United States Environmental Protection Agency Office of Public Affairs (A-107) Washington DC 20460

EPA JOURNA

Volume 14 Number 1 January/February 1988

Ecology and EPA

Ecology and EPA

EPA is concerned with nature as well as with public health. This issue of EPA Journal explores the ecological side of the Agency's mandate, including its job as an environmental watchdog at the federal level under the National Environmental Policy Act (NEPA).

In the first article, the Agency's Administrator, Lee M. Thomas, discusses the ecological and the public health sides of the equation as EPA carries out its responsibilities. Then, in an EPA Journal Forum, six respected ecologists address the question, what ecological knowledge do we need to do a better job of protecting the environment? In a third feature, Dr. Peter R. Jutro of the Agency's Office of Research and Development discusses a difficult issue facing EPA in a complex society and a complex natural environment: how do we know what to try to protect?

The next articles concern two major environmental systems—first, our country's northern extreme, the Arctic, and second, in a warmer climate, the Everglades—and some of EPA's concerns for their protection.

Governor Thomas H. Kean of New Jersey explains rising national concerns about

another environmental system-wetlands. Kean is Chair of the National Wetlands Policy Forum. From another perspective. **Congresswoman** Claudine Schneider writes about her recent trip to the island of Madagascar in the Indian Ocean to learn more about the reasons for the planet's declining biological diversity. Rep. Schneider, R-RI, is ranking minority member of the House Subcommittee on Natural Resources. Agriculture Research and Environment.

Author and teacher Bruce Wallace presents a scientist's view of our cities: they have an ecology too, he says.

The second, related section of this issue reviews the health and well-being of the National Environmental



Policy Act (NEPA), which was enacted to help create a day-to-day consciousness about actions affecting the environment. Jennifer Joy Wilson, EPA's Assistant Administrator for External Affairs (OEA), explains EPA's goals under that law. Then, Richard E. Sanderson, Director of OEA's Office of Federal Activities, discusses some cases currently "on the firing line" as EPA assists in implementing NEPA.

An observer of NEPA since its early days, Alvin Alm, writes about this statute's past, present, and future. Alm helped launch NEPA and was later Deputy Administrator of EPA. Dinah Bear, General Counsel of the President's Council on Environmental Quality, takes the pulse of NEPA: has it really made environmental protection part of the federal way of doing business? And Malcolm Baldwin, a Council staffer during the 1970s and now a writer and consultant, suggests ways from an environmentalist viewpoint that NEPA might become a stronger tool in the effort to guard the nation's natural values.

Closing this section, Gary L. Larsen of the U.S. Forest Service explains how another federal agency is using NEPA to address a tough, controversial environmental problem, in this case the spraying of herbicides on national forest lands in the West.

On another subject, the next article discusses the environmental impact of a modern-day product, plastics. This issue of EPA Journal concludes with two features about the Agency— Appointments and Presidential Awards. □

Water lilies flourish in a Louisiana swamp.

United States Environmental Protection Agency Office of Public Affairs (A-107) Washington DC 20460 Volume 14 Number 1 January/February 1988

Lee M. Thomas, Administrator Jennifer Joy Wilson, Assistant Administrator for External Affairs Linda Wilson Reed, Director, Office of Public Affairs

John Heritage, Editor Ruth Barker, Assistant Editor Karen Flagstad, Assistant Editor Jack Lewis, Assistant Editor James Ballentine, Circulation Manager

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

The EPA Journal is published by the U.S. Environmental Protection Agency. The Administrator of EPA has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget. Views expressed by authors do not necessarily reflect EPA policy. Contributions and inquiries should be addressed to the Editor (A-107), Waterside Mall, 401 M St., S.W., Washington, DC 20460. No permission necessary to reproduce contents except copyrighted photos and other materials. Thinking Like a Mountain From "A Sand County Almanac" by Aldo Leopold 2

The E in EPA by Lee M. Thomas 3

A Forum: Speaking Ecologically 5

How Do We Know What to Protect? by Peter R. Jutro 8

Environmental Treasures: The Arctic by Richard Sumner 10

Environmental Treasures: The Everglades by Eric Hill Hughes 12 Waking Up to the Value of Our Wetlands by Thomas H. Kean 14

Lessons Learned from Madagascar by Claudine Schneider

Cities Have an Ecology Too by Bruce Wallace 18

EPA and NEPA: Challenges and Goals by Jennifer Joy Wilson 22

EPA and NEPA: Cases in Point by Richard E. Sanderson 25

NEPA: Past, Present, and Future by Alvin Alm 32 Does NEPA Make a Difference? by Dinah Bear

Thoughts about Improving Environmental Care by Malcolm Baldwin 36

Herbicides, the Forest Service, and NEPA by Gary L. Larsen

Plastics: Concerns about a Modern Miracle by Matthew Coco 40

Appointments 41

Presidential Awards

Front Cover: Alaska's North Slope. Pictured here is Okpilak River drainage along the coastal plain with glaciated peaks in the distance. See article on page 10. Photo by Dennis Miller of Caribou Enterprises, Fairbanks, Alaska. Design Credits: Donna Wasylkiwskyj; Ron Farrah; James R. Ingram.

EPA Journal Subscriptions

Name - First, Last									PLEASE PRINT																	
					1	1				prime in			1	1	-											
Company Name or Additional Address Line																										
	1																				1	1	1		1	
Street Address																										
				1	1		1	1	1					1		1	1	1		1	1				1	1
City																		S	State				Zip Code			
					1					1	1				1			L				L		1		
	Payment enclosed (Make checks payable to Superintendent of Documents)																									
Charge to my Deposit Account No																										

The annual rate for subscribers in the U.S. for the EPA Journal is \$11.00. The charge to subscribers in foreign countries is \$13.75 a year. The price of a single copy of the EPA Journal is \$1.75 in this country and \$2.19 if sent to a foreign country. Prices include mail costs. Subscriptions to the EPA Journal as well as to other federal government magazines are handled only by the U.S. Government Printing Office. Anyone wishing to subscribe to the EPA Journal should fill in the form at right and enclose a check or money order payable to the Superintendent of Documents. The requests should be mailed to: Superintendent of Documents, GPO, Washington, DC 20402.

n.,

Thinking Like a Mountain

by Aldo Leopold

A deep chesty bawl echoes from rimrock to rimrock, rolls down the mountain, and fades into the far blackness of the night. It is an outburst of wild defiant sorrow, and of contempt for all the adversities of the world.

Every living thing (and perhaps many a dead one as well) pays heed to that call. To the deer it is a reminder of the way of all flesh, to the pine a forecast of midnight scuffles and of blood upon the snow, to the coyote a promise of gleanings to come, to the cowman a threat of red ink at the bank, to the hunter a challenge of fang against bullet. Yet behind these obvious and immediate hopes and fears there lies a deeper meaning, known only to the mountain itself. Only the mountain has lived long enough to listen objectively to the howl of a wolf.

Those unable to decipher the hidden meaning know nevertheless that it is there, for it is felt in all wolf country, and distinguishes that country from all other land. It tingles in the spine of all who hear wolves by night, or who scan their tracks by day. Even without sight or sound of wolf, it is implicit in a hundred small events: the midnight whinny of a pack horse, the rattle of rolling rocks, the bound of a fleeing deer, the way shadows lie under the spruces. Only the ineducable tyro can fail to sense the presence or absence of wolves, or the fact that mountains have a secret opinion about them.

My own conviction on this score dates from the day I saw a wolf die. We were eating lunch on a high rimrock, at the foot of which a turbulent river elbowed its way. We saw what we thought was a doe fording the torrent, her breast awash in white water. When she climbed the bank toward us and shook out her tail, we realized our error: it was a wolf. A half-dozen others, evidently grown pups, sprang from the willows and all joined in a welcoming melee of wagging tails and playful maulings. What was literally a pile of wolves writhed and tumbled in the center of an open flat at the foot of our rimrock.

In those days we had never heard of passing up a chance to kill a wolf. In a second we were pumping lead into the pack, but with more excitement than accuracy: how to aim a steep downhill shot is always confusing. When our rifles were empty, the old wolf was down, and a pup was dragging a leg into impassable slide-rocks.

We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes—something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view.

Since then I have lived to see state after state extirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. I have seen every edible bush and seedling browsed, first to anaemic desuetude, and then to death. I have seen every edible tree defoliated to the height of a saddlehorn. Such a mountain looks as if someone had given God a new pruning shears, and forbidden Him all other exercise. In the end the starved bones of the hoped-for deer herd, dead of its own too-much, bleach with the bones of the dead sage, or molder under the high-lined junipers.

I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer. And perhaps with better cause, for while a buck pulled down by wolves can be replaced in two or three years, a range pulled down by too many deer may fail of replacement in as many decades.

From Runes of the North by Sigurd Olson. Illustrated by Robert Hines. Copyright © 1963 by Sigurd F. Olsor Reprinted by permission of Alfred A. Knopf, Inc. So also with cows. The cowman who cleans his range of wolves does not realize that he is taking over the wolf's job of trimming the herd to fit the range. He has not learned to think like a mountain. Hence we have dustbowls, and rivers washing the future into the sea.

We all strive for safety, prosperity, comfort, long life, and dullness. The deer strives with his supple legs, the cowman with trap and poison, the statesman with pen, the most of us with machines, votes, and dollars, but it all comes to the same thing: peace in our time. A measure of success in this is all well enough, and perhaps is a requisite to objective thinking, but too much safety seems to yield only danger in the long run. Perhaps this is behind Thoreau's dictum: In wildness is the salvation of the world. Perhaps this is the hidden meaning in the howl of the wolf, long known among mountains, but seldom perceived among men. □

From A Sand County Almanac: And Sketches Here and There by Aldo Leopold. Copyright 1949, 1977, by Oxford University Press, Inc. Reprinted by permission.





The E in EPA

by Lee M. Thomas

EPA was created in 1970, at the height of an era of social consciousness. In part, the Agency was founded as a reaction to mounting public concern about the deteriorating state of America's environment. It was also established in recognition of the need to unify our environmental protection efforts under a single agency's leadership.

The laws we administer give us responsibility to protect both public health and the environment. Yet the reality of congressional priorities, budget constraints, and immediate public concerns has always focused our primary attention on the health side of

3

the equation. Generally, we have addressed broader ecological relationships in the context of the connections between the health of people and the health of their environment.

This is not surprising. Many of the programs originally culled from other federal agencies to form EPA nearly two decades ago had specific public health missions. And over the years, EPA has attracted a large contingent of Public Health Service officers, toxicologists, and others who have brought with them important expertise on the human health effects of various pollutants. Fortunately, measures that protect public health frequently are beneficial to the natural environment as well.

Since 1970, we have seen significant public health improvements in the quality of our air, water, and land resources. Now, we are also seeing the emergence of new issues with consequences primarily for the environment. Examples run the gamut from broad issues of international scope to relatively specific matters involving individual chemicals. They include such things as the ecological consequences of stratospheric ozone depletion and global warming, the effects of acid deposition on forests and lakes, concerns about America's vanishing wetlands, adverse impacts associated with urban and agricultural runoff on coastal and estuarine resources, and threats to wildlife caused by pesticides.

Clearly, we have moved into an era where we must pay increasing attention to the ecological aspects of our mission at EPA. To do so, we will have to vastly improve our understanding of the complex networks of interacting biological and physical systems that make up the natural environment in which we live.

While our understanding of many health-related issues has grown exponentially during EPA's lifetime, our knowledge of the environment and ecosystem processes is still rudimentary. Our data bases on both ambient conditions and the environmental effects of human activity are sparse. And although we have dramatically improved our ability to detect toxics in the environment that may represent health threats, we lack similarly sophisticated tools and methods to provide data for environmental assessments and ecosystem evaluations.

I became acutely aware of some of these problems early in my tenure as Administrator when I had to make some major decisions on wetlands protection. As we gathered our information, it became clear that we needed a better scientific basis for decision-making. We simply had no foundation for knowing what proportion of a wetland area could be depleted without long-term damage to the ecosystem, when such damage was likely to occur, or how to restore a system once damage had occurred. Our ability to answer such key questions was seriously compromised by a lack of understanding of how ecosystems function and how they interrelate.

While our understanding of many health-related issues has grown exponentially, our knowledge of the environment and ecosystem processes is still rudimentary.

Today, we are moving forward to address these concerns. In addition to wetlands preservation, we are also expanding efforts in several EPA program offices to protect our environmental heritage as well as our health. Our program to improve the quality of near-coastal waters and estuarine resources is a good example. The Chesapeake Bay cleanup is representative of the work we are doing to address important ecological questions. Similar work is under way at Albermarle and Pamlico Sounds in North Carolina, Buzzards Bay in Massachusetts, Narragansett Bay in Rhode Island, Long Island Sound in New York and Connecticut, Puget Sound in Washington, and San Francisco Bay in California.

Our pesticide program is also looking harder than ever at ecological issues. Our endangered species program is one example. And ecological concerns like bird kills are becoming more important considerations in the pesticide special review process.

The Superfund program confronts us with particularly difficult situations where we often have only part of the environmental and ecological equation in front of us when making decisions about cleanup schedules and stringency. Fortunately, however, these decisions often can be made with caveats that allow implementation with increased stringency when there is evidence of a pervasive or significant ecological effect. This is supplemented by existing Superfund regulations requiring assessments of natural resource and environmental damage from hazardous wastes.

More work needs to be done here as well, however. Established toxicological approaches to risk assessment that are based on single species and single chemical exposures are not very useful for evaluating the consequences posed to ecosystems. Ecosystems are complex entities. They are composed of numerous plant, animal, and biotic species, as well as water, soil, and physical components. All of these interact both internally and with external forces. In order to understand the consequences of ecosystem stress, we must understand relatively unstressed systems and compare them to perturbed ones. This requires measurements and evaluations that often must be conducted over very long periods of time.

EPA's public health responsibilities and its broader environmental agenda complement each other. This Agency's public health mission and its role in protecting the environment both enjoy broad public support. Each contributes to our ability to assess risk in a balanced fashion, one that allows both ecosystem consequences and human health risks to be brought into our decision-making. EPA will always have to operate with finite resources. We may never be able to do all the things that are desirable. Even so, priorities can and will be chosen with care.

Environmentally sound decision-making can be facilitated through a rededication to ecological concerns along with our continued strong efforts to deal with public health risks. This will involve a new look at data collection, trends monitoring, and development of new ecological risk assessment methodologies. A broader ecological view also will require commitments to research conducted according to a carefully conceived strategy that has a strong consensus of support inside the Agency, elsewhere in government, and in the academic community.

(Thomas is the Administrator of EPA.)

A Forum: Speaking Ecologically

What ecological knowledge do we need to do a better job of protecting the environment? EPA Journal asked six ecologists for their opinions in response to this question. Two of the ecologists-Dr. Phillippe Bourdeau and Dr. Paul G. Risser-are members of the **Research Strategies** Committee of the Agency's Science Advisory Board, A third-Dr. Robert K. Colwell-serves with the Agency's Biotechnology Science Advisory Committee. All six ecologists are known and respected in their fields. Their answers:



Thomas Lovejoy

Ecological research needs to be significantly broadened from its traditional focus on the effects of pollution on human health to the effects of wastes on all living systems—our "biological diversity." Even in the United States, our knowledge of the variety of life, as well as the ecology and geography of life, is too skimpy to guide us from making major environmental blunders.

I have heard it said that science isn't even aware of the existence of the majority of organisms that exist in a handful of soil. We need to revitalize the "Science of Systematics" which describes, classifies, and understands the variety of life on this planet, with systematic supporting field work organized perhaps through a National Biological Survey. Species aggregate in communities of many kinds of plants and animals, but we know very little about how and why this happens, and perhaps more importantly how and why this diversity functions. We also need to know more about rare species that exist in almost any biological community. A broadened

understanding of biological diversity is needed not only at the level of small ecological communities but must also be studied at the national and global levels as well. Habitat destruction is wreaking havoc with the major pool of biological diversity in tropical forests. Ironically, as the forests burn, the problem is compounded by the adding of CO2 to the atmosphere. Our global cycling system for carbon is already overburdened. The consequences of all this are only hazily perceived but they certainly will include climate change, a rise in sea level, and profound effects on species. There is an urgent need to understand what the specific consequences will be and how to minimize them. It seems pretty clear, however, that reducing greenhouse pollutants is a more feasible remedy than building dikes around coastal cities to keep the oceans out.

(Dr. Lovejoy is Assistant Secretary for External Affairs at the Smithsonian Institution and was until recently Executive President of the World Wildlife Fund-U.S.)



Paul G. Risser

It is impractical to test for the possible adverse environmental effects of every new chemical. This is because hundreds of new chemicals are produced each vear and because ecological systems are too complex for us to judge the impact of these compounds right away. Therefore, we must develop methods for predicting trouble on the basis of certain characteristics of chemicals. Some progress has already been made. There is no secret as to what needs to be known-we simply have to organize the research effort and proceed with the needed experiments.

Naturally, not everything can be done at once; we have to set priorities. Pathways of chemical flow should be identified and then the most sensitive parts of the ecosystem must be evaluated. This approach will require collective expert judgments, system modeling, and key field and laboratory measurements. The analytical framework must permit us to integrate the incoming and apply it in a timely way.

Too often we have focused on the unknowns rather than the knowns. In ecological systems it will always be important to search for similarities and predictable patterns-all the while being alert for unexpected relationships and responses. These unexpected events are especially fascinating: for example, organic processes which may render a dangerous chemical harmless or make an innocuous one harmful, food chain dynamics which make a chemical non-toxic at one level but toxic at another, and the enormous range of susceptibilities and tolerances among the life forms of the planet. Under such conditions, absolute certainty will never be achievable, but reasonable approximations will be. These approximations, however, depend upon a systematic analysis of existing information and a judicious acquisition of new information on key ecological processes.

(Dr. Risser is Vice President for Research at the University of New Mexico and a past president of the Ecological Society of America.)



Ruth Patrick

We need know-how that will give us more effective ways of reducing excessive waste volumes that are depleting our natural resources and contaminating our environment. As a start, let's understand that our air. water, land, and the subsurface of the biosphere all interact to form one environment. We can't casually remove a pollutant from one place on earth and dump it into another without causing harm to some part of the environment. This is a truism whether we are trying to cope with the deleterious effects produced by the manufacturing of materials for society's use, the perturbing of the landscape for immediate needs, or the creation of faster methods of transportation.

