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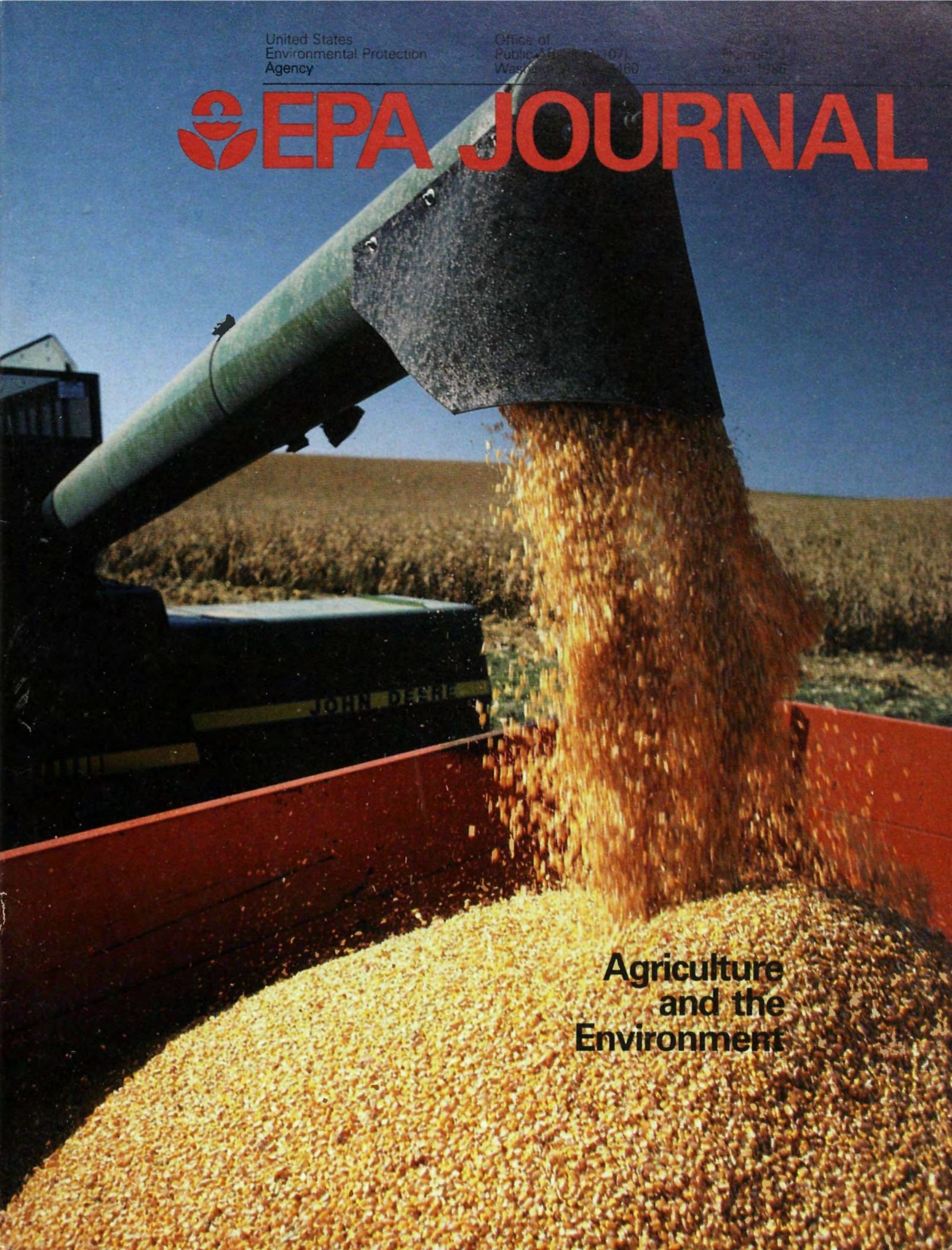

Agriculture and the Environment

Agriculture and the Environment

Like other spheres of life in America, farming brings with it environmental problems that the nation is attempting to deal with. In this photograph, cattle graze near a farm's stock watering tank. The tank is supplied with well water by a windmill. Animal waste in proximity to the well casing could contaminate ground-water supplies.

History is being made in the way the nation looks at agriculture and its relationship to environmental quality. New programs, new perspectives, and in some cases, new ways of farming are being established. This issue of *EPA Journal* explores this significantly changing picture, attempting at the same time to provide a view of the problems concerned from a fresh vantage point.

Lee M. Thomas introduces the issue with an article looking at some of the trends, implications, and prospects from his point of view as EPA's Administrator. In an interview, Peter C. Myers discusses the situation as seen from his position as Deputy Secretary of Agriculture. Senator Patrick Leahy (D-VT) provides a Congressional perspective focusing on the precedent-setting environmental provisions in the Food Security Act of 1985. Leahy is Chairman of the U.S. Senate Agriculture Committee. Then William K. Reilly, President of The Conservation Foundation, looks ahead to specific ways agriculture policy and environmental policy might be more fully woven together to the benefit of both.

The *Journal* then focuses on farmers themselves. In a forum, 14 farmers from across the United States speak on how environmental problems and regulations affect them. Then a feature explains for the general reader some of the myths and realities about agriculture today—who is farming, the scale, the economics, the hurdles.

An article looks at the agriculture/environment situation in one state, Iowa, in the heartland of American farming. And a piece concentrates on a local situation, in Pennsylvania, where farm innovations are being tried to control pollution that is affecting the Chesapeake Bay through its tributaries. Another piece looks at some of the steps being taken in other countries to deal with environmental concerns that aren't confined to U.S. agriculture.

In the next feature, two authors with differing views debate how EPA should proceed in carrying out its responsibilities to protect endangered species from pesticides, a controversial subject. Another article reports on "alternative agriculture," an approach some are using to farm with less reliance on chemical fertilizers and pesticides.

Wrapping up this *Journal*'s focus on agriculture and the environment is a feature taking a broad perspective, past, present, and future, by an EPA specialist on the subject, Rob Wolcott.

Articles on non-agricultural matters include a look behind the daily news reports during last January's oil spill on the Monongahela River in Pennsylvania and an explanation by an observer of nature of why he decided to leave a big oak tree where it fell in his backyard.

This issue of the *Journal* concludes with a regular feature—Appointments. □

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EPA is charged by Congress to protect the nation's land, air, and water systems. Under a mandate of national environmental laws, the agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life.

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Front cover: Modern agriculture at work—the corn harvest in Iowa. Photo by Dale Thompson, Folio, Inc.

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The EPA Administrator's View

by Lee M. Thomas

As a child growing up in rural South Carolina, I saw first-hand the close bonds between farmers and the environment. No one was more concerned about erosion than farmers; no one was more concerned about the quantity and quality of local water supplies. As I learned from my experience as a member of the South Carolina 4-H, farmers then prided themselves on their long tradition of good stewardship of the natural resources under their care.

The world has changed a great deal since then, and the lives of farmers and the quality of the environment have changed with it. For example, the U.S. population and economy both have grown rapidly since the 1950s, leading to much larger total loadings of environmental pollutants, and placing a much greater strain on the environment's ability to assimilate them. In today's more crowded and complex world, our lives are intertwined more tightly with our neighbors. Thus the activities of farmers today are more likely to affect, and be noticed by, people living in neighboring towns and cities than they were 30 years ago.

Farmers and farming have changed, too. For one thing, farmers have improved their productivity enormously. Although there are far fewer farmers today than at the turn of the century, they are harvesting much larger crops. The agricultural bounty that we sometimes take for granted has been nurtured by a sharp increase in the use of agricultural chemicals—insecticides, herbicides, and fertilizers. To produce still larger harvests, chemical-intensive farming has been introduced onto heretofore marginally valuable land. The end result of this farming evolution is that more chemicals are being used on more land

to produce more food than ever before in our nation's history.

The astounding productivity of the American farm has contributed to a U.S. standard of living that is among the highest in the world. The American people spend a smaller share of their income on food than almost anyone else. The quantity, quality, and variety of food available to the U.S. consumer is unmatched.

Yet, as we have seen in other parts of the American economy, sometimes the economic practices that contribute so much to our national quality of life have unforeseen and unintended environmental side effects. The same American farming methods that have supplied a cornucopia of foodstuffs to people all over the world are also contributing to some serious environmental problems that have the potential to impose substantial health and economic costs on all of us, including farmers, in the future.

Agricultural chemicals are leaching into ground-water aquifers, even in remote locations. Topsoil, fertilizers, animal wastes, insecticides, and herbicides are being washed off farm and ranch land and into rivers and streams. Surface-water pollutants originating on farms are ending up in our nation's estuaries, thus contributing to the ongoing degradation of those ecologically rich areas.

The cultivation of marginal farmland is reducing wildlife habitats, and the underground storage tanks prevalent on many farms have the potential to foul ground-water aquifers, including those that supply drinking water directly to farm families. The health of farm workers is being threatened by exposure to agricultural chemicals, and chemical residues are showing up in our national food supply. In short, the evolution of American farming—in the context of an expanded population and economy—has led some people to suggest that the American farmer is no longer able to maintain adequate stewardship of the environment.

There is no doubt that modern agricultural practices have contributed to environmental concerns about ground-water quality, surface-water quality, and endangered species. Recognizing the linkage between agricultural production and environmental protection, Congress has passed several pieces of legislation that attempt to balance the public's interest in both areas, and the Environmental Protection Agency has been given a large measure of responsibility for implementing that legislation.

In the years ahead, EPA will be working closely with state and local governments in a number of ways that will affect the farm community in this country. We will be cooperating on research efforts to define the environmental effects of different agricultural chemicals. We are committed to removing from commercial use those pesticides that pose an unreasonable risk to human health. We will continue our cooperative efforts to identify the sources and extent of ground-water pollution. We are going to work together to protect endangered species and their habitats.

Corn is being planted and herbicide, fertilizer, and insecticide are being applied, all at the same time—a common agricultural practice. Chemicals are an integral part of most American farming operations. Wolfgang Hoffmann photo, University of Wisconsin—Madison, Agricultural Journalism Department.

But strong government regulatory programs, by themselves, will not solve the environmental problems that are linked to agricultural practices. Because those problems are so diverse, and because agricultural practices vary so widely from farm to farm, we're going to need the creative, voluntary participation of farmers all across the country if we hope to achieve our national environmental goals.

I believe that farmers can be enlisted as allies in the fight against agricultural pollution for a number of reasons. For example, farmers have a substantial self-interest in protecting the quality of ground-water aquifers, because their homes often are supplied with water directly from farm wells. Thus any impurities in ground water are likely to show up in farm homes first.

Farmers will make productive partners in national pollution control efforts for another reason as well: because they are closer to the problems, they are more likely to know how to solve them effectively. If farmers can be convinced that agricultural run-off needs to be controlled, they will not need government regulations to show them how to do it.

At the federal level, we need to give farmers enough information and incentives so that they volunteer to put their initiative and skills to work for the environment. The Food Security Act of 1985 provides incentives for farmers to keep marginal lands and wetlands out of crop production; those incentives are helping to preserve valuable ecosystems while restraining crop production. We need to do more of that. I believe that farmers will be willing to reexamine their use of agricultural chemicals, and revise other agricultural practices as well, if they understand the consequences of, and the alternatives to, their present methods of doing business.

Daniel Webster once said that farmers "are the founders of human civilization." From the perspectives of human health and environmental quality, they may well be the preservers of civilization, too. The sense of stewardship that I saw in the South Carolina farmers of my childhood has to be reapplied to the environmental problems facing us today. Because of their heritage and training, no one is more capable of good stewardship of natural resources, both today and in the future, than America's farmers. □

(Thomas is Administrator of EPA.)

Planting alternate strips of corn and small grain helps reduce erosion on this farm in Carroll County, Maryland. USDA Soil Conservation Service photo.

The Outlook of the Deputy Secretary of Agriculture

An Interview with Peter C. Myers

Seeking to present the viewpoints of some key people involved in issues regarding agriculture and the environment, EPA Journal interviewed Peter C. Myers, Deputy Secretary of the U.S. Department of Agriculture. The text of the interview follows:

Q The 1985 farm bill (see box on p. 7) is often touted as a major step toward placing environmental concerns in the mainstream of U.S. agricultural policy. On the other hand, the farm bill is also said to reduce government's role in agriculture. Does the same law really serve these two seemingly disparate purposes?

A The bill does try to make government programs more market-oriented, and I think that's where your second point is coming from, concerning a reduced government role. For instance, our loans to farmers are geared more closely to the market prices of commodities.

At the same time, from the standpoint of tying conservation and farm programs together, the farm bill increases government involvement in agriculture—very definitely. Of course, the farmer does have the option of electing not to participate in federal farm programs, in which case he's free to do whatever he wants to do with his land. But if a farmer wants to participate in our federal programs, then he's going to have to adopt reasonable conservation practices and avoid converting wetlands.

Q Why this new emphasis on the environment in our farm programs now—i.e., in the last couple of years or so, as opposed to 10, 15, or 20 years ago?

A We're clearly becoming more concerned in this country about what we're doing to our soil and water. In fact, that's what brought me to Washington in the first place. I saw what was happening to Missouri when, in the 1970s, we converted a lot of grassland into cropland, and that caused me to start looking at soil conservation problems. And the more I learned about soil conservation, the more I understood

that it tied in with water quality—both surface water and underground aquifers.

The whole package of conservation and environmental issues just wraps together. We are becoming increasingly concerned about what we are doing to our environment. We want to continue our production of food for the next few centuries—and beyond—and we want to do so in a manner that conserves our soil resources, affords a reasonably clean environment, and sustains profitability for America's agriculture.

Q Was there a time in this country when farming was more environmentally sensitive than in recent decades?

A I don't think so. If you look at the history of farming in the United States, starting with the pilgrims on the east coast . . . they just farmed until the land was gone. The same thing was done in the southeast, with cotton. When the topsoil was gone, people just moved west.

Since we've reached the Pacific Ocean, there's no more moving away from the problems: we have to farm with what we've got. The point is we have a history of not recognizing and facing up to problems we've created. This began to change 50 years ago when the soil conservation movement was born. [Hugh Hammond] Bennett and others saw what was happening, and President Teddy Roosevelt also realized what was going on. I think that's when an awareness of soil conservation was first born. Of course, this was also the dustbowl era.

Q What has USDA done to enforce the Swampbuster policy established by the 1985 farm bill?

A Starting last year, any farmer who comes in to sign up for a farm program must sign a statement certifying that he has not converted a wetland for cropland use. And, of course, USDA personnel go out and spot-check compliance. Right now, we have 300 cases under investigation for possible violations of Swampbuster.

I have seen some articles that say USDA is not enforcing the Swampbuster policy. In fact, we are enforcing it. I know we have the farmers' attention on this because many of them are reacting with righteous indignation. And I would submit that we have basically stopped the wholesale conversion of wetlands.

I think Swampbuster, on balance, is going to prove to be a good piece of legislation. I think we should leave it alone and let it function.

Q What about Conservation Reserve: how successful has this program been so far in terms of farmer sign-ups? Has the turnout been disappointing?

A No, if you look at volume of acreage, we're ahead of schedule. Under Conservation Reserve, the goal is to retire 45 million acres of highly erodible cropland out of production for 10 years. At this point, we're approaching 27 or 28 million acres, depending on what we can accept from this last sign-up.

We're now getting some of the erosive land in southern Illinois, southern Indiana, and parts of Ohio. However, we may need to raise our bid levels in the Corn Belt. On the whole, we have probably paid a little too much for some lands, and probably not enough for others.

We are also going to have to go after land that could impact water, for instance. For example, we need to look at some of the hydrologic units in the Chesapeake Bay area.

The program has been, I think, an unqualified success, but we still have some fine tuning to do.

Q So you can consider water quality and underground aquifers when you accept land into Conservation Reserve?

A Not necessarily, unless the land is highly erodible. The law does afford a lot of leeway, but our regulations do not at this time allow us to make aquifer damage a consideration for taking land into the program. On the other hand, we are finding—in Nebraska, in the Sandhills, for instance—that there will be a positive effect on water quality as a direct consequence of Conservation Reserve.

We have just begun taking filter strips—strips of land along bodies of water—into the Conservation Reserve, regardless of erodibility. Since filter strips serve as "filters" for sediment and chemical loadings, this new policy is intended to have a positive impact on surface water quality.

Q Do you favor an expanded Conservation Reserve? If so, how should it be expanded?

A I do favor an expanded program, probably with the next farm bill in 1990—but with the stipulation that Conservation Reserve would be the only set-aside program that we would have.

There have been several proposals to expand the Conservation Reserve to 65 million acres. There is reason to be nervous about getting that much land out of production *in addition to* the normal set-aside acreage. With too much land out of production, we could be giving away our production capacity to other countries, and giving away our export markets.

I would support a farm bill that designated 65 million acres to Conservation Reserve as the *only* set-aside program in this country. Sixty-five million acres would be just about the right balance of land out of production in the United States—and it would be erodible land, and land that affects water quality. That makes sense to me.

Q For highly erodible cropland that remains in production, how strictly will USDA be enforcing the Conservation Compliance program set up by the farm bill? What happens when the January 1990 deadline arrives?

A We intend for all soil conservation plans to be written by the end of 1989. Any farmer who is farming highly erodible land will have to have an approved plan and begin implementing it by January 1, 1990.

We will allow farmers five years to put their soil conservation plans fully in place—but this doesn't mean waiting until the fifth year, for instance, to start practicing conservation tillage. The law says farmers must be actively putting these plans to work.

We're giving farmers flexibility on their conservation plans. We're not out to put farmers out of business. On the contrary, it's our job to keep them in business but help them learn to be good stewards of their land. We intend to enforce Conservation Compliance, but we intend to do it with reason and balance.

Farmers with erodible land must sign a certification statement concerning their implementation of a conservation plan. USDA will spot-check about 10 percent of these farms per year—so that in five years, we'll have checked at least 50 percent of the farms involved. Generally, in 99 percent of cases, we find that farmers are doing exactly what they've certified they would do.

Q On the use of farm chemicals . . . , it seems that over the past couple of decades, U.S. farmers have greatly

intensified their use of agrichemicals, always striving to obtain maximum possible crop yields per acre—even if the end result may be crop surplus at the expense of the environment. Is there a way out of this pattern?

A I would challenge that statement, that we have intensified the use of agrichemicals. We have *continued* the use of chemicals. I've been farming for three decades, and we used more punitive insecticides 30 years ago than we use now. On the other hand, we are using more herbicides than we did back then. We've always used commercial fertilizers.

Something we need to remember is that most commercial fertilizers are natural. Potash phosphate comes out of the ground. It's a natural element. Nitrogen comes out of the air. People tend to get uptight talking about chemical fertilizers when in fact these are natural fertilizers.

Nitrogen is our biggest problem. And we do get phosphorus overloading in some bodies of water, but this comes from a lot of different sources. I think farmers are beginning to learn how to manage their fertilizer application. As a result, I think we are going to be seeing a lot fewer problems related to run-off.

On the pesticides, particularly the herbicides, I really believe a lot of changes are coming in the next few years. I see farmers moving away from herbicides that contaminate ground water. After all, who are the biggest losers? Farmers. They're the biggest users of well water.

I think we're going to see a new breed of herbicides that will not damage the environment. Maybe they'll be organic and biodegradable. Maybe they'll be bacterial pesticides—fungal herbicides, for example, which already exist in research stages.

Q **So do you predict a decrease in agrichemical usage in the next decade or so?**

A I see a change in the use profile, a movement toward more organic practices. Most of the major chemical companies are already doing research on biological pest controls in all kinds of shapes and forms.

