War II, but now, fewer than one million farms account for more than 95 percent of all U.S. farm output. Another million or so part-time farming operations add to agricultural supplies, although the operators of these farms earn more from jobs they hold off the farm than from farming itself.

Together, higher incomes on commercial farms and more off-farm income on part-time farms have brought farm households income parity with all other U.S. households. Within the farm sector, however, there is an enormous diversity of income: the largest farms receive incomes several times the national household average (figure 1-1).

FIGURE 1-1: Diversity of Farm Income



SOURCE: U.S. Department of Agriculture, Economic Research Service, *National Financial Summary,* ECIFS-13-1, 1993

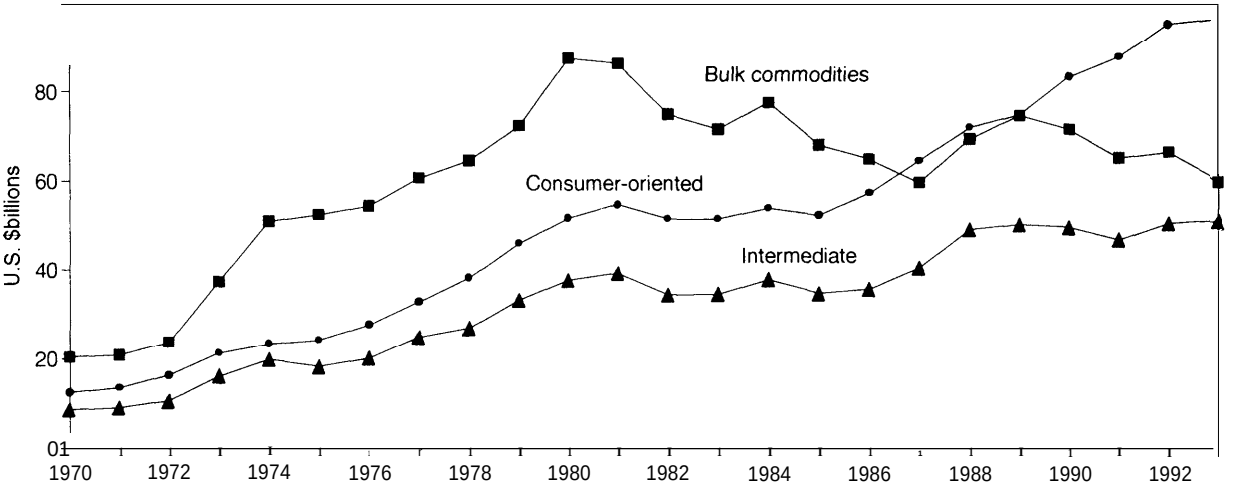
Nonetheless, the improved economic status of farm households overall has helped stabilize the farming sector, slowing the reduction in farm numbers and improving the asset position of farming operations.

A variety of technological, economic, and social forces combined in past decades to reshape the structure of farms and raise farm output. Farm size expanded as farm machinery grew in size and capacity. Farm output increased as each year's new crop varieties replaced the old. As domestic surpluses became the norm, commodity prices were depressed, forcing high-cost operators out of farming enterprises. Budget costs for disposing of stocks replaced concern over adequate food supplies. And, as environmental issues gained prominence, the American public placed greater emphasis on food quality, human nutrition, a safer food supply, protection of the environment, and the development of a sustainable agricultural system.

With new demands from consumers, new marketing arrangements emerged to improve the coordination of farm output with consumer needs. Contract production and vertical integration are used increasingly by agricultural producers, lowering economic risk and improving quality control. These new arrangements account for ever-larger portions of total output. Although open markets with many buyers and sellers still account for most sales of food and feed grains, for specialty crops and livestock the trend has been toward markets with relatively few buyers and sellers—many of whom establish terms of trade through contracts or vertical integration. Some 49 percent of fresh vegetable production, for example, moved through open markets in 1970, compared with 35 percent in 1990. Turkey production went from 28 percent of production moving through open markets in 1970 to 7 percent in 1990. Citrus production is now entirely handled through contracts and vertical integration. Overall, vertical integration and contractual arrangements, many involving MNCs, account for an increasing proportion of agricultural marketing.

As marketing arrangements have changed, so has overseas demand for agricultural products. Most notably, as the composition of other countries' agricultural imports has broadened, the

FIGURE 1-2: World Trade in Value Added Products



SOURCE: U.S. Department of Agriculture, Foreign Agricultural Service, *Desk Reference Guide to U.S. Agricultural Trade,* Agricultural Handbook No. 683, revised April 1994

