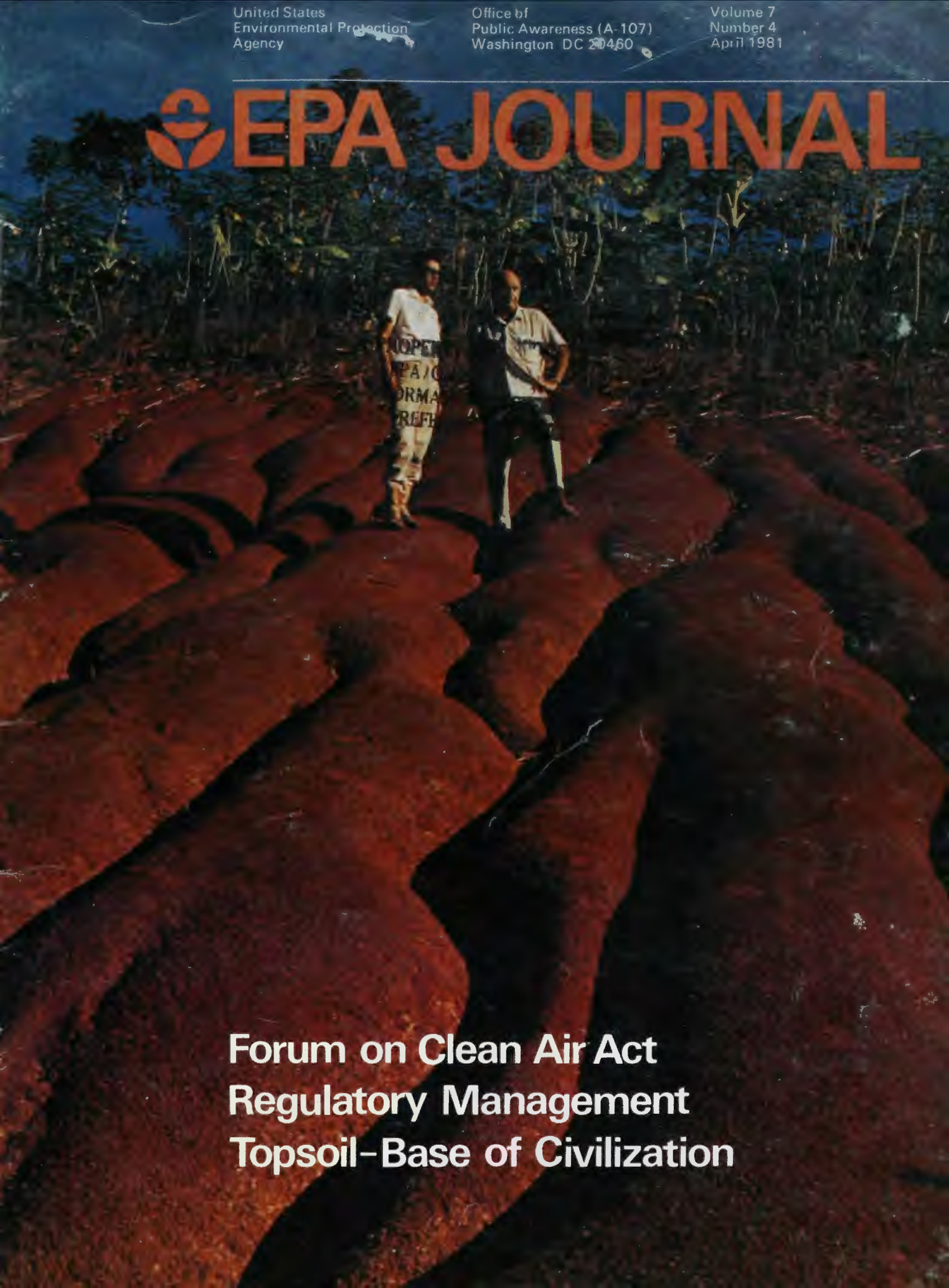


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EPA JOURNAL



**Forum on Clean Air Act
Regulatory Management
Topsoil—Base of Civilization**



EPA JOURNAL

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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 focused on air and water quality, solid waste management and the control of toxic substances, pesticides, noise and radiation, 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.

Articles

President Sets Rules for Rulemakers 2

President Reagan has signed an order to minimize the creation of new regulations by EPA and other agencies, and to improve regulatory management.

Forum on the Clean Air Act 4

Representatives of a major auto company and an environmental group offer their views on this important legislation.

A Free Enterprise Approach to Air Pollution Control 8

Trading pollution control credits is fast becoming a multi-million-dollar activity.

Eroding the Base of Civilization 10

Lester Brown explains the links between topsoil, erosion, crops and population.

EPA's Soil Research at Corvallis 12

Scientists are investigating the ways that pollutants are carried through soils and sediments.

Alaska's 20 Million Virgin Acres 14

Aided by environmental studies, Alaska is opening up vast areas to farm production.

Our Vanishing Tropical Forests 16

Former EPA Administrator Russell E. Train describes the devastation of a biological treasure.

Why Our Topsoil Is Precious 18

An interview with Norman A. Berg, Chief, U.S. Soil Conservation Service.

Louisville Explosions 24

Sewer explosions in Louisville, Ky. are a warning to other cities of the dangers from toxic material.

The Global Importance of American Cropland 26

A State Department specialist explains how our food exports and foreign policy are intertwined.

A Helping Hand for Indonesia 29

How EPA is aiding a nation faced with serious environmental problems.

Protecting America's Farmland 32

The National Agricultural Lands Study warns that much prime farmland is being paved over for other uses.

Clean Water and Energy from Hyacinths 34

With advice from EPA scientists, Japan is using water plants in unusual ways.

Departments

Around the Nation 30 Update 36

Almanac 38 News Briefs 39

From cover: AID agrarian specialist and local official survey badly eroded clay farmland in Colombia, South America. The scene illustrates why concern is growing over world-wide loss of topsoil.

Photo credits: Carl Purcell, AID; Peyton Johnson, FAO; USDA—Soil Conservation Service; "Valley Turbulence" (p. 10) © 1978

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Opposite: Contour strip cropping on a farm near Kasson, Minn.

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President Sets Rules for Rulemakers

"As a first step in implementing the President's order, we are in the process of reviewing some noise and air proposals to determine their soundness. These proposals deal with the noise from trash compactors and particulate emissions from industrial complexes."

The President's order:

—Requires Executive Branch agencies to identify "major rules" that have been issued or are under consideration, defining these as regulations likely to impose annual costs of \$100 million or more on business or consumers, or lead to "major increases" in consumer prices or industry costs, or have a significant impact on U.S. firms in competition with foreign entities.

Every major rule must be accompanied by a "Regulatory Impact Analysis" identifying the potential costs and benefits of the rule and a description of alternative approaches that could "achieve the same regu-

The Administration plans to rescind such regulations, new and old, aides said. Some proposed regulations can be changed dramatically by direct action, while a revision of existing ones would require agencies to reopen lengthy rule-making hearings in many cases, aides said.

In general, the President's order directs regulators to issue no rule unless the potential benefits to society from the regulation outweigh the potential costs to society.

Regulators also are directed to set up priorities for action in order to achieve the maximum benefit for society, "taking into account the condition of the particular industries affected by regulations" and "the condition of the national economy."

This language builds into government policy the concept that industry—and thus society—has only a limited amount of money to spend on regulation

ministration would create more jobs by reducing regulation.

Both the Regulatory Task Force under Bush and the Office of Management and Budget under Stockman can designate regulations as major rules, making them subject to the new requirements if agencies fail to do so. Each also can require agencies to consider more evidence and information in reaching final rulemaking decisions.

OMB and the task force also are directed to work with Congress in proposing new legislation to reform the regulatory process.

According to Bush, the Administration hopes to reach a consensus with members of Congress who have been pushing for regulatory change since the mid-1970's. Legislation is needed, he said, to assure a change in direction for the independent agencies, but the President also intends to fill vacancies in these agencies with people who share the Administration's determination to reduce regulation, Bush added.

Neither Bush nor his aides would identify a full list of major regulations they have in their sights, although several were mentioned by James C. Miller, executive director of the task force. He cited Department of Transportation rules that specify how transit agencies must make buses and subways accessible to the handicapped, and proposed EPA regulations governing excessive noise.

In separate actions, the President revoked the temperature control regulations established by former President Carter to conserve energy and rescinded another executive order that would have sharply limited the export of hazardous products that are banned or restricted from use in the United States.

In striking the restrictions on exports of hazardous products, the President directed the Departments of State and Commerce to find ways to accomplish the same goals at a lower cost. The Carter Administration's order required exporters to obtain special licenses for products that had been labeled "extremely hazardous" after a review by government regulators. □

President Reagan recently signed an order setting strict new rules for regulators in the Cabinet departments and agencies, directing them to issue regulations only when essential and to follow the least costly approach.

The regulatory rules issued by the President create a lever that his Administration intends to use to "get government off the back" of the American people. EPA will be among the agencies affected by the new rules.

The authority to monitor and enforce the new regulatory approach is given to the Administration Task Force on Regulatory Relief, headed by Vice President George Bush, and the Office of Management and Budget under its director, David A. Stockman.

In commenting on the President's order, EPA Acting Administrator Walter C. Barber said the action "will provide government with a more uniform and consistent means of assessing our regulatory needs."

"The new order will mean fewer but better rules. It means that we will take a harder look at our regulatory needs before we regulate. It also gives the Office of Management and Budget an appropriate role in reviewing new regulations government-wide. It provides us with a clear policy directive."

"This is not a radical departure from our past rulemaking procedures. But it does and should result in a more orderly, cost-effective approach that should benefit all segments of our society."



President Ronald Reagan

latory goal at lower cost."

—Extends the 60-day regulatory freeze ordered by Reagan Jan. 29 by directing that major new rules that have been approved by Executive Branch agencies but have not taken effect must be postponed until the regulatory analysis is completed.

There are exceptions to this requirement exempting, for example, regulations issued under a legislated or court-ordered timetable or issued in response to an "emergency" situation.

—Requires agencies to review existing major rules to pinpoint any that do not follow the least costly regulatory approach or duplicate other regulations.



Vice President George Bush

and that rulemakers not only must find the least costly approach but also issue regulations that promise to achieve the greatest benefits, setting aside others that have a lesser impact.

Vice President Bush said the executive order creates the bureaucratic machinery "to make things happen. . . . There has been too much regulatory action which is adversely affecting our productivity in this country."

"It's gone to an extreme, and we're seeking a balance," he added, promising that the Ad-

Should the Clean A

One of the healthy characteristics of democracy is full dialogue about the many options we possess as a society. As Congress plans a review this year of the Clean Air Act, it is useful to consider divergent points of view.

Needed: A More Balanced Approach

By Howard H. Kehrl
Vice Chairman, General Motors Corp.

Yes, the Clean Air Act does need to be changed—but to improve its operation, not to abandon the national commitment to air quality.

There is no question that the legislation has been instrumental in helping reduce man-made pollution over the past decade, and by nearly every measure, air quality is improving or staying about the same despite continued robust growth in the country. Neither is there any question that continued Federal programs are necessary to maintain air quality where it is acceptable and achieve it in those few instances where it still is not.

But after 10 years experience with the Clean Air Act, the country ought to be able to make its air pollution control efforts simpler, less costly, more efficient and in better balance with other high priority national goals. These include reducing inflation, restoring economic growth and the creation of jobs, the production and conservation of energy, and improving productivity so that U.S. industry can compete against its global competition.

These new concerns have taken on critical importance since the Act was written and last revised. It's true, of course, that these goals can compete—and some-

times even conflict—with efforts to control air pollution to exceedingly low levels. But there is no question that a more balanced approach is required. Some of the Nation's pressing problems either have been caused or exacerbated by regulatory or legislative efforts designed to pursue a specific goal with a single-minded intensity that precludes any recognition of other important national objectives.

As for the Clean Air Act and its impact on our industry, a few of the changes we would like to see would require some revision of the Act itself. But many of them can be accomplished by administrative action. Therefore, a great deal of the balance that is needed can be provided at the discretion of the EPA Administrator. This is true of both stationary and mobile changes that we think are necessary and appropriate.

Of course, when it comes to vehicular pollution, more progress has been made than in any other area. The industry is meeting the very tight standards for the 1981 model year which Congress wrote into the Clean Air Act, reducing hydrocarbons and carbon monoxide 96% and oxides of nitrogen 76% compared to an uncontrolled car. Even though the industry has developed the technology required to achieve these reductions, we believe the auto standards ought to be reassessed and based on what is needed to achieve the national air quality standards for the least cost. This clearly is not possible as long as auto exhaust numbers are written into law while national air quality standards can be set or changed administratively by the EPA. While we do not challenge Congress' authority to establish exhaust rules by law, the practice raises doubts that the Nation is really getting the most effective pollution control for the money that is spent, or that the mandated levels of control are necessary to achieve air quality goals. If, for example, it costs a dollar a ton to control a

particular pollutant from automobiles and two dollars a ton to control it from stationary sources to help meet the national air quality standards, then the automobile is the logical source to control. But if the cost is reversed, additional controls on stationary sources are appropriate.

Aside from this continuing concern that cost effectiveness considerations be applied equally to mobile and stationary control efforts, General Motors ultimately would like to see the adoption of a control program for mobile source emissions similar to the approach already being used to reduce stationary source pollution. It would:

- Introduce the idea of the "mobile bubble" to vehicular emission control. It is the total emissions that impact air quality—either nationally or in any specific location; any single vehicle's contribution is unimportant. Allowed to compute their emissions the way they do fuel economy, manufacturers would have increased flexibility to reduce automotive air pollution in a more cost effective way. The "bubble" concept to control stationary source pollutants already has found acceptance in both industry and government.
- Avoid the unnecessary expense and redundancy in the levels of compliance enforcement, such as simultaneous programs covering certification, production line tests, in-use surveillance, and in-plant audits. Adopting the "mobile bubble" idea and in-use compliance in the future would require manufacturers to accept basic responsibility for designing, developing and producing a fleet of vehicles that stays within the limits of compliance for the period required by law. We recognize, of course, that a method of determining

Can the Act Be Changed?

In this forum, we present the viewpoints of
Howard W. Callaway, Chairman, General Motors Corp., and those of Richard
E. Ayres, Director, Project for Clean Air, Natural Resources Defense Council's Project for Clean Air.

A Record of Accomplishment

By Richard E. Ayres

Director, Project for Clean Air,
Natural Resources Defense Council

The implied topic of this forum is how the Clean Air Act should be redone in 1981. I would hope the implication in the word "redone"—that what exists should be torn up root and branch—does not represent the views of most people today. And I would ask you to consider what the Act has—and hasn't—achieved before you subscribe to the idea that it should be "redone."

For I think a great deal has been accomplished by this law to address a problem that afflicts all of us—rich or poor, environmentalist or businessman, Republican or Democrat. Because of the Clean Air Act, we have made real progress towards cleaner air. To be sure, much remains undone, but progress—real and tangible—has been made under this law. At a time when it is fashionable to question the accomplishments of government programs, that is an important point.

The Clean Air Act has substantially reduced national emissions of several of the regulated pollutants, and curtailed the rate of increase of others. Without it, our Nation's air quality would have continued

to decline as our economy grew, and as we moved towards greater use of dirtier fuels. Minimum Federal health standards for particulate matter and ozone remain unmet in most urban areas, but the quality of the air now meets these standards for most of the other regulated pollutants. This is not to suggest that all is well. Important pollutants, such as acid rain, fine particulates, and many toxic air pollutants remain largely unregulated. But it does mean substantial success in the areas where the law has concentrated.

The Clean Air Act has also stimulated rapid innovation in pollution control technology. When the 1970 law was passed, the catalytic converter was still a mote in an engineer's eye. Now half the auto fleet has catalysts that capture 70-90 percent of hydrocarbons and carbon monoxides. Ten years after the 1970 Clean Air Act, the auto companies are installing a second generation of catalysts, controlled by sophisticated electronic gear, that cut emissions of all three major pollutants. Indeed, by forcing the development of electronic controls, the Clean Air Act has helped achieve the rapid increase in fuel economy we need to solve our energy problems.

The Clean Air Act is also largely responsible for the rapid development of control technologies for sulfur oxides and particulates from industrial operations. In ten years, the first generation of scrubbers has been commercialized, and we have entered a second generation of dry scrubbing. Electrostatic precipitators have become far more effective. And a new generation of baghouses has been developed, suitable for capturing fine particulates from even utility boilers.

These developments, and others like them in other industries, contribute more than cleaner air. They help us reach our goal of economic growth, by making industrial growth compatible with keeping the air clean. They also help us reach our

energy goals, by allowing us to shift away from oil without jeopardizing public health and the environment. Had these technologies not been developed, you in industry would face far greater controversy than you now do.

To point to these accomplishments is not to suggest that the job is done. Far from it. Progress towards clean air in industries such as steel and copper remains disappointing. And far more electric power plants have installed tall stacks than pollution control equipment.

I think we must also consider what the Clean Air Act has *not* done. Over the past ten years, I have seen the Clean Air Act blamed for nearly every evil that has befallen America. If you believed some of the critics, you would think this law was almost single-handedly responsible for the Nation's energy problems and its economic woes. Common sense alone should tell us how implausible some of these claims are, but let's take a closer look at them.

Take energy. It is often asserted that we must choose between our energy goals and having clean air, as if the two were mutually exclusive.

I say there is no such unavoidable conflict. We do not have to choose between these two goals, and I think it is time to stop talking as if we do.

Let us think a bit carefully about this. What do we mean when we talk about our "energy goals?" I think there are two: one, to meet the demand for energy to maintain our standard of living; and, two, to minimize our dependence on foreign oil. As I see it, the Clean Air Act jeopardizes neither.

In the first place, the last few years have taught us forcefully that there is no fixed relationship between the amount of energy

compliance still would be required, and believe it should be as cost-effective as possible. In fact, the "bubble" concept might even be expanded to recognize the exchange, purchase, or sale of "offsets" as an alternative to recalls for noncompliance. If adopted, this idea would recognize for the first time the benefits of emissions control performance better than the standards require. Manufacturers also would warrant emission control equipment against defects in materials or workmanship and take remedial action to correct noncompliance for a model year's production when required.

- Assure adequate lead-time before new exhaust rules became effective and give a set of standards sufficient time to see how they're working before more stringent ones are adopted. In each case, the minimum time should be three years. Year-to-year changes in the exhaust emission standards are extremely costly for the small, incremental reductions in vehicular pollution that they achieve. Continued changes in the standards also make it difficult to optimize control systems for fuel economy, cost and overall vehicle performance. Given more time for development and testing, manufacturers should produce control systems which perform better in the field—again, where it really counts.

At a very minimum, Congress should look at several essential items this year, including primarily a re-examination of the automotive standards for carbon monoxide and nitrogen oxides. As for hydrocarbons, the current level of control may be necessary to achieve the very stringent national air quality standard for ozone, although meteorological variances may be obscuring just how much progress has been made toward meeting it. A more realistic standard for ozone would allow five exceedences per year, which is more consistent with the degree of error characteristic of measuring accuracy of the monitoring systems and instruments.

However, ambient levels of carbon monoxide are clearly declining about 7 percent per year, faster than originally expected. It's significant, we think, that carbon monoxide is the only criteria pollutant to which automobiles are the pre-dominant contributor. Given the reductions already measured, the relaxation of the present 3.4 gram/mile (g/m) standard to 7 g/m (the 1980 Federal Standard) probably would bring all cities into compliance around the end of the decade.

