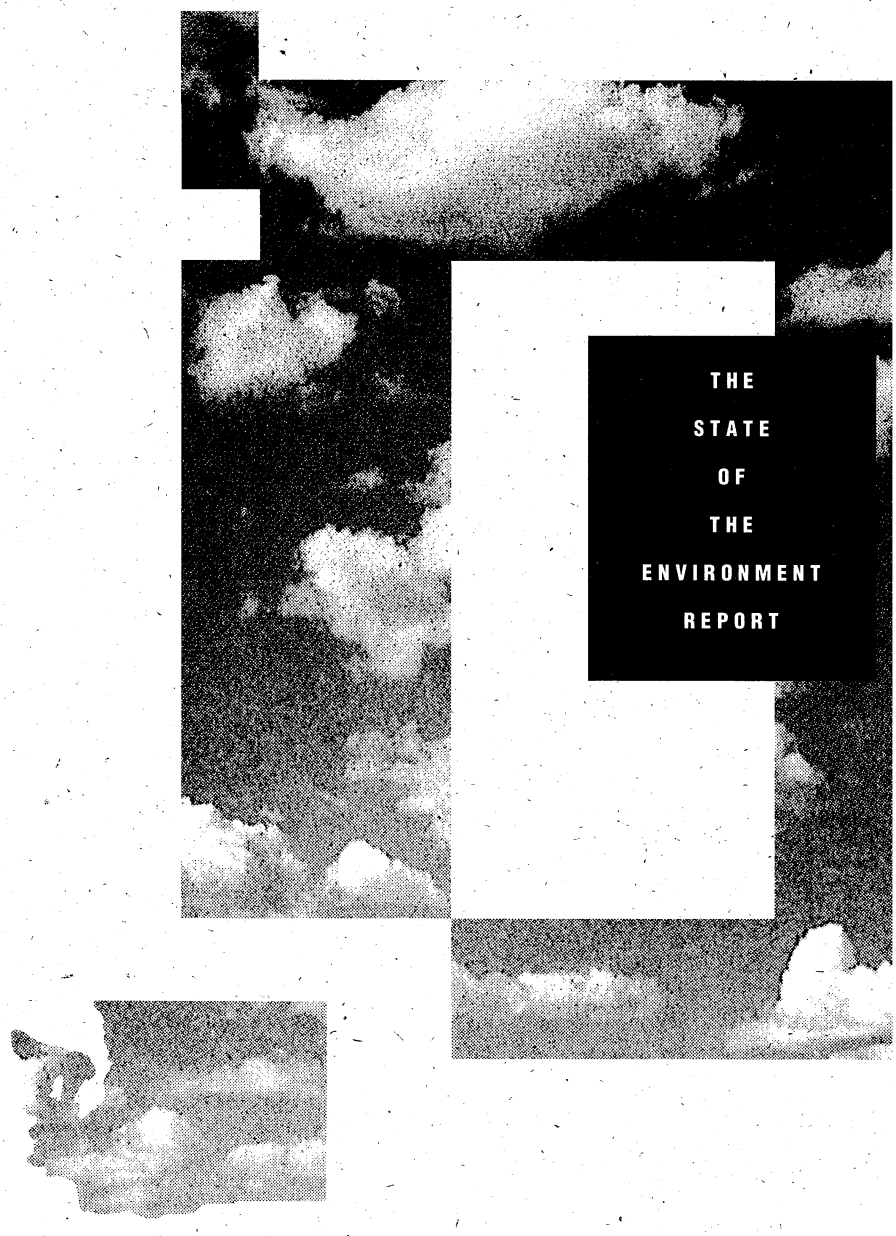
ENVIRONMENT 2010



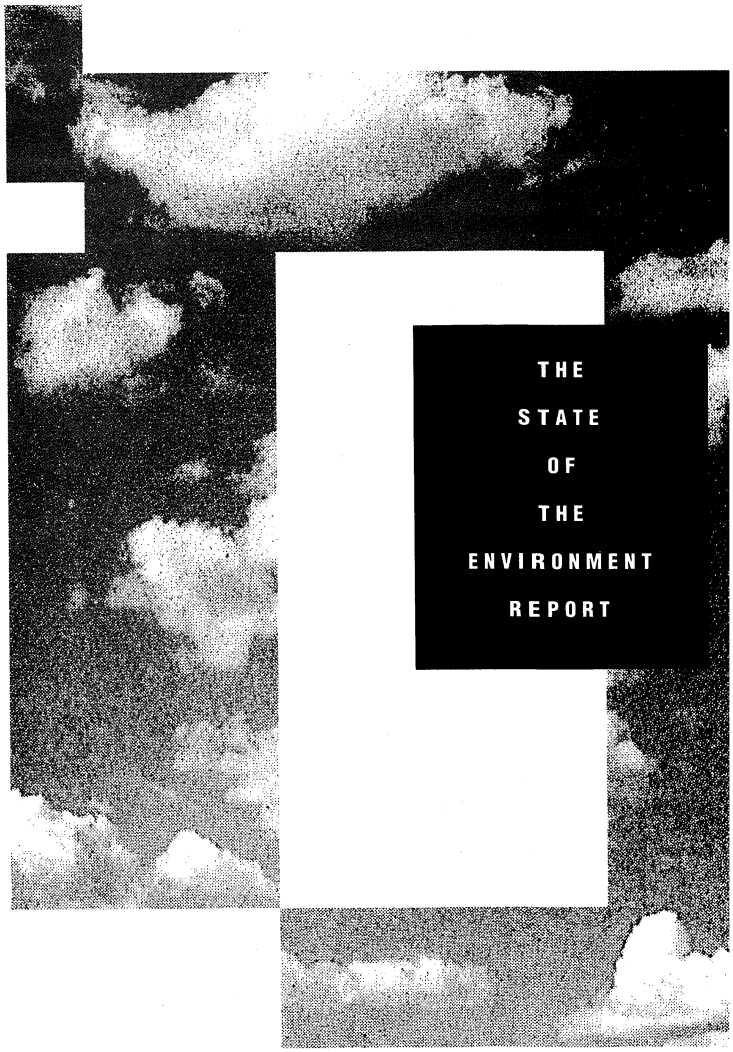
THE STATE OF THE ENVIRONMENT REPORT

Ecology Publication: 89-01-004

ENVIRONMENT 2010

A Joint Project of the State of Washington, and the US Environmental Protection Agency

A Status Report on Washington's Environmental Resources – With a Look Toward the Future



A Product of Washington Environment 2010

November 2, 1989

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A Joint Project of the State of Washington, and the US Environmental Protection Agency

November 1989

Dear Reader:

Last December the state launched an ambitious long-range planning effort called Washington Environment 2010. In doing so, we committed ourselves to the production of a State of the Environment Report that features both the current and projected status of our environmental resources. We also made a commitment to create environmental priorities and strategies for action. We promised an action plan that would not sit on the shelf, but rather, would provide information and incentives to develop a truly effective and comprehensive environmental program for Washington state.

This report fulfills the first of the Washington Environment 2010 commitments — the production of a status report on Washington's environmental resources. This report doesn't have all the answers to the environmental challenges facing us. It is a snapshot of our state's environmental realities — where we are and where we are likely to be in the future if only the status quo is maintained.

The real challenge of 2010 follows this document's release. How do we build an action agenda for this state that creates a future that is environmentally healthy and economically strong? Frankly, government alone is unable to answer that question. This next year will mark a concerted effort on the part of Washington Environment 2010 to get substantive input from every citizen in this state who cares about our environmental future.

The nature of the environmental crisis facing the world is profound. In Washington state, we have the luxury of debating the issues in the context of preserving our quality of life. For much of the world, these debates must occur in the context of preserving life itself. Preserving Washington's environment for future generations will require fundamental changes in the way we live our lives, personally, publicly and corporately. We will be challenged to balance economic development and environmental management. We will have to find ways to work cooperatively — government, business and citizen groups alike.

We can simply accept our future, or we can choose to actively participate in creating it. I urge you, the reader, to participate.

Sincerely,

Booth Gardner
Governor

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"We travel together,
passengers
on a little spaceship,
dependent on its
vulnerable resources
of air and soil; all
committed for our safety
to its security and peace;
preserved
from annihilation
only by the care,
the work,
and – I will say –
the love, we give
our fragile craft."

Adlai Stevenson

INTRODUCTION: SETTING THE STAGE

SECTION 1

INTRODUCTION: SETTING THE STAGE

It is difficult to find common ground on the contentious environmental questions that confront us — the state's citizens and policy-makers — as we approach the 21st century. What is the appropriate balance between development and preservation in places such as Snoqualmie Valley? What is the "best" use of our remaining old-growth forests? Which is a higher environmental priority: hazardous waste sites or air pollution?

Our views on these issues vary widely, depending on where we live, how we live, what we do for a living, and a host of other factors.

But we seem to agree on two basic points. First, we generally agree that the state of Washington is a very special place to be. The fact that we *have* old-growth forests and other unique resources to manage is a cause for celebration, not consternation. The steady influx of newcomers from other parts of the country is evidence of something Washingtonians have recognized for a long time: this state offers a richness and a diversity of opportunity — aesthetic, environmental, cultural, recreational, and economic — that is difficult to find anywhere else.

A second point on which we appear to agree is that our state is at a crossroads of its environmental evolution. By the year 2010, the state's population is projected to grow from about 4.6 million to about six million — an increase of more than 30 percent. Most of that increase — close to 90 percent — is expected to take place in a dozen counties that border Puget Sound; roughly 80 percent will take place in just five counties: King, Pierce, Snohomish, Thurston, and Kitsap. This expansion will further strain our resources — our air, water, land — and our small-town quality of life.

We are bracing ourselves for these changes. Many are resisting it. But we need to do more than brace ourselves. And resisting change that is inevitable is a waste of energy — and time. Instead, we need to be imaginative, deliberate, and forward-looking enough to *manage* the change in a way that preserves the richness and diversity of opportunity that sets our state apart.

WHAT IS WASHINGTON ENVIRONMENT 2010?

In 1988, environmental policy-makers and natural resource managers recognized that we did not have a clear strategy for guiding ourselves through today's environmental crossroads. Environmental management, though often effective, too often was synonymous

with crisis management: haphazard, reactive, frenzied. The state did not have a systematic approach for identifying and assessing existing environmental and natural resource management issues, for anticipating emerging ones, and for setting priorities among them. There was no explicit vehicle for coordination among the many autonomous state agencies with expertise in, and jurisdiction over, these decisions. Nor were there mechanisms for anticipating and resolving conflicts, and for involving all vested interests — most importantly the citizens themselves — in the policy-making process.

Washington Environment 2010 was created to close these gaps — or at least narrow them. A steering committee consisting of the directors of 13 state agencies and representatives from two federal agencies joined forces to forge a bold, first step toward transforming the way in which environmental policy is made in the state of Washington. This bold step is rooted in the present, but focused on the future — on creating a vision of where we want the state of the environment to be in the year 2010, and developing a strategic plan for getting there.

Washington Environment 2010 is an exercise in environmental ark-building. It is a process aimed at gathering and analyzing the information, and mobilizing the resources necessary to build an ark — an environmental agenda for the future — that has everyone on board, and that still floats. The process consists of four interrelated components: analysis, vision, outreach, and action.

ENVIRONMENTAL ARK-BUILDING

"We know that it is raining," Governor Booth Gardner said in announcing the project last December. "The challenge now is to figure out how to build the ark."

Washington Environment 2010 is an exercise in environmental ark-building. It is a process aimed at gathering and analyzing the information, and mobilizing the resources necessary to build an ark — an environmental agenda for the future — that has everyone on board, and that still floats. The process consists of four interrelated components: analysis, vision, outreach, and action.

Analysis. A critical question needs to be answered before effective ark-building can begin: How hard is it raining? As we begin to think about the future, we need to reflect on present conditions and trends. We need to know what problems exist (or are imminent), which of those problems are most urgent, which are getting better, and which are getting worse. Washington Environment 2010's first-year analysis takes aim at these questions. It involves an extensive and systematic evaluation of the condition of the state's environmental resources, an assessment of the major threats to those resources, and estimates of future conditions. The premise of this analytic component is that better analysis of environmental issues leads to a more informed dialogue about them and, ultimately, to better environmental decision-making. The product of the analytic component of Washington Environment 2010 is this State of the Environment Report.

Vision. It is wise to have a clear and shared idea — a vision — of where we want the ark to take us before the building begins. Washington Environment 2010 involves the crafting of a common vision of the state's environmental future — a vision statement that will serve as a starting point for a broader discussion of our environmental goals. Underlying this component of the process is a belief that it is better to define and pursue a future that we prefer than to merely react to whatever comes our way.

Outreach. Building an ark is a big job. And, when the job is done, everyone needs to be willing to step on board, or the purpose is defeated. The public outreach component of Washington Environment 2010 — which will consist, in part, of a series of public meetings and presentations on the project, its findings, and its goals — has two purposes. First, it will educate the participants, helping them to better understand some of the environmental challenges the state faces, and the contributions that individuals as well as institutions can make toward meeting those challenges. Second, it will initiate a wider dialogue on these issues, and promote more involvement in, and responsibility for, creating a vision of the state's environmental future, and making the difficult choices that will be necessary to realize that vision.

Action. A sturdy ark — an environmental action plan that will help guide our environmental policy-making and natural resource planning over the next two decades — is the ultimate goal of Washington Environment 2010, and the product of this phase of the project. All of the other components — analysis, vision, and outreach — support the construction of an environmental agenda for our state, an agenda that is thoughtfully conceived, carefully targeted, widely supported, and generally useful to the architects and stewards of the state's environmental and natural resource policies.

WHAT IS THE STATE OF THE ENVIRONMENT REPORT?

This document, the first of a periodic series of State of the Environment reports, culminates the initial phase of Washington Environment 2010. It is extracted from more than 1200 pages of reports and represents close to a year's worth of analytic work. Specifically, this report briefly describes the process and the results of the Washington Environment 2010 research effort, including evaluations of the condition of the state's major environmental and natural resources, and an assessment of the major threats to those resources. The report also includes preliminary environmental priorities for the state, and a short description of the process by which

those preliminary priorities were generated. Finally, the report features a set of broad conclusions and common themes, culled from Washington Environment 2010's first year.

NOT A FINISH LINE

This State of the Environment Report is a starting point, not a finish line. It marks the beginning, not the end, of a dialogue on environmental priorities and policies. This report, along with a forthcoming vision statement, supports the outreach and action components of Washington Environment 2010. It serves as the foundation for broader discussions, among policy-makers and citizens alike, about Washington's environmental future — discussions about where we are, where we appear to be heading, where we want to be, and how we plan to get there from here.

THE WASHINGTON ENVIRONMENT 2010 ANALYSIS

SETTING THE STAGE FOR BETTER ENVIRONMENTAL DECISION-MAKING

Washington Environment 2010 is focused on the future — on creating a vision of what we want our environment to be in the year 2010, and designing a strategic plan for getting there. We can't plan effectively for the future without a firm understanding of where we are, and where we appear to be heading. Decisions about where to focus our environmental emphasis and actions need to be grounded in an assessment of current conditions and trends.

Washington Environment 2010 undertook the mammoth task of assembling policy-makers, experts and concerned citizens from inside and outside of government, and from Redmond to Royal City, to conduct such an assessment, including:

- An evaluation of the current condition of the state's environmental resources, and important trends that affect those resources, such as those in population growth, economic development, energy demand, and transportation needs;
- An assessment of the major existing and emerging threats to the environmental resources;
- An assessment of our potential for managing those threats; and
- A preliminary list of priorities for environmental action.

Environmental resources studied

Air
Includes outdoor and indoor air

Water
Includes fresh surface waters, ground water, and marine waters

Land
Includes agricultural lands, forest lands, recreation lands, and range lands

Wetlands

Fish and shellfish

Wildlife

EVALUATING RESOURCES

What is the current state of the environment? Washington Environment 2010 assembled a team of more than 25 technical experts from a variety of state agencies involved in environmental protection and natural resources management. This technical committee, comprised

Threats to resources studied

Ambient air pollution

Indoor air pollution

Radioactive releases

Indoor radon

Nonionizing radiation

Global warming and ozone depletion

Point-source discharges to water

Nonpoint-source discharges to water

Drinking water contamination

Acid deposition

Hydrologic disruptions (e.g., dams)

Regulated hazardous waste sites

Uncontrolled hazardous waste sites

Nonhazardous waste sites (e.g., landfills)

Materials storage (e.g., tanks)

Accidental releases

Litter

Wetlands loss/degradation

Impacts on forest lands

Impacts on recreation lands

Impacts on range lands

Impacts on agricultural lands

Pesticides (not covered elsewhere)

of experienced environmental professionals with a wide range of expertise and perspectives, identified six key environmental resources — air, water, land, wetlands, fish and shellfish, and wildlife — and gathered data on the current status of those resources. They also reviewed historical data and information on other trends, such as those in population growth, that could affect the future of each resource.

ASSESSING RISKS

As part of its evaluation of environmental resources, the technical committee identified major threats to the resources and to the uses of those resources, ranging from ambient air pollution to nonpoint source water pollution to uncontrolled hazardous waste sites. The committee identified and defined 23 threats in all, and assessed the risks posed by those threats, using an analytic approach known as comparative risk assessment. The comparative risk analysis focused on three types of risks: human health risks, ecological risks, and economic risks.

- The *human health* risk analyses estimated each threat's potential for causing adverse health effects ranging from headaches and eye irritations to cancer.
- The *ecological risk* analyses focused on each threat's potential for harming ecological systems, including fish, shellfish, wildlife, and plants. The assessments focused on the breadth and severity of those effects, and the extent to which they can be reversed.
- The *economic risk* analyses addressed the threats' potential for economic damages such as damages to fisheries and crops.

Together, these three categories encompass all or most of the risks that affect our natural resources, and the uses of those resources.

THE LIMITS OF THE ANALYSIS

The Washington Environment 2010 analysis, including both the evaluation of resources and the assessment of risks, is the most comprehensive and rigorous in the state's history. But it is not perfect. The analysis has some important limitations, most of which involve the information on which they are based — or the lack thereof.

Environmental data in Washington State are limited in a number of ways. In some cases, good information simply does not exist. There is very little information, for example, on levels of toxic air pollutants in the ambient air. Regulatory programs and monitoring programs historically have focused on other types of air pollution. In addition, monitors are difficult and expensive to operate.