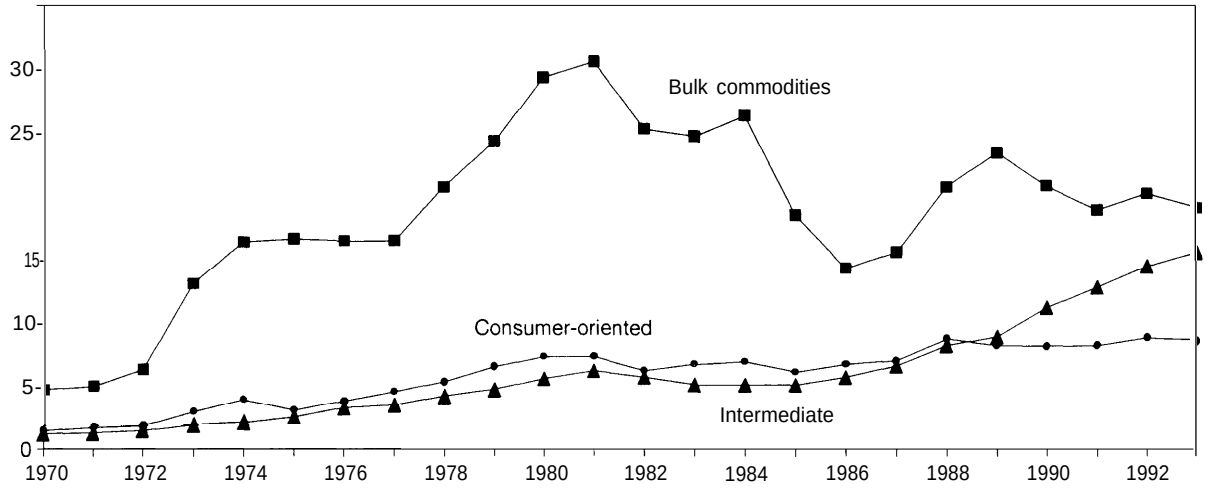
global market for value-added agricultural items has expanded.[1] Between 1972 and 1993, worldwide trade in value-added products grew at an annual rate of 8.5 percent, from $27 billion to $148 billion. By contrast, trade in bulk commodities increased from $24 billion to $60 billion, reflecting an annual growth rate of 4.5 percent. The share of world agricultural trade attributed to value-added food products was 71 percent in 1993, compared with 51 percent on 1970. The combined value of world trade in agricultural bulk commodities and value-added food products was $51 billion in 1972 and **$208** billion in 1993.

In keeping with the times, the United States has expanded its exports of value-added agricultural products, which now make up a majority of U.S. farm exports. However, value-added agricultural products dominate world food trade by a ratio of 2.5 to 1, while the ratio for U.S. exports is 1.25 to 1 (figures 1-2 and 1-3). U.S. exports of agricultural products have not grown as rapidly as world trade, leading to a loss in U.S. share of global agricultural markets. Part of the problem is the United States' continuing emphasis on bulk commodities, a legacy of farm programs that originated in the 1930s. These programs result in restraints on land use that limit the responsiveness of production to market forces. The programs also require multiple subsidies—first for producing bulk commodities, and then for disposing of them in export markets. Substantial budget savings and greater efficiency could be attained by gradually phasing out government-enhanced incentives for producing bulk commodities and allowing market signals to guide farm output toward expanding global markets.

Another useful change would be to redirect current market research efforts. Approximately 60 percent of all agricultural research expenditures is directed to increasing animal and crop production;

[1] Value-added food products include semi-processed products such as wheat flour, oilseed meal, and vegetable oil, as well as end products that require little or no additional processing for consumption such as fresh and processed fruits and vegetables, fresh and processed meats, and bakery products. Bulk commodities are products that have not been processed such as wheat, corn, cotton, and rice.

FIGURE 1-3: U.S. Trade in Value Added Products



SOURCE: U.S. Department of Agriculture, Foreign Agricultural Service, *Desk Reference Guide to U.S. Agricultural Trade,* Agricultural Handbook No 683, revised April 1994

less than 5 percent is spent on researching international and domestic markets. As global markets continue to change, more research on foreign market institutions and trends in agricultural trade, and their implications for U.S. agriculture, is essential.

New Technologies for New Markets

A range of new technologies complement the market trend toward value-added products. Information technology, for instance, enables firms to identify new markets and customize products to satisfy changing markets. The traditional constraints associated with variability in raw material supplies are slowly being removed, as new biotechnologies can alter a raw agricultural product to fit specific end uses. A highly publicized example of such a product was recently introduced by Calgene, a multinational biotechnology/information technology-based seed, food, and specialty chemical company that is developing proprietary plant varieties and plant products. Since the mid-1980s, Calgene has genetically engineered new kinds of tomatoes in an effort to significantly extend shelf life and improve taste. The company has successfully produced a fresh market tomato with at least seven to 10 days of extended shelf life. The consumer benefits are that the genetically engineered tomatoes may be harvested ripe for full flavor, shipped without refrigeration, and delivered fresh to domestic and global markets. The company received the first U.S. patent covering the use of genetic engineering in tomatoes and commercially launched the Flavor Savr tomato in 1994.

Calgene also provides a good example of the new marketing arrangements discussed above. The company will competitively select growers to produce and harvest the new tomatoes under specified conditions, will control the distribution of the tomato, and will merchandise it under its own label. Thus, Flavor Savr tomatoes will be available to consumers through a vertically integrated MNC that controls the product from seed to retail sale.