While there is no clear trend evident in ambient nitrogen oxide levels, only two cities outside California exceed the strict ambient standard at present. The cars now contributing to such emissions typically emit an average of about 3 g/m of this pollutant, so returning the 1981 standard of 1.0 g/m to the 1980 standard of 2.0 g/m would ensure a continued reduction in automotive nitrogen oxides. It also should assure compliance with the national air quality standards essentially everywhere except in the Los Angeles basin and will permit the application of more cost-effective technology, continued production of fuel-efficient diesel engines, and potentially greater mileage on all cars.

Changing those two requirements slightly would also reduce U.S. imports of the costly precious metals required for catalysts, which are available only in adequate quantities from South Africa and the Soviet Union.

Finally these changes—which will have little effect on air quality—hold out promise of a significant cost savings for new car customers in the future. It cost nearly \$500 per car to put GM's Computer Command Control system on 1981 gasoline models. The use of such electronic engine controls has other benefits besides reducing emissions, and in many cases, we expect electronics would still be used even if the carbon monoxide and nitrogen oxides standards are revised. But with these slight revisions, as much as half of the cost of Computer Command Control could be saved.

When it comes to stationary source emissions, one of the principal priorities should be to simplify and streamline the permit approval procedures which add uncertainty, cost and time to the construction of new or remodeled plants. Just as with automobiles, the best way to reduce stationary source pollution is to replace older factories with new ones which incorporate modern control technology. The Clean Air Act, especially the Prevention of Significant Deterioration concept which was added in the 1977 amendments, can discourage and delay construction of modern facilities. This concept should be eliminated except in those wilderness or scenic areas where it is important to preserve long-distance visibility. We do not believe, for instance, that powerplant plumes should mar the view in places like the Grand Canyon in Arizona, Isle Royale in Michigan, or Mount Desert Island in Maine. But Prevention of Significant Deterioration, with the uncertainty of case-by-case reviews dictated by the Best Available Control Technology requirement—or the use of the Lowest Achievable Emissions Rate in nonattainment areas—

imposes serious delays in new plant construction. The same is true of the extensive preconstruction monitoring and atmospheric modeling frequently required for new permits. Air quality can be maintained or improved through use of New Source Performance Standards while avoiding the delays and cost inherent in existing Prevention of Significant Deterioration. Similarly, in areas meeting the national air quality standards, simply requiring compliance with New Source Performance Standards would do the job more efficiently.

At GM, we believe these changes will not only meet air quality goals, but do so in a more efficient way. □

A Record of Accomplishment

Continued from page 5

we use and gross national product. We can use energy profligately or efficiently. How much we use to produce any given product is determined by its price, operating through the market. When the price rises, we substitute other factors of production for energy—insulation for heating oil, fuel-efficient cars for gas guzzlers, efficient electric motors for inefficient ones, and so on.

Now when government requires energy facilities to install pollution control equipment, it does increase, to some extent, the price of energy. That price increase will affect the demand for energy in a marginal way. But unless the market system breaks down entirely, energy supply and energy demand—or "need"—will balance. In other words, requiring pollution control will *shift the market* for energy. But it is a long and quite misleading step from that true statement to the claim that pollution control will deprive the Nation of needed energy.

Some people suggest that by slowing the construction of coal-fired power plants, the Clean Air Act interferes with meeting our goal of lessening dependence on foreign oil. I don't think this claim holds up either. Let's face it. The major reason for the slower rate of power plant construction in the past few years is lack of demand—or put more positively, people are conserving energy. Coal-fired power plants are being built where the demand exists, but practically none of those are in places where they displace oil-fired capacity. Some of those plants are cleaner because of the Clean Air Act—but EPA has a virtually unblemished record for issuing permits to them.

Finally, some people say the Clean Air Act is preventing the conversion of oil-fired boilers to coal. As to industrial boilers, preliminary analysis, done by the Kennedy

School at Harvard, suggests that environmental controls have not been a major factor impeding conversion.

As to utility boilers, I think there are two factors far more important than the Clean Air Act for the utilities' reluctance to convert to coal. First, until the massive increases in the price of oil in 1979, the difference in cost between oil and coal had not become so large as to be politically embarrassing to pass through to customers through the fuel adjustment clauses. Second, many of the oil-fired plants are simply too old and operate too little to be economical candidates for conversion, even at today's oil prices.

To be sure, there have been continuing and acrimonious disagreements over what pollution controls should be installed on converting power plants. These arguments may have marginally affected the overall rate of utility conversion. But with oil now four times as expensive as coal, the economics strongly favor conversion even under the strictest clean air requirements. And I would hasten to add that neither the Clean Air Act nor the States are now mandating such controls.

What about the Clean Air Act and the economy? Has the law slowed economic growth, cost jobs, or hurt our foreign trade? Once again, I think the answer is "no."

With few exceptions, studies of the Clean Air Act's impact on economic growth and jobs support the common sense idea that new investments for pollution control have more than balanced the impact on regulated industries. In the past five years, they tell us, Gross National Product was probably higher because of investments in pollution control. And for every job lost because of pollution control, ten to twenty have been created.

In recent months the Nation has begun to look more closely at our competitiveness with other industrial nations, and some people have suggested that if the Clean Air Act were weakened, we could strengthen our position. But unless we chose to discriminate against the products of other countries, that hypothesis seems hard to defend. For after all, foreign auto makers must meet the same standards as domestic car companies. And our main competitors in steel already meet pollution control requirements stiffer than ours.

Pollsters often ask the public whether they would be willing to sacrifice air quality in order to have enough energy, or higher economic growth. And they seem surprised at how many people say they prefer clean air. I'm not, because I think people are answering a different question—one that I have never been asked. I think the people understand the issue better than the pollsters (and many politicians). I think they know they don't have to make that choice—that we do not need to sacrifice healthy

air for a healthy economy and a better energy situation. In other words, I think the people know what the Clean Air Act has done—and what it hasn't done—and they want to keep it strong.

Nevertheless, it has become fashionable here in Washington to be for clean air, but not for the Clean Air Act. Many calls are heard now for a more "balanced" Clean Air Act, or for one with less "red tape" and regulation.

Efficiency is a goal everyone can support. Attacking "red tape" is one of the oldest crusades in this city. Like the original crusades, it has provided a holy banner for all manner of less holy objectives, too. To convince the skeptics that those who call for more efficiency are really concerned about *how* we go about achieving cleaner air, rather than *whether* we go about it, the opponents of red tape are going to have to come forward with constructive alternatives to accomplish the same goals.

For if one agrees that the market, by itself, does not provide incentives for cleaner air, then it seems to me one must propose some system of government regulation to protect public health and the environment. And that regulation must inevitably affect, steer, and to some extent control the conduct of business in ways that business may find objectionable.

There are only so many ways the government can influence business decisions. The present Clean Air Act uses national air quality standards as a benchmark, and specific technology standards to spur innovation in pollution control. Some people have proposed using emission fees, or similar measures more akin to the private market. And of course, government can give subsidies, directly or through the tax system, to encourage pollution control. If you believe in the need for government intervention, you must pick among these, not just criticize the one we have.

For example, I have heard many in industry argue for more flexibility in regulation, to minimize the cost of achieving less pollution. There is much to be said for ideas like the "bubble." But while the bubble lowers the cost for industry, it increases the cost of government, by complicating the problem of making sure the requirements are met. Unless industry recognizes this, and supports higher permitting fees or other means to raise the needed funds, the public may be tempted to see less protection for public health, rather than more efficiency, as the outcome of embracing the flexibility of the bubble.

Similarly, the call for "balance" must not be used as a euphemism for emasculating. There is room for debate over many of the regulatory specifics of the Clean Air Act, but some basics are not debatable under the rubric of "balance."

We cannot, for example, balance the cost of attaining health standards against the evidence of health effects when we establish National Air Quality Standards. As the courts have recognized, the Clean Air Act provides a multitude of means to balance cost against the achievement of the standards through decisions about control strategies, attainment dates, and other matters. But if we alloy health with the base metal of economics when we set the health standards themselves, we will have destroyed the standards as devices to let people know whether the air they breathe is healthy. A decision to trade public health for economic goods is not a technical matter, to be decided by cost-benefit bureaucrats. It should be publicly visible, and it can be only if we continue to set our health standards as health standards.

We must recognize the importance of the Federal role in air pollution control. Where there is unproductive duplication, let us eliminate it. But let us not forget that the most effective parts of the Clean Air Act are those where the Federal government takes the largest part. The role of the Federal government in air pollution control has grown for good reason, as we learned painfully in the 1950's and 1960's, when the States proved unequal to the task of controlling national and multinational corporations.

We cannot propose abandoning the air quality increment system in Prevention of Significant Deterioration areas without proposing a workable alternative method of protecting air quality from deteriorating in these areas—the large majority of all the country's air resources. We cannot accept the idea that even rural areas be allowed air quality at the levels tolerated in major industrial cities.

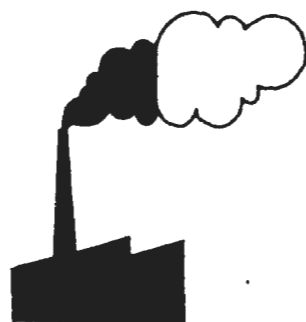
Nor can we propose to abandon the goal of minimally healthful air quality in our major urban areas by eliminating attainment deadlines, or eliminating the requirement to attain national standards. We cannot abandon the offset system unless we have an alternative to assure continued progress towards attainment. And we should not alter the air quality standards to disguise the fact that the air remains unhealthy.

And finally, if balance is the objective, there must be some moderation of the rhetoric that has been heard about the Clean Air Act. The idea that moderate adjustment, rather than wholesale change, is the goal rings hollow when this single law is blamed for energy crisis, economic stagnation, unemployment and other ills it did not and could not markedly affect, and when discussion begins from the unexamined premise that the law must be "redone."

I hope that these reflections will contribute to a more moderate and thoughtful approach to the coming debate. □

A Free Enterprise Approach to Air Pollution Control

By Dave Ryan



Firm A creates a surplus pollution reduction for \$100/ton.



Firm A receives a credit for the surplus pollution reduction.



New firm B buys the credit for \$150/ton.

All right, ladies and gentlemen, what am I bid for this beautiful 100-ton reduction in sulfur dioxide pollution from Electrifying Power Company? ... \$1 million! Do I hear \$1.5 million? ... Going once, going twice, going three times. Sold! To the man in the white hat from Wentworth Widgets."

This fanciful "auction" may seem strange to those locked into traditional ways of thinking about pollution control. But the Environmental Protection Agency hopes the idea it symbolizes will become what some observers have already called it—a "wave of the future" where free market trading of emission reductions supplements or replaces government rules, yielding more air cleanup at less cost.

Auctioning, as portrayed in this oversimplified example, is an outgrowth of a series of important EPA regulatory reforms called Controlled Trading. These reforms let companies meet air pollution laws by securing needed pollution reductions from other firms (or from other sources within their own facilities) which can produce them more cheaply. This lets industry increase its flexibility and sharply reduce compliance costs. Controlled Trading offers a rare opportunity to promote both economic growth and continued progress towards clean air, at a time of rising pollution control costs and shrinking resources.

Under the Controlled Trading umbrella are three main programs that reinforce one another in saving industry money while continuing to protect the environment: The Emission Offset Policy, the Bubble Policy, and Emission Reduction Banking.

The Emission Offset Policy applies to new plants and makes industrial growth compatible with air quality improvement in areas that haven't yet met Federal standards for healthy air.

Normally a new plant (or expansion of an existing one) wouldn't be allowed in an area where its pollution would intensify violations of national health standards. The Offset Policy, however, lets a new facility build (or an existing one expand) in these areas if it installs stringent pollution controls and gets an existing plant in the vicinity to cut its pollution by an amount

greater than the emissions the new facility will add. The bottom line of any emission offset transaction is that the air must be cleaner than before the new source arrived.

Since January 1977 nearly 40 States have adopted offset rules as their preferred means of promoting economic growth with progress towards clean air. There have been at least 1000 identified offset transactions, with new sources paying existing plants over \$1000 per ton for some particulate offsets. However, due to the difficulty of finding and securing sufficient offsets from existing sources acceptable to State air agencies, most offset transactions to date have been "internal"—within the same company—rather than between firms. EPA's Banking Policy (see below)—will substantially ease this difficulty by making "external" offsets much easier to obtain.

The Bubble Policy allows managers of existing factories to figure out the best way to clean up air pollution at individual plants, provided overall clean air requirements are met. In contrast to the traditional approach where government officials set uniform emission standards for each stack or vent in a factory, the Bubble Policy permits plant managers to propose their own emission standards—tightening them in places where it is least costly, and relaxing or even eliminating them where pollution control costs are high—so long as the plant's overall impact on air quality does not change.

As an example of the bubble concept in practice, suppose the owners of an auto painting shop decide it's more cost-effective to control smog-forming hydrocarbon pollution from grease removal rather than from painting operations. If State environmental officials and EPA approve, the owners could reduce or even eliminate pollution controls at the painting end in exchange for a compensating increase in controls at the degreasing process.

Multiplant bubble projects can also be used between two or more factories of the same or different companies in the same area.

The Bubble Policy was issued in December 1979. Over 70 plants around the coun-

try are actively developing applications with more than 20 approved by States or proposed for final approval by EPA. These bubbles average \$2 million each in annual cost savings with many producing energy gains and net reductions in emissions, too.

A number of recent measures by EPA to streamline the Bubble Policy could help American business save hundreds of millions of dollars more without adverse environmental effects, if New Jersey's experience is any guide. Last November, EPA proposed to approve a New Jersey rule which would let that State give final approval to individual bubble projects involving hydrocarbon emissions, without case-by-case Federal review. (In January EPA announced several additional streamlining steps extending this approach to other pollutants and giving firms more time to implement bubble projects.) By February 1, 1981, more than 30 New Jersey firms had submitted bubble applications even before that State's rule was approved, and State officials say they expect to approve more than 100 chemical plant bubble projects (representing at least \$200 million in estimated savings) in 1981.

Emission Reduction Banking strengthens both the Bubble Policy and the Offset Policy by allowing Controlled Trading to occur over a period of time (instead of only via simultaneous emission increases and decreases).

Under the Banking Policy, firms can cut pollution beyond what the law requires, and "bank" these extra reductions for their own future use under the Bubble Policy or for sale to other companies as emission offsets. This pollution credit "savings account" is not tied to any specific transaction, so a company can draw on the account any time it wants.

Some of the advantages of banking are:

- It will give firms considerable incentive to find pollution controls that produce extra reductions most efficiently.
- It will reduce the uncertainty and transaction costs which confront new plants trying to find, negotiate for, or finance sufficient offsets.

• It will produce the cheapest possible reductions by allowing firms to create them when replacing worn-out control equipment or meeting new requirements (instead of by expensive retrofits).

• It will expand opportunities for cost saving by facilitating trades between plants with widely varying control costs.

• It will create a ready pool of identified pollution reduction credits to help long-range community growth planning, and

• It could change industry's whole perception of which pollution controls are "feasible," by making extra reductions a valuable income-producing commodity instead of a "nonproductive" cost.

Three area-wide pollution banks with over 100 deposits are currently operating in San Francisco, Seattle, and Louisville, Kentucky. At least a dozen more areas will have banking systems operating within the year.

EPA is developing controlled guidance and model rules that States can quickly adopt to provide a firm legal basis for these systems, integrate them with the Bubble and Offset Policies, and provide business the incentive certainly needed for active markets in emission reduction credits.

This is where a concept called "brokering" comes in. EPA is promoting the idea of private sector brokers acting as environmental agents for companies, buying needed emission reduction credits from other firms and selling their clients' credits for profit. As banking and trading programs become established and grow, the demand will increase for brokers who can help companies avoid time-consuming searches for offsets and bubble partners by bringing buyers and sellers together, packaging deals, and handling all the necessary negotiations.

Generally speaking, the primary function performed by private trading brokers will be to bring together buyers and sellers, but they could also perform other essential functions, including:

• Appraising the market value of an emission reduction credit and the costs of producing it;

• Helping secure public or private financing for producing or purchasing a reduction;

• Counseling buyers and sellers about market conditions and trends;

• Performing engineering analyses to identify profitable reduction opportunities;

• Preparing financing, tax, and permit paperwork;

• Securing necessary permits;

• Supplying legal advice (in the case of licensed attorneys); and

• Helping States and localities set up Controlled Trading systems.

These roles could be—and in a significant number of cases, have already been—filled by lawyers, accountants, engineers, commodity brokers, environmental consultants, equipment manufacturers, industrial site packagers, and economic developers.

How much money can brokers expect to make?

"The profit potential for brokers in this field is vast and the competition virtually non-existent," says Mike Levin, Chief of EPA's Regulatory Reform Staff. "As pending bubble applications indicate, many of these transactions spell big money, often several million dollars or more. Assuming a five percent cut, that can mean a healthy commission for a broker."

To encourage brokers to enter this fascinating new field, Levin's staff held a national brokering conference which drew nearly 200 paying participants to Washington, D.C. on January 26 of this year. The conference laid out what brokers must know to successfully enter this high-growth field, and provided nuts-and-bolts information on the legal structures, tax implications, and market demand related to emission reduction credits, as well as case histories by successful brokers.

Because private trading is the most direct means of bringing together buyers and sellers, and because it requires minimal attention and resources from the public sector, it's the approach many communities are likely to adopt. The brokering function, however, need not be limited to agents on commission. In several cases public agencies and concerned organizations have actively arranged offsets for firms trying to move into their communities.

To help all types of brokers, EPA is encouraging selected areas to set up information clearinghouses so that those seeking reductions for offsets or bubbles can easily locate companies wanting to sell them. Whether these clearinghouses are operated by the local air agency, local economic development groups, or a consortium of entities, EPA sees them growing into commodity "banks" which quantify the amount of surplus emission reductions, maintain them in an accessible central registry, and promote regular sales.

As promising as brokering is, it's not the only way to trade pollution credits. Here are two alternatives:

• *Public Auction System.* A local organization administers the entire auction, putting credits up for sale and determining which firms are eligible to participate. Public auctions are open and avoid problems that may arise when potential buyers are excluded from the opportunity to purchase credits.

• *Central Trading Systems.* A single organization, called a central trading exchange, would be solely responsible in a specific area for buying credits from producing firms and reselling them to user companies. The association would negotiate purchase prices, set resale prices, and maintain a credit inventory. The central trading system is particularly useful in protecting small businesses, providing a stock of credits readily available to potential buyers, and offering a ready market for firms creating credits. It would also facilitate public price information to stimulate the voluntary creation of more emission reduction credits.

Whatever the approach used in carrying out EPA's Controlled Trading reforms, they all serve to correct a crucial weakness in America's current air pollution control programs: Industry now is given little incentive for innovation in pollution control equipment or pollution-reducing process changes. A company that installs traditional pollution controls can generally count on keeping enforcers off its back, regardless of the cost or effectiveness of the technology used. Yet a firm that develops more effective measures gets no reward for doing so. Worse yet, the innovative firm risks making itself a target for extra regulation, since it has shown it can do more. For most firms, it's simply not "profitable" to invest in innovative efforts to do more than the law requires. This point is critical, for in the long run only innovation can produce improved air quality at reduced—rather than increasing—costs.