Information on other threats was available but was not in usable form. Other data were available, but inaccessible, either because of the short time-frame within which the Washington Environment 2010 analysis was conducted, or because the information is inconsistently collected, or is not managed in a way that makes it easy to use.

In fact, this first state of the environment report might be as useful in suggesting what we *don't* know about our environment as it is in illuminating what we *do* know. This applies more to effects on the environment than to human health effects; it applies most of all to economic risks. Economic risks are the most difficult of the three to assess, since that involves estimating the dollar values of things — a healthy wetland, for example — that are not typically valued in that way. Because of the limitations on economic risk analysis, Washington Environment 2010 was unable to assess economic risks associated with environmental threats to the state's resources in a way that the project's technical and public advisory committees considered adequate for priority-setting purposes.

Despite the shortfalls in information, the project participants believe the environmental information collected and analyzed for the Washington Environment 2010 is the best available, or close to it. A fundamental premise of Washington Environment 2010 is that, in setting environmental priorities, it is better to use such information, and acknowledge its limitations, than to ignore it.

THINKING ABOUT RISK MANAGEMENT

In setting environmental priorities, we need to know more than what the problems are and how serious they are. We also need to know what, if anything, we can realistically *do* about them. Do technological or policy solutions exist? How effective are those solutions likely to be in reducing risks to human health and ecological systems? Do we have the legal and the institutional wherewithal to implement them? How costly will they be?

Washington Environment 2010 assembled a team of policy analysts and environmental managers from a number of state government agencies to provide information on these and other questions. Specifically, this risk management committee assessed the relative manageability of the 23 environmental threats listed on page 9, focusing on criteria such as existing legal authority to address the threat, the extent to which government programs already are in place to control the threat, the availability of additional controls, and likely costs and effectiveness of such controls.

Comparative risk assessment is an innovative approach to thinking about environmental problems and priorities that has two basic premises:

- Not all environmental problems are equally important. There is no shortage of environmental issues facing an expanding industrial society such as ours. With steady advancements in environmental science and increasing public sensitivity about environmental problems, it seems new issues are emerging every day. Many are urgent, but they are not equally so.
- We can't do everything at once. The number, and in some cases the magnitude, of environmental problems is growing. At the same time, however, competition for limited public monies is intensifying. If our time and budgets were unlimited, we could solve, or at least try to solve, all these problems. Since our resources are finite, we must make difficult choices about how to channel those resources most effectively.

Comparative risk assessment is a framework for assessing environmental issues and highlighting important differences among them that can help us establish priorities and focus limited time and money where they are most needed, and where they can do the most good in terms of human health and environmental protection. The approach has been developed in recent years by the U.S. Environmental Protection Agency and been applied by different levels of government in different parts of the country.

What it *Does*...

There are several characteristics of comparative risk assessment that make it a potentially useful tool for distinguishing among problems and guiding priority-setting. First, it is a systematic, disciplined, and information-driven approach. Second, it is focused on the fundamental objectives of environmental agencies at all levels of government: reduction of risks to human health, and ecological systems, and the beneficial uses of environmental resources. Third, it promotes a cross-cutting approach. Rather than focusing on one environmental issue or a particular set of issues at a time, as many existing environmental planning approaches do, comparative risk assessment attempts to look comprehensively and simultaneously at a wide range of environmental problems. Fourth, it attempts to look at these problems in a reasonably consistent way, to allow for rough comparisons across problems.

...What It *Doesn't* Do

Comparative risk assessment is not a planner's panacea; it has important limitations. First, while it is relatively systematic, and while it utilizes the principles of quantitative risk assessment where possible, it is not a strictly scientific approach. It does not generate precise measures of the the risks associated with environmental threats; it is not intended to do so. Rather, it generates rough estimates of relative risk that are useful in making comparisons. Second, comparative risk assessment requires more than just an analysis of relative risks; it recognizes that human experience and expertise are important in priority-setting as well.

Also, the approach is only as good as the data upon which it relies. For a number of reasons, useful and reliable data often are not available. ■

SETTING PRELIMINARY PRIORITIES

After evaluating the current status of our state's key environmental resources, assessing the environmental risks that threaten these resources, and the potential for managing those risks, Washington Environment 2010 took another step. Governor Gardner appointed a group of citizens — educators, farmers, business people, legislators, environmental advocates, and others — to digest and synthesize the assessments, and develop a preliminary list of priorities for action. This Public Advisory Committee, compared and categorized the 23 environmental threats analyzed by Washington Environment 2010, based on six factors:

- The relative *human health* risks associated with the threat, as assessed and compared by the technical committee;
- The *risks to ecological systems* associated with the threat, as assessed and compared by the technical committee;
- The threat's potential for causing *economic damages*, as judged in large part by the Public Advisory Committee;
- The apparent *trend* the threat appears to be following, as estimated by the technical committee;
- The *manageability* of the threat, as assessed and rated by the risk management committee; and
- Their own *personal and professional experience and judgment.*

The Public Advisory Committee's preliminary categorization of priorities is shown on the next page. The committee divided the 23 environmental threats into five categories. Category I includes those threats that the committee believes are the state's highest priorities for environmental action; the threats in Category V are the lowest priorities, relatively speaking.

There are a number of points to keep in mind in interpreting the results of this preliminary priority-setting process:

- This is only a preliminary list of priorities for action. It is intended as the starting point for a broader dialogue.
- The list represents a consensus of the Public Advisory Committee — a diverse group of leaders who have differing perspectives on environmental issues, but share a deep concern for, and vested interest in, the state's environmental future.
- The committee believes the distinctions *between* priority categories are reasonably significant; they did not distinguish *within* priority categories, however. The ordering of environmental threats within each priority category in the table is meaningless.
- The priority listing is based on a *statewide* view of the environmental threats. Local priorities in specific parts of the state might differ.
- All of the threats pose significant issues. The categories, however, are intended to identify the *relative* significance of the threats.
- The rankings consider our potential for managing the threats, including consideration of whether or not we *already* are managing them. In some cases, then, the low categorization of a threat may reflect more the existence of an effective control program than a lack of significant risks.

2010 PUBLIC ADVISORY COMMITTEE RANKING OF TOP 23 THREATS TO THE ENVIRONMENT

Priority level 1	Ambient air pollution Point source discharges to water Nonpoint source discharges to water
Priority level 2	Drinking water contamination Uncontrolled hazardous waste sites Wetlands loss/degradation Impacts on forest lands Impacts on agricultural lands
Priority level 3	Indoor air pollution Hydrological disruptions (e.g., dams) Global warming and ozone depletion Regulated hazardous waste sites Nonhazardous waste sites (e.g., landfills) Impacts on recreational lands Pesticides (not covered elsewhere)
Priority level 4	Indoor radon Radioactive releases Acid deposition Accidental releases Impacts on range lands
Priority level 5	Nonionizing radiation Materials storage (e.g., tanks) Litter

All threats at each priority level are considered distinctly higher risk management priorities than the threats included on the next level. Threats are *not* ranked within each priority level.

IN THE REMAINDER OF THIS REPORT...

The information generated during the first year of Washington Environment 2010 — the evaluation of key environmental resources, the assessment of risks and of risk management possibilities, and the setting of preliminary priorities — constitute the project's findings, and the subject of the remainder of this report.

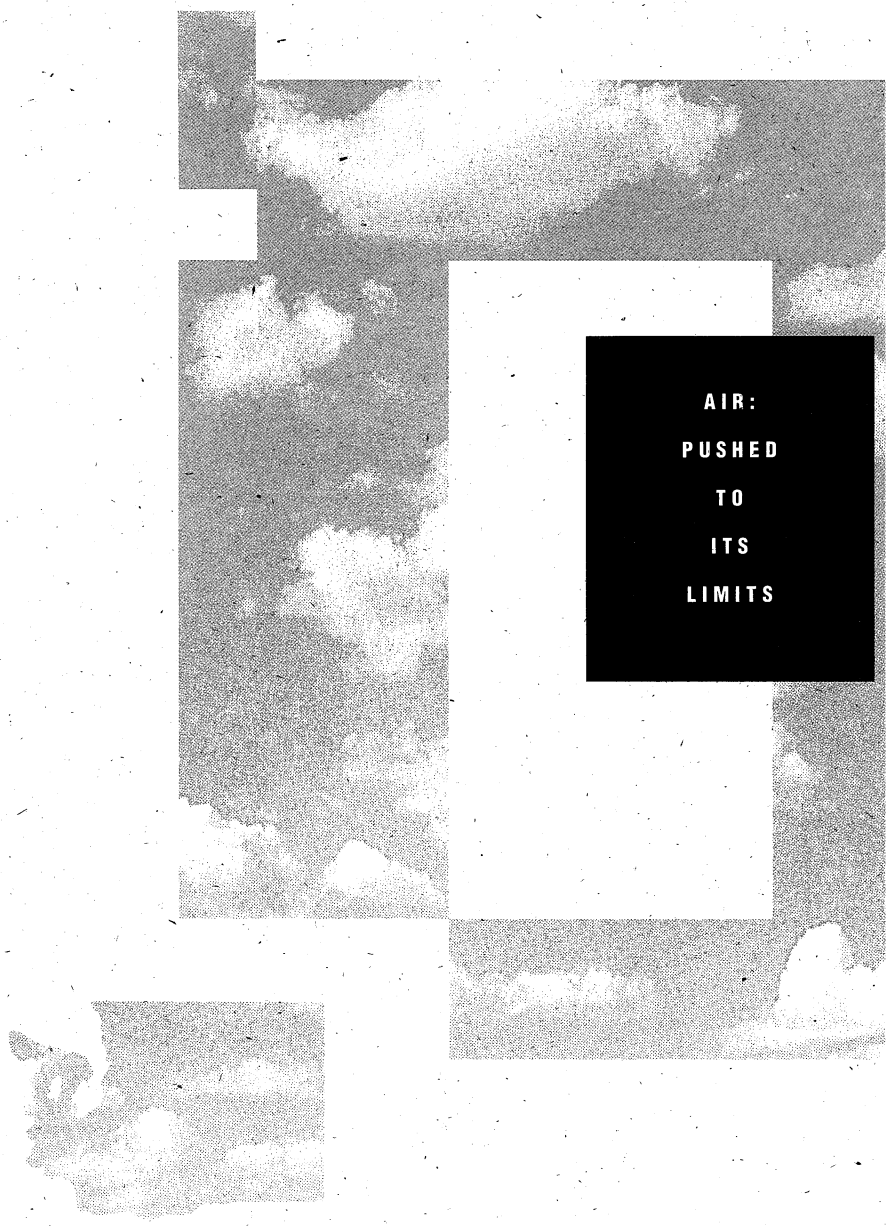
The next six sections of this report — Sections II through VII — discuss the six environmental resources evaluated by Washington Environment 2010: air, water, land, wetlands, fish and shellfish, and wildlife. Each section briefly describes the current and possible future condition of a resource, as well as major threats to that resource.

Section VIII addresses cross-media issues — threats that travel through, or have impacts on, more than one environmental resource.

Section IX features a discussion of some key observations, conclusions and common themes.

"Some people ask: What if the sky were to fall?"

ancient Latin expression



AIR: PUSHED TO ITS LIMITS

SECTION 2

AIR: PUSHED TO ITS LIMITS

Clean air is essential to the health and well-being of virtually all of the state's inhabitants, whether they are ancient trees towering over the Olympic Peninsula, black bears foraging for berries in the North Cascades, or young children playing hide-and-seek in backyards in Seattle or Spokane.

Air that is clean and clear is particularly precious here in the state of Washington, where it is essential to our economic vitality, and the rich, rustic quality-of-life the state has come to symbolize. The resources that are the backbone of the state's economy — forests, fisheries, and farms — thrive on healthy air. In addition, the renowned mountain vistas, and the outdoors orientation of many who live and visit here, combine to place an especially high premium on good visibility here in Washington state.

In general, the quality of the air over most of Washington is good, especially relative to other, more industrial, more densely populated, and perhaps less environmentally conscientious states. Overall, air quality here and across the country, judging from monitoring data on the most prevalent and closely regulated pollutants, has improved over the last decade. Levels of carbon monoxide in the atmosphere, for example, have decreased by roughly 30 percent in Washington since 1979. The levels of several other major pollutants have declined as well. Reductions in this state over the last 15 years in emissions of sulfur dioxide from pulp and paper mills, fluoride from aluminum smelters, and lead and carbon monoxide from automobiles, are notable examples of successful air pollution controls.

Any perception of Washington's air as pristine, however, is a false one. Despite improvements in air quality in recent years, such as those cited above, a number of important and formidable challenges remain. Ambient air pollution — pollution of the outdoor air — is still one of the most significant environmental risks in the state. Emissions into the atmosphere from a variety of human activities — producing commercial goods, generating energy, transporting ourselves and our commodities — continue to foul our air, and to threaten our health, our ecological systems, and the many economic and quality-of-life benefits that we derive from this invaluable but often undervalued resource. In addition, the quality of indoor air has emerged in recent years as a significant human health concern here and across the country. Also, emissions of certain air pollutants have been linked with international and global environmental threats that could have important implications for Washington state.

Sources of major toxic air pollutants in Washington

Dioxins

Woodstoves/fireplaces

Other wood-burning

Benzene

Natural gas use

Gasoline

Slash burning

Toluene

Gasoline

Slash burning

Point sources

Phenols

Woodstoves/fireplaces

Other wood-burning

Manganese

Slash burning

Woodstoves/fireplaces

Other wood burning

Xylene

Gasoline

Point sources

Formaldehyde

Woodstoves/fireplaces

Other wood burning

Chloroform

Pulp and paper mills

AMBIENT AIR POLLUTION

IS GROWTH OFFSETTING GAIN?

Despite progress over the last decade in controlling emissions — especially those from larger industrial sources — ambient air pollution (pollution of outdoor air) continues to be one of the most serious environmental threats in the state. The key findings of Washington Environment 2010's evaluation of the state's air quality, and analysis of the human health and ecological risks posed by ambient air pollution, are described below.

CONCLUSIONS ABOUT RISKS

■ **We have made noticeable headway in reducing the ambient levels of six of the most prevalent pollutants** — called "criteria" air pollutants — for which national health-based standards have been established. *But there are still a number of places in the state, particularly the heavily populated urban areas, where serious air quality problems persist.* Levels of carbon monoxide in Seattle, Tacoma, Spokane, and Yakima, for example, exceed the national standard. And carbon monoxide is a problem in smaller cities such as Vancouver and Bellingham as well. In addition, there are a number of areas in the state where the air exceeds (or comes close to exceeding) national standards for ozone and airborne particulates. All areas of the state are not monitored; there probably are other problem areas that have not yet been discovered.

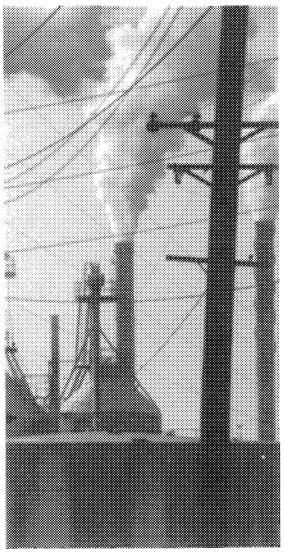
■ **Criteria air pollutants — particularly ozone, carbon monoxide, and small particulates — continue to pose significant human health risks to Washingtonians.** The potential health effects of these pollutants range from dizziness and headaches to premature death. *Small particulates* are perhaps the most significant health concern. Large numbers of Washingtonians inhale levels of small particulates that can cause breathing difficulties and other respiratory problems, according to the Washington Environment 2010 analysis. This particular type of air pollution also may be responsible for premature deaths in the state. Problems from airborne particulates can be especially severe during the winter months, when woodstove use is heavier, and when weather patterns can keep pollution closer to the ground.

The Washington Environment 2010 analysis also suggests a large percentage of the state's population, at one time or another, is exposed to levels of other criteria air pollutants that can cause health problems. For example, the analysis estimates that close to four million people in the state are exposed at least one day a year to levels of *ozone* that can cause headaches, while more than three million people are exposed to levels that can aggravate asthma

and chronic bronchitis. Between one and two million people are exposed at least once a year to levels of *carbon monoxide* that can cause headaches and dizziness, and roughly 200,000 people breathe levels that can aggravate angina.

■ **The risks to human health posed by hundreds of "noncriteria" air pollutants — commonly called toxic air pollutants — also may be significant, but are poorly understood relative to those associated with criteria air pollution.** Historically, regulatory programs here and across the country have focused on criteria air pollutants. Consequently, there is relatively little information available on toxic air pollutants. In fact, with a few exceptions, these pollutants are not regulated or monitored. In recent years, however, scientists and policy-makers have been turning their attention toward these pollutants, many of which can cause cancer and a variety of other adverse health effects. The Washington Environment 2010 analysis indicates toxic air pollutants such as benzene, toluene, manganese, formaldehyde, chromium, arsenic, and dioxins do pose risks of cancer and other health effects that are medium to high relative to the others analyzed for this report. People living in urban areas are especially susceptible to those risks.

■ **Comparatively little is known about the effects of ambient air pollution on plants, animals, and ecological systems, since regulatory programs and data-gathering efforts historically have focused on human health effects.** Nonetheless, experts believe some ecological damage may be occurring here in the state. Since many pollutants are known to harm humans, it is possible they have similar effects on other animal species, particularly other mammals. In addition, evidence suggests elevated levels of ozone measured throughout the state could be damaging sensitive hardwood trees and probably other sensitive plant species as well. Other studies indicate air pollutants deposited on the thin surface (or "microlayer") of water bodies like Puget Sound, can interfere with development of fish and shellfish eggs and larvae.



CONCLUSIONS ABOUT SOURCES

■ **Smaller and more diffuse sources of air pollution, called "nonpoint" or "area" sources, are emerging as the predominant sources of ambient air pollution in the state.** For most people, the term "air pollution" conjures up images of large billows of gray smoke rising out of tall stacks at pulp mills, oil refineries, power plants, and other large, industrial sources. Smokestack emissions from those types of facilities, called "point" sources, still contribute to the state's air quality problems, despite regulatory control of such emissions. But the more dispersed and often smaller and more subtle sources — motor vehicles, residential woodstoves and fireplaces, dry cleaners, slash burning, agricultural burning, and other outdoor burning, and a variety of other individually small emission sources — are the major contributors of ambient air pollution in Washington state. Woodstoves and other wood burning, for

Criteria air pollutants and major sources

Carbon monoxide

Motor vehicles

Other transportation sources

Aluminum production

Woodstoves/fireplaces

Sulfur dioxide

Electric utilities

Industrial boilers

Pulp and paper mills

Home furnaces and coal-burning stoves

Ozone

Motor vehicles

Gasoline delivery, handling, and storage

Particulates

Motor vehicles

Woodstoves/fireplaces

Slash burning

Lead

Gasoline combustion

Lead smelting

example, are the main sources of small particulates in air over many residential areas, and motor vehicles are the major source of carbon monoxide emissions.