International Trade Agreements

Among the forces accelerating global integration of the agricultural sector are international trade agreements. Although most countries intervene in

their agricultural sectors to achieve certain national objectives, the trend is overwhelmingly toward less government support. Trade agreements such as the URA complement this trend not only by requiring reductions in such support, but also by acting as a major impetus for policy to move toward greater flexibility to meet changing market conditions. The URA reduces tariffs on many of the agricultural goods traded among WTO members, which will increase competitive pressures and place a premium on the marketing skills of agricultural businesses worldwide. NAFTA completely phases out North America's regime of agricultural tariffs over the next decade and a half. Tariffs on about half of the agricultural products traded between the United States and Mexico were eliminated on January 1, 1994. Even though tariffs on "import-sensitive" products, such as corn and beans for Mexico, and orange juice, peanuts, and sugar for the United States, are being phased out more slowly, the trend toward open markets is clear.

The URA and NAFTA will expand markets for U.S. agricultural products. Conversely, U.S. markets will be opened to countries that may have a comparative advantage in the production and marketing of certain agricultural items. Because the United States already imports large amounts of agricultural products, and its tariffs have been among the world's lowest, it is unlikely that imports will jump dramatically. Nevertheless, competition will increase and markets will expand.

Even though they will help to redirect some U.S. agricultural efforts, international trade agreements alone cannot align U.S. production and exports with global markets. The URA provisions may focus U.S. attention on exporting more value-added food products, but current programs that support farm commodity prices and subsidize commodity exports (most of which show little promise of large export-value gains) will work at cross purposes with this trend. Not only are these programs clearly detrimental in terms of myriad trade opportunities and revenues lost; they also conflict with the spirit of international trade agreements, which the United States has, through the years, strongly supported. The United States is consequently reaching a point where it must choose between supporting global free trade and insulating its agricultural interests from the global marketplace. The challenge ahead is to allow the incentive system to encourage more production of items to meet expanding international markets.

ENVIRONMENTAL PROGRAMS DO NOT EMPHASIZE NEW PRIORITIES

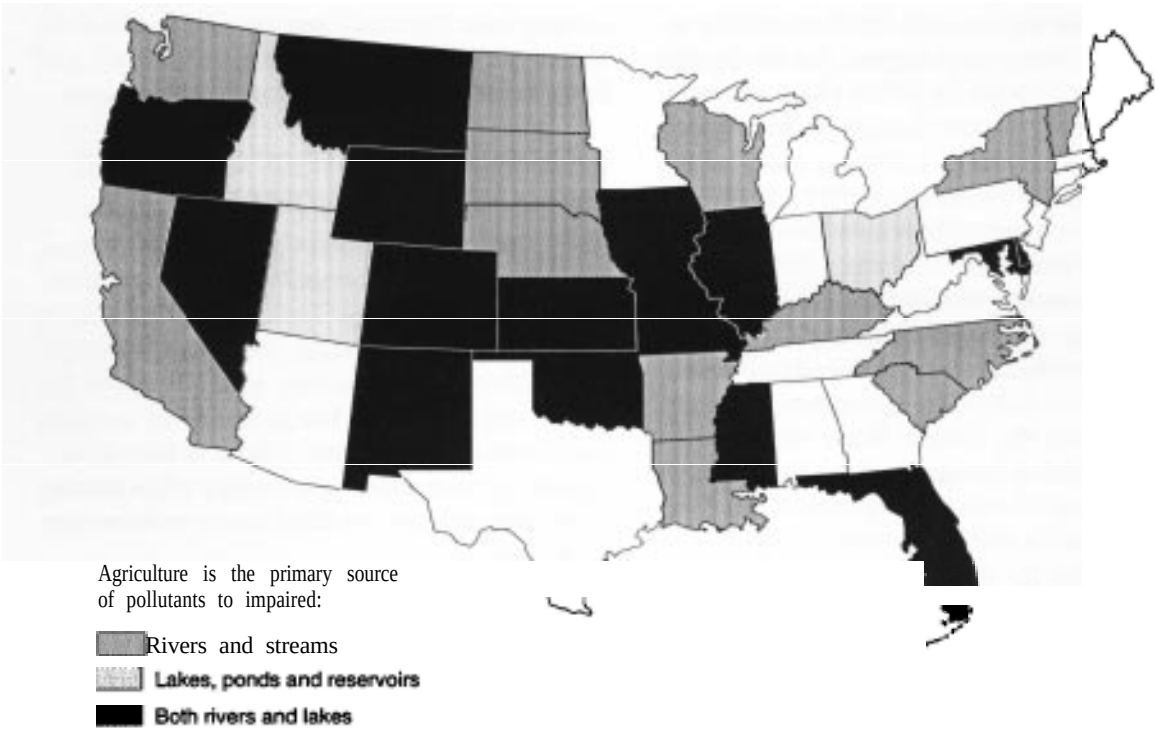
As it copes with the forces of global integration, the U.S. agricultural system is also facing new environmental dilemmas. Traditionally focused on soil and water conservation, the system must now deal more with water quality, wildlife habitat, and soil quality problems. The fundamental question confronting policymakers is how to take advantage of global market opportunities while making acceptable progress on this broader environmental agenda.