Of course, *agrichemicals* is an all-encompassing word. We can't just point to agrichemicals as the bugaboo; we have to look at specifics—how and in what form we are using farm chemicals, on what crops, on what soil types. We cannot produce food for this country without using basic fertilizers because not enough livestock exist in the country to put back the basic nitrogen, phosphate, and potash that we take from the soil when we harvest crops. So we have to use fertilizer, but with intelligence.

In the use of agrichemicals as in other things, farmers are going to have to be better managers. Being a better manager will mean different things to different farmers, depending on crop, soil, and regional considerations.

Q **What is USDA doing to promote the kinds of changes you've mentioned—to promote low-input agriculture, if that is the right term?**

A Call it low-input, sustainable, or alternative agriculture, as you like: these terms are becoming more popular. USDA has been doing research in this area for years; we just haven't labelled it as such. We now have contracts in four or five states for research specifically on what people are now calling alternative agriculture. I expect that most farmers will adopt a combination of alternative and traditional agricultural practices.

USDA has a big role to play in conducting the necessary research on alternative farming methods. It's also up to us to make this knowledge available through outreach programs, not only to farmers, but also the people who manage lawns and gardens. The states also have an important role to play, through cooperative extension services, in imparting up-to-date information. So does the Soil Conservation Service in providing on-the-land technical assistance. So does EPA, through publications, for example.

Q **Some people have described agriculture and the environment as a battleground right now. Would you agree?**

A If you look at things that way, you could say there are battlegrounds all over—in the cities as more "people pressure" results in more sewage dumped into the Mississippi River or Lake Michigan, or whatever.

I don't like to consider agriculture and the environment a battleground. I think that's a hype. There's a need to work with the environment more carefully as we use our renewable soil and water resources more intensely, again to accommodate more people pressure. The soil is a living entity, constantly changing. If you don't believe that, just work with it for awhile. Also, we need to keep in focus that over many years America's soil, water, and plant resources have contributed to our gross national product in a major way. Our timber resources, for example, have supplied jobs and millions of homes for Americans. Yet our timber resources today are generally of high quantity and quality and are better managed than 100 years ago. Certainly we need to work *with* each other. And I think we at USDA have good working relationships with EPA and are making a lot of progress together.

Q **This is a deliberately broad question: Are farmers over-regulated?**

A The farmer generally thinks he's overregulated. Having been a farmer for 30 years, I don't like anybody telling me what to do. But sitting in my present position, I can see that we, as a society, probably do need some regulations. . . just as we need penalties for speeding.

There is a punitive aspect to Conservation Compliance. If you fail to have a conservation plan, you lose access to farm benefits. On the other hand, the Conservation Reserve program works through incentives. In general, we're trying to use incentives more than punitive regulations.

Like beauty, "over-regulated" is in the eye of the beholder. While the farmer is likely to tell you he is overregulated, a lot of people who are sensitive to the environment would say we're not tough enough on farmers.

Q **Would you say that environmental regulation has a disproportionately bigger impact on small farmers than on larger agribusinesses?**

A Here again, the impacts felt by farmers depend on their methods of operation. For example, if you're a small farmer, and you use total mulch and manure and you monitor your run-off, you probably will not be hit hard by regulatory requirements. On the other hand, if you run a large farming operation and you depend entirely on herbicides for weed control, you might have some adjustment problems.

Q **Has environmental regulation actually impeded the production of food and fiber in this country? In any other country?**

Conservation Provisions of the 1985 Farm Bill

Several provisions of the Food Security Act—the 1985 farm bill—make the goals of USDA farm and conservation programs mutually more consistent. These new provisions are designed to encourage the reduction of soil erosion and the preservation of wetlands, and reduce production of surplus commodities.

Conservation Reserve: The Conservation Reserve offers farm producers help in retiring highly erodible cropland. The Agricultural Stabilization and Conservation Service (ASCS) will share up to half the cost of establishing permanent grasses, legumes, trees, windbreaks, or wildlife plantings on highly erodible cropland. Under 10-year contracts, ASCS will make annual rental payments to farmers as long as the terms and conditions of the contract are met.

Conservation Compliance: Conservation Compliance applies where farmers continue planting annually tilled crops on highly erodible fields. To remain eligible for certain USDA program benefits, farmers must develop and be actively applying a locally approved conservation plan for those highly erodible fields by January 1, 1990. Farmers must have the plan fully implemented by January 1, 1995.

Sodbuster: Sodbuster applies where farmers plant annually tilled crops on a highly erodible field that was not used for crop production during the period 1981-85. If farmers plow out such a highly erodible field, they must do so under a conservation system approved by the local conservation district in order to remain eligible for USDA program benefits.

Swampbuster: Swampbuster applies if farmers convert naturally occurring wetlands to cropland after December 23, 1985 (the date the farm bill was signed). With some exceptions, to remain eligible for certain USDA farm programs, farmers must discontinue production of annually tilled crops on newly converted wetlands.

USDA Programs Affected

- Price and income supports
- Crop insurance
- Farmers Home Administration loans
- Commodity Credit Corporation storage payments
- Farm storage facility loans
- Conservation Reserve Program annual payments
- Other programs under which USDA makes commodity-related payments.

A I can't speak for other countries, and I don't see it slowing us down right now in this country. But it could happen—if we lose some key herbicides, for instance, or if we get overly paranoid about fertilizer. Before we totally eliminate some of the practices now being used, we need to have alternatives available.

There are exceptions—for instance, if a pesticide, like DDT, is obviously damaging to the environment, then its use should stop. There's no doubt about that. But there should be reasonable proof—not just suspicion, but scientific evidence for removing a product from the market. And farmers should be educated not to use it if they have some of the product left.

Q **As a farmer, did you worry about using agricultural chemicals—your own exposure to them, their potential to contaminate ground and surface water? Are most farmers worried today?**

A My wife and I have been testing the wells on our farm for years, having water samples analyzed for herbicides, etc. In our case, we've found no contamination. But there are many variables from farm to farm—in the use of farm chemicals, management techniques, soil types, weather, etc.

Most farmers today are worried about farm chemicals. They are very aware of the issues because there's been good coverage by the press and by various agencies on problems with certain herbicides, for example, or too much manure getting into water supplies. With many farmers, the first perception is: this is somebody else's problem. But now farmers are beginning to look at their own operations, as I did. And farmers are becoming better and better managers as they become more knowledgeable. Farmers will resolve these kinds of problems on a voluntary basis if properly advised based on the facts.

Q **More and more states are reporting ground-water contamination as a result of normal agricultural uses of pesticides and fertilizers. In your view, what should be the federal role in ground-water protection?**

A Number one, we should play a strong educational and technology role at the federal level. We need to know what we're talking about, so research is the beginning. Also, coordination is important since myriad agencies are involved. At USDA we have put together a very strong group—with representatives of eight or nine agencies—to look at ground water, ranging from researchers to the people who will be responsible for imparting knowledge to farm producers in the field.

Regulation to protect ground water should be implemented more at the state level rather than the federal level. There's no way I can sit here in a Washington, DC, office and decide what should be done in a certain area in California; the state would have a much better feel for that. However, I do think it is up to federal policy-makers to decide on an overall general strategy to be implemented at the state level, perhaps through a series of incentives . . . .

Q **As anyone who reads the newspapers knows, many farmers have serious economic difficulties right now. Realistically, given this kind of economic pressure, aren't environmental concerns likely to be low on farmers' list of priorities?**

A No. On the contrary, I think that farmers are having to become better managers from a business standpoint. At the same time, I see them becoming better managers from a conservation and environmental standpoint. They are going to be looking very closely at *all* their inputs to crop production, including farm chemical inputs, using just about everything in a more exacting manner. So as farmers become more efficient economically, I think they will become more efficient environmentally. I see this happening now. □

The Perspective of the Chairman of the Senate Agriculture Committee

by Senator Patrick Leahy

The 1985 Food Security Act began a new era in American agricultural policy—an era of treating our agricultural programs as assets rather than liabilities in environmental protection. The Conservation Title requires farmers, for the first time ever, to meet an environmental standard in order to be eligible for farm program benefits. It was an ambitious and unprecedented departure from past policy.

In examining the success of the Conservation Title to date, it is helpful to distinguish between the two approaches in the conservation legislation. One program provides a carrot, namely the Conservation Reserve Program (CRP); the other wields the stick, which includes the Sodbuster, Swampbuster, and Conservation Compliance provisions.

As one might expect, the carrot has produced more immediate and tangible results. The voluntary CRP program created an economic incentive for farmers to take highly erodible land out of production. In doing so, the CRP not only ensured immediate progress toward reducing soil erosion, but also provided farmers an opportunity to delay meeting potentially costly Conservation Compliance requirements on their highly erodible lands.

As of January 1988, the CRP has taken almost 23 million acres of highly erodible cropland out of production (with an additional 4.5 million acres currently bid by farmers and under consideration by USDA). This is more than halfway to the 1990 45-million-acre target for the program. The soil savings from those 23 million acres is an estimated 467 million tons per year, or 16 percent of the total annual soil erosion on the nation's cultivated cropland.

I am not totally satisfied with the way the Department of Agriculture has operated the program. If one looks at the geographic breakdown of accepted bids for the CRP, there has been a clear bias towards the parts of the country from which farmers submit the lowest bids, even though those may not be the acres which are the biggest problem. Clearly, the Department needs to balance budget needs with conservation needs. Sooner or later we are going to have to accept additional land from the Corn Belt into the program.

While the CRP has been an effective tool in reducing soil erosion, its broad political support has come in large part from its equally impressive impact on farm income and the budget. The CRP has proven to be more cost-effective as an acreage reduction program than the paid set-asides or diversions used for commodity programs. According to a recent study done by the American Farmland Trust, the CRP, in reducing crop production and causing a corresponding increase in commodity prices, is likely to reduce government outlays for commodity programs by $11.2 billion from 1986 to 1990, while costing $7.9 billion to implement. The result: a net budget savings of $3.3 billion from 1986 to 1990. Again, the Department has been operating the program more with an eye on the budget than on effectively reducing our water quality problems.

The CRP has affected farm income in two ways. First, it ensures farmers a steady cash flow from their enrolled land. Second, it has a cumulative impact on commodity prices. According to the American Farmland Trust, by reducing crop production by 45 million acres, the CRP will increase net farm income by an estimated $700 million from 1986 to 1990.

While the primary mandate of the CRP is soil conservation, it also contains provisions intended to encourage reforestation and improve water quality. Though it has come close to its tree enrollment goal, evidence suggests that the CRP has not achieved significant water quality improvements. In a recent analysis of the impact of the CRP on water quality, EPA found that the CRP has reduced sediment loadings by 4.3 percent. The analysis also suggested that achievement of better results has been hampered by the lack of targeting enrollment in counties identified as those where cropland controls would provide significant water quality improvements.

To address this concern, USDA recently revised the CRP eligibility criteria to allow the enrollment of filter strips along wetlands and other bodies of water. Since the first filter strip enrollment began with the February 1988 sign-up and the results are not yet known, it is too early to judge the popularity or effect of this action.

In looking at the progress and potential of the other regulatory provisions of the Conservation Title, one has to understand the magnitude of their impact on the agricultural community. By 1990, in order to comply with Sodbuster, Swampbuster, or Conservation Compliance requirements, 1.2 million farms will need to have a Soil Conservation Service (SCS) determination made on whether the farm has wetlands or highly erodible land. In addition, 800,000 farmers will need to meet with SCS personnel to develop a conservation plan for their highly erodible land. All told, some 169 million acres (43 percent of the nation's farmland) will be affected.

The impact of these provisions is not yet clearly visible, in part because of the sheer volume of work that needs to be done before implementation can occur. In making the necessary determinations and developing the conservation plans, USDA has faced an enormous workload, a tremendous educational campaign, and the need for expertise in wetlands identification, an area with which it is not altogether familiar.

In the longer term, the impact of these provisions will ultimately rest on the ability of USDA field personnel and the local conservation districts to adapt to a very new role. Prior to the 1985 Food Security Act, soil conservation programs were voluntary. The mandatory nature of Sodbuster, Swampbuster, and Conservation Compliance has changed the role of SCS field personnel and local conservation district members, many of them farmers themselves. In the past they largely gave advice and provided incentives. They now must measure the compliance of a farmer's activities with broader public goals in mind. It is a role that may not yet have taken hold.

As we approach the 1990 farm bill, the agricultural community is faced with three major issues.

First, will the precedent established in the 1985 farm bill, that farm programs must support, and not

North Dakota wetlands. Such areas are important to local wildlife and migratory birds and also help protect water quality by filtering out pollutants. Swampbuster provisions of the 1985 Food Security Act are designed to protect wetlands from agricultural conversion. North Dakota Game and Fish Department photo.

undermine broad environmental goals, continue to be a basic principle of the 1990 farm bill? I think the answer must be "yes" because a sound resource conservation policy is in the long-term interests of both our nation and our farm community, and because farm programs will not be able to retain broad public support, in Congress or in the nation as a whole, if they are perceived as anti-environmental.

The second major issue Congress will face is whether the conservation provisions in the 1985 farm bill will be translated from legal precepts into farming practices. Since only two producers thus far have actually lost farm program benefits because of violations of Sodbuster or Swampbuster, there has been little impetus to dismantle them. However, maintaining the political will to insist on the 1990 compliance deadlines, particularly during a farm bill debate, may be very difficult. The outcome will depend in large part on the Department's commitment over the next year and a half to the development of the compliance plans and education of the farm community.

The third issue in the 1990 farm bill is whether we will move beyond the programs and principles established in the Conservation Title provisions of the 1985 farm bill. It is clear that agriculture's contribution to environmental problems has continued to grow. Ground-water contamination is perhaps the most compelling problem. Continued nonpoint source pollution, excess soil salinity, and wetland conversion for agriculture are a few of the others.

The design of the Conservation Title had essentially one purpose: soil conservation. While keeping that goal intact, the challenge of the next farm bill will be to broaden that goal to address other critical problems, particularly ground-water and surface-water quality.

One of the best opportunities for doing so may be in expanding the goals and the scope of the CRP. Several legislative suggestions for doing so have already been introduced, most of them focusing on targeting CRP enrollment on environmentally sensitive rather than highly erodible lands. Increased state participation in CRP cost-sharing has also been suggested, particularly as a tool for states to use in fulfillment of nonpoint source programs.

The Conservation Title demonstrated that addressing pervasive environmental problems through agricultural policy is possible. Environmental protection makes sense not only to the American taxpayer, but to the American farmer as well. In developing our agricultural policy in 1990, the challenge will be to expand on the integration of environmental goals into our agricultural programs in a way that continues the environmental and economic successes of the 1985 Food Security Act. □

(Senator Leahy (D, VT) is Chairman of the U.S. Senate Committee on Agriculture, Nutrition, and Forestry.)

The Viewpoint of the President of The Conservation Foundation

by William K. Reilly

This spring, for the first time in five or more years, one could sense a cautious optimism in American agriculture. Prices for such key crops as wheat and soybeans have strengthened, thanks to tightening global supplies. Crop exports are on the rise. Land values show signs of stability, even increase, in areas that suffered calamitous deflation in the first half of the decade. Even my father, retired owner of a grain farm in Piatt County, Illinois, who has not had an optimistic word to say about farm prospects in this decade, recently allowed as how land prices had finally bottomed out.

Granted, the farm sector remains heavily dependent on government assistance, to a degree that would have seemed unthinkable just a few years ago. Yet subsidy costs did decline from over $25 billion in 1986 to an estimated $18-$22 billion for 1987. It seems that the worst of the economic ordeal of the 1980s might at last have passed; the most recent of U.S. agriculture's long, hard winters might be coming to an end.

It is far too early to tell if recovery is indeed in the wind for American farmers. At this point, we can say for certain that the human costs of the 1980s farm depression have been staggering. For the first time in more than a century, the nation's farm population fell below 5 million in 1987—to 2 percent of the population—a decline of 240,000 from the year before. The misery that many of those 5 million experienced was documented by almost daily news stories of suicides, breakdowns, and the disintegration of families.

The farmers and farm families who remain have been reminded most painfully that, with the exception of a few years in the mid-1970s, American agriculture has a persistent, sometimes disastrous problem of excess capacity. The problem varies in severity from commodity to commodity, and from year to year. But excess capacity—too many resources producing too many goods for existing markets—is a fact of life for U.S. farm policy-makers. And it must be a central consideration for anyone interested in the integration of agricultural and environmental policies over the next decade.

Mountainous, costly stocks of grain and other commodities symbolize not just economic problems in the farm sector, but environmental problems as well. According to Conservation Foundation estimates, for example, at average yields and chemical application rates, it probably required 7 billion pounds of fertilizer and more than 110 million pounds of pesticides to grow the surplus portion of the country's 1986 ending stocks of wheat and corn. This represents about 28 percent of the fertilizer and 40 percent of the pesticides used on corn and wheat that year.

Clearly the environment, the farm sector, and the taxpaying public would benefit from policies that simultaneously address the economic and environmental consequences of excess capacity in U.S. agriculture.

The first steps in that direction were the soil and wetlands conservation provisions contained in the 1985 Food Security Act, the most recent omnibus farm bill. These new policies were designed to harness the Keynesian fluctuations of farm subsidy programs to enhance conservation, instead of undermining it as in the past. Under the 1985 farm bill, farmers' eligibility for farm programs is linked to certain soil and wetlands conservation requirements. Both the strengths and the limitations of the Conservation Reserve Program (CRP) and the Sodbuster, Swampbuster, and Conservation Compliance programs derive from the very nature of this linkage.

The most logical and promising next steps for integrating agricultural and environmental policies begin where USDA's subsidy programs end. These programs are intended to counterbalance the ups and downs in the farm economy. For this reason, the program payments, farmer participation rates, the amount of land idled under the programs, and overall program costs tend to increase in hard times, like those experienced since 1982. Whenever the farm sector enters a recovery phase, supplies begin to come into closer balance with demand, and prices begin to strengthen; there is simply less need for USDA commodity programs, and their scale and influence are reduced.

As these programs become less important during an economic upswing, the disincentives to resource abuse embodied by Sodbuster, Conservation Compliance, and Swampbuster are likewise diminished. Also diminished are the incentives for farm policy-makers to idle land, either through annual programs or through such long-term programs as the CRP. With a very robust recovery, and certainly with a "boom" like the one that temporarily eliminated excess capacity in U.S. agriculture in the mid-1970s, the conservation provisions of the 1985 farm bill would no longer have much impact at all.

I know of no conservationist who wants to see prolonged economic hardship in agriculture; neither do I know of one who does not view potential recovery with some trepidation. For it is not impossible to imagine that a surge in export demand, crop prices, and farm income could undo much of the progress in conservation that has been achieved under the Title XII provisions of the 1985 farm bill.

One solution to this dilemma would be to link conservation policy to the large and relatively constant financial

This Nebraska feed lot illustrates the link between agricultural production and environmental issues such as water quality. USDA Soil Conservation Service.

mechanisms in U.S. agriculture: namely, the flow of loans for farm acquisition and operation. These loans are issued by Farm Credit System (FCS) institutions, banks, and insurance companies. These lenders currently place no conservation restrictions on their loans. The only lending agency that does so is the federal Farmers Home Administration (FmHA), which is required by the 1985 farm bill to ensure that its loans do not contribute to sodbusting or swampbusting.

Congress rejected a proposal to place similar requirements on other lenders last year. It enacted a major "bail out" of the financially crippled FCS and provided federal guarantees for a new secondary market for farm real estate loans—potentially a very lucrative

I know of no conservationist who wants to see prolonged economic hardship in agriculture; neither do I know of one who does not view potential recovery with some trepidation.

mechanism for private farm lending institutions, including banks and insurance companies. Conservationists suggested that some protection against a repeat of the mid-1970s experience, when farm lenders financed widespread conversion of highly erodible lands and wetlands, would be a reasonable *quid pro quo* for the substantial assistance Congress intended to provide FCS and other institutions. Uppermost in the minds of conservationists was the question: Will farm lenders assisted by Congress in 1987 make loans in 1997 to help farmers bring land back into full production which has been idled in the CRP, with no conservation practices whatsoever? In a bull grain market, that could be a very real concern.