Close to 90 percent of all emissions of toxic air pollutants, and the majority of most of the criteria air pollutants as well, come from these types of sources, according to available data. These area sources are more numerous, more diffuse, often more a function of individual behavior and personal choice, and therefore considerably more difficult to control than the classic point sources.

■ **A particular subset of nonpoint sources stands out as an especially significant contributor to air quality problems: transportation sources.** Cars, buses, and trucks, collectively, are the most significant source of carbon monoxide, ozone, and nitrogen oxides in the state, and are a major source of toxic air pollution as well. And, while we have made improvements over the past two decades controlling emissions from cars, a steady increase in the number of cars on Washington's roads, and an even more rapid increase in the number of miles those cars drive each year, appear to be offsetting, and perhaps reversing, many of these gains.

■ **There is a clear relationship between population growth and ambient air pollution in the state.** More people bring more cars, more woodstoves, and a higher demand for the goods and services that have pollution as a byproduct. There already is some evidence to suggest that growth-related stresses are offsetting recent improvements in the quality of Washington's air. It is true that the levels of most monitored pollutants have decreased over the last decade. In some areas of the state, however, levels are actually increasing, and in others the *rate* of decline has tapered off. Experts estimate that — barring new breakthroughs in controlling sources of air pollution, especially nonpoint sources — the quality of the state's air will worsen considerably in the next 10 to 20 years, due in large part to the projected growth in the state's population and economy, and the new emissions of air pollution that will accompany that growth.

➤ The Washington Environment 2010 Public Advisory Committee, in light of these and other findings, identified ambient air pollution as one of the state's highest environmental priorities, placing it in the highest of five priority categories. In doing so, the committee highlighted the widespread exposure to the threat, the pervasive and relatively high human health, ecological, and economic risks that result from that exposure, the multitude of sources of the threat, the difficulty in controlling many of those sources, and their expectation that the problem will get worse.

WOODSTOVE EMISSIONS

The new state law regulating the use of woodstoves — with its focus on a large number of small sources and its reliance on voluntary compliance by individuals — could become a model for air pollution control in the 1990s and beyond.

Woodstoves are one of a number of diffuse "nonpoint" sources that are now the predominant cause of ambient air pollution in Washington state. Woodstoves are a significant source of a number of potentially harmful pollutants — small particulates, dioxins, manganese, formaldehyde, and phenols, to name a few. These pollutants can cause cancer or other adverse health effects if inhaled in high concentrations and for extended periods of time. In addition, woodstove emissions can interfere with visibility.

Washington's recently promulgated law regulating the use of woodstoves is arguably the most comprehensive in the country. It requires that stoves sold in the state be certified as clean-burning; it restricts wood burning during periods of impaired air quality (as determined by local air pollution officials); and it requires that people burn only properly seasoned wood.

This regulation could significantly improve the state's air quality — especially in those areas where woodstoves are highly concentrated — and reduce the human health risks and visibility problems associated with woodstove emissions. Its effectiveness, however, very much depends on the voluntary compliance of residential wood burners throughout the state. Since the state and local air quality control agencies do not have the enforcement capability to ensure strict compliance in all corners of the state at all times, the success of the restrictions will depend largely on individual awareness and willingness to cooperate. ■

INDOOR AIR POLLUTION

NO PLACE TO HIDE?

Unfortunately, our homes and offices are not necessarily perfectly safe places to hide from pollution in the outdoor air. In fact, the air some of us breathe in our living rooms may cause more harm than the air we breathe in our backyards.

In recent years, *indoor* air pollution has emerged as a human health concern around the country, and here in Washington. Historically, air pollution laws and regulations have focused on outdoor air pollution. Lately, however, concern about toxic emissions from such diverse and seemingly innocuous indoor sources as air conditioners and new carpets has been growing.

The major sources of indoor air pollution are outdoor air pollution that has moved indoors, and indoor sources such as tobacco smoke, household pesticides, cleaners, and other chemicals, building materials, and furnishings. Common indoor air pollutants that come from these and other sources include carbon monoxide, nitrogen dioxide, particulates, formaldehyde, volatile organic compounds, allergens, asbestos, and radon.

Poor ventilation can create or exacerbate indoor air quality problems by allowing pollutants such as these to accumulate and concentrate. In fact, indoor air pollutants often are found at higher

Inhalation of environmental tobacco smoke, often referred to as "passive smoking," is a major indoor air concern, primarily because exposure to smoke is so widespread. The ongoing debate over whether or not to allow smoking in airplanes and public buildings is an example of this growing concern.

concentrations than their outdoor counterparts, since there usually is less circulation and dispersion of air indoors. The exposure to these pollutants also can be greater because most people spend much more time indoors than they do outdoors.

The Washington Environment 2010 analysis suggests that widespread exposure to indoor air pollution poses risks of cancer and other health effects for Washingtonians and that these risks are high relative to those posed by other threats analyzed for this report. In particular, inhalation of environmental tobacco smoke, often referred to as "passive smoking," is a major indoor air concern, primarily because exposure to smoke is so widespread. The ongoing debate over whether or not to allow smoking in airplanes and public buildings is an example of this growing concern.

➤ Despite the relatively high human health risks associated with exposure to indoor air pollution, the Public Advisory Committee rated it as a medium priority overall (in the third of five priority categories), citing the uncertainty about the risk estimates as a factor. The committee also noted that, unlike many of the other environmental threats analyzed for this report, indoor air pollution primarily affects human health; it does not threaten ecological systems or natural resources, and its economic effects are relatively low.

RADON

HAVE YOU MONITORED YOUR BASEMENT LATELY?

Radon is an indoor air pollutant that has received special attention in recent years, ever since the discovery, in 1984, that a construction engineer in a nuclear power plant in Pennsylvania had been contaminated not by work-related exposures, but by extremely high levels of radon gas in his home.

Radon gas — which occurs naturally from the decay of radium in many types of soil and rock — can enter homes and other buildings through cracks or openings in foundations or basements, and can accumulate to unhealthy levels. The risk of cancer from exposure to high levels of radon gas has emerged over the past five years as a major health concern in this country, especially in those parts of the country where radioactive rock and soils are common.

Here in Washington, radon poses high risks of cancer, relative to the other environmental threats studied. Studies suggest, however, that high radon levels exist mainly in a few regions of the state. Specifically, radon levels tend to be higher in eastern Washington,

particularly in northeast Washington. Relatively high levels of radon have been detected in Skamania County and other regions as well.

➤ The Public Advisory Committee, citing the limited scope of the problem in this state, rated radon as a relatively low priority, putting it in the fourth of five priority categories. The committee pointed out that radon is exclusively a human health threat, and that the threat is relatively easy to control by preventing radon gas from entering and accumulating in homes and other buildings.

MICROWAVES, TVs, & YOU

What do microwave ovens, television sets, radios, radar devices, and power lines all have in common? They all emit low-frequency radiation, or nonionizing radiation, long-term exposure to which some scientists believe might be causing headaches, weariness, dizziness, irritability, loss of appetite, and similar effects. Exposure to particularly high levels of nonionizing radiation — levels not commonly encountered — could cause more serious health effects, such as measurable increases in body tissue temperature, warm sensations, and excessive perspiration.

There is a growing concern but great scientific uncertainty about the effects of exposure to nonionizing radiation, particularly low-level exposures. Available studies are limited, but they suggest only a tiny fraction of the state's population is exposed to levels of nonionizing radiation that might cause minor health effects.

➤ The Washington Environment 2010 Public Advisory Committee, based on available information, ranked nonionizing radiation in the lowest of five priority categories. They noted, however, that the emergence of new scientific evidence on the effects of long-term, low-level exposures on human health could alter that ranking in the future. ■

ACID DEPOSITION

UNSCATHED (SO FAR)

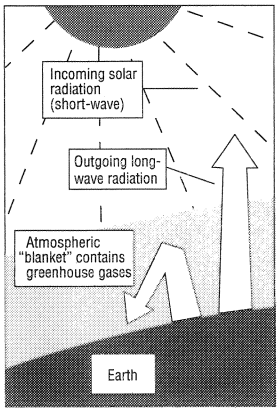
Acid deposition — which occurs when acidic compounds form in the atmosphere and fall to the earth as acidic rain, snow, fog, or dust — is a serious environmental concern in many industrialized nations, and in many parts of this country, particularly in the eastern United States, where many lakes and streams have been acidified. No such impacts have occurred in Washington state, however. The Washington Environment 2010 analysis indicates that the state's lakes, even those in the high alpine regions that are highly sensitive to acidic precipitation, are not being damaged by current levels of acid deposition. Research is ongoing, however, into the possible acidification of alpine lakes and streams during snowmelt, and on the effects of acidic fog on forests at high elevations.

➤ Since its impacts appear to be limited in this state, acid deposition was rated as a relatively low environmental priority (in the fourth of five priority categories) by the Public Advisory Committee. The committee pointed out, however, that the possibility of increased emissions of nitrogen oxides from transportation sources, the particular sensitivity of alpine lakes to acid, and the uniqueness of those lakes, suggest the need for continued vigilance in monitoring for possible impacts from acid deposition.

GLOBAL WARMING

IMPLICATIONS FOR WASHINGTON STATE

The emission of certain chemicals and gases has been linked to long-term changes in the global atmosphere that could have serious implications for Washington state. Specifically, scientists believe emissions of carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons (CFCs) are conspiring to create a "greenhouse effect," trapping in the lower atmosphere heat from the sun that normally would rise higher. The result: warmer global temperatures that could fundamentally alter the hydrologic cycle and ecological systems, change the composition of forests and crops, and cause the sea level to rise.



In terms of *potential* impacts, nearly everyone seems to agree that global warming is virtually in a category by itself. There is less agreement, however, both nationally and within Washington state, on what the *actual* impacts are likely to be.

Washington state's contribution to the total global emission of carbon dioxide and other "greenhouse gases" — most of which comes from transportation sources — is small. North America contributes about 27 percent of all CO_2 emissions; of that, this state contributes approximately one percent. But because Washington is a coastal state — heavily dependent on hydroelectric power and with an economy that thrives on agriculture, forestry, and fishing — it could be especially vulnerable to the changes that many scientists believe global warming will bring about.

The average annual temperature in the Pacific Northwest is projected to rise by three to five degrees Celsius over the next century. This could fundamentally alter the hydrologic cycle by increasing precipitation and snowmelt, and changing seasonal runoff patterns. These changes, in turn, could have profound impacts on the availability of water in the state for such things as hydroelectric power generation and crop irrigation. Also, this temperature change could alter the growth patterns of the state's forests and crops.

Global warming is expected to cause the sea to rise by two to 11 feet by the year 2100, due to the thermal expansion of the ocean and the increased melting of snow and ice. This sea level rise could drown coastal wetlands and shallow waters in Puget Sound, and thereby damage intertidal habitat and spawning grounds for surf smelt, Pacific herring, chum salmon, and other types of fish and wildlife.

Projections of the impacts of global warming are mostly national in scope, and are highly imprecise; it is impossible at this time to predict regional effects with reasonable accuracy. A great deal of research into the potential regional impacts of global warming is on-going at universities and in government laboratories throughout the Pacific Northwest.

In the meantime, however, there is circumstantial cause for concern; some of the state's environmental and economic characteristics make it particularly vulnerable to the potential impacts of global warming.

➤ The Public Advisory Committee placed global warming near the middle of its list of environmental priorities for the state — in the third of five priority categories. The committee noted the enormity and pervasiveness of the potential impacts, but also cited the scientific uncertainty about the magnitude and the timing of those impacts. The committee also recognized that, while the state's capacity to single-handedly reduce the global warming threat is limited, we share the responsibility for confronting the issue. Actions aimed at reducing greenhouse gases, such as energy conservation, would have economic as well as environmental benefits, and would demonstrate leadership in reducing the risk of global warming.

LOSING GROUND

Though we have made some improvements over the last 15 years in reducing air pollution, a number of formidable challenges remain. Indoor air pollution and radon in particular are significant human health concerns in Washington. But ambient (or outdoor) air pollution is the predominant threat to our air, and to the health, environmental, economic, and quality-of-life benefits it provides.

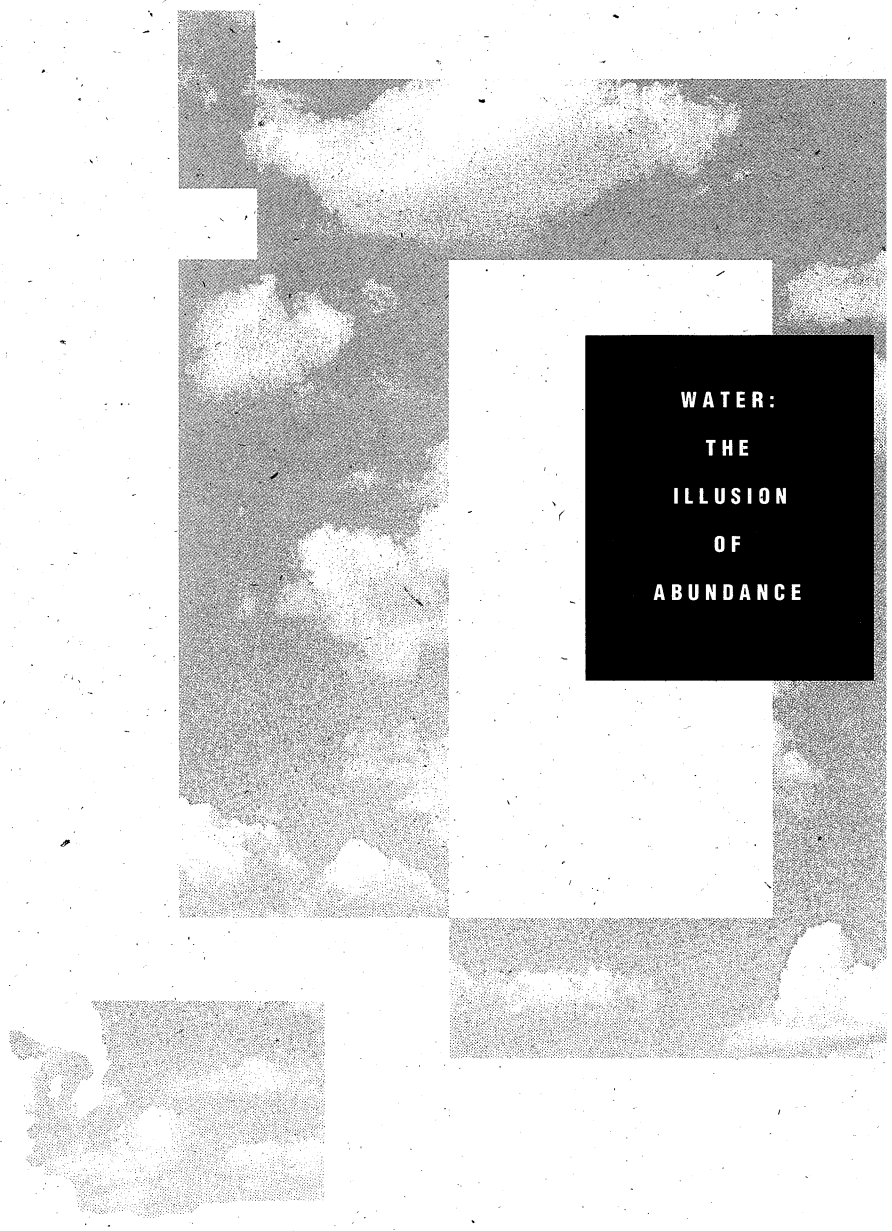
Unhealthy levels of carbon monoxide, ozone, and airborne particulates persist in many regions of the state, particularly urban areas. Toxic air pollutants also pose significant risks to human health and the environment, but the extent of the problem in Washington state is largely unknown.

The growth in population and economic activity that is projected to occur in the state will bring increased sources of air pollution. There already is evidence that air quality improvements are being offset or reversed by such growth.

The control of nonpoint sources — diffuse sources such as motor vehicles that collectively have emerged as the major contributor of air pollution in the state — is a particularly difficult and urgent challenge for citizens and policy-makers alike.

"Water has a life of its own."

Ute saying



WATER: THE ILLUSION OF ABUNDANCE

SECTION 3

WATER: THE ILLUSION OF ABUNDANCE

Water. We drink it, bathe in it, cook with it, clean with it. We swim in it and fish in it. We sail on it, ski on it, ship on it. We run it through turbines to produce electricity. We use it for processing and cooling in our industries. We dam it, channel it, pipe it. We pump it on our land to grow our food. And sometimes we just look at it and wonder at its power and the life it sustains.

Water. We take it for granted. And in Washington, on the surface, we seem to have plenty: 163 miles of coastal shoreline, more than 2,900 square miles of estuaries, more than 40,000 miles of rivers and streams, and more than 8,000 lakes (with a total surface area of more than 613,000 acres). Precipitation and snowmelt replenish these waters at the average rate of 140 million acre-feet per year. (An acre-foot is the volume of water that will cover one acre to a depth of one foot.)

Except for the small quantity of water carried from the biosphere by astronauts and disposed of in space, nearly every molecule of water present when the seas formed on earth is still present on the planet.

Underground there is more: aquifers with ground water storage of about 80 million acre-feet. These waters receive an average annual recharge — the volume of precipitation and snowmelt that percolates down to aquifers — of 7.5 million acre-feet. An elegant circle connects all this water in what scientists call the "hydrologic cycle."

Except for the small quantity of water carried from the biosphere by astronauts and disposed of in space, nearly every molecule of water present when the seas formed on earth is still present on the planet. The hydrologic cycle sees to that. Water enters the atmosphere through evaporation from surface waterbodies and transpiration from plants. It falls to earth in the form of precipitation. Aquifers and surface waterbodies store it, and ground waters supply the base flows of rivers and streams. It has, as the saying goes, a life of its own.