Environmental conditions associated with agricultural systems vary significantly throughout the United States. For the most part, this variation is simply a reflection of the diverse distribution of environmental resources across the national landscape. However, different types of agricultural production operations also create different types of environmental stress. Generally, the effects of agricultural operations on the U.S. environment are local or regional in nature. A first step toward defining possible federal program responses, then, is to appraise the pattern of environmental problems nationwide, so that priority areas can be identified and effectively targeted.

Agriculture's Effects on the Environment: Negative and Positive

Research and monitoring conducted since the 1970s provide broad evidence of both degradation and improvement in the quality of water, wildlife resources, and soil conditions affected by agriculture. Overall, water quality suffers most from its association with agriculture. Agriculture ranks as the primary contributor to today's surface water quality problems, principally through sediment deposition and agrichemical runoff from dryland and irrigated systems. Agriculture contributes

FIGURE 1-4: Agriculture's Role in Impairment of U.S. Surface Waters



States assessed only portions of rivers, lakes, and coastal estuaries in 1992. In 32 states, agricultural pollutants were the main source of pollution in surface waters that were unable to support their intended uses. Im paired estuaries in Oregon, California, Florida, Delaware, and Connecticut were predominantly effected by agricultural pollutants. Because four states did not report sources of pollution to rivers and lakes (Tennessee, New Jersey, Idaho, and Georgia), and six states did not report sources of pollution to lakes, ponds and reservoirs (Minnesota, Wisconsin, Tennessee, Pennsylvania, Vermont, and Alaska), this map may underestimate agriculture's role in those states.

NOTE: Data for Alaska and Hawaii is not available. States shaded whlte did not report agriculture as a source of pollution to impaired surface waters.

SOURCE: OTA, 1995. Compiled from data in U.S. Environmental Protection Agency, *National Water Quality Inventory 1992 Report to Congress,* EPA-841-R-94-G01, 1994.

pollution to over one half of the assessed streams, rivers, lakes, and reservoirs suffering impairments. As shown in figure 1-4, agriculture's relative importance to surface water impairments is spread throughout the country. Recent research indicates that more than 70 percent of U.S. cropland is located in watersheds of "poor water quality," where at least one agricultural contaminant exceeds recreational or ecological health guidelines. Nitrate in groundwater appears to be increasingly prevalent: 16 percent of the samples taken from under agricultural lands show nitrate levels that exceed drinking water standards. Although incomplete, groundwater monitoring of agricultural pesticides indicate that residues exceed drinking water standards in some states.

Overall, wildlife habitats (and as a result, wildlife populations) have been diminished or degraded by agricultural cultivation, drainage, and pollution for the past half-century. Indeed, agricultural production has been the nation's leading cause of habitat alteration, including wetlands alteration, and is the most prominent activity endangering species today. It is important to note, however, that selected wildlife species, such as pheasants and migratory waterfowl, have made

significant recoveries since conservation land set-aside programs began in the mid-1980s, indicating that reversals are possible.

Dramatic improvements have been made in controlling soil erosion. Overall, soil erosion levels have fallen 50 percent since 1945 and one-third over the past decade. The benefits are not only lower productivity losses but also future improvements in water quality as reduced pollution from sediment, nutrients, and pesticides allows rivers, wetlands, estuaries, and reservoirs to recover. Not all regional erosion trends are positive, however: some areas have been subjected to greater stress from cropping and production practices. And 120 million acres are still eroding at levels considered excessive for maintaining productivity while also causing environmental damages. Aspects of soil quality apart from erosion, such as microbial activity, have not been monitored and cannot be evaluated at the present time.

Incomplete and Ineffective Program Coverage

Today, at least 40 federal programs give incentives to farmers and ranchers to adopt conservation and environmental technologies. There are three basic approaches: 1) voluntary programs, which provide education, technical assistance, and/or subsidies for practice cost-sharing and land rental; 2) compliance measures; and 3) regulation. An overall evaluation of each approach or for the total set to assess duplication, conflicts, and coverage has not been conducted. However, existing evaluations indicate that strategic improvements are possible to improve long-term environmental performance while saving public and private costs.

Voluntary educational and technical assistance programs, often coupled with subsidies, grew out of the Great Depression "Dust Bowl" soil erosion problems, and remain the government's dominant approach. There is a lack of scientific evidence to indicate that educational and technical assistance programs have produced significant environmental improvements, except when combined with subsidies. Whenever sufficient private economic incentives exist, farmers will eventually adopt environmentally preferable production technologies without public educational or technical assistance programs. The explosion of so-called conservation tillage technology over the past decade and the growing use of field nutrient testing to cut fertilizer use are two prominent examples. These successes with "complementary technology"—technology that simultaneously benefits agricultural operations and the environment—arose largely without public research or education program initiatives. The benefits might be even greater if public policy targets resources to such innovations and helps spread adoption farther and faster.