We have several options for reducing wastes in the environment. We can generate less waste and recycle those wastes that must be generated for societal needs. We must also design methods and develop models that will allow us to predict the ecological, sociological, and economic effects of changing the natural landscape and waterways. What seems to be immediately beneficial to society is often extremely costly in the long run. whether it's cutting down tropical forests, draining wetlands, or altering the course of waterways.

(Dr. Patrick is Senior Curator at the Academy of Natural Sciences in Philadelphia.)



Robert K. Colwell

As an evolutionary ecologist, I am particularly concerned about the effects of human activities on non-human species and on their interactions with one another. These effects are accelerating rapidly with deforestation and global atmospheric changes. To understand changes in species interactions and predict their consequences, we must learn much more about the roles of organisms in the structure and functioning of biological communities.

We don't fully understand the reasons for ecological specialization or why one community supports greater biological diversity than another. We also need to know more about how fauna and flora change under environmental stress and how to predict the effects of introducing exotic species into a particular environment. For microorganisms, even less is known about these questions than for higher plants and animals.

Gene technologies clearly stand to benefit from the genetic diversity of the millions of species in natural ecosystems, now threatened with degradation and destruction. We must learn how to maintain genetic diversity in the face of increasing fragmentation of these areas and accelerating geographic distribution of new genetic varieties. We have the responsibility to ensure that the design of technologically produced organisms minimizes their unintended impacts while facilitating the development of environmentally sound solutions to pressing environmental and social problems.

(Dr. Colwell is a Professor of Zoology at the Department of Zoology at the University of California at Berkeley.)



Simon A. Levin

Society is facing great environmental problems on a broad scale. We are confronted with changes in the composition of the atmosphere on a worldwide scale, with the alarming loss of biotic and habitat diversity, with contamination of our aquifers, with the need for alternatives, and with the collapse of resource systems. The science for addressing these challenges must be integrated across scientific disciplines and set in a holistic perspective encompassing ecosystems and the biosphere. We must improve our understanding of the linkages between the biotic and abiotic parts of ecosystems.

We must recognize the multiplicity of scales that exist within ecosystems, and develop a perspective that encompasses them all. We need to couple system-level testing with mechanistic studies designed to provide understanding and the basis for extrapolation, so that we can classify the ways ecosystems respond to stress. We need theoretical models that capture the basic relationships and provide the logic for extrapolation.

Finally, we must acknowledge the limits of our ability to predict. And we must be prepared to manage in the face of uncertainty,

which will require the development of more sophisticated and flexible approaches to risk assessment and management. It also will require an increased public awareness that there are limits to predictability, and that the fuzzy boundary between science and policy justifies, even necessitates, public involvement in the decision-making process. There are few scientific absolutes in environmental decision-making; rather, environmental management must be an expression of the values and needs of society, as manifest in the statutes the peoples' representatives enact and in societal participation in public discourse on environmental issues.

(Dr. Levin is Director of the Center for Environmental Research at Cornell University and Charles A. Alexander Professor of Biological Sciences.)



Philippe Bourdeau

Progress on today's environmental issues is being limited in some cases by economic and political considerations, and in others because our scientific knowledge is insufficient for us to advise policymakers on the right course of action. Seen from a western European viewpoint, the main problems may be classified according to a spatial (local, regional, continental, global) or a temporal (short, medium, long-term) scale.

Any sensible, publicly funded research program designed to provide scientific support for the enforcement of an environmental protection policy should be made up of three strands. The first should focus on tactical short-term problems of a concrete nature, the second on mid-term strategies and the third on understanding the workings of the environment in order to predict natural and man-induced change and prevent major disasters from arising far into the future.

At present, the following random list of issues and problems seems to be of special concern in the European Community.

Atmospheric Pollution: (acid deposition and photochemical oxidants):

• episodic and long-term behavior of ozone in the troposphere

• relationship between emission and deposition of pollutants

• stratospheric ozone (ozone "hole," etc.)

• long-term effects of acidification in forest watersheds and fresh-water bodies

Environmental Health Protection: development of early indicators of health effects due to exposure to pollutants, to be used in surveillance and early warning systems.

Chemical Risk Assessment: improvement of the available scientific basis.

Toxic Wastes: detoxification through "low-temperature" treatment and by means of biotechnological methods.

Ecosystems:

• development of indicators of "ecological health"

• measures of the "state of the environment"

• conceptual models to describe and predict the functioning of ecosystems under natural and anthropogenic stresses

• improved understanding of the control mechanisms of the global ecosystem ("Gaia").

Climate Change: induced by CO2 and other greenhouse gases:

• reliable regional and seasonal prediction of climatic change

• impacts of climatic change on European land and water resources; refinement of links between large-scale climate models and small-scale crop-field models; hydrological models, etc.

• prediction of sea-level rise and its critical potential impact on European coastal regions

• reduction of CO2 emissions; technologies for disposal of power plant CO2.

Biotechnology: assessment of possible risks resulting from deliberate release of engineered organisms.

Environmental Cost-benefit Analysis: estimating the cost of man-inflicted damage to the environment versus the benisons thereof. □

(Dr. Bourdeau is Director of the Environmental Research Program at the Commission of the European Communities in Brussels, Belgium.)



While"warm fuzzy species" tend to stir protective efforts, "icky" invertebrates may be overlooked. Pictured is the millipede *Polyzonium* rosalbum, an inhabitant of the Eastern deciduous forest, recently discovered to be the source of potent insect repellents of novel chemical structure.

How Do We Know What to Protect?

by Peter R. Jutro

A number of years ago, a letter to the editor appeared in the prestigious journal Science. In it, a scientist who studied mangrove forests in south Florida reported on a troublesome outbreak of a parasite, a small isopod that bored into mangrove roots, and in the process, killed the plants. His letter was a plea for assistance from the scientific community in seeking an answer that could help avert the possibility of an ecological catastrophe. Several weeks later, Science published a reply. It was from another scientist who wrote that he read the first letter with great excitement, for he had been studying this rare isopod for years and was delighted to see a report indicating that it was making a comeback.

Whether or not the reply was tongue-in-cheek is irrelevant, for one could-hardly hope to find a better parable to illustrate the problem that environmental scientists face. Despite an obvious societal concern with the quality of its environment, there is little agreement about what we are actually trying to protect, let alone how to go about doing it. Why is this such a problem?

There are several answers. First of all, the legislation that supports the activity of EPA has an interesting and unique pattern. There is no single piece of legislation that directs EPA to live up to its name, to "go forth and protect the environment." Rather, there are stacks of laws, enacted under the jurisdictions of different Congressional committees, that are intended to protect various elements of the environment. Additionally, while most of these laws spell out in some clearly interpretable detail what they expect from EPA regarding the protection of human health, they are much vaguer with respect to ecological protection.

An example is the Clean Water Act, which calls for the restoration and maintenance of the "chemical, physical and biological integrity of the nation's waters," and protection of the "natural structure and function" of ecological systems. The problem with this, and other normative exhortations scattered throughout our environmental laws, is not that Congress was in error; the problem is rather that Congress, and often scientists, were unaware of the complications inherent in these definitions. As a result, there is much disagreement about what they all mean.

Thus the agency which is effective at conducting research and undertaking regulatory actions in the health area, finds itself in something of a quandary when it tries to do the same in ecology. Society agrees that it wants to be protected against the health effects of hazardous chemicals. We know we want to be protected against risks of cancer birth defects, or neurological damage. These are recognizable and definable outcomes or endpoints which we can take action to prevent.

Unfortunately, society's wishes are not nearly as clear with respect to other values. We know that as a society we wish to protect wilderness, lakes, fish, forests, visibility, endangered species, and wetlands, but we have no consistent notion of what that protection implies, how to balance among possibly competing goals, or what price we are willing to pay. What happens as a result is that we react to situations. Shellfish populations decline in the Chesapeake Bay, so we attempt to determine the causes and then to do something about them. The eagle

In ecological policy, we frequently make our decisions on the basis of values and politics rather than objective science.

population declines. We determine that a pesticide may be responsible and take steps to eliminate it from the food chain. We find lakes with no fish and seek controls on stack emissions that may acidify lakes. We find forests in decline and seek the answer in the control of air pollutants. The pattern is that what receives attention is what we seem to value as a people. Charismatic, warm, and fuzzy species tend to be protected. Icky invertebrates, which might be more essential to the elusive concept of natural structure and function of ecosystems, are not.

Some of this is inevitable. Through our laws and actions, we try to deal with situations we care about and deal first with the ones that we, as a society, either care about most, or about which we are most vocal. Put in other words, in ecological policy, we frequently make our decisions on the basis of values and politics rather than objective science. Nonetheless, we hope that research in ecology will lead us to an understanding of what species, environments, or processes are critical to our environment and that a protection program would logically follow.

The complexity of nature continues to amaze us. We are constantly surprised by situations where an action we take, often intended as a public benefit, has unforeseen consequences. Occasionally, these indirect effects are beneficial. In India, for example, saving the tiger, the national symbol, has become something of a political obsession. Habitat destruction has posed the greatest threat to tiger survival. As a result, efforts aimed at tiger habitat preservation have probably done more to control deforestation than any direct campaign would have accomplished.

Such an example, however, is unusual. Most unintended policy consequences are negative. This has led to caution on our part. That leaves us again with the problem with which we began: how do you make hard decisions with environmental consequences?

The problem is compounded by the limited predictive power of ecological science in complex situations. If science cannot firmly predict the broad implications of intended actions, if it cannot assess the risk, how do we then make the risk-management decisions that the law requires be based on best scientific judgment? We have a number of alternatives.

More often than not, we simply accept the fact that these are guesses colored by value judgment, and make the best possible decision based on our understanding of the science and the associated uncertainty. The absence of certainty, however, also offers the potential for abuse. Ecological science has, in the past, been used to justify environmental decisions that were instinctively felt to be morally or ethically correct even if the likelihood was that there was no strong scientific justification for such an interpretation of existing data. Similarly, uncertainty has been exploited to opposite effect. It can provide a decision-maker with the opportunity to accomplish something that scientists feel may well be damaging, even though they cannot prove definitively that it will be. Although the latter two scenarios are fundamentally dishonest, the former is generally necessary.

What this means, simply, is that we continue to make imperfect decisions. But more importantly, we must learn from each decision. Each situation gives us the opportunity to better understand what scientific information would improve the quality of our decisions. We recognize that although ecology may not now have the predictive power we would like, there are directions of scientific inquiry that may help us answer such questions in the future. Designing such a risk-based research program in ecology is the major challenge now facing the Office of Research and Development.

(Dr. Jutro is Special Assistant to EPA's Assistant Administrator for Research and Development.)

Environmental Treasures: The Arctic

by Richard Sumner

The far north has always gripped our imaginations. The stories of Jack London and the explorations of Peary and Amundsen have left us with images of a bleak, inhospitable wilderness. But though the climate is harsh, the native Inuit (Eskimos) have lived there for thousands of years, relying on mammals, birds, and fish to supply their needs.

Now, exploration and development of the oil fields has brought change to the Arctic, and intense public debate focuses on the environmental effects of industrial activity along the North Slope. The issue of whether development should occur in the Arctic National Wildlife Refuge, for example, is now before Congress. EPA's position remains one of impartial analysis, based on the best available scientific evidence.

Experience with oil development in the Arctic is not very extensive. Prudhoe Bay opened in 1968 and the National Petroleum Reserve west of the Colville River was explored in the 1940s and 50s. Based on this limited experience, the environmental impacts of new oil development have been reduced. Nonetheless, considering the value of arctic life, we must be cautious. Continued inquiry into the intricacies of arctic ecology is still the only prudent course. Central to this debate is the structure of the arctic ecosystem as a whole.

The biological zones encountered as one moves north through Alaska are like those one finds while climbing a mountain: first the tall evergreens, then dwarf trees, then hardy alpine shrubs, such as heather, and finally grassy meadows and lichens. Geographers define the Arctic to include the treeless areas of the far north. This area called tundra comprises about five percent of the earth's land surface. The tundra extends in a nearly unbroken band across the northern parts of Europe, Asia, and North America. Plant and animal species are remarkably similar throughout this vast realm.

The North Slope of Alaska covers more than 200,000 square kilometers and embraces three major physiographic regions: the Brooks Range, the foothills, and the coastal plain. The Brooks Range is a rugged, glaciated extension of the Rocky Mountain chain that has a mix of arctic and alpine tundra. Slopes and high ridges are sparsely vegetated, often only with lichens, and are similar to the polar deserts of northern Canada and Greenland. Lower, more protected slopes have dry-meadow communities dominated by mountain avens, a dwarf shrub featuring white, eight-petaled flowers. Near the valley bottoms are moist sedge meadows or shrub tundra with willow and dwarf birch.

The Brooks Range slopes downward to foothills in the north. These rolling hills of glacial deposits are covered by large stands of tussock tundra—compact

tufts of cotton grass. Exposed ridges have alpine-like communities similar to those of the Brooks Range. Wet swales and valleys feature willow thickets and sedge meadows. Further north is the coastal plain, a gently sloping expanse of marine sediments dominated by grasslike sedge communities.

The tundra is underlain by permafrost, permanently frozen soils up to 1,500 feet deep. A thick, insulating mat of moss rests on an active soil layer often less than six inches deep. This thin soil, combined with the short growing season and low summer temperatures, results in slow rates of growth and decay. Thick layers of frozen peat develop, locking up the nutrients necessary for plant growth. Arctic vegetation thus responds dramatically to fertilization, and lush growth can be found near bird mounds and animal burrows in July and August.

There are many lakes and rivers on the North Slope but most are too shallow to support overwintering fish, and this limits the size of freshwater fish populations. Species like whitefish and arctic char are found along the coast during the open-water season, but return to deep pools in freshwater streams or brackish river deltas to spend the winter. Only two major rivers in the Northern American Arctic empty into the Arctic Ocean-the MacKenzie in Canada and the Colville in Alaska. The mouth of the Colville forms a large delta system with many freshwater and saline lakes and channels. A tremendous diversity of habitats supports large populations of overwintering and breeding fish and some of the largest waterfowl and shorebird populations on the North Slope.

Though the North Slope receives less than 10 inches of precipitation per year, low temperatures keep evaporation to a minimum, and the permafrost layer prevents absorption into the soil. For this reason, flat or gently sloping surfaces are usually saturated or flooded throughout the summer. The coastal plain becomes a vast wetland.

But the tundra is a dynamic landform. Extreme cold causes the ground to contract, much in the way that cracks form in a parched river bottom. Snowmelt then freezes in the cracks. The ice wedges down and out into the soil to form the rims of polygons. Some drain and some combine eventually into lakes. From the air, the land resembles a honeycomb.

The steep slopes of the Brooks Range also suffer frequent rock slides and avalanches. In the foothills and coastal plains, frost churns the surface into scattered patches and rings called frost scars or boils. The annual flooding during ice breakup inundates the tundra for up to two weeks at a time. Thermal erosion melts ice wedges, causing river and lake banks to slump, and converting wet, low-centered polygons into dry, high-centered ones.

Animal species have evolved a number of means to adapt to this ever-changing tundra environment. Immense herds of caribou and large flocks of waterfowl and shorebirds arrive in the spring to take advantage of the rich wetlands for feeding and breeding, and then migrate south again as the season shifts. Some of the animals that remain for the winter either hibernate (ground squirrels) or become torpid (bears). The few large herbivores (such as musk oxen) and even fewer birds (such as ptarmigan) that remain active have developed large body masses, thick insulation, and the ability to feed through the snow. Lèmmings, one of the most abundant herbivores in the Arctic, build large nests and graze on old grasses and sedges under the snow.

Are popular depictions of the tundra biome as a fragile environment correct or not? Tundra organisms are adapted to natural disturbances, but their recovery may take far longer than in temperate climes. Removal or disruption of the insulating mat of vegetation causes the underlying permafrost to melt and can produce trenches that continue to erode for many years before natural restoration can occur.

While the immediate effect of removing the organic mat is to destroy existing vegetation and hamper resprouting, a long-term consequence is the loss of accumulated soil nutrients. It may take up to 10,000 years to replenish these nutrients at current rates of accumulation. While the ecosystem as a whole can accommodate a certain degree of disruption, recovery of a specific site may take centuries due to both the short growing season for tundra organisms and their slow rates of growth. The total effect of many such incidents over a large area is uncertain, but could be critically destabilizing.

Much of the ability of plants and animals to adjust to local environmental stress derives from the large expanse of similar habitats that can be exploited and the existence of nearby populations that serve as reservoirs for recolonization. There is great uncertainty as to the effect of destroying high-use or critical habitats.

This issue, of course, is central to the debate over oil exploration in the Arctic National Wildlife Refuge, site of the main calving area for the famed Porcupine caribou herd. As development proceeds and the tundra becomes increasingly fragmented, the recovery of local populations may be hampered by the lack of neighboring populations. Moreover, what we know over the centuries to come. Once lost, our natural heritage can never be regained. As stewards of the earth, we must protect it for the enjoyment of generations to come. \Box

(Sumner is the Team Leader in EPA's Alaska Operations Office of Wetlands and Environmental Review.)

Editor's note: See article by Richard E. Sanderson for a discussion of cases involving EPA reviews under the National Environmental Policy Act of possible environmental impacts by the actions of other federal agencies.



of tundra biological change and accommodation is mostly based on our experience with plant communities. We know less about the long-term stability of wildlife and of the biome as a whole, and even less about their synergies and interactions.

The tundra ecosystem, then, can be seen as a naturally resilient system. We know that plant and animal communities have been able to adapt to their harsh surroundings, but the slow pace of the tundra's biological clock constrains its ability to deal with the sudden intrusions of industrial development. The time periods necessary for regeneration of plant communities must be considered when making any resource management decisions.

We must move carefully, a step at a time, until we know for certain what we are doing and what our impact will be Above: A lone caribou braves Lake Peters, Alaska. Each spring, herds of caribou arrive to take advantage of the rich wetlands for breeding and feeding, then migrate south.

Left: Snow geese arrive in Alaska as early as August 15 and feed until the heavy storms begin around mid-September. Then they start their long trip to New Mexico and California. This flock is on the Jago River, Alaska.