Controlled Trading offers a way out of this technological trap. By making it in a businessman's own economic self-interest to secure as much air pollution reduction as possible, it puts the profit motive to work for the environment, in ways which use the special knowledge of control opportunities which only plant managers possess. □

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Persons seeking further details on Controlled Trading should write the Regulatory Reform Staff, Office of Planning and Management, PM-223, U.S. Environmental Protection Agency, Washington, D.C. 20460. Tel: (202) 287-0750.



A dust storm in California creates wave-like formations from topsoil.

Eroding the Base of Civilization

By Lester Brown

The loss of soil is in some ways the most serious of the threats civilization faces. Degraded biological systems can usually recover if given the opportunity, but an inch of topsoil through erosion may take nature centuries to replace. Alternatives to oil can be developed, but there are no feasible substitutes for soil in food production. Civilization existed long before the discovery of oil and may well survive the exhaustion of oil reserves, but it cannot long survive the continuing wholesale loss of topsoil.

Croplands are the foundation not only of agriculture but of civilization itself. Ever since the beginning of agriculture, the relationship between people and cropland has been critical. When people lack access to fertile land, they often go hungry. When soils are depleted and crops are poorly nourished, people are often undernourished as well. When soils deteriorate, so does the capacity to sustain life.

Since mid-century, pressures on the earth's croplands have mounted. Growing populations demand more land not only for

food production but for other purposes as well. Even as the need for cropland expands, more and more farmland is being put to nonagricultural uses. Worse, the most vulnerable soils are among the most pressured.

As the 1980's unfold, humanity faces a worldwide shortage of productive cropland, acute land hunger in many countries, and escalating prices for farmland almost everywhere. In a world with no excess agricultural capacity, the continuing loss of productive cropland anywhere drives food prices upward everywhere. For most people rising food prices are the most immediate, the most disastrous face of inflation, fueling political instability with desperation.

Expansion of Cropland

Historically, the expansion of cultivation has been closely tied to growth in human numbers. Responding to population pressures, farmers moved from valley to valley

and continent to continent, gradually extending the area under cultivation. Today, one-tenth of the earth's land surface is under the plow, and the promising settlement frontiers have all but vanished.

Over time, as the demand for food pressed against local supplies, farmers devised ingenious techniques such as irrigating, terracing, and fallowing for extending agriculture onto new lands. Irrigation enables farmers to grow crops where rainfall is low or unpredictable. Terracing permits the extension of agriculture onto steeply sloping land, even mountainsides. Centuries of laborious effort shaped the elaborate, often picturesque systems of terraces in Japan, China, Nepal, and Indonesia, and in the Andean areas the Incas once inhabited.

In semi-arid regions—such as Australia, the western Great Plains of North America, the Anatolian plateau of Turkey, and the drylands of the Soviet Union—where rainfall cannot sustain continuous cultivation, alternate-year cropping has evolved. Under this system, land lies fallow every other year to accumulate moisture; all vegetative cover is destroyed during the fallow year, and the land is covered with a dust mulch that curbs the evaporation of water from the soil. Where fallowing leaves the soil vulnerable to wind erosion, fields are plowed in strips: alternate strips are cropped and fallowed, with the cropped strips serving as windbreaks for the fallow strips. Such strip-fallowing permitted wheat production to continue in the western Great Plains after the Dust Bowl years of the 1930's.

In Venezuela, parts of Brazil, the outer islands of Indonesia, and other tropical regions where more nutrients are stored in vegetation than in the soil, fallowing restores soil fertility. Stripped of the dense vegetative cover, soils in the humid tropics quickly lose their fertility. In response, tropical farmers have mastered shifting cultivation, whereby they clear land and crop it for three or four years, and then systematically abandon it as crop yields decline; after 20 to 25 years, when the exhausted soils have revived, "shifting cultivators" repeat the cycle.

These practices have enabled farmers to move on to land where conventional agriculture would not survive. In doing so, they have greatly increased the earth's capacity to feed people. But now, under population-induced stress, these time-tested practices are beginning to break down.

Agronomists understand only too well the mounting pressures on land, but analyses of overall cropland trends have until recently been sketchy because data have been sparse. An alternative is to use data for grains only, since grain occupies some 70 percent of the world's cropland. This sacrifices comprehensiveness, but the reliability of data more than compen-

sates. According to the U.S. Department of Agriculture computer data bank, rising land productivity from 1950 to 1980 accounted for close to four-fifths of the growth in the world food supply since mid-century. Between 1950 and 1980, when the area planted to cereals expanded by 152 million hectares, or some 25 percent, two spurts of rapid expansion occurred. During the first, from 1951 to 1965, fully half of the increase came from the extension of grain production onto the "Virgin Lands" of the Soviet Union. In the sixteen years between 1956 and 1972, the area planted in cereals increased only 7 percent worldwide. During this period of excess production capacity, the United States idled some 20 million of its 140 million hectares (350 million acres) of cropland.

The second spurt occurred from 1972 to 1976 in response to poor weather and short harvests. Some 50 million hectares were added to the world's harvested area of cereals in this four-year period, a mere trice in agriculture's long history. Overall, the area increase amounted to another 7 percent, at least one-third of the grain reflecting the return to production of U.S. cropland previously idled under government programs. A smaller share came from reducing the amount of land fallowed in the United States and the Soviet Union and from expanding the cultivated area in Argentina, Brazil, and Nigeria, and other developing countries.

When the food supply tightened a decade ago, the agricultural system had enough slack to allow the land planted to cereals to expand in one giant step. But that increase gives us no grounds for hope for another. Special circumstances obtained then: we had idled cropland and fallow fields to return to production. Now we have neither.

Thinning Topsoil

Just as important to food production as the amount of land available to produce crops is its condition. Only inches deep (usually less than a foot) over much of the earth's surface, topsoil forms a fertile carpet over less productive subsoils. As the topsoil layer is lost, subsoil becomes part of the tillage layer, reducing the soil's organic matter, its nutrients, water-retention capacity, aeration capacity and other structural characteristics that make it ideal for plant growth. Beneath this life-giving layer lies a planet as barren as the moon.

Soil erosion is a natural process, one that occurs even on untended grasslands and in pristine forests. But on land that is cleared and cropped, soil erosion accelerates and becomes another proposition altogether.

Whenever the pace of erosion exceeds the natural rate of soil formation, the topsoil thins and eventually disappears, leaving only subsoil or bare rock. When the topsoil can no longer adequately support vegetation, the cropland is abandoned. But the gradual loss of topsoil and the slow decline in inherent fertility that precedes abandonment may take many decades.

Soil erosion and cropland abandonment continue for good reasons even in the press of food shortages. As the demand for food mounts, cultivation is both intensified on the existing cropland base and extended onto marginal soils. Unfortunately, some of the techniques for raising land productivity in the near term exacerbate soil loss. In the American Midwest, pressure to produce has led farmers to plant corn continuously, thereby eliminating the rotations that traditionally included the soil-retaining pastures and hay. The shift to continuous cropping of corn has been abetted by cheap nitrogen fertilizers that replaced nitrogen-fixing legumes in crop rotations. In Iowa alone, 200 million tons of soil are lost from cropland each year. According to a 1977 report from the Iowa State University Experiment Station, that soil "simply cannot be replaced within our lifetime or those of our children. The eroded soil is gone, depleting the fertility of the land."

Throughout the United States, the U.S. Department of Agriculture's Soil Conservation Service reports, farmers are not managing highly erodible soils as well today as farmers did a generation ago. Taking conservation measures is relatively easy when the system has excess capacity. But the high grain prices and food shortages we now have tempt farmers to forgo these essential measures. By Soil Conservation Service calculations, almost three billion tons of soil was lost from U.S. cropland in 1975, an average of 22 tons per hectare, double what the Soil Conservation Service considers a tolerable loss.

Elsewhere in the world, the doubling of demand for food over the past generation has forced farmers onto dry and steep lands, which are inherently susceptible to erosion. In the Third World, population growth has forced farmers onto untended mountainous soils. On these unprepared lands, the natural cover quickly breaks up and the topsoil washes into adjacent valleys where it silts streams, reservoirs, and canals.

In Andean Latin America, skewed land-ownership patterns aggravate this problem. Wealthy ranchers use the relatively level valley floors for cattle grazing, forcing small landholders onto steep slopes to produce subsistence crops. This pattern leads to severe soil erosion on the slopes, which impairs the productive capacity of both the mountainsides and the valleys.

Continued to page 40

EPA's Soil Research at Corvallis

By Mark Schaefer



A Corvallis laboratory scientist studying acid rain effects on soils and vegetation.

The EPA's Environmental Research Laboratory in Corvallis, Ore., has undertaken a diverse research program to investigate how pollutants are transported through soils, how they are chemically transformed, and where they ultimately end up. The laboratory is particularly concerned with how toxic chemicals affect organisms in farm and forest soils. In addition, scientists are investigating how sediments affect life in streams, rivers, and estuaries, as well as how organisms living in or on freshwater and marine bottom sediments are affected by toxic pollutants. "Most of the persistent toxic chemicals which enter the environment seem to end up either in soils or in sediments," states Dr. Thomas Murphy, Director of the Corvallis Laboratory. "It is important that we know how

much of these chemicals is accumulating in soils and sediments, and what levels are likely to result in harm to our health and the environment."

The potential contamination of soils by hazardous and toxic chemicals is a continuing concern in the United States. Some communities are suffering the effects of pollution from disposal of hazardous wastes through soils into public water supplies. In addition, pesticide residues persisting in soils can be absorbed by agricultural crops, thereby creating health problems for people. And aquatic life in waterways and coastal areas of the country is threatened by toxic chemicals washed from soil surfaces. Once these chemicals enter streams, sediments frequently play a role as they are carried downstream.

Little is known about the processes by which toxic chemicals are transported and transformed, and scientists agree there is a critical need for more information on these processes to prevent adverse environmental and human health effects. There are currently over 50,000 chemical substances in commerce and this quantity grows by several hundred each year. The Toxic Substances Control Act requires EPA to evaluate all new chemicals for possible adverse effects on the environment before manufacture and use are permitted. The Act also requires that manufacturers of new chemicals provide EPA with laboratory and other test data on the fate and effects of chemicals that constitute a possible hazard to a biological population. EPA is helping industry devise rapid, objective, and reliable tests to comply with the law.

Simulated Environment

Corvallis scientists are using land microcosms or simulated environments to measure the effects of toxic chemicals on soil microbes and to determine how substances move through the soil system. Developing environments of this kind is difficult because of the complex chemical nature of soils and the diversity of microbes and other life within them. However, once a controlled system is available, the ability to predict the impact of toxic chemicals in the environment will be greatly enhanced.

Pesticides have become an indispensable part of modern agriculture. Although the Federal Insecticide, Fungicide, and Rodenticide Act places restrictions on the use of many classes of pesticides, the use of newer toxic varieties is expected to increase. Between 1945 and 1975 pesticide use in the United States rose from about 100 million pounds to 1.2 billion pounds annually. This dramatic increase

over such a short period of time has created unforeseen environmental problems, primarily because of the chemical stability of these substances. Pesticide residues in soils therefore are a matter of extensive study by scientists throughout the country.

The Corvallis Laboratory is sponsoring research at Oregon State University to develop the tools needed to predict the behavior of chemicals in soil. The way chemicals move and settle in soil is determined in large part by their physical and chemical properties. Consequently, it is necessary to have reliable measurements of these quantities and to define how they travel and are distributed. Oregon State University scientists are studying the behavior of chemicals in soil and soil-water environments, and the release of chemicals into the air by evaporation. In addition, they are developing more sensitive methods of detecting chemical residues in soils, and are examining how toxic substances are transferred through the food chain.

Acid rain resulting from the increased combustion of fossil fuels is affecting soils throughout the United States, particularly in the Northeast. Soil acidification is a natural process that occurs continuously in any soil through which water percolates. Problems arise, however, when polluted rainfall acidifies soil at an unacceptably rapid rate. This suppresses the decay of organic matter, an important source of plant nutrients. It also inhibits the ability of bacteria in the root nodules of legumes to transform elemental nitrogen to ammonia, the source of nitrogen for plants.

In addition, acids in rain may affect the ability of soil to store nutrients. Valuable nutrients such as calcium and magnesium are bound to soil particles and thus are protected from being rapidly washed into groundwater. Although normal rain can break these bonds to leach them out, acid rain can greatly accelerate the process. Acid rain may also cause plants to take up and retain greater amounts of potentially toxic substances. For example, leafy plants such as lettuce retain an increased amount of cadmium when exposed to acid rain. Even if lettuce productivity is not affected, a plant may not be marketable because of such contamination.

The Corvallis laboratory recently supported a preliminary study of the sensitivity of Eastern U.S. soils to acid rain. Geographical areas were mapped according to various sensitivity factors. Some soils are more susceptible than others to changes brought about by acid rain, and preliminary maps have been drawn that are now being used to help select areas for in-depth studies of their ecosystems.

Corvallis scientists also recently developed a soil chemistry model that enables technicians to estimate the loss of nutrients

from soil due to acid rain. Research of this kind is helping to predict the consequences of future acid rain on farmlands and forest soils.

Soils and sediments are intimately related in the environment. The principal cause of U.S. soil loss is water erosion. Some four billion tons of sediment enter the waters of the continental U.S. each year. Three fourths of the Nation's water-borne sediment comes from agricultural lands. About one billion ends up in the ocean, and the remainder settles in rivers, lakes, streams, and reservoirs, adversely affecting productivity. Eroded agricultural soils containing fertilizers, pesticides, herbicides, and other by-products of modern farming practices can seriously degrade such bodies.

Sediment Vs. Trout

Corvallis scientists recently developed new information on the role of stream sediments in salmon and trout spawning. Researchers found that for the best survival of young fish from incubation emergence, the diameter of gravel in the stream bottom should be about four times larger than the egg diameter. Excessive amounts of fine sediment from improper logging, agricultural, or construction practices deprive the eggs of necessary oxygen and block the emergence of young fish during hatching. Corvallis scientists are now investigating the adverse effects of sediments on entire stream communities, and the role sediments play in transporting toxic chemicals.

Because of the large amount of sediment entering the Nation's rivers, frequent dredging is required in many locations to keep shipping channels open. Each year approximately 60 million tons of dredged material is dumped into the ocean. Before ocean dumping of dredged material occurs, the Army Corps of Engineers in cooperation with EPA must determine whether or not the sediments are contaminated by toxic substances. The Clean Water Act prohibits dumping of dredged materials which may adversely affect the marine environment.

A bioassay test has been developed by Corvallis scientists at the laboratory's Newport, Ore., coastal field station that allows investigators to determine the toxicity of dredge sediments proposed for disposal in the marine environment. Benthic, or bottom-dwelling organisms, are most susceptible to the adverse effects of ocean dredging, dumping, and discharge practices, because pollutants tend to concentrate in bottom sediments. To perform the benthic bioassay, samples of sediments are taken to a laboratory where the behavior and death rates of test organisms, (in this case small marine crustaceans), can be monitored. This information is compared

with controlled experimental data to determine the extent of pollution in the sample. The benthic bioassay is now a criterion for determining the suitability of dredged materials for disposal under Corps of Engineers regulations. The test is being refined, will soon be available for a wider range of monitoring applications, and eventually may be used to determine the toxicity of sediments near sources of contamination such as municipal sewer outfalls.

Newport researchers are refining another procedure which may eventually complement the bioassay test. Since it is known that pristine coastal locations normally are dominated by marine organisms such as brittle starfish that filter their food from water, and polluted areas are favored by bottom-dwelling creatures such as marine worms that scavenge in dead plant and animal deposits, scientists have put this information into a kind of pollution yardstick called an Infaunal Trophic Index. In simple terms, it means that where a preponderance of one type of organism occurs, this information helps scientists determine if an area is polluted or clean. To date the test has been used in several southern California locations where outfalls empty into the ocean.

In addition, marine microcosms are being developed by Newport scientists to investigate the ecological effects of a variety of pollutants on marine bottom-dwelling organisms. Because of the difficulty in monitoring ocean sediments over a long period of time, EPA scientists are developing laboratory microcosms which simulate some of the major physical, chemical, and biological characteristics of the ocean floor. These particular controlled systems will simulate a major food chain so the transfer of pollutants from one organism to another can be investigated. In addition, the behavior of various pollutants in an assortment of sediments is being monitored to determine, for example, how pollutants travel between seawater and the ocean floor, and what effects they have on the microcosms. Ultimately, this technique will be used to examine the environmental effects of metals, sewage effluents, dredged material contaminants, and chlorinated hydrocarbons.

Physical changes such as soil erosion play an important role in influencing the quality of coastal environments. Estuaries, the link between inland waters and the ocean, are among the most productive waters in the world. Corvallis scientists are using Yaquina Bay, a small estuary on the central Oregon coast, as a model for studying the physical processes influencing larger estuaries. Suspended particles in

the water are the subject of a special study due to the role they play in the transport and dispersion of pollutants.

Poisonous Stream Beds

For the past several years, EPA scientists have put forth considerable effort to develop water quality criteria to assist regulatory officials in adopting water quality standards. These criteria do not reflect economic or technological concerns; they are simply the best scientific estimate of the maximum concentration of a pollutant that aquatic life can tolerate under typical circumstances. The Agency is now exploring the need for sediment quality criteria to protect aquatic life. Researchers believe that in some cases a stream might contain harmless concentrations of pollutants in the water but unsafe levels in bottom sediments, making the development of water quality criteria more difficult. Fish and other aquatic life that live or spawn on the bottom, or that feed on bottom-dwelling plants or animals, may be poisoned even if a body of water meets water quality criteria.

Ocean sediments are the ultimate sink for a wide variety of pollutants. Chlorinated hydrocarbons, petroleum compounds, metals, and radionuclides are reentering the water or being ingested by marine organisms. Once pollutants enter the food chain, human contamination becomes a possibility. In recent years excessive contamination of marine life by synthetic organic chemicals such as DDT and polychlorinated biphenyls (PCB's) has required the closure of major fishing areas, resulting in severe economic disruption of the industry.

Marine sediments quality criteria may be necessary to protect coastal organisms, just as freshwater sediment criteria may be necessary to protect life in our lakes, rivers, and streams. Scientists at the Newport field station are investigating both bottom and suspended sediments and how they interact with other physical, chemical, and biological ocean processes. Some day sediment quality criteria and water quality criteria together may form the foundation for environmental standards.

Soils and sediments provide the essential nutrients and physical foundation for nearly all plant life. They also provide a habitat for innumerable species of microorganisms and animals. The need to maintain and protect from pollutants the well-being of this critical component of our environment is clear to us all. For, as the Roman poet Virgil observed 21 centuries ago, "Not every soil can bear all things." □

Mark Schaefer is a writer / editor at the Corvallis Environmental Research Laboratory.

Alaska's 20 Million Virgin Acres

By Robert C. Pollock

Alaska is beginning major crop production on nearly 20 million acres of land which has summer days averaging 20 hours in length.

Since this area has a frost-free growing season similar to that of many northern States, scientists have recognized the crop-growing potential for years. But only recently has the State been able to take advantage of today's production, transportation, and marketing knowledge.