Subsidy programs, by themselves or in conjunction with education and technical assistance, have produced conservation and environmental gains. However, they generally have not been targeted to address areas suffering the largest damages and have not always encouraged cost-effective practices. For example, enrollments in the Conservation Reserve Program (CRP), under which the government "rents" environmentally vulnerable land from farmers, did not initially include some of the nation's most fragile lands. Further, the CRP rules did not permit farmers to produce profitable commercial crops on the enrolled land, even if they could simultaneously meet the program's environmental objectives—a feature that could have lowered the government's rental payments and enhanced international competitiveness. Enrollment procedures instituted after the Food, Agriculture, Conservation, and Trade Act of 1990 improved CRP targeting, but in general did not allow the enrolled land to be used commercially. Careful targeting and greater attention to costs will be essential to the success of future subsidy programs, which will likely have much more limited scope as a result of federal budget pressures.

Compliance schemes, a landmark development of the 1985 Food Security Act, link farmers' agricultural program payments to environmental improvement. The programs cover the use of highly erodible cropland, pasture or grassland conversion, and wetlands alteration. Perhaps because the compliance measures were untried, their imple-

mentation was slow and filled with uncertainty. Regardless of their efficacy to date, the schemes suffer from two basic shortcomings. First, the size of the compliance penalties, and so the incentives to meet given standards, are not necessarily aligned with environmental priorities. Second, compliance schemes depend on the continued renewal of adequate agricultural program benefits—an increasingly difficult and costly proposition in the face of budget constraints and global agricultural economic integration.

The use of voluntary subsidy approaches and the difficulty of monitoring pollution from agricultural lands—the nonpoint source problem—has meant that agriculture has been subject to less environmental regulation than other industries. However, a growing number of regulations have surfaced over the past two decades, and their perceived influence on farmers' management decisions is growing. Pesticide registration, involving a protracted and costly review process that is behind schedule, may have the broadest effects. The regulation of pesticides has not meant overall economic loss for the industry, but it has disadvantaged specific sectors and retarded innovation that could result in environmental improvement. For example, the registration of new or existing pesticides for "minor use" crops, such as many fruits and vegetables, has been a problem because the registration costs do not compare favorably with the pesticides' small market potential.

The problems with regulation extend beyond pesticides. Long delays and conflicting rulings from multiple agencies have plagued some farmers' attempts to obtain permits for altering wetlands. Even though the percentage of these troublesome cases is small, their very existence may have spread uncertainty to other farmers who will not be likewise affected. The prospect of future regulations to protect endangered species, control coastal zone water pollution, or address other environmental issues adds more uncertainty for farmers in planning their production operations. Further, the implementation of regulations is often uneven across states. For example, point-source water pollution from confined animal operations is regulated under federal water quality programs delegated to states, and the states have widely differing approaches. Allowing states to use different approaches to pollution control may cause problems, however, when pollutants migrate across state boundaries.

Taken as a whole, the current mix of regulations, voluntary programs, and compliance schemes neither cover the broader set of environmental priorities nor operate efficiently. As matters stand, there is no clear set of environmental objectives and priorities for the agricultural sector, and excessive costs for producers, consumers, and taxpayers, as well as environmental losses, result. Further, inadequate understanding of agroenvironmental systems, conditions, and health implications can lead to uncoordinated programs and ineffective signals for the agricultural sector regarding the goals of production, technology development, and environmental protection. Clarification of agriculture's environmental responsibilities, including public and private roles and improved science would reduce uncertainty and help target scarce public resources to environmental priorities.

EXPANDED TRADE CAN COMPLEMENT ENVIRONMENTAL PROTECTION

As global economic integration proceeds, and as domestic and international environmental agendas broaden, two subjects of increasing concern have been how trade might affect the environment, and how environmental regulations might affect trade. Whether the forces of expanding trade and environmental protection can work together, or whether they necessarily conflict, has been a matter of intense debate. Over the past 20 years, the scope of the debate has widened from domestic economic and environmental issues under U.S. jurisdiction to include international commerce and global environmental questions. The simple label "trade and environment" consequently covers a large, complicated, and ever-growing web of topics that are crucially important to legal, economic, and environmental interests alike. Four aspects of the relationship between trade and the environment merit special attention.

First is the effect of environmental regulation on trade. According to some schools of thought, costly environmental regulations can force domestic producers to lose export markets or move overseas. Studies of nonagricultural industries indicate that overseas migration resulting from environmental regulations has not been significant overall, and that trade has been little affected. Because the U.S. agricultural sector is subject, for the most part, to voluntary conservation and environmental programs implemented with subsidies, its compliance costs are low, and so its competitiveness in world markets is relatively unhindered. Moreover, competitors abroad must comply with agroenvironmental programs similar to those affecting the U.S. agricultural sector as discussed below. Ultimately, the effects of a larger environmental agenda on trade will depend on the types of environmental and other programs implemented to promote mutually beneficial outcomes.

Some specific sectors with special environmental problems may be exceptions and find that their competitiveness is hindered as a result of environmental regulation. The most noteworthy case thus far concerns methyl bromide, a chemical used in agricultural production and trade, and slated to be banned in the United States because it contributes to air pollution. Although the benefits to U.S. society as a whole of banning methyl bromide are estimated to far exceed the costs, some agricultural sectors will suffer disproportionately, losing about $1 billion per year in the short term. Cases such as methyl bromide should be the focus of research to investigate the policy opportunities, domestic and multilateral, to ease adjustment, create better substitute technologies, and help retain international markets.