SUPPLY AND DEMAND

SHIPS THAT PASS...

Water in Washington is not always available *when* needed. The months of lowest streamflow and precipitation correspond with the period of highest demand for human uses, especially for agricultural irrigation, but also for a variety of municipal uses. Conversely, the period of lowest demand matches the time of highest availability. In addition, water is not always available *where* needed. If the water source is not reasonably proximate to the demand, then for all practical purposes it is not available.

We can compensate to some extent when inherent hydrologic conditions restrict the availability of water. We can, for example, build reservoirs to store water for later use, and we can build pipelines or aqueducts to transport it to where the demand is. But these solutions can cost too much both environmentally and financially. And regardless of our interventions, the hydrology of the state sets the parameters of water availability.

The estimated water use in Washington in 1985 totaled 2.4 trillion gallons, not including water for hydropower generation. As difficult as this volume is to comprehend, it represents only four percent of our average annual runoff, a figure plump with paradox. We suffer occasional shortages, witness intense competition among uses, and fully appropriate the water available from some sources, while 96 percent of our annual runoff returns to the sea untapped for consumptive uses. Water used for hydropower generation is an important exception to this pattern. Virtually the entire flows of the Snake and Columbia Rivers go through generators at dams along the way.

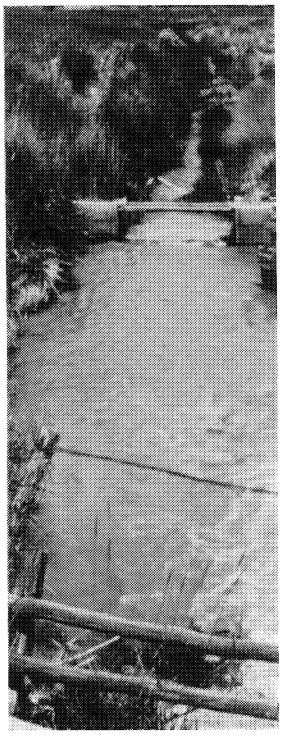
FEDERAL AND INDIAN RESERVED WATER RIGHTS

The issue of federal and Indian reserved water rights is complicated and contentious, and adds yet another dimension to the complexities of the overall water availability question in Washington. According to the federal reserved rights doctrine, when the federal government reserves land for federal purposes, including Indian reservations, by implication it also establishes a reservation of the then-unappropriated water necessary to accomplish the principal purposes of the reservation. The rights of Indian Tribes to take fish in usual and accustomed places — established by treaties and court decisions — are distinct from the reservation-related rights. Several tribes allege that these rights to take fish imply a requirement to maintain instream flows at a sufficient level to protect fisheries habitat, but the extent of this environmental protection right remains unresolved.

If the environmental rights eventually are defined, and the rights are treated as reserved rights with treaty priority dates, then existing rights could be subordinated to the instream fisheries requirements. The extent of the existing water appropriations suggests that the resolution of these issues will have a major effect on the state's water appropriation program.

THE BENEFICIAL USES OF WATER

The federal Clean Water Act sets national goals for water quality and establishes a link between quality and a water source's beneficial uses. State law follows the federal lead, and according to Washington's Water Resources Act, the beneficial uses of water include:



Irrigation: The single largest out-of-stream water use in the state, irrigation contributes significantly to Washington's agricultural production. There are more than 1.6 million acres of irrigated cropland in the state, an amount that represents more than 20 percent of our total cropland. Most of this irrigated land is east of the Cascades and not only supports local farm economies but also contributes to state, national, and international trade.

Municipal uses: Water supports the full range of domestic and commercial activities. Daily life in our households and businesses depends on a reliable supply of clean water for drinking and other purposes. Likewise, domestic and municipal water availability is a prerequisite for growth and development.

Industrial uses: Water used in processing and cooling enables several important industries to operate in Washington. Pulp mills, semiconductor chip manufacturers, and food processors are among the industries that rely heavily on water. These industries and other water-dependent industrial users provide employment opportunities and contribute to the tax base.

Hydropower: Washington relies heavily on electric power produced by hydropower facilities, not only for households but also for industry and commerce. Hydropower has historically supported economic development, and continues to provide a strong base for the state's economy.

Navigation: Several Washington rivers support commercial navigation, including barge traffic all the way to Idaho, and several estuaries are used for port facilities.

Recreation/Aesthetics: The value of the water resource's aesthetic contribution to life in Washington is difficult to quantify but easy to recognize. Residents and visitors enjoy the wide array of recreational opportunities created by our diverse water resources. These recreation outlets in turn contribute substantially to the state's economy. Tourism as well as commercial and industrial enterprises associated with recreation provide employment and, in some communities, establish the base of the local economy.

Support of fisheries and other wildlife habitat: Among the many positive aspects of the water resource are those that are primarily ecological. Water's support of fisheries and other wildlife habitat falls into this category. Washington's diverse waters create varied habitats that support a wide range of wildlife. This diversity has its own intrinsic value, and it also supports a variety of human uses. Commercial and sport fishing are multi-million dollar industries in the state. Other human benefits include the opportunities for bird-watching, hunting, and related outdoor activities.

Each water source has its own set of beneficial or characteristic uses, and its own limitations. An aquifer, for example, may provide a drinking water supply, a river can drive turbines to generate electricity, and large water bodies can support navigation. Virtually all surface waters provide fish and wildlife habitat, and also may support recreation activities. On the other hand, marine waters do not supply drinking water supplies, and alpine lakes do not support commercial navigation.

The beneficial or characteristic uses of water are not always compatible with each other, and water users often find themselves in competition. The Columbia River, for example, supports a wide range of uses and can illustrate the potential for conflicts. Withdrawals for irrigation or for municipal or industrial uses reduce the instream flow. This reduction affects fish and wildlife habitats. Hydropower generation also relies on stream flows of sufficient levels, but this instream use itself affects fish habitat. Disruptions of the timing, quantity, and velocity of flows, as well as the lack of screens and ladders at dams, all affect fisheries.

STATE WATER USE

By source: Surface waters contributed 82 percent of the water used in 1985; ground water contributed the rest. The proportion of ground water use is increasing (up from 10 percent in 1980), and fully two-thirds of the state's population rely on ground water sources for drinking water.

By use: Irrigation accounted for 76 percent of water use in 1985; industrial uses, 13 percent; and municipal uses, 11 percent.

By region: Each of three regions in the state has its own dominant water use. In the east Puget Sound region, municipal use is highest, with a significant industrial component. In southwestern Washington, and including the Olympic Peninsula, industrial use predominates, and in eastern Washington, irrigation far exceeds all other uses. (These figures do not include water used for hydropower.) ■

WATER QUALITY

The Environmental Protection Agency and the Department of Ecology have developed a system that enables analysts to evaluate a water source's quality by measuring the extent to which it supports its beneficial uses. A computerized management information system already is in use for surface water bodies, and Ecology currently is developing a similar system for ground water. The Clean Water Act requires states to file biennial water quality reports; Washington published its most recent report in June of 1988.

SURFACE WATER QUALITY

The 2010 findings are mixed. Marine and lake waters generally are supporting their designated beneficial uses to a greater extent than rivers and streams are. But there are inconsistencies in the breadth of the assessments for the different types of water bodies, and even where the percentage of nonsupport is low, the problem may be significant.

In the state's assessment of surface water quality, the term "beneficial use" refers to the attainment of the Clean Water Act goals of a water body being "fishable" and "swimmable." "Impaired" refers to a water body that does not support or only partially supports, its beneficial uses. "Threatened" refers to a water body that currently meets Clean Water Act goals, but is in danger from adjacent activities and may slip into the "Impaired" category.

Here are some of the details from the state's most recent assessment:

Marine waters: All 163 Pacific coast shoreline miles in the state are fully supporting their beneficial uses. The assessment of estuaries — those areas where fresh and marine waters mix such as in Puget Sound — covers 2,100 of a total of 2,943 square miles, and finds that 78 percent of the assessed waters fully support their beneficial uses. Fourteen percent of the estuary waters are threatened, while eight percent are impaired.

Rivers and streams: Of the more than 40,000 miles of rivers and streams in the state, the water quality report assessed 4,621 miles (12 percent), and of these assessed stream miles, 50 percent are impaired. Twenty-two percent are fully supporting their uses, and 28 percent are threatened.

Lakes: Most of the lake waters fall into the threatened category. The report covers 157,000 of the 613,582 total surface acres of lakes in the state, and finds that four percent are fully supporting, and that 74 percent are threatened.

GROUND WATER QUALITY

We do not currently know nearly as much about the quality of ground water as we do about surface waters. There are, however, documented instances of some ground water contamination in 28 of our 39 counties. Recent studies reassure us that ground water quality is still very good in Washington, but also warn us that human activities are causing a variety of pollution problems. The sources of ground water pollution are many and varied:

- Waste and chemical storage facilities such as landfills, surface impoundments, and above- or below-ground storage tanks.

Ground Water Contamination: The Case for Prevention

By the nature of its confinement, ground water often is not able to cleanse itself through dilution to the extent that surface waters can. Ground water contamination tends to form plumes that move slowly and unpredictably throughout an aquifer. Such contamination is often exceedingly difficult, prohibitively expensive, and extremely time-consuming to clean up. Some damage may, in fact, be irreversible.

- Waste treatment and disposal methods including septic systems, land application of domestic or industrial waste, and wastewater injection wells.
- Accidental releases of hazardous material in transport — through sewers and pipes, by truck or by rail.
- Releases associated with other activities — agricultural practices, urban runoff, mining, and excavation.

Once a contaminant is on or below the surface of the ground, it can work its way to ground water. Some substances dissolve in infiltrating water, which then carries them to ground water sources. Other substances — notably petroleum products — are not readily soluble, and migrate under the force of gravity. The migration of contaminants can be very slow and, as a result, there can be a long lag time between the release of the contaminants and when they reach ground water.

GROUND WATER DEPLETION

The problem of ground water depletion — when withdrawals and discharge exceed recharge — can exacerbate, and even cause, ground water contamination. In coastal areas when ground water levels drop too far, seawater can flow into a freshwater aquifer. This saltwater intrusion can render the ground water source useless for many human purposes. Saltwater intrusion is a potential problem in all coastal areas of the state, and it already is a particularly serious problem in Island and San Juan counties, where residents depend almost entirely on ground water for public water supplies.

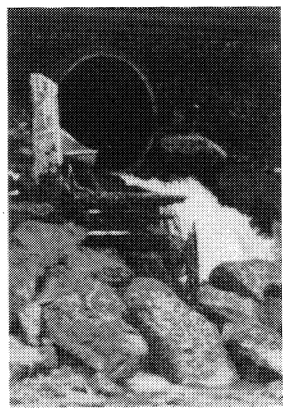
THREATS TO THE WATER RESOURCE

Many kinds of environmental pollution affect water directly and immediately — a discharge of wastewater straight into a lake or river, for example. But other sources of pollution affect water in more insidious ways. The removal of streamside vegetation, for example, can cause a water temperature rise that can alter habitat sufficiently to reduce fish populations. And airborne heavy metals can fall to water bodies, sink to the bottoms, and contaminate plant and animal communities that live there. While other sources pose much more serious threats to water, these examples illustrate the subtleties and complexities of water pollution analysis.

POINT SOURCES

A point source discharge is so called because its point of origin is easily identified, often a pipe. In Washington, the following municipal and industrial point sources, among others, contribute to the pollution of our state's waters:

- Wastewater treatment plants
- Combined sewer overflows and storm sewers
- Urban runoff
- Pulp and paper processing
- Oil refineries
- Chemical manufacturers
- Aluminum mills
- Electric utilities
- Food processors



Combined sewer overflows can occur when sewage and storm water flow through the same system. During high flows, some sewage can discharge directly to receiving waters without first being treated. The term "urban runoff" refers to the contaminated water that storm sewers and ditches collect and discharge. As storm water washes over streets and industrial, commercial, and residential areas, it picks up concentrations of metals, bacteria, organic compounds, and debris. This contamination makes urban runoff one of the most significant point source threats to water.

Among industrial point sources, pulp and paper mills pose the most serious threats. The major pollutants associated with pulp mill discharges include pathogens, suspended solids, and toxic organics. These pollutants contaminate fish and shellfish habitat. Some of these toxic organics bioaccumulate in fish and shellfish and pose a cancer risk to humans who consume the contaminated fish.

The consumption of fish, shellfish, or water contaminated by bacteria can lead to gastrointestinal illness, and direct contact with bacteria-contaminated water can cause skin irritations. Beaches and shellfish beds are occasionally closed to avoid these adverse effects, but is done so at the expense of our being able to enjoy the resource.

NONPOINT SOURCES

A nonpoint source is diffuse as opposed to originating in one place, and, as a rule, nonpoint sources are not as easily contained nor as well regulated as point sources. Among the nonpoint sources of concern in Washington are the following:

- Agricultural practices including irrigation, pesticide and fertilizer applications, grazing, and animal holding areas and feedlots.
- Forest management practices including attendant road-building, clear and partial cutting, and logging debris management.

- Construction and hydrologic disruptions
- Resource extraction
- Septic systems
- Hazardous waste management practices

Agricultural nonpoint discharges result from a diverse set of practices associated with both crop and animal production. Pollution from agricultural practices is highly variable and depends on numerous environmental and management factors. The major pollutants of concern — animal wastes, eroded sediments, and agricultural chemicals — can degrade fish and wildlife habitat as well as water quality. Humans are exposed to health risks through the consumption of contaminated fish and shellfish or through direct contact with the toxic algal blooms that can result from excessive nutrients. The Washington Environment 2010 analysis identifies the nonpoint source discharges associated with agricultural practices as among the most serious threats to surface waters.

BREAKING THE CYCLE

Hydrologic disruptions
The list of nonpoint sources includes hydrologic disruptions, a large and important category in its own right. Washington Environment 2010 analyzed the following group of disruptions to the hydrologic cycle:

- Dam construction and operation
- Surface water withdrawals
- Construction and flood control within streams, lakes, and flood plains
- Forest practices
- Irrigation distribution works, dryland agricultural practices, and livestock grazing
- Urban development
- Ground water withdrawal

➤ The analysis found a wide range of ecological effects, but no direct human health risks, and on the basis of these findings the Public Advisory Committee ranked the threats posed by hydrologic disruptions at a priority level of three out of five. ■

The most significant threats to ground water include agricultural and industrial sources as well as hazardous waste management practices, and underground injection wells. In addition, ground water remains at risk from past hazardous waste management practices that resulted in uncontrolled releases to the ground because contaminants from those releases are still migrating down to aquifers.

➤ The Washington Environment 2010 Public Advisory Committee ranks point and nonpoint source discharges among the top priorities for environmental policy in the state, and bases its ranking on the magnitude and pervasiveness of the effects:

- Contamination of ground and surface waters used for drinking supplies can result in a range of human illnesses from stomach aches to cancer.
- Degradation of fish and wildlife habitat results in shellfish closures, fish contamination, and potential wildlife kills.
- Human consumption of contaminated fish or shellfish can lead to food poisoning and other food-borne illness.
- Direct contact with polluted waters poses human health risks. Swimming in contaminated waters, for example, can result in gastroenteritis.

DRINKING WATER

One of the most obvious and most important beneficial uses of either surface or ground water is as a source for drinking water. The Washington Environment 2010 analysis finds that, in general, the condition of the state's drinking water is good, but that there are causes for concern. There are, for example, cases of waterborne diseases spread by microbial contamination of drinking water, and in some places the level of fluoride exceeds national health standards. These problems are serious — especially to those experiencing them — but they are for the most part isolated and limited.

A growing concern of potentially greater magnitude is the proliferation of small water systems, those systems with between two and 1000 connections. The number of small water systems in Washington has increased by 610 new systems per year, on average, for the past decade. Small systems traditionally have had difficulty complying with state and federal drinking water regulations, accounting for a disproportionate share of drinking water quality violations. In addition, a history of maintenance and operation problems with small systems may contribute to an increased incidence of waterborne disease outbreaks.

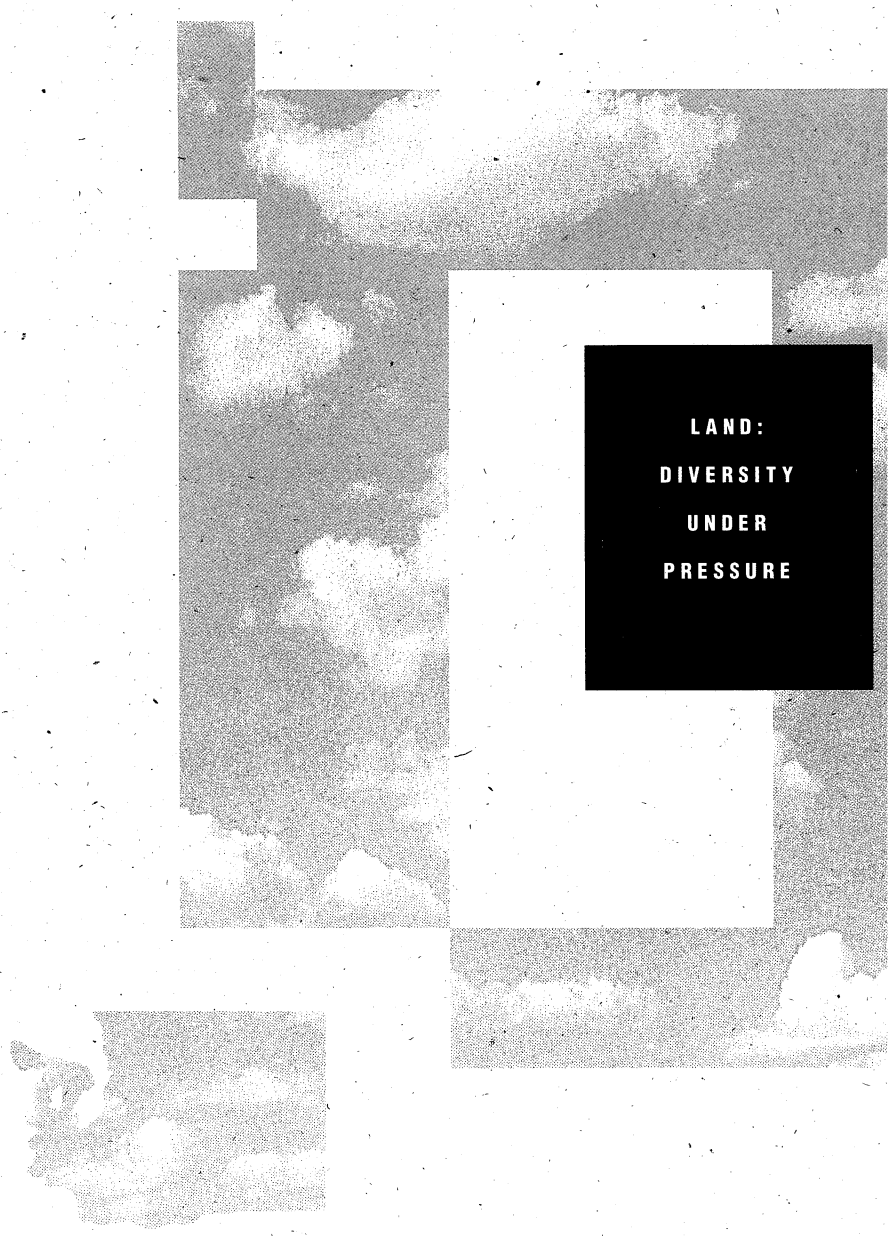
Perhaps the most important drinking water concern, however, relates to the condition of ground water. Citing our strong reliance on ground water for drinking water sources, along with the vulnerability of the resource, the Public Advisory Committee ranked drinking water contamination as a priority environmental concern in a category second only to ambient air pollution and point and nonpoint source discharges.