Environmental Treasures: The Everglades

by Eric Hill Hughes

• ay the word "Everglades," and Dpeople envision a broad, dynamic, self-renewing, never-ending swamp replete with birds, alligators, and snakes. That's how it appears on TV nature shows that focus on the lush sub-tropical vegetation. But the sad fact is that the Everglades is but a shadow of its former self, and Everglades National Park, which makes up only 7 percent of the Everglades drainage basin, is in grave jeopardy.

The federal government recognized the value of this unique resource as early as 1934, and, in 1947, the Everglades National Park was established as part of the U.S. Park Service. Unfortunately, the watershed that feeds the park and makes it viable has never been sufficiently protected.

Portions of the drainage basin north of Lake Okeechobee have been drastically altered by flood control and channelization in the Kissimmee River Valley. Fish and wildlife populations in the Kissimmee corridor have plummeted as wetlands have been converted to farms.

South of Lake Okeechobee, the original Everglades marsh has been compartmentalized by multiple levees and canals. In recent years, Lake Okeechobee itself has begun to eutrophy, probably as a result of nitrogen and phosphorus-laden run-off from dairy operations north of the lake and from agricultural backpumping to the south of the lake. Huge areas of the Everglades were converted in the 1960s into water conservation areas encircled by a 1,400 mile-long levee and canal system. A 1,000-square-mile area of Everglades marsh south of the lake was converted to agriculture, predominantly sugar cane fields.

The Everglades south of Lake Okeechobee today is, in fact, a series of water conservation areas with very carefully regulated water levels and movement, employing numerous large water-pumping stations and canal/levee systems managed by the U.S. Army Corps of Engineers and the South Florida Water Management District. Water managers regulate the flow not

only to farms but to large urban areas along the coast of southeast Florida stretching from West Palm Beach south to Miami. Agriculture in South Florida is a major segment of the economy, so water is carefully allocated to provide for winter crop irrigation.

The Everglades is also the prime water-recharge area for the Biscayne Aquifer, the drinking-water source for more than 3 million people in the Broward and Dade County areas. Recharge from the Everglades maintains the fresh ground-water system in the upland coastal ridge area and protects the coastal aquifers from saltwater intrusion-a problem which has occurred in some areas as a result of over-drainage in the Everglades. The Aquifer is not covered by thick layers of protective soil and is very transmissive, so it is highly vulnerable to surface contamination.

One of the major resource challenges that we face in coming years is how to manage finite water supplies so that the interests of urbanization and agriculture can peacefully co-exist, at some level of acceptable compromise and accommodation, with the Everglades.

The remaining ecosystem provides a home for numerous endangered, threatened, and rare animal species found nowhere else in the continental U.S., including the Cape Sable seaside



Everglades National Park, home to many species of wildlife, was established in 1947.

Frear, National Park Service

sparrow, the American crocodile, and the Florida panther. Studies indicate that maintaining natural, seasonal water flow and timing of water deliveries to the Everglades National Park is crucial to successful maintenance of wildlife populations.

Current water management strategies under evaluation by the Corps of Engineers and the South Florida Water Management District are aimed at returning a more natural seasonal water input from the extensive water conservation areas to the Park itself.

These efforts to restore some of the natural hydrology to the Everglades are supported by EPA, the Department of the Interior, the State of Florida, and the Corps of Engineers, as well as the general public. For instance, construction of levees in the 1960s and early 1970s reduced the width of the Shark River Slough, the main surface waterbody providing water to the Everglades, so that water releases into the park were allowed only across the western half of the Slough. Park officials have worked diligently with state and federal water managers as well as other wildlife management agencies in an effort to restore the Everglades water delivery system to its historic dimensions to the extent possible across the entire breadth of the Shark River Slough.

Along the eastern edge of the Shark River Slough lies the East Everglades, an area sandwiched between the water conservation areas to the west in Broward and Dade counties and the heavily urbanized areas to the east on the coastal ridge, including Miami and Fort Lauderdale. Hundreds of square miles of former wetlands in western Broward and Dade counties have been lost or seriously degraded by drainage projects undertaken over the past 40 years in order to support urban, farming, and mining uses.

The proof? Witness the skyrocketing of the metropolitan Miami population from approximately 5,000 people in 1910 to more than 2 million people in 1988! However, large acreage of functional wetlands is still in private ownership in the East Everglades and, though vulnerable to agricultural conversion and commercial or residential development, can be saved.

In 1972, the Federal Water Pollution Control Act Amendments (later amended as the Clean Water Act) established a permitting program for

Concerns about Rockplowing

On April 22, 1987, the EPA Region 4 office in Atlanta, Georgia, initiated action under Section 404(c) of the federal Clean Water Act to protect three wetland properties, totaling 432 acres, where rockplowing projects had been proposed or were anticipated in Florida's East Everglades. If finalized, this action could prevent issuance of Section 404 permits for these projects.

"Rockplowing" converts seasonally inundated pinnacle-rock prairie wetlands into fields suitable for agriculture. A bulldozer drags a plow-like implement over the surface, breaking it up to make the land smooth and level enough for vegetable crops during the winter dry season. The result is the destruction of valuable wildlife habitat and major disruption of the food chain production and water purification functions provided by the wetlands.

About 55 percent of the wetlands extant in the lower 48 states in colonial times have been lost, largely due to human activity. Since the turn of the century, approximately 40 percent of South

regulating discharges of dredged or fill material into waters of the United States, defined to include most wetlands. The permitting program is jointly administered by the Corps and EPA under section 404 of the Act. Under this program, property owners must obtain permits to discharge fill into wetlands—to bulldoze roadways, build commercial or housing developments, lay out farms, or put up levees.

Today, the East Everglades region is caught in a flurry of development. Water allocation decisions and wetland filling permits are subject to the intense pressures of urban construction and agricultural interests. The question is, can we effectively protect, restore, and manage the Everglades while allowing some use of altered wetland systems on its eastern margin? EPA, the Corps of Engineers, the Department of the Interior, and the State of Florida are working with developers and other Florida's freshwater wetlands have been destroyed, and a significant additional acreage has been adversely affected by drainage. Despite the public's current heightened awareness of wetland values, approximately 300,000 acres of wetlands still are being lost every year, some 96 percent of which are the freshwater type. Agricultural conversion accounts for about 87 percent of freshwater wetland losses nationwide.

A public hearing on Region 4's proposed Section 404(c) action was held on November 18, 1987, in Homestead, Florida, near the East Everglades, to provide property owners, governmental agencies, and the public an opportunity to comment on EPA's proposal to deny federal authorization for the conversion projects. The next step in the process was a decision by the **Regional Administrator which** recommended a prohibition on the use of the acreage for rockplowing. Final Agency decisions on regional recommendations are made by the Assistant Administrator for Water in EPA Headquarters.

county, state, and federal agencies in an effort to strike an environmentally sensitive balance between the Everglades and economic progress.

Many hard choices will confront us over the coming years. Can we apply the lessons learned, or will the Everglades become a mere memory, another object of pity or nostalgia for what might have been? The answer cannot depend merely upon self-serving impulses. It must flow from an aroused nation, one unwilling to trade its natural resource heritage for short-term "profit."

(Hughes is a Wetlands Ecologist in the Water Management Division in EPA's Region 4.)



Mallards in a marsh in eastern Maryland. Wetland areas were once considered useless. Now there is increasing action to save them.

Waking Up to the Value of Our Wetlands

by Thomas H. Kean

Wetlands—the word conjures up an image for each of us. For the hunter it may be the sight of a flock of Canada geese slowly circling to land; to the birder it may be the memory of sighting a rare or endangered species. On the other hand, many view wetlands as areas which serve no useful function. However, while many positive aspects of wetlands may be hidden, they are very real. Wetlands provide many and varied benefits from reducing the damage caused by flooding to providing habitat for endangered species of plants, fish, and other wildlife.

Wetlands are an important natural resource; they are an important national resource as well.

But they are a threatened resource. When this country was settled by our European ancestors, there were over 200 million acres of wetlands in what is now the continental United States. Today, we have less than half of that amount, and in some areas, more than 90 percent of the wetlands that existed at the time of the Revolutionary War have been lost. Our desires for housing, places for jobs, and sufficient supplies of food, oil, timber, and other products cause us to take actions, both in and near wetlands, which cause the loss. These losses must be stopped, and there is a growing realization that we must act quickly. Many states, including New Jersey, have adopted legislation protecting coastal or inland wetlands, or both; many private non-profit groups are active in purchasing or otherwise protecting wetlands, and the federal government has a range of programs, both regulatory and non-regulatory in nature, designed to reduce these losses.

Wetlands Benefits

In the past, wetlands were looked upon as wasted, useless lands. For example, in 1845 Florida's legislature described the vast wetlands system of southern Florida, remnants of which are now Everglades National Park, as "wholly valueless." They were lands to be filled, drained, cut, or diked—anything but left in their natural state.

However, the "beneficial" alterations we have allowed and encouraged in our wetlands have resulted in other, less desirable changes. As wetlands adjacent to rivers were destroyed by filling or diking, flooding downstream increased. As coastal wetlands were filled or dredged for residential or other development, important fisheries which relied upon those wetlands as nursery areas were affected. As wetlands in the Midwest's central flyway were lost, the vast annual migration of waterfowl, one of the hemisphere's great natural phenomena, was greatly reduced. The examples, both local and regional, are many and disturbing.

Each time a wetland is converted to other uses, some or all of its beneficial functions are lost. Researchers have tried to sort out the individual functions which wetlands provide us-in one case, 15 were counted. These include: providing recharge for our vital ground-water sources; storing rainwater during periods of heavy rain, thus reducing the size of floods downstream; protecting our coasts from the pounding force of the sea; providing breeding grounds for a majority of the nation's coastal fish and shellfish; providing resting points for the great waterfowl migrations; and acting as refuges from the hustle and bustle of our busy daily lives. But it may be easier to think of it this way—when was the last time you saw a flock of ducks flying south in the fall? When was the last time you had fish for dinner? When was the last time you took a drink from your tap? Chances are wetlands played a role in each of these.

Every wetland is a unique mix of functions; no single attribute defines these complex systems. This fact makes protection of wetlands that much more important. It also makes their protection that much more difficult, since there is no simple way to tell whether a specific activity which influences such a complex interdependent system will have other, unintended side effects.

Wetlands Losses

Changes to wetlands occur for a myriad of reasons. Filling a wetland to construct an office building or draining one to plant soybeans may be obvious examples of alteration. Contamination of wetlands by irrigation return waters, as has occurred in California's Kesterson Wildlife Refuge, or changes to wetlands resulting from diversion of ground or surface waters, are examples of less obvious, but still important, influences on wetlands systems. Since the location and character of wetlands depend upon water, topography, soils, and vegetation, any influence on these factors will result in changes to the wetland.

With few exceptions, these alterations are avoidable. We must understand where our wetlands resources are, so that farmers, developers, and those in government who build roads, dams, and other projects understand, before they invest large amounts of time and money into specific sites, that constraints may be placed upon their actions. We must protect our most important wetlands areas by purchasing them, if necessary. And we must ensure that our regulatory programs are comprehensive enough and strong enough to stem the tide of losses.

National Wetlands Policy Forum

Crafting solutions which achieve these goals is a difficult and elusive task. Regulatory programs, especially at the federal level, involve a number of agencies with different interests and mandates, and are seen by those who are regulated as unpredictable and unnecessarily time-consuming. At the same time, others view them as not protective enough. To complicate matters, there are many governmental programs, such as road-building and other public works programs, which encourage activities that may result in wetlands conversion, and thus provide mixed signals about the nation's real intentions with respect to protecting these resources.

The National Wetlands Policy Forum, which I chair, is a group of state and local government leaders (including three governors), leaders of major environmental organizations, representatives of major industries with an interest in wetlands (agriculture, and the timber, oil and gas, and development industries), and academics. Heads of the major federal agencies which deal with wetlands (including EPA Administrator Lee Thomas) participate in the discussions as well. The group was formed to provide some overall direction for policymakers at the federal, state, and local level, and for private owners and users of wetlands. We will attempt to sort out such difficult questions as the role of various levels of government in protecting wetlands, the type of incentives which should be provided for private landowners to protect wetlands, how to reduce government-encouraged alterations, and how to make tradeoffs between the need to protect wetlands and other important public goals.

New Jersey's Wetland Protection Programs

We in New Jersey have long recognized the value of wetlands. As the most densely populated state, with a strong economy and continuing development pressure, we recognized the need for a variety of approaches to protect our tremendous coastal and freshwater wetlands resource.

The state has regulatory programs designed to ensure that activities which will damage or alter wetlands are generally prevented, unless other major public goals are served by the disruption. The Wetlands Act of 1970 protects the state's coastal wetlands, and the Freshwater Wetlands Protection Act, passed in 1987, extends this protection to the remainder of the state.

The coastal wetlands program has been a tremendous success. At a time when demand for luxury housing on or near the state's coastal bays was increasing, the program made clear that wetlands were a precious resource that should not, except in rare circumstances, be developed. We hope to do the same with the new freshwater wetlands program, which was passed after a long and often bitter legislative battle pitting development and environmental interests against each other.

The state also acts to purchase specific wetlands sites. Since 1984. sales of waterfowl stamps and prints to collectors and hunters (who must purchase New Jersey stamps along with the federal stamp and a state hunting license) have provided about \$1 million to purchase waterfowl habitat. In addition, our Green Acres Program, which uses money from bond issues to purchase land for the state, and our "Green Trust," which gives grants and loans to local governments for open space acquisition, have also funded purchases of about 80,000 acres of wetlands. These programs also work together with the federal government and with private, not-for-profit groups such as Ducks Unlimited and The Nature Conservancy on specific acquisition efforts.

Conclusion

Wetlands may be silent, but they should not be forgotten. They play vital roles in the cycles of water and life upon which we depend, and their destruction will made us all poorer. As we develop and redevelop our cities, and work to revitalize our farm communities, we must not lose sight of the basic resources which support us all. \Box

(Kean is Governor of New Jersey and Chair of the National Wetlands Policy Forum.)

Lessons Learned from Madagascar

by Claudine Schneider

Those of us interested in tracking the diversity of our planet's biological species are well advised to start with the giant footprint in the Indian Ocean that is Madagascar. One thousand miles from heel to toe and 350 miles across at the arch, the Texas-sized island nation off the southeastern coast of Africa was once the single richest oasis of the earth's biological diversity.

While singular in its "mega-diversity" of flora and fauna, the world's fourth largest island does share commonality with other ecologically rich countries in one compelling respect: Madagascar's lush tropical life is vanishing at a dangerous rate.

The rainforests and evergreen woodlands that once crowded the plateaus and valleys are evaporating like



Madagascar's lush tropical life is vanishing at an alarming rate. Right, these endemic palms, genus *Needipsas*, are growing near Fort Dauphin. Above: The island's wildlife includes 29 species of lemurs, but agriculture and towns are encroaching on habitat.



summer puddles. In fact, 80 percent of Madagascar's forests have already disappeared into tracts of parched earth. They have been largely scarred and denuded by the effects of a soaring birthrate that has doubled the island's population every 30 years, coupled with grossly counterproductive agriculture and livestock practices that lack sound environmental management techniques.

Madagascar's sandy west coast and tropical climate are developing an attractive tourist trade. That was hardly good reason, however, to endure the rigorous 20-hour flight there last summer. I spent a fortnight on the island for some R&R, albeit not the traditional kind. I was there for some Research on Rainforests.

My interest in Madagascar comes as much from my work as Ranking Republican on the House Subcommittee on Natural Resources, Agriculture Research and the Environment, as it does from my personal commitment to conservation. The island has one of the highest concentrations of endemic species in the world, meaning that the country has a large number of plant and animal species found only in Madagascar and nowhere else.

One such plant, originally endemic to Madagascar, was the rosy periwinkle. This is the source for two critical alkaloids that are used to treat childhood leukemia and Hodgkin's disease. The rosy periwinkle does not face extinction since it still thrives on Madagascar and has been exported to many other countries. The point is that this particular plant is safe because its beneficial medical properties had already been identified before it could become endangered. Unfortunately, with today's pace of development, many other such species could likely pass from existence altogether before we know just how much good they can do for mankind. It is clear that the threat of extinction of endemic plants and animals has consequences beyond the aesthetic nicety of protecting a luxuriant environment.

The tropical forests that gird the earth's equatorial belt are proving to be veritable goldmines of valuable resources. They provide disease-resistant germplasm for enhancing the productivity of U.S. agriculture, provide a broad range of life-saving pharmaceutical drugs, and promise a wealth of oils, resins, plastics, and feedstocks for the chemical, energy, and basic materials industries.

Unfortunately, the population pressures and resource depletion so apparent in Madagascar are but a microcosm of similar destruction worldwide. Tropical forests are being destroyed at the rate of one area the size of Pennsylvania every 12 months. The continuation of present trends could result in the extinction of over one-third of the world's irreplaceable genetic resources within our lifetime. This verges on the tragic, given the fact that this germplasm is the very stock and trade of the bio-technological revolution now transforming our world economy. Moreover, recent climatological research indicates that the world's tropical forests are intimately linked to the global atmospheric system, and that widescale destruction of this rich biota could trigger dramatic, and irreversible, changes in the earth's climate.

Unless world attention can be riveted on the urgency of this situation, these new frontiers will never be explored and future generations will have been deprived of a tremendous heritage. My tour of Madagascar, guided by several of the world's foremost conservation biology experts working with the World Wildlife Fund, was designed to show me both sides of the future: the bleak prospect of a depleted planet bereft of its genetic endowment, and a more hopeful prospect of preserving the remnant forest through strategic conservation efforts.

Madagascar, like other mega-diversity countries such as Brazil, Peru, Indonesia, Mexico, and Colombia, faces acute threats to their remaining torests if population growth goes unchecked and the inefficient "hoe and hoof" practices of the past continue to prevail.

Fortunately, vigorous efforts spearheaded by the World Wildlife Fund and the International Union for



the Conservation of Nature (IUCN) have convinced the World Bank, the U.S. Agency for International Development (AID), and other development agencies to work with the Madagascar government to establish a conservation strategy. The focus is on conserving core areas of biological diversity in the form of parks and reserves; developing the areas to plan utilization of timber products, food, fodder, and fuel; and involving local communities

The strategy is very promising because it is inexpensively designed so that even the most impoverished villagers can help secure themselves an enriching livelihood that is at the same time ecologically sustainable. Children are an integral part of the program, which is vital to the long-term success of this strategy, because young people comprise the majority of the population. Education programs at all levels are part of this strategy. The school children are literally both planting and protecting their present and future economy.