Yet Congress did not oblige the conservationists, despite the persuasive arguments of Senator Wyche Fowler (D-GA), who chairs the Senate Agriculture Committee's Conservation subcommittee. Alternatively, the farm financial community could develop effective voluntary guidelines to achieve the ends of Swampbuster and Sodbuster. Failing that, however, it is fair to assume that conservationists will press for a reconsideration of conservation and credit linkages during the development of the next farm bill in 1990.

Another idea certain to receive attention over the next year is the adaptation of the CRP to deal with nonpoint source water pollution, both of surface water and ground water. Senators Robert Dole (R-KS) and Sam Nunn (D-GA) each have introduced legislation authorizing a higher enrollment ceiling for the CRP, and their proposals would also expand the criteria for the CRP to include water quality considerations as well as soil erodibility.

USDA already has utilized its authority under the 1985 Food Security Act to enroll in the CRP land that contributes to nonpoint source surface-water pollution. The Department is now accepting CRP bids for planting "filter strip" areas along water bodies, even though the land may not have high rates of erosion, since those areas contribute disproportionately to sediment and nutrient loading of lakes and streams. Keeping them in natural cover should also reduce the amount of sediment and contaminants that flows through them from upland sources of erosion.

The Dole and Nunn proposals signal a very encouraging interest on the part of policy-makers to explore long-term linkages between environmental and agricultural policies. As this exploration continues en route to the 1990 farm bill, several broad questions must be answered. First, how can we develop good, defensible criteria for targeting this modified CRP to our most serious ground-water and surface-water quality problems? Even the soil erosion criteria used for the existing CRP are far from perfect; identifying lands contributing most seriously to ground-water and surface-water phenomena is much more difficult. In any case, it is probably not advisable to extend the CRP to deal with water quality problems without also extending and adapting the Sodbuster and Conservation Compliance concepts to those same problems. For it is the ensemble effect of these policies that makes them so significant.

But even if these technical problems can be solved, idling relatively small areas of land in the CRP is unlikely to solve our ground-water and surface-water problems. Broader, more extensive and subtle changes in the management of agricultural chemicals will still be necessary in many areas. It is important that we integrate the implementation of these programs with the nonpoint source control programs that states are developing in response to the 1987 Water Quality Control Act, and with the ground-water protection programs that many states have begun to adopt. In fact, one of the key recommendations of the National Ground-Water Policy Forum, sponsored by The Conservation Foundation in association with the National Governors' Association, was that, to be effective, ground-water protection programs need to be integrated with other natural resource management programs. The agricultural programs I have been discussing here provide perhaps the pre-eminent example of this type of coordination.

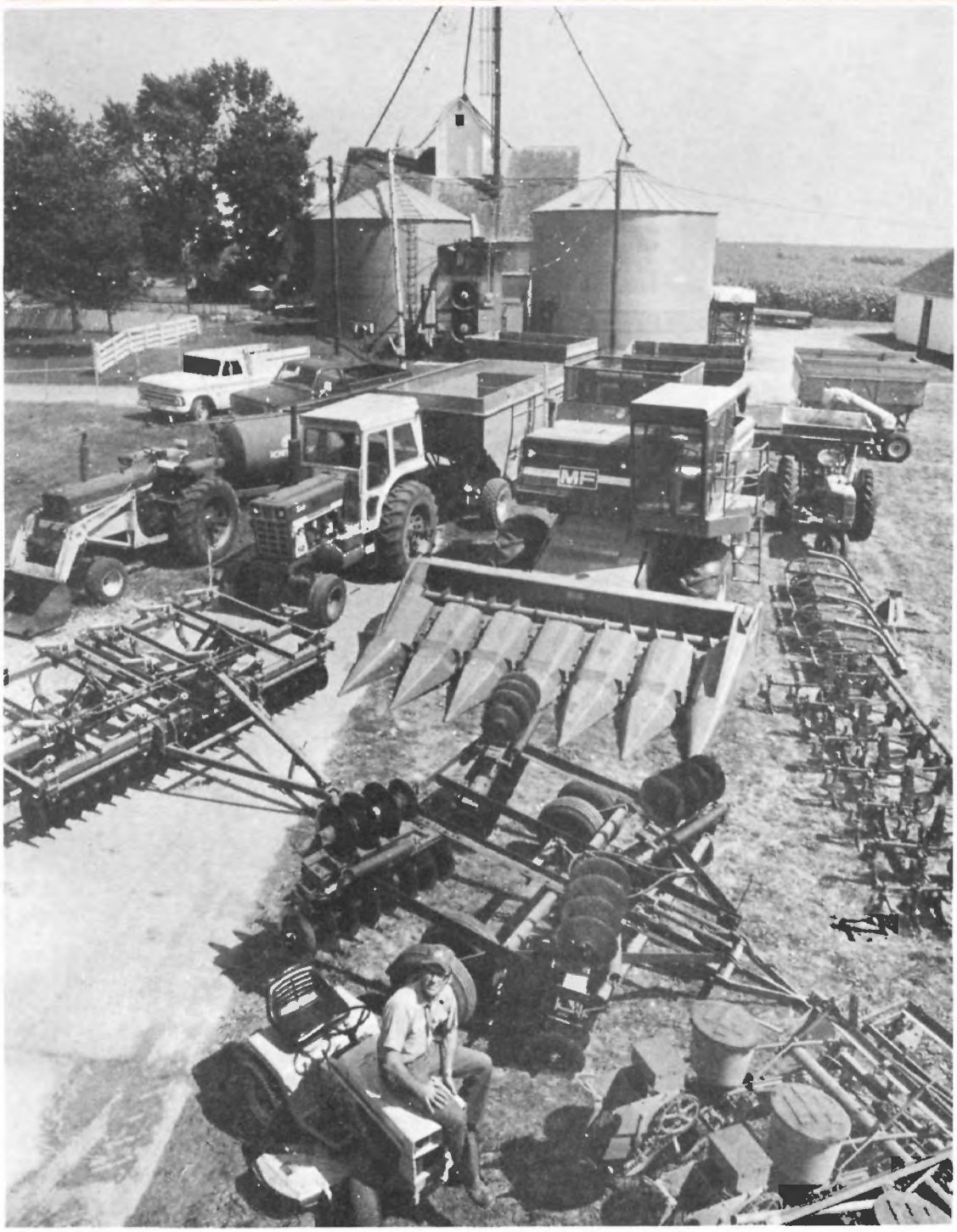
I have roughly outlined the principal directions that further integration of agricultural and environmental policies will take over the next decade. By far the most important influence on future integration will be the success of Title XII in the field, and how well it is integrated with other environmental protection efforts. If Title XII is fairly implemented and achieves its goals of soil and wetlands conservation, additional reforms will be more likely to pass the test in Congress.

Environmentalists do need to bear in mind that there are limits, both practical and political, on the degree to which agricultural programs can be altered to serve environmental goals. It is equally important that the agricultural community recognize the role environmental reforms can play in dealing with the persisting problem of excess capacity. Farmers, agribusiness, the environment, and the taxpayer—none have been well served by the extreme changes U.S. agriculture has undergone in the past decade. □

(Reilly is President of The Conservation Foundation and World Wildlife Fund.)

Farmers Speak

Most farmers have substantial capital tied up in their cropland and machinery and hope to make a good return on their investment. All of this equipment was used on one Iowa farm that produced corn and hogs in the 1970s. USDA photo.



How do environmental regulations affect farmers, and how do farmers feel about these rules? EPA Journal asked some farmers who grow different crops in different parts of the country to comment. Here are their answers:

Mike Ellis
Eminence, Kentucky

Tobacco, corn, soybeans, and wheat. 2,500 acres.

"Environmental regulation has significant effects, but I can't say it has cost tremendous amounts of money. For one thing, EPA is requiring pesticide applicators to have training to apply restricted-use pesticides. And under the federal right-to-know law, we will have to report on chemicals we are using as well as reporting any spills. That will take time and effort.

Three years ago, we weren't able to use sludge offered from the city of Louisville as fertilizer because the county zoning board said we couldn't apply it. It would have been a big economic boost to get it, and I believe there are ways it could have been used safely.

Still, I'm not opposed to it all. Environmental problems affect me and my neighbors and everybody else."

Bernell Harlan
Woodland, California

Tomatoes. 1,600 acres.

"We are under very strict regulations from EPA, and

Like any other form of agriculture, catfish farming is affected by environmental regulations. These men are pulling in a catfish harvest in Perdido, Alabama. Roy E. Lee photo, USDA Soil Conservation Service.

the State of California also has its rules. It's very difficult to operate under all of these stringent regulations, many of which seem duplicative.

The rules are becoming so strict that companies don't want to register chemicals in California. We have only one pesticide left to control nematodes (which attack plant roots), and the canneries don't like the tomatoes that are resistant to nematodes.

Another thing. Four years ago, everybody was encouraged to bury the diesel fuel tanks on farms for safety. Now we're being asked to raise them above ground.

We might complain a lot, but you have to realize we're under strict regulation. Unfortunately, people see us as 'farmers,' not as people with an operation that has to make a profit."

Larry Lynch
Gilmore City, Iowa.

Corn and soybeans. 600 acres.

"We've found that the chemicals we use could affect our own drinking water. That's because we have to use wells to drain the fields. Otherwise, we would have to let the land revert to prairie. My drainage well goes down to 80 feet; my drinking water well is at 100 feet.

We're caught between an economic and environmental issue here. Drink contaminated water, and you could be hurt; lose the farm, and you will be hurt. We have a problem and we're doing our best to address it. If someone has a solution, I sure would appreciate it."

Varel Bailey
Anita, Iowa

Corn, soybeans, and other farming activities. 1,200 acres.

"No question but what environmental regulation affects my operation in many different ways.

A few years ago, the attitude was that any product that made it through the government regulations was okay to use. Now the farmer tries to consider the side effects—the health effects, the potential effects of residues.

Another real problem: Farmers now have to think about how to dispose of empty containers. You may have half a box of pesticide left and almost no way to get rid of it.

Another new fact is that the whole Conservation Compliance, Swampbuster, Sodbuster side of the government has changed things from using the carrot to using the stick. This year, I want to shift part of some fairly steep fields into strip cropping, then shift some adjacent grassland into more intensive cropping. My application for permission has been in for a month now. It's close to the planting season and there has been no indication of a go-ahead.

One other area with its effects is the Conservation Reserve Program. As millions of acres of land go out of production, support industries that are important to the farmer may close down. For example, the grain elevator with a custom spraying business may either raise prices or drop that side of the business.

Another concern is the whole ground-water issue. It's a big black hole with a lot of questions. Farmers drink out of wells on their land. There is a big lack of solid information on how to deal with the problem."

Alvin Heeg
Mt. Horeb, Wisconsin

Dairy farmer, milking 80 cows. 330 tillable acres.

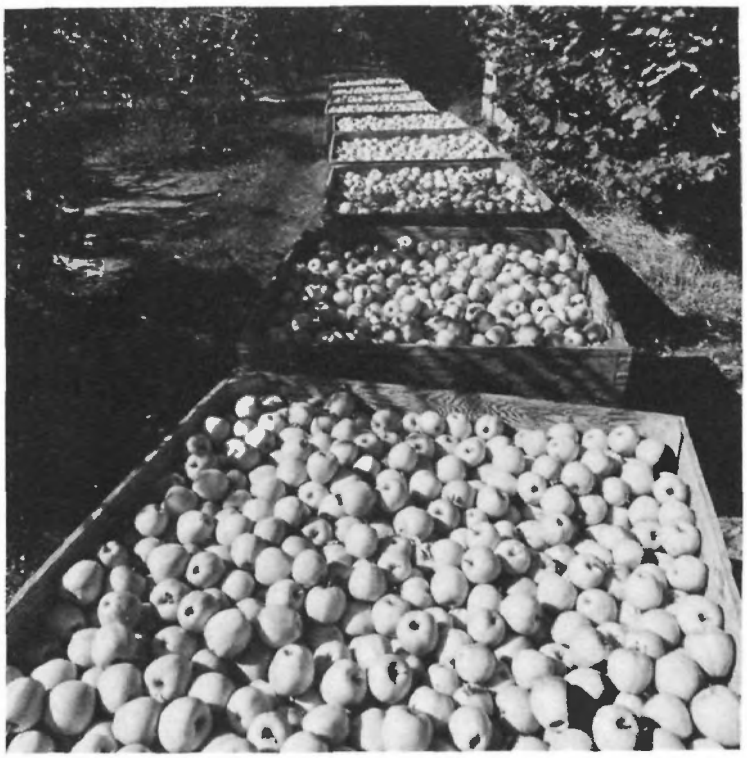
"I do a lot of different things to avoid pollution. I have a filter system that holds back manure, and I do a lot of diverting of water so it doesn't run through the livestock area. I preserve the manure; it is valuable fertilizer.

Most of my farm is in strip crops that I rotate. This slows erosion. I use minimum plowing too, to save top soil. And I don't overuse commercial fertilizer and pesticides. I always stay under whatever the label on the pesticide can reads. Too many farmers overdo it—they go two to three pounds when one would do.

Of course, I couldn't go without using herbicides and insecticides. If you use them in a controlled way though, I don't believe there is anything wrong with it.

I'm hoping that our young people will have the same soil and water we do. I fish and hunt, and I'd like to keep it so my children and grandchildren have some joy in life. I'm proud of what I'm doing."

Crated Golden Delicious apples are readied for shipment from a Yakima Valley, Washington, orchard. Agriculture increasingly resembles other kinds of business in such facets as marketing, business management, and dealing with environmental regulations. Doug Wilson photo, USDA.



Lee Eaton
Lindsay, Montana

Wheat. 4,000 acres.

"The biggest thing affecting our operation is the restrictions on what you can do with certain pesticides. We've had some grasshopper trouble the past few years and can't use the chemicals that were most effective against them. Probably there has been some overreaction in regulation, although maybe there was a reason to put it on because of some misuse. If used in the right way, there wasn't any problem with these pesticides."

Thed Spree
Boligee, Alabama

Catfish farming.

"The environmental regulators have gotten after the catfish processing plants and could possibly shut them down. Nobody knows exactly how to handle the situation. It's a severe challenge to the catfish industry in western Alabama. We're a specialty agriculture. It's hard enough to make a nickel in it as it is.

On the other hand, the trains go by my farm and stir up dust that has turned my ponds yellow. Nobody has done anything about that, even though I have complained."

Dick Ballantyne
Lamoni, Iowa

Corn and soybeans. 200 acres.

"The liability laws are changing. That's what could affect me the most. They're trying to change the law, so it doesn't matter whether I follow the regulations or not; if my chemicals caused the pollution, I'm liable. One state already has a law to that effect.

On the brighter side, manufacturers are working vigorously to come up with chemicals that won't be pollutants. And at a recent meeting, we were told about planting rye and beans together—the rye produces a chemical that acts as a herbicide that kills the weeds. I'm going to try that on a 30-foot strip down a field.

The fact is, we've been raising 'sissy' plants with strong weeds. We select corn for its high yield and then apply herbicides so that the only weeds that can survive are the strongest ones. It's survival of the fittest."

Everett Mosher, Jr.
South Dayton, New York

Dairy farmer, with 275 milking cows. 700 to 800 tillable acres.

"Our biggest concern is agricultural chemicals. We're certainly concerned about some that are under review. For example, one that is being investigated as a possible ground-water pollutant is a quite important part of our chemical application program.

Requirements for notification before spraying will cause us some problems. We will end up using stronger chemicals that are less sensitive to weather. It may protect people in some ways but damage the environment in others.

There needs to be more coordination of state and federal agencies trying to police the same thing, with uniform standards at the national level. When a state is stricter, it drives up the cost for companies to comply with the tougher regulations.

Sometimes it looks like there is an adversarial relationship between farmers and EPA. But that's not really the way it is. Farmers in general understand and want to portray an image of care in the use of chemicals. There is ignorance on the part of some users, but I don't think there is any lack of care for the environment.

I will add that environmental regulation does affect farm income, and I only see it getting to be more so. People get concerned when you tinker with their incomes."

(Continued on next page.)

Cherry tomato plant. USDA photo.

Philip Succop
Sparta, Michigan

Apple grower. 180 acres.

"The registration or reregistration of pesticides affects us very much. Apples are a specialty product. It's hard to get new chemicals registered for them because they are such a small crop. Furthermore, the Delaney clause makes it almost impossible to get anything registered.

A lot of pesticides don't function for us anymore because pest resistance has built up. And the companies have dropped some that did work because it is too expensive to reregister them. We lost one chemical that we had had for 30 years; the sales were down a little, and when the time came for the company to reregister it, they dropped it.

The solution? Maybe it will come when the consumer can justify a lesser quality product at a higher or the same price without the use of pesticides. But they buy with their eyes; if they just had the opportunity to look at some food with no pesticides on it—they won't receive the product that they're used to without the use of certain chemicals.

Some pest-resistant varieties of fruit are being developed. But we can't change over in six months to a year. It takes 10 years to get an apple orchard into production."

Editor's note: The so-called "Delaney clause" is contained in section 409 of the Federal Food, Drug, and Cosmetic Act, which governs tolerances (legal residue limits) for pesticides and other food additives in processed foods. The Delaney clause prohibits the approval of a food additive that has been found to "induce cancer" in humans or animals. In light of a study completed in 1987 by the National Academy of Sciences, EPA favors a negligible-risk approach to implementing the Delaney clause, rather than a literal (zero-risk) interpretation.

J. A. Driver
Yuba County, California

Mostly rice. 4,100 acres.

"It affects us. There are standards on drainage from the rice fields that goes into the water and downstream. One part per billion is too stringent, but that's what they're regulating us by now in California. We can't use some of the old faithful chemicals any more.

I think it's fair, although sometimes it's going a little bit to the extreme. If they said no chemicals, it would present big problems down the road."

Don Blomgren
Ames, Iowa

Corn and soybeans. 2,000 acres.

"We have to be licensed to purchase and apply restricted-use chemicals. It isn't too costly. Most farmers want to protect the environment too.

I do feel we have to use chemicals. I don't want to go back to the way we did things 30 and 40 years ago. We have a few million dollars tied up in land and machinery, and we expect to make a decent living.

We do try to use chemicals in moderation. We're using half as much through ridge tillage, which doesn't disturb the soil as much. We use different herbicides than we used to—herbicides that don't need to be incorporated into the soil.

Of course, it's been hard in farming the last few years, costly for a lot of farmers. And it's tough to make the switch to something like ridge tillage; kind of expensive."

Fred Wise
Delphi, Indiana

A hog farmer, marketing 25,000 animals a year. 2,500 acres.

"I've never had a problem; nobody has been on our back. We try to handle everything right. A few years ago, I didn't cut our manure into the soil. Now we do; it cuts down on the odor and it means we're not just dumping it off the edge of the road. We cover 1,500 acres with our hog manure. There are no problems that I am aware of with ground-water contamination; we've been using the same wells for years."

Steve Yoder
Blountstown, Florida

Row crops and a dairy and beef herd. 2,000 acres.