TROUBLED WATER

We can continue to take water for granted only at our own peril. The hydrology of the state imposes certain limitations, and technological solutions for overcoming those limitations create their own environmental problems. The threats to the quality of our water — along with the human health, ecological, and economic risks associated with those threats — are primarily of our own making. Any solutions will be primarily of our own devising. The competition among water uses is likely to intensify in the coming years and the challenge of reconciling conflicts — especially between instream and out-of-stream uses — looms large on the environmental horizon for Washington state.

"They ain't making any more of it."

Will Rogers



LAND: DIVERSITY UNDER PRESSURE

SECTION 4

LAND: DIVERSITY UNDER PRESSURE

Washington's land resources are amazingly diverse and abundant — 43 million acres of everything from mountain wilderness areas to vast deserts, glittering islands, fertile farmlands, and even a rainforest. We humans share these land resources with a wildlife population that matches the land in diversity and abundance, and increasingly we find ourselves in conflict not only with the wildlife but also with each other. As the human population of the state continues to grow, the land use conflicts are likely to intensify because, as Will Rogers pointed out, "they ain't making any more of it."

THE LAY OF THE LAND: A GENERAL SUMMARY

Type	Acres
Forest	24,000,000
Cropland	8,000,000
Range/Pastureland	7,000,000
Urban/Other	3,000,000
Bedlands (under water)	1,000,000
Total	43,000,000

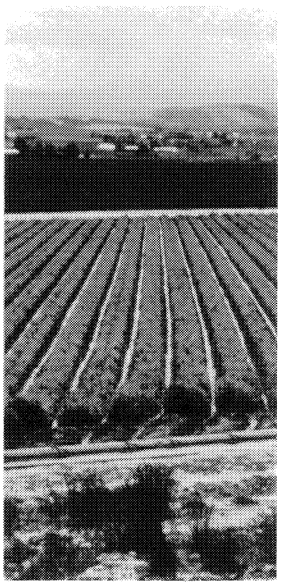
Recreation land does not appear as a separate category, but recreation activities occur on all land types.

LAND USE IN WASHINGTON

Washington Environment 2010 evaluated the state's land resources by dividing them into five separate categories — agricultural, forest, range, recreation, and urban lands. While providing a fairly comprehensive basis for an assessment of the land resources, these categories are by no means all-inclusive, nor are they mutually exclusive. Some roads and some lands managed by the federal departments of Defense and Energy, for example, are not included in this scheme, and some of the categories overlap. The inventories listed on this and the following pages provide the details.

Washington's lands support three of the state's most important industries — agriculture, forest products, and recreation. Agriculture in this state is a three billion dollar per year industry, and the Washington State Department of Agriculture proudly points out that, "The natural resource endowment is an integral part of the productivity

that has propelled Washington farmers to produce more potatoes per acre, more milk per cow, and more dryland wheat per acre than farmers in any other state." Both cropland and range land support this agricultural production.



AGRICULTURAL LAND INVENTORY

According to the Washington State Department of Agriculture, there are 38,000 farms in the state, and 16 million acres of land in farms. These 16 million acres comprise the eight million acres of cropland identified in the general land summary, along with another eight million acres in range and grazable forest land.

Agricultural land	**Acres**
Cropland:	
Dryland	*6,140,000*
Irrigated	*1,653,000*
Cropland subtotal	7,793,000
Other agricultural land	8,207,000
Total	16,000,000

RANGE LAND INVENTORY

There are three different types of grazing land in Washington:

Grazing land	**Acres**
Pastureland	1,000,000
Grazable forest	5,500,000
Range land	6,000,000
Total	12,500,000

Pastureland is land that is primarily used for the production of adapted domestic forage plants for livestock. Grazable forest land is open forest with understory vegetation suitable for forage. And range land is land on which the highest ecological development of the plant community is predominantly grasses, forbs, and shrubs suitable for grazing or browsing.

Washington's forest products industry employs 50-60,000 workers across the state, and harvests 4-7 billion board feet of timber annually. The economic contributions of recreation are equally impressive, both in terms of commercial and industrial enterprises associated with recreation, and in the more general context of tourism. Not all tourism in this state is directly related to our recreation lands, but these lands are no doubt responsible for a significant

share of the state's 3.7 billion dollar per year travel and tourism industry. Each of these industries not only plays an important role in the state economy, but in many communities around the state, farming, forest products businesses, or tourism forms the basis of the local economies.

The land resource also provides many other benefits besides those that are strictly economic:

- Food for our tables and the tables of others.
- A diverse array of both year-round and seasonal habitats that support the state's wildlife, including several threatened or endangered species.
- Recreation opportunities that support the activities of literally millions of residents and visitors each year.

The importance of outdoor recreation to the people of Washington is evidenced by the state's rank among all other states in several visitation categories: third in per capita visits to state park and recreation areas; sixth in number of campers in national forests; and 14th in number of visits to national parks. Deception Pass, for example, had over three million visitors in 1986; Mt. Rainier National Park, almost two million; and Olympic National Park, nearly 3.5 million.

FOREST LAND INVENTORY

Of the 24 million acres designated as forest land in the general land summary, 21.4 million acres meet the U.S. Forest Service forest land definition as land that is at least 10 percent stocked by live trees or land formerly having such tree cover and not currently developed for nonforest use.

Forest land	**Acres**
Timberland:	
National forest	*5,288,000*
Other public	*3,792,000*
Private	*8,186,000*
Timberland subtotal	17,276,000
Reserved timberland	1,605,000
Other forest	2,492,000
Total	21,373,000

Timberland is forest land capable of producing 20 cubic feet per acre per year of industrial wood. Reserved timberland meets the productivity requirements but is withdrawn from timber utilization by statute, ordinance, or administrative order. The other forest land meets the Forest Service definition of forest land, but does not meet the productivity requirements to qualify as timberland.

RECREATION LAND INVENTORY

The recreation land identified here includes dedicated park land in the Urban/Other category of the general land summary as well as multiple-use forest lands currently designated for recreation use, but on which other uses may occur.

Land Category	Acres	Percentage
Urban/Rural	82,000	1
Roaded	2,253,000	29
Semi-Primitive:		
Motorized	*251,000*	*3*
Nonmotorized	*918,000*	*12*
Semi-Primitive subtotal	1,169,000	15
Primitive	4,252,000	55
Total	7,756,000	100

The table overstates actual land available for recreation in two ways. First, the multiple-use lands in the roaded and semi-primitive categories are still available for timber harvesting, grazing or mining. And second, the primitive acreage (essentially unmodified areas) includes vast areas that are virtually inaccessible. In the Mt. Baker-Snoqualmie Forest, for example, only 4-5 percent of the area is at a grade less than 35 degrees — too steep for most people — and, statewide, snow precludes use of most primitive acreage for about eight months of the year.

URBAN LANDS

While recognizing urban lands as an important component of the land resource, Washington Environment 2010 does not analyze urban lands separately. By definition, these lands already are built up for residential, commercial, industrial, and community services purposes, and urban development has already drastically altered the original ecosystems. This does not mean, however, that environmental issues no longer pertain to urban areas. On the contrary, the findings of most of the Washington Environment 2010 risk assessments are applicable in urban areas.

ENVIRONMENTAL THREATS AND THE CONDITION OF THE LAND

The Washington Environment 2010 analyses of our land resources rely on indicators of how well the different land types support their human and ecological purposes. Conversely, human activities associated with use of the land pose the most serious environmental threats: soil erosion on agricultural land, the conversion of forest land to other purposes, and overgrazing and inundation by noxious weeds on range lands.

The harvesting of old growth forests has reduced the amount of forest land with stands more than 100 years old from approximately 11 million acres in the 1930s to approximately four million acres today.

Key findings of the Washington Environment 2010 risk assessments include:

- Population growth and urbanization between 1930 and 1980 resulted in the conversion of about four million acres of forest land to other uses, thereby reducing the diversity of flora and fauna as well as the sustained timber harvest level.
- The harvesting of old growth forests has reduced the amount of forest land with stands more than 100 years old from approximately 11 million acres in the 1930s to approximately four million acres today.
- Overuse by humans currently poses the most serious ecological threat to recreation lands, especially to primitive lands. The result of overuse is habitat degradation.
- Urbanization and development affect recreation lands indirectly by increasing the demand for use in already overused areas.
- Range land is a unique and sensitive ecosystem that, once degraded, takes an unusually long time to recover. Overgrazing has damaged approximately 3.5 million acres of range land. More than one-half million acres are inundated by noxious weeds.
- The soil erosion rates on cropland in eastern Washington far exceed the maximum acceptable rate.
- Most of the land converted to urban uses over the past decade has come from the forest land base, but between 1982 and 1987 about 1,350 acres of cropland and pastureland per year were converted to urban or built-up uses.

POPULATION GROWTH AND THE CONVERSION OF FOREST LAND AND CROPLAND

Washington's projected population growth is distributed unevenly across the state's 39 counties, but even if the growth pattern were uniform, the effects on agricultural and forest lands would be different from county to county. The amount of agricultural and forest land in the county, the availability of other land, and the pathway of development all play a role in the overall effect of population growth on the land.

A careful analysis of cropland and forest land losses and the consequent effects on production and on resource-dependent communities must include a consideration of many elements. What local controls will mitigate the effects of growth? Which cropland or forest land specifically is at risk? And to what extent is the community dependent on the economic benefits of the agriculture or forest products industry?

CROPLAND SOIL EROSION

The Soil Conservation Service of the U.S. Department of Agriculture calls soil erosion on dryland and irrigated cropland "the most serious land resource problem in Washington state." The generally accepted maximum rate of soil erosion is five tons per acre per year, a rate of soil loss that is balanced by natural soil formation. The composite soil erosion rate for all counties west of the Cascades is 1.97 tons per acre per year, well under the standard. On the east side of the mountains, however, the rate is 8.53 tons per acre per year — faster than the soil's ability to regenerate itself.

EROSION EAST AND WEST OF THE CASCADES — THE TOP TEN COUNTIES BY NET FARM INCOME

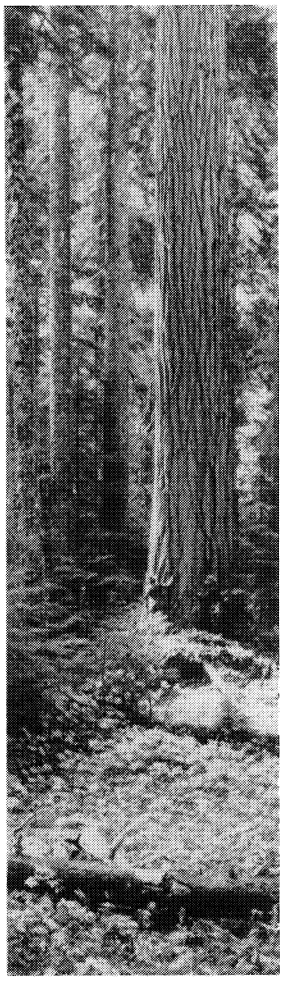
A comparison of erosion rates for the ten top counties ranked by net farm income reveals the disparity in regional soil erosion rates.

	County	Net Income Rank	Erosion Rate (tons/acre/year)
East Side	Yakima	1	7.07
	Grant	2	8.27
	Whitman	3	13.90
	Chelan	5	2.64
	Spokane	7	9.66
	Lincoln	8	8.05
	Benton	9	5.72
	Composite		9.48
West Side	Whatcom	4	1.74
	Skagit	6	1.51
	King	10	1.46
	Composite		1.61

The cumulative effects of erosion are difficult to assess, but persistent erosion at rates in excess of the soil's ability to regenerate itself will result in reduced productivity over time. The high production values of Washington agriculture suggest that the soil remains in good condition, and the Washington Environment 2010 analysis finds that the state's cropland is capable of sustaining high levels of output indefinitely under proper management.

(WHERE SELDOM IS HEARD) A DISCOURAGING WORD

Of all Washington's land resources, range land is in the worst condition. The harsh environment of the range belies the fragility of this sensitive ecosystem. Ranchers rely on the range for forage for their animals, but overgrazing has damaged some 3.5 million acres. Erosion rates on the range are lower than the rates for cropland, but



they are higher than the range's soil formation rates, and more than one-quarter of the range needs additional protection from erosion. The inundation of the range by noxious weeds degraded 560,000 acres to a fair or poor condition. Overall, only 10 percent of the range attains an excellent rating while 20 percent rates good. The remaining 70 percent is evenly split between fair and poor condition.

OLD GROWTH

Of all the complex and contentious environmental issues confronting the state, none entails more controversy than the issue of the old growth forests, starting with the definition of what an old growth forest is. Using the definition of old growth as forest land with stands of trees 100 years old, the Washington Environment 2010 analysis finds that timber harvests have reduced the amount of old growth from 11 million acres in the 1930s to about four million acres today.

But Washington Environment 2010 also recognizes a newer definition of old growth, one based on attributes in addition to age. By this definition ancient forest is over 250 years old and contains several trees over 40 inches in diameter on every acre. These forests are multi-layered, contain many snags and fallen logs, and provide a unique habitat for flora and fauna dependent on old growth ecosystems. About one-half of the four million acres of old growth counted under the earlier definition also qualify as old growth under this more recent definition.

These old growth forests support the most diversity of species, structure, and function of any forest in the state. The harvest of these forests and their subsequent conversion to second growth therefore entails a greater loss of diversity than the harvest of other forests. The Washington Environment 2010 analysis projects that these old growth stands will decline to about 1.5 million or fewer acres by the year 2010.

RANKING THREATS

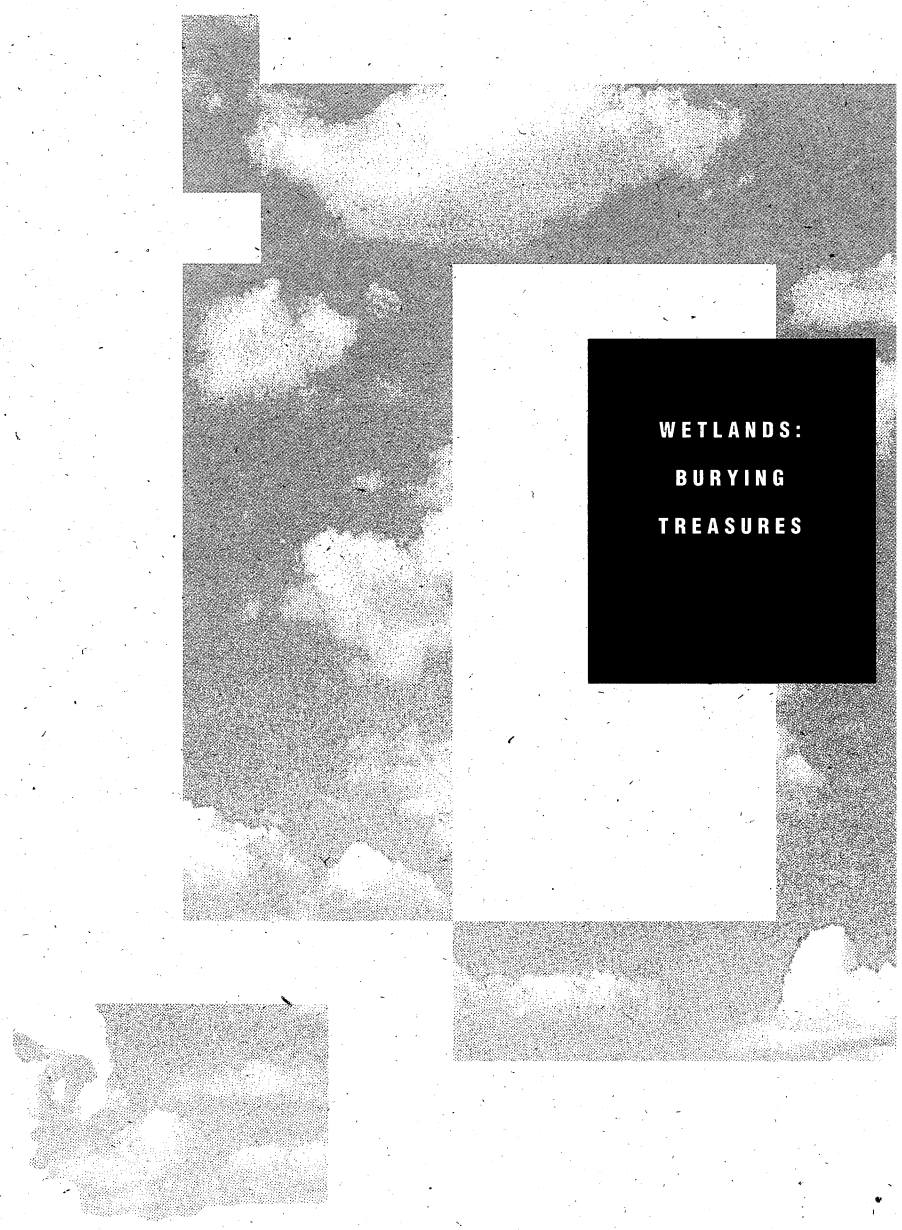
➤ The Washington Environment 2010 Public Advisory Committee considered separate assessments of the nonchemical risks posed to each of the four major land types. The committee ranked the threats to forest and agricultural lands in the second priority category, citing the continuing threats of erosion and conversion and the serious economic consequences associated with degradation of these land resources. The committee ranked threats to recreation lands in the third priority category recognizing that the demand for recreation land exceeds supply and that outdoor recreation is a "quality of life" issue in Washington. And finally, the committee ranked threats to range lands in the fourth priority category noting that conversion is not as much of an issue as it is for forest and agricultural lands. ■

LAND AND OPPORTUNITY

Washington's diverse land resources support essential state industries — forest products, agriculture, and recreation — but these resources are under pressure. The threats to the diversity and abundance of Washington's land manifest themselves in different ways. Erosion is the greatest threat to agricultural lands east of the Cascades. Forest land is threatened with conversion to other uses. Overgrazing and noxious weeds are damaging the range. And overuse is harming recreation lands. Continued population growth will increase the pressure on these already intensively used and highly valued resources. Can the state grow and prosper and still maintain the opportunities created by the forest, agriculture, range, and recreation lands we have here? The answer lies in our individual and collective responses to this challenge.