Second is the role of product standards. National product standards, such as tolerance levels for pesticide residues, can serve as legitimate nontariff measures to screen certain imports. The URA established new health and safety, as well as "technical barriers to trade," codes that address this issue. Among other things, the codes specify that product standards should be based on science and restrict trade no more than necessary to achieve a nation's desired level of protection. The specific aim of these new negotiated agreements was to reduce the likelihood that U.S. agricultural exports would be subject to unwarranted import barriers. However, product standards are also crucial to addressing certain environmental ills related to agriculture. For example, keeping harmful nonindigenous species (HNIS) out of the United States (now a significant environmental concern) depends primarily on strictly enforcing measures covered by the codes, such as quarantines. Because of the lack of precedent under the URA, it is not clear whether product standards for environmental purposes will come under fire as unjustifiable barriers to trade. If they do, only future rulings by the WTO will determine their status. Other agricultural-trade-environmental issues extend from product standards to the growing gray area of process standards, currently illegal under WTO rules. Examples include the enforcement of domestic country rules excluding genetically engineered plants and animals and market standards for organic farm products. Multilateral attention to these issues could enhance U.S. production and environmental interests.

Third is the effect of trade liberalization and expansion on the environment. Estimated shifts in agricultural production that result from the new trade agreements will likely cause little overall damage to the U.S. environment. Indeed, environmental conditions may improve in some areas, if imports displace environmentally damaging domestic production. Certain other areas—such as border zones, where trading could flourish—may come under added environmental stress, and foreign species, such as invasive weeds on rangelands, could pose new commercial and environmental risks as they enter through new trade pathways. Controlling these short-run domestic environmental quality challenges and longer-term conflicts hinges principally on how U.S. agroenvironmental programs are run. As explained above, current programs are not wholly effective: they do not offer comprehensive and enduring environmental coverage, nor do they encourage complementary technology research and development. NAFTA and the URA do not require the United States to reduce current commodity pro-

gram payments affecting production, or to "decouple" (that is, separate) the payments from levels and type of crop production. Had the URA significantly reformed domestic agricultural commodity programs, some net environmental improvement would likely have occurred. The net effect of such reform depends on weighing increased erosion pressure against less chemical use.

Expanding agricultural production through trade liberalization may pose special risks for countries that have inadequate environmental programs and would respond to higher world prices by producing more for export. Pressures on transboundary and global environmental resources of interest to the United States, such as border water resources and wildlife habitats, may result in significant costs. With the exception of the environmental side-agreement approved with NAFTA, neither the URA nor the present patchwork of multilateral environmental agreements addresses this kind of situation. Trade agreements will not cover all environmental problems because of their necessary orientation to commerce. Some type of multilateral environmental agreement or organization to coordinate and stimulate solutions to transboundary and global environmental problems is also required.

Fourth is how trade measures are used to meet international environmental objectives. NAFTA and the URA were the first trade agreements to incorporate significant environmental provisions, but the ultimate efficacy of those provisions depends on future political dynamics. The use of trade measures in a limited number of international environmental agreements, such as the Montreal Protocol to Control Substances that Deplete the Ozone Layer, has been shown effective. Current WTO rules do not specifically address the use of international environmental trade measures, and therefore clear guidelines are not at hand. Further, critical questions about the conditions justifying unilateral or multilateral actions and extraterritorial objectives remain unanswered. Such "offensive" environmental trade measures have not been widely applied to agriculture, although they may be in the future. Clear rules promulgated by the WTO would assist environmental and trade efficiency. Again, a multilateral organization responsible for global environmental management could work with the WTO to ensure that both global trade and environment needs receive appropriate consideration. Such an organization could help promote alternative measures, such as technical assistance and technology research and development, to avoid unnecessary trade disruptions.

Efforts to expand agricultural trade and upgrade environmental quality can complement each other, if "appropriate" environmental management programs that target significant environmental problems and focus on low-cost solutions are properly run. To achieve this outcome research needs to be targeted on these problems and solutions. Unfortunately, current programs at domestic and international levels do not ensure that this will happen. Reconstitution and retargeting of domestic environmental programs and technology research and development, introduction of new multilateral institutions, and greater levels of multilateral cooperation are essential.

AGRICULTURAL RESEARCH NEEDS A NEW DIRECTION

For many years, the nation has benefited from a long stream of agricultural research breakthroughs that have increased agricultural output and lowered the real cost of food. However, relatively little research has been directed toward agriculture's relation to trade or to the environment. Little if any information on changing trade flows, new and emerging agricultural markets, and strategies to meet the needs of those markets is available. On the environmental front, comprehensive information is not available on national trends in water quality, soil quality, and agriculture's effect on wildlife resources. Moreover, the potential for science to aid in devising complementary technologies remains largely unexplored.