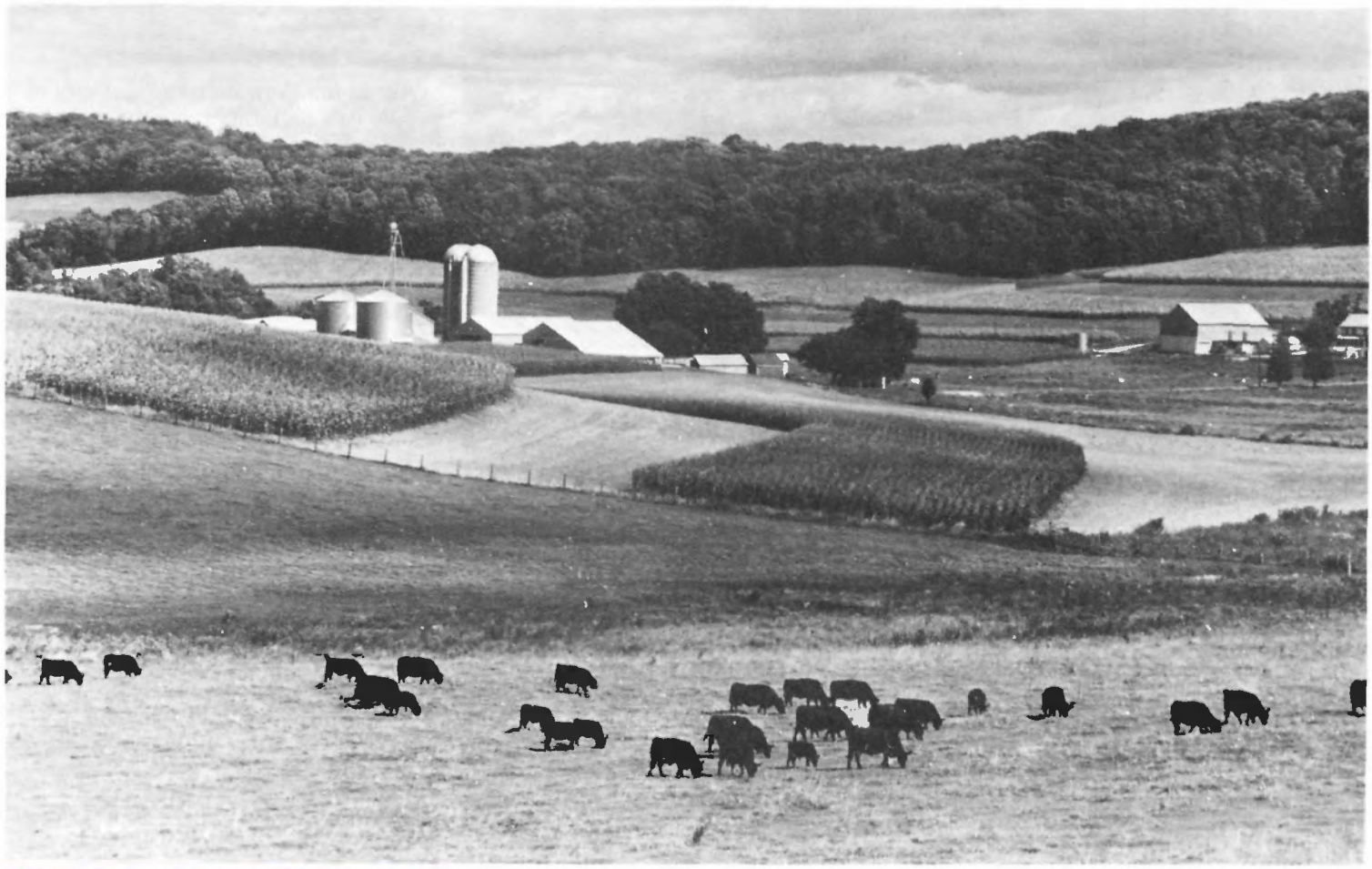
"Because of restrictions in the works to protect endangered species from chemicals, we're going to have a real problem. I have a 100-acre field where chemicals would be restricted because they would endanger the Indigo snake. If the land were developed for homes, I believe the homeowners would be able to use the same chemicals without any restrictions. It doesn't seem fair. Also, the regulators need to be careful in setting the boundaries around land for restricted spraying to make sure they don't take in any more land than necessary.

Another problem with the chemicals is that sometimes fears become reality. Even if EPA clears a chemical for use after studying it, if the fact that they were studying it is known to the public, the public may demand that the farmer quit using it.

As a general rule, I think the farmers in our part of the state will try to work with EPA if we feel we're being heard out. We feel, I should add, that we're being restricted without compensation. But our biggest gripe is that the farmers are being policed while the homeowners are not. We feel that we're being blamed for things that are not our problem. If we could see that some others are carrying some of this burden . . . ." □

Modern Farming: Myths and Realities

by Steve Lovejoy and Will Erwin



A farm in Carroll County, Maryland. Tim McCabe photo. USDA Soil Conservation Service.

The changes in American agriculture during the 20th century have been dramatic. More than one-half of all Americans lived on farms in 1862, 30 percent in 1920, and about 20 percent in 1940. However, in the 1980s less than 4 percent of Americans live on farms, and less than 2 percent of the workforce is engaged in farming.

These trends resulted largely from increasing agricultural productivity. Today we spend only 15 percent of our disposable income on food, while much of the world spends 40-50 percent or more. While farming and farm life are important components of our cultural heritage, few of us have any first-hand knowledge of modern agriculture. Many who were raised on farms in the late 1940s and early 1950s would barely recognize modern farming equipment and techniques. They—and we—are blinded by a number of myths and misconceptions that need to be dispelled.

Myth: A couple of generations ago, most Americans were farmers.

Fact: Even in the late 1800s, less than 50 percent of the total population lived on farms. We have had a largely urban population for over a century.

(Continued on next page)

Myth: Most farmland is owned by big corporations; the family farm is disappearing.

Fact: Of the 2.2 million farms in this country, less than 3 percent are owned by corporations and they control less than 10 percent of the farmland. There is an increasing number of incorporated farming operations, but these are generally family-owned and family-operated enterprises. In addition, the percentage of farms operated by owners has risen during the past several decades. In 1945, only 67 percent of farms were owner-operated; by 1969, nearly 90 percent of a much smaller number of farms were owner-run.

Myth: Foreigners have grabbed a major chunk of American farmland.

Fact: In 1986, only 12.4 million acres of U.S. farmland were foreign-owned. That is less than 2 percent of all American farmland.

Myth: Most farms are big spreads.

Fact: Nearly 60 percent of all farms operate less than 180 acres. Only 7.4 percent of farms operate 1,000 or more acres. While the size of the average farm has risen from less than 200 acres in 1940 to over 400 acres, the trend seems to be toward a higher percentage of small farmers, a larger number of big farmers, and proportionately fewer mid-sized agricultural operations.

Myth: Farmers enjoy high incomes.

Fact: The Census Bureau reports that nearly 9 percent of non-farm families earn $60,000 or more, while only 3.6 percent of farm families earn that much. Whereas over 30 percent of non-farm families earn more than $35,000, only 21 percent of farm families earn as much.

Myth: Farm families are more self-sufficient than the rest of us.

Fact: Years ago, farm families were more self-sufficient because they grew and canned their own vegetables, fruits, and meats, but modern farmers exhibit consumption patterns similar to their urban counterparts. The U.S. Department of Agriculture estimates that in 1983 some 60 percent of farm family income was earned off the farm. Many farming operations specialize in one or two crops and do not raise or process any more of their own food than urban households.

Myth: Farming is a safe, healthy, outdoor occupation.

Fact: While the activities occur outdoors, farming is the second most dangerous occupation (mining is first), with an annual accidental death rate of 49 per 100,000 workers and an annual injury rate of 5,312 per 100,000 workers. Farming can be very hazardous.

Myth: Farmers suffer less stress than others.

Fact: The National Institute of Mental Health rates farming as one of the most stressful occupations because of tremendous uncertainty about weather, yields, prices, etc., as well as a perception that the consequences of sub-optimal decisions might mean financial disaster and the destruction of the family business and way of life.

Myth: Farming in the United States is still a very labor-intensive occupation.

Fact: The agricultural sector uses more mechanical hoursepower per worker than the manufacturing sector. The drop in labor needed to produce food, feed, and fiber commodities is suggested by the declining number of farmers as well as even greater cuts in the amount of labor needed to produce a given crop volume. In 1880, some 1.8 manhours were needed to produce one bushel of corn; by the late 1970s, only 0.1 manhour was required.

Myth: In the Corn Belt, the majority of people live on farms and earn their living by farming.

Fact: In the entire country, only six million people live on farms. Though the Corn Belt has the highest percentage of farmers, less than 10 percent of total employment is on the farm. Even most Iowans live in urban communities.

Myth: The government protects all farmers from failure.

Fact: In FY 1987, some 5,700 farm families filed for bankruptcy.

Myth: Federal law limits the liability of farmers regarding their use of chemicals, so long as they use chemical products according to their label directions.

Fact: False. Present environmental laws do not preclude farmers from liability for damages due to chemical contamination even if such damage results from application in accordance with labeling directions. One point being debated concerning proposed amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is whether farmers should be exempted from such liability except in cases of pesticide misuse.

Myth: Farmers are virtually guaranteed a profit by federal price supports.

Fact: In 1983, farmers, on average, had negative farm income. In other words, their families' off-farm income subsidized their farming operations, or they were using their savings to continue their farming operations. □

(Lovejoy is an Associate Professor, Department of Agricultural Economics, Purdue University, presently on leave to the EPA Office of Policy Analysis. Erwin, an Indiana farmer, is a Special Consultant to the EPA Administrator.)

Agriculture and Ground-Water Pollution in Iowa

by Michael Duffy and S.R. Johnson

Iowa is a prominent agricultural state. The nation's agriculture depends on Iowa, and Iowa depends on its agriculture, which is dominated by four commodities: corn, soybeans, cattle, and hogs. These commodities provide over 90 percent of the state's agricultural income, and last year Iowa led the nation in production of corn, soybeans, and hogs, and was fourth in beef production.

The state's economy depends directly and indirectly on agriculture. In 1985, for example, over 20 percent of the state's personal income came from agriculture or related industries. And this was in a year of farm financial crisis.

This high level of agricultural production and modern production technology is accompanied by high levels of agricultural chemical usage. In 1985, Iowa farmers treated over 95 percent of their corn and soybean acreage with herbicides. The 1985 Iowa Pesticide Use Survey showed that Iowa farmers applied over 58 million pounds of active herbicide ingredients to corn and soybeans. They also applied over 6 million pounds of active insecticide ingredients, and used over 950,000 tons of nitrogen fertilizer, primarily on corn crops.

This heavy use of agricultural chemicals by Iowa farmers has raised concerns over possible ground- and surface-water contamination. Questions are being asked about what happens to these chemicals after they are applied to crops. Do they cause human health problems? What can be done to prevent contamination?

A state Department of Natural Resources study in the spring of 1986

Iowa led the nation in corn production in 1987. The state's high production rate is achieved with the use of millions of pounds of agricultural chemicals. Gene Alexander photo. USDA Soil Conservation Service.

found detectable levels of pesticide compounds in 30 of 33 public water supplies tested that used surface water. These tests were done after a rainfall and reflected water affected by run-off from the fields. (It is interesting to note that only one of the 10 pesticide compounds found has a standard in the federal Safe Drinking Water Act.)

This and other water quality studies raised at least three fundamental questions:

- How did the pesticides enter the water? Was it because of the high volume of use, or was it from misuse, over-application, improper disposal, direct contamination of wells, or all of the above?
- Does exposure to chemicals at parts per billion or parts per trillion levels pose a threat to human health?
- A third question involves length of exposure. The Iowa studies were conducted after a rainfall. What are the short-term and long-term exposure levels? Given the nature of agricultural chemical use in Iowa, the spring and summer months would see the heaviest chemical use and higher possible contamination. Are health risks increased or decreased by higher exposure for a shorter time?

Although these fundamental questions may never be completely, satisfactorily answered, political pressure moved the Iowa Legislature. In 1986, the first version of a ground-water bill was introduced, debated, and defeated, but in 1987 the Ground-Water Protection Act was modified, reintroduced, and passed.

This legislation has been labeled both "landmark environmental regulation" and the "destroy the family farm and agribusiness act." Neither description is accurate. The bill is a balanced approach, relying more on education and demonstration than on regulation.

Years of study preceded passage of the Ground-Water Protection Findings from these studies are reported in Section 103. Some of the principal findings note the variability and uncertainty of the health effects, but go on to state that there are health concerns; another says any detectable quantity of a synthetic organic compound in ground water is unnatural and undesirable; and another notes that preventing ground-water contamination is of paramount importance.

The goal of ground-water protection, as summarized in Section 104, is "to prevent contamination of ground water from point and nonpoint sources to the maximum extent practical, and if necessary to restore the ground water to a potable state." The goal of this Act is not to create a pristine environment, but to create an environment compatible with good health.

One of the Act's main features is the establishment of the Ground-Water Protection Fund. The Fund's Solid Waste Account receives money from a sharp increase in dumping fees. (The previous fee of $.25/ton increased to $1.50/ton in FY 1988 and is scheduled to increase $.50/ton per year, up to $3.50/ton.) This account will then disburse funds to a variety of projects such as monitoring guidelines and programs, assistance to small businesses in solid and hazardous waste handling, and demonstrations for alternatives to landfills, including recycling.

The Agricultural Management Account receives funds from registration and license fees. These include a pesticide dealer fee based on a percentage of gross annual sales, a pesticide product registration fee on manufacturers ranging from $250 to $3,000 per year depending on use rates, and a nitrogen fertilizer tax. These funds will be used to establish a sustainable agriculture research center to test rural water and private wells, to demonstrate alternatives to agricultural drainage wells and sinkholes, and to develop health effects data bases.

Iowa raised more than 21 million hogs last year—roughly 25 percent of U.S. hog production in 1987. This farrowing house shows how piglets are typically raised on a modern farm. Fred S. Witte photo. USDA.

The Household Hazardous Waste Account is funded by an annual permit fee based on gross sales of retailers who sell hazardous materials. These funds will be used to provide grants for reclamation and recycling projects and pilot study projects for oil collection, and to sponsor a toxic clean-up day and education programs.

The Storage Tank Management Account receives the one-time $10 registration fee and the annual $15-per-year fees for tanks over 1,100 gallons. These funds will be used to administer the program, provide insurance, and conduct remedial clean-up efforts.

The Oil Overcharge Account is for funds received due to overcharges on petroleum products and will support a variety of demonstration projects in ag-energy management, waste-to-energy and solid waste management, and energy resource development.

As originally passed and when fully implemented, the Act is expected to raise $9.37 million annually. This is about $3.20 per Iowan per year.

The ground-water legislation also details specific programs and mandates. Among these are developing procedures to certify all commercial, public, and private pesticide applicators. Also mandated are license and inspection fees and special programs for agricultural drainage wells, sinkholes, water wells, abandoned wells, and solid waste management.

The 1987 Iowa Ground-Water Protection Act is sweeping legislation, but does not rely solely on taxes and regulations. Because of its nature, the Act is criticized by a wide variety of groups who focus on its complex nature and ambiguities—and on their own resistance to changing the status quo.

How effective the legislation will be in stemming ground-water contamination can't be predicted. Also unknown is how effective expected efforts to dismantle various sections will be. The Iowa Act does, however, take a broad look at complex questions, and it tries a mix of both "the carrot" and "the stick."

The state's situation, and experience with the Iowa Act, may contain lessons for the future. Although health risks are uncertain for many compounds,

information on the agricultural chemical problem was sufficient to support the broad, sweeping Act, and the trend is for science to show that active organic compounds induce health problems. Society should not gamble with such high stakes.

Nevertheless, the law does not impose specific limits, taxes, or penalties related to use levels or loading because there still is much uncertainty about the ultimate environmental fate of the chemicals involved. It does, however, support research to determine fate in the environment and a more suitable basis for selecting regulation.

The Iowa law was enacted in a state less diverse than most. Perhaps this means that legislation by states will be more locally focused on problems that vary significantly by application level, soil type, climate, and other factors.

Will technology be the eventual answer to the problem it has caused? Sustainable farming, carriers of active compounds that bond with soil and do not leach or run off, and less toxic compounds are among the possible solutions. But these are in the future, and the problem is now. Legislation like Iowa's, balancing risk, what is known about chemical fate, and economic interests is on the rise. Let's hope this enlightened approach continues in state and local regulation of agricultural chemicals. □

(Duffy is an Extension Economist, Department of Economics, Iowa State University. Johnson is a Professor of Economics and Administrator, Center for Agricultural and Rural Development, Iowa State University.)

Editor's note: In requesting this article, EPA Journal did not intend to endorse Iowa's particular approach to ground-water protection from agricultural chemicals. Several states are trying other approaches which may prove just as effective or better.

The Federal Role: EPA's Proposed Ground-Water Strategy

In February 1988, EPA proposed for public review and comment a national strategy aimed at protecting U.S. ground-water resources from contamination by pesticides. The strategy is usually referred to as the "Agricultural Chemicals in Ground-Water Strategy." One of the proposed strategy's major aims is to help coordinate efforts between EPA and the states to minimize further damage by pesticides to ground-water quality.

Evidence of pesticide contamination of ground water has been growing in recent years. In 1986, EPA estimated that 24 states had reported the presence in wells of one or more of 19 different pesticides, as a result of normal agricultural use of these chemicals. EPA is currently assessing new data from the states that will likely show an increase in both the number of states finding contamination and the number of pesticides being detected.

Some states have already taken aggressive action to deal with ground-water contamination problems, the origins of which are highly localized in nature. EPA is strongly in favor of the state initiatives already under way, and expects through its proposed strategy to foster similar efforts elsewhere. The Agency believes that efforts to protect ground water from agricultural pesticides are most likely to be successful if the states take a significant role.

Under the proposed strategy, EPA is providing each state with the opportunity to take the lead role in controlling agricultural pesticides within its borders. EPA will establish the level of ground-water contamination that would be unacceptable and will also evaluate individual state plans in terms of their likely effectiveness in preventing such levels from being reached or exceeded. For ground water that is a current or potential source of drinking water, EPA's reference point for unacceptable contamination will be the Maximum Contaminant Levels established by the Agency under the Safe Drinking Water Act.

Once a state's plan is determined by EPA to be effective, the plan could serve as the basis for EPA's continued approval of certain pesticides for use within that state. The Agency will also rely on the predictive capabilities afforded by its monitoring data and computer models for ground water in assessing the likely effectiveness of a state's plan.

If a state decides not to take a lead role or to develop an appropriate plan, EPA will develop an alternative plan that may include statewide or countywide prohibitions as well as other limitations on the uses of specific pesticides. The Agency will also be influenced in its future registration of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act by the patterns it observes in the individual states and the nation as a whole as the strategy is implemented.

In addition to state management plans, EPA's proposed Agricultural Chemicals in Ground-Water Strategy calls for Agency-directed preventive measures that all states must implement, on a nationwide basis. Among these is the requirement that certain pesticides may be applied only by certified applicators. At present EPA is working with the U.S. Department of Agriculture as well as the states to develop a ground-water protection program as an added training requirement for certified pesticide applicators.

A Local Situation: Thinking "Long Distance"

by Paul A. Schuette

Calibrating manure spreaders is one of the final steps in developing a manure management plan. Mitch Woodward, Penn State Extension, measures the amount of manure being spread. *Pennsylvania Farmer Magazine* photo.

Paul Clugston doesn't sail on the Chesapeake Bay. He doesn't troll for blues or "chicken neck" for crabs. In fact, Clugston seldom even sees the Chesapeake. But the way he (and many others like him) runs his business has an important bearing on the future health and productivity of the Bay and its tributaries.

Clugston's business is dairy farming. He milks 180 Holsteins and raises crops on 349 acres of land about 20 miles north of Harrisburg, Pennsylvania, in the Susquehanna River watershed.