"Wetlands are nature's kidneys."

Anonymous

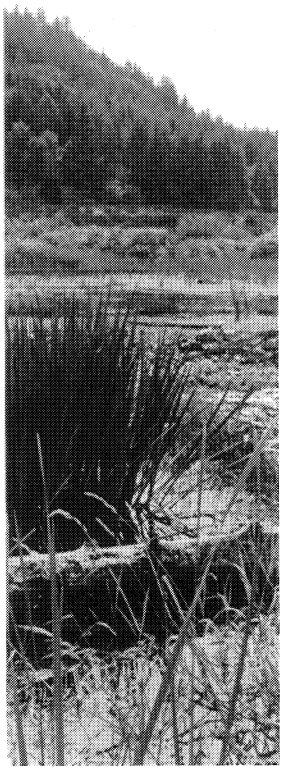


WETLANDS: BURYING TREASURES

SECTION 5

WETLANDS: BURYING TREASURES

Wetlands teem with life. Still water and rich nutrients provide habitat and food sources for a wide variety of fish and wildlife. Wetlands also serve a number of soil and water functions such as promoting the recharge of ground water, providing a margin of safety in dissipating flood waters, and stabilizing streambanks. In addition, wetlands improve water quality by providing a natural filtration of sediments and pollutants.



Washington boasts a tremendous diversity of wetlands — alpine meadows in the high Cascades, riparian corridors in eastern Washington, salt marshes along the Pacific coast, river mouth estuaries within Puget Sound, and large areas of freshwater marshes in the Columbia basin, some created by irrigation projects. Each type of wetland has its own chemical and biological characteristics. Some wetland systems are dynamic, changing continuously. Others — such as bogs — are stable for thousands of years. All are critical ecosystems that support a rich variety of fish, wildlife, invertebrate, and plant species.

Prior to the 1970s there were few regulations controlling the filling or drainage of wetlands. On the contrary, federal policy often encouraged such activity. Major wetland losses occurred through drainage for agriculture, grazing, mining, forestry and port and industrial development. Today, the primary threats come from urban expansion, timber harvesting, and livestock grazing. In the future, global warming may pose the greatest threat to estuarine wetlands because of a rise in sea level. Interior wetlands will also be affected by disruptions in the hydrologic cycle.

Wetlands also can be damaged or destroyed by a variety of natural forces including droughts, extreme floods, fire, wind storms, and natural subsidence.

In recent years, as recognition of the importance of wetlands has increased, several efforts have emerged to protect these vital areas:

- The federal Clean Water Act of 1972 prohibits the filling of certain critical wetlands, but it does not regulate dredging, draining, or land clearing. It exempts normal farming, ranching, and forestry practices. The act also allows the filling of wetlands smaller than one acre.
- The state Shoreline Management Act of 1971 restricts most activities in certain wetlands, but the act excludes normal farming and forestry practices, and does not cover 75 percent of Washington's wetlands. Local jurisdictions are largely responsible for

implementation of the act, and the extent of wetlands protection can vary from one jurisdiction to another.

- Federal and state agencies, as well as private conservation groups, have acquired thousands of acres of wetlands to be set aside in their natural form.
- Many local governments have begun to protect wetlands by enacting ordinances that require buffer strips, greenbelts, or on-site storm water control.

THREATS TO WETLANDS

The recent protective efforts notwithstanding, Washington's wetlands remain threatened. Studies project that our state will continue to lose wetlands to residential growth, construction of roads and rail lines, and ongoing agricultural practices.

Here are the key findings of the Washington Environment 2010 analysis:

Destruction of wetlands reduces flood control, sediment stabilization, and water purification capabilities of the natural ecosystem. In some cases, municipalities will have to pay for expensive engineered structures to provide the same benefits natural wetlands currently provide.

- In spite of federal, state, and local protection measures, Washington is continuing to lose between 700 and 2000 acres of wetlands each year. At this rate, an additional 14,700 - 42,000 acres of wetlands will be lost by the year 2010, out of a current inventory of 938,000 acres.
- The loss or degradation of wetlands has dramatically reduced fish and wildlife habitat. Prior to 1850, Washington had an estimated 1.5 million acres of wetlands. Today's inventory of 938,000 acres represents a conservative, estimated loss of over 33 percent of the 1850 figure. Local areas have experienced much higher losses.
- Some 70 percent of the tidally influenced emergent wetlands in Puget Sound have been lost to diking, dredging, and filling. Core urban areas have lost 90-98 percent of their original wetlands.
- The major factors responsible for wetland degradation are: urban growth; dikes and other construction barriers; erosion and siltation caused by increased stormwater and construction activities; invasion of exotic plants and animals that reduce habitat values for native species; and forest and agricultural practices.
- Activities exempt from the regulatory process account for a significant share of wetlands losses. The draining of wetlands, for example, is not regulated, and consequently twice as much acreage is lost to draining as is lost to filling, an activity that is regulated. The filling regulations, however, permit the filling of wetlands of less than one acre, and the cumulative effect of this exemption is a substantial loss of wetlands. Other exempt activities include agriculture, silviculture, small-scale development, and highway construction.

■ Continued destruction of wetlands could have serious economic implications for Washington. Wetland-related outdoor recreation — including fishing, hunting, hiking, boating, and birdwatching — contributes millions of dollars annually to the state economy.

Destruction of wetlands reduces flood control, sediment stabilization, and water purification capabilities of the natural ecosystem. In some cases, municipalities will have to pay for expensive engineered structures to provide the same benefits natural wetlands currently provide.

➤ The Washington Environment 2010 Public Advisory Committee ranks the threats to wetlands in the second of five priority categories. The committee recognizes both the irreplaceable role of wetlands in the environment and the seriousness of the current and future threats. In its deliberations, the committee expressed concern about the relatively high level of uncertainty over the wetlands inventory and the continuing loss of wetlands habitat.

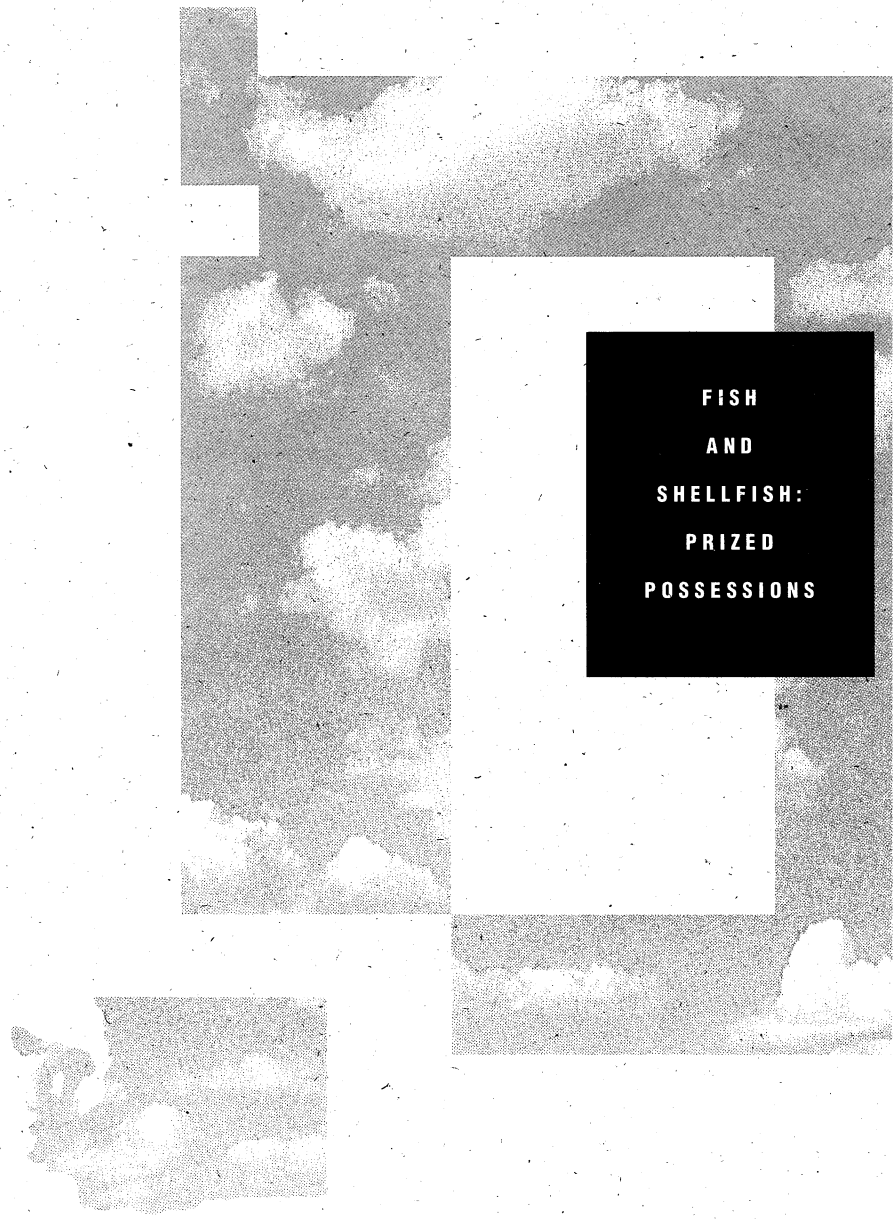
FINDING A FINE BALANCE

Wetlands, now recognized as a resource with enormous ecological, recreational, scientific, and economic value, have been misunderstood and undervalued for years.

Despite recent regulatory efforts to protect wetlands, they are still being degraded and destroyed by development and other activities at an alarming rate. Our challenge is to find the fine balance between preservation of this natural resource, and continuation of many important human activities that support Washington's economic stability.

"My worst day of fishin' was better than my best day of workin'."

Anonymous



FISH AND SHELLFISH: PRIZED POSSESSIONS

SECTION 6

FISH AND SHELLFISH: PRIZED POSSESSIONS

Every year, hundreds of thousands of people go fishing in the state of Washington. Some fish for Pacific salmon in places such as the Columbia River and the Puget Sound. Others fish for herring, halibut, and cod, or dig for hardshell clams and Dungeness crab, off the coast of the Olympic Peninsula. Some travel to one of the state's 5,000 lowland lakes or 3,000 alpine lakes in search of trout, sunfish, pike, and bass.

Some fishers fish for food; some fish for fun. Others fish for profit.

For large numbers of people in this state and elsewhere, fish and shellfish from Washington's waters are an important source of nutrition and recreation. For others, they are simply a source of beauty and fascination. To Northwest Indians, fish are a cherished cultural and spiritual symbol, as well. And to many fishers up and down the West Coast, Washington's fish and shellfish resources are a source of income and livelihood.

In short, fish and shellfish are among the state's most precious resources.

MANAGING FISH AND SHELLFISH

SPLIT RESPONSIBILITIES

The complex task of managing the state's fish and shellfish resources — and protecting the aesthetic, recreational, culinary, and economic values that we derive from them — is divided between two separate state agencies, the Department of Fisheries and the Department of Wildlife. Both agencies have similar statutory mandates, but they manage different species. The Department of Fisheries is responsible for preserving, protecting, and perpetuating food fish (fish that are caught exclusively for food) and *all* species of shellfish, while the Department of Wildlife is responsible for preserving, protecting, and perpetuating the state's game fish (fish caught for food or sport).

The Department of Fisheries manages, with the exception of landlocked Atlantic salmon, all of the salmon species in the state and in off-shore waters, including chinook, coho, chum, pink, and sockeye salmon. The Department of Fisheries also is responsible for managing all species of shellfish (including razor and hardshell clams, Dungeness crab, sea urchins, sea cucumbers, geoduck and shrimp),

and marine fish (including herring, surf smelt, halibut, flounder, sole, and cod). The fish and shellfish managed by the Department of Fisheries generally are harvested by *both* recreational and commercial fishers.

The Department of Wildlife manages resident fish (fish that do not migrate out to sea, such as trout, char, and land-locked salmon), warmwater fish (including sunfish, catfish, perch, pike, and bass), and some anadromous fish (steelhead trout and other fish species that hatch in fresh water, migrate to salt water to live, then return to fresh water to spawn). Species of fish managed by the Department of Wildlife, with the exception of steelhead trout, are harvested solely by recreational fishers.

The state's Indian tribes cooperate with the Departments of Fisheries and Wildlife to manage those species of fish that are included in a series of treaties between the United States and the state of Washington.

THE STATUS OF WASHINGTON'S FISH AND SHELLFISH

MOSTLY GOOD NEWS

The condition of the fish and shellfish resources are measured by evaluating various kinds of historical and current data: the number of fish and shellfish caught or harvested in the state by commercial and recreational fishers, the number of fish produced in hatcheries, the number of fish escaping from natural spawning areas, and so on. Data such as these indicate that, with some notable exceptions, Washington's fish and shellfish resources generally are in good shape.

- Pacific salmon populations are stable, using as an indicator historical information on the number of salmon commercially harvested in the state. The salmon populations in the Columbia River and in other areas of the state are smaller than they have been historically, however.
- Fewer marine fish (herring, whiting, Pacific cod, and flatfish, for example) have been caught in Puget Sound during the 1980s due to a host of factors, including water quality problems in urban embayments, excessive fishing, shoreline development and increased predation by marine mammals.
- Dungeness crab populations, despite heavy harvesting and sensitivity to poor environmental conditions, are generally healthy.

Oil spills and other accidental releases of chemicals into rivers and coastal waters kill or contaminate fish and shellfish. A 239,000-gallon oil spill near Port Angeles in 1985, for example, destroyed more than 12,000 pounds of clams.

■ Commercial harvest of hardshell clams in the Puget Sound and the straits has increased steadily since 1980, despite problems with paralytic shellfish poisoning (commonly called "red tide"), and various types of pollution.

■ Razor clam populations in Washington's coastal waters have been declining for a decade, a trend exacerbated in 1983 by a heretofor unknown disease.

■ The shrimp in Washington's coastal waters appear healthy overall.

■ Resident fish populations in most areas of the state are in fair to excellent condition. Trout populations in lowland lakes, for example, are in excellent condition, largely because of successful hatchery programs. Fish populations in alpine lakes are in excellent condition as well. Stream trout are not faring as well; they are in fair condition due to the development of shorelines and excessive harvesting. Fish populations in alpine lakes are in excellent condition.

■ Warmwater fish populations are generally healthy.

■ The news on anadromous game fish species is mixed. Wild steelhead trout populations are rebounding due largely to increased protection. Populations of sea-run cutthroat trout and sea-run Dolly Varden, however, are believed to be depressed in many areas of the state.

It is important to note that these measurements are imperfect. The number of fish and shellfish caught or harvested in a year, for example, is not a precise indicator of *natural* fish and shellfish populations, since those numbers are also affected by fishing regulations and since they include fish raised artificially in hatcheries.

THREATS TO FISH AND SHELLFISH

OF HABITATS AND HARVESTS

Despite their reliance on fish and shellfish for food, recreation, and income, humans do a variety of things that threaten those resources. Most of these activities fall into one of two categories: habitat degradation or destruction, and excessive harvesting.

The Washington Environment 2010 analysis finds that the loss or alteration of fish and shellfish habitat is the major threat to the resource. Fish and shellfish habitat — the places where fish and shellfish live, grow, and spawn — is damaged or destroyed by a variety of human activities:

■ Dam-building, though it sometimes creates new fish habitat, can seriously disrupt fish populations by blocking migration to spawning

areas. The decline of salmon in the Columbia River since the construction of hydroelectric power systems there is a stark example of what can happen. Anadromous fish habitat was reduced by more than 30 percent — from 13,000 miles of river in 1850 to just under 9,000 miles today. During that same period, salmon populations have decreased by nearly 80 percent, from an estimated 10 to 16 million fish to 2.5 million. Steelhead trout populations also have suffered. Before dams were constructed, the Columbia River alone supported close to 550,000 steelhead trout; today there are fewer than that (about 525,000) statewide.

- Other types of construction or building, such as bridge-building or channel-building, on or near lakes, streams, and rivers also can damage or destroy fish habitat. The development of lake and stream shorelines, for example, has resulted in the loss of spawning and rearing areas for resident, warmwater, and anadromous fish. Development of marine shorelines such as the Puget Sound shoreline also degrades or destroys important areas for fish spawning and rearing.

- Low stream flows, due to withdrawals of water from rivers and streams for other uses such as irrigation, can make it difficult for fish to migrate, and can interfere with the spawning and incubation of salmon eggs.

- Pollution is another major source of habitat loss or alteration. Increased sedimentation due to erosion or dredging operations can suffocate fish eggs and bury organisms that fish rely upon for food. Discharges from nonpoint sources such as private septic tanks and farm run-off into lakes, rivers and streams, and point sources such as pulp mills and oil refineries, contaminate fish and shellfish and interfere with their development, reproduction and survival, as well. Contamination of fish and shellfish has led to closures of shellfish beds and advisories against eating fish caught in certain parts of the state, particularly in streams and estuaries near urban areas. In fact, point and nonpoint source water pollution were ranked as high environmental priorities for the state by the Washington Environment 2010 Public Advisory Committee, largely due to the serious risks they pose to fish and shellfish populations and, consequently, to the state's economy.