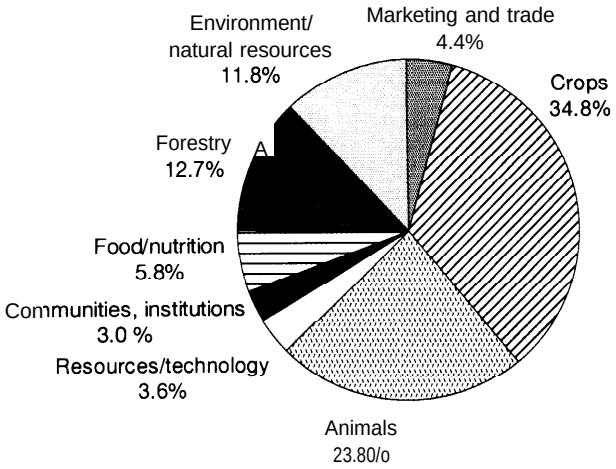
A primary explanation for these differences in research achievements can be found in the budgetary resources allocated to these topics. In 1993, the United States devoted $2.9 billion to agricul-

tural research through federal and state research institutions. The allocation of these funds heavily favored research on crop and livestock production (figure 1-5), which received almost 60 percent of all resources. Funding for research on the environment was only 12 percent, and for research on trade, a mere 4 percent. As a result, many potential chances to improve environmental conditions and trade revenues are being missed, and many key developments in world markets are identified belatedly, if at all. The dramatic shift of world trade away from bulk commodities and toward value--added agricultural products, for instance, went unnoticed for nearly a decade.

To take advantage of the trade opportunities available to it, the U.S. agricultural community needs information on markets in a wide range of countries. Food consumption trends in other countries, as an example, are important to track. Many of the countries that will be responsible for shaping the composition of future global trade in agricultural products are in different stages of development, with different income levels and different responses to changes in incomes, food prices, and availability of new food products. For the United States to become proficient at marketing agricultural products to these countries, it must become more knowledgeable about their conditions, about food tastes and taboos, and about cultural habits that shape food consumption. This new direction would present a major challenge to an agricultural research community that has focused most of its attention on enhancing yields of commodities that are declining in relative importance in international markets.

The relatively low priority of agroenvironmental research is reflected in the fact that federal agencies do not have major initiatives to understand the relationships between agricultural and environmental systems. Nor do they collect or maintain databases designed to evaluate comprehensively national water quality, trends in soil quality (except for erosion), or agriculture's effects on wildlife resources. Individual agencies monitor conditions separately, resulting in incompatible databases for building a national picture.

FIGURE 1-5: Agricultural Research $ Breakdown



SOURCE: USDA/CSRS, Inventory of Agricultural Research, 1993

Finally, even with adequate national monitoring data, the implications of those conditions for environmental health remain poorly understood. For example, many agrichemicals have not been evaluated fully for their potential effects on the health of humans or environmental systems. Because market incentives to enhance environmental quality are incomplete, it is unrealistic to expect sufficient research and development to emanate from the private sector. Public research to provide adequate science and data on agroenvironmental topics, and for developing complementary production and environmental technologies, is clearly necessary.

The low level of funding for agroenvironmental research and lack of major program support for complementary technology, will slow the reorientation of public research priorities from traditional production emphases to enhancing the integration of production and environmental goals. Given the current research system, promising new developments in biotechnology, biological pest controls, and information technologies to increase the efficiency of inputs will not reach their full potential. Only anew generation of inte-

grated research and technology developments can set the stage for an economically and environmentally sustainable agricultural system.

THE VIEW FROM ABROAD

Issues relating to agriculture, trade, and the environment are clearly not unique to the United States. The question is, how similar or dissimilar are the specific problems faced by other countries, and what kinds of policies are they implementing to address the problems? Are other countries experiencing agroenvironmental problems similar to those of the United States? How do their responses compare with ours? If the United States regulates agriculture to preserve its environment, will it still be competitive in world agricultural markets? Do other countries offer more support to their agricultural sectors than the United States does, or less? Do other countries restrict agricultural trade more, or less?

All of the countries considered in this report (Argentina, Australia, Brazil, Canada, France, Germany, Japan, Mexico, the Netherlands, New Zealand, Taiwan, and the United Kingdom) intervene in their agricultural sectors to achieve certain national objectives, such as maintaining a secure, safe, and adequate food supply; increasing agricultural productivity; and enhancing the living standards of farm families. In recent years, however, budget constraints, international pressure, and socioeconomic changes have led almost all of these countries to cut back on government support for their agricultural sectors. New Zealand went so far as to eliminate government support altogether in 1984, other than for pest and disease control and some research. Mexico and the European Union (EU) have advanced efforts to decouple agricultural support from product prices. As part of its economic reforms, Argentina has drastically reduced the implicit tax it levies on its agricultural sector.

This is not to suggest that barriers to agricultural trade are becoming obsolete. All countries continue to use some combination of border measures—tariffs, quotas, export promotions, health and safety regulations, licensing schemes, and other devices—to protect domestic agricultural producers and enhance their opportunities to increase agricultural exports. Taken together, these measures can restrict overall world trade. However, through increased participation in regional trade blocs such as NAFTA, and in the WTO, many countries are choosing to liberalize, rather than hinder, agricultural trade.