The writer H.G. Wells once said that the future of humankind hangs on the race between education and catastrophe. His quip could well serve as the succinct commentary of my stay in Madagascar. Until recently, members of the scientific community have been alone in awakening the world to the massive challenge now before us. They have marshalled an impressive array of information that shows good stewardship of natural resources to be an imperative for, not an inhibitor to, sustainable economic development.

At last, the World Bank and other commercial lenders, plus AID, are beginning to incorporate the scientists' message of growth management designed to sustain biological diversity.

Even the U.S. Congress has recently signaled its dawning recognition of this problem by adopting my amendment to the Foreign Assistance Act calling upon the President to pursue an International Convention that would determine how to act more swiftly in conserving the world's living natural resources. Ultimately, however, it will take a concerted interest on the part of each and every one of us to ensure that we preserve for future generations the same rich endowment bestowed upon us. \Box

(Rep. Claudine Schneider (R-RI) is the ranking minority member of the House Subcommittee on Natural Resources, Agriculture Research and Environment. The subcommittee is part of the Science, Space, and Technology Committee.)

Cities Have an Ecology Too

by Bruce Wallace



Cities survive and thrive even though most cannot provide food to sustain themselves nor the water their inhabitants require. Pictured is one city famous for its beauty, San Francisco.

Theoretically, cities should not exist; persons should be scattered more or less uniformly over a rural (or forested) countryside. But, you say, while pointing to New York, Dallas, Rome, and Paris, cities do exist. So much, then, for your theory. It's just a theory, like so much else in science.

Before abandoning the theory, however, consider an analogous one: the second law of thermodynamics. This law states that useful energy is always lost, never gained. The universe is running down. Nevertheless, local exceptions to this law abound; every living organism is such an exception. Every act that requires energy-whether it is walking up a flight of stairs or forming urine in the kidneys-is an exception. These are, however, local exceptions. They are the eddies and whirlpools that form as the river of energy flows inexorably downhill. In particular, life on earth is possible only because it taps into and uses energy released by a declining star, our sun.

Ecologists tend to formulate admonitions rather than laws. One such, coined (I believe) by Professor Garrett Hardin, is, "Thou shalt not exceed the carrying capacity of the environment." For any group of organisms (including human beings), the resources of the environment are sufficient to sustain a certain number of individuals, and no more. These resources include nutrients, water, oxygen (for most living things), and physical space. Every individual, whether a bacterium, a fly, or a person, requires a certain amount of food, a certain amount of water, oxygen with which to burn its food, and space equal to its body dimensions, if not more. Whenever any of these individual requirements, when multiplied by the total number of individuals, exceeds the amount that can be obtained from the environment, life for at least some individuals becomes impossible.

Two especially dismal aspects of the resulting culling can be mentioned. As if impelled by Parkinsonian logic, life tends to increase to exhaust available resources; the starving inhabitants of sub-Saharan nations have not stemmed the still-increasing populations of that region. Second, if a clearcut basis for culling the excess individuals does not exist, all individuals may be fatally injured in the ensuing struggle for existence; it is no accident that the very young, the weak, and the very old are among the first victims of any famine.

The limitation imposed upon any population by environmental resources is, like the second law of thermodynamics, a global limitation which has its eddies, whirlpools, and other exceptions. Urban centers are such exceptions for human populations; the inhabitants of neither Hong Kong nor New York produce sufficient food to sustain themselves. Nor does the ground these cities occupy contain the water required by their inhabitants. Nevertheless, these cities exist and have existed for several centuries. The basis for such anomalies-the basis for and the consequences of these exceptions to the general ecological admonition-must be understood not only by city dwellers but by those who provide them their necessary support.

Exceptions Cannot Become the Rule

Unlike the children of Lake Woebegone, all of whom are above average, densely populated urban centers (where the demand for resources exceeds the local environment's ability to provide) must be counterbalanced by areas where production exceeds the needs of local inhabitants. Counterbalancing alone is not sufficient; an incentive that causes needed resources to flow from their place of origin to the dependent city (or otherwise over-crowded urban area) is essential. The inhabitants of Hong Kong and of the Netherlands are fed by others only because they provide worthwhile services in return. In my opinion, for one million persons to set off to sea in a steel and concrete tetrahedonal structure as once suggested by R. Buckminister Fuller would be extremely foolish. While floating at sea, what services would they provide that would assure the scheduled arrival of ships bearing grain and other essential foodstuffs? Persons contemplating a life at sea should remember a second, better-



Mardi Gras in New Orleans provides residents and tourists with a pre-Lenten frolic. Based on complex, interconnected systems, cities have an ecology of their own. known admonition: "Out of sight, out of mind."

Dwellers of cities located in the midwestern United States, even of a large city such as Chicago, generally appreciate the role of American farmers in feeding not only Americans but also many persons living abroad. The same cannot be said of all New Yorkers, nor of many other persons living in coastal metropolises. A colleague who was lecturing at Barnard College on the yield per acre and total acreage planted in corn in midwestern states was questioned by a student: Why, she wanted to know, should she be interested in corn; she bought only a few frozen packages each year-packages she could easily forego. This student lacked any concept of the food web as it applied to her and her fellow New Yorkers: from grain to pigs, cattle, or chickens to supermarket counters. Unfortunately, such ignorance breeds thoughtless schemes promoting coast-to-coast skyscrapers and high-rise apartments. Under current agricultural practices, four or five acres of arable land are needed to feed each U.S. citizen (as well as other persons living in Europe, Asia, and Africa). Divided into quarter-acre lots, four or five acres would house 80 persons or more-persons who would then require 300 to 400 acres for nutritional support. Similar but more complex relationships apply to water supplies as well; here, however, we must recognize that Memphis' urine becomes New Orleans' drinking water.

The Road to the Dump Grows Shorter

The above phrase was the alternative title for a lecture delivered at Cornell University 20 years ago. Today, a barge full of refuse sits in a Long Island Harbor after a multi-nation ocean cruise in search of a dump site. Waste management has become crucial for the continued well-being of urban dwellers. Landfills have become just that-filled. In becoming filled, many have managed to contaminate subterranean water supplies-aquifers that may require thousands of years to recover. When confronted with a spate of news articles and TV programs dealing with the urgency of waste disposal problems, one urban housewife asked, "Why can't we do as we have been doing? I put my garbage by the curb, and the garbageman takes it away."

As a flagrant violator of Hardin's admonition, any city must be assured that food arrives steadily (every day for

perishables) and that wastes (garbage and body wastes) are removed. If the inward flow is interrupted, residents are quickly reduced to eating mice, rats, and dogs, as many European city dwellers learned during World War II. The Berlin airlift of 1948-1949 demonstrated the enormity of any effort to maintain life in a blockaded city of two million inhabitants. Conversely, an interruption of the outward flow of wastes quickly inundates a city in filth. This point has been recorded pictorially for New York and other major cities following strikes by garbage collectors: only days are required before plastic garbage bags are stacked shoulder high on nearly every sidewalk.

Free as Air We Breathe

City dwellers rely on others to produce their food and to receive, store, or incinerate their garbage. Fresh air, however, comes with every breeze, down every air shaft, and even penetrates the underground subways and metros. Or, so it has seemed in the past.

Because of forces-natural and otherwise-that determine where persons will aggregate and form urban areas, cities are prone to air pollution. Coastal areas are, at times, washed by fresh sea breezes; to experience a sunny, early summer day in New York City with a fresh wind from Battery Park is to experience one of nature's beauties. Too often, however, cities lie in hollows, in valleys carved by ancient rivers, and on the bottoms of extinct lakes. And, again too often, meteorological conditions (atmospheric "inversions") arise that trap volatile pollutants over the city like a murky soup in a shallow bowl. The smog of Los Angeles has been notorious for decades. The air pollution problems of Phoenix and Denver are of more recent origin, caused, ironically, by the influx of persons (with their automobiles) seeking fresh air. The "smoake" of London was lamented in a pamphlet written in 1661; historic relics in Venice, Athens, and in other European cities are literally melting because of acid rain and other corrosive chemical emissions. Finally, industrial accidents account ever more frequently for urban disasters such as Donora, Pennsylvania; Bhopal, India; and Chernobyl, USSR.

Decisions, Decisions,

Urban dwellers, much more so than their country cousins, rely upon the smooth operation of a complex transportation network. Trucks carrying goods into the city arrive continuously on interstate highways; those hauling garbage (as well as the commercial products of the city's inhabitants) lumber outward. Railroads and ships play their roles in maintaining a healthy city life. Underground are the aqueducts that bring water into the city and the sewers that collect hundreds of thousands of gallons of human waste daily, even hourly.

The proper functioning of urban facilities does not depend directly upon

Fresh air comes with every breeze, down every air shaft, and even penetrates the underground subways and metros. Or, so it has seemed in the past.

individual involvement; the city as a political institution is responsible for maintaining essential services. The individual persons who dwell within the city do need to eat, they do need water for drinking and washing, and they do need to eliminate body wastes. These needs are virtually hourly needs.

During a two-month stay in Alexandria, Egypt, I frequently walked from my hotel to the American Information Center. At one intersection, I was obliged to detour from the sidewalk into street traffic because of a large, fetid curbside puddle. An American acquaintance called my attention to the source of the pollution: a broken stand pipe. The city sewer was clogged at that point (the system was built for use by 250,000 persons but now serves several million), he explained; therefore, in order that the toilets and sinks in the building might drain properly, one of the apartment dwellers had smashed the stand pipe with a heavy hammer. Now, the facilities worked well within the building but a horrible mess accumulated on the street.

Careful thought will reveal that smashing a stand pipe, messy as it seems to the pedestrian, is not an irrational (illegal, perhaps, but not irrational) act by a citizen who has been forced to solve a problem whose proper solution is the community's responsibility. Urine and feces are, of necessity, part of man's lot. For a family to tend their bodily functions on the street solves nothing; walking to the beach would be no better. Until the city sewer is unclogged, the broken stand pipe, at least, assures individual privacy.

Urban centers, because they violate Hardin's admonition, generate problems whose solution must be sought in institutions operating at the proper level: the proper disposition of personal waste is a matter the community must solve; the proper disposition of community wastes is a matter the state must solve; the proper disposition of state wastes is a matter for the nation to solve; and, finally, the proper disposition of a nation's waste (the industrial emissions that result in acid rain, for example) is a matter that supra-national organizations must solve. The homeless persons in large American cities cannot be asked to cease eating, drinking, or creating individual wastes; city governments must cope with problems that accompany each individual's existence. The municipal government of Nice, France, cannot purify its beaches with phenol and perfume when the pollution arrives by sea from beachside communities that line the entire Mediterranean coast.

Epilogue

Many professional ecologists have had rural origins; their interest in biology often has sprung from childhood experiences. One should not, on that account, believe that these ecologists fail to appreciate cities, or, worse, that they dislike cities and city dwellers. The proper understanding is that cities are entities defying Hardin's admonition not to exceed the carrying capacity of the environment. Cities, in an ecological sense, are analogous to living organisms in a thermodynamic sense: their existence requires a constant input of energy derived from outsider sources. Consequently, unless firm lines of communication, transportation, and commerce have been established with less urban nations, each nation should provide for a proper balance between its own urban and rural life: cities, to thrive, must be fed, watered, and cared for. Cared for properly, however, they can-like living organisms-exhibit exquisite beauty.

(Dr. Wallace is University Distinguished Professor at Virginia Polytechnic Institute and State University and is a widely published author.)

A Look at NEPA

The National Environmental Policy Act



The Tennessee Tombigbee Waterway. Massive public works were one of the reasons NEPA was enacted. The aim is to understand and deal with environmental impacts before such projects are built. The science of ecology stresses the inter-connectedness of all aspects of the environment. The National Environmental Policy Act (NEPA), which became law in 1970, is aimed at insuring that the activities of the federal government itself stay in harmony with the environment. The following section treats the overall implementation of this law, and explains EPA's role.

EPA and NEPA: Challenges and Goals

by Jennifer Joy Wilson

N early two decades ago, in February 1969, Congress began to consider a whole range of new legislation designed to protect our nation's environment. As these laws were debated, questions arose. Protect the environment against whom? The majority said industry. For what reason? To safeguard human health, or so most people seemed to say, although there was a great deal of discussion at the time about "ecology" and protecting the "biosphere."

But our nation's legislators did not forget the need to regulate the regulators—the officials in charge of the vast expanse of federal land and facilities scattered throughout the United States. Their concerns were enshrined in two extremely important laws: the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act.

Both NEPA and the Clean Air Act were written with broader objectives in view, but they had precedent-setting impact on one specific aspect of American life: the way federal activities and facilities are planned and monitored to avoid adverse environmental ramifications. Also, both NEPA and Section 309 of the Clean Air Act have helped keep alive the ecological overview that so often becomes obscured as the news media, the public, and government officials debate the health effects of individual contaminants.

NEPA

Both NEPA and Section 309 took effect in 1970, the first at the very beginning of that pivotal year and the second at the very end. President Nixon signed NEPA into law on January 1, 1970. The symbolic significance of the date was not lost on anyone involved; the White House had, in fact, chosen it to emphasize the dawn of a new era of environmental awareness. The President declared: "The 1970s absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its waters, and our living environment. It is literally now or never."

The provisions of NEPA were broad enough to warrant the ballyhoo. Section 101 of the new law instructed the federal government to use "all practicable means and measures...to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social and economic and other requirements of present and future generations of Americans."

These goals applied to society at large, but NEPA did not overlook the need to watch the watchdog. The federal government was told to coordinate its own plans, functions, programs, and resources so as to avoid adverse impact on the environment. NEPA directed all federal agencies to determine the potential environmental impacts of their proposed activities and to consider those impacts in their formal decision-making process.

While NEPA did not contain regulatory requirements or penalties that could force an agency to take specific actions, the new law did lead to significant alterations in the basic federal decision-making process. In weighing the advantages or shortcomings of a proposed project, federal agencies could no longer confine their deliberations to traditional factors such as economic costs and engineering feasibility. Agencies were now required to address and fully consider the impact their actions might have on the environment.

If the project in question was expected to have a significant adverse effect, the agency proposing it was required to prepare an environmental impact statement fully disclosing its potential impact and, more importantly, providing a sound rationale for carrying it out in the way planned.

In addition to preparing environmental impact statements, NEPA called on the lead agency to consult with and obtain comments from any other federal agency possessing jurisdiction or having special expertise with respect to the environmental impacts involved in the proposed action. The goal of this requirement was to reduce agency bias, or "tunnel vision," as well as to balance the differing goals of federal agencies and meet the government's overall responsibility for preserving and enhancing ecological values.

The central problem with NEPA, in the view of many experts, was its lack of enforcement powers. Supervised by an executive oversight body called the Council on Environmental Quality (CEQ), NEPA's interagency review and consultation process spelled out steps federal agencies were to follow. But it had no enforcement powers to ensure that the process was actually carried out or that final plans for given projects did, in fact, reflect a constructive adjustment to valid opinions offered by commenting agencies.

Section 309 of the Clean Air Act

At the very end of 1970, when the new Clean Air Act was under discussion on Capitol Hill, Congress decided to add a provision that would give greater momentum to the goals of NEPA. The legislators decided to insert in the Clean Air Act a special section that considerably expanded EPA's role in environmental oversight of other federal agencies.

Under NEPA, all federal agencies, including EPA, had the responsibility to comment on matters under which they held "jurisdiction by law or special expertise." The Clean Air Act's Section 309, however, gave EPA a larger mandate. The Agency was now to Our nation's legislators did not forget the need to regulate the regulators—the officials in charge of the vast expanse of federal land and facilities scattered throughout the United States.



Washington, D.C., headquarters for many federal agencies.

Washington Convention and Visitors Association

comment on "any matter relating to" its duties, responsibilities, or authority, including those only "indirectly" related to the Agency's specific statutes. Section 309 also called upon EPA to review and comment on certain federal agency actions that were excluded from NEPA's impact statement requirements, including proposed regulations and proposed legislation.

Clearly, Section 309 of the Clean Air Act magnified EPA's role in environmental oversight of actions by other federal agencies. The young Agency was suddenly charged with a major new responsibility: comprehensive review of the potential environmental impacts of nearly all major federal agency actions, regardless of whether they met the NEPA threshold of "actions significantly affecting the quality of the human environment."

The rationale was that the environmental impact statements that federal agencies would be developing under NEPA should be subject to review not just by CEQ but also by environmental specialists at the nation's major environmental agency. Furthermore, EPA was charged with making the results of such review available to the public. Overall, the Agency's 309 work was to complement and reinforce the CEQ's mission under NEPA.

Over the past 17 years, EPA has reviewed and publicly commented on almost all of the more than 30,000 documents submitted to it by other federal agencies. These documents have informed EPA of a wide variety of proposed regulations, legislation, contruction projects, and other types of "action" being considered by the many arms of the federal government.

While EPA's oversight role has not always made the Agency popular with our sister federal agencies, we believe our role has been both constructive and valuable. Today, environmental planning is second nature to government decision-makers in a way inconceivable in 1970. The net result is a safer and healthier environment for all of us.

One factor has been critical to the success of EPA's environmental review process: early and open communication with other federal agencies. The Agency has pursued this approach to an extent not required either by NEPA or Section 309 and built up a credible and constructive process of interagency communication and consultation. In doing so, EPA has been able to take a more active role in identifying and preventing potential adverse impacts associated with proposed federal actions.

There is a broad consensus that the evolution of the environmental review process over the past 17 years has given substance to NEPA's courageous goal of creating and maintaining "productive harmony" between man and nature. It is fair to say that most federal agencies now fully endorse the environmental review process and have made great

While EPA's oversight role has not always made the Agency popular with our sister federal agencies, we believe our role has been both constructive and valuable.

strides toward integrating environmental consultation into their decision-making process.

Success in the environmental consultation process has resulted in real environmental improvements. Federal projects are now better sited and better designed; in a number of instances, proposals that have embodied unacceptable environmental impacts have been modified or canceled.

This is how the NEPA/Section 309 process works at EPA as we begin 1988: The extent to which the Agency gets involved depends on the level of environmental impacts of a proposed project; the ability and willingness of the proposing federal agency to mitigate those impacts; and the level of responsibility EPA has over the type of impacts at issue.