In 1978, Alaska started its drive for self-sufficiency in agriculture with a demonstration project of 58,000 acres near the small community of Delta Junction, 100 miles southeast of Fairbanks. In a State whose citizens pride themselves with putting the land and environment first, the initial step was to implement a series of environmental baseline studies. These studies ranged from surveys of the hydrologic systems of the area, sampling of the air quality, studies of small mammal and bird populations, and pesticide residue sampling.

The objectives of the environmental studies were to produce information useful to agricultural development, to maximize the amount of data gathered from early agricultural development for the benefit of future projects, and to determine methods of ameliorating the environmental impact of agricultural developments. Although the surveys aren't final, the preliminary results have yielded some very interesting information. Tests have proven that water feeding precious clearwater salmon spawning rivers originates from

areas outside the boundaries of development and won't be subject to potential runoff problems. Also, through the investigative process, the potential of agricultural irrigation was identified. Additionally, aquatic invertebrate populations and plant life were shown to be remarkably stable with little likelihood of disturbance by agriculture.

Preventing Wind Erosion

One potential problem that concerns everyone is erosion caused by characteristic local winds. As a preventive measure, farmers were required to leave windbreaks every quarter mile throughout the project, and research is being conducted to identify new farm practices to reduce the need to till the farm ground every year. These "no-till" practices will help conserve valuable soil moisture and also leave a stubble residue to prevent soil movement.

Clearing the scrub black spruce from the land to leave open fields has led to one environmental problem that the State has not yet been able to solve. After vegetation is pushed into huge piles, burning has proved to be the only economic method of removal. In the project's first year, accidental fires—often a problem in Alaska's vast reaches—charred more than 30,000 acres and cost the State in excess of \$5 million to bring under control. Efforts are now under way not only to minimize accidental blazes but to find alternative ways of clearing the land. One proposed method would involve huge self-propelled chipping and mulching machines which could salvage the wood debris in addition to eliminating fires.

An interesting aspect of this new agricultural development is a problem that the very first pioneers faced in the Great Plains States—wild, free roam-

ing bison. A wild herd of 350 to 500 animals, originally introduced from Montana, roam throughout the Delta Junction area and from time to time graze on farmers' haystacks and grain fields. At times, the multiple-use land concept is a bit strained, but coordinated efforts by agriculturists and wildlife managers to divert the bison to areas away from the farms and to create new habitat ranges appears to offer a possible solution.

Land Without Weeds

One aspect of agricultural development that could prove to be uniquely beneficial to Alaska is in the area of pest control, both weeds and insects. It's hard to imagine for anyone associated with developed agriculture, but newly cleared land in Alaska has no weeds. Even older, developed farm ground has only minor annual weeds that can be controlled with proper cultural practices and minor use of chemicals. Only the extremely naive person would believe that weed problems won't come to this new land, but proper management and attention to seed quality together with conscientious efforts by regulatory agencies could avoid many mistakes of the past and also give farmers an economic advantage over many other areas.

Where chemical control of weeds is needed, the State Division of Agriculture, the University of Alaska, and the U.S. Environmental Protection Agency are working very closely to monitor the use and the effect on crops and the environment. For the last several years researchers have been observing the experimental and emergency use of the chemical Treflan on rapeseed.

The Canadians have done extensive research on this chemical, and it has been cleared for use on other crops in the United States. Last May EPA issued an experimental use permit to the State of Alaska's Division of Agriculture for the product, subject to a number of restrictions. Authorities also are keeping a watch on the Delta

Project for potential environmental problems such as air pollution from dust blowing off newly-plowed fields.

Because of the tremendous potential this northern climate crop has for rapeseed oil—a product much in demand in the Orient—and also for high protein animal feed, a coordinated effort to monitor its usefulness and effect is essential.

Local residents and agricultural scientists have known about the possibilities for agriculture in Alaska for many years, but only recently has a complete coordinated effort been attempted, due mainly to petroleum revenues and the current State administration's desire to develop renewable resources.

When someone mentions agriculture today, most people think about sophisticated equipment, technologically advanced pesticide controls, and one of the most efficient industries in the world. In a world of modern, fast, and well developed agriculture a person can scarcely imagine what it was like prior to our scientific advances. But that's what the situation resembles in the State of Alaska.

The story of agricultural development in the United States is one involving years of trial and error, successes, and some failures. In their efforts to implement agriculture, Alaskan officials are hoping to avoid many of the mistakes of the past, especially where the environment is concerned.

Only through the efforts of everyone—farmers, government agencies, universities, and urban residents—can success be achieved. Developing an agricultural industry is an exciting challenge and monumental task, but the rewards will be even greater in terms of self-sufficiency, renewable resources, employment, standard of living, clean environment, and multiple use of our land in Alaska. □

Robert Pollock is Executive Director of the Agricultural Action Council, State of Alaska.

Fertile Alaska farmland typical of the acreage now being developed in Delta Junction.





Our Vanishing Tropical Forests

by the U.S. Train

Tropical deforestation is the greatest environmental issue ever confronted in human history. It is proceeding apace far beyond the horizon, unheard and unseen, so distant as to seem inconsequential and esoteric. Never has the ecology of a region been altered so rapidly, in such an essentially irreversible fashion and, ironically, for so little gain.

Tropical rain forests are biologically the richest expanses of land found on earth, sometimes with ten acres containing three hundred species of trees compared to an average of twenty or so per acre in temperate forests. They cover only seven percent of the earth's land area yet support up to five million of the ten million forms of life estimated to exist worldwide today. The richness of these forests represents a biological haven and storehouse of existing and potential genetic resources, most with capacity still unknown.

Yet this terrestrial biological treasure trove is far from untouched. Today our tropical forests are diminishing at alarming and accelerating rates, to a point where they now cover only 66 percent of their original expanse. In the past century and a half, 1.5 billion acres have been devastated around the globe. Africa has destroyed over 50 percent of its rain forests; over 40 percent of Asia's have disappeared, and 66 percent of Central America's original forests are already gone. Based on the projections outlined in the Global 2000 Report, only one-fourth of the world's original forest cover may still stand twenty years hence. Worldwide these forests are being destroyed through settlement, land conversion and harvesting of timber at a rate of 45 million acres per year. At this rate, there will be no rain forests left in 80 years. The gloomy predictions of massive extinctions in the Global 2000 Report stem mostly from tropical deforestation.

Population and economic growth place the most pressure on these forested regions. The pressure for land for homes and farms, and the need for firewood—the main fuel supply for 75 percent of the earth's people—are major causes of forest destruction. Thousands of acres are burned to convert the land into pastures, often useful for very short lifespans. In some parts of the world, slash and burn commercial harvesting is creating deserts where jungles stood not long before.

Destroying Future Medicines

The husbanding of biological diversity is of inestimable value to medicine, industry, and agriculture. The tropical forests are of particular importance in this regard because such a large portion of the world's species occur in them. More than one-fourth of all prescriptions are biologic in

origin, and many plants possess medicinal functions not yet discovered, let alone marketed. Two drugs recently developed from a tropical forest plant now give the leukemia sufferer an 80 percent greater chance of recovery. Many oils, resins, dyes, gums, and other commercially useful compounds can be found in the rain forests of the world. Presently researchers are working with the plant genus *Euphorbia*, which contains a material similar to the hydrocarbons found in petrochemicals. Recently a tree (*Copaifera langsdorffii*) was discovered in the Amazon basin which contains a sap that can be directly used to power diesel engines. Just two years ago, a wild perennial corn was discovered in southern Mexico, intriguing scientists with its potential for greatly simplifying corn production techniques. Yet this "lowly weed" lay in an area under extreme stress from nearby expanding human settlement.

How many resources are yet to be discovered? What potential contributions to human welfare are still out there, waiting to be tapped? Only by carefully examining existing rain forests and then, through careful planning, will we be able to benefit fully from them. Needed resources are being wasted and sometimes eliminated. Scientists and conservationists everywhere must strive to reverse these destructive trends.

Climate Changes

The environmental effects of deforestation are increasingly significant as well. The climate may show modification through an increase of temperature which may in turn cause regional drying trends; polar ice caps may shrink and the sea level rise. This could well result from atmospheric accumulation of carbon dioxide and other gases, which would reflect radiated heat back to the earth's surface. The fact that carbon dioxide is increasing is not questionable, but the causes are less clear. The tropical rain forests do represent an enormous reserve of the earth's accessible carbon—up to 340 billion tons.

Tropical forests play important roles in hydrological cycles. Forests retain water, gradually releasing it throughout the year. By doing this, forests maintain a consistent supply of quality water, regulating flow to downstream agriculture, industry, and human living areas. Further, it is estimated that 50 percent of Amazonian rainfall is induced by the rain forest itself. Tropical deforestation may also cause a drying trend in the jungles by destroying this capacity to generate rainfall.

Rain forests are very efficient at cycling nutrients. In many instances most of the nutrients are locked up in the living systems and the soil is nutrient-poor. The ways in which land is being deforested and used

after clearing must be looked at seriously in terms of nutrient recycling. Harvest problems must be studied in terms of constant nutrient renewal and avoiding nutrient loss. The trend, however, is one of deteriorating conditions.

Deforestation as the result of timbering occurs in two main ways. The first, modification through selective logging, would seem to least upset the forest ecosystem, but in many instances techniques are crude and the physical destruction goes beyond the removal of select trees. Erosion occurs, nutrients are depleted jeopardizing regeneration, diversity is lowered, and balance is upset. The economic benefits of the second form, transformation forestry, are immediate. But here too, problems arise when the lack of diversity present in a monoculture opens plantations up to the influx of disease, pest plants and animals. Yet it must be remembered that in principle a well-managed plantation forest can meet timber demands, taking pressure off the natural forests.

Plans For Protection

The outlook for tropical rain forests may look unpromising thus far. Serious problems are on the rise, but there do exist worthwhile efforts to deal with these problems. The Amazon forest area is one where the fate is not as dark. Amazonia is covered in more tropical forest than exists anywhere else and 70 percent of its jungle is yet untouched. The understanding of how to develop forests for the diverse resources they offer, and the knowledge of how large an ecosystem must be to sustain renewability, are matters presently under study. The Indonesian government is supporting policy plans on management of island conservation; Costa Rica maintains a well established national park system; Ecuador and Colombia are creating new protected areas; Brazil has more than tripled its national park system in area in one and a half years—worldwide, nations are approaching the problem of development and conservation.

The ultimate test of whether governments will rise to the challenge presented by the awesome possibilities in the Global 2000 Report or respond to the incontrovertible message of the World Conservation Strategy about the mutual dependence of conservation and development will be in the tropical forest regions. The problems are much harder there than elsewhere. Yet the stakes are much greater, for so much is to be gained by keeping the 50 percent of the world's variety of biological resources they represent, and so little is gained from the current treatment of tropical forests. □

Mr. Train was EPA's second Administrator and is now President of the World Wildlife Fund, U.S.

Why Our Topsoil is Precious

An interview with
Norman A. Berg,
Chief, U.S. Soil
Conservation Service



Norman A. Berg

Q It has been stated that the average depth of topsoil in the United States is now about half of what it was when the Pilgrims landed in the New World. What is the significance of this for the future?

A I think that wherever rolling type land has been extensively used, we've lost a large part of what was the original topsoil. Maybe an average of half of the original topsoil is gone and in some cases it may be all gone; we may be into the subsoil. I've seen areas like that. They show up dramatically as you fly over rolling lands where you can see the bald spots or lighter areas. That loss and its importance depends on how deep that soil was in the first place. In many parts of the country the loss has already occurred. What we're concerned about is avoiding continued degradation of the soil. We need to recognize that other civilizations in the world have suffered and we don't think this country should have to go through that because we have the professional ability to help land users improve their soil and not let it degrade.

Q When you say other civilizations that have risen and fallen because of this, which ones would you have in mind?

A Well, the areas that have been written about over time have surrounded the Mediterranean.

I might mention that at the invitation of the people of China, we may be giving additional assistance on soil conservation to their government. There are some good results from the standpoint of what we're beginning to build in terms of a new relationship there. The people in India also had a fairly long history of asking for and receiving our technical assistance. Other parts of the world also have been asking for our guidance.

Q Are you giving technical assistance to China now?

A A team has just returned from China looking at the kinds of things that they're interested in. And the Chinese

have been here, and I think we're opening up some areas that we are both going to learn from. They have some knowledge and experience after four or five thousand years of agriculture that we can gain considerable knowledge from. And we're not bashful about that either. I think we need to know what they've done and how they've done it. So it's interesting from the standpoint of our particular agency.

Q You mention the Chinese practicing certain things thousands of years ago. Would that be terracing and contour planting?

A Right. Very extensive work in terms of terracing and leveling the land, very high utilization of all of the organic wastes, and extreme dedication to making certain that their agricultural production is not impaired in any way. And they're adding to their irrigation capability now. They have extensive water management activities. They've done work in aquaculture—we can gain from their knowledge in that area. They still have very serious conservation problems, but they've got a lot of good things going on too.

Q In the service we can offer them, would that be in tree planting programs, for example?

A Very much so. Our plant materials activities apply to what they're doing. Some of our technology in how we design and lay out the specifications for reservoir structures would be helpful. We need to recognize that they have a different type of economy and a different way of doing their work. It's more labor-intensive than ours, but we can offer technology that will help get more results from what they're doing.

Q For the benefit of city-dwellers, what is the importance of topsoil?

A The loss of topsoil is of direct concern to consumers. It costs them money. Just taking sediment out of harbors is very

costly—improving quality of water if it's been sedimented—and you have other non-point types of pollutants coming in that are expensive to clean up. There is concern over the options that are available to urban people in terms of how land is used that provide not only our food and fiber and high quality water, but what the opportunities are for fish and wildlife. They're concerned about the availability of land for recreation. We still have in this great country the options to have these additional land and water uses that go beyond just the production of food and fiber. And I think that people are going to be concerned that those options do exist for the future. We've dedicated, of course, a sizable acreage in our country—nearly a third of our Nation is in some sort of a public domain use.

One thing our people report coming back from a country like China is that we are very fortunate in having alternatives for the use of land and water that go beyond just the necessities to produce food and fiber. In terms of the urban view of this country, we must do the best we possibly can to maintain some of these options for the future, and have land and water dedicated to uses that include food and fiber production at a dependable rate and at reasonable cost and yet have concern about wetlands and the more fragile areas of our ecosystems.

Q Have there been any examples of floods in the United States due to improper land use, comparable to the 1966 flood in Italy that was partly attributed to overcutting of forests upstream?

A Yes, we've had quite a few regions of the Nation that we can cite. Probably the most dramatic shift in terms of land use has been in the South where we had very extensive cropping that went back for at least a hundred years. That land was highly eroded and subject to flooding. It has now moved back primarily into trees and grass—a very productive use of the land. That land use shift has been very dramatic in the last three decades. We attribute

some of that to the concern for the soil and water losses and the very serious flooding problems that had occurred. It's one of the reasons for conservation programs being strong and for TVA being highly recognized in that particular area. They had very serious soil loss and flooding problems, and now the land use changes are dramatic. A combination of extensive land use changes back to trees and land treatment on cropland has changed the landscape considerably.

Q Last November the Department of Agriculture predicted world reserves of cereal grains would reach their lowest level in 5 years within a year. What are the reasons for this, and what remedies would you propose?

A It's perhaps easier to tell some of the reasons, as we understand it, than the remedies. But, there isn't any question about the reserves of cereal grains being down. Even though the grain production outside of the U.S. has increased an average of 21 million tons per year, the consumption has been rising at the rate of about 25 million tons annually. Therefore, we do have a gap. Then, on top of that, we had the weather situation in several key places in the world, including our own country, that has caused some depletion in carry-over stocks. There were disappointing harvests worldwide for a variety of reasons in 1980.

The fact that we do face this prospect just two years after we had the largest global stocks of grains in over a decade simply underscored the continued vulnerability of our world food situation and that the balance between too much or too little tilts easily and rapidly.

In terms of soil and water conservation, what we've been concerned about is that our basic land and water production base is in place, is not degrading, is there for sustained yield, and, hopefully, increases in yields each year over a very long period of time. Our evaluations in the Soil Conservation Service and in other agencies in the

Department connected with the Resources Conservation Act are looking at a 50-year time horizon. So, even though that's a long time, in terms of making projections based on past history, it indicates that we are concerned about a sound natural resource base. You need a long-term look at it to make some of the adjustments that are important.

Q You mentioned increased consumption. Is that due to population growth throughout the world?

A Yes, no question about it. That's one of the things that we've analyzed as to the condition of the natural resources. World population is on a trend that will probably double from where we are now by the turn of the century.

Q The U.S. is losing about 3 million acres of farmland a year to developers, highway builders, and other uses. Yet, a Harris poll commissioned by USDA shows that more than 50 percent of Americans consider the loss of good farmland a serious problem. How do you view this discrepancy?

A It's a fact that there are continued movements of good productive agricultural land to non-agricultural purposes, in spite of the concern that the public expressed.

People have recognized the problem, and they are concerned about it and there are some things underway which I think will be helpful.

A year and a half ago the Chairman of the Council on Environmental Quality and the Secretary of Agriculture commissioned, along with several of the other major U.S. agencies, the National Agricultural Lands Study. This is related to the availability of agricultural land. Their report released in January has a much more detailed analysis of the supply and demand area that is concerned with our land resources—what is the trend and what's been

happening to agricultural lands, especially our more important farm lands moving from agricultural to non-agricultural, urban type uses.*

Some aspects of this report deal with what can be done at the State and local level and the proper role of each level of government. There's a set of recommendations that recognize the importance of what the Harris Poll people were telling us and the fact that the loss is getting a lot of attention. This is on the agenda of a lot of different groups around the country.

Q What are the implications for our future if this kind of loss continues?

A They're the soils that are usually quite level, quite deep; they require a minimum of conservation management to be effective in terms of intensive cropland use. They probably require less energy use to produce a crop, but because they are level and accessible, they are also extremely attractive to non-agricultural uses, including urbanization, highways, airports, and that sort of thing. That's why the movement of these types of land to non-agricultural uses has been occurring.

The implications relate to what this does to our productive capacity, especially when we couple it with continuing soil erosion problems on our intensively cropped lands. What are the implications for increased inputs such as fertilizers, pesticides, and energy-intensive activities to continue to produce food in the quantity that's needed and also at the cost—in a most cost-effective way—from the standpoint of the price to the consumer? The National Agricultural Land Study simply indicates many of these areas that are of concern because of the nature of the types of soils that have been moved from agricultural to urban uses.

Many of the things that we're talking about are regional or local in character. But the studies show that around our major metropolitan areas,

where the pressure is very high, some of these important farm lands are moving to non-agricultural uses, and that's an irretrievable loss. We also find quite a dispersion out into rural areas of industry and population. The movement to the so-called Sun Belt impacts areas like Florida, Arizona, and Southern California, where we do have extensive areas of excellent agricultural lands that are being given priority for urbanization.

Q Some agricultural technologists claim that, because there are some 2.3 billion acres in the U.S., the danger of "paving over" farmland is exaggerated and that urban areas, highways, etc., are only 2.7 percent of that total. Do you have a response to that?

A Yes. It is a mixed story regarding where people are located as to how they view this. In many of the local areas, including my county in Maryland, Anne Arundel County, they feel very much concerned about this problem. Now, Maryland itself is limited in terms of its good agricultural land, so there have been actions taken in our State as there have been in several others regarding this problem. If we look at the 2.3 billion acre area in the country, one might ask, isn't there very ample land for all uses? But we need to pull that back to what lands would be best for intensive crop use. And it's considerably less than this. It's a figure that is slightly over 500 million acres.