This move toward freer trade coincides with growing environmental concerns and a range of government efforts to address those concerns. By the mid-to-late 1980s, most governments had instituted at least some environmental legislation and regulations, and had taken moderate measures to help mitigate problems. Generally, in the industrialized countries, the percentage of GDP that is used for pollution abatement and control by the public and private sectors averages less than 2 percent.

Although the nature and extent of the problems may vary, most countries are contending with similar agroenvironmental concerns. Until recently, though, the agricultural sectors of most countries were generally not subject to environmental policies and regulations. Initial policies addressing agroenvironmental issues focused mostly on soil erosion, because it directly affects agricultural productivity. As the agroenvironmental agenda has broadened, however, many countries have begun to implement provisions for enhancing water quality as well as protecting habitats, wetlands, and countryside amenities in their agricultural policies. Canada, Japan, and the United States have each reduced their wetlands by more than 70 percent in some regions, but have now introduced policies geared to protecting remaining wetlands that are deemed significant, or to preventing a net loss of all wetlands.

Most countries are coping with the environmental effects of agricultural production by discouraging harmful practices or encouraging beneficial ones through a variety of programs. It must be kept in mind, however, that federal programs designed to assist agriculture still emphasize production rather than general environmental goals. To a large extent, existing agricultural policies ei-

ther effectively raise farmers' prices for output, or decrease prices for inputs—both of which encourage farmers to adopt intensive farming practices that may be harmful to the environment. Agroenvironmental policies are then introduced to counteract these effects, but the artificially high prices for agricultural goods make it difficult for such policies to work. It is more profitable for farmers to use land for agricultural purposes than to let it be used, for example, as wildlife habitat, and agricultural programs enhance this disparity.

This dilemma is being addressed now by governments the world over. Confronted with shrinking budgets, they are finding it more and more difficult to rationalize maintaining such conflicting policies—and they are increasingly unwilling to pay not only the financial, but also the environmental, costs of supporting their agricultural sectors as they did in the past. Partly as a result, agroenvironmental policies are moving away from strictly voluntary efforts to cross-compliance schemes and regulatory measures. These policies may increase production costs, but if all countries are implementing similar policies and all face increased costs, the ultimate effects on competitiveness may be minimal.

A NEW CONTEXT FOR POLICY

Global integration, expanding and changing world agricultural markets, and heightened environmental concerns are defining new policy challenges and opportunities for the United States. These trends manifest themselves in an agricultural system that must respond more to global markets; an emerging environmental agenda that extends beyond traditional conservation concerns; and an expanding research agenda that increasingly emphasizes environmental protection, food safety, marketing and trade, and profitable, yet environmentally sustainable agricultural systems.

While the context has changed, federal policies and programs affecting the agricultural sector have not changed. They promote production of bulk commodities and hinder possible opportunities for U.S. farmers in fast growing value-added export markets. They divert major resources to soil conservation while newer issues of significance—water quality, wildlife habitat, and soil quality—remain relatively neglected. Almost two-thirds of agricultural research funding is devoted to increasing farm output, even though more output will mean more federal subsidies to export surplus crops, and still more federal funds to "idle" land to control surpluses.

As the United States moves toward the year 2000, and as continuing budget pressures constrain traditional subsidy solutions, government must explore innovative approaches to these dilemmas. Furthermore, tensions between agricultural policies and trends in both trade and environmental spheres create costly inefficiencies. Seeking complementary and mutually reinforcing policies for agriculture, trade, and the environment could not only lessen budget pressures but also help ensure that the nation's policies are oriented to the future.

Seeking complementarity would involve:

- synchronizing domestic trends with global forces,
- targeting program resources on priority areas,
- encouraging development of technologies that serve multiple objectives, and
- using markets or market-like mechanisms wherever possible.

Policy options discussed in chapter 7 for agriculture, trade, and the environment illustrate how policies and institutions can be complementary rather than in conflict. Central to the process will be allowing market forces to have more influence in food production while at the same time compensating for the market's inability to signal the value of environmental effects that result from agricultural production. Modern market forces are tuned to world-wide trends. Their signals help guide production patterns toward future markets, rather than tie them to past patterns of use. Those same signals can help research institutions determine research priorities that are consistent with national and international trends. Current commodity and conservation programs tie U.S. agriculture to the past. To provide complementarity

among agricultural production, trade, and the environment many current programs need to be dramatically restructured, if not eliminated; fundamental policy changes need to be considered.

The pace of change must be carefully planned, however, so that the agricultural system and related environmental stresses are not thrown out of balance by abrupt suspension of federal programs. In chapter 7, a number of policy options are spelled out that would move federal programs toward a better balance with international markets, budget realities, trade deficits, and environmental concerns. The time sequence is five years which is in keeping with the time framework of recent agricultural legislation.

As the United States heads into the next century, such complementarity could have a key influence on the standing of U.S. agriculture in a global economy. Indeed, seeking complementarity among these policies will allow the United States to capture the opportunities of global market expansion while protecting and advancing domestic goals related to environmental quality as well as to the competitiveness of the agricultural sector. Moreover, seeking complementary and mutually reinforcing policies will likely require fewer government resources in an era of increasing budget stringency. Equally important, pursuing complementarity can help ensure that the nation's policies are oriented to the future, not anchored to the past.