- Oil spills and other accidental releases of chemicals into rivers and coastal waters kill or contaminate fish and shellfish. A 239,000-gallon oil spill near Port Angeles in 1985, for example, destroyed more than 12,000 pounds of clams.

- Excessive harvesting can cause problems. Sturgeon in the Columbia River provide an example — and a lesson. The species was nearly eliminated when the rising demand for caviar and smoked sturgeon led to excessive fishing in the late 1800s and early 1900s. Commercial and recreational harvests have been increasing

steadily in recent years, but the annual catch typically is still less than 500,000 pounds, compared to the three to six million pounds caught in a typical year during the 1890s.

- Wetlands provide habitat for a variety of fish species — the contamination or filling of wetlands degrades or destroys that habitat.
- Global warming — an increase in global temperatures that many scientists believe is being caused by emissions of carbon dioxide and other gases into the atmosphere — could have significant impacts on Washington's fish and shellfish resources. This phenomenon could reduce stream flows during the summer months, for example, which could interfere with the rearing and migration of anadromous fish. A change in water temperature could harm temperature-sensitive species of fish and shellfish, such as halibut, Pacific cod, pink salmon, and razor clams. Also, a rise in sea level, which could result from a heat-induced expansion of the ocean and from increased melting of snow and ice, could flood coastal wetlands, intertidal areas, and other important fish and shellfish habitat.

INCREASED PRESSURE ON FISH AND SHELLFISH

The condition of the state's fish and shellfish resources is largely a function of two things: the condition of the habitat in which fish and shellfish live and reproduce, and the levels at which fish and shellfish are harvested. The degradation or destruction of habitat is the more serious of the two threats, since its effects on fish and shellfish populations are permanent; populations that are vulnerable to excessive harvesting can be protected and revitalized through careful harvest management.

Population growth and economic expansion will increase both of these threats to our fish and shellfish. Greater numbers of people will mean greater demand for shoreline development and for out-of-stream uses of water, and a higher risk of water pollution, all of which will further jeopardize fish and shellfish habitat. In addition, greater numbers of both recreational and commercial fishers will mean greater competition for fish and shellfish harvesting.

These increased pressures, in turn, will increase the pressure on both the citizens of the state who enjoy and rely upon these resources, and the policy-makers who steward them, to treat habitats and harvests with care and foresight.

"For the animal shall not
be measured by man.
In a world older and
more complete than ours
they move finished
and complete,
gifted with extensions of
the senses we have lost
or never attained,
living by voices
we shall never hear."

Henry Beston

WILDLIFE: THE ISSUE IS HABITAT

Endangered species

Species on the state endangered species list are on the brink of elimination from all or a significant portion of their range in Washington. The current list includes:

Leatherback sea turtle
American white pelican
Brown pelican
Peregrine falcon
Sandhill crane
Snowy plover
Upland sandpiper
Spotted owl
Gray wolf
Grizzly bear
Sea otter
Gray whale
Sei whale
Fin whale
Blue whale
Hump-backed whale
Black right whale
Sperm whale
Woodland caribou

The Columbia River tiger beetle and the yellow-billed cuckoo are possible candidates for the endangered list.

WILDLIFE: THE ISSUE IS HABITAT

More than 500 species of wildlife reside in or pass through the state of Washington each year. As our cohabitants, these species have needs not unlike our own — food and water, shelter and resting places, space of their own. The environmental characteristics of a specific place occupied by a wildlife species constitute its habitat, and Washington Environment 2010 finds the condition of wildlife habitats is the central determining factor in the condition of the wildlife resources in Washington. Sixty-seven wildlife species are currently listed as vulnerable to extinction in Washington, and their declines from historic levels are largely attributable to habitat loss or alteration.

To put Washington's current wildlife situation in a global and historical context, consider this: of an estimated 500 million species of plants and animals that have existed since life began on earth, somewhere between 2-4 million are present today. Most of these losses resulted from natural causes and species' inability to adapt to changing conditions. In more recent times, however, human activities have accounted for many of the changes in environmental conditions. About 300 species of animals worldwide have become extinct since the year 1600, for example, and the major causes of extinction, in descending order of importance, are: habitat loss or disturbance; commercial hunting; introduction of competing or predatory species; sport hunting; pest and predator control for the protection of crops and livestock; hunting for food; the collection of specimens for pets, zoos, or research; and pollution.

The condition of Washington's wildlife varies by species. We have vibrant and abundant populations of many big game animals, migratory waterfowl, and other game and nongame species. But as many as 11 breeding populations of nongame species may become extinct in the state by the year 2010. In Washington today, the critical issue for wildlife — as it is with fish and shellfish — is habitat.

HABITATS CRITICAL AND SPECIAL

The term "critical habitat" refers to habitat that is essential to the conservation of a species. The specific needs of a species over its entire life cycle determine the full extent of its critical habitat. Large predators, for example, usually have large home range requirements — continous, undisturbed habitats to roam for prey. Migratory animals have special breeding and resting grounds, and other wildlife species have little mobility, and never leave their comparatively small home areas.

The diversity of environmental conditions in Washington provides numerous special habitats that in turn support a diversity of wildlife. Here is a brief survey of some special habitat types and the vulnerable species each supports:

- **Shrub-steppe** regions are treeless areas with vegetation dominated by shrubs and grasses. They occur mainly in eastern Washington and provide habitat for these threatened or sensitive species: ferruginous hawk, pygmy rabbit, burrowing owl, golden eagle, gyrfalcon, loggerhead shrike, sage sparrow, sage thrasher, Swainson's hawk, Merriam's shrew, and pallid bat.
- **Old growth forests** support the spotted owl, fisher, grizzly bear, long-eared myotis, northern goshawk, pileated woodpecker, Larch mountain salamander, and Dunn's salamander.
- **Riparian areas** — the land along streams or rivers — provide special habitat for the bald eagle, common loon, long-eared myotis, purple martin, western pond turtle, wolverine, Columbia white-tailed deer, and peregrine falcon.
- **Bogs and other small wetlands** support the sandhill crane, western pond turtle, Beller's ground beetle, Hatch's click beetle, and silver bordered fritillary.
- **Marine waters** support the California sea lion, northern sea lion, killer whale, harbor porpoise, Dall's porpoise, Minke whale, California gray whale, and numerous marine birds.

Threatened species

The state's threatened species list includes:

Western pond turtle
Oregon silverspot fritillary
Green sea turtle
Bald eagle
Ferruginous hawk
Pygmy rabbit

Possible candidates for the threatened list include the Giant Columbia River limpet, Great Columbia River spire snail, Chinquapin hairstreak, Larch mountain salamander, loggerhead sea turtle, common loon, and Townsend's big-eared bat.

WILDLIFE MANAGEMENT

With responsibility for the management of almost 500 species of fish and wildlife (not including invertebrates), the Washington Department of Wildlife (WDW) organizes its programs around eight large groups of species. The species listed as vulnerable in the previous section all fall into the agency's "nongame" category. The other categories are big game, migratory game, furbearers, upland game, and three groups of fishes (which are discussed in the fish and shellfish section of this report).

Washington's *big game* species include black-tailed deer, mule deer, white-tailed deer, Roosevelt elk, Rocky Mountain elk, black bear, cougar, mountain goat, bighorn sheep, moose, pronghorn antelope, grizzly bear, and caribou. There is no hunting season on the pronghorn antelope, and the grizzly bear and caribou are protected species. The ranges and habitats for these big game vary widely. Cougars, for example, inhabit forested areas throughout the state, and have a home range of 75 to 100 square miles — generally the same as its prey, which include deer, elk, mountain goats, and mountain sheep. Moose, on the other hand, live in the far northeastern part of the state, and prefer marshes, ponds, lakes, and wetlands.

BIG GAME HUNTING

Species	Year	Estimated Population	Animals Taken
Black-tailed deer	1960	250,000	22,000
	1987	200,000	20,000
Mule deer	1960	150,000	12,000
	1987	135,000	12,000
White-tailed deer	1960	50,000	6,000
	1987	67,000	6,000
Elk	1960	50,000	8,000
	1987	57,000	8,000
Black bear	1960	30,000	9,000
	1987	19,000	1,000
Cougar	1960	600	40
	1987	1,500	60
Mountain goat	1960	10,000	270
	1987	7,500	140
Bighorn sheep	1960	35	0
	1987	700	8
Moose	1960	20	0
	1987	180	5

The *migratory game* category consists of approximately 40 species of birds including ducks, geese, swans, coot, snipe, band-tailed pigeon, and mourning dove. The breeding populations of waterfowl in the state have been increasing since 1970, and Washington now provides wintering habitat for approximately one million ducks, geese, and swans.

All of the species in the *furbearers* category have fur coats of commercial value. The distribution and abundance of furbearers is not well known, but they rely on riparian areas of lakes, streams, ponds, and wetlands. The Washington furbearers include opossum, beaver, muskrat, nutria, coyote, wolf, red fox, raccoon, marten, fisher, short-tailed weasel, mink, wolverine, badger, striped skunk, western spotted skunk, river otter, Canada lynx, and bobcat. The wolf, fisher, and wolverine are classified as endangered or protected species.

The *upland game* category comprises 21 species of grouse, quail, pheasant, partridge, rabbit, and others. These animals occupy a wide variety of habitats — everything from range land in eastern Washington to alpine meadows to Olympic Peninsula rainforests.

Rabbit and ruffed grouse are the most abundant and widely distributed upland game species in western Washington, and chukar, rabbit, and ring-necked pheasant are the most common and widely distributed species in eastern Washington. Grouse, rabbit, and hare are native Washington species, but most of the other upland game species are not.

THREATS TO WILDLIFE

The issue is both simple and complex. The simple part is that any threat to wildlife habitat is a threat to wildlife. The complex parts are that human activities threaten habitats in a number of ways, and that each species responds to environmental changes in its own fashion. Since wildlife habitat consists of land and water, it follows that threats to these resources are also threats to wildlife.

The long list of human activities that result in habitat loss or disturbance — all of which are discussed in detail in the land and water sections of this report — includes:

- The conversion of land to urban or built-up uses.
- Timber management practices such as road-building, clear and partial cutting, and the conversion of old growth forests to second growth.
- Agricultural practices such as pesticide use and the grazing and overgrazing of range lands.
- Recreation use including campsite development and off-road vehicle activities.
- Hydrologic disruptions such as dam construction and withdrawals of water from lakes, streams, and rivers for other uses.

The opportunity to move to a new habitat in response to a loss or disturbance does not exist for many species. Some species are not capable of traveling the distance required, but a more important factor may be the carrying capacity of neighboring habitat, that is, the amount of wildlife that it can support. For some species, the fragmentation of habitat also is a consideration. Fragmentation occurs when part of a habitat is lost or altered, and the consequences can include the disruption of migration patterns, a reduced home range, and the potential for invasion of the habitat by other species, which results in the displacement of the native species.

LETHAL LITTER

➤ The Washington Environment 2010 Public Advisory Committee ranked litter as the lowest priority environmental threat of all those analyzed, but the committee did recognize the serious threat that litter poses to marine birds and mammals.

Discarded or lost fishing nets, fishing line, plastic debris, and plastic six-pack rings all entangle marine birds and mammals. The result is death by strangulation or drowning. Marine birds also mistake bits of plastic for food, and not only eat them but feed them to their young. The result is death by starvation or infection.

As far as these wildlife species are concerned, litter is more than an eyesore. ■

THE CONSERVATION RESERVE PROGRAM

The Soil Conservation Service and the Agricultural Stabilization and Conservation Service of the U.S. Department of Agriculture manage the Conservation Reserve Program (CRP), the goal of which is to convert highly erodible farmland to other uses — permanent grasses, trees, or wildlife habitat. The program was designed and developed to help farmers, but it also directly benefits wildlife by adding acres to the land that can serve as habitat.

As of April 1989, Washington farmers and ranchers had enrolled more than 850,000 acres in the program. The CRP contract requires farmers to keep their enrolled land out of commodity production and refrain from grazing it for 10 years. Most of this land is converted to grass and may return to production when the CRP contracts expire, but the Soil Conservation Service expects CRP to follow the soil bank experience of the early 1960s. Eighty percent of the land that originally went in to the soil bank remains there.

Taking cropland, even highly erodible cropland, out of production may seem to contradict the goal of maintaining high levels of agricultural output. CRP-eligible land, however, is the least productive of all cropland. It requires the highest inputs of fertilizer and management, and produces the lowest outputs. By taking this land out of production, a farmer receives an income for the 10 years of the contract, and can reallocate the resources of the farm to other more productive land. Often farmers find that their production remains at their pre-CRP levels, and that their net income increases.

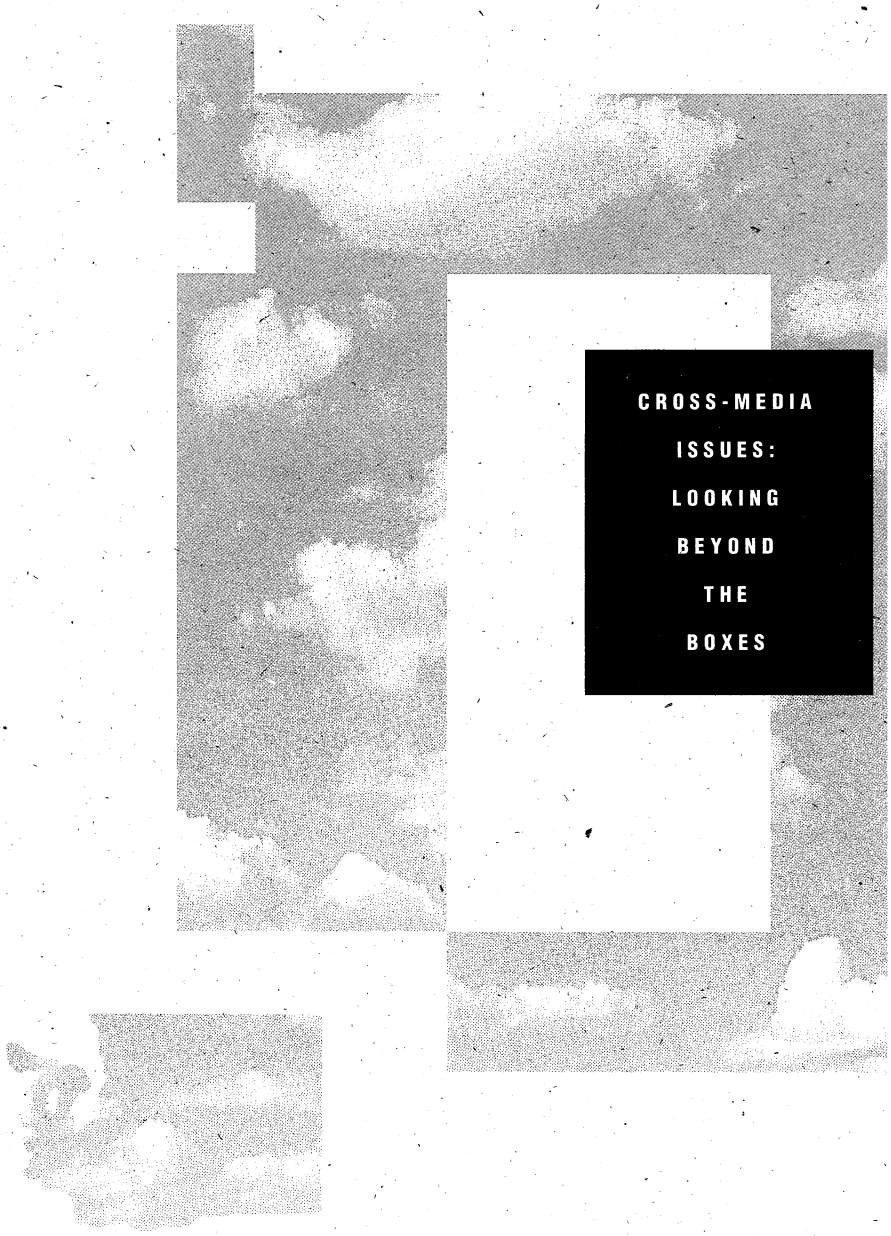
Both farmers and consumers are well-served by CRP, and many wildlife species also reap some benefits.

HABITAT AND SURVIVAL

The condition of Washington's wildlife varies by species. The state enjoys vibrant and abundant populations of many big game animals, migratory waterfowl and other game and nongame species. On the other hand, 67 species are listed as sensitive, and the breeding populations of 11 species are likely to become extinct in Washington by the year 2010 despite wildlife management efforts. The condition of wildlife species is inextricably linked to the condition of their habitats, and to a large extent their habitats depend on us. A wide range of human activities — agriculture, forestry, recreation, dam-building, and urbanization — pose a wide range of threats to wildlife habitats. As far as the wildlife are concerned, the benefits to humans from these activities are irrelevant. For some species the issues are abundance and range: how large will populations be, and how widespread? For other species the issue is survival.

"When you dip your hand into nature, you find that everything is connected to everything else."

John Muir



CROSS-MEDIA ISSUES: LOOKING BEYOND THE BOXES

SECTION 8

CROSS-MEDIA ISSUES: LOOKING BEYOND THE BOXES

Environmental laws, and the agencies and programs that we have created to implement them, have tried to sort environmental issues into tidy boxes: an air box, a water box, a land box, and so on. Washington Environment 2010, in evaluating and reporting on the state of the state's environment, used these boxes as a starting point. But the environment is more like a system than a series of separate pieces; environmental issues seldom fit neatly into a single box. Most of the threats analyzed by Washington Environment 2010 are "cross-media" threats, that is, they work through, or have potential impacts on, more than one environmental resource or pathway. Ambient air pollution, for example, primarily affects the air resource, but it also has impacts on water, land, fish, and wildlife. Those cross-media issues that are most difficult to associate closely with a single environmental resource are described briefly in this section of the report.

PESTICIDES

Pesticide contamination is a cross-media issue that recently has been in the foreground of public attention across the country and here in Washington. Pesticides — used by farmers, homeowners, and others to control pests and regulate plant growth — can have unintended harmful effects on human health and the environment if they occur in high enough levels in the air, in the water, in the food supply, or on the land.

The Washington Environment 2010 analysis of pesticides focused on the risks due to pesticide residues on foods, household use of pesticides, and aerial drift of pesticides. The human health and ecological risks associated with pesticides in water were analyzed separately, and were discussed in the water section of this report. Washington Environment 2010 did not assess the risks to pesticide applicators or to farm workers.