Q That would be prime land?

A That's our better agricultural land that we would classify as suitable for cropland. Much of that is now being used for cropping. In terms of data there may be another 125 or 130 million acres that are now in grass or trees that have potential for cropland that could under very special circumstances be brought back into production, although this would be somewhat costly because of the good uses that they're in

* Ed note: A separate article on the land study appears elsewhere in this issue.

now for grass and trees primarily, and wildlife cover. At the same time, we do have in present cropping perhaps 30 to 40 million acres that are marginally suited for this purpose. So that latter balance of land probably should be moved out of crop use and the land now in another use could be shifted back into crops. Really, when you look at the long-range future, there is not much over what we now have as a reserve that would be good land to convert back to cropping if needed.

Q Some of these critics claim we create over 1 million cropland acres annually by swamp drainage, irrigation, and other techniques. What is your view of this statement?

A Well, much of our productive crop area in the country is because there has been improved water management, either because of problems that were related to too much or too little water. And I think we'll always have some of that someplace in the country. We have managed water and land for a long time to have land that is now considered prime or very important farmland. But the restrictions on what can be done about the so-called wetlands are increasingly prohibitive to allow them to come into agriculture. The possibility of new irrigated acres is becoming more costly. Good reservoir sites are pretty well used up. The underground water supply is also of major concern as to how ample that is. In some areas it's being drawn down quite rapidly. So, there's going to be less opportunity to develop good agricultural land from the standpoint of removing too much water or adding where we have too little. The acres that then are available to shift because of water management to an intensive crop use are going to be less than what they have been in the past.

Where we have good cropland because we added water or we've taken away water that wasn't needed, we're concerned that those soils are properly managed, so that they are held primarily for agricultural pur-

poses, and that the systems that have allowed them to become highly productive for agriculture are kept in place. And that's going to require quite an investment because in many cases they need to be updated.

Q A number of States have enacted laws to protect their wetlands because they've realized in recent years these are valuable ecologically as spawning ground for aquatic life, and also act as filters to remove sediment. Do you believe that draining these wetlands to create farmland may be counter-productive?

A Well, there are concerns regarding land use no matter how you shift. If land is now in grass or trees, but could be considered potential cropland, there are going to be objections to that land coming out of grass or trees because there are people concerned about those types of uses. It's equally true of land that's been identified as wetlands; there are laws in several States that protect those types of land as they protect other ecologically vulnerable areas. This limits the types of lands that would have been available for transition one way or the other without too much of a handicap. It is also very costly to try to do something about these water management problems. That cost increases annually because of many other pressures including inflation, roughly 10 to 20 percent each year.

Q The Soil Conservation Service is making an inventory of prime and other farmlands. Is there a relationship of this inventory to the Surface Mining Control and Reclamation Act of 1977?

A The 1977 Act itself does require the restoration of prime farmlands after mining. The mining plan itself has to indicate how that will be done before the mining permit is granted. We have helped identify along with the State agencies responsible for mining activities the extent of those prime lands that would be disturbed by mining. Although the Act does not obviously prohibit

surface mining of prime land, it is concerned for the future use of those lands so that they are commensurate with good agricultural practices.

This area is in litigation, as you may know, in terms of whether or not the Federal Act has in some way infringed on State and local responsibility in how land should be used and how it should be controlled. But, we're providing the technical data regarding the types of soils, the measures that would be needed to restore it to a productive use.

Q You're in essence saying, "This is prime land and if you want to go ahead and strip mine it, that decision is yours, but at least you're aware of what you're doing."

A It's more complicated than that. But we're providing the technical data to help people determine what kinds of lands are on the surface to begin with, and what kinds of lands would be important to recognize in the mining process as needing some restoration.

Q Can stripped land be restored?

A Yes, we have been doing a lot of work along this line, cooperating with the companies that do the mining. Several States have laws that they think should be in place to help do this sort of thing. There's more research needed to get at the most effective ways of doing this. Incidentally, we're spending quite a bit of time, too, on helping reclaim those lands that have been left in an "orphaned stage," where it is almost a no-man's-land that has been mined over many years in the past when we didn't have the restoration policies we now have. Those so-called abandoned areas, highly erosive or damaging from the standpoint of water quality, are being examined as to what can be done to restore them to some sort of productive use including recreation, wildlife habitat, or, in some cases, even agriculture.

Q In the aftermath of the Dust Bowl era of the 1930's, many trees and hedges were planted as windbreaks on farms in the Plains States. We understand some are being cut down now as firewood or to expand farms. Is there any effort to replace them to prevent environmental damage?

A First of all, the windbreaks and shelter belts in that region were introduced by human beings because it wasn't a natural tree country. Although many of these areas were planted back in the Dust Bowl days, people also began quite an extensive tree planting program in the Plains area even before then. Some of these trees and hedgerows are now being removed because in many cases these windbreaks and shelter belts under present standards are outdated. The trees are not the best species to have in that area. They really have gone through a process in that many of them are just naturally going to disappear anyway. And we have better recommendations now in terms of tree species, planning and design, that are going to offset the loss.

We made a special study to estimate the miles of windbreaks that had been removed in five of the Great Plains States. There were something over 1,100 miles removed during a five-year period in the 1970's. But there were still nearly 39,000 miles of these windbreaks still in place. So, about 3 percent of the total had been removed during that period. They were removed, in some cases, because the windbreak had to be replaced anyway. In other cases, they had been removed because the large areas they were covering weren't needed under our present designs. Some of the modern equipment, including pivot irrigation, has caused some re-thinking of where these trees should be located and their height. Our studies also show that there is more replacement of windbreaks that have been taken out than what is being removed. So, I think we're holding our own on this one.



Willow windbreaks protect topsoil from erosion in northern Michigan.

There needs to be more encouragement to have land users keep this conservation measure in place. There are a lot of people who are not going to give up some type of tree protection in the Plains and other areas where we encouraged farmstead windbreaks, and shelterbelts, because they've learned to like that sort of an environment. They are very happy about seeing trees on the horizon, and they're going to try to keep something there.

Q These hedges, we understand, are also breeding places and protective shelters for a lot of game bird species that are very desirable.

A Very much so. They have a multiple use including wildlife. They have considerable value for holding down the ravages of wind in terms of soil erosion. They are desirable from the standpoint of lowering the costs of heating in winter. Some have been quite effective in restoring moisture through snow. Another reason as to why some are troublesome, they do act as a kind of snow fence. In some cases they weren't properly designed, and the highway people ended up having to fight snow drifts all winter. So we've had to move some back away from the road.

Q You mean they caused drifting of snow?

A Yes, but in the wrong place. It's great to have that drifting to hold the snow on the farm or ranch field, but when it ended up right in the

middle of the highway, that wasn't good. There's another thing about this area that I think you might recognize. We're working throughout the country with the private land users of the Nation, and most of this kind of action is a sizable investment on their part. The payoff comes very, very slowly to them. What is the proper mix of things that would cause a private land user to do these things in the interest of the public? How can society share part of the cost of doing this sort of thing? What types of incentives will cause people to do this sort of thing that is fairly long-range, and benefits the public perhaps more than it does the individual land user?

Q How does that tree planting program work? Do you fund it? Or do you simply give the information to the farmers and they plant?

A It's a combination of several things. Both we and the Forest Service have programs that aid in developing the best types of species and types of planting design that are most desirable to have in a particular geographic part of the country. Then we offer the technical information and assistance needed to design the windbreak. The Conservation Districts have done an excellent job of securing the planting stock. In some cases, the equipment that wouldn't be profitable for an individual farmer or rancher to buy can be made available. So there's a whole series of things that have developed over nearly 50 years to help an indi-

vidual land user when he decides that he wants to plant some trees. The sources are local and available, and they're ready to go when the planting season opens up. That plus the necessary follow-up to ensure that the planting gets the proper care and is going to be successful. A combination of State and Federal funding plus the technical assistance that we provide through the Conservation Districts has been part of the incentive to the land user. It's a very good activity that each year results in more and more trees being planted.

Q New England farms suffered a heavy outflow of population in the 19th Century due to various factors. Are they making any kind of comeback?

A We've worked quite closely with the farm and agricultural and other interests in rural areas in the New England states to examine the condition of their resources. They especially worried during the energy crunch earlier that they were on the far end of the distribution line for many of the food products they depend on. What was the future of agriculture in that area? There's also concern on the part of younger people having access to farming as lifestyle. And so they led the effort quite early to retain their important farmlands. Now a lot of those lands have just naturally moved from agricultural to other uses, but they're not yet urbanized. They're primarily in trees. As our agricultural production has moved from New England westward as the better soils opened up in other regions, they have asked how best to keep a viable agriculture in New England, because you get down to a critical mass in terms of how many farms are still in an area. And, unless you keep them in a viable setting, the infrastructure begins to disappear, the markets, the roads, and all that sort of thing. The question was examined in the National Agricultural Land Study.

Q You served as U.S. Co-Chairman of a joint U.S.-Canadian water quality study that looked into sedimentation and other problems affecting the Great Lakes. What were its conclusions, particularly on soil erosion?

A The International Joint Commission has been in business for a long time—for all of this century, and during the 1960's and the early part of the 1970's, there developed a major international concern about the quality of the water in the Great Lakes. At that time it was quite evident that Lake Erie, especially, was in serious condition. So a water quality agreement was promulgated by the two nations, specifically aimed at improving the water quality in the Great Lakes. As part of that effort they set up a special reference group that I chaired for the U.S. My Co-Chairman was Dr. Murray Johnson from Canada. We were charged with looking at the effect of land use in both countries on water quality. We studied that area, set up several pilot watershed projects, evaluated all of the knowledge that was available, and came up with

a long series of recommendations to the Commission. They have adopted these recommendations for the most part and have sent them on to the governments of both countries, national, State and local, as to actions that were needed.

We did find a very close connection between how land is used and the effect on water quality. Soil loss, erosion, and sedimentation, the result of soil loss, were factors. Water runoffs carried certain things from the soil that can damage water quality, especially phosphorous, and some pesticides and insecticides. We made a very extensive series of recommendations that included concentration on areas that were critical as sources of problems, incorporating proper land use practices and conservation measures in the planning process of local governments, and emphasizing the types of incentives for land users to give this more attention. This ranged all the way from improving the way in which soils are managed, to protecting the streams, handling the organic wastes in a more acceptable manner, and the problems of urbanization where lands are moved from rural to urban uses. You can

produce a lot of sediment during highway, housing or shopping center construction. We also looked at the governmental institutions and how they function, recognizing that it's a State and local problem on the U.S. side that needs to be strengthened. We were encouraged by the work of U.S. Conservation Districts. They are giving these recommendations very high priority.

Q Do Americans have a strong ethic to conserve the soil?

A I've talked to many of the Conservation District leaders in this country. As you know there are about 3,000 Conservation Districts, usually representing an area about the size of a county. They're governing boards of people not necessarily all farmers, ranchers, or foresters. There's a mixture of people serving these governing boards including urban interests. Among these people, there is a strong land use and soil conservation ethic. They have, cooperating with their Conservation Districts in the country, nearly two million participants who express, through a volun-



Drifted topsoil in New Mexico where not enough stubble was left in a nearby field to prevent wind erosion.

tary process, a desire to do a better job managing their soil and water. And so I think we have a pretty sound foundation here that for nearly 50 years people have been willing to do something about serious soil loss, water quality, or any other resource problem that relates to their management of the land. There are others, of course, perhaps far removed from the area, who own land with tenants on the property who may not have that view. But there are many people that are concerned about the future of their land because they know it will be passed on to the next generation. Some of these people are handling the land as maybe the fifth, sixth, or seventh generation in that particular family.

I had the good fortune to look at land operations in the Scandinavian countries last fall. And I was on land that had been farmed for a thousand years. We do not yet have that history in this country.

One other thing about Scandinavians. They have a general philosophy that the land belongs to all the people. Translated into practice, this means that you often see city dwellers on weekends and after hours hiking through woods because they have the right to do this. It nurtures a respect in everyone for the land. Their local governments also encourage city dwellers to go to the country and work on farms to help the farmers during the summer. This instills a genuine feeling among the people for the land, almost a religion, that is very important for the well-being of the country. The children are taught this from their earliest years. There's a much stronger land use ethic that is very uniform throughout those countries than what we have in the U.S.

But we have an excellent beginning on this. And each year, in nearly every county of the country, there is a strong dedication to what they call the soil stewardship concept. This is sponsored by the Conservation Districts and the churches of

the country. It indicates a very deep concern for the land.

Q You mention the Scandinavian countries. Was it your impression that those people were mostly living and working on their own property rather than absentee owners?

A Yes. That's one of their strong tenets, that farming and forestry operations are conducted by people who do own that property. They are not very high on having land operated by a tenant.

Our Conservation Districts, locally organized and governed by local people, have a great deal of experience that they can call on to cause people to be concerned about how their property is handled. We're finding that in areas where there is neglect of property, there are nuisance laws that have been called on.

Q What do you think is the most important step we can take to combat loss of our soils?

A First of all, create an awareness of the severity of the problem. There are still very serious soil losses from our intensively-used croplands. It's exceeding perhaps two billion tons annually. In addition, we have another billion tons of soil loss from stream banks, gully type erosion, construction sites, that sort of thing. So we need an awareness of the fact that there is a serious problem.

Now where is this problem occurring? We can identify the types of land areas that are most vulnerable. We can identify the types of crops that tend to induce serious soil loss unless the land is properly managed. We can offer, once people are aware of the problem, most of the technical guidance that's needed to correct the problem. In some cases, this is a matter of the types of land use that is practiced. Some land is better suited for cropping than others. And if it's used for cropping, then it requires a certain type of conservation system. If land is used for cropping and it would be better in grass or trees, we can make that recommendation.

The providing of knowledge and the translation of that knowledge into a plan and then into action are obviously the things we have to do to combat these losses. We do have some chronic and critical areas that we don't have good answers for. We need to have additional studies of how best to work on those problems. We've identified them. We're willing to dedicate and target additional resources into those areas to see what can be done. A good example is West Tennessee, where all of the agencies at the local and State level are cooperating to do more to aid that area, to identify the problem and to come up with some better answers.

Q What is unique about West Tennessee?

A Well, it's a highly erosive area, along the Mississippi River. We've also found a considerable land shift there as the demand for more soybeans came in the last decade. That's responding to the market, but it's also putting a very heavy stress on those fragile resources that are very vulnerable because of the combination of soils and rainfall and that sort of thing.

Q What happens after you harvest the soybeans and the land is left bare?

A It's very valuable. There is water erosion in that area, the soil loss is much in excess of what we consider a tolerable level. We have an average loss in this country that nature can replenish of about five tons per acre per year. In those areas that we are talking about we may be exceeding 35-40 tons.

Q In a place like Western Tennessee, is it a matter of planting a cover crop after the soybeans are harvested to hold the land in place?

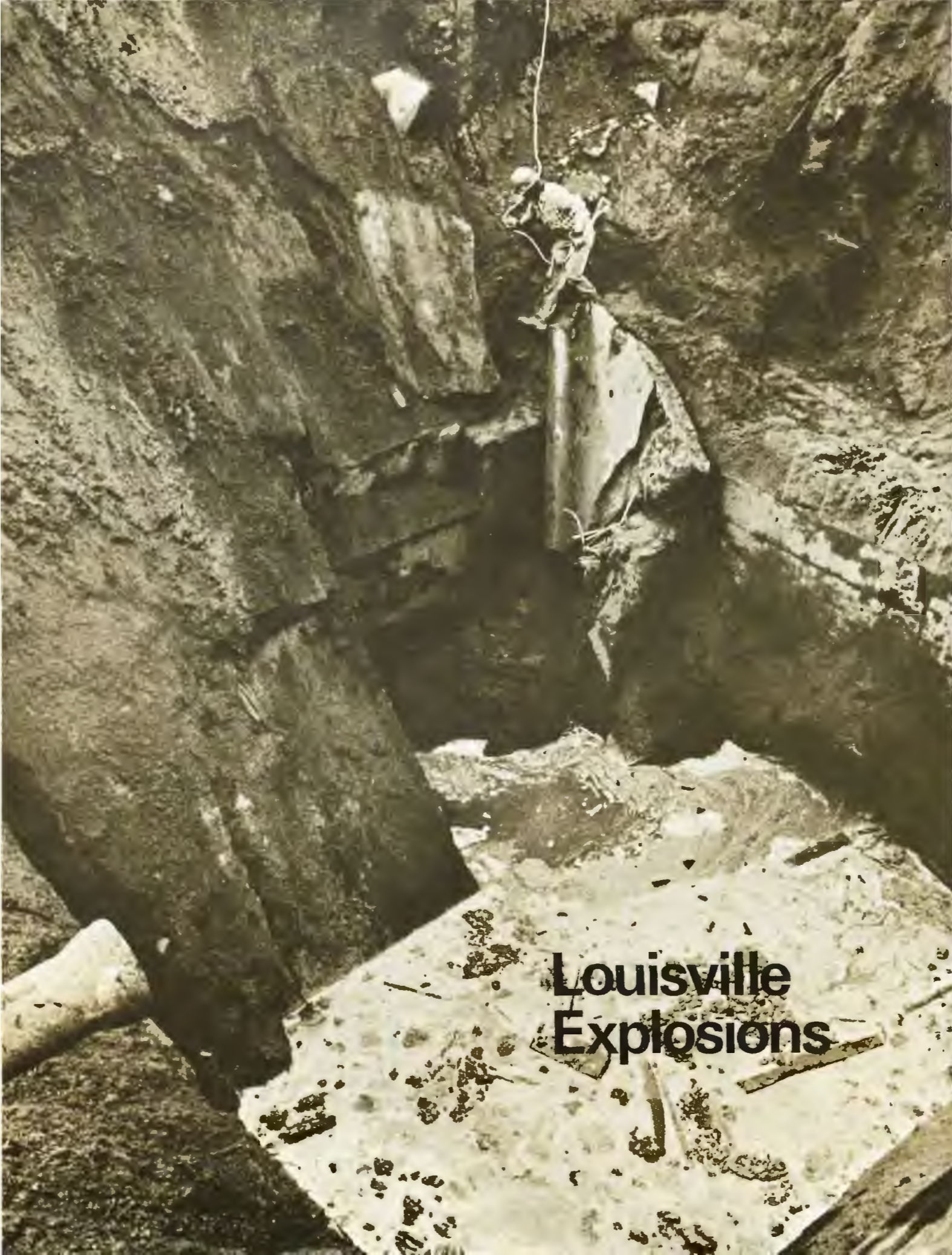
A Some land that should not be cropped can be replanted to grass or trees. And it's not an easy thing because that's usually a loss in terms of immediate cash income. In other cases, if land is suitable for cropping, it needs a very ex-

tensive conservation system, including grass waterways and contouring and perhaps terracing if that's a practice that fits that particular area. A whole series of things can be done to improve the way in which the land is handled. Yes, they do need some kind of cover on that soil to the maximum extent. One of the rapidly growing practices that we're encouraging is what we call minimum tillage. It's a matter of leaving the residues being produced by the crops to the maximum on the surface. This means the land is disturbed the least possible to get the next crop in. And that is good practice in that area.

Q Given the soil loss figures, are there any indications that farm production will decline as a result, or can we compensate with other farming techniques?

