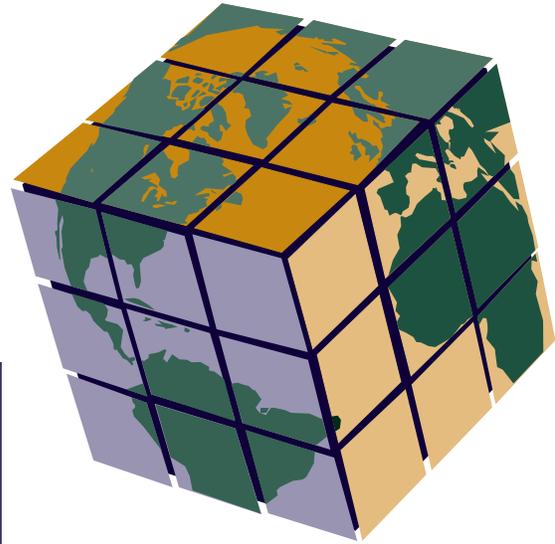


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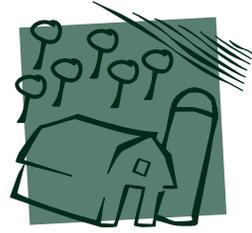
Natural Resources & the 21st Century: Where Are We Headed?



1997 STARKER LECTURES

College of Forestry

Natural Resources & the 21st Century: *Where Are We Headed?*



What lies before us
and what lies beyond
us is tiny compared to
what lies within us.

Henry David Thoreau

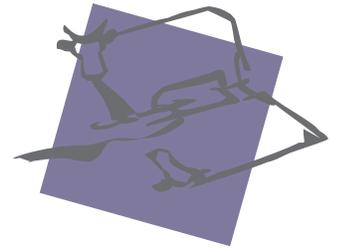
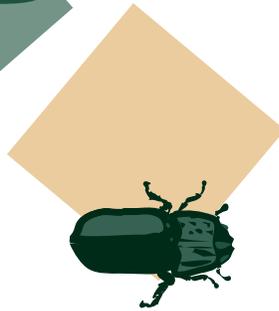
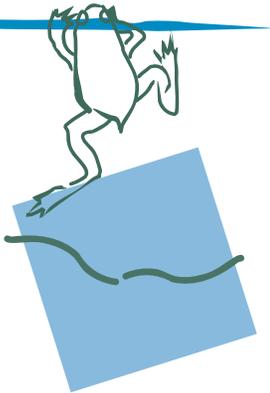


TABLE OF CONTENTS

DEDICATION	4
FOREWORD	5
THE FUTURE OF EDEN’S HEDGE: THE FORESTS OF THE WILLAMETTE VALLEY BASIN IN THE 21ST CENTURY Robert Liberty	6
PACIFIC SPIRIT—THE FOREST REBORN Patrick Moore	36
FISH HABITAT IN THE INTERMOUNTAIN WEST Don Chapman	63
BUZZWORDS, BUZZSAWS, AND BUZZARDS: REFINING DIRECTIONS FOR THE 21ST CENTURY Fred Bunnell	76

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Compiled by Bo Shelby and Sandie Arbogast

DEDICATION



The Starker Lecture Series is sponsored by the Starker family and dedicated to the memory of T.J. and Bruce Starker. As leaders of modern forest management, T.J. and Bruce Starker were visionaries for sustainable forestry in Oregon.

T.J. Starker

Thurman, known to all as T.J., was born in Kansas and lived his youth in Burlington, Iowa. He moved with his family to Portland in 1907 and began working in and studying forestry, graduating in the first class of foresters from Oregon Agricultural College in 1910. He then studied 2 years for an M.S. degree in forestry at the University of Michigan and returned to Oregon to work for the USDA Forest Service. Subsequent employment with the forest products industry and a variety of summer jobs, while he was teaching forestry at O.A.C./O.S.C., gave T.J. broad and thorough experience in all aspects of forestry.

T.J. began purchasing second-growth Douglas-fir land in 1936—the beginnings of Starker Forests. Through his work experiences and teaching forest management, T.J. has had a major influence on sound forestry and community development in Oregon.



Bruce Starker

Bruce Starker studied for a forestry degree from O.S.C. in 1940 and an M.S. in forestry in 1941. After service with the Coast Guard, Bruce joined his father, T.J., in acquiring and managing Oregon forest land, always with an eye for sound reforestation, management, and conservation for multiple benefits and values. He worked with university, state, and federal forestry agencies, as well as with private industry, to advance reforestation, management, and equitable taxation to encourage private forest management. Bruce continued the family tradition of active community service in many ways, including civic activities, regional forestry work, and contributing to writing the Oregon Forest Practices Act.

With advances in knowledge, technology, and public environmental issues, forestry practices in the Starker Forests have changed, but the constant value of tending the land remains unchanged. The sound, progressive forestry and community spirit of T.J. and Bruce Starker continue today.