If the action is a federal project to be located in or on a specific site, the appropriate EPA regional office has the jurisdiction and delegated responsibility for carrying out the Section 309 review and working with the proposing federal agency to resolve any problems. If the action by the proposing federal agency is legislative or regulatory, or if it is presented in a programmatic or multi-regional environmental impact statement, the Section 309 review is conducted directly at EPA headquarters, in the Office of Federal Activities, which is part of the Office of External Affairs.

For federal projects that involve a NEPA environmental impact statement, EPA headquarters becomes involved if the region finds that the proposed action in the draft EIS is "environmentally unsatisfactory" or that the draft EIS is "inadequate" to assess the potentially significant environmental impacts of proposed actions. In such cases, headquarters must approve the regional comment letter before it is sent. In addition, headquarters works with regional personnel to inform interested parties about the EPA action and to assist the region, as needed, in meeting with the proposing federal agency to resolve controversial issues.

The entire process is carried out with several objectives in view: not just to protect the environment but to ensure EPA's independence, to maintain a cooperative atmosphere congenial to the resolution of conflict, and to keep the public informed of major developments. The challenge is to maintain and improve a process that is now both mature and respected.

As EPA's Assistant Administrator for External Affairs, I have made a firm commitment to those goals. I am particularly interested in strengthening EPA's process of consultation and negotiation under NEPA and Section 309. One initiative currently under way should give the process both higher visibility and a more accurate image. We are strengthening EPA's NEPA/Section 309 communication strategy so the Agency will be better able to defend its case when controversial opinions are handed down on EISs from other agencies.

Many other challenges remain. We at EPA—and our colleagues at CEQ and other federal agencies—will strive to meet them, and as we move ahead in the future, we genuinely hope man and his environment will be brought into ecological balance and "productive harmony."

(Wilson is Assistant Administrator for the EPA Office of External Affairs.)

How The NEPA/Section 309 Process Works

EPA exercises its environmental review program under two general statutory authorities: (1) the National Environmental Policy Act (NEPA) and the accompanying regulations of the Council on Environmental Quality (CEQ), and (2) the Administrator's specific responsibility under Section 309 of the Clean Air Act—to review and comment on the environmental impact of any legislation, regulation, or major action proposed by federal agencies.

Except for projects that are categorically excluded, federal agencies must prepare an Environmental Assessment (EA) and/or an Environmental Impact Statement (EIS). About 10,000 EAs-generally prepared for projects with minimal environmental impacts-are prepared annually. Several hundred EISs are also prepared, all of which are processed through and reviewed by EPA. EISs are generally prepared for projects that the proposing agency views as having significant prospective environmental impacts.

Whereas only about one-fifth of EAs are reviewed by EPA, all EISs are reviewed as part of the Agency's environmental review program. Most reviews are coordinated by the environmental review staff within each region, with assistance from appropriate program offices (air, water, solid waste, etc.).

General program oversight and management is under the Assistant Administrator for External Affairs and, specifically, the Office of Federal Activities (OFA). OFA also coordinates the review of nationwide, programmatic, and other types of EIS that are not the province of a particular region. Finally, OFA works in close cooperation with the regions on EIS reviews of controversial projects that would trigger significant, adverse environmental effects.

Both the regions and headquarters OFA use a special rating system to evaluate EISs submitted by other agencies. This system evaluates not just the environmental impact of a proposed action but also the adequacy of the impact statement itself.

Environmental impacts are rated:

LO—Lack of Objection.

• EC—Environmental concerns. The EPA review has identified environmental impacts that should be avoided. Mitigation measures may be required.

• EO—Environmental Objections. EPA has identified impacts that must be corrected to provide adequate environmental protection.

• EU—Environmentally Unsatisfactory. The review has identified highly objectionable adverse environmental impacts. If the potential impacts are not corrected in the final EIS stage, the proposal will be recommended for referral to CEQ.

Numerical ratings are assigned to EISs as a measure of their adequacy level:

1—Adequate. No further information required by EPA.

2—Insufficient Information. EPA believes the information presented in the EIS is insufficient to fully assess the environmental impacts that should be avoided to fully protect the environment; or the EIS has not analyzed a reasonable alternative that might have less severe impacts.

3—Inadequate. EPA does not believe the EIS adequately assesses potentially significant environmental impacts; or EPA has identified reasonable alternatives that should be analyzed in view of the significant impacts from the other alternatives. EPA believes a revised or supplemental EIS is required.

If a final EIS receives an "environmentally unsatisfactory" rating from EPA, and no agreement on a new approach is feasible, EPA can refer the project and its EIS to CEQ for further investigation, in accordance with the Administrator's responsibilities under Section 309 of the Clean Air Act.

EPA and NEPA: Cases in Point

by Richard E. Sanderson

ne of the first pieces of legislation passed at the dawn of the environmental era was the National Environmental Policy Act, or NEPA, which became law on New Year's Day, 1970. Soon after, EPA itself was created by executive reorganization, largely from pieces of several other agencies. Perhaps because they were born at about the same time and have similar acronyms, NEPA and EPA are often linked together in the public consciousness. (Even at EPA, I sometimes hear NEPA referred to as the "National Environmental Protection Act.")

Historical Ties

But the linkage between NEPA and EPA goes beyond public perception. On the very last day of 1970, the Clean Air Act Amendments were signed into law. Among its new amendments was a little-noticed provision, Section 309, that forged a legal link between the fledgling EPA and the National **Environmental Policy Act. Section 309** made EPA a central clearinghouse for ensuring an on-the-record review of proposed actions by other federal agencies that might adversely affect the environment. It further required that if EPA determined that any proposal was "unsatisfactory from the standpoint of public health or welfare or environmental quality," EPA's Administrator was to make public that determination and refer the matter to the Council on Environmental Quality (CEQ), the White House office that oversees the Executive Branch's implementation of NEPA. In the years since passage of Section 309, EPA has become a powerful partner in assisting CEQ to ensure federal compliance with NEPA.

Although they are the two primary environmental entities within the Executive Branch, CEQ and EPA are charged with thoroughly different missions. CEQ oversees the implementation of the National Environmental Policy Act, which requires (as numerous courts subsequently have confirmed) federal agencies to assess and make public the impacts of their activities on the environment. (EPA is also legally bound by NEPA, though many of its actions—presumed to be statutorily protective of the environment—are exempt from direct application of the statute.)

It is EPA, however, that is the nation's primary environmental regulatory agency responsible for cleaning up and maintaining the environment. As understanding of the magnitude of EPA's task became clearer, and as the more insidious of the nation's environmental problems were perceived as being linked to dreaded human diseases such as cancer, EPA's emphasis has shaded more towards protecting human health through pollution abatement, rather than restoration of the natural environment.

To some extent, this has led some people to see EPA as the Agency concerned with environmental threats to human health, while CEQ—although not without its health concerns—is seen as the guardian of the natural environment. This is an artificial dichotomy. Both organizations share both goals.

The links between CEQ and EPA forged by NEPA and Section 309 of the Clean Air Act are still working well, both in day-to-day reality and in the public consciousness. Perhaps because of the preeminent role of EPA as the nation's premier environmental regulator, EPA's opinion on issues touching on human health and the natural environment carries special authority with the public, Congress, and other federal agencies.

Through its NEPA and Section 309 review responsibilities, EPA now is generally seen as the "environmental watchdog" of the federal government, and that is exactly the role Congress envisioned for the Agency nearly two decades ago.

Negotiation and Consultation

Being an "environmental watchdog" is no easy task, and it involves a wide range of contacts outside the federal government. In the Office of Federal Activities (OFA), EPA's "watchdog" role means working intensively with federal, state, and local agencies to lessen threats to the environment posed by various federally sponsored proposals.

The Agency pursues its goals through a multi-pronged negotiation and consultation strategy that encompasses: early involvement and consultation with the federal agency as it develops the project (a process referred to as "scoping"); coordination of project and environmental impact statement (EIS) review; and negotiation through the entire structure of the department or agency to encourage mitigation or elimination of the environmentally damaging aspects of its projects or programs.

If, for particularly damaging projects, negotiation and consultation fail to satisfy EPA's environmental concerns, the Administrator may refer a proposed project to CEQ for resolution under Section 309.

Some recent case studies show how the system works:

• A nationwide grasshopper control program.

• Expansion of O'Hare airport in Chicago.

• A project to increase farmland through channelization of streams on the Delmarva Peninsula.

• Removal and destruction of obsolete chemical warfare agents.

• An increased drinking-water supply for Fort Smith, Arkansas.

Grasshopper Control

Two years ago in the spring of 1986, EPA reviewed the Department of Agriculture grasshopper control program proposed by the Animal and Plant Health Inspection Service (APHIS). The APHIS plan called for combating grasshopper infestation on the nation's rangelands by spraying with three pesticides: malathion, carbaryl, and acephate. APHIS wanted to move ahead fast on this plan to defeat a scourge that threatened the livelihood of thousands of apprehensive cattlemen.

While EPA recognized the need for the basic project, our reviewers were concerned about the safety of the three chemicals involved: their potential for damaging surface waters, threatening wildlife (especially endangered species), and contaminating the meat of cattle fed on the sprayed forage. EPA wanted APHIS to consider Integrated Pest Management (IPM) alternatives, including non-toxic biological pest control. As might be expected, APHIS staff initially resisted EPA's recommendations but became more amenable when they learned that our Office of Pesticides Programs would provide them with substantial additional information about alternative approaches.

One of the first steps was appointment of interagency scientific and technical committees, including representatives from EPA, APHIS, the Department of the Interior, the U.S. Forest Service, the Bureau of Land Management, the Fish and Wildlife Service, the Agricultural Research Service, and the National Park Service. Each agency brought to the table a different perspective; these were revealed in general discussion at the first meetings, which also led to the formulation of a programmatic base.

After input from EPA experts, followed by further negotiation and consultation, a decision was reached at APHIS to develop a new EIS for 1987. The program's managers also decided that a five-year, multi-agency, 100,000-acre demonstration and research project should be established to examine the full range of potential IPM techniques for grasshopper control.

In 1986, EPA reviewed the Department of Agriculture grasshopper control program, which proposed spraying rangelands with three pesticides. EPA wanted to consider alternatives. Currently, interagency scientific and technical committees from eight agencies are participating in future plans. Such techniques can boost productivity and cut costs while ensuring the survival of vital rangeland ecosystems.

APHIS' willingness to work with EPA has been gratifying. Plans are under way for EPA to participate in the design and evaluation of APHIS' future program objectives. As one of our staff working on this project says, "APHIS people now call us whenever they're thinking of starting a new project, which means that EPA is in on new or expanded program design even before an EIS is drafted. Our various concerns become interchangeable at the very beginning."

O'Hare Airport Expansion

The O'Hare Airport project is another example of negotiation and consultation being used at the early stages of a project to determine the environmental impacts that should be considered within the scope of the EIS. At "scoping" conferences, representatives of concerned agencies meet to discuss all possible environmental aspects of a proposed federal construction or program action.

Five years ago, EPA's Region 5 participated in a meeting about the proposed expansion of O'Hare Airport in Chicago, one of the busiest terminals in the nation. The regional staff was concerned with the possible impact of heavier airport automobile traffic on air-quality standards. EPA's review of the draft EIS developed by the Federal Aviation Administration in conjunction with the City of Chicago raised issues concerning air quality and noise. The final EIS still concerned the region. because if background, or "normal," levels of carbon monoxide and nitrous oxide were added to the projected extra amounts of CO and NOx, National Ambient Air Quality Standards would be exceeded. That meant a measurable effect on the health of infants, the sick, the elderly, and exercising athletes.

The air-pollution models used to prepare the EIS also appeared inadequate. The region suggested that agreed-upon mitigation measures be put in place immediately. However, the Chicago authorities refused to accept immediate implementation of the measures. At the same time, a local group opposed to airport expansion on grounds of noise and congestion urged EPA to refer the matter to CEQ and sued to have the EIS set aside. A complete impasse seemed likely. By persevering in the negotiation and consultation process, the parties involved were able to break the logjam. EPA emphasized to Chicago officials that a referral to CEQ under Section 309 was a statutory possibility should air quality violations continue. As a result, EPA and Chicago were able to agree on specific mitigation measures, coupled with a two-year monitoring program.

Those measures, surprisingly, had nothing to do with aircraft (jet exhaust over the runways disperses quickly) but focused on the siting of parking lot entrances, placement of toll booths, and new traffic controls at the terminal pickup and drop-off points, which could limit emissions from the growing number of vehicles in the area.

Chesapeake Bay

Protection of unique areas has been a major focus of the environmental review program. For example, EPA Region 3's strong support for wetlands and the Chesapeake Bay led to the cancellation of a long-standing ditching project that would have had deleterious effects on the Bay.

The Upper Chester River Watershed Project, proposed by the Department of Agriculture's Soil Conservation Service (SCS), would have affected about 240 miles of the river's tributaries in four Maryland and Delaware counties. Eleven years in the planning, the project involved straightening, deepening, and widening stream channels to promote better drainage on several thousand acres within these Delmarva Peninsula counties.

Region 3 was concerned about the losses the project might have inflicted on riverbank habitats and wetlands associated with these tributaries. In addition, changing former bottomlands to agricultural use would have increased the loading of nonpoint source agricultural run-off to the Chesapeake Bay, thus carrying increased soil and agricultural chemicals into that already fragile environment.

Early last year, Region 3's Administrator, James M. Seif, used the region's comment letter on the supplemental draft EIS to rate each of the various drainage alternatives as environmentally unsatisfactory. By working with the SCS and interested environmental groups, the region saw the project reconsidered, then dropped: a true testimony that when all environmental concerns are understood, good public policy decisions are the likely result.

Chemical Weapons Demilitarization

One of the most nationally sensitive projects to come under the purview of EPA's environmental review system has been our involvement in working with the Army to plan for destruction of the nation's stockpiles of obsolete chemical weapons. Congress requires that the process be completed by September 1994.

These stockpiles—located at eight military installations in Indiana, Kentucky, Maryland, Alabama, Arkansas, Colorado, Utah, and Washington—include explosives and non-explosive munitions and bulk containers filled with various deadly nerve agents and mustard gas that are from 17 to more than 40 years old. Some have been placed in protective overpacks to keep the chemicals from leaking out. The overpacks have in turn been stored in isolated, specially designed, and reinforced concrete igloos.

EPA and the states have direct permitting authority over the disposal program under the Resource Conservation and Recovery Act, the Clean Air Act, the Clean Water Act, and the Toxic Substances Control Act.

The Army's draft EIS presented three alternative scenarios for disposal, each involving construction of RCRA-permitted incinerators of extremely high destruction efficiency. The options involved: site-specific incinerators at each of the eight sites; incinerator construction at two regional sites, with transportation of the munitions from each site to the closest regional site; or construction of an incinerator at one national site, with haulage to that site from the other seven sites.

EPA's rating of the draft EIS indicated that certain information was needed to satisfy the Agency's environmental concerns. The final EIS was released in late December 1986. Elizabeth Cotsworth of the Office of Solid Waste, Sandy Williams of OFA, and other EPA staff are continuing to work closely with military planners to help them reduce the risks of an accidental release, minimize possible environmental effects on- and off-base, and assist the Army as they make their way through EPA's various permit requirements. The Army, eager to reduce potential risk to human health and the environment, has welcomed EPA's assistance.

Fort Smith Water Supply

The City of Fort Smith, planned to dam Lee Creek, a pristine Arkansas River tributary that flows through parts of Oklahoma and northwestern Arkansas. The proposed design included a small hydroelectric plant, a feature that brought the project under the licensing authority of the Federal Energy Regulatory Commission (FERC).

EPA Region 6's review of the draft EIS indicated several areas of environmental concern. The EIS did not address the second phase of the project, which called for significant expansion of the reservoir to accommodate 70 million gallons of water per day (gpd), and there was no apparent consideration of other acceptable alternatives. The draft EIS was a candidate for an environmentally unacceptable rating, with potential referral to CEQ by EPA's Administrator.

The Agency then entered into a protracted negotiation and consultation process with FERC, the City of Fort Smith, the states of Arkansas and Oklahoma, and the Corps of Engineers. The need for a reservoir of that size was reviewed, as well as other ways to meet the city's future water demands.

EPA asked that the planners repair leaks that were costing Fort Smith 16 percent of the water in its pipes and storage elements. Further, the Agency suggested that the community consider, as an alternative, using treated water taken directly from the Arkansas River rather than from its tributary.

There was great political support locally for the project, and FERC initially opposed EPA's recommendations. But Region 6 continued its efforts. As a result of these negotiations, all parties accepted a compromise involving a 10 million gpd reservoir. In addition, the compromise called for leaks in the existing system to be fixed and for other water conservation methods, as well as additional use of Arkansas River water, to be considered. Through the NEPA process, the City of Fort Smith will have sufficient water into the next century, and the damage to the environs of Lee Creek will be minimized.

The negotiation and consultation process, backed by the potential of a CEQ referral, is highly persuasive. Approximately one-fourth of the original draft EIS proposals reviewed by EPA exhibit potential environmental problems. That number drops to about five percent for final EIS submissions. Reviews of federal EISs show that environmental factors play a direct role in the choice of the Agency's project alternative. Although final choices are not always the environmentally preferable alternatives, NEPA's goal of requiring federal agencies to consider

Plans to dam Lee Creek near Fort Smith, Arkansas, were opposed by EPA's Region 6, which felt there might be other solutions to providing additional water for the city. Fort Smith had already been giving high priority to stopping water loss in many ways such as replacing this 12-inch pipe, which cracked longitudinally.

environmental issues in their decision-making continues to be met.

NEPA Compliance by EPA

In addition to its review of EISs prepared by other agencies, EPA must assure compliance with NEPA for several of its own activities. These include construction grants and EPA-issued new source National Pollutant Discharge Elimination System permits under the Clean Water Act, as well as research and development and facility-support activities. Also, in the years since 1974, the Agency has followed a policy of voluntarily preparing EISs in some areas where it has been exempted from NEPA, including ocean disposal site designation, and selected rulemaking actions under the Clean Air Act, the Noise Control Act, the Atomic Energy Act, and the Federal Insecticide, Fungicide, and Rodenticide Act.

EPA's own NEPA compliance integrates overall environmental assessment into the decision-making process for specific program activities. We also use EISs as a vehicle for public communication and participation. A few examples will illustrate the Agency's approach.