A One of the things we've identified in our studies of the effectiveness of the conservation programs is that topsoil loss and the effect on crop yields has been masked or covered up by our new technology that's come in place the last three or four decades. We've made tremendous strides in introducing new varieties of pesticides, herbicides, and additional mechanization that have tended to offset the soil loss effect on crop yields. But we're at a point now where that is not as available in the form of new technology. The annual yields per acre show a decrease or at least a plateau from the standpoint of past trends, so we're estimating that, for instance on corn yields, they can decline three or four bushels per acre for every inch of top soil lost. And in terms of a long-term projection, we're suggesting that, unless farm production technology continues to increase at the rate that it had earlier, the effects of soil loss are going to be quite serious in some sections of the country for certain types of crops. We do need additional research to have available the technology we had in the past. □

This interview was conducted by Truman Temple, Associate Editor of EPA Journal.



Louisville Explosions

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A chain of massive sewer explosions blew deep craters along two miles of streets in Louisville, Ky., in February and left the city with the short-term possibility of a health hazard and the long-term problem of how to pay more than \$40 million in damages.

The cause of the disaster is believed to have been a highly explosive chemical, hexane, which may have escaped from a nearby industry. EPA's Region 4 Office in Atlanta took part in the investigation of the explosion's cause. The results of the inquiry have been turned over to the Justice Department.

The Louisville explosions are a warning to other cities around the country of the dangers from leaks or spills of toxic materials into municipal sewer systems.

The explosions collapsed almost two full blocks of Hill Street, a city thoroughfare, and catapulted manhole covers and jagged pieces of concrete into a wide area. The explosions broke water mains, interrupted electricity and caused natural gas leaks. At least four people were injured.

(A) A large hole grows deeper on 9th Street just south of Hill Street. One of the big main sewer intersections was located here.

(B) Louisville Water Co. employees checked for leaks after the explosion in the sewer system blew a huge crater in the pavement at Seventh Street and Jordan Avenue.

D

(C) Yards of pavement collapsed on Hill Street after the blasts along the city sewer line.

(D) Gary Sullivan stood in the bathroom of his apartment on South Second Street after a manhole cover crashed through his ceiling and floor and damaged the apartment below.

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C



Wheat harvest in the U.S. by David M. Little, EPA/USDA, Washington, D.C.

The Global Importance of American Cropland

By David M. Little

In the present era of global resource scarcity, the United States is exceptionally well endowed with a valuable asset—cropland. Favorable climatic conditions and extraordinarily efficient production methods allow this American land base to produce an agricultural bounty unmatched in any other nation. This productivity has a significant effect on international trade, which in turn affects the domestic economy in such areas as food prices and the demand for agricultural land. American agriculture has for many years been attuned to a domestic and foreign market system that operates in a semi-automatic, self-balancing manner. However, accelerating United States involvement in export agriculture during the last decade, and the world food situation in general, have created new problems and forces.

The extent to which U.S. agriculture has become dependent on overseas markets can be gauged from the following indicators. In the early 1950's, ten percent of the American farmer's cash earnings came from exports. Today the figure is 25 percent. Export volumes increased by 77 percent in the decade between 1967 and 1977. International trade in the coarse grains and oilseeds, which the U.S. dominates through

its prolific corn and soybean production, has tripled since the late 1960's due to rising incomes in the more affluent countries. This reflects in part an increased demand for meat and dairy products produced with internationally-traded grain. The U.S. export market for grains for direct human consumption also has expanded due to population growth and modest income increases in poorer nations. The potential for expansion in the latter market is considerable.

A Political Force

As events have shown in the post-World War II era, the capacity of the United States to produce more food than it consumes has important political and humanitarian as well as economic consequences. Economic benefits and costs, although complex, can be calculated with some precision. Other less easily quantified benefits are associated with U.S. food exports and with aid shipments made outside the market system. For example, there is a direct linkage between food availability and political stability. Though difficult to measure, these



benefits are nevertheless real and add to the social utility of maintaining an abundant supply of readily available agricultural lands in this country. One benefit is the diplomatic advantage of having other nations perceive the U.S. as capable of sustaining and increasing food exports over the long run. Another results from the U.S. ability to fulfill humanitarian obligations for food assistance to less-developed nations.

Growing dependence on overseas agricultural trade imposes increased pressures on the land, potentially adverse environmental impacts, and social costs affecting the traditional American family farm. These costs typically are not included in calculations of the country's international agricultural trade balance. The surplus balance that has been realized from this trade sector is an important offset of the deficit incurred in other trade sectors as a result of large U.S. petroleum imports. So long as international trade in these other sectors is heavily in the red, there will be strong economic incentives for maintaining, and wherever possible expanding, overseas shipments of farm products. Even in the absence of a strong need for earning foreign exchange, the American farmers' never ending quest for higher prices would exert pressure for exports.

To the extent that the loss or degradation of its farmland could affect the United States' ability to produce food for trade and aid, such loss would unavoidably have international economic and political consequences. This possibility is not normally considered in domestic debates on land use, nor does it receive priority attention in the continuing debate over United States foreign agricultural policies. Nonetheless, one expert in the field has stated that "to the extent that agricultural land use becomes a tool of foreign policy, we can expect this to be the greatest influence upon competition for land in the United States in our time."

Pressure on U.S. Cropland

The value of United States agricultural exports was expected to total \$39.7 billion in 1980. Subtracting an anticipated \$18 billion in agricultural imports, this leaves a positive trade balance of \$21.7 billion. Significantly, the nation is expected to run a total trade deficit of \$33 billion in calendar year 1980, up from \$24.7 billion in 1979. This increase primarily derives from an onerous \$90 billion in petroleum imports. Favorable agricultural trade therefore offsets about one-fourth of the foreign oil bill. There is reason to believe that the agricultural sector will in fact be called upon to generate similar or greater surpluses until the United States achieves greater energy independence. Further pressures on cropland thus can be expected—both in terms of the intensiveness of cultivation and the area required. As Philip Raup has observed, the acreage devoted to exports has increased from 50 million in 1950 to 100 million in 1975 and 133 million in 1978. "In terms of competition for the land, we have reached a degree of agricultural export dependency for which parallels can only be found in the antebellum cotton South or in our Colonial era," he notes.

World population is expected to increase from a present level of 4.4 billion to 6 billion or more by the year 2000. Lagging agricultural productivity in the developing nations, where the major portion of this population growth is occurring, thus can be expected to generate continuing demands for more direct food aid and concessional sales.

Immediate export pressures on the U.S. presumably will be on the coarse grain croplands, for example the Middle West; however, rangeland areas in the West and Southwest, and forest and range areas of the Southeast and Delta States could be affected in future years as well if expanding overseas markets prompt their conversion to cropland use. Such conversion will eliminate any forest, range, or pasture uses

to which these acres previously may have been put.

The present extent of malnutrition in countries unable to finance necessary imports signals pervasive overseas food problems that generate special foreign policy concerns. Malnutrition, famine and actual starvation normally are perceived as humanitarian problems, but they hold obvious political implications as well. Economic expectations are rising in many countries; governmental failure to meet minimal demands for food and employment can trigger social and political unrest and, in some instances, revolution.

During the early 1970's production shortfalls in several parts of the globe and a Soviet decision to import feedgrains on a massive scale in the face of domestic crop failures enabled the United States to draw down its surplus stocks and bring soil-banked land back under cultivation to meet an unprecedented export demand. It now appears that this demand may persist, subject to cyclical variations, for years or even decades, as a result of such global phenomena as population growth, the increasing magnitude and frequency of natural and man-made disasters, and rising affluence and the consequent demands for more and better food. American agriculture productivity is thus beginning to be perceived in terms of new, trade-oriented economic and political opportunities, while food aid is becoming a more costly proposition in the face of rising prices and budget stringencies. The practical result of the latter development is that cereal exports (as food aid) were only about 6 million tons in 1980, whereas the level was 13.5 million tons in 1960 and 10 million tons in 1970.

Leading Export

The economic aspects of United States dominance in the international grain trade have both domestic and international political ramifications. Agricultural sales abroad lead all other export earnings and thus help to remedy chronic balance of payments problems and shore up the declining value of the dollar. In another sense, agricultural exports provide an outlet for surplus production that otherwise would lower farm income. However, some critics of current U.S. export policies believe that the growth of international trade may be strengthening large-scale farming operations at the expense of weakening the traditional family farm system. The trend toward increasingly large farming operations is placing the smaller operators and prospective young farmers at a distinct disadvantage.

Virtually all futures scenarios for the world predict a worsening petroleum supply situation in the 1980's and 1990's, especially as the USSR begins to compete as a net importer.

Since grain is likely to remain a principal source of export earnings for the United States, it can be perceived as a primary means of paying the rising oil bill. In the past surplus grain could be funneled into foreign aid at an actual savings in storage costs, land set-asides and other domestic subsidies. In the future, each bushel that is given away, whether for purely humanitarian reasons or for political motives or a combination of the two, will "cost" what it could have brought in the world market. The fact that the *quantity* of U.S. cereals aid has declined from 10 million tons in 1970 to 6 million tons in fiscal 1980 underscores the economic realities now prevailing.

Plowing to the Fence Posts

The sudden expansion of export trade beginning in 1973 temporarily eliminated surpluses but imposed new pressure on agricultural land. Farmers plowed "fence post to fence post," resorted to more monocropping, and utilized heavier equipment and more fertilizer and pesticides. The results have been described as "soil mining." In retrospect, it may be asked whether world market prices really compensated for the longer term damages incurred. For example, the annual economic impact of soil compaction alone has been estimated to be as much as \$3 billion. Erosion is potentially an even greater problem. U.S. cropland erosion in excess of the Tolerable level of 5 tons per acre per year was calculated by USDA at about 1 billion tons in 1978.

There is no question about the legitimacy of the humanitarian sentiments underlying public support for expansive United States food aid in the post-World War II era, or for that matter following World War I. Nonetheless, it must be admitted that actual decisions to donate food in massive quantities were based at least partially on the fact that it was available, cheap, badly needed by the recipients, and accordingly likely to pay good political dividends. Eliminating storage costs was also a powerful incentive. The negative feature was that in some instances free (or at least very cheap) food depressed local market prices and thus discouraged the development of local farming abroad. Nations remained on the dole when in some instances they could have become largely self-sufficient in basic diet essentials while graduating into cash customers for American feedgrains and other ingredients of a better diet.

This leads to ethical questions concerning the world population problem. To what extent is the United States obligated to use, and possibly degrade, its croplands to feed nations which fail to restrain population growth or to reform feudal agricultural systems? Governments which follow high

birth rate policies or give only token attention to family planning while simultaneously neglecting their own land resources and rural development could be viewed as seeking a disproportionate share of the world's food production.

Helping Others Grow More Food

Probably the most efficient way to eliminate hunger in the poorer nations over the long term is not through food aid or concessional sales but rather through technical assistance that will enable these nations to produce more of their own food and to expand employment opportunities. This would be in the U.S. self-interest because it would decrease pressures on the domestic agricultural base, help to restrain the upward movement of domestic food prices, and contribute to political stability and overall development.

Another ethical question relates to the adverse environmental effects that could result from even more intensified U.S. food production for overseas consumption. This could invoke excessive use of pesticides (notwithstanding the present availability of integrated pest management systems), other types of chemical pollution, soil degradation—including compacting, salinization and alkalinization—and the accelerated depletion of groundwater resources.

If, for all the obvious economic and political reasons, agriculture is an important American foreign policy asset, would a material decrease in agricultural land availability significantly affect the United States ability to achieve its overseas objectives? The adverse effects would not stem from an immediate threat of devastating cropland loss but rather from a possible long-term trend in which the gradual but steady dis-

appearance of our best land undermined the agricultural productivity upon which these foreign policy objectives were based.

National Vs. Local Interests

Irrespective of public interest or understanding, cropland availability can help or hinder the attainment of foreign policy objectives because it has a direct bearing on productivity and hence on the United States' credibility as an agricultural superpower. However, foreign policy is the exclusive preserve of the Federal Government, whereas most land use planning, regulation and taxation occurs at the State or local levels.

Since over-production and consequent low market prices have posed problems to American agriculture over the years, optimal short term land policies may differ markedly from those that would be consistent with longer-term foreign policy interests of the country.

The fact that cropland conservation and the enhancement of agricultural productivity for foreign relations objectives do not mesh neatly with near-term market concerns does not mean that the latter set of problems should predominate or that traditional responses are the only ones available. When prime agricultural land is converted to other uses according to current economic rationale, reconversion to agriculture in response to some future need is generally impossible, or at best very costly. This suggests that the national interest will best be served by more coordinated Federal, State and local planning that perceives of land as important in a combined local, national, and global context. Such planning need not involve compromises so much as the resurrection of what the naturalist Aldo Leopold so eloquently argued for in his writings: The land ethic.

International relations in the 1980's and 1990's are likely to be influenced by resource scarcities to a considerably greater extent than in the past. These, rather than conventional political rivalries, will pose increasing dangers to global security. While the fossil energy situation poses the most immediately visible problem, failure within the developing world to pace population growth with agricultural development could generate a comparable or even more critical food security problem well before the end of the century. In these circumstances, or even in the less severe world food situation now prevailing, American cropland must be perceived as a global as well as a national resource. □

David McClintock is a specialist on food and agriculture in the State Department's Office of Food and Natural Resources. The above was excerpted from an article for the National Agricultural Lands Study.



U.S. grain for Ethiopia being unloaded.

A Helping Hand for Indonesia

By Truman Temple

A government van recently drew up at the Indonesian Embassy in Washington, D.C. to discharge some 25 cartons from EPA.

The boxes were addressed to a number of universities in Indonesia and to Dr. H. Emil Salim, State Minister for Development Supervision and the Environment. Inside were hundreds of documents describing the laws and regulations that the United States has created over the past decade dealing with environment.

The shipment is one example of how this Nation is exporting not only pollution control equipment but the whole philosophy of environmental protection including the concept of a permit system, government grants to encourage communities, and the decentralized approach to local enforcement.

The gift was made possible by C. William Carter, EPA Deputy Assistant Administrator for Resources Management, who has acquired an extensive knowledge of environmental and conservation problems in Indonesia over the past dozen years. When Dr. Salim visited Washington last year looking for help in establishing a system of environmental management for his country, one official quickly referred him to Carter, who revealed during the course of the meeting his first-hand experience with Indonesia's development.

Rich Hardwood Resources

Carter's interest in the archipelago in the South Pacific began in 1969 when he was sent there by the First National City Bank of New York to look into opportunities for a new branch the institution was setting up in Djakarta. One of the things that sparked his interest was the forests of mahogany representing the largest single stand of homogeneous tropical hardwood in the world.

"Very little provision had been made either to develop or to conserve this very rich resource," he explained. "At the same time, Indonesian officials were opening up the country to investment by industry from other nations and bringing in technicians to help restore the economy. So much needed to be done."

Carter, an economist, became so intrigued by the forests that he later went back and wrote his Ph.D. dissertation on the Indonesian timber industry at the Fletcher School of Law and Diplomacy, Tufts University. He also served in 1971-72 as a consultant to the Indonesian Ministry of Finance on taxes and industrial policy. Last fall Carter again visited Indonesia, under auspices of the Agency for International Development, to gather material for a report on the status of that country's environmental protection efforts.

The assistance by EPA and AID comes at a time when Indonesia is pressing forward in a number of areas to improve the quality of life for its people. The nation is building 15 environmental research centers at universities, and its Ministry for Development Supervision and the Environment is working on a new draft environmental law and water quality guidelines to lay the groundwork for environmental programs.

"In its third Five Year Plan," Carter notes, "Indonesia hopes to press forward with a number of larger projects where attention to environmental issues will require extensive management effort and resources. It also has to weigh carefully the environmental effects of what it has done over the last ten years." One example of future construction is a natural gas field in the Natuna Islands west of Borneo which, when developed, would be one of the largest in the world.

"Unfortunately, it also would have a fair share of complicated environmental problems that have national and potentially international spill-over effects," he said.

"Another example is industrial pollution. There are increasing reports of mercury poisoning of fish and other problems related to toxic industrial effluent in the large cities.



Abundant palms are a South Anson and primary for Indonesian lands.

Under the leadership of Dr. Salim, Indonesia is beginning to build the capacity to evaluate the nature and scope of the problems," he declared.

Population Pressures

Indonesia's efforts in environmental management are arriving none too soon. Once described as a Pacific paradise, this collection of islands stretching 3,400 miles along the Equator south of the Philippines and Vietnam is beginning to suffer a number of 20th century problems. The pressures of its population—more than 144 million—have forced people to cultivate steep slopes, causing widespread erosion. Poor upland management has resulted in damaged irrigation systems brought about by flash floods and siltation. Aggravating the problem is the country's heavy rains—more than 70 inches a year. (In one city, Bogor, there are thunderstorms some 300 days a year.) When the torrential rains hit exposed farmland on hillsides, the runoff of fertile soil becomes a serious problem.

Aid to Other Lands

EPA also has furnished advice and technical assistance on environmental matters to a number of other countries. Last December, for example, James J. Boland, Pesticide Incident Monitoring System Coordinator in the Office of Pesticides and Toxic Substances, visited Jordan as part of a three-man team of specialists to help that country develop a system of pesticide management. The Jordan Valley since Biblical times has been noted for its fertile, productive soil, and the intense development of farmlands there in modern times has brought with it the need to control the problems of pesticide handling and use, Boland explained. His trip also was under AID auspices.

F. Allen (Tex) Harris, Director of the EPA Office of International Activities, and Richard Dewling, Deputy Administrator of Region 2, last August visited Nigeria under auspices of the International Communications Agency to make a general survey of environmental problems there. EPA also has furnished technical information to a number of other countries and localities including Singapore, the Philippines, and Kenya.

Carter said he is continuing to discuss with Indonesian authorities strategies for solving their environmental problems, particularly in urban areas where the need to preserve clean water in the face of accelerating population pressure is especially acute. □

Truman Temple is Associate Editor of EPA Journal.

1 REGION

Minorities

Region 1 recently sponsored an exposition entitled "Working Together to Bridge the Gap," focusing on the need to include minority and women-owned businesses in EPA's construction grants program for wastewater treatment facilities. The exposition was held in Providence, R.I., and was attended by about 1,000 people.

Over 100 minority and women-owned business enterprises including public relations agencies, equipment leasing and rental, graphic design, legal services, trucking, construction contractors and manufacturers as well as architects and engineers provided exhibits and displays.

Region 1 also recently sponsored a public meeting to solicit comment on its draft 1990 construction grants strategy. The strategy is designed for the remaining clean water needs, goals for 1990, and what changes need to be made in the construction grants program in the 1980's to meet those goals.

2 REGION

Refuse

EPA Region 2 intends to publish in late April an environmental impact statement on the Upper Passaic River Basin 201 Facilities Plan in New Jersey. A major issue to be addressed in the statement is the impact on the Great Swamp National Wildlife Refuge of the flows from two sewage treatment plants slated for upgrading and expansion. The major environmental problem facing the Refuge is non-point source pollution from nearby developments. U.S. Fish and Wildlife Service reports indicate that uncontrolled development of headwater streams leading to the Great Swamp is turning the Refuge into a sink for sediments, fertilizers, and other pollutants.

Preservation of the Great Swamp is a vital necessity for the tens of thousands who depend on the area as a recharge zone for pure drinking water, Region 2 officials said. Even more communities situated in the Passaic River Basin rely on the Refuge to draw off flood water during heavy rainfall.