Pennsylvania farmers are getting special attention in the campaign to clean up the Chesapeake Bay because the Susquehanna accounts for about half the freshwater flow into the 200-mile-long estuary. And that flow includes nutrients, sediments, and other pollutants accumulated as the Susquehanna and its tributaries drain some 17 million acres spanning Pennsylvania from Maryland to the Finger Lakes region of New York State. Nutrient enrichment is considered to be a primary villain in the decades-long degradation of the Chesapeake. "Nutrient enrichment" may have a wholesome sound to it, but the effect is quite the reverse. In the Chesapeake, nutrients—including nitrogen and phosphorus from farmland—drive a process of excess algae production, decomposition, and recycling that contributes to oxygen depletion of the Bay's bottom waters. Oxygen-starved waters, in turn, threaten the survival of oysters, crabs, striped bass, and other species once produced in such rich abundance that H. L. Mencken was prompted to describe the Chesapeake as "a great big outdoor protein factory."

Clugston doesn't claim to be an expert in the problems of the Chesapeake Bay. But the 43-year-old farmer does know more than a little about controlling nutrients on his own farm. And his operation comes about as close as any to being a model of what farmers can do to restore and protect the Chesapeake. Clugston has been a pioneer in "manure management," a term devoid of glamour but rich in environmental implications for the Bay.

Farmland makes up less than a quarter of the 38 million acres in the Chesapeake watershed, but agricultural run-off contributes significant amounts of nutrient pollution to the Bay. Nitrogen reaching the Chesapeake from farms ranges from 19 percent of the total in years of average rainfall to about 32 percent in wet years. The phosphorus contribution ranges from 29 percent in average years to about 57 percent in wet years. Cropland erosion and animal waste are the principal sources of the agricultural nutrients.

In December 1987, Pennsylvania, Maryland, Virginia, the District of Columbia, and the federal government joined in a new Chesapeake Bay Agreement which, among other commitments, calls for a 40-percent reduction by the year 2000 in the amounts of nitrogen and phosphorus reaching the Bay.

In Pennsylvania, manure management is getting primary attention as an effective means of nutrient reduction on the farm. Erosion control is important too, but soil conservation techniques have been central to agricultural programs for many years now. Manure

management, on the other hand, is only just coming to the fore. Why? One reason manure is getting more attention now is that there is more of it, relatively speaking.

"You have to recognize what has happened in agriculture," said Victor Funk, watershed management branch chief in Pennsylvania's Bureau of Soil and Water Conservation. "Agriculture has become more intensive. There has been an increase in livestock density. We are generating larger quantities of manure on less acreage. Farmers have been using manure on fields as a way of getting rid of it."

But too much manure, said Funk, elevates nutrient levels beyond amounts crops can use, leaving an excess of nitrogen and phosphorus to pollute streams and the Bay.

Clugston recognizes the problems created by improper storage and use of manure, but thinks people are too quick to blame the farmer. In the past, farmers were relying on chemical fertilizers, not manure, to enrich their soil, he explains. In doing so, they were just "following instructions, doing what commercial dealers told them to do," Clugston maintains.

Now, however, state and federal money is being funneled to farmers in the Bay watershed who agree to employ "best management practices" that will reduce the migration of nutrients from fields to waterways. Reducing the need for expensive commercial fertilizers is one of the advantages that encourages farmers to participate, Funk said. Clugston's own introduction to efficient manure management began in 1980 when he decided he had to do something simply to raise the "comfort level" of having a manure stockpile nearby. He started his manure storage system with some financial help from a U.S. Department of Agriculture cost-share program.

"As time went on, I saw the benefits of storage," he said. "I could designate areas to go to instead of having the weather in control. Instead of a daily spread throughout the winter, I could apply the manure at a more appropriate time of year."

Now, Clugston has manure management down to a science—literally. He employs an agronomy firm to analyze the nutritional value of the manure from his animals and to regularly test the soil to determine what it needs.

Clugston's manure storage system retains solids in one tank, while liquids drain into a second container. He applies the semi-solid manure from the first tank as a slurry, and hires a commercial applicator to apply the liquid manure as a spray.

Clugston's knowledge of manure management has been furthered by his involvement in agricultural research projects sponsored by Penn State University, the University of Pennsylvania, and the Susquehanna River Basin Commission. The Penn State project focuses directly on nutrient management.

"The big plus from my point of view is that it has made me aware of the actual pounds of nutrients going onto fields," Clugston said. "Most people apply more than they think they do."

Clugston raises corn for silage, hay, rye, and soybeans. He tracks the amount of nutrients he applies to the soil, and he knows the amount each crop takes from the soil.

"Through monitoring, we know only 18 pounds of nitrogen per acre are unaccounted for," he said. "One missing link here as far as I am concerned is that we don't know what we started out with as residue nitrogen."

Other unknowns are the amount of nitrogen that percolates down into ground water, evaporates into the air, or is carried away in run-off, but Clugston hopes to start getting answers to those questions this year. Five wells are being drilled on the farm to monitor ground water, and a new weir in a grassed waterway will help in checking nutrient levels in run-off.

Clugston said he got into research projects by accident: "I just happened to be in the right place at the right time." But he feels that all parties concerned are benefitting.

"I do it for the information," he explained. "And I think one of my selling points [to the universities] is that I give them accurate records."

He also sees an advantage in having research carried out on a working farm. There is more assurance that results will have practical application, he indicated.

"I have to come out on the plus side or I'll go broke," he said.

Clugston's operation does not generate more manure than his crops can use, even though he added 67,000 broilers last year to supplement income from his dairy herd. But excess manure is a problem on many other Pennsylvania farms, which tend to be considerably smaller in the Susquehanna valley than the 349 acres Clugston works. (The average size of a farm in Lancaster County is 60 to 65 acres, Funk said.)

The state is exploring various mechanisms for moving excess manure to areas where it is needed, said Funk. One new approach is to treat transportation of manure as a "best management practice" entitling the farmer involved to financial assistance, he said. Composting and incineration also are being looked at, Funk added. Some entrepreneurs are drying manure and packaging it for sale to home gardeners, but Funk said this activity is "just a small thing now."

Clugston's comprehensive approach to nutrient management may still be atypical, but John Vogel, editor of *Pennsylvania Farmer* magazine, has noted a growing awareness among readers of the practical benefits of the efficient use of manure.

"Most farmers are more conscious of using manure as a fertilizer," said Vogel. "They are more conscious of the threat of nutrient overloading from an environmental standpoint. Ground-water contamination is also a concern."

Clugston, a Dauphin County Conservation District board member, also sees growing interest among his neighbors in manure management and he fields a lot of questions about his methods. He enjoys answering them.

"It's fascinating to me that what is economically beneficial to us, is environmentally beneficial to the community," he said.

Clugston puts considerable value on a sense of community. He is host to 400 to 500 students a year who visit his farm on school tours. And, each December, Clugston individually wraps some six dozen one-pound packages of butter to deliver to his neighbors. He started this practice four or five years ago, and it takes more time now than it used to.

"Now that I've gotten to know people, they want to talk more," he said. "People wave now or toot their horns when they pass."

Clugston clearly is pleased that his dedication to nutrient management is making a contribution to a healthier Susquehanna River and Chesapeake Bay, but he won't be checking out the results for himself. "I'm just not a water person," he explained.

Others might dispute that modest description. □

(Schuette is on temporary assignment to EPA's Chesapeake Bay Program from the Agency's Office of Public Affairs.)

Some Steps in Other Countries

by Michael D. Young

As the impacts of farming practices on the environment become increasingly apparent, many countries are seeking to integrate environmental and agricultural policies that have often been in conflict and to enhance the positive role that farmers can play in maintaining the landscape.

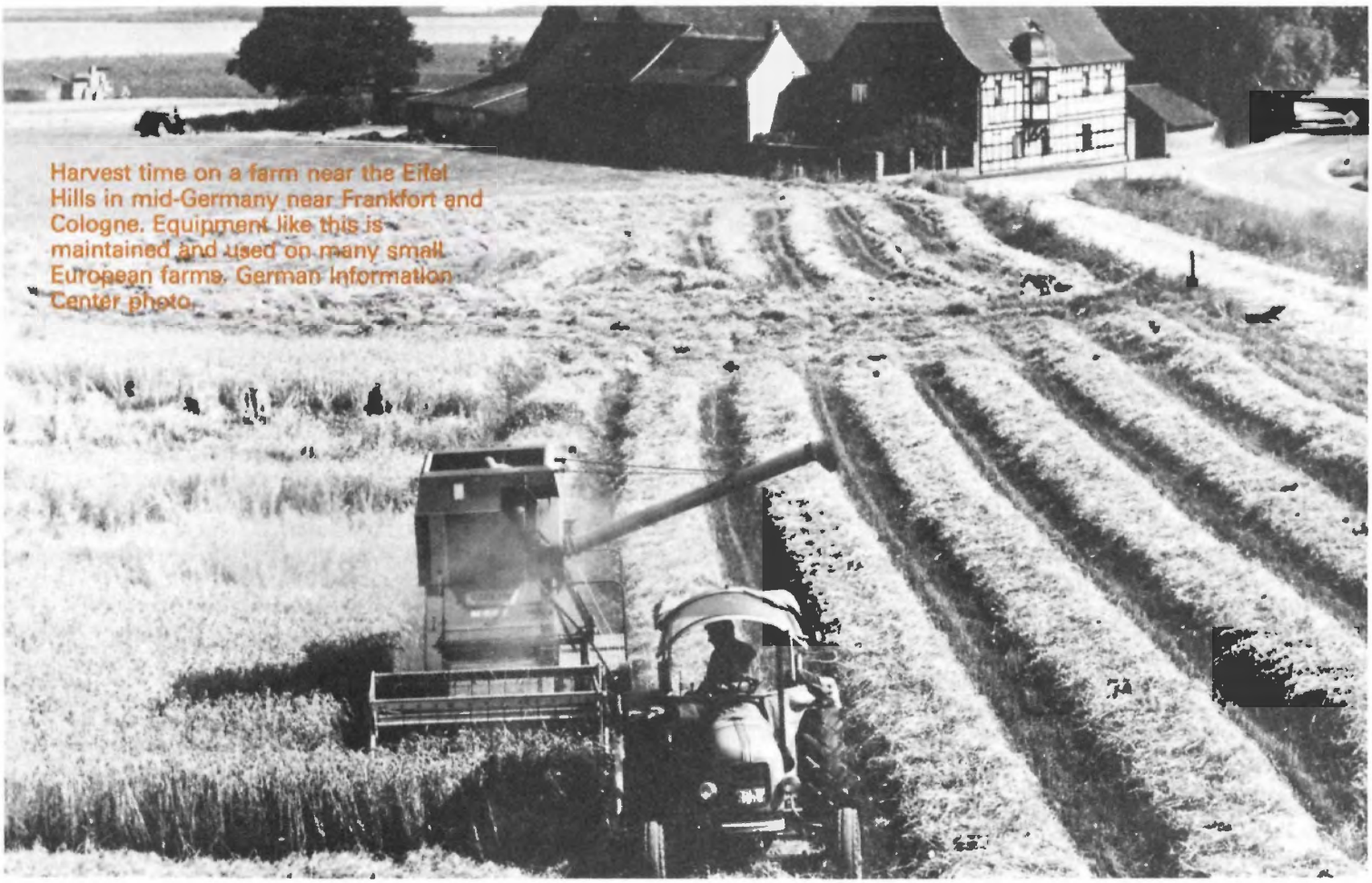
This is especially true in Europe, where market intervention, tariff protection, and other incentives have boosted farm production to the point where the use of nitrogen fertilizers has more than doubled since 1960, and the practice of intensive animal production has risen substantially. The result has been an increase in serious nitrate and other agricultural pollution problems.

The number of water-supply sources exceeding the European Community's maximum permitted level of nitrates in potable water is rising rapidly in many key agricultural areas. In West Germany, for example, the number of areas in violation of the prescribed safety level for drinking water rose from 126 in 1979 to 805 in 1983. In the United Kingdom, it is likely to cost an estimated $200 million in capital expenditures and $10 million in annual operating costs to keep present water sources within the standard. Also, wildlife habitat and landscape quality are declining in many areas.

To combat such environmental degradation, a number of nations are seeking to resolve the competing interests reflected in their agricultural and environmental policies. In Europe, such integration is being pursued by modifying supply controls, changing and expanding extension and advisory services, introducing environmentally protective farm management agreements, strengthening regulation of farming practices, and taxing or placing other levies on fertilizers and pesticides.

In fostering such actions and generally in the context of its work on agriculture and the environment, the Organization for Economic Cooperation and Development (OECD) recognizes that integration usually requires the development and implementation of policies which make conscious trade-offs between competing objectives. Care is taken to avoid implying that it is always possible to develop policies that can simultaneously achieve both the agricultural and environmental objectives. Examples of policies which are truly mutually supportive and reinforcing are few.

The Danish government, for example, is concerned about the impact of nitrate and phosphate pollution on the nation's fishing industry and other natural resources. Agricultural, industrial, and urban sources of the pollutants are being required to change their management practices in order to halve nitrate and phosphate levels over the next five years. As part of this effort, farmers must prepare management plans showing how fertilizers and manure will be applied to their lands with minimal nitrate or phosphate run-off or leaching into nearby waters. Moreover,



Harvest time on a farm near the Eifel Hills in mid-Germany near Frankfort and Cologne. Equipment like this is maintained and used on many small European farms. German Information Center photo.

since most nitrate pollution comes from bare, fallow fields in autumn, Danish farmers must establish a green cover crop or pasture over a fixed proportion of their acreage every fall, and must upgrade their manure storage facilities to nine months' capacity.

Sweden; Finland, and Austria employ a variety of economic incentives to encourage cereal grain production and then use charges on fertilizers to subsidize the sale of the resultant surpluses on world markets. The Swedish 20-percent levy and 5-percent tax on all fertilizers also serve to finance research and extension activities associated with the reduction of pollution. In addition, advisory officers are in the process of visiting all farmers in areas with serious nitrate pollution problems to ensure that they apply only the quantity of fertilizers needed for maximum profit. Many are learning that they can increase their profits by decreasing the quantity of fertilizers they apply to their crops. This combined advisory-economic strategy of raising input costs and drawing farmers' attention to the benefits of reviewing the quantity of fertilizers they use is reported to have significantly reduced agricultural pollution. Drawing on this experience, Sweden introduced a 25-percent pesticide tax in 1986 which, combined with strengthened advisory services and stricter regulations, is expected to reduce pesticide use by 50 percent before the end of 1990.

In the Netherlands, manure from increasingly intensive livestock production is responsible for 20 percent of the Dutch contribution to acid precipitation and for the unacceptable levels of nitrates in ground water used for drinking in many locations. Much of the increase in Holland's pig and dairy production results from preferential trade agreements between the European Community and developing countries. These agreements permit the importation of cassava and some other feed substitutes tariff-free.

To reduce the environmental problems resulting from increased farm production, the Dutch government limits the amount of manure which may be spread per hectare. Manufactured feed inputs are taxed to finance anti-pollution research and extension services. The limits on manure are defined in terms of kilograms of phosphate per hectare, with the amounts varying according to crop and soil type. Farmers must calculate the amount of manure they will use and how much surplus their livestock will produce. The surplus is taxed, and must be disposed of at the farmer's expense. Because in 1986 the surplus came to 13.6 million tons, manure banks have been established and markets for the surplus are being sought.

As elsewhere, Western Europeans have debated about who should pay the costs of reducing agricultural pollution. In 1972, the governments of OECD countries agreed to implement a "polluter pays" principle, which requires polluters to pay the full costs of any pollution prevention and controls resulting from their activities, so that these costs are reflected in production and consumption patterns. Exceptions can be made during transition periods, providing they do not lead to significant distortions in international trade and investment.

Many countries have applied the "polluter pays" principle to industry but not to agriculture, the Swedish and Dutch experience notwithstanding. Alternative regulatory efforts (to some extent consistent with approaches to industry) include requirements that farmers adopt non-polluting methods. For example, West Germany forbids spreading manure on frozen ground. Sweden bans aerial pesticide spraying to reduce the threat to wildlife and human health. Australia restricts the planting of crops next to water courses to prevent erosion.

As indicated earlier, the severity of almost all agricultural pollution problems has been worsened by agricultural production incentives (price supports, tariff barriers, and preferential trade agreements), which stimulate increased use of chemicals. Thus, reducing such supports can be expected to reduce pollution and improve the quality of the environment. However, there are those who say that without such supports there would be fewer farmers in economically disadvantaged areas, and farmers are necessary to preserve traditional agricultural practices. Without them, it is argued, landscape quality would deteriorate and regional unemployment would increase. However, New Zealand has recently removed nearly all support to agriculture and reports that this has not only led to reduced use of agricultural chemicals but also to the diversification of production into other activities.

On the other hand, many European countries are supporting farmers who undertake environmentally helpful actions and are finding that this has worked well. Austrian farmers are paid to maintain traditional herb-rich meadows that attract tourists, and Swiss farmers who cut hay on mountain slopes to reduce risks of snow avalanche are given grants. Some of these grants are financed by local taxes on tourism and others from government revenues.

Many countries do recognize the positive contribution farmers can make to the environment. South Australia offers farmers heritage agreements (conservation easements or covenants prohibiting certain activities in return for grants, ongoing rate concessions, and other benefits) and a vegetation clearance program in return for improving wildlife and the environment by preserving natural areas on their farms. And throughout Western Europe, voluntary management and grants agreements are extensively used to encourage adaptation of environmentally favorable farming practices. The United Kingdom has identified environmentally sensitive areas within which farmers can apply to receive payments to help them improve and maintain the environment by deferring hay-making, grazing livestock so as to improve pasture composition, using less fertilizer, not ploughing their fields, etc. Similarly, in Germany, some farmers are paid to leave the edges of fields unfertilized. A key difference between the South Australian heritage agreements and most European schemes is the length of the agreement. The South Australian agreements run in perpetuity and are attached to the land title. Most European agreements, however, run for only five years and thus do not guarantee long-term environmental improvement.

In other words, many countries are finding ways to enhance the role which farmers can play in protecting and improving the environment by pursuing the integration of agricultural and environmental policies. There is, however, considerable potential for short-term progress through the adaptation of agricultural policies so that they take greater account of their effects on the environment. In the longer run, the general reduction of support to agriculture, particularly in key production areas, also offers strong prospects for reducing pollution from agriculture. □

(Young is an Administrator with the OECD's Environment Directorate in Paris, France. The views expressed are his own and not necessarily those of his organization.)

The Controversy Over Pesticides and Endangered Species: Two Points of View

The Attwater's Greater Prairie Chicken is an endangered species, its habitat having been reduced by urbanization and agriculture. The 1988 census counted only 156 of these birds living in the Attwater's Greater Prairie Chicken Wildlife Refuge, Eagle Lake, Texas. Another 770 were found outside the refuge in Texas and Louisiana. Steven Holt photo, VIREO.

The Endangered Species Act requires that federal agencies must ensure that their actions do not jeopardize the continued existence of any threatened or endangered species. This seemingly straightforward mandate has proved difficult for EPA to implement under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which governs the regulation of pesticides.

Other federal agencies might re-route an interstate highway or consider alternatives to a full-scale dam for flood control to avoid an endangered species habitat. EPA, on the other hand, is charged with protecting these species while registering pesticide products in accordance with FIFRA.

EPA originally proposed, in early 1987, an extensive endangered species program for implementation beginning February 1988. The program was intended to apply to certain pesticide products registered under FIFRA for use on rangeland and/or pastureland; on selected crops (corn, cotton, soybeans, sorghum, wheat, oats, barley, or rye); in forests; or as mosquito larvicides.

Specifically, the Agency proposed to use pesticide product labeling and county-specific maps of endangered species habitat as means for limiting pesticide uses as necessary to protect endangered species. Applications of certain pesticides were to be limited only within the currently occupied habitats of the species. Approximately 900 U.S. counties are presently known to contain endangered species habitat within their borders.