North Carolina Barrier

In 1982, EPA's Region 4 office was concerned with the impact of federally financed development on the North Carolina barrier islands. EPA had received six plans for wastewater treatment facilities on the barrier islands; five of these plans proposed regional treatment systems to replace existing local treatment works.

The region had three major concerns about these plans:

• Would the increase in treatment capacity stimulate excessive growth?

• What would be the impact of this growth on sensitive island environments such as dunes and wetlands?

• Would the local communities have the financial ability for plant construction and operation?

As a result of these concerns, it was decided to develop an EIS on wastewater treatment for the North Carolina barrier islands. The proposed EIS was issued in June 1983 and, following public review and comment, was issued as a final EIS in January 1984. The EIS looked at options for wastewater treatment ranging from continued use of existing facilities to construction of the regional treatment plants originally proposed.

The EIS also examined water-quality problems related to wastewater treatment and development. An especially important finding was that the impact of septic tank discharge on shellfish bed closure had been over-estimated—and that nonpoint run-off resulting from development was a larger factor in such closures than had been thought. The adverse impact of development on ground water was also assessed.

The EIS found that development resulting from regional treatment systems could well have adverse environmental impacts that would diminish the benefit to water quality from additional waste treatment. As a solution to this problem, the EIS identified a strategy for barrier island communities to more precisely determine wastewater treatment needs and to balance these needs against environmental impacts and financial considerations. This will allow barrier island communities to individually document and address problems associated with existing treatment plants, rather than making an overall decision to get rid of them in favor of regional systems.

Hudson River PCB Contamination

Another situation where the EIS process was used as a framework for decision-making concerned PCB contamination in the Hudson River. In Section 116 of the Clean Water Act, Congress authorized an EPA demonstration project to clean up these toxic materials. Although this action was exempted from NEPA, Region 2 determined that an EIS would be a useful means to develop cleanup alternatives, to assess the full range of the impacts of those alternatives on natural and cultural resources, and to inform the public of the Agency's reasoning on this very controversial case.

The final EIS issued in 1982 identified a cleanup alternative involving dredging and land disposal. However, a subsequent lawsuit concerning the disposal option has required the region to reconsider its favored alternative. As a result, EPA—in cooperation with the Army Corps of Engineers and the state of New York—is in the process of developing a supplemental EIS, which is scheduled to be issued in final form in early to mid-1988. In addition to assessing other disposal sites, the current analysis has identified an alternative that involves concentrating dredging in the most contaminated areas and thereby maximizing the environmental benefit of the cleanup investment.

According to Region 2, the EIS process has been an effective means of coordinating the analysis of alternatives among EPA, other federal agencies, the state, and the public. It has also been an effective means of addressing the full

Through its NEPA and Section 309 review responsibilities, EPA is now generally seen as the "environmental watchdog" of the federal government.

range of impacts that dredging, transport, and construction of containment facilities can have on human health, wildlife, sensitive environmental areas (especially wetlands), and cultural resources. It has led to the development of mitigation measures, such as monitoring during and after cleanup, as well as steps to protect wetlands.

Red Dog Mine

In 1983, Region 10 prepared an EIS in connection with an EPA National Pollutant Discharge Elimination System permit decision on a proposal by a Canadian mining firm for a lead/zinc mine on native lands in northwest Alaska. Two environmental issues were of principal concern: the effect a 57-mile access road would have on the Cape Krusenstern National Monument, and the potentially toxic impacts mining would have on the Wulik River, which is used by Alaska natives for subsistence fishing. In addition, the permit decision required extensive negotiation and consultation with the state, Alaska natives, and the Department of the Interior, which was required to obtain both Presidential and congressional approval for any development in the national monument area.

The final EIS was issued jointly by EPA and the Department of the Interior in September 1984. The EIS analysis resulted in an approach to siting and operation of the mine that will actually reduce zinc contamination of waters from naturally occurring levels. By examining the EIS, EPA and Interior were able to assess alternative access routes. As a result, they determined that the route through the national monument was actually the alternative with the least environmental impact. This addressed environmentalists' concerns and provided a good basis for getting Presidential and Congressional approval of this option.

Some Current Issues

The examples just discussed are, in general, "success stories," cases where the goals of environmental review and compliance brought about needed changes in federal projects, changes that minimized potential damage to the environment.

While not every story has a happy ending, EPA continues to pursue its goals through the NEPA/Section 309 consultation and negotiation process. That process is now shaping the ultimate environmental impacts of a number of significant programs and projects that are currently before the Agency:

The Arctic National Wildlife Refuge: EPA has joined the national debate on one of the major environmental issues of this decade: whether the lands within the coastal plain of the Alaska National Wildlife Refuge (ANWR) will be opened to oil and gas exploration. Concern focuses around the regulatory regime appropriate for protecting the fragile tundra environment of the ANWR coastal plain.

EPA'S Region 10 reviewed and commented on the Department of the Interior's proposal to open the lands to oil and gas exploration, and has testified before several congressional subcommittees considering the fate of ANWR's coastal plain. (See article about the Arctic's ecology on page 10.)

Homeporting: A number of EPA regions have had to deal with issues stemming from the Navy's "Homeporting" program, which is intended to disperse elements of the fleet among various coastal ports.

Particularly noteworthy was the homeporting of the battleship U.S.S. Missouri in San Francisco Bay. There was protracted debate within the Bay area over a wide range of issues related to the Navy's proposal. One key issue revolved around EPA Region 9's concern that the dredging required to prepare the Bay for the battleship would cause environmental damage by stirring up polluted sediments, and in the

Several EPA regions have had to deal with the U.S. Navy's plan to dock elements of the fleet at various coastal ports. Dredging and disposal continue to be key discussion topics.

Denver's plan to build Two Forks Reservoir received low environmental marks from EPA's Region 8. Trout fishermen can continue to enjoy their "Gold Medal" trout stream while the agencies involved try to resolve environmental issues.

process create new disposal problems. EPA Region 9 and the Navy worked out a satisfactory compromise, but the environmental impacts of the "Homeporting" program—particularly as these relate to dredging and disposal—continue to be hotly debated in other coastal regions. Two Forks Reservoir: EPA Region 8 has been highly active in plans for siting a new water supply reservoir for the Denver metropolitan area. The Two Forks Reservoir project, proposed by the Denver Board of Water Commissioners, would have inundated or otherwise damaged a significant portion of the wetlands in the area; it would also have eliminated a "Gold Medal" trout stream.

Based on a review of the draft EIS, EPA Region 8 rated the project "environmentally unsatisfactory." The region is continuing to work with the Denver Board of Water Commissioners, the U.S. Army Corps of Engineers, and other agencies to resolve the environmental issues involved.

The Future

EPA's environmental review process lacks formal regulations and legal penalties, but it continues to make a valuable contribution to the Agency's overall environmental protection goals. The main way it does this is by ensuring that other federal agencies are not working at cross purposes to EPA's goals.

The key to the success of this non-regulatory program is EPA's ongoing process of negotiation and consultation with other agencies. By working constructively with other agencies, particularly during the early stages of program and project planning, EPA helps assure that their actions are neither contrary to the Agency's goals nor destructive of the natural environment.

Lending weight to this approach are not just the policy goals articulated in NEPA, but also the specific authority given to EPA's Administrator under Section 309 of the Clean Air Act. When necessary, EPA has shown the will to put the full force of the Administrator's authority and responsibility behind Section 309 by referring controversial projects to CEQ. In one sense, referral to CEQ is EPA's closing argument in its effort to seek resolution through the consultation and negotiation process.

EPA remains the federal agency to which the public ultimately looks for protection of the nation's environmental resources, both for this and for future generations. The environmental review process is a valuable and unique mechanism for carrying out that public trust. □

(Sanderson is Director, EPA Office of Federal Activities.)

Federal Agency Pollution Abatement Projects

Federal agencies prepare annual pollution abatement plans that EPA reviews under a directive from the Office of Management and Budget (OMB Circular A-106) as part of the Office of Federal Activities' federal facilities compliance program. The chart shows how A-106 projects have increased both in number and funding level during the past few years.

In fiscal year 1985, federal agencies proposed 343 projects totaling approximately \$261 million. By fiscal year 1988, there were 758 proposed projects with funding requests totaling nearly \$1.1 billion.

Much of this increase can be attributed to the challenge of meeting new provisions written into the amended versions of recently reauthorized EPA statutes. For example, the Resource **Conservation and Recovery Act** (RCRA), as amended in 1984, requires compliance by smaller-scale generators of hazardous waste. This means that many federal facilities previously exempt from RCRA, such as rural post offices, remote field stations, or laboratories, now must set aside funds to ensure compliance with RCRA's new regulations.

The scope and extent of environmental management programs at federal agencies vary considerably. Many smaller agencies have only a few people dedicated to environmental compliance, and they do virtually all of their work out of their Washington headquarters. Some of the large agencies, however, may have 40 to 50 people on the environmental staff at a single installation.

The Department of Defense (DOD) is, of course, the leading spender in this area, as in others. DOD has established a separate "fenced" account to clean up its inactive hazardous waste sites. In fiscal year 1987, this account contained \$407 million earmarked exclusively for hazardous waste cleanups. In addition, with the intention of avoiding future cleanup bills, DOD's various programs have large budgets devoted to curbing pollution in their current operations.

Since July 1986, EPA has been encouraging all regulated federal entities, regardless of size, to enhance the efficiency of their environmental operations by setting up environmental auditing programs. Environmental auditing serves as an internal quality assurance check to verify compliance, evaluate management effectiveness, and assess risks from facility operations and practices.

EPA is providing technical assistance to federal agencies interested in designing and initiating audit programs at their facilities. Already, almost half have either established an auditing program or are initiating such a program.

EPA will be hosting a national "Environmental Auditing Conference for Federal Agencies" in Atlanta from March 22 to March 24, 1988. The purpose of this conference is to spread the word about audit programs and help personnel at other agencies develop needed auditing skills.

Total Proposed Federal Agency Pollution Abatement Projects

NEPA: Past, Present, and Future

by Alvin L. Alm

The National Environmental Policy Act (NEPA), signed into law on the first day of 1970, stands in stark contrast to other environmental legislation enacted in the 1970s and 1980s. Beginning with the Clean Air Act, passed in late 1970, environmental legislation became increasingly prescriptive, detailed, and complex. NEPA, on the other hand, was short, simple, and comprehensive. It established a national policy to protect the environment, created a Council on Environmental Quality (CEQ), and required that environmental impact statements be prepared for major federal actions having a significant effect on the environment. This simple Act can be compared to the current crop of environmental laws that take up hundreds of pages and generate bookshelves worth of regulations. With little statutory guidance, the newly created CEQ set about building a staff and staking out an agenda. CEQ's highest priority was to become the federal environmental policy arm. The environmental impact statement and annual report requirements were both lower priority.

CEQ made major advances in the policy area. During the early 1970s, CEQ developed a comprehensive environmental program which included,

NEPA established a national policy to protect the environment the same year Earth Day was first celebrated.

among others, amendments to the Federal Water Pollution Control Act, the Toxic Substances Control Act, forerunners to the Resource Conservation and Recovery Act (RCRA), and the Safe Drinking Water Act and amendments to the pesticides legislation. During its formative years, CEQ laid the groundwork for almost all current environmental legislation except for Superfund and asbestos control legislation.

CEQ also developed guidelines for the environmental impact statement process. At the time they were developed, CEQ staffers had no idea how revolutionary the environmental impact statement process would become.

One very early event substantially influenced EPA's role in reviewing other federal agency actions. It happened when the U.S. Department of Transportation refused to release agency comments on the environmental impact statement for the proposed Supersonic Transport. Congress took subsequent action. It added Section 309 to the 1970 Clean Air Act, which stated that EPA must comment on all EISs and that EPA's comments must be made public and would be transmitted to CEQ for action if the environmental impacts were "environmentally unsatisfactory." Under this Clean Air Act mandate, EPA set up a structured program for reviewing and rating federal agency projects that continues to this day.

Concurrent with the creation of NEPA was the founding of new environmental litigation organizations—namely the Natural Resources Defense Counsel and the Environmental Defense Fund. NEPA was like grain dust to the environmental litigators' match. These and other environmental and citizen groups used the NEPA tool to sue a host of federal agencies for noncompliance with NEPA. The courts generally came down on their side.

The initial impacts were dramatic. The Atomic Energy Commission's nuclear licensing process was stopped dead in its tracks for more than a year as a result of the Calvert Cliffs decision. Outer Continental Shelf oil drilling was held up until a proper environmental impact statement was prepared. Controversy over the Alaska Oil Pipeline was brought to a close only when Congress decreed the environmental impact statement process was completed.

NEPA had other unexpected results. The Courts interpreted NEPA to cover not only direct impacts from federal projects and activities but also indirect effects. These indirect effects might include increased traffic or secondary development from projects. For example, the initial proposal for a John F. Kennedy library at Harvard University was dropped when the environmental impact statement projected increased congestion and air pollution.

Some have argued that the NEPA process has also been misused at times. For example, environmental impact statements have been used to challenge public housing projects. The real concerns in these cases were only partially environmental; in many, they were predominantly neighborhood issues; sometimes, they were racial issues.

By the middle of the 1970s, environmental concerns were routinely being built into government actions. In most cases, a major defeat or slow-down of a project precipitated action. Environmental staffs were formed, consultants mobilized, and line staff became more sensitive to environmental concerns. Also, through the last part of the 1970s and during the 1980s, the composition of government projects and actions changed. Lower energy prices created less demand for a host of energy projects, particularly electric powerplants. The federal highway system was essentially complete; most of the funds were used to upgrade existing routes.

NEPA's lack of notoriety may well be its measure of success. By and large, government agencies have institutionalized environmental quality concerns in decision-making. Few projects proceed today that provoke an environmentally unsatisfactory rating from EPA. Many projects contain environmental safeguards that would not have resulted without the NEPA prod.

In some cases, generic programs have been fundamentally altered because of NEPA concerns. For example, EPA's sewage treatment grant strategy shifted from one of encouraging large regional facilities to one that encouraged smaller units. This strategy resulted in large part from concerns over stimulating urban sprawl and development in sensitive areas by financing long interceptors into undeveloped areas.

The CEQ, created by NEPA, played a major policy and education role, as well as becoming the caretaker of the environmental impact process. During its early years, CEQ was the undisputed policy arm of the government's

NEPA's lack of notoriety may well be its measure of success.

environmental apparatus. Its annual reports were authoritative and well respected. Not only did the CEQ develop major pollution control legislation and policy, but it also addressed a range of non-pollution issues, such as the urban environment, clearcutting, predator control, and off-road vehicle use.

The massive growth of EPA, coupled with large percentage staff cuts at CEQ, has reduced the Council's policy role. EPA now takes the lead in many areas which during the early years would have been CEQ's province. CEQ still provides coordination of some large programs, such as the National Acid Precipitation Action Plan, but these types of responsibilities have been rarer in recent years.

Overall, NEPA has been a quiet but effective success after a turbulent and dynamic beginning. CEQ continues to play a positive, although diminished, role. The CEQ annual reports are still the best overall review of environmental issues and trends. The NEPA process has wrought a major change in the way government deals with environmental issues, and this model has been replicated in whole or in part in 23 states. All in all, NEPA has codified an important national policy commitment and created helpful procedural and organizational tools to further that policy objective.

(Alm was Staff Director for the President's Council on Environmental Quality from 1970 to 1973. Currently, he is President and Chief Executive Officer of Alliance Technology Corporation. Prior to this, he was Deputy Administrator of EPA.)

Does NEPA Make a Difference?

by Dinah Bear

While the NEPA process is well known for having dramatically expanded the involvement of private citizens in federal agency processes, its effect on federal decision-makers frequently goes unnoticed by parties not concerned about a particular proposed action. This article will offer some observations about NEPA's effect on federal decision-making and will suggest some ways to improve its effectiveness.

How can the impact of the NEPA process on federal decision-makers accurately be evaluated? While impossible to quantify with precision, its cumulative effect, over the past 18 years of implementation, is enormous. The NEPA process is applied, albeit unevenly, to the broadest range of federal activities of any environmental statute: highways and dams, to be sure, but also to the formulation of programs, promulgation of regulations, development of new weapons systems, recommendations for Senate approval and consent to treaties, biotechnology experiments, forest management plans, even the abandonment of railroad tracks-the list extends as far as the federal governments' reach. The judiciary, the Council on Environmental Quality (CEQ), and, to a lesser degree, Congress, have provided strong oversight and enforcement of the procedural requirements of NEPA, thus providing a continual reminder of the penalties of ignoring the process. Major projects have been modified, delayed, or, in rare instances, cancelled because of the information revealed through the analysis of environmental impacts.

Not surprisingly, however, the seriousness and intensity with which the NEPA process is integrated into decision-making varies enormously from agency to agency and sometimes from project to project. Generally speaking, agency NEPA compliance appears to fall into one of three stages of "environmental evolution." In the first stage, agency officials strongly resist application of the NEPA process to their agency's activities, citing conflicting purposes between NEPA compliance and their "real" mission. They may develop a theory of why NEPA doesn't apply to certain of their activities, or they may totally ignore NEPA, viewing an absence of litigation as proof that their position is acceptable.

In the second stage of evolution, often arrived at after one or more judicial decisions affirming the agency's obligation to comply with NEPA, agency officials will concede the obvious and promulgate agency procedures consistent with CEQ regulations. Staff will prepare numerous NEPA documents, and the minimum public involvement requirements will be followed. However, the agency decision-makers believe that the primary value of compliance is to avoid successful litigation. They invariably grumble about the time and paperwork the process often entails.

In the third stage of compliance, an agency will aggressively reach beyond the minimum legal requirements to use the NEPA process as a vital part of the decision-making process. It generally will be creative and open towards the involvement of all interested parties, both in and out of the federal government, and will seriously ponder the alternative courses of action evaluated in the NEPA process. Whether an agency reaches this stage of evolution seems to depend largely on the personal commitment of individuals in an agency-particularly the decision-maker(s), high-level staff in environmental review or compliance offices, and the Solicitor's or General Counsel's office-as well as an understanding of the process on the part

of the program people. Hostility or apathy towards the process from any of these players can be a significant detriment; the decision-maker, of course, can most easily set the tone of full and spirited compliance.

This three-step evolution towards NEPA compliance was summarized in a statement by a decision-maker in the U.S. Air Force. In essence, that gentleman said, "At first, I really resisted complying with NEPA every step of the way. Then, after getting beaten over the head enough times, I started complying with it, but I grumbled all the time. Finally, one day, I thought—well, I might as well try using the system. And you know what happened? It actually worked—it definitely improved the quality of my decision-making."