We, at Oregon State University, College of Forestry, family and friends, are pleased to be honored with this lecture series.

FOREWORD

Natural Resources are a crucial part of our world. It is difficult to imagine the next century independent of these resources, but predicting the future is always a risky business.

This year's Starker Lecture theme—"Natural Resources & the Twenty-first Century: *Where are we headed?*"—offers a unique attempt to look at the next hundred years. Our speakers come from a variety of backgrounds and offer diverse thoughts about important natural resource issues.

Robert Liberty is the Executive Director of 1000 Friends of Oregon, a conservation group particularly interested in Oregon's land base. He writes about the distribution of human settlement on the landscapes and the way that urbanization has affected forest and farm land.

Patrick Moore is an ecologist and author, a co-founder of Greenpeace, and founder of Greenspirit. He writes about biodiversity and the effects of forest uses and forest policy, including the role of managed forests in the biodiversity equation.

Don Chapman is a fish biologist and president of BioAnalysts, Inc., a Boise, Idaho, consulting firm. He writes about the quality of fish habitat and the way it is affected by land husbandry, particularly by forestry and grazing practices in the Intermountain West.

Fred Bunnell is a biologist and Director of the Centre for Applied Conservation Biology at the University of British Columbia. He writes about the roots of environmental "buzzwords" and the difficult challenges of actually managing for ideals such as biodiversity and natural disturbance regimes.

Bo Shelby
Professor of Forest Resources



The Future of Eden's Hedge: The Forests of the Willamette Valley Basin in the 21st Century



Robert Liberty
Executive Director,
1000 Friends of Oregon
Portland, Oregon

The Willamette Valley and its Forests: Then and Now

Historical accounts of the Valley and its forests

The timber and appearance of the country is much as before described. the up lands are covered almost entirely with a heavy growth of fir of several species like those described in the neighborhood of Fort Clatsop.... we had a view of Mount St. Helens and Mount Hood. the 1st is the most noble looking object of its kind in nature. its figure is a regular cone. both these mountains are perfectly covered with snow; at least the parts of them which are visible. the highlands in this valley are rolling tho' by no means too steep for cultivation they are generally fertile of a dark rich loam and tolerably free of stone. this valley is terminated on its lower side

by the mountainous country which borders the coast, and above by the range of mountains which pass the Columbia between the great falls and rapids of the Columbia river. it is about 70 miles wide on a direct line and it's length I believe to be very extensive tho' how far I cannot determine. this valley would be competent to the maintenance of 40 or 50 thousand souls if properly cultivated and is indeed the only desirable situation for a settlement which I have seen on the West side of the Rocky mountains.

Meriwether Lewis, Sunday, March 30, 1806

The favorable impression the Lewis and Clark expedition had of the Willamette Valley was echoed and amplified by later travelers.

It is the concurrent testimony of the many, who have explored the country, both about DeFuca and the Columbia, that the top soil is a deep black mould; that the forests are heavy and extensive; and the trees are of vast dimensions; and vegetation generally is luxuriant to a degree unknown in any other part of America; and we can add, that there are physical causes to render the climate the most healthful in the world.

Kelley 1830



No wonder the Willamette Valley came to be known as “the Eden at the end of the Oregon Trail.”

If the valley floor was an earthly Garden of Eden, then the dense forests of fir, spruce, hemlock, and cedar, which rimmed the valley, were the awesome hedge around the garden. As did Lewis and Clark, the 19th century white settlers found the forests overpowering and sometimes alien. But it was in the shadow of the forests that the settlers built their cabins, barns, and fences, because the forests provided the materials.

The national and local economic importance of the Willamette Valley's forests

The larger world needed the Valley's wood as well. The potential economic value of Oregon's big trees to the white settlers was evident as long ago as 1788, when British Captain Meares loaded his ship with spars made from the trees of Vancouver Island, for sale in China.

Since 1919, when it ranked third (Clark 1927), Oregon has been consistently among the top lumber-producing states. The forests from the 10 counties in the Willamette Valley have been a very important part of the Oregon economy, and a very important part of the nation's wood supply.

According to 1970 data, the United States had a total of 9.55 million acres of forest land with a cubic foot site index of 165 or greater (USDA Forest Service 1974). Of that total, 1.45 million acres, one-seventh of the national total, were located in the 13 Willamette Valley and North Coast counties of Oregon (Jacobs 1978; Mei 1979).

In 1995, total softwood production in the United States was 31.9 billion board feet; Oregon's share was 4.95 billion, more than 15 percent of total U.S. production (Warren 1997). The Willamette Valley counties' share of state timber harvests in 1995 was about 40 percent of the state's total; almost 90 percent of that production came from private lands (Bourhill n.d.). A little extrapolation from the second figure leads to the estimate that about 5 percent of the nation's total softwood production now comes from the 10 Willamette Valley counties.

Of course, the Valley's forests are much more than just raw material. They also provide habitat for wildlife, a source of the water in our streams and rivers, and a place for recreation and spiritual renewal.