Following its 1987 proposal, EPA received extensive comments from states, other federal agencies, and the public. A review of these comments convinced the Agency that additional time and effort were needed to resolve practical difficulties in defining currently occupied endangered species habitat, clear up widespread misunderstanding in the pesticide user community about EPA's endangered species initiative, and refine the overall plan into a fully workable program.

Right now, EPA is gathering extensive public input on all aspects of its previously proposed program for implementing the Endangered Species Act. A Federal Register notice was published March 9, 1988, initiating public comment on specific major issues (the comment period closes June 7, 1988), and EPA has held numerous public meetings on the subject. The Agency is also working with those states which have elected to develop state-initiated plans for the protection of endangered species from pesticides.

In light of the controversy over pesticides and endangered species, EPA Journal asked two observers with different vantage points on the subject to respond to the following question: Is it possible to protect endangered species from pesticides without causing major agricultural disruption? The respondents are Susan Hagood of Defenders of Wildlife, an environmental organization, and Mark Maslyn of the American Farm Bureau. Their comments follow:

Susan Hagood

It is not possible to determine with certainty whether protecting endangered species from pesticides will cause "major" agricultural disruption. Although we know that pesticide restrictions for the protection of endangered species may be necessary in approximately 910 of 3,050 U.S. counties, we do not know the number of acres devoted to agricultural production within those counties that could be subject to restrictions; the value of the crops produced on those acres; their contribution to national production levels; the costs of alternative pesticides or techniques whose use could result from species-protective restrictions; or the feasibility of alternative crop production.

What we do know is that many species in danger of extinction are jeopardized by continued use of certain pesticides. Texas wild rice, the Everglade snail kite, the gray bat, and the bluntnosed leopard lizard, to name but a few of the hundreds of species about which concern has been expressed could face extinction unless changes are made in the use of agricultural chemicals.

EPA has admitted that it mishandled its first attempt to implement long-overdue endangered species protections. Even before Congress forced a delay in implementation of this program, EPA had signaled

its intent to put the program on a slower track and to correct the deficiencies which had been identified.

The agricultural community was not unanimously against the program even as initially proposed. For instance, the chief of pesticide enforcement of the California Department of Food and Agriculture declared last October, "I feel fairly confident that we can accommodate the needs of the species and agriculture at the same time." An official with the Wyoming Department of Agriculture stated that with enough involvement of state officials and the public, a workable program is possible. Perhaps the strongest opposition to EPA's initial program came from the American Farm Bureau Federation. A spokesman for that organization objected to the omission of public hearings, saying, "That's what's outrageous about it."

The concerns of critics of EPA's first attempt to implement endangered species protections should be met by the opportunity for public involvement now provided and by EPA's commitment to develop a program based on accurate information and valid pesticidal hazards to endangered species.

This program will cause some disruption in the agricultural status quo. But the paramount need is to protect endangered species from further jeopardy. Ironically, it is agriculture which is one of the chief beneficiaries of species preservation. Crops from which we directly or indirectly derive most of our food were developed from wild flora. Wild plants are still used to improve their domesticated relatives.

It is in all our interests to assure that endangered species are not further jeopardized by pesticides. We cannot afford to fall short of that goal. □

(Hagood is a Wildlife Management Specialist with Defenders of Wildlife.)

Mark Maslyn

Rarely has an issue generated as much controversy within the agricultural community as the recent proposal by EPA to protect endangered species from pesticides. Most farmers are conservation-minded and take pride in seeing wildlife thrive on the farm or ranch. The controversy is not over whether endangered species should be protected, but whether or not endangered species are actually jeopardized by the selective and seasonal use of pesticides in farming.

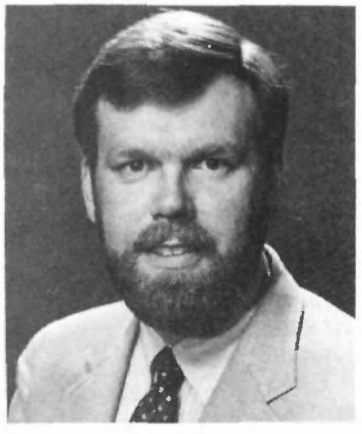
The recent proposal to ban approximately two-thirds of all pesticides in all or part of 1,000 U.S. counties because of a purported threat to endangered species was greeted with a healthy dose of skepticism from farmers and ranchers. This doubt was fueled by widespread knowledge of inaccuracies in the proposed habitat maps and in the jeopardy opinions. It was exacerbated by the lack of opportunity for farmers and ranchers to have input and participate in the process.

Any future proposal to address the endangered species problem must contain several essential elements.

First, it must show clearly that there is a cause and effect relationship between the routine seasonal use of pesticides and risk to endangered species. Jeopardy opinions are currently based on assumptions of maximum exposure to maximum dose, which is not representative of actual conditions. On the farm, pesticides are diluted significantly; exposure, if it occurs at all, is to the diluted mixture on an infrequent basis during the growing season. If it is shown that routine use of a pesticide under actual conditions results in jeopardy, then the Fish and Wildlife Service should be required to consider mitigating changes such as altering the rate, timing, frequency, or method of application as ways of removing jeopardy while still allowing use.

Second, the program's scope must be reasonable. Prohibiting the use of an insecticide used to control the corn borer because the corn borer is one of the sources of food of the Piping Plover is taking the requirements of the Endangered Species Act too far!

Third, the delineation of habitat areas must be reliable and specific. A clear policy should be adopted in those instances where habitat area is increased or where species have been reintroduced. Farmers should not be threatened with the loss of crop protection products because a species has been reintroduced (or introduced) where currently it does not exist.



Fourth, the proposal should involve an outreach effort that extensively involves the farm and ranch community. Ultimately, this program depends on voluntary compliance and it will succeed or fail on the basis of whether it is perceived as fair and reasonable. Farmers and ranchers will want to "kick the tires and drive it around the block" in order to feel comfortable with it. In short, you must involve the regulated community fully in the planning and design of any program.

Fifth, a successful program should be tailored to individual state needs and priorities. Once it is determined that there is jeopardy, the primary responsibility for designing, implementing, and enforcing a program should be that of the state.

Finally, there should be an economic analysis of the program's effects on agriculture and some means of compensating the landowner if the land can no longer be cropped or if value is lost. There should also be an examination of this program's relationship to commodity and conservation programs.

In conclusion, to be successful a program must be reasonable, fair, and based on sound scientific evidence. In addition, it must also be respectful of private property rights and flexible enough to allow for customizing to fit local situations. Most importantly, it must involve farmers and ranchers fully in all phases of development and implementation. □

(Maslyn is Assistant Director, National Affairs, American Farm Bureau Federation.)

Soybeans grow in corn residue in an Iowa no-till system. Increasing numbers of farmers are turning to "alternative" agricultural practices in an effort to become better businessmen and conservationists. H.E. Alexander photo. USDA Soil Conservation Service.

"Alternative Farming": A Report

by Roy Popkin

In Clare, Iowa, grain farmer Jim Stahl worries about erosion and ground-water pollution and has been "thinking this way for 20 years." As a consequence of environmental consciousness-raising over the last two decades, Stahl sees a renaissance in more environmentally compatible farming practices that were predominant in the United States before World War II. "Fifty years ago," he says, "it was all organic. But then in the 1950s, they told us to raise more and more corn for export. We had to use a lot of weed killers and fertilizers." Now he uses "no-till" soil conservation practices—planting seed among the unplowed residue of last year's crop—and is pursuing a "low-input farming" approach, cutting way back on his use of chemical pesticides.

Sylvia and Walter Erhardt raise fruits and vegetables on their intensively farmed acreage in Knoxville, Maryland. They are pursuing an "organic farming" approach by using no chemical products. Says Mrs. Erhardt: "I know a farmer who walked across a field that had been sprayed with paraquat the day before. He wound up in the hospital with severe leg problems." The Erhardts use a panoply of integrated pest management (IPM) and organic farming methods.

And Todd Greenstone of Brookville, Maryland, raises mostly corn on over 1,200 acres in the midst of suburban Montgomery County. Even though he practices monoculture (growing corn almost exclusively), he's into no-till agriculture and has cut back on chemical pesticides and fertilizers.

Greenstone, Stahl, and the Erhardts are among the growing numbers of American farmers who are trying to avoid the negative environmental impacts resulting from the heavily chemical-supported farm systems that have dominated American farming since the 1950s. These farmers are not simply discarding farm technology as it has developed over the last four decades, nor are they giving up agrichemicals completely. However, they are turning in their own ways to "alternative" agriculture—also variously known as "conservation," "sustainable," or

"regenerative" farming. Some are attempting to use no synthetic chemicals—an organic farming approach. A number of others are trying to reduce their use of such chemicals for both economic and environmental reasons—a low-input farming approach.

The U.S. Department of Agriculture (USDA) defines alternative farming as follows:

> . . . a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks, and aspects of biological pest control to maintain solid productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests.

Clearly, many of the practices considered to be alternative farming methods are not new (some of them date back to the 1700s). In order to understand where alternative agriculture is coming from in the 1980s, it is necessary to look back to the 1950s when, in the wake of World War II, pressure for large-scale production increases began to mount.

Since the war, according to Dr. I. Garth Youngberg, Executive Director of the Institute for Alternative Agriculture, "American agricultural practices have been substantially altered. . . ." As Youngberg recounts,

> Large-scale, highly specialized, capital- and energy-intensive farms came to dominate U.S. agriculture. Monocultural cropping systems, particularly of cash grains, large confinement animal feeding operations, and fossil fuel-based production technologies, especially the heavy use of synthetically compounded fertilizers and pesticides, were widely adopted by American farmers.

While these post-war changes did lead to what Youngberg calls the "United States' contemporary agricultural abundance," they have led to growing concerns about their long-term effects on the nation's environment. Throughout much of the United States, modern farming methods have accelerated soil erosion and resulted in chemical pollution of soil and water. The old soil-conserving crop rotation practices were replaced by widespread monoculture of grain or continuous row cropping accompanied by heavy tilling, which encourages erosion. There is growing concern about agricultural run-off and the harmful impacts of chemicals in drinking-water sources and the food supply.

In addition to soil conservation and environmental issues, there are economic concerns as well. Consider, for example, the following variety of concerns cited in USDA reports covering the years 1980 and 1981:

- High and increasing costs of energy and agricultural chemicals, as well as concerns about the future availability of some chemicals.
- Weeds and insects becoming more resistant to chemicals.
- Loss of soil productivity, organic matter, and plant nutrients because of erosion and agricultural practices.
- Loss of wildlife, bees, and beneficial insects due to pesticide use.
- Nonpoint source pollution of surface waters by sediments and farm chemicals.
- Potential human and animal health threats from pesticides and feed additives.
- Harmful impacts of farm chemicals on food quality.
- Drop in the number of family farms and local or direct-marketing systems; growth of big farms, with concentration of sales and assets.
- Growing capital-intensity of agriculture in general.

Since these reports were issued, what Youngberg calls "growing scientific disquiet over agriculturally related environmental degradation, accelerating economic pressures on the family, and faltering farm exports" have led agricultural policy-makers, scientists, and conventional farmers to renew their interest in "farm enterprise diversification, including specialty crops and direct marketing . . . the benefits of mixed cropping systems which include legumes, hay, and other nitrogen-fixing crops . . . as a way to stabilize and enhance farm income, reduce production costs, and make agricultural ecosystems more sustainable in the long term."

Ten years ago, organic purists like the Erhardts would have been dismissed as food faddists or back-to-the-landers. Farmers like Stahl and Greenstone might have been scoffed at or even resented by neighboring farmers. Today, their kind of farming is becoming noticeably more common in many parts of the country. Just possibly, they may represent a major movement to adopt many of the principles and practices of pre-war farming, although this remains to be seen.

Proponents of such a movement argue that it makes sense from environmental *and* economic standpoints. Says Wilder Foundation's Craig Cramer, former editor of *New Farm*: "The organic movement is now related to concern over profitability and the environment." And, says Youngberg, "Alternative farming has become part of the mainstream. There are articles in all the mainstream agricultural publications; there are conferences, workshops, and teaching programs at 10 to 12 universities, programs that didn't exist three to four years ago."

Under the Food Security Act of 1985, anti-erosion plans for individual farmers are mandated, and USDA has established a $4 million research program to look at all aspects of low-input farming. Information on the subject, until recently relatively hard for farmers to obtain, will be available not only in specialized magazines but also from county extension agents.

In addition, the National Academy of Sciences is soon to release a major study on alternative farming. According to the Executive Director of the Academy's Board on Agriculture, Charles A. Benbrook:

> Nearly everyone active within American agriculture today is taking notice of the sometimes rather remarkable accomplishments of successful low-input, sustainable agricultural systems. The mythology and rhetoric of organic farming in the 1970s is giving way to the bottom-line profits of mainstream farmers who have chosen to become innovators.

Writing in the 1987 *Yearbook of Agriculture*, Kenneth Cook of The Conservation Foundation basically agrees with Cramer, Youngberg, and

Benbrook on the dual economic and environmental motivations presently behind alternative agriculture:

> Economics may be the overriding motive behind alternative farming today, but concern about soil and water conservation, wildlife, and the environment is not far behind. Alternative farming systems tend to be very effective in controlling erosion, runoff, and pollution of surface water and ground water .... One final motivation is concern about ... the effects agricultural chemicals may have on their health or that of their family and neighbors.

A 1986 Iowa State University survey, for example, found that 80 percent of the farmers in the state's Big Spring Basin worried about pollution of their drinking water and favored protecting the environment at all costs.

How widespread *is* the trend to alternative farming? According to USDA estimates cited in a recent directory of sustainable agriculture and horticulture, at least 30,000 of the nation's 2,100,000 farmers use no chemicals at all. While this does not reflect large-scale "conversion" to organic practices, soil scientist Robert Papendick of the USDA Agricultural Research Service says his Agency also predicts that virtually all American farmers eventually will use some form of low-erosion, low-pollution, pro-resource conservation tillage, such as what the *American Journal of Alternative Agriculture* describes as ranging from "a few tillage operations for weed control and seedbed preparation to one-pass, no-till planting."

While Youngberg feels that adoption of alternative farming methods should be more widespread, he asks, "How do you define alternative farming? Is it total absence of chemicals? There are not too many of those. The number of certified organic farmers in California, for example, is only between 400 and 500. While there are relatively few purists, there are many farmers who use some pesticides but have reduced amounts and are moving towards low-input alternative procedures. If you step back a little further, you'll see farmers experimenting with new crops, legumes, and crop rotations. You'll find quite a lot of change out there, with clean and sustainable agriculture as its goal."

Reflecting some of the change that is "out there," some states are now formally certifying organic farmers according to state-adopted standards. In California, some supermarkets say they are buying produce only from such certified sources.

The economic motivations are both cost- and market-related. While surveys indicate that yields may be smaller for some, money saved by not using chemical agricultural products and the more efficient use of mechanical equipment can create a net profit which is often the same or greater despite a lower yield. A recent study of what farming in the Palouse of Washington and Idaho showed production costs of a "perpetuating-alternative-legume system" were 56 percent lower than conventional farming, and that when high-yield non-subsidized market conditions exist, profits were $14.95 per acre higher.

These farmers are not simply discarding farm technology as it has developed over the last four decades, nor are they giving up agrichemicals completely.

IPM methods, such as using biological controls like pest-specific predators or organic sprays, also reduce costs. Recently, cranberry farmers in Massachusetts reported that IPM increased income of $200 an acre. Biological products have literally wiped out once-chronic infestations of the alfalfa weevil. And the return to crop rotation and cover crops (which all but disappeared over the past three decades) is also reducing the need for chemical products.

Although many farmers say it is hard to find markets for organically grown foods, others reflect a growing demand. Sam Smith, in northwestern Massachusetts, turns five acres into a net of over $20,000 a year in an area that has few natural food addicts. "The demand is for quality," he says. In many areas, supermarkets are installing natural food departments.

Grape growers, for example, find a big demand for naturally grown output because chemicals interfere with the microbial fermentation processes of the winemakers. Sylvia Erhardt sold her produce to downtown Washington DC's most important French restaurants. "French chefs," she says, "want the very best in everything from spices to berries to vegetables, without chemicals." She also grows vegetables for more than 50 families who order a year's worth of produce at a time. She successfully encouraged several small manufacturers of organic sprays and fertilizers to increase their marketing and production methods to meet the growing demand.

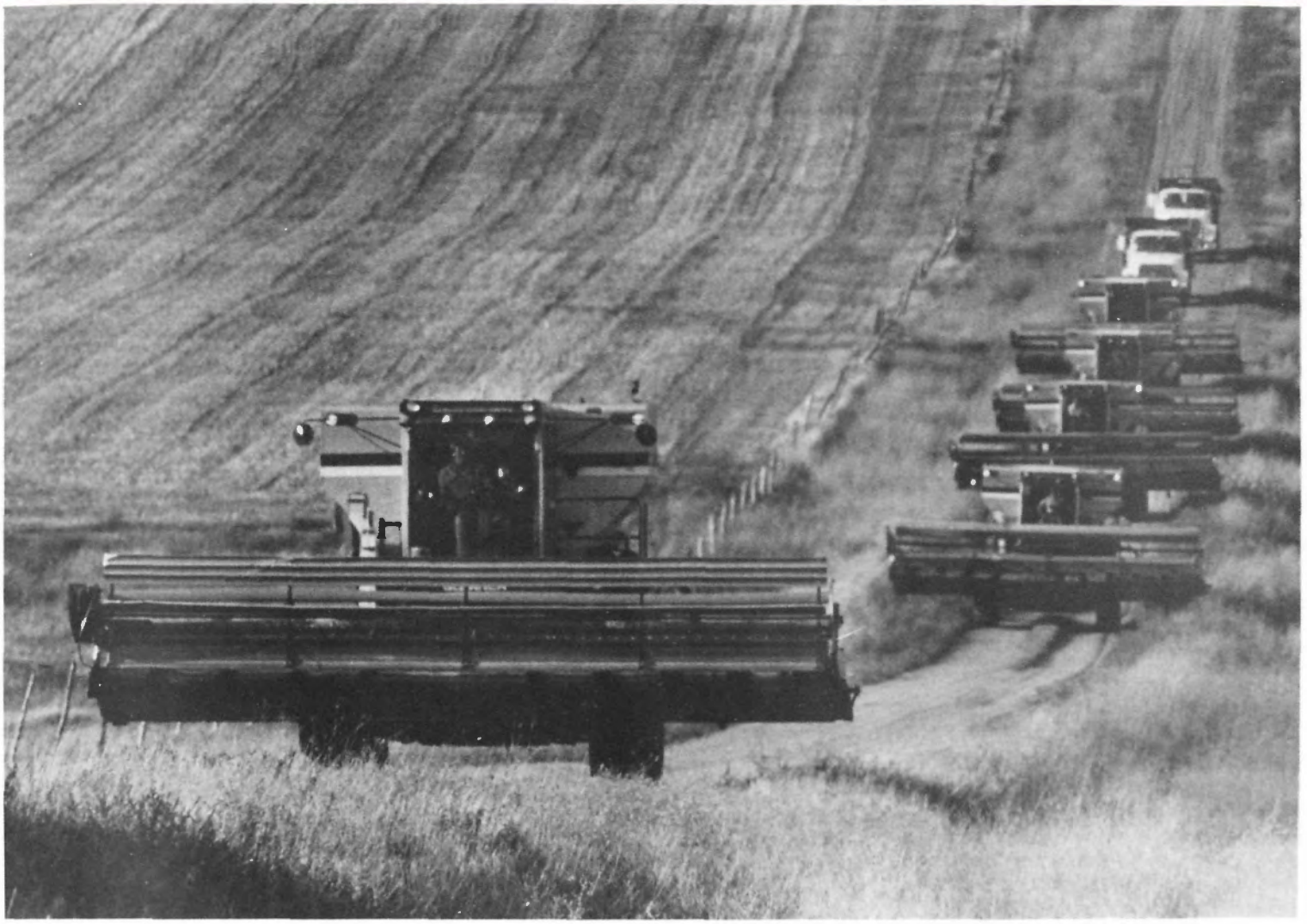
Other developments also seem to reflect a trend. A major chemical industry magazine reports that agrichemical "manufacturers are not considering growth, they are now worried about shrinkage." Iowa is taxing the sale of chemical agricultural products to raise money for research and information dissemination. The American Farm Bureau Federation (AFB) has gone on record supporting IPM practices; at its 1988 annual meeting, the AFB adopted a policy stating, "We support the widespread promotion and use of Integrated Pest Management (IPM) as a method of reducing costs, risks, liability, and total dependence on farm chemicals."