At present several Federally-administered programs provide for land use constraints that will help resolve the runoff and flooding problems in the Refuge. In addition, as part of the environmental impact statement process, EPA intends to use new Federal discharge permit regulations and designate the Great Swamp watershed a General Permit Program area, subject to conditions governing the program.

3 REGION

Settlement

FMC Corporation has agreed to pay \$1 million into an environmental trust fund in order to settle a Federal suit charging the company and two of its employees with conspiracy, withholding information, and obstruction of Agency proceedings. These charges stemmed from EPA Region 3's investigation of the discharges of carbon tetrachloride into the Kanawha River from FMC's South Charleston, W. Va. plant in 1977.

FMC pleaded guilty to the withholding information and obstruction charges. In exchange for the withdrawal of all charges against the individual employees and the conspiracy charge against the company, FMC also agreed to pay the maximum fine of \$35,000 and to pay the \$1 million into the trust fund.

The agreement specifies that the money will be used on projects related to water quality or the effect of water pollution on human health. Whenever possible, preference will be given to projects which benefit individuals or the environment of the Kanawha and Ohio River valleys.

Coal Study

Region 3 recently completed an environmental assessment on the impact of coal mining in West Virginia, aimed at reduc-

ing the time and cost for obtaining most new mining permits by highlighting environmental concerns early in the planning stages.

The assessment covers the impact of coal mining on all aspects of the environment such as fish, erosion, sedimentation and wildlife, as well as water quality. Prior to the study, it could take up to one year for a coal company to receive a National Pollution Discharge Elimination System permit for discharge into waterways. Now, because of this statewide study and other cooperative agreements with the West Virginia Department of Natural Resources, EPA will be able to process nearly 85 percent of the coal mining permits within one month of receipt of their application.

4 REGION

Synfuel

Region 4 officials are presently studying the potential impacts on air quality of proposed synthetic fuel installations on Tennessee and Alabama.

A Koppers Company and Cities Service facility in Oak Ridge, Tenn., would burn 29,000 tons of high sulfur coal a day to produce 50,000 barrels of gasoline. The coal would be mined in eastern Tennessee. Region 4 staff and the State are helping the companies prepare Prevention of Significant Deterioration (PSD) applications.

A synfuel plant planned for Memphis would convert 3,000 tons of high sulphur coal into 150 million cubic feet of gas. A draft environmental impact statement and PSD application are under review.

Regional Office personnel are reviewing a draft environmental impact statement prepared on a proposed Tennessee Valley Authority facility in Guntersville, Ala. Natural gas and other chemical feedstocks would turn 20,000 tons of coal a day into synthetic gas equivalent to 50,000 barrels of imported oil.

5 REGION

Clearinghouse

Region 5, in cooperation with the Illinois EPA, has awarded a \$50,000 grant to the Illinois State Chamber of Commerce for the establishment of an information clearinghouse to promote among Illinois industries a better understanding of the Clean Air Act requirements and to encourage innovative, cost effective ways to come into compliance with existing air quality standards.

Through technical, financial, brokering, and informational assistance, the clearinghouse hopes to be able to help industries take advantage of options available to them in meeting clean air standards, as outlined in the 1982 Illinois State Implementation Plan for clean air. Those options, generally known as controlled trading, include the "bubble" concept, emission offsets, and emission offset banking and trading. They were designed as part of EPA's regulatory reform efforts and were meant to give industries a bigger say in how and where within a plant or a series of plants shall air emissions be controlled.

Illinois industries interested in further information or participating in the clearinghouse program are invited to contact the Illinois State Chamber of Commerce, 20 N. Wacker Drive, Chicago, Ill. 60606; (312) 372-7373.



PCB Incineration

EPA Region 6 recently approved the Rollins Environmental Services of Deer Park, Texas, and Energy Systems Company of El Dorado, Ark., as the first two commercial chemical waste incinerators for destruction of polychlorinated biphenyls (PCB's).

EPA considers incineration of PCB's at extremely high temperatures to be the only acceptable method of disposal for liquids containing 500 or more parts-per-million of PCB's.

Test burns at both sites showed that the equipment destroyed more than 99.9999 percent of the PCB's, and health studies showed that, under worst case conditions, over a 70-year period, the chance of cancer following the Rollins test would be less than one in 50,000, and less than one in 2.5 million in Arkansas.

Region 6 was assisted in the testing and analysis by EPA's Office of Pesticides and Toxic Substances, Headquarters; Office of Research and Development at Triangle Park, N.C., and Wright State University, Dayton, Ohio.



EPA Action

Region 7 recently filed a complaint seeking a fine of \$19,000 against National Industrial Environmental Services, Inc. of Wichita, Kan., for alleged mishandling of polychlorinated biphenyls or PCB's.

The charges resulted from an EPA inspection of the facility in which an electrical transformer containing PCB-contaminated cooling liquid was discovered in a storage space without a roof or walls. This transformer and two large high voltage PCB capacitors stored in a vault within a PCB storage area were found not properly marked. The EPA inspection also revealed that the company had failed to prepare and maintain records on PCB storage and disposal as required by Federal regulations.

Test Burn

Union Electric, a St. Louis, Missouri-based utility company, recently test burned 100,000 gallons of PCB-contaminated mineral oil dielectric fluid at the utility's Labadie Power Plant in Labadie, Mo. The burn was the first of its kind in Region 7.

EPA technicians were on hand to monitor the test burn and take samples during and after the incineration process. The analysis of those samples showed no detectable levels of PCB's.

EPA is awaiting results of stack gas samples taken by a consultant firm contracted by Union Electric. If those samples show no detectable amount of PCB's, the Labadie facility will be given the go-ahead for future incineration of the utility's PCB-contaminated waste materials.



Air Quality

Region 8 recently awarded a \$43,981 grant to Montana's Assiniboine-Sioux Indian Tribes which will enable them to continue working on an air pollution control program on the Fort Peck Reservation.

These funds will help make it possible for the tribes to continue monitoring air quality on the Reservation. Emphasis is being placed on collecting information on particulates, ozone, and sulfur dioxide. Additionally, the tribes will continue developing air pollution control regulations for reservations.

Energy development has raised concerns among the tribes, who cite the possible degradation of the relatively clean air on or near Fort Peck. Last year the tribe issued formal notices of intent to seek Federal reclassification of the reservation to Class I under a special provision of the Clean Air Act.



Compliance Order

Region 9 recently issued a compliance order to Capri Pumping Service of Los Angeles, Calif., and its owner, Refugio Carasco, for violations of Federal hazardous waste program requirements.

While conducting an inspection of the Capri facility, EPA inspectors found violations of Federal interim status standards applicable to hazardous waste treatment and storage facilities under the Resource Conservation and Recovery Act.

The order requires that Capri comply with all Federal interim requirements before treating any waste or accepting new waste and that it post a performance bond to ensure that the facility is properly closed and decontaminated after operation. In addition, EPA assessed a penalty of \$46,000 against Capri and Carasco for the violations.



Court Order

A large chemical processing facility near downtown Seattle which stores hazardous waste has been ordered by a U.S. District Court judge to keep conditions at the site from returning to the situation of last summer when the Seattle Fire Department discovered serious fire and explosion hazards. The judge's order drew this comment from Region 10 Administrator Donald Dubois: "If the company (Chemical Processors, Inc.) complies with the injunction and the fire precautions required by the City of Seattle, conditions at the facility will never again reach the dangerous situation discovered by the Seattle Fire Department. Even before the judge's action, steps taken by Region 10 had led to substantial improvement at the site. The current situation at Chem-

ical Processors is far from being the threat it was last August. Now, with the injunction, the Government's efforts to seek continued improvement have the force of a court order." □

States Served by EPA Regions

Region 1 (Boston)

Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
617-223-7210

Region 2 (New York City)

New Jersey, New York, Puerto Rico, Virgin Islands
212-264-2526

Region 3 (Philadelphia)

Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia
215-597-9914

Region 4 (Atlanta)

Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Kentucky
404-881-4727

Region 5 (Chicago)

Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota
312-353-2000

Region 6 (Dallas)

Arkansas, Louisiana, Oklahoma, Texas, New Mexico
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Alaska, Idaho, Oregon, Washington
206-442-1220



Encroachment by housing developments on farmland, such as this threatened California artichoke farm in foreground, has stirred concern

Protecting America's Farmland

By Truman Temple

The long-awaited National Agricultural Lands Study, warning that much prime farmland is being taken out of production by housing developments, highways, Federal projects and other uses, has called for a series of measures to preserve this rich resource for future generations.

Among other things the report called upon the Federal government to put its own house in order. It urged agencies to stop promoting or financing projects that gobble

up good agricultural land and instead to encourage construction on other types of terrain.

"The United States has been converting agricultural land to non-agricultural uses at the rate of about three million acres per year—of which about one million acres is from the cropland base," the study noted. "This land has been paved over, built on, or permanently flooded, i.e., converted to non-agricultural uses. For practical purposes, the loss of this resource to U.S. agriculture is irreversible."

The report pointed out that of 37 Federal agencies it reviewed, only two—the Envi-



ver vanishing cropland.

Environmental Protection Agency and the U.S. Department of Agriculture—have explicit policies to consider the effect of their programs on agricultural land. Noting that environmental impact statements by agencies seldom assess the cumulative adverse effects that a series of programs have on prime farmland, it called upon the government to create other tools by which the impact of Federal projects on good crop soil can be controlled.

Government decisions, the study declared, also "have a powerful indirect effect by spurring the conversion of agricultural land. This may depend on where a highway is built, where the interchange is located, where a sewer line goes, whether government financing is available for housing or a subdivision, or whether government programs lead to new job opportunities in a rural area."

One of the major reasons why officials view the loss of rich farmland with concern is the major and growing contribution that America's farm exports have on our international balance of payments. In 1979 U.S. agricultural exports exceeded \$40 billion, some \$8 billion higher than the previous year and more than \$18 billion above the level five years earlier. The sales, constituting nearly a fifth of the value of all U.S. exports, now go a long way toward offsetting outlays for foreign oil, and the future market for our food and fiber is expected to expand sharply. The study projects that foreign demand for U.S. farm products will nearly double by the year 2000 as global population increases.

A dozen Federal agencies including EPA participated in the 18-month study, which was initiated by the Department of Agriculture and the President's Council on Environmental Quality. Robert Gray, executive director of the study, noted that in addition to the Federal agencies, 50 public interest groups were involved including a cross-section of farm and business organizations. Nearly a score of workshops were held by staff members with community and area leaders across the Nation last year in their efforts to give local interests a voice in the whole question of future farmland preservation.

At a press conference announcing the study results last January, CEQ officials warned that if the farmland losses continued unchecked for the next two decades, it would result in "unacceptable inflation," with land so expensive that farmers could not pay for it out of earnings. They also predicted that bringing marginal land into production would result in increased erosion.

According to the study the United States now has about 413 million acres in crops with another 127 million acres of potential farmland. However, if present trends continue for the next two decades, the Nation will have to cultivate an additional 140 million acres to meet domestic and foreign demands. The report said this will mean large-scale shifts of forage land into crops, with less land available for livestock grazing. That in turn will mean more "confinement feeding," that is, trucking grain to feedlots where cattle are penned in, a practice that promises to raise the cost of meat production, the study suggested.

Among its recommendations to head off the loss of good farmland, the study said State governments should take an active role in protecting such terrain, setting up programs before developers foreclose local options. It emphasized the "primacy" of State and local governments in this problem and did not attempt to spell out what kind of tax or zoning approaches should be used to preserve farmland.

At the Federal level, the study urged that the national interest in agricultural land should be articulated either by a Presidential or a Congressional statement of policy. An Executive Order or Congressional action should require each Federal agency to adopt a policy of considering adverse effects when its programs result in converting good farmland to other uses, the report declared. Such policies should be monitored by an interagency group, it added.

Noting that less than 20 million acres of farmland in the U.S. are protected under comprehensive State or local land-use policies, the report urged Federal assistance to States and localities that want to create land-protection systems.

"The Federal government should not finance or subsidize development projects that occur on good agricultural land," the study said. In addition to requiring applicants for financial aid, where farmland conversion is involved, to demonstrate there are no other practical sites available, the Federal government should provide lower interest loans to attract development away from prime farmland and onto sites less desirable for crops, it added. Preferential interest rates would apply to current Federal loans and grants for housing and industrial development, loan guarantees, home mortgage assistance, and services such as water, sewers, and electrification.

The study also urged improved technical assistance and data to aid in better protection of farmlands.

Former Agriculture Secretary Bob Bergland said at the press conference that he planned to discuss the study with John R. Block, his successor.

Officials said the land study was completed at a total cost exceeding \$2 million. Other agencies participating, in addition to EPA and Agriculture, were the Departments of Commerce, Defense, Energy, Interior, State, Transportation, Treasury, Housing and Urban Development, and the Water Resources Council. □

Truman Temple is Associate Editor of EPA Journal.



Clean Water and Energy from Hyacinths

By William Duffer and Jane Kellogg

Speeding through Japan, the electrical train called the "Bullet Express" moves along at 150 miles per hour, carrying passengers between Tokyo and Kyoto. Gazing out the window at rice paddy after rice paddy, a visitor might find it hard to understand why the Japanese Ministry of Agriculture and Fisheries is considering the conversion of many of these rice paddies into large areas for the purpose of culturing the water hyacinth.

But this lowly weed is beginning to receive attention as a possible source of animal feed, mulching material, soil additive, and a source of energy. It also may help remove pollutants from wastewater. The plant, originally brought to Japan as an ornamental in the 1890's, quickly fell into disfavor in that era because it invaded and often clogged a variety of water systems such as ponds and irrigation channels. These waters provided a perfect habitat for the hyacinth, which prefers water with low clarity, poor movement, and which is enriched by waste products from agricultural fields, residences, or industries. The very reason that the hyacinth flourishes in an environment undesirable for plants has prompted studies by scientists of its ability to cleanse polluted waters.

Recognizing the need for methods such as aquaculture for treating the waste streams

gushing out of factories and cities in this highly industrialized, heavily populated island, Japanese officials began to look for the latest information available. Since abundant research was being produced in the United States on aquaculture, they sought information from the Environmental Protection Agency, among other agencies.

Ada Lab's Role

Workshops, seminars, and informal sessions were arranged by EPA for Japanese scientists and government officials including members of the Japanese Ministries for International Trade and Industry and of Agriculture and Fisheries. Dr. William Duffer of the Robert S. Kerr Environmental Research Laboratory, because of his work in aquaculture, was able to share information in the United States concerning aquaculture and the water hyacinth.

This research has shown that the water hyacinth has the ability to clean a variety of wastestreams. One water hyacinth wastewater treatment system in operation at Disney World in Orlando, Fla., for example, has demonstrated an effectiveness equal to that provided by conventional secondary treatment systems.

Water hyacinth systems cost considerably less to build and operate than the more traditional concrete and steel wastewater treatment facility. For a conventional system with a treatment capability of one million gallons per day, for example, construction costs would be approximately \$1.6 million, while a water hyacinth system capable of treating the same volume would cost approximately \$830,000. In comparing operational costs, a significant energy savings is also possible through the use of the water hyacinth system. A conventional system will use

nearly 7.5 billion British thermal units per year compared to less than 3.5 billion per year for the water hyacinth system.* This is before taking into consideration the energy savings also possible from the production of biomass by the hyacinths.

Studies by 15 Cities

This treatment effectiveness coupled with the potential for cost and energy savings has prompted at least 15 municipalities to consider seriously the installation of water hyacinth wastewater treatment systems. In San Diego, scientists and engineers are currently in the process of designing such a system, in combination with other treatment components, for the cleaning of municipal wastewater.

Studies currently underway at the National Aeronautics and Space Administration laboratory in Mississippi have also shown promising results in the ability of the water hyacinth to treat chemical wastewaters. This system receives discharges from photographic and chemical laboratories and is able to produce an effluent which meets discharge standards.

Japan, like many other countries, has a limited amount of available water, and as such is looking at ways of reusing and recycling all wastewaters. At the present time, a variety of industries have successfully developed reuse or recycle techniques. These include the textile industry, steel and paper mills, and tin-nickel plating operations. In the future, these industries may be using aquaculture to help treat their wastewaters while reducing their costs of operation.

Fast-Growing Weed

With an active growth period of seven to 10 months per year in tropical and semitropical regions around the world, the water hyacinth quickly reaches a height of from 16 to 40

inches. During the growing season, this weed is capable of absorbing pesticides, heavy metals, nutrients, and organic contaminants. To achieve maximum removal of nutrients, plants must be in an active period of growth. With frequent harvesting, it is possible to produce 70 dry tons of biomass per year per acre.

The biomass can be processed into animal feed, mulching material and soil supplements, or can be converted through a fermentation process into methane gas. The significance of the latter is that the gas can be burned like natural gas as an energy source. For a nation such as Japan that produces only one percent of its energy needs, this methane could be a significant bonus.

Conversion of rice paddies to the production of the water hyacinth may enable Japan to gain a more economical, less energy-intensive method of treatment for wastewater as well as an added capability of producing methane gas, an alternative energy source.

In the United States today, gasohol, a fuel which is produced through a fermentation process from crops such as corn and wheat, is readily available. In the near future, methane gas produced from the water hyacinth plant may be just as available.

Using green plants to trap solar energy in living cells while cleansing wastewater, and then extracting that solar energy in the form of methane gas, sounds like a science fiction story. But, as we increasingly look for answers to our pollution and energy problems, as well as new sources of food for ourselves and the animals that feed us, some innovative solutions are being found. □

William Duffer is a research aquatic biologist and Jane Kellogg is a writer/editor at EPA's Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma.

Rice farming in Japan may give way in some areas to water hyacinths.

*A British thermal unit is the heat required to raise a pound of water one degree F.

Update

A review of recent major EPA activities and developments in the pollution control program areas.

AIR

Clean Coal

A report published recently by EPA has confirmed that cleaning coal before burning it can help reduce its sulfur content, thereby reducing the amount of sulfur oxide pollution emitted by coal-fired power plants.

The report, entitled "Cost Benefits Associated with the Use of Physically Cleaned Coal," was compiled for EPA by PEDCo Environmental, Inc. of Dallas, Texas.

Copies of the report can be obtained by writing ORD Publications, Center for Environmental Research Information, USEPA, Cincinnati, Ohio 45268; refer to publication number EPA-600/7-80-105.

ENFORCEMENT

Vehicle Survey

EPA recently released its 1979 Motor Vehicle Tampering Survey which shows an 18 percent rate of tampering with the emission control equipment of the country's 1973 through 1979 model automobiles. This number is essentially the same as the 19 percent tampering rate found in EPA's 1978 survey.

The report also examined the extent of fuel switching, which is the use of leaded gas in vehicles requiring unleaded gas. It found that nine percent of the cars had been subjected to fuel switching, a result close to other EPA estimates.

The tampering included disabled exhaust gas recirculation systems, removed catalysts, altered filler neck inlets to permit the use of leaded gas in cars requiring unleaded gas, and disabled vacuum spark retard. Only eight percent of foreign cars inspected showed evi-

dence of tampering as compared to 20 percent of domestic vehicles. And older cars showed higher rates of tampering than vehicles only a year or two old.

The 1979 survey was based on checking about 2,500 cars in eight States: Arizona, Delaware, Minnesota, New Jersey, Tennessee, Texas, Virginia, and Vermont.