Aside from anecdotal stories, what evidence is there of NEPA's influence on federal decision-making? While there is no direct evidence comprehensively addressing this question throughout the government, some facts suggest certain conclusions. Virtually all agencies whose activities have some degree of environmental impact have now adopted agency procedures which are generally consistent with the CEQ regulations. The last agency to do so, the Federal Energy Regulatory Commission, adopted such regulations on December 9, 1987.

Requests from the agencies themselves for statutory exemptions from NEPA are extremely rare; requests for deviations from the normal process, provided for in the CEQ regulations, are also quite rare.

Litigation based on NEPA causes of action is declining. The lowest number of NEPA lawsuits ever filed was recorded during 1985: a total of 77 cases, and concomitantly, the lowest number of injunctions against the government was issued, with a total of eight injunctions. This compares to 189 cases filed during 1974 and a record of 21 injunctions during 1983. The decline in litigation may reflect agencies' greater experience and expertise in carrying out their NEPA responsibilities.

These statistics, however, don't mean that all things are well with regard to NEPA in all agencies. The author has personal knowledge of some agencies with a high level of commitment to NEPA's substantive goals as well as procedural requirements. Nevertheless, I would say that many agencies are still in "stage two" of their evolution in complying with NEPA, with some "stage-one" problems in certain program areas. The reasons for these problems are both internal and external to the agencies. First, at the risk of sounding trite or simple, I must stress the importance of individuals' attitudes in key positions. The best procedures in the world will mean little if viewed as nothing more than legal requirements. While important in relation to implementation of any environmental statute, this fundamental rule may be even more essential in the NEPA process because of its broad application and integrated approach to federal programs which would otherwise involve little interaction with people or disciplines outside that program's normal purview.

Second, the usefulness of the NEPA process to decision-makers often is weakened by a persistent tendency to overload NEPA documents with a voluminous amount of irrelevant or often highly technical data. No one wants to read such documents: not public citizens, not members of public interest organizations, not federal judges, and certainly not decision-makers. Why, then, does this habitual overloading of EIS(s) exist? The common excuse is, "the lawyers made us do it" to avoid litigation risks. I am not persuaded that this is valid reason for weakening the value of the NEPA process to decision-makers, either on substantive grounds or for some kind of litigation strategy. It remains, however, a disincentive to using the NEPA process to improve the decision-making process and has. I believe, contributed to an unfortunate and unnecessarily cynical attitude about EIS(s) in particular.

Third, agencies far too frequently find themselves in the position of playing "catch up" with their obligations under NEPA, whether for particular projects or entire agency programs. Agency personnel should constantly be alert to any programs for which integration of the NEPA process is not a normal part of doing business. At the same time, agencies sometimes don't comment on another agency's NEPA analysis at all until the final stages of the process, causing considerable delay and hard feelings.

Finally, NEPA is to a certain extent a victim of its own success in the context of environmental law. Because it is the oldest of the environmental statutes passed as a result of the environmental movement in the 1960s and is the most widely implemented of the environmental statutes in the federal government, and, perhaps, because no reauthorization of NEPA is required, a certain aura of benign neglect is associated with the NEPA process.

Following the public's cue, Congress and the private sector have increasingly turned their attention to specific environmental problems, notably, clean up of hazardous waste sites, disposal of toxic wastes, etc. This trend can inadvertently reinforce a view that NEPA is about production of documents, while the "real" action is implementation of other environmental laws: at best, it sends a signal that creative, vigorous NEPA compliance is not something which is highly valued. While not pervasive, any manifestation of such attitudes is harmful. NEPA is the one environmental statute which forces all federal agencies to look at all of the environmental consequences of their actions; it is the one statute that requires the federal decision-maker to seriously consider alternatives to a proposed action, and, in the context of the EIS process, to explain the rationale for the final decision.

In November 1987, CEQ held a national conference, co-sponsored with the Environmental Law Section of the New York State Bar, on the preparation and review of environmental impact statements at both the federal and state levels. The conference was well attended by federal and state officials and members of the private sector who are significantly involved in the NEPA process or its equivalent at the state level. Persons from all parts of the country, ranging from Hawaii to Puerto Rico, discussed with insight and enthusiasm the strengths and weaknesses of the environmental assessment processes. One of the panels focused specifically on the relationship between the process and agency decision-making. Among the ideas which CEQ intends to pursue as a result of the discussions at the conference are the following:

• Recognition of superior NEPA compliance. During the conference, the observation was made that there is never positive reenforcement for excellent compliance with NEPA but only negative results for inadequate compliance. While good implementation which leads to better decision-making should be of great internal satisfaction, CEQ will explore ways to visibly recognize innovative and vigorous NEPA compliance in the federal agencies.

 Tackling the "EIS horror story" syndrome. CEQ has long been concerned with the problem of lengthy, unreadable NEPA documents. The CEQ regulations were specifically written to emphasize ways to make the NEPA process more useful to decision-makers and the public, to reduce paperwork and the accumulation of extraneous background data, and to emphasize real environmental issues and alternatives. Unfortunately, both the spirit and specific requirements of the regulations which address this problem are frequently disregarded in favor of the "more is better" syndrome. During the coming year, the CEQ General Counsel's office will focus on compliance with these aspects of the regulations which were drafted to improve integration of the NEPA process with decision-making and to eliminate documentation which is of no use to anyone.

• Engaging in alternate dispute resolution. Because the motivation behind the less productive aspects of the NEPA process is the fear of litigation, we will also explore the desirability of engaging in alternative dispute resolution in situations which seem likely to result in traditional litigation.

We will continue to seek out ideas to improve the relevance of the NEPA process to decision-making at all times and welcome suggestions from any interested persons. \Box

(Bear is General Counsel of the President's Council on Environmental Quality.)

Thoughts about Improving Environmental Care

by Malcolm Baldwin

There was little opposition when Congress passed and President Nixon subsequently signed into law the National Environmental Policy Act (NEPA). NEPA was enacted on the wave of strong public support from citizen groups frustrated by the federal government's repeated failure to provide environmental safeguards when approving the construction of dams, highways, airports, and other major public or private projects.

NEPA's birth, in effect, was the culmination of a 10-year period during which an emerging environmental constituency fought a rearguard action against several large federal projects including a jetport in the middle of the Florida Everglades and a large dam on the Colorado River that flooded parts of the Grand Canyon. Major highway projects in densely populated areas were also approved even though they destroyed many an old city neighborhood and other parts of the urban environment. Scores of large private projects were approved and developed without environmental safeguards or oversight.

What gave birth to NEPA was the growing recognition that the federal government was itself contributing to the nation's environmental problems. This produced a consensus that the entire executive establishment from the President to the various federal agencies should be accountable for decisions that affect the environment, and that citizens had the right to participate and to influence the development of such decisions.

NEPA included two specific provisions for achieving these dual objectives. The first was to create a Council on Environmental Quality (CEQ) modeled after the already existing Council of Economic Advisors. CEQ was set up to give high-level advice on environmental matters to the President and to make certain that all federal agencies were complying with NEPA provisions. The second landmark provision from NEPA was the environmental impact statement (EIS). This required that all federal agencies prepare an environmental statement analyzing the impacts of proposed actions and alternatives before taking any major action that would significantly affect the human environment.

Eighteen years later, we take these and many other NEPA provisions almost for granted. In the early 1970s, however, the new CEQ often had to prod a somewhat reluctant administration to enact and incorporate programs and initiatives that derived from NEPA mandates.

CEQ helped to establish EPA in 1970, and it subsequently developed three comprehensive environmental programs during the Nixon administration. Again in the late 1970s, CEQ drafted two more environmental programs for President Carter which included many programs and Executive Orders (on wetlands and floodplains for example) that remain in effect to this day.

CEO also established and helped evolve the basic structure for EISs, supported by court decisions that often moved the process forward in the face of political pressure or bureaucratic inertia. In the early 1970s, for example, the Department of the Interior tried to justify the 800-mile Trans-Alaska Pipeline with a paltry four-page impact statement. The entire environmental impact statement process seemed to hang in the balance. It appeared to some that NEPA's EIS requirements were on the road to bureaucratic obscurity. In this case, however, a successful suit against the Department of the Interior made the Agency go back to the drawing boards. This was followed by subsequent court decisions that further strengthened the EIS process. After a painful period of agency adjustment and energetic troubleshooting by CEO, EISs that were once the deus ex machina of administrative processes have become routine parts of much more open and informed agency decision-making throughout the federal government.

Other countries have adopted environmental impact statement practices based largely on the logic of the American EIS process and U.S. experience in using it. The European Common Market Countries, as well as the 17-nation Organization for Economic Cooperation and Development (OECD), have endorsed the concept of environmental impact assessment (EIA), thanks largely to leadership on this issue from the Dutch government. EIAs are also now required in many countries of the developing world including Sri Lanka, Indonesia, and Thailand, which alone prepares over 300 EIAs annually. The U.S. Agency for International Development, often with EPA's help, assists these countries. The U.S. experience with impact statements continues to be seen as an encouraging example of how the process can work successfully. American help is readily sought by many in the international community.

It would please me to end my article here with an upbeat conclusion that predicted bigger and better things from NEPA in the future, but that would be a disservice to my readers and the NEPA process. Much of NEPA's potential has not been achieved and many of its promises have not been realized. On the positive side, the Reagan administration's CEQ has continued to support the EIS process as it developed and evolved through previous administrations in the 1970s. Environmental factors are almost routinely incorporated into the bureaucratic process, and we don't get many projects approved that are blatantly destructive to the environment.

Balanced against this are several problems and shortcomings. One is that we simply don't know how well NEPA is working within each agency, and we have not yet seized the initiative to improve the efficiency of the EIS process or to integrate environmental and economic priorities and decisions of most federal agencies. The federal government is in a holding pattern that creates few waves or complaints but that often results in unknown or unrecognized benefits. We could do worse, but we could also do much better.

We need a comprehensive review to identify the benefits and problems of the EIS requirement, how agencies actually use it, how citizens view it, and how it can be used more effectively. When complaints arise about costs for the program, we lack the evidence to know whether they are valid or off the mark. One example involved a proposal to CEQ by the Army Corps of Engineers to make major changes in what it claimed were costly and redundant NEPA procedures concerning its approval of private projects. The CEQ approved this request over EPA's objection, even though it lacked even the most basic information on the actual scope or costs of the problem, or the effects of the proposed change. It has been over 10 years since CEQ undertook its comprehensive, agency-by-agency fact-finding review of NEPA, which led in 1978 to revised EIS regulations. It's time for another such fact finding review.

My eclectic observations over the past seven years suggest that the EIS process is too often neglected at the decisionmaking level, is often weak on analysis of reasonable alternatives, and tends to be too narrow in scope. I believe certain things need to be done to rectify these problems and improve the process.

One is carefully to integrate EISs into local or regional planning processes such as Special Area Management plans that affect and are affected by federal decisions. Careful integration of various local, state, and federal environmental responsibilities could produce more practical environmental assessments and fewer, but much better, EISs. This would also promote sounder public and private environmental and development decisions in environmentally important and sensitive areas such as estuaries, large wetlands, and endangered species habitat. Such integration would provide substantial environmental and economic benefits to the nation.

Another area of reform is needed to rectify the problem of overly long and very expensive EISs on private projects. There may be better ways to use and to circulate informal environmental assessments that can often be more practical than EISs because they are more flexible and responsive to rapid changes in information, design, or environmental concerns. We need to identify ways to reduce EIS costs and inherent delays in the existing process. We also need to manage EIS consulting work more carefully and ensure that private applicants seeking federal approval pay the full costs of environmental assessments.

There are also practical bureaucratic problems to attend to. Like the agency staff in other countries I have visited, federal agency staff who prepare and review EISs are highly susceptible to burnout because they too often get little reward for, or feedback from, their work. Rotational assignments from EIS offices in regions or headquarters to the action offices in the field and visa versa could help morale and performance.

Finally, we need to recognize that although NEPA was established in part to provide a high-level advisor to the

President on environmental matters, the scope of that function essentially derives from the priorities of each administration. The only way ultimately to bridge such priority differences is simultaneously to advance and harmonize priorities related to sound economic growth and environmental conservation. It has always been difficult to reconcile economic growth and environmental conservation. The integration of long-range environmental analyses into budget decision-making was an early goal of NEPA, but its successful implementation has always eluded the Office of the President. It's clear, however, that we could save money and possibly the environment if we could find ways to do so. We must find ways to strengthen the environmental review and advice process within the Office of the President and integrate it adequately

with the work and advice of the Office of Management and Budget and the Council of Economic Advisors. If it turns out that the CEQ can no longer perform this function, then some other entity must take up the slack. The EIS process itself might be vastly improved by requiring economic analyses of proposed actions and alternatives, including the feasibility of using market mechanisms in place of government subsidies. The United States as well as the entire world would benefit from energetic efforts to strengthen the economic and environmental policy connection.

(Baldwin is a former staff member and Acting Chairman of the President's Council on Environmental Quality. He is now an environmental consultant.)

The Dan Ryan Expressway in Chicago. The NEPA process is applied to actions and activities of federal agencies, including the funding of highways and dams. Litigation based on NEPA is declining, perhaps because other agencies now have greater experience in complying with their responsibilities under this law.

Herbicides, the Forest Service, and NEPA

by Gary L. Larsen

The National Environmental Policy Act (NEPA) is a catalyst for sound environmental policymaking. It also provides a framework for managing conflicts over environmental matters that invariably arise as government agencies carry out their missions and responsibilities.

One recent example of these dual benefits involves the way the Pacific Northwest Region of the USDA Forest Service is using NEPA to make decisions about controversial issues surrounding the management of competing and unwanted vegetation in the National Forests of Oregon and Washington. This management sometimes includes two controversial methods: the use of herbicides and prescribed burning. Both methods generate strong opposition from some environmental groups as well as concerns from some state and local authorities.

There has been, in fact, a full decade of intense controversy associated with herbicide use by the Forest Service in Oregon and Washington. This controversy culminated in a landmark 1984 judicial ruling that any government body (including the Forest Service) which uses pesticides must fully consider potential human health problems associated with its programs. This requirement goes well beyond the consideration given to human health as part of EPA's pesticide registration requirements. The court decision also directed government agencies to involve the public in assessing and weighing potential human health effects as part of the NEPA process.

This judicial decision helped set the stage for the Pacific Northwest Region of the Forest Service to take a new approach in resolving the long-standing controversies regarding its use of herbicides and newer concerns with the use of prescribed fire. The new

Having the public involved in planning and analysis from the very beginning has resulted in open and productive communication among all key constituencies affected by, or concerned about, vegetation management in the western forests under the jurisdiction of the U.S. Forest Service.

approach involved developing an entirely new program of managing competing and unwanted vegetation and included a deep commitment to involvement of interested citizens, organizations, and agencies in the whole process, from the very beginning.

The scope of the conflict was not just between the Forest Service and groups opposed to the use of herbicides; it was much larger. It included a broad range of issues such as community stability, maintenance of ecosystems, and the efficacy of techniques, as well as human health. The interested parties were many and varied. They included county weed control boards, state agencies (such as departments of transportation, agriculture, and public health), and industry groups. The timber, chemical, and agricultural interests in particular were concerned that our analysis and decisions would lead to unnecessary restrictions on their own use of herbicides.

The common thread among conflicting views was that all wanted the forests to be managed carefully and to good purpose. The differences were primarily in the assessments of "How careful is careful enough" and what constitutes "good purpose."

NEPA provides a framework and process that allows dialogue among

interested persons about those differences and provides an agency the means for using that dialogue to improve the quality of its decisions. The NEPA process was used effectively by the Forest Service to establish and strengthen working relations among interested persons, and to enlist the help of interested citizens in developing a new program of vegetation management.

The process is working because all participants including the Forest Service have a commitment to listening and being willing to be educated by the views of others. The framework of NEPA provided the Forest Service with five distinct but closely related steps to guide public involvement efforts.

The first step was to identify all key constituencies affected by or concerned about the various aspects of vegetation management (including the use of herbicides and prescribed fire), and to involve them at the earliest stages of planning a new program of vegetation management.

The Forest Service used mailings requesting public participation and discussion as well as workshops to identify broad issues. Subsequent detailed working group sessions with business and the environmental and forestry community were also used to develop alternatives and identify analytical needs. Other affected and interested groups were identified and contacted by employees working in the field. Many agencies (both state and federal) became formal cooperators in planning and analysis.

The second step was to determine the interests and concerns of each of these constituencies relevant to vegetation management. Concerns were identified particularly with human health, economics, and the efficacy of herbicides and prescribed burning.

Two positive results came from this step. One was that the Forest Service came to recognize that it really hadn't been listening as carefully as it should. The second was the discovery that many groups and individuals had well thought-out and articulate contributions to make to improving vegetation management in the Pacific Northwest Region. It was interesting to note that many of these groups had very little knowledge of the basic Forest Service mission, how the agency makes decisions, and the benefits of managed forests.

The next step in the process was to decide which issues could be handled. Activities for which decisions were needed included some aspects of

As a result of the NEPA process, the U.S. Forest Service learned that prescribed burning and its effects were as great a concern to some people as the use of herbicides.

reforestation, roadside vegetation management, range management, and control of noxious weeds. The public and other agencies identified the issues that needed to be considered for each activity. The issues included health effects, as well as a broad range of economic, social, and environmental effects.

Step four was to **decide how to deal** with the issues effectively, in a manner promoting collaboration among the participants. This step assisted the Forest Service in being responsive to public interests and concerns as it developed a vegetation management program.

Seven alternatives were developed and fully analyzed for both their benefits and drawbacks. The results of that detailed examination are contained in the Draft Environmental Impact Statement (EIS) issued for public comment in October 1987. The public comment period extended to mid-February 1988. The alternatives ranged from doing nothing (not managing competing and unwanted vegetation) to an aggressive program that would use all tools of vegetation management, including herbicides and prescribed burning.

The fifth and last step in this process will be for the Regional Forester to carefully consider public and other agency comments and **make a final decision** about the alternative or combination of alternatives that best responds to the issues and the Forest Service mission. While this decision has not yet been made, support for the decision and associated programs is expected to be much higher than in the past because interested parties were involved in the planning and analysis from the very beginning.