The evaluations of pesticide residue on food, household use, and aerial drift were based on incomplete information and could be greatly improved by strengthening research and monitoring efforts specific to Washington. Despite these limitations, the important findings of those analyses include the following:

- A review of sampling data indicates that a very small percentage of foods sampled in Washington has pesticide residues above those allowed by federal regulations; it is difficult to draw definitive

conclusions from this information about actual risks to consumers, however, without knowing more about the representativeness of the sampling procedures.

- An elaborate regulatory framework — intended to protect consumers from unacceptably high levels of pesticide residues in foods — is in place; there is disagreement, however, over the effectiveness of that framework.
- There are documented cases of sprayed pesticides drifting off-site and potentially affecting "nontarget" species — plants, people, and other animals. But the frequency and actual impacts of those episodes are not well documented.
- In general, little is known about the ecological impacts of pesticide use in Washington. Though there have been instances in which birds have been killed by unintended exposure to pesticides, the frequency of such mishaps is unknown, and the available information is not current.

➤ The Washington Environment 2010 Public Advisory Committee ranked the risks due to pesticides as a medium environmental priority for the state — in the third of five categories. The committee recognized the need for more information to resolve disagreements about the risks associated with pesticide use. The committee also expressed special concern about the use of pesticides in private homes and yards, which is widespread but not as closely regulated as commercial and agricultural use.

WASTE MANAGEMENT

Improper management of both hazardous and nonhazardous wastes can result in contaminated air, water, and land as well. Washington Environment 2010 looked at three waste management issues with potential cross-media impacts: regulated hazardous waste sites, uncontrolled hazardous waste sites, and nonhazardous waste sites.

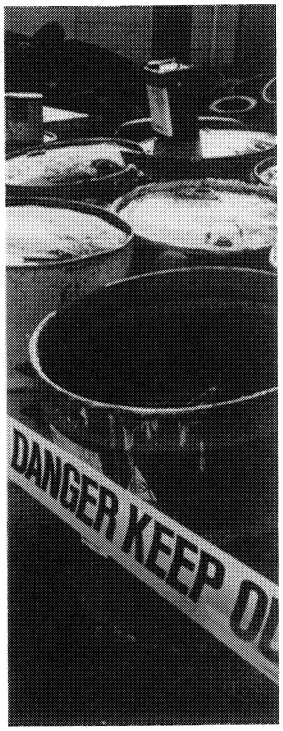
The primary concern about each of these threats is the contamination of ground water that is (or could be) used for drinking, or that can migrate into lakes and streams and harm fish, wildlife, and other living things. There are other concerns, however; chemicals from these facilities also can vaporize into the air, or contaminate nearby soils.

- *Regulated hazardous waste sites* are facilities that currently generate, treat, store, or dispose of hazardous waste according to federal and state regulations. Hazardous waste experts in the state believe that the risks to human health and the environment posed by these facilities are low relative to other threats analyzed by Washington Environment 2010, primarily because the sites are reasonably well-controlled. There is some concern, however, about facilities that

generate waste — particularly small-quantity generators, such as dry cleaners and printers, that produce only small amounts of waste annually. Mismanagement of hazardous waste by these types of facilities can cause releases into the environment that eventually require clean-up. These generators are numerous (there are more than 3,000 in the state) and not as closely regulated as other types of hazardous waste facilities.

■ *Uncontrolled hazardous waste sites* are abandoned hazardous waste dumps, sites where illegal dumping of hazardous waste has occurred, or operating waste facilities where a spill has occurred or where the remnants of historically poor waste management remain. Contamination from these sites (there are more than 700 known sites in Washington) can pose significant risks to people and other living things close by; statewide, however, the risks to human health and the environment are moderate to low, since the contamination usually does not travel far from the sites, and since most sites are located away from heavily populated areas.

Uncontrolled hazardous waste sites are the target of a federal clean-up program — the so-called Superfund program — that is among the best-financed environmental programs in the country. The state administers a similar though smaller-scale clean-up program under the Model Toxics Control Act.



■ Municipal landfills, trash incinerators, and other facilities that ostensibly deal only with waste that is not hazardous are known as *nonhazardous waste sites*. Though these facilities are not intended to manage hazardous wastes, such wastes sometimes are found at them, so that they can pose risks similar to those presented by uncontrolled hazardous waste sites. In fact, a number of old landfills in Washington state have been classified as uncontrolled hazardous waste sites that will require clean-up. In addition, methane gas can accumulate at landfills, raising the risk of fire or explosion.

The Washington Environment 2010 analysis, which focused on municipal landfills, indicates that the risks to human health and the environment posed by such facilities are typically low relative to others analyzed by the project. Leaks from landfills, similar to those from hazardous waste sites, usually stay near the facilities themselves, so that exposure to the contamination is limited. Also, federal and state regulations that restrict disposal at landfills to certain types of waste, and that establish strict standards for the design and operation of new landfills, are expected to lower the risks.

➤ The Washington Environment 2010 Public Advisory Committee believes that, among the three waste-related threats, uncontrolled hazardous waste sites, in part because they are largely uncontrolled, present the greatest risk to human health and the environment. The committee believes that federal and state clean-up programs,

combined with federal and state regulations governing the current management of hazardous wastes, should result in lower risks in the future. The committee, nevertheless, rated the uncontrolled sites as a relatively high priority in the state (in the second of five categories) out of a recognition that sites that have already been identified often are extremely difficult to remedy, and out of a fear that many sites have yet to be discovered.

➤ Both regulated hazardous waste sites and nonhazardous waste sites were rated as lower priorities than uncontrolled hazardous waste sites (in the third of five categories) because they are subject to tighter regulations. The Public Advisory Committee did, however, express concern about limitations on the state's *capacity* for future disposal of hazardous and nonhazardous wastes. Insufficient in-state disposal capacity, they noted, could result in greater risks to human health and the environment by increasing the need to transport wastes great distances, and by inadvertently encouraging illegal dumping.

MATERIALS STORAGE

Materials storage — the storage of chemicals in tanks located above or under the ground — is another cross-media environmental threat analyzed by Washington Environment 2010. Leaks from storage tanks, like those from waste sites, can contaminate existing or potential drinking water supplies, or seep into lakes and streams where they can threaten fish and wildlife. Vapors from leaked chemicals also can migrate into sewer systems or private homes, contaminating the air and introducing the risk of fire and explosion.

The Washington Environment 2010 analysis focused on underground tanks containing gasoline or other petroleum products, since such tanks constitute over 95 percent of all underground storage tanks in the state. The potential for people to be exposed to leaks from these tanks is significant; of the roughly 45,000 tanks in the state, about 11 percent (close to 5,000 tanks) could be leaking, according to the best estimates available. The Washington Environment 2010 analysis, however, indicates that the risks to human health due to leaking tanks are low, relative to other threats analyzed by the project, since people can taste gasoline in water and smell it in air (and therefore avoid drinking or breathing it) before it is likely to cause serious problems. The risks to the environment are also believed to be relatively lower, since leaks generally do not migrate far from their sources without being detected and contained.

➤ In light of these findings, and in light of new federal and state regulations requiring the monitoring of existing tanks and the careful installation of new ones, the Public Advisory Committee placed storage tanks in the fifth, or lowest, priority category. Nonetheless, the committee noted its concern for the possible loss of existing and potential ground water supplies due to leaking tanks.

ACCIDENTAL RELEASES

The recent oil spill in Alaska's Prince William Sound, and a similar though smaller accident last year near Grays Harbor, are examples of another cross-media environmental threat: *sudden and accidental releases.* Petroleum products and other chemicals are frequently released accidentally into the air or water, or onto the land, during transport, production, storage, or use. Most of these spills are small; but some have catastrophic consequences. Washington Environment 2010 estimates that roughly 3,000 such accidents occur annually in the state. Of those, about two percent (50 accidents) result in human injury, while three percent or so (90 accidents) result in environmental damages of some kind. The vast majority of accidental spills are small, and have only minor impacts on human health and ecological systems. Occasionally, however, the impacts can be significant, including injury or death to humans, birds, fish, marine mammals, and other wildlife.

Since 1983, there have been four major oil spills in Washington (one occurs every one to three years, on average); each spill killed approximately 2,000 shore birds except for the Nestucca *spill in 1988, which killed between 10,000 and 55,000.*

Since 1983, there have been four major oil spills in Washington (one occurs every one to three years, on average); each spill killed approximately 2,000 shore birds except for the *Nestucca* spill in 1988, which killed between 10,000 and 55,000.

➤ The Public Advisory Committee, however, rated sudden and accidental releases in the fourth of five categories due to the relatively low probability of such catastrophic effects.

RADIOACTIVE RELEASES

Radioactive releases are potentially harmful leaks into the air or water, or onto the land, from such sources as naval nuclear facilities, commercial nuclear power plants, weapons production facilities, uranium mill tailings disposal sites, academic research facilities, and nuclear medicine facilities. The Washington Environment 2010 analysis, which assumes the continuance of existing and planned regulatory controls over these sources, indicates that, barring an accident, the risks they pose to human health and the environment are lower relative to those posed by other threats analyzed. In fact, current exposures to radioactivity from these sources is much lower than exposure to naturally-occurring radioactivity.

The large volume of radioactive wastes stored at Hanford poses a significant long-term risk unless it is disposed of satisfactorily. The technical and regulatory means to prevent future harm are generally available; funding to implement these controls, however, is still being sought.

➤ In view of these findings, the Washington Environment 2010 Public Advisory Committee placed radioactive releases in the fourth of five priority categories.

LITTER

➤ Litter — including marine and beach debris as well as roadside litter — was placed in the lowest of the five priority categories. This cross-media threat is considered to be mostly aesthetic in nature, except for marine litter, which can seriously threaten birds, mammals, and other marine life. Litter poses much lower risks to human health and ecosystems relative to other threats analyzed by Washington Environment 2010.

"We should be careful
to get out of an experience
only the wisdom that is in it
– and stop there,
lest we be like the cat
that sits down on the
hot stove lid.
She will never sit down
on a hot stove lid again –
and that is well; but also
she will never sit down
on a cold one any more."

Mark Twain

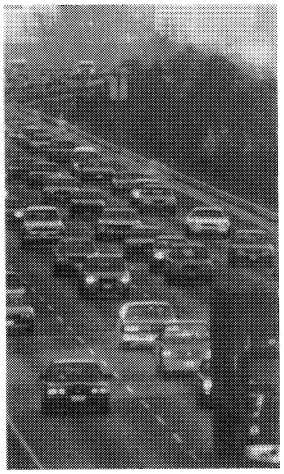
OBSERVATIONS AND CONCLUSIONS

SECTION 9

OBSERVATIONS AND CONCLUSIONS: LOOKING BACK AND AHEAD

The state of Washington is, in fact, at an environmental crossroads. The population expansion and the economic growth that we are experiencing and that is projected to continue — and the increased demand for energy, water, transportation, housing, and other goods and services that will accompany that expansion — places significant additional burdens on our environmental resources. Many of the environmental threats analyzed by Washington Environment 2010 will intensify as the sources of those threats increase. Ambient air pollution is an illustrative case-in-point. The quality of our air is already showing the strains of growth; recent improvements in air quality are being offset or reversed by new sources of pollution.

Our land and water resources will be stretched further as well. The pressure to develop forest lands, agricultural lands, and open spaces will intensify. The increased demand for out-of-stream uses of water — for drinking supplies or industrial processes, for example — will jeopardize the availability of adequate water for in-stream uses such as recreation and fish and wildlife habitat.



The additional stress on our environmental resources threatens our health, our uniquely diverse environment, our economic vibrancy, and our small-town quality-of-life. We need to anticipate and manage (rather than ignore or resist) these burdens with imagination, purposefulness, unity, and foresight.

Getting to where we want to be will require hard choices — choices about how to manage our lands, our water, and our other natural resources in a way that preserves the long-term viability and diversity of those resources, and the opportunities that they provide.

COMMON THEMES

Several observations and common themes, culled from Washington Environment 2010's first year, provide some useful food for thought as we approach these hard choices.

■ **Economic growth and environmental preservation are interdependent, not mutually exclusive, interests.** These interests commonly are perceived as diametrically opposed and mutually exclusive. But Washington Environment 2010 recognizes that is not the case. In the short-term, advancements in environmental protection often involve setbacks for economic development, and vice versa. In the longer-term, however, the two depend upon each other. The principle of

sustained development, widely discussed in the context of developing nations, applies to this country — and to the state of Washington — as well. If we do not sustain our environmental resources, eventually our economy will falter. Conversely, if we do not sustain a healthy economy, we will lose the ability and the freedom to protect, preserve, and enhance our natural resources.

Policy-makers and citizens need to think more broadly and more long-term about the relationship between the environment and the economy; economic planning and environmental planning need to be closely coordinated and integrated.

- **Land-use planning, energy planning, and environmental management need to be closely related as well, since decisions we make about how to use our lands and how to meet our demand for energy have profound impacts on our natural resources, and, consequently, the long-term economic and environmental well-being of the state.** Land-use planning and energy planning need to be comprehensive and forward-looking, and they need to consider the different long-term environmental ramifications associated with different land-use and energy choices.

- **The institutional barriers that discourage a holistic approach to environmental management need to be broken down, or at least lowered.** Washington Environment 2010 brought together groups of people from inside and outside of government with sometimes widely divergent views on environmental issues. This type of interaction of differing perspectives, and the creativity, camaraderie, and cross-fertilization of ideas and understanding that it generates, could serve as a model for future priority-setting efforts.

- **Prevention is usually superior to treatment as a mode of environmental management.** In most cases, the prevention of a potential environmental threat is easier, more effective, and less costly than treatment of an existing problem. Ground water contamination is a perfect example. Once ground water has been contaminated from a waste facility or some other source, restoration of that ground water to levels that are safe for drinking and other purposes is time-consuming and costly at best. Preventing ground water from becoming contaminated in the first place, by better control of the sources of that contamination, is a markedly better approach.

- **Comparative risk analysis is a potentially useful approach to setting priorities among environmental issues.** This approach, despite its limitations, is a powerful tool for organizing our thinking about environmental problems and priorities. It provides us with a useful framework for comparing a wide spectrum of issues, and encourages us to think systematically and holistically about those issues.

Several general conclusions about our environmental resources and the threats to those resources emerge from the Washington Environment 2010 analysis:

■ **The public's perception of the seriousness of an environmental threat, and the level of media attention a threat receives, do not always correspond to the actual level of risk, as determined by analysis and expert judgment.** Ambient air pollution, for example, is not commonly perceived as a more serious risk to human health and theenvironment than uncontrolled hazardous waste sites. Reconciling such divergences between perception and reality is one of the major challenges that face the state's policy-makers.

■ **Typically less visible, more diffuse, and more numerous sources of pollution, called "nonpoint" sources, are emerging as the predominant source of some of the state's most serious environmental threats.** Since environmental protection began full-force in the 1970s, the primary focus has been on the larger, more obvious sources of pollution — big factories with tall smokestacks and wide pipes, spewing pollutants into the air and water. The Washington Environment 2010 analysis, however, suggests this focus is, or should be, expanding to include nonpoint sources, which are more numerous, more diffuse, often less visible, and typically more difficult to control than the classic "point" sources.

In air pollution, for example, sources such as woodstoves and cars are replacing pulp mills and aluminum smelters as the primary sources of concern. In water pollution, nonpoint sources such as the runoff from farms and highways are considered cumulatively to be at least as serious a concern as direct discharges from big industrial sources.

This realization has important implications for future efforts to control environment threats. Since nonpoint sources are so dispersed, numerous, and difficult to pinpoint and harness, they are considerably more difficult to regulate. Since controlling sources such as these often requires behavioral or cultural changes rather than technological fixes, different approaches to control — approaches, for example, that establish economic incentives for changing behaviors or procedures — might be necessary.

■ **There is plenty of room for improvement in environmental data management.** The Washington Environment 2010 analysis has been just as useful in identifying what we do *not* know about the state of the environment as it has been in identifying what we *do* know. In many cases, important environmental data either are not collected, or are not collected and assembled in a way that is useful to analysts and decision-makers. This is more the case for data on risks to ecological systems than it is for data on human health risks; data oneconomic risks are especially weak.

The Washington Environment 2010 analysis, by exposing these weaknesses and gaps, will help the state focus its data-gathering and management efforts in the future. A number of steps already have been taken since the completion of the analysis to begin to address this critical issue.

■ **Toxic chemicals in the environment represent another formidable challenge for environmental scientists and policy-makers in the coming decades.** Toxic chemicals are pervasive, subtle, still somewhat mysterious, and often very difficult to detect and control. Many of the environmental threats analyzed by Washington Environment 2010 involve toxic chemicals; toxics threaten virtually all of the state's environmental resources. Unfortunately, there is still a great deal that we don't know about many toxic pollutants — how to detect them, the levels to which humans and the environment are exposed, and the actual effects of those exposures, for example.

■ **In the environment, as John Muir observed, "everything is connected to everything else." Environmental policy-makers and planners need to look at the environment as a whole.** Environmental laws — and consequently the agencies and programs that have been established to administer them — tend to divide the environment into boxes: air, land, water, and so on. But environmental problems don't fit into tidy boxes. To recognize the true magnitude and interconnectedness of environmental threats, to compare and set priorities among them, and to design solutions that do not just result in the transferral of problems from one environmental medium to another, we need to look beyond the boxes, and approach environmental planning holistically. ■

A CALL TO ARMS

If there is a single overriding message arising from Washington Environment 2010's first year, it is this: Now, more than ever, individuals need to get involved in environmental protection. Many of the environmental threats analyzed in Washington Environment 2010 can be traced, to some degree, to *individual* choices: whether to drive a car, take a bus, or ride a bicycle; whether to burn wood to heat a home or use a cleaner fuel; whether or not to recycle cans, bottles, newspapers, and other wastes; whether to pour used oil down a storm drain or bring it to a recycling center. Poor choices by individuals harm the environment; better choices can help it.

This state of the environment report, by providing useful information on which to base decisions, represents an important first step toward improved choice-making by individuals as well as public and private organizations. What is needed now is renewed commitment to an environmental ethic in the state of Washington — a new awareness of, sensitivity toward, and responsibility for, the impacts of individual choices on the environment. "Think globally, act locally," needs to be more than just a bumper-sticker slogan. It needs to be a way of life.

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SECTION 10

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