Said Benbrook at a Montana State University conference on new directions for rural communities:

> Low-input or alternative agriculture is channelled in a broader river of change. It has gained definition through the actions and experiments of practical farmers, who talk with their neighbors. The dialogue in recent years has been much more grounded in practical lessons and accomplishments ... adoption is progressing at very different rates across the country. Two things are increasingly clear. Low-input systems can work and be highly profitable. Tangible accomplishments motivate change.

Alternative agricultural practices, the proponents and practitioners of such practices seem to be saying, represent an approach whose time has come—again. □

(Popkin is a Writer/Editor for EPA's Office of Public Affairs.)



This Oklahoma farm operation has hired a custom harvesting crew and their equipment to reap its wheat. With the price of many combines exceeding $100,000, many farmers are choosing to hire such services instead of purchasing their own machines. USDA photo.

Analyzing the Challenge Ahead of Us

by Rob Wolcott

Prior to World War II, the typical U.S. farm was labor-intensive, diversified, and relatively self-sufficient. Today, our farms are generally capital-intensive, specialized units of mass production. Heavily influenced by federal farm programs, the development of advanced technology, and the competitive drive to achieve high rates of productivity, U.S. farms have become models of efficient, high-volume food and fiber production.

The old days were very different. The threat of pest infestation, adverse weather conditions, and commodity price fluctuations required a variety of crops and activities to hedge against these problems. In the absence of commercial pesticides and fertilizers, crop rotation and old-fashioned weeding were used to inhibit pest infestation and restore soil fertility.

In the late 1940s and early 1950s, the vast majority of farmers were eager to take advantage of newly developed, disease-resistant seed varieties, fertilizers, pesticides, and advanced machinery to achieve higher yields from fewer crops on larger tracts of land. This shift led farmers to rely heavily on purchased inputs.

(Continued on next page.)

From an environmental standpoint, the most notable of these commercial inputs were agricultural chemicals: pesticides (insecticides, herbicides, fungicides, plant growth regulators, etc.) and fertilizers. Their use, virtually non-existent prior to World War II, has burgeoned into a $4.5 billion industry. In 1986, over 500 million pounds of agricultural pesticides were used in this country. Between 1960 and 1986, our annual use of nitrate fertilizer increased fourfold, reaching more than 12 million metric tons in 1986.

The great majority of agricultural chemical use is for the purpose of sustaining yields of the basic commodity crops supported by the U.S. government's farm program. Corn, for example, accounts for over 30 percent of all agricultural pesticide use. Six basic commodity crops—corn, wheat, rice, cotton, barley, and soybeans—all of which have some kind of U.S. Department of Agriculture (USDA) price support or loan program, account for a combined total of over 80 percent of the total volume of agricultural pesticides.

In addition to growth in the use of agricultural chemicals on the USDA program crops, there has also been a sharp increase in the kinds and amounts of chemicals used on specialty crops (fresh produce and fruits in particular). A wide variety of chemicals have been developed, not only to combat pests and plant diseases but also to regulate the growth of fruits and vegetables and enhance the cosmetic appearance of produce.

Apart from relatively isolated concerns expressed by the scientific and environmental communities, the trend toward chemically intensive agriculture was generally welcomed in the decades following the war. Consumers enjoyed inexpensive food, as well as year-round supplies of diverse produce. Until the mid-1980s, farm incomes steadily increased, and the U.S. trade balance was bolstered by escalating export earnings from this technology-induced cornucopia.

Now, in the late 1980s, three areas of concern have converged to spark a re-examination of the social merits of continuing such chemical-intensive production. The first set of concerns revolves around the health and ecological effects of agricultural chemicals. Concerns about the potential effects of pesticides and other agricultural chemicals are not new in the 1980s. Rachel Carson raised the public consciousness about the potential effects of pesticides with the 1962 publication of *Silent Spring*. However, these concerns have in some ways been heightened in recent years—particularly with the detection of ground-water contamination in increasing numbers of states, as a result of normal agricultural uses of pesticides.

Apart from relatively isolated concerns expressed by the scientific and environmental communities, the trend toward chemically intensive agriculture was generally welcomed in the decades following the war.

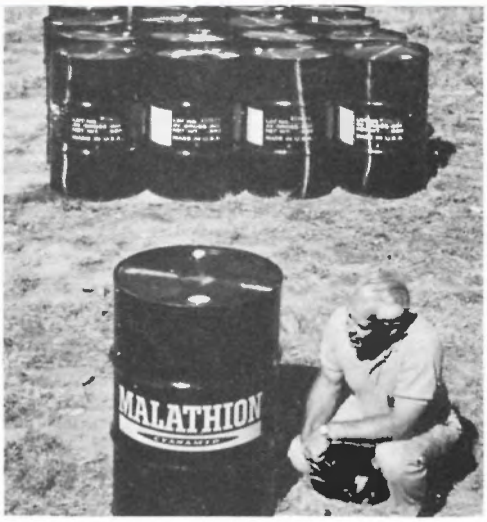
A second area of concern is the overproduction of many crops, resulting in significantly decreased commodity prices, as compared to the price peaks of the 1970s, and decreased farm incomes. In 1982, for example, 90 percent of the chemicals in question were being used on crops already in excess supply—rendering any increments of increased production attained through agrichemical usage of questionable value to society. A third and related concern involves the dramatic increases in federal farm program costs during the 1980s, which are particularly troublesome in the face of record federal deficits.

Health Concerns

While some pesticides have been linked with cancer and other health problems, many chemicals have not yet been fully tested and their potential health effects are unknown. These data gaps introduce a measure of uncertainty into nearly all discussions of the adverse effects of agricultural chemicals. Scientists at EPA and other regulatory agencies compensate for scientific uncertainties by using cautious assumptions when making risk estimations.

Human exposure to pesticides may occur through a variety of pathways (including food, air, and water). Residues of pesticides and fertilizers have been found in ground and surface water and may pose health risks when consumed in significant concentrations. During pesticide application, farm laborers and neighboring populations may be subject to inhalation or dermal exposures to chemicals.

In its 1987 report on the significance of the relative risks posed by current and prospective human health and ecologic exposures, *Unfinished Business: A Comparative Assessment of Environmental Problems*, EPA ranked pesticide-related cancer and non-cancer risks in the highest category of effect. This 1987 study rated such risks higher than those that currently dominate the attention of EPA and Congress, measured in terms of budgetary resources and institutional focus. Here once again, however, data gaps make hard-and-fast conclusions very difficult.



The pesticide malathion is widely used to protect fruit and vegetable crops from insect damage. USDA photo.

During the past decade, evidence has been building about the contamination of ground water as a consequence of normal, recommended uses of agricultural chemicals, with serious implications for drinking water safety. At present, nearly half of the United States relies on ground water for its drinking water supplies. In 1986, EPA estimated that 24 states had reported the presence of at least one of 19 pesticides in wells as a result of normal use of pesticide products. In 1984, the United States Geological Survey found the presence of nitrates in over 20 percent of the 124,000 well samples collected over a 25-year period; a primary source of such contamination is the agricultural use of nitrogen fertilizers.

Ecological Concerns

In addition to adverse human health effects from intensive chemical use, certain agricultural practices can damage terrestrial and aquatic ecosystems. In 1979, EPA found that agricultural run-off was the primary cause of water quality problems in 30

percent of U.S. stream miles. In 1986, another group of researchers found that cropland soil run-off accounted for more than 30 percent of the sediment and 40 percent of the nitrogen entering U.S. waterways.

Nonpoint-source pollution from agricultural sources (loadings of soil, nutrients, and pesticides) has been found to cause substantial damage to lakes, streams, estuaries, and wetlands. (See box.) The overall economic cost of cropland run-off to the United States in 1986 alone was estimated to be $2.2 billion.

In particular, the impacts of agricultural practices on wetlands warrant special attention. These valuable ecosystems are being threatened not just by conversion to agricultural uses, but by exposure to the chemicals and sediment that accompany that conversion. Nearly 400,000 acres of wetlands are being drained or otherwise destroyed each year. Over 80 percent of these losses have been attributed to agricultural production practices and expansion of croplands. The Swampbuster provisions of the 1985 farm bill are aimed at reducing these losses.

Overproduction

In the early 1980s, there were record domestic and worldwide harvests. The result was an accumulation of surplus supplies and a sharp drop in commodity prices. Corn, wheat, and soybean prices dropped by an average of 40 percent between 1981 and 1986. By 1985, 43 percent of corn production, 25 percent of soybean production, 78 percent of wheat production, and 73 percent of cotton production went directly to surplus stocks. In addition to the impacts of commodity price drops, there were storage costs for maintaining surplus stocks from year to year; alternatively, there were export subsidies to dispose of these stocks abroad. The value of U.S. agricultural exports fell to 26 billion in 1986 from 44 billion in 1981.

Across the nation, the farm economy was battered. Many farms went bankrupt. Particularly vulnerable to bankruptcy were those farmers who had gone heavily into debt to acquire more land and machinery during the boom years of the 1970s. USDA commodity support and credit programs were all that kept many others from going under.

Soaring Farm Program Costs

The heavy demands placed on commodity support and credit programs in the early 1980s resulted in enormous costs to the federal government in an era of soaring budget deficits.

From 1972 to 1980, total cumulative farm program costs were $25.9 billion, averaging $2.9 billion per year. From 1981 to 1987, cumulative farm program costs were $108.3 billion, averaging $15.4 billion per year. These costs peaked in 1986, reaching nearly $26 billion. In that year, USDA commodity program support represented 67.5 percent of total net farm income.

Since 1985, costs have been coming down due to increased commodity prices and reduced rates of participation by farmers in the commodity programs. However, the costs remain very high in both relative and absolute terms, $17.2 billion in 1988.

A New Beginning?

Severe stress in the farm community, high costs of government farm programs, mounting concerns about the effects of agrichemicals on human health and the environment: each of these concerns, considered by itself, is "bad news." However, the convergence of these concerns may be the harbinger of good fortune, born of adversity, if it leads to changes necessary for the integration of agricultural and environmental policies in this country.

There is reason for optimism in that many experts have concluded that a re-examination of current U.S. environmental and agricultural policies is in order. There is a need for reshaping these policies so as to mutually reinforce objectives that environmentalists and agriculturalists are now pursuing largely in isolation.

But what can be done to better integrate agricultural and environmental policies in this country? Where do we begin?

One obvious place to begin is by making information readily available that is useful to policy-makers. At EPA, the Office of Policy, Planning, and Evaluation and the Office of Pesticide Programs have been cooperatively developing an information system called the Comprehensive Economic Pesticide Policy Evaluation System (CEPPES), sometimes referred to colloquially as the "Pesticide Macro-project." Once the system becomes operational, it can be used to project the impacts of a variety

Environmental Degradation Effects of Agricultural Run-off

Nonpoint Source Pollutant	Aquatic Species Damages
Increased Turbidity	Reduces photosynthesis, leading to decreased productivity of phyloplankton and benthic organisms
	Impairs vision-dependent feeding activities for aquatic species
	Delays spawning activities for some species
	Clogs fish gills
	Increases susceptibility to disease
Increased Sedimentation	Smothers spawning beds
	Fills in stream depressions necessary for habitats
	Increases streambank erosion that destroys riparian habitat
	Increases water temperature
Increased Organic Loadings	Decomposing organic material can lead to oxygen depressions, species changes, and fish kills
Increased Nutrient Levels	Increases eutrophication, algal blooms, and oxygen demand, leading to species changes and fish kills
Increased Pesticide Loadings	Impedes growth and reproduction of aquatic and terrestrial species
	Acute pesticide concentrations can cause fish kills

Wheat field at dusk. In 1985, after several years of record harvests, nearly 80 percent of our wheat crop became surplus stock. USDA photo.

of agricultural and environmental policy options in terms of farm income, government costs, and crop production patterns, as well as health and environmental risk implications. The system is intended to provide policy-makers with a broad spectrum of information needed in shaping national program policies. It is expected to facilitate policy decisions not only in the management of agrichemical-related risks, but also in the implementation of USDA's commodity, crop insurance, and conservation programs. The system is expected to be operating this fall.

In the immediate future, two specific areas of federal agricultural policy afford opportunities for EPA and USDA to work together toward integrating agricultural and environmental policies. The first is the soil Conservation Reserve program established by the Food Security Act of 1985 (the 1985 farm bill). The second relates to USDA's commodity programs.

The 1985 farm bill established a set of conservation programs designed to reduce erosion, reduce surplus production, stabilize farm income, enhance water quality, and protect wetlands. (See box on page 7.) One of these programs, the Conservation Reserve, compensates farmers for taking cropland that is highly erodible out of production.

Research recently completed by EPA suggests that more "targeting" of the Conservation Reserve on critical environmental lands could yield significant water quality and habitat protection benefits while reducing overall federal farm program costs. Further, the reduction in cropped acreage would reduce chemical use while holding farm incomes constant. EPA is currently working together with USDA on ways to implement these findings.

Logical candidates for such target planning include wellhead protection areas, ground-water recharge areas, lands with porous soils over shallow aquifers, endangered species habitats, and other lands, stream-side and upland, that significantly contribute to nonpoint pesticide, fertilizer, and sediment loadings to surface waters.

Moreover, this overall targeting approach would complement the EPA/state approach to implementing the Water Quality Act of 1987. This collaborative approach involves the development by states of State Clean Water Strategies that focus, from a water quality perspective, on high-priority water bodies and the development of program plans to achieve specified water quality objectives. The Conservation Reserve and the other conservation provisions of the 1985 farm bill are several of many programs that could be used to achieve these results.

The second area that warrants mention here is USDA's basic commodity programs. In their present form, certain provisions of of the commodity programs tend to foster continuous, single crop (monocultural) production practices. Such practices typically require higher levels of pesticide and fertilizer input than is necessary when crops are rotated to increase the level of nitrogen fixation in the soil and retard pest infestations.

Monocultural cropping, such as continuous corn planting, presently dominates much of the Corn Belt, requiring intense chemical management. In Iowa, for example, a 1986 study indicated that 85 percent of farmers growing continuous corn applied insecticides to control corn rootworm; by comparison, only 15 percent of farmers who rotated corn with other crops used these insecticides.

Looking Down the Road

Agricultural chemicals and selected agricultural production practices pose public health and environmental risks of major proportions. The management of these risks is complex, dynamic, and immensely challenging from social, political, institutional, and economic perspectives. In the past, conflicting federal policies, a highly dispersed industry, scarce resources, and political considerations have presented formidable barriers to comprehensive risk management.

During the past five years, however, a number of factors have come together to afford an opportunity to integrate agricultural and environmental policies, allowing for mutual achievement of the respective goals of the agricultural and environmental community: safe and affordable food, a prosperous farm sector, and stable, productive ecosystems.

As a practical matter, the successful integration of agricultural and environmental policies will be highly cost-effective. Compensating farmers for retiring environmentally sensitive land from production can enhance water quality and habitat while at the same time reducing farm program costs. The challenge is in bringing together such highly diverse groups as farmers, conservationists, and regulators, among others, first to achieve an understanding and respect for each other's goals and values, then to build a broad-based commitment to attaining mutually compatible objectives. □

(Wolcott is Director, Environmental Resource Economics Division, in the Office of Policy Analysis of EPA's Office of Policy, Planning, and Evaluation.)

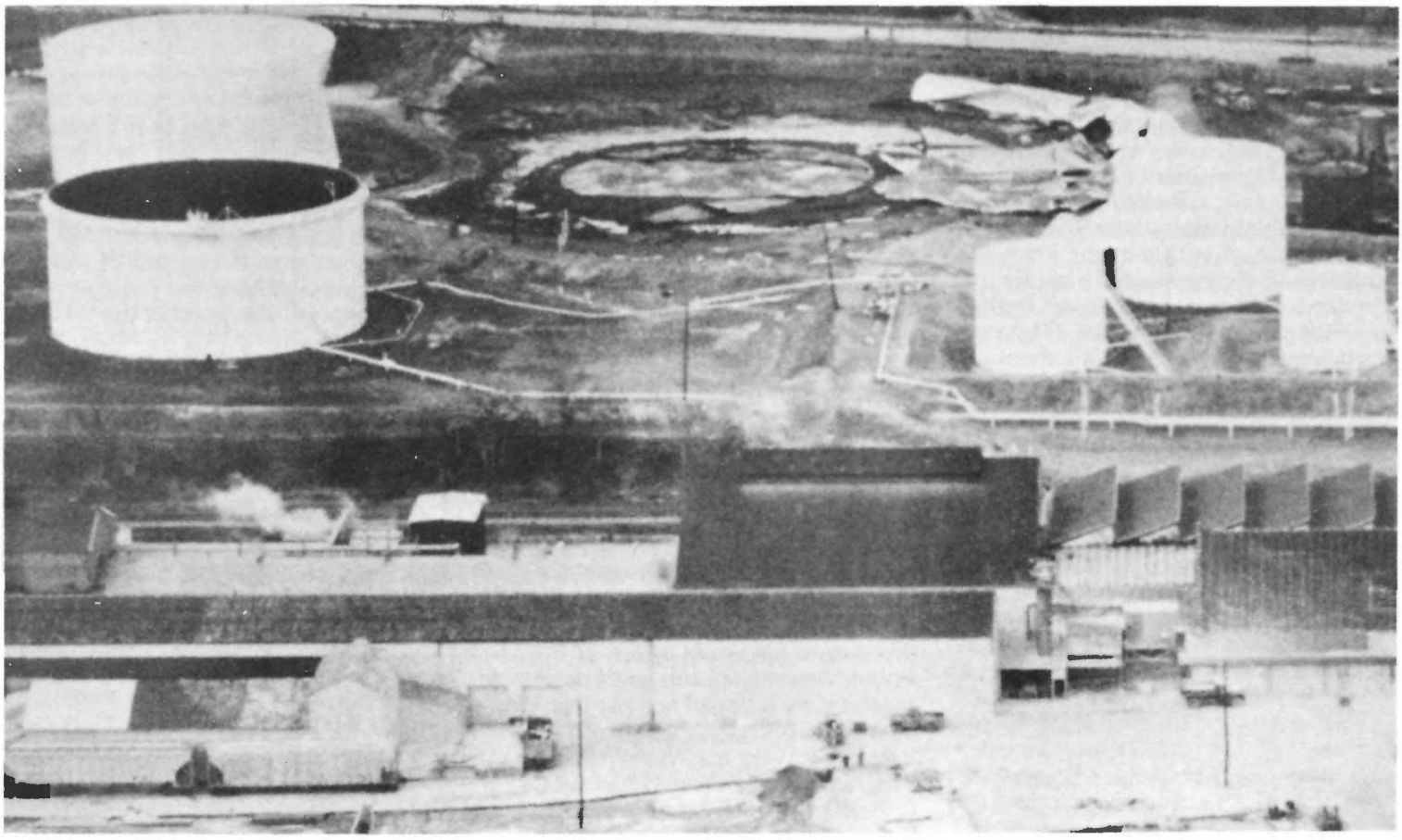
Oil Spill on the Monongahela: As the Story Unfolded

by Ray Germann

To Ashland Oil Company workers, it sounded like a giant water balloon bursting. But what they were hearing was anything but a conventioneer's prank. It could easily have claimed their lives.