Admittedly, no process can completely resolve all controversies about the safety, efficacy, and costs of using herbicides. And difficult questions remain about prescribed burning and other tools of vegetation management.

In the end, the Regional Forester of the Pacific Northwest Region will have to find the best possible balance among a range of considerations and conflicting points of view. Nothing can eliminate the controversies entirely, but they are being inevitably modified and tempered through the dialogue provided by the NEPA framework.

Many groups will be satisfied that their concerns were at least understood and considered in the final decision. In an imperfect world where conflicts arise over many important issues, NEPA requirements and the process they identify for public involvement provide an excellent means for managing conflicts in a constructive and reasonable manner. \Box

(Larsen is the Group Leader, Vegetation Management, the Pacific Northwest Region of the U.S. Forest Service.)

Plastics: Concerns about a Modern Miracle

by Matthew Coco

Plastic bags look like jellyfish in the water. Unfortunately, they are not digestible. This loggerhead sea turtle, a threatened species, apparently died from ingesting plastic wrap near Galveston, Texas.

Remember the "one word of advice" Mr. Robinson gave young Benjamin Braddock in The Graduate? It was "plastics." Well, Benjamin ignored the advice and instead was seduced by Mrs. Robinson. America, on the other hand, was seduced by plastics.

The ever-increasing manufacture of lightweight, convenient, durable, and inexpensive plastic products is adding to the nation's solid waste disposal problem. Of the estimated 150 million tons of commercial and residential trash produced in America each year, 10.5 million tons (about seven percent) is plastic. Since plastic tends to be lightweight but voluminous, it is taking more and more space in America's dwindling landfill areas. And because landfill space is increasingly hard to find, solid waste disposal fees rose 12.6 percent nationally in 1986 alone.

Plastics are petrochemical products of crude oil or natural gas, first produced in the mid-19th century. Their development was hastened by the metal shortages of World War II, and was fostered by the relatively low cost of oil and gas. The only recent downturns in plastic production corresponded with oil price increases related to OPEC.

The amount of plastics production devoted to packaging rose from approximately 7.9 billion pounds in 1977 to 12.8 billion pounds in 1985. Since packaging is by its very nature disposable, the effects of increased use of plastic packaging on the solid waste stream will continue to grow.

Grocery stores are a good example of the mushrooming role of disposable plastics. Plastic bags offer many advantages over paper bags. They have handles for easier carrying, do not fall apart when wet, require less storage space in the warehouse or at the checkstand, and are cheaper to purchase and ship in bulk.

Fish and other marine life are endangered by plastic packaging.

Much of this plastic packaging winds up in remaining landfill space, in vacant lots, or along roadsides. Some is dumped in the ocean and on beaches, where it poses both an unsightly aesthetic problem and a deadly danger to marine life. Plastics reach the marine environment from merchant ships, commercial fishing and recreational boats, off-shore oil rigs, beach use, combined sewer overflows, stormwater runoff, landfills and transfer stations. sewage treatment plants, manufacturing facilities, and open dumping. According to the Center for Environmental Education's Plastics in the Ocean study, partially funded by EPA, world-wide merchant shipping is believed to dump 639,000 plastic containers into the ocean daily. The Center estimates that 30,000 fur seals die each year after being entangled in plastic fish nets and packaging debris. And plastic pellets resembling eggs or plastic bags that look like jellyfish are mistaken for food by marine creatures. Seabirds that ingest plastics often die of suffocation or fatal digestive blockages.

New Jersey beaches were closed last summer because of solid waste, some of it plastic, washing ashore. Oregon state fish and wildlife agencies report that a 1984 cleanup of 150 miles of Oregon beachfront yielded 48,898 chunks of styrofoam bigger than baseballs, 1,442 six-pack rings, 4,787 plastic jugs and bottles, 4,909 plastic bags or sheets, and 5,339 plastic food utensils. A similar cleanup along a 122-mile strip of Texas coastline produced 125 tons of trash, more than half of it plastic.

As with many environmental problems, preventing and reducing "plastic pollution" will require a combination of behavioral changes, voluntary reduction campaigns, technological advances, and governmental intervention. There are many factors that will make it difficult to deal with the plastic problem. Here are some of the possibilities... and some of their pitfalls.

Behavior Modification. Many lifestyle changes can heighten environmental awareness by substituting alternative products for minimally convenient products. Replaceable blades can be used in place of disposable plastic razors. At the grocery store, plastic produce sacks can be reused again and again; better yet, paper or reusable fabric or net shopping bags can be used as they are in many European countries. We can request takeout food to be wrapped in waxed paper instead of plastic. Non-generation. It is easier to eliminate pollutants before they enter the biosphere than to clean them up later. The point is that choices of products and processes must be made early if pollutants are to be best controlled. In this spirit, the Institute of Scrap Iron and Steel advocates designing recycling into the production process.

Non-production of plastic waste would eliminate the problem, but certain advantages of plastics are inescapable and difficult to ignore. Shatterproof plastic shampoo bottles contribute to home safety. Plastic soft drink bottles reduce shipping costs and thus reduce consumer prices. Although public education might help identify uses that could be changed or eliminated, the generally non-toxic properties of manufactured plastics make it unlikely that sufficient public concern can be mustered to support prohibition or restrictions on plastic product use.

Anti-littering Campaigns. Most states have laws against discarding trash in public areas or outside of prescribed areas. Many rural communities have designated trash pickup points. Washington State requires motorists to have trash bags in their cars and provides the bags. Oregon provides special litter bags for boaters. Ironically, the bags are plastic.

Recycling and Resource Recovery. Oregon recently enacted an "Opportunity to Recycle" law which requires municipalities over 4,500 in population to provide a curbside recycling program where feasible. New Jersey requires recycling: the goal is 25 percent recycling. Sanctions against plastic packaging are being considered if the recycling rate is low.

Resource recovery is possible with plastics, but more complicated than with other forms of solid waste. It requires trash separation, and, unlike bottle and can recycling, it may be hard to determine what is plastic and what is not since plastic comes in so many forms. Plastic's light weight may also deter private recyclers since it may be hard to accumulate enough plastic by weight to make recycling economically attractive.

And not all plastics are recyclable. Remelting of thermoplastics, which include polyethylene, polystyrene, and nylon, requires little energy. But their chemical composition varies enough so each must be segregated, with all contaminants removed, before melting. The more durable thermoset plastics cannot be melted for reuse, but they do break down into mixed organic gases and liquids which might be used for chemical feedstocks or fuel.

In any event, recycling won't completely solve the plastics disposal problem. Dwindling landfill space prompted Seattle's mayor to propose an ambitious recycling program to complement solid waste incineration. The plan's goal is to recycle 40 percent of the waste by 2010, although the goal for plastics is only 22 percent. While this is an improvement over the current seven-percent level, it still consigns a lot of plastic to the environment or to incineration.

The future of recycling also raises the question whether government will intrude into the home with mandatory programs if the voluntary plans fail to capture a significant share of the waste stream. Although some local recycling programs go beyond newspapers and aluminum cans, there is a question as to how willing and successful the public will be in coping with the need to segregate glass, different metals, paper, plastics, et al., in household trash.

Incineration. This has the advantage of dramatically reducing the sheer volume of solid waste, including plastics. Garbage separation allows for reclamation of some of plastic's resource value, especially as an energy resource; plastic contains 1.600 BTU per pound as compared to 750 BTU per pound for regular garbage. But incineration, even if tied to energy reclamation, yields some undesirable byproducts. Residual ash must still be landfilled, and it may include heavy metals and other toxic elements which must be kept out of soil and water. Moreover, there is a growing public concern about the possibility of incineration creating airborne dioxin and furans that could pose a threat to the public health.

This public perception has led to a number of controversies and lawsuits against proposed and functioning incineration projects. King County, WA, for example, has published a preliminary list of possible incinerator sites, and although a final choice is a year or more in the future, the City of Kent has already sued the county over the siting. Because incinerator siting issues are primarily dealt with as state and local matters, such controversies and legal actions, based more on

This herring gull at Mustang Beach, Texas, may never be able to remove this six-pack plastic ring from its neck.

perceptions of dangers than on actual scientific evidence of danger, may slow down the move to incineration as a solution to the solid waste (and plastic waste) disposal problem.

Shifting to Degradable Plastics. The degradability of traditional plastics is limited in the presence of sunlight and its ultraviolet rays. Some attempts are being made to chemically alter plastics to hasten photo-degradation by sunlight. If they work, current landfill technology involving waste burial-in effect, hiding it from the ultraviolet rays-would have to be abandoned unless an extensive waste separation effort saved the plastics for separate treatment. Unless this were done by the individual homeowner, separating out the plastics after the trash is collected would require a higher capital investment or increased staff, at a higher cost to the ratepayers. It would also require more space, which becomes more and more of a problem as landfills are closed and opposition to new sites spreads. Photo-degradation is also affected by the weather, which places northern latitudes at a disadvantage.

Another possibility is the use of microbes to break down certain plastics. Although this might require substantial investment by local ratepayers, biodegradable plastics may be better suited to landfill disposal.

Another handicap for degradability as a means of dealing with plastic waste is that it inhibits recycling. Plastics designed to break down will not be durable enough for reuse; their presence in this mix could lessen the quality of recycled products, and it would be difficult to separate them from other plastics in the waste stream.

In spite of all the problems, there are encouraging developments. On November 5, 1987, the U.S. Senate ratified Annex V of the International Convention for the Prevention of Pollution from Ships, which regulates the disposal of garbage, including plastics and floatables, from ships at sea. During 1987, Congress also passed the "Plastic Pollution Research and Control Act," which bans the dumping of plastics by any vessel within 200 miles of the U.S. Coast. Among other things, the Act also authorizes research by EPA and the National Oceanic and Atmospheric Administration on issues concerning the land-based sources of plastics pollution, the effects of plastics on marine life, and the use of biodegradable plastics.

Another possible remedy is adaptation of a law passed in Oregon, where the legislature imposed a \$1 surcharge on new tires sold in the state, with the funds generated to be used for cleaning up tire piles and subsidizing tire recycling. If this could be adapted to sale of plastics, with the vast number of products and packages involved, a way to pay partial disposal costs might be available. Perhaps a surcharge on plastics manufacturers could be applied to cleanup measures and to research into alternatives to plastics use and degradable plastics.

McDonald's recently decided to stop using foam plastic cups, plates, and cartons. The city of Berkeley, CA, has banned use of such items by fast-food merchants. These are steps in the right direction. While these actions will not eliminate plastics, they show that a major corporation and a local legislative body can take aggressive action in the face of environmental danger. What's more, the Berkeley ordinance was accompanied by a recommendation that fast-food merchants reduce their use of non-biodegradable packaging by 50 percent.

Our nation is finding waste disposal of all kinds more and more of a pocketbook issue. Dwindling landfill space and the costs of treatment, storage, and disposal mean that utility bills will be a monthly reminder that waste, including plastics, costs money. This fundamental market mechanism may be the ultimate answer to plastics pollution. As people pay the price, whether in higher fees or time spent separating trash, questionable plastics uses may be abandoned and only the more beneficial products will remain.

(Coco is a writer working in EPA Region 10.)

Appointments

EPA Administrator Lee M. Thomas has named **Daniel W. McGovern** to be the new Regional Administrator for EPA Region 9, headquartered in San Francisco.

McGovern served from 1986 until this appointment. as General Counsel of the National Oceanic and Atmospheric Administration in the U.S. Commerce Department. From 1981-1985, he was Deputy and Principal Deputy Legal Advisor and Acting Legal Advisor to the U.S. State Department. He served from 1973-1981 as a senior research attorney to the California Supreme Court and from 1971-1973 as a **California Deputy Attorney** General.

McGovern holds a law degree from the UCLA School of Law. Administrator for the Office of Air and Radiation from August 1983, after serving for a year as the Director of the Office of Air Quality Planning and Standards. Prior to his 1982 return to EPA, Meyers directed the National Nuclear Waste Management Program at the Department of Energy for four years after working for a year at the Nuclear Regulatory Commission.

Meyers has also served as Director of EPA's Office of Federal Activities and as Director of the Office of Solid Waste.

Meyers received a Bachelor's Degree in Marine Engineering from the State University of New York, his M.S. in Mechanical Engineering from the University of Michigan, and his MBA from New York University. Meyers was named a Princeton Fellow in Public Affairs in 1964-1965 and received the Presidential Rank Award of Meritorious Executive in 1981, and in 1986 received EPA's Gold Medal for Exceptional Service.

selected for this position, DeRemer served for three years as Director, Office of Congressional Liaison, here at the agency. He has also served with the U.S. Army Corps of Engineers as a legislative specialist for three years and as a water resources planner for seven years. DeRemer also worked as a congressional staff member at the U.S. House of

Representatives for four years. DeRemer graduated magna cum laude from State University of New York at Buffalo and went on to get his Masters of Science from Colorado State University.

Patrick Quinn has been appointed Director of the Office of Congressional Liaison at EPA.

Ouinn, who has been with the Agency since 1986, brings a broad range of government experience with him. He has served as Assistant to the Deputy Administrator at EPA; prior to that he served as Assistant to the Deputy Secretary at the U.S. Department of Agriculture. Quinn has also worked in private industry as **Executive Vice President** with the National Council of Agricultural Employers and also as a Legislative Liaison with Seyfarth, Shaw, Fairweather & Geraldson. Quinn worked with the U.S. Senate as a Legislative Assistant for Senator John Chafee (R-Rhode Island).

Quinn received his Bachelor's Degree in history from the University of Virginia after attending St. Mark's School in Massachusetts.

Richard J. Guimond has been named Director of the Office of Radiation Programs (ORP).

From December 1986 until the time of his new assignment, Guimond served as Director of the ORP Radon Division, which is the focal point for the Agency's Radon Action Program. Prior to that assignment, he was Director of the ORP Criteria and Standards Division, a post he assumed in November 1982.

Guimond served the previous four years in several managerial positions in the EPA Office of Toxic Substances (OTS). There he was responsible for developing regulations dealing with asbestos, PCBs, CFCs, and other toxics. Before joining OTS, during his first tour of duty with ORP, he worked in several responsible positions.

Guimond received a Bachelor's Degree in Mechanical Engineering from the University of Notre Dame in 1969 and a Master's Degree in Nuclear Engineering from Rensselaer Polytechnic Institute in 1970. In 1973, he was awarded a Master of Science degree in Environmental Health at Harvard University. □

Sheldon Meyers has been appointed Acting Associate Administrator for International Activities, moving from his previous post of Director of the Office of Radiation Programs (ORP).

Prior to that, Meyers served as Deputy Assistant

Craig W. DeRemer has been appointed to be Executive Assistant to EPA Administrator Lee M. Thomas.

In this capacity he will serve as Chief of Staff and principal advisor to the Administrator. Prior to being

Presidential Awards

Rebecca W. Hanmer

L very year, a number of career Senior Executive Service (SES) employees are selected to receive the Presidential Rank Award for extended exceptional service with the federal government. There are two categories for the award: Distinguished Executive Rank and Meritorious Executive Rank.

The Agency is proud to announce that among the 1987 recipients of the **Distinguished Executive Rank** award are three EPA employees: Michael B. Cook, Director, Office of Drinking Water, Rebecca W. Hanmer, Deputy Assistant Administrator for Water, and Alexandra B. Smith, Deputy Regional Administrator, Region 8. In conjunction with the award, they receive \$20,000 each. Also, 10 EPA employees received Meritorious Executive Rank Awards which include \$10,000.

Cook has been with the Agency nearly 15 years and has served many important functions. Cook was responsible for the planning of municipal treatment works and for legislative policy in EPA's multi-billion dollar construction grants program. He has since managed the Agency's emergency response programs and served as Deputy Director of the Office of Solid Waste. He is currently Director of the Office of Drinking Water. No stranger to receiving awards, Cook has received EPA's gold, silver, and bronze medals.

Michael B. Cook

Hanmer has been with the federal government more than 20 years. Since joining EPA in 1972, she has worked with great success in many divisions. She began her career at EPA as an Assistant Director, Office of Federal Activities; she then went on to become director of that office. She left EPA headquarters to serve as **Deputy** Regional Administrator in Region 1 and then went on to Region 4, where she served as Regional Administrator. When she returned to headquarters, she became a Special Assistant. Since then, Hanmer has been in the Office of Water as Acting Assistant Administrator for Water and, currently, Deputy Assistant Administrator for Water, Hanmer has received several awards, including the Administrator's Special Achievement Award, the Presidential Meritorious Executive award, and EPA's gold and silver medals.

Smith began her government career in 1972 at the Department of Housing and Urban Development as a Development Specialist. She joined EPA in 1976 as Director of EPA's Office of Federal Affairs in Seattle and served in that position for two years. She then became Chief of the Environmental Evaluation Branch. Smith currently serves as Deputy Regional Administrator of Region 8 in Denver. The Region includes six states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Alexandra B. Smith

The winners of the Meritorious Award are: Herbert Barrack. Assistant **Regional Administrator for** Policy and Management, Region 2; Don R. Clay, **Deputy Assistant** Administrator for Air and Radiation. Office of Air and Radiation; Frank M. Covington, Deputy Regional Administrator, Region 5; Willis E. Greenstreet, Director, Office of Administration and Resources Management, Research Triangle Park Office of Administration and Resources Management; Norbert A. Jaworski, Director, Environmental Research Lab-Narragansett, Office of Research and Development; James R. Moore, Regional Counsel-Region 10 Office of General Counsel: Thomas A. Murphy. Director. **Environmental Research** Lab-Corvallis, Office of Research and Development; Courtney Riordan, Director, Office of Environmental Processes and Effects Research, Office of Research and Development; John H. Skinner, Director, Office of Environmental Engineering and Technology, Office of Research and Development; and Stephen R. Wassersug, Director, Hazardous Waste Management Division, Region 3. □

Lightning cracks across the sky in a thunderstorm in the Midwest.

Back Cover: Mangroves dominate the shore of much of the world's tropical ocean. They are critical to the coastal environment and provide a feeding and breeding ground for a large number of aquatic species. The dense, almost impenetrable root systems shelter the land from storms and are part of nature's land-building process. It is through the mangroves that the water of the Everglades passes as it leaves the sawgrass and enters the Gulf of Mexico. These black mangroves are found on Lignumvitae Key, a unique botanical preserve immediately adjacent to Everglades National Park in south Florida. Photo © by Peter R. Jutro.