Fuel Violations

EPA recently filed administrative complaints against five Maryland gasoline retailers and four refiners for violations of fuel regulations of the Federal Clean Air Act.

The retailers, who were cited for selling contaminated unleaded gasoline, and the amount of assessed penalties are: Bay Oil, Inc., Havre de Grace, Md.—\$6,000; Dale's Sunoco Service, Bethesda, Md.—\$2,000;

Foerster's Getty, Baltimore, Md.—\$500, and Lansdowne Shell Station, Lansdowne, Md.—\$1,000. The refiners cited and the penalties assessed are: Sunoco—\$7,000, Chevron—\$7,000, Getty—\$6,000, and Shell—\$6,000.

The fifth retailer, Belair Mobile of Bowie, Md., was cited for allegedly having an improper nozzle on a leaded gas pump which allowed the nozzle to fit through the filler inlet restrictors on vehicles requiring unleaded fuel and was assessed a penalty of \$5,000.

HAZARDOUS WASTE

Reproposal

EPA recently announced a reproposal of standards for permits for existing hazardous waste facilities in which wastes are placed permanently in the ground. These facilities include landfills, land treatment facilities, and surface impoundments and underground injection and seepage facilities. Following public comments, these standards are subject to review before a final decision is made. The repropo-

sals were issued under a court-ordered timetable.

The Agency also issued interim final regulations which will allow permits of urgently needed new facilities until the proposed standards are finalized, and set standards for incinerators which treat hazardous wastes.

PESTICIDES

Insecticide

The EPA recently announced it has decided to allow the continued use of the insecticide dimethoate on the condition that farm workers and home gardeners wear protective clothing while mixing and applying it.

The decision ends a two-year investigation into the benefits and risks of dimethoate to determine whether it should be allowed to be used, used under restrictions, or banned.

Dimethoate is used on crops such as corn, sorghum, wheat, safflower, soybeans, cotton, tobacco, alfalfa, fruits and nuts, vegetables, and for other purposes. Home gardeners use it on ornamental plants and trees. The insecticide was being investigated because it was shown to cause birth defects in animals, and there was evidence that it could cause tumors and genetic damage in animals also.

RADIATION

Traces

The EPA's Environmental Radiation Monitoring System has revealed that trace amounts of fission products were present in air particulate samples taken from the cities of Los Angeles and Berkeley, Calif.; Santa Fe, N. Mex.; and Las Vegas, Nev., recently. The samples collected show the presence of barium-140 which has a relatively short radioactive half-life. However, the quantities measured are so small that the Agency concluded that they are probably the last traces of fallout from China's nuclear detonation on October 16, 1980.

The Department of Energy also informed EPA that facilities under its jurisdiction in Iowa and Tennessee reported detecting trace amounts

which are probably due to the Chinese test.

EPA says that the levels recently measured are lower than those measured last fall, and that neither level is high enough to pose any significant health hazard to the public.

RESEARCH

Joint Effort

EPA recently announced a major Agency effort to promote joint research by industries into new ways to reduce pollution.

The Agency will begin working closely with a number of major business organizations to inform the Nation's industries about guidelines from the Justice Department that clarify possible antitrust aspects of joint industrial research efforts. EPA believes that uncertainties about the antitrust implications of such joint research have discouraged industries from entering cooperation projects that potentially could find needed answers to tough pollution control questions. And

the Agency feels that such research is vital to the effectiveness of future pollution control efforts.

The Justice Department guidelines will be distributed by the U.S. Chamber of Commerce, the Environmental Industry Council, the National Environmental Development Association, the National Federation of Independent Businessmen, the National Association of Manufacturers, and other major trade groups. In addition to their memberships, broader distribution of the guidelines will be attained through special EPA mailings.

Air Quality

The EPA has awarded a \$555,764 contract to the Rockwell International Corporation of Newbury Park, Calif., to collect and monitor air quality data in seven U.S. cities in support of the Agency's epidemiology research, a branch of medical science that deals with the incidence, distribution and control of disease in a population.

The project is to last through mid-1981. The seven cities involved are: Granite City, Ill.; Bakersfield, Calif.; Tampa, Fla.; Cleveland, Ohio; Riverside, Calif.; Owensboro, Ky., and Houston, Texas.

These cities were selected by the type and amount of certain population concentrations indicated in previous studies and the predicted amount of growth levels in certain gases and particulate emissions due to new industries scheduled to open in some of the cities.

Air samples will be collected from three different locations in each city and each site will be monitored continuously for two months.

TOXICS

Asbestos Use

The EPA has proposed a new program to collect needed information on how asbestos, a cancer-causing substance, is used in the United States.

A "profile" on asbestos use and exposure will be assembled from data to be submitted by indus-

tries producing asbestos or asbestos-containing products. By giving a comprehensive picture of the life cycle of asbestos fibers from mining and milling through product manufacturing, use and disposal, EPA will be provided with sufficient data to decide whether controls on usage are warranted.

EPA proposed the rule under authority of Section 8(a) of the Toxic Substances Control Act, which gives the Agency the authority to collect information on existing chemicals; it can also restrict their production or use, if warranted.

WATER

Minorities

The EPA recently proposed revising and clarifying its policies and procedures related to construction businesses owned by minority-owned architectural, engineering, consulting, and construction firms in the construction of EPA-funded sewage treatment facilities.

The proposed revisions consist mainly of clarifications to the existing requirements and would not affect the basic purpose of the policies. □

Scenes From a Train Window

The Washington-bound commuter train whistled and its headlight cut a swath through a dawn rain shower as it rounded a curve and headed for the ancient cobweb-festooned railroad station at Harpers Ferry, W.Va.

As the train approached the waiting passengers huddled under umbrellas on the platform, a mourning dove which had been feeding near the tracks flew up with a sudden whir of its long pointed wings.

While the passengers boarded the train, a gust of wind lashed them with rain and a flash of lightning glinted off the windows of the pastel-painted hillside houses of historic Harpers Ferry, a town of 500 people nestled in the shadow of the Blue Ridge Mountains.

The train lurched forward and began approaching the bridge where the rain-swollen Potomac swirled below to meet the Shenandoah River.

The passengers could see through the rain-streaked win-

dows the famous confluence where these two great rivers burst through a gap in the Blue Ridge Mountains and descend toward Washington.

This is the scene Thomas Jefferson described as being so spectacular that it was worth making a trip across the Atlantic Ocean to see it.

After crossing the river the train rides over the last section of bridge above a rain-soaked C&O Canal and then enters a tunnel through the Blue Ridge Mountains. When it emerges, the storm has abruptly ended and under a brightening sun the train runs parallel to the canal and the Potomac on the way to the old railroad town of Brunswick, Md.

An alert passenger may be fortunate enough at this time of year to see a yellow form flitting in the trees. Was it a goldfinch or the prothonotary warbler, the golden bird with blue-grey wings which figured so prominently in the Alger Hiss trial?

The train moves on before the question can be answered to the gingerbread-style station at Point of Rocks, Md. Here part-time farmers have plowed up small plots for vegetable gardens. In the early morning hours robins are checking out the freshly turned earth for worms. When the train stops, a rooster can be heard crowing in the distance and sparrows twitter from a large sycamore tree near the station.

As the journey continues, a crimson flame becomes noticeable in the trees lining the railroad tracks. The new leaves of

the red maple light up Spring as the dying leaves of these trees will brighten Autumn.

The train rumbles by green-ing farm fields and approaches the Monocacy River, where a towering smoke stack from the Potomac Electric Power Co. plant at Dickerson, Md., reaches into the sky.

Nearing the next stop, Gaithersburg, the train passes a series of fairground sheds where cattle and sheep are displayed. Shopping centers and housing subdivisions rise from newly converted farm fields and are often surrounded by cud-chewing cows who manage to keep their placid demeanor despite the signs of growth.

At Rockville, the next stop, the golden blossoms of forsythia brighten many yards. Between Rockville and Silver Spring the train crosses the traffic-clogged Beltway.

At Silver Spring, a flock of pigeons burst into the air as the train arrives and wing by a huge poster of a little girl crying and saying, "Daddy, you're not sober, please pull over," an advertisement sponsored by the Maryland New Car Dealers Assn.

Finally the train inches across the spaghetti of railroad tracks at Washington and draws to a stop near Union Station.

In front of the station the flags of the U.S. and the States are flapping furiously in a brisk breeze. At the Capitol a few

blocks from the station gulls are wheeling above the reflecting pool.

From the Capitol West Front the green Mall stretches ahead. Streets crossing the Mall are swelling now with heavy volumes of traffic as Washington area residents awake and begin another day.

How many in this army of workers realize that all the splendor and power of one of the world's great capitals is utterly dependent for its existence upon simple natural systems such as an April rain replenishing the Potomac River?

Do they recognize that while Washington is a city of great beauty, its real glory may be based on its surrounding countryside—the rolling mountains, the wild beauty of the C&O Canal and the other treasures that can be observed in a commuter's train journey?

Perhaps some of these assets have no economic value, but, as Aldo Leopold pointed out long ago in his classic work, "A Sand County Almanac":

"A system of conservation based solely on economic self-interest is hopelessly lopsided. It tends to ignore, and thus eventually to eliminate, many elements in the land community that lack commercial value, but that are (as far as we know) essential to its healthy functioning. It assumes falsely, I think, that the economic parts of the biotic clock will function without the uneconomic parts."—C.D.P. □



News Briefs

Industry Awards

Five companies and two utilities were honored recently for outstanding achievement in protecting the nation's environment. The seven, winners of the 1981 National Environmental Industry Awards, are Minnesota Power and Light Co., Duluth Minn., for air pollution control; Diamond Walnut Growers, Inc., Stockton, Calif., for energy conservation; Goodyear Tire and Rubber Co., Akron, Ohio, for hazardous waste control; AMAX, Inc., Greenwich, Conn., for land reclamation; Finch, Pruyn & Co., Inc., Glens Falls, N.Y., for solid waste management; Western Lake Superior Sanitary District, Duluth, Minn., for wastewater control; and Hillshire Farm Company, New London, Wis., for waste treatment. The awards, sponsored by the White House Council on Environmental Quality and the Environmental Industry Council, are in recognition of management commitment, sound economic planning and engineering excellence. The winners were chosen by an independent panel of judges.

Block Urges Farmland Preservation

Secretary of Agriculture John R. Block has called for a national land use policy that stops urban development of some of the country's richest farmlands. "In the next 20 years we cannot realize a 60 to 85 per cent increase in demand for U.S. agricultural products while urbanizing three million acres of productive land each year and maintaining current low productivity rates," said Block in a recent speech at the National Agricultural Lands Conference in Chicago. He endorsed findings of the National Agricultural Lands Study which warned that the U.S. faces a land crisis in the next decade unless policy changes stop development sprawl over productive croplands.

Block said the conversion of agricultural lands is a potential crisis in a number of ways: "To meet the projected demands for the next 20 years, most of this nation's 540 million-acre cropland base would have to be in cultivation. This would mean major shifts in the U.S. agricultural system: taking land away from forage and grazing uses, farming poor quality land that is costly to cultivate and subject to erosion and environmental problems, and resulting in higher food prices."

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In dryland wheat producing areas, pressures to reduce the area in fallow can also sap the soil of moisture, as happened in the U.S. Great Plains during the Dust-Bowl years and in the Soviet Virgin Lands during the 1960's. Except where land can be irrigated, the natural constraints on cultivation under low-rainfall conditions cannot be altered substantially.

Where fallowing and other restitutional agricultural practices have fallen by the way, compensatory measures can go only so far. In the Soviet Union, attempts to regain food self-sufficiency by investing heavily in agriculture are stymied because soils have lost some of their inherent productivity. Measuring the degradation of croplands in terms of gully formation, soil scientists at the Soil Erosion Laboratory at Moscow University have found that while only 2 percent of the south central Soviet Union shows severe gullying, as much as 50 percent of the land could follow suit as efforts to intensify agriculture proceed. A parallel Soviet study of the present gully network in the Steppe and Forest Steppe regions in the European USSR found that gully formation has accelerated as "good land reserves became exhausted and sloping land began to be plowed." In an analysis of Moscow's agricultural plans, Harvard's Thane Gustafson observes that the Soviet Government must now reckon with "50 years of neglect [that] have left a legacy of badly damaged soils."

Even while soil erosion raises the demand in the Soviet Union for food imports, it reduces export capacity elsewhere. For example, Australia is also experiencing serious soil erosion as it responds to the growing world demand for grain exports. Canberra-based soil scientist C. L. Watson reports that "some 50 percent of our existing agricultural and arid lands needs ameliorative measures to just maintain present productivity."

Neighboring Indonesia is falling prey to the same neglect. A report from the U.S. embassy in Jakarta indicates that soil erosion is bringing on an "ecological emergency" in Java, laying waste to land at an alarming rate, much faster than present reclamation programs can restore it. Similar pressures are building in Pakistan's rainfed agricultural regions. An AID officer in the Punjab area reports the annual abandonment of several thousand hectares of cropland because of severe erosion degradation. In South Africa, biologist John Hanks estimates that the province of Natal, incorporating Kwazulu, is losing 200 million tons of topsoil annually, the same as is lost in Iowa.

In Nepal, the country's rivers now annually carry 240 million cubic meters of soil to India, making that country the recipient of what has been described as Nepal's "most precious export." In Ethiopia, according to U.S. AID Mission reports, "there is an environmental nightmare unfolding before our eyes. . . . It is the result of the acts of millions of Ethiopians struggling for survival: scratching the surface of eroded land and eroding it further; cutting down the trees for warmth and fuel and leaving the country denuded. . . . Over one billion—one billion—tons of topsoil flow from Ethiopia's highlands each year."

Far from complete, this litany of disasters merely suggests the scope and impact of soil erosion. A 1977 United Nations survey reported that almost one-fifth of the world's cropland is now being steadily degraded.

Determining precisely the extent to which topsoil loss reduces cropland fertility is fairly complicated since increasing fertilizer use can disguise declining natural productivity. However, as Cornell's David Pimentel has noted, three U.S. studies show that other things being equal, corn yields decline by an average of "four bushels per acre for each inch of topsoil lost from a base of 12 inches of topsoil or less."

Underscoring the gravity of the erosion threat is convincing evidence indicating that adopting erosion-control practices is not cost-effective for the farmer. An interdisciplinary team of agricultural scientists studying land in southern Iowa where erosion was excessive, calculated the projected near-term costs of erosion in terms of additional energy use, additional fertilizer use, and reduction in yields. They found that the costs of reducing soil erosion to a tolerable level came to three times the economic benefits of doing so. In the absence of governmental cost-sharing of erosion control practices, a typical farmer with a narrow profit margin and with land suffering from excessive erosion would appear to have two choices: Adopt the needed erosion control measures and face bankruptcy in the relatively near term, or continue with business as usual until eventually the inherent productivity of the land fell to the point where it would be abandoned.

The tough choice confronting Iowa's farmers must be made the world over. Differences in economic systems notwithstanding, the same basic pressures on the land are at work everywhere.

Spreading Deserts: The Human Hand

In semiarid regions where human and livestock populations are expanding at record

rates, deserts or desert-like conditions are being created. According to reports prepared for the U.N. Conference on Desertification, some 630 million people, or one person of every seven, live in arid or semiarid areas. An estimated 78 million people inhabit lands rendered useless by erosion, dune formation, changes in vegetation, and salt encrustation. For this group, desertification means the destruction of livelihood as well as land.

Agronomists who specialize in managing arid and semiarid croplands have long been aware of the mounting pressure on fragile arid soils and of their progressive deterioration. It was not, however, until the droughts of the late 1960's and early 1970's in Sahelian Africa that the social consequences of desertification—starvation and dislocation—became painfully apparent.

Fed by human abuses of the land—overgrazing, deforestation, and overplowing—the world's major deserts are all growing larger. As human and livestock populations increase, deserts or desert-like conditions are spreading throughout the Middle East and in Iran, Afghanistan, and northwestern India. Brazilian ecologist J. Vasconceles Sobrinho reports that the semiarid tip of Brazil's Northeast is being desertified; similar conditions are developing in Argentinean states of La Rioja, San Luis, and La Pampa.

The Loss of Irrigated Land

Irrigated lands, which provide a disproportionately large share of the world's food, are also under siege. They are threatened both by ecological forces—waterlogging and salinity—and by economic forces that divert water to competing uses. In addition, some land is being irrigated by so-called "fossil water"—water from aquifers that can't be recharged. On balance, the world's irrigated acreage is still expanding since the area in new projects exceeds losses. But in some locales, irrigated acreage is shrinking.

As old as irrigation itself, waterlogging and salinity probably contributed to the decline of some early Middle Eastern civilizations. But these proverbial problems have modern-day solutions. If the designers of the earliest irrigation systems in the Tigris-Euphrates Valley did not understand the subterranean hydrology well enough to prescribe corrective action, modern irrigation engineers do. Now the problem is the cost: by recent U.N. estimates, average salvage costs are \$650 per hectare.

Worldwide data compiled in a 1977 U.N. report indicate that one-tenth of the



Wind-blown sand drifts up to six feet deep on a farm in South Dakota.

total area irrigated is waterlogged—some 21 million hectares. The productivity on this land has fallen by 20 percent; almost as much land has been rendered less productive by salinization. Even though these estimates are crude, they tell in capsule the story of a second Carthage. Although fully half of the world's irrigation capacity has been developed since 1950, those gains are already being undermined by waterlogging and salinity.

How much cropland will be paved over, built on, strip-mined, or flooded over the remainder of this century is unknown, but if the projected growth in population and income should materialize, urbanization, energy production, and transportation are certain to continue to encroach upon cropland. The threat posed by this continuous conversion of cropland to nonfarm uses is hard to exaggerate.

Although attempts to expand the globe's cultivated area will likely be numerous, both government efforts and the initiative of individual farmers will be offset by ecological backsliding. Well before the end of the century, for example, the topsoil will be gone

from hillside plots in the Andes, the highlands of East Africa, and the foothills and rugged valleys of the Himalayas, and all will have been abandoned.

Although the hunger for land has never been greater, the amount of cropland abandoned each year as economic pressures interact with ecological forces may also be at a record high. On balance, it is difficult to envisage an increase in the cultivated area of much more than 10 percent by century's end. With projected population increases, even this increase would leave us with less cereal land per person than we now have.

If this cropland assessment is reasonable, it will be difficult to satisfy the doubling in world food demand projected for the final quarter of this century by the United Nations. Given the modest possibilities for expanding the cropland area, the future rise in land productivity would have to accelerate sharply, at a time when it is slowing. The best estimates available indicate that the long-term fertility of one fifth of the world's cropland base is now being undermined by the rapid loss of topsoil.

Responding effectively to the threats to cropland associated with mounting food demands poses a dilemma for farmers and government planners alike. Both economic pressures and political instincts encourage a short-term focus, but pressures to wring too much out of the land in the short run can destroy it over the long run.

Preserving civilization's foundation requires redoubled efforts to protect cropland from erosion and from conversion to non-farm uses. Staggering as the challenge may seem, countries have pulled back from disaster's edge before. The United States overcame the Dust Bowl threat, and perhaps China's longest march has been that on the road to agricultural recovery since 1940. □

Lester Brown is President of the Worldwatch Institute. The above article has been excerpted from his book, Transition—The Worldwide Effort To Create A Sustainable Society, to be published in 1981 by W. W. Norton & Co.

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