Shortly after 5 p.m. on Saturday, January 2, a 45-foot high, partially filled oil tank at Ashland's Jefferson Borough facility collapsed, spilling almost a million gallons of oil in a matter of seconds. As the tank's walls peeled away, the oil fell outward in a giant wave-like motion. This 30-foot wave of heavy oil surged over containment barriers with such force that it nearly caused a nearby tank to collapse. Company officials said it was miraculous that no employees were working in the area, for they certainly would have been swept into the nearby Monongahela River.

Local volunteer firemen and Allegheny County Emergency Management personnel stationed in Pittsburgh were among the first to reach the twisted mass of pipes and steel mired in a lake of oil. As they observed the scene, they saw something which stirred fear in even the most seasoned veterans: a gasoline tank less than 50 yards away appeared damaged. The smell of gasoline was in the air. According to Emergency Management Director Robert Kroner, this deadly mixture of oil and gas had the potential



When a storage tank crumpled and fell, about a million gallons of diesel fuel leaked into the Monongahela River. This picture shows where the tank once stood. U.S. Coast Guard photo.

In the direction shown by this map, diesel fuel oil began oozing down the Monongahela River on Saturday, January 2. By Sunday, it had covered 27 miles to reach Pittsburgh, Pennsylvania, where the Monongahela joins the Allegheny to form the Ohio River. Work crews used booms, barges, and barriers to remove or slow the advancing oil slick.

to cause an explosion which could have "wiped out half the town."

Evacuation of nearby residents was initiated. By dawn, almost 1,200 people had been rousted from their beds and placed in emergency Red Cross shelters.

After several hours of sloshing through oil-soaked muck, firemen and county workers located the gasoline leak. Fortunately, it was in a pipeline, not the tank, and involved hundreds, rather than thousands, of gallons. By 10 a.m. Sunday, lots of hard work and a golf tee supplied by a county worker put a stop to the gasoline leak. This "engineering" feat took on almost legendary status by week's end as a symbol of the "can do" attitude of the Pittsburghers fighting the spill. The evacuees were back in their homes before noon.

As the attention of the nation turned towards spill clean-up efforts, Jefferson Borough residents were catching their first daylight glimpses of their soiled river. U.S. Coast Guard Commander Gene Miklaucic, who had been in charge of the Monongahela River cleanup throughout the night, knew the spill was of unprecedented size. He had already closed the river to barge traffic to allow placement of booms. (The booms, made of plastic or absorbent material, are used most often in coastal waters or the open sea to catch oil floating on the surface.) By closing the river to barge traffic, Commander Miklaucic was severing an economic lifeline for many Pittsburgh area industries. He also directed Ashland Oil contractors to place containment booms to control the oil oozing down-river towards Pittsburgh, and directed tanker trucks to the containment areas to begin pumping oil from the river.

He knew time was of the essence because three water suppliers provided river water for tens of thousands of people living along the 25-mile stretch between Jefferson and Pittsburgh. Some were better equipped to treat their supplies than others, but none could continue to operate if the oil contamination became serious.

It was this potentially disastrous situation that faced EPA On-Scene Coordinator Jerry Saseen when he arrived Sunday morning. Saseen, a veteran clean-up manager with more than 20 years' experience, was prepared for the worst. He knew that a spill of this magnitude posed a slew of technical problems and could lead to an explosion of political activity and media interest.

Before leaving his Wheeling, West Virginia, home, Saseen called EPA's Region 3 Office of Public Affairs in Philadelphia to initiate the Agency's efforts to provide information to the public and press. Public Affairs staff quickly joined him at the site and remained until the worst of the crisis had passed.

Upon arrival, Saseen assumed control of the clean-up effort from Commander Miklaucic, but the two continued to work together, along with a host of federal, state, county, and local agency representatives.

For the first 36 hours after the spill, news media coverage was intense but was mostly by local and nearby reporters. By Monday morning, however, reporters from all over the

world had converged on Jefferson Borough and downstream municipalities. News bureaus as far away as Australia were getting hourly updates from reporters at the scene.

The eyes of the world watched as clean-up crews fought to prevent millions from going without water. They saw a clean-up effort in full swing, with thousands of feet of booms in place to contain the spreading oil and hundreds of workers pumping oil from the river into barges and tanker trucks. But most viewers who saw this on TV were unaware that those dedicated workers risking frost-bite on the decks of frozen clean-up vessels were fighting a losing battle.

The quickly flowing river, the oil mixing easily with the water, and the river's system of locks and dams (which speeded this mixing process) combined to hamper the clean-up effort, which was already plagued by arctic temperatures. It was clear that most of the oil in the river would be lost. Saseen called in river experts from the National Oceanic and Atmospheric Administration and the Ohio River Basin Sanitation Commission to help him quantify and track the spill so downstream communities could be better prepared.

Water suppliers began closing down Sunday morning as oil-contaminated water neared their intakes. The suppliers worked round-the-clock to find new sources of clean water. Pennsylvania Governor Robert Casey declared a state of emergency Monday, making state resources available to assist in the water supply efforts.

Water quality experts from EPA's Environmental Response Team in Edison, New Jersey, joined water companies and various authorities to determine treatment technologies best suited to the unique circumstances. Pittsburgh officials and representatives of unaffected water suppliers worked to establish interconnections that could be used to provide emergency water supplies. The Pennsylvania Emergency Management Agency provided "water buffaloes" (tanker trucks filled with potable water) to communities in danger of losing water service.

Ashland Oil, for its part, did everything requested of it and more. At Saseen's direction, the company obtained four one-million gallon capacity barges to bring fresh water from the nearby Allegheny River to needy water suppliers. High-ranking company officials, including Chairman of the Board John Hall, came to the scene shortly after the spill, lending support and promising to make restitution for losses incurred.

As the week progressed, eight water suppliers in the three states along the Monongahela and Ohio rivers (into which the Monongahela flows) between Jefferson Borough, Pennsylvania, and Wheeling, West Virginia, were forced to shut their intakes because of oil contamination. Many of the affected communities tried to plan for their potential pollution problems but lacked first-hand information about what they could do.

As the attention of the nation turned towards spill clean-up efforts, area residents caught their first daylight glimpses of their soiled river.

Finding even a minute to spare from the clean-up effort seemed impossible, but EPA officials realized that face-to-face communication with these downstream communities was imperative. Three days after the spill, Saseen and EPA Hazardous Waste Management Division Director Steve Wassersug met with state and local officials in Wheeling. Television crews followed them from the time their helicopter landed at the Wheeling airport until it departed 90 minutes later. During that time, EPA officials provided information and answered questions. Community representatives learned they were not fighting alone. Another meeting in Huntington, West Virginia, proved equally reassuring.

One of the most important factors which kept the spill from becoming a major disaster was the cooperative spirit and the iron will of Pittsburgh area residents. Even before the Governor's declaration of a state of emergency, schools and businesses began making plans to conserve water and to close down, if necessary, to make sure that enough water would be available for hospitals and those people, many of them elderly, who depended on hot-water or steam heat. When the situation worsened and schools and non-essential businesses were ordered closed, compliance was near 100 percent.

One could not read a newspaper or switch on a radio or television set during the week of January 2-9 without hearing pleas to conserve water. Several stations established 24-hour call-in lines so residents could talk to someone who had a basic knowledge of the current situation.

No one took the oil spill lightly. Tension was eased slightly by writing and airing "fight songs" such as "Old Man River" and "You Can't Hurry Crud." The *Pittsburgh Press* even created an official spill T-shirt.

By the end of the crisis, nearly three weeks after the spill, fewer than 25,000 people had gone without water for even a short time. This was hailed as a victory since water supplies for more than a million people had been threatened.

However, the region faces the problems of still-untold damage to the river, which brings water and a livelihood to many Pittsburgh area residents. In addition to forcing some families out of their homes temporarily and several thousand to go without water in their homes for up to a week, the spill dealt a severe blow to the recovery of the Monongahela watershed. Before the spill, an ecology once poisoned by industrial waste was again becoming a home for multitudes of fish and migratory birds. Within a month of the spill, oil in the river water had all but disappeared and water suppliers were operating as usual, but there were tons of oil-stained sediments and thousands of dead birds and fish.

Of the almost one million gallons of oil spilled, about half remains unaccounted for and is presumed lost in the environment. Studies have been initiated to define the extent of long-term damage but their conclusions may be months or years away. Fish and wildlife experts believe the oil spill will set back the full recovery of the Monongahela basin ecology by a number of years. No accurate estimate of the monetary cost of the spill and subsequent emergency activities has been made. The cause of the tank collapse, which made its solid steel tear like tin foil, is still being investigated.

But what we do know is that the character of the people who fought and lived through the spill is made of stronger stuff. □

(Germann is Superfund Community Relations Coordinator, EPA Region 3.)

Environmental Almanac: A Tale of a Big Red Oak

by Dennis W. Brezina

Flowers are Lovely; Love is flower-like;
Friendship is a sheltering tree.
—From Youth and Age, Samuel Taylor Coleridge

Imagine my surprise. In the middle of a meeting I was summoned to the phone to hear my wife's breathless story. "I was looking at the huge red oak out the window," she said, "and all of a sudden it crashed to the ground, shaking the whole house." Thankfully, she was safe since the tree had fallen away from the house.

Driving home, I thought about the mess a fallen oak tree must have made in the formal gardens. The tree had loomed somewhat menacingly over the south slope just beyond the kitchen, its large trunk bending down the hillside away from the house at a precarious angle—putting immense pressure on its aged roots. High winds from an unusually fierce summer thunderstorm that afternoon toppled the majestic oak onto an as-yet unplanted part of the gardens.

Years before, when clearing away the dense thicket covering the long-neglected flower gardens, I had contemplated having the leaning oak removed. Loggers came to cut down a dozen large hardwoods on the edge of the woods by our early 19th-century manor house in Southern Maryland. However, I decided not to touch the cluster of big trees around the house. They had important jobs to do: give a dignified atmosphere to the restored manor, charm our bed and breakfast guests, and oversee the replanting of the gardens.

Now the plan was altered. What was I to do about a tree half the length of a football field, five feet in diameter at its base, that was draped over the hillside? One bed and breakfast guest teasingly suggested that I hollow out the trunk into another bedroom.

Southern Red Oak. P. Freeman Helm photo. U.S. Forest Service.

At first I was inclined to have the monster carted off. The intimidating presence of the towering tree was still very much on my mind. I continued to perceive it upright as the rigid tyrannosaurus from which I had not been able to divert my eyes, particularly when I passed near the window of the family room upstairs. So why not get it out of sight altogether, now that it had fallen?

Suprisingly, my feelings toward the red oak began to change. As I worked in proximity to the tree, a kind of bond developed. After clearing away the smaller limbs and branches, a half-hour task each day for almost two months, I decided to leave it on the ground as a centerpiece for that part of the gardens. After all, the mighty oak had borne witness to the colorful history of our home and farm which dated back to pre-Civil War days. Now, as a friend, it deserved to stay.

By my calculations, this old friend went back about 125 years. (I counted about 100 annual growth rings on the lowest large limb, which was 75 feet from the rotted base, suggesting that the tree could have been 25 years old before sprouting that limb.) As a sapling, the oak had undoubtedly heard Colonel Sprigg Harwood, a state legislator and first owner of our home, champion the cause of the South during the Civil War.

When the tree fell, Coleridge's sentiment rang in my ears as I cleared away the brush. Stripping down a tree might not seem like a friendly gesture. But as I worked I knew, and I think the tree did too, that I was tailoring it for a permanent role in the yard. Of course, it had to stay. Flowers could be planted in beautiful patterns around the huge trunk, once I completed sawing the medium-sized limbs and splitting them

into firewood. How impatient I was to finish this task, little realizing that it would take more than a year with my one-man Japanese cross-cut saw, sledge hammer, and wedge.

By fall, the tree's friendship helped draw me even closer to the natural world nearby. I witnessed the early signs of autumn with rapt enthusiasm. More welcome than ever were the grackles, doves, and robins flocking together in response to the shorter days. No less a thrill was watching the ruby-throated hummingbirds pirouetting among the end-of-summer flowers before taking their airborne ballet southward. The mornings were cooler, the days brighter. The processes of nature started to slow. And slow was beautiful. Indeed, it was so.

Fierce snowstorms buffeted the tree, now in its prone position, draping it and the surrounding slope in thick blankets of white. I celebrated nature's profound stillness, so typical of that time of year. Juncos, white-throats, cardinals, and carolina wrens flitted here and there to seek food in the grasses poking out of the nooks and crannies around the tree. No question, the fallen tree had a purpose. It was here for the duration.

So was our friendship. My affection deepened as I grew to depend on the tree for more than the enjoyment of the wildlife and flowers that gathered around it. For instance, I could jest about this friendship with others, saying that I was developing an intimate relationship with an old friend and my wife seemed not to mind. In addition, the oak shielded the harsh north winds while I gratefully sunned myself now and then during February and March—an inexpensive alternative to vacationing in Florida. One day, when the snows had melted, I climbed onto the trunk, carefully, or so I thought, walking up and down to survey my domain. My slippers did not grip the bark firmly and I slid off the side, tumbling head first into a crevice between the trunk and another branch. Miraculously, I was unhurt. Maybe this was the tree's way of teaching me a lesson. Watch your step in life, it seemed to say in a friendly, caring way.

As a tribute to the red oak's friendship and its centering effect on the gardens—most especially at iris time when those bearded beauties bloomed in breathtaking profusion around the trunk—I gave it an official name. Two laquered plaques—slices of one of its limbs with the title burned into the wood—hang from either side of the trunk near the base. The tree is now known as the "Fallen Oak Shopping Mall." The other oaks, not to mention the beeches and hickories nearby, are green with envy—well, at least for six months of the year. □

(Brezina is a free-lance writer and nature observer from Harwood, Maryland.)

Appointments

Robert H. Wayland III has been appointed as Deputy Assistant Administrator of the Office of Policy, Planning, and Evaluation (OPPE).

Wayland has held a number of vital positions since joining the Agency in

1974 as a Congressional Liaison Officer. He was a Special Assistant to Administrator Lee M. Thomas and Deputy Administrator A. James Barnes. He was Director of the Policy and External Staff in the Office of Solid Waste and Emergency Response Policy and a program analyst in the Office of Enforcement.

Prior to joining the Agency, Wayland held staff positions in the U.S. Senate and House of Representatives and was Assistant to the General Manager at the National Transportation Safety Board.

Wayland received his bachelor's degree from George Washington University.

Donald G. Barnes has been appointed as the Director of the Science Advisory Board (SAB).

Barnes has served as Science Advisor to the EPA Assistant Administrator for the Office of Pesticides and Toxic Substances since 1979. From 1968 to 1979, Barnes was an Associate Professor of chemistry and physics at St. Andrews Presbyterian College in Laurinburg, North Carolina.

At EPA, Barnes has chaired the Chlorinated Dioxin Work Group for seven years; been a consultant to the World Health Organization; chaired

a group of scientists working under the North Atlantic Treaty Organization; and served as a member for eight years on the White House inter-agency work group on Agent Orange.

Barnes received a bachelor's degree in chemistry from the College of Wooster and his doctorate in physical chemistry from Florida State University. He won the EPA Gold Medal in 1984 for leadership in dioxin issues.

EPA's Assistant Administrator for Water, **Lawrence J. Jensen**, will be EPA's Acting General Counsel.

Jensen has been with the Agency since 1985, serving in the Office of Water. Before joining the Agency he served as an Associate Solicitor for Energy and Resources at the U.S. Department of the Interior. Prior to that, he served as the department's Associate Solicitor for Indian Affairs, and was a trial lawyer in the Civil Division of the U.S. Department of Justice. Before coming to Washington, Jensen was an associate with the law firm of

Jones, Waldo, Holbrook, and McDonough in Salt Lake City, Utah.

Jensen received his bachelor's degree in History from the University of Utah, and earned his law degree from the J. Reuben Clark Law School at Brigham Young University.

Rebecca W. Hanmer, currently Deputy Assistant Administrator for Water, will become Acting Assistant Administrator for Water.

Hanmer has performed in many capacities since she joined the Agency in 1970. She began her career at the Agency in the Office of Federal Activities and became the Director of that office. She has served in Region 1 as Deputy Regional Administrator and also in Region 4 as Regional Administrator. Upon returning to headquarters, she became a Special Assistant to the Administrator. Hanmer has served as Acting Administrator for Water previously, and as Director, Office of Water Enforcement and Permits.

Hanmer received her bachelor's degree from the College of William and Mary and her master's degree from The American University. She has also received many awards at the Agency.

Karen V. Brown has been named EPA's Asbestos Ombudsman. She will focus on asbestos-in-schools issues, questions, and complaints. Brown and her staff will meet with affected organizations and others to explain and interpret the new school regulations under the Asbestos Hazards Emergency Response Act (AHERA) and will handle any questions or problems they may have.

This position as ombudsman is not unfamiliar to Brown; she also serves as Small Business Ombudsman for EPA's Office of Small and Disadvantaged Business Utilization. She has been with EPA since 1981, where she has held management positions in the offices of the Administrator, Deputy Administrator, and Assistant Administrator for Solid Waste and Emergency Response.

Prior to joining EPA, Brown was a chemist and environmental specialist with the District of Columbia's Environmental Health Administration and with two business firms.

Brown received her bachelor's degree in biology from the University of the District of Columbia.

Don Clay, who has served for two years as Deputy Assistant Administrator for the Office of Air and Radiation (OAR), recently became its Acting Assistant Administrator.

Clay has served as Director of the Office of Toxic

Substances and as Acting Assistant Administrator for Pesticides and Toxic Substances. Prior to joining the Agency he held management, planning, and engineering posts at the Consumer Product Safety Commission and served as Deputy Assistant Commissioner for Planning and Evaluation at the Food and Drug Administration.

Clay received both his bachelor's and master's degrees in Chemical Engineering from Ohio State University.

Eileen Claussen, who has served as Director of the Office of Program Development in OAR, has become Acting Deputy Assistant Administrator in that office.

Claussen has served as a consultant with Booz, Allen, and Hamilton, Inc., and with the Boise Cascade Corp. She started her EPA career in the Office of Solid Waste (OSW) in 1972, where she served in several positions. She became Director of the OSW Characterization and Assessment Division in 1984 and stayed in that position until 1987.

Claussen received her bachelor's degree from George Washington University and her master's degree from the University of Virginia. She has received an EPA award every year since 1973.

David L. Dull will take over for Claussen as Acting Director of the Office of Program Development in OAR.

Dull has served in many positions at the Agency, including Staff Attorney for Water and Hazardous Materials Branch in Region 5; Chief Attorney-Advisor for Notice Review Branch, Office of Toxic Substances (OTS); OTS Branch Chief; and Deputy Director of the OTS Chemical Control Division. Dull also served in several positions before joining the Agency. He has worked as an Assistant Professor at three major U.S. universities, as a law clerk with the Detroit Edison Co., and as a Maitre de Conferences in Montpellier, France.

Dull received his bachelor's degree in chemistry from Pennsylvania State University, his Ph.D in chemistry from Stanford University, and his J.D. from Wayne State University Law School. □

A tractor pulls plows through the previous year's stubble to prepare for a new crop. USDA photo.

Back cover: Gully erosion on a wheat farm in Oregon. Cropland erosion—with its environmental and economic consequences—becomes increasingly a problem when marginal lands are brought into production during agricultural "boom" times. Photo by Cooperative Extension Services, University of Idaho and Washington State University.