Such Oregon writers as Robin Cody and John Daniels have provided a new perspective on the forests rimming the Valley, thus capturing the struggle between their industrial uses and their natural uses. The long-

running, rancorous debate over whether federal, state, and private forests should be producing more salmon and owls and less wood fiber, or vice versa, is now part of the Oregon political tradition.

While this debate has raged, all of the antagonists could lift their eyes up from the negotiating table or their computer screens to see, ringing the horizon from east to south to west, the dark blue hedge around our Garden of Eden. No matter what side they were on, none of the antagonists doubted that the forest would be there. But the issue for the 21st century is not going to be how the Valley's forests are managed, but whether or not the forest will continue to exist as a unified, coherent part of the landscape around the increasingly crowded residents of this Garden of Eden.

Does this seem far-fetched? Let's consider the numbers.

Trends in Population Growth and Land Consumption in the Willamette Valley Counties

Population trends

Today about 2.3 million people—about 70 percent of all Oregonians—live in the Willamette Valley Basin. The Valley counties are attracting about 70 percent of the state's population growth (Wineberg 1996). According to the State Economist, between 1995 and 2040 the population of the Willamette Valley is expected to increase by 1.5 million persons (Office of Economic Analysis 1997). That is the equivalent of building 30 new cities the size of Corvallis, or 12 new cities the size of Eugene, or adding a metropolitan area the size of Portland and another the size of Salem in just 45 years. More than a half-million people will live in Lane County, and three-quarters of a million will live in Washington County.

To date, population growth in the Valley has been expressed as three different patterns of development: (1) the growth of cities, big and small, (2) the spread of rural residential area, and (3) the construction of individual homes on farm and forest lands. If they continue in their present form and intensity, all three patterns of development threaten the forest hedge around our Garden of Eden.

Urbanization in the Valley

Satellite image analysis has shown that the urbanized areas of the Valley expanded from 240,000 acres in 1970 to 460,000 acres in 1990 (Oregon Progress Board 1994). At that rate, in the next 15 years, urbanization will claim another 220,000 acres.

According to the USDA Forest Service, during the period from 1971–1974 to 1982, 63,000 acres of nonfederal primary forest in western Oregon were lost to other uses. During the same period, urban land area increased by 45,000 acres and the low-density urban area increased by 81,000 acres; this is approximately 8,600 acres per year (Gedney and Hiserote 1989). Annual forest land conversion rates for select counties during that period were 514 acres per year for Clackamas and 1,321 acres per year for Lane (Gedney and Hiserote 1989).

The *National Resources Inventory*, prepared by the USDA Natural Resources Conservation Service (1995), has produced statistics on land conversions between 1982 and 1992 by hydrologic region. In the Willamette and Lower Columbia river basins, between 1982 and 1992, 30,400 acres of forest land were converted to urban and rural residential development. Almost all of that was prime forest land.

If we continue to consume forest land at the same rate per capita population growth as we did during the decade from 1982 to 1992, then between 1995 and 2040 we will lose 175,000 acres of forest land to urbanization and rural residential development. This acreage is equal to a band of land, 4 miles wide, running from Portland to Corvallis.

Rural residential sprawl

Urbanization is not the only, and probably not the major, threat to the Valley's forest lands. The spread of low-density rural residential development and the proliferation of large-lot homesites are equally dangerous. These phenomena are similar, but not identical, and require separate discussion.

Rural residential areas are places outside cities and urban growth boundaries where commercial farming and forestry have given way to large-lot residential uses or strip commercial development. The typical range of density in these areas is from 1 to 10 acres per house.

During the first half of the 1980s, Oregon's land use planning program required counties to identify areas of preexisting rural development, which are classified as "developed" or "committed lands." They are also called "exception areas." In order for land to qualify for an "exception" to statewide planning Goal 4 (Forest Lands) and Goal 3 (Agricultural Lands), the landowner or the county had to demonstrate that development on that property, or nearby, made forestry or farming "impracticable." (This is a lawyer's fancy substitute for "impractical.")

Statewide there are about 800,000 acres of these exception lands—an area nearly equal to all the land inside all urban growth boundaries in Oregon; in the Willamette Valley in 1986, 290,000 acres of exception areas were zoned for development, outside urban growth boundaries (Oregon Department of Land Conservation and Development 1986). That is more land than is inside the Portland and Corvallis metropolitan urban growth boundaries, combined. Most of this land, just under 270,000 acres, is zoned for rural residential development; the remainder is zoned for commercial and industrial uses.

Much of this land is already developed, yet a great deal of it is only lightly developed. Some of this land is still in commercial forest and farm production, even though that use contradicts the conclusion that forestry and farming are “impracticable.” Many of the new houses now being built in rural areas are located in the exception areas zoned for this purpose more than a decade ago.

The increase in density in these areas in Washington County has been mapped and measured by 1000 Friends of Oregon. The density in Washington County’s rural residential zones increased from 8.5 acres per house in 1975 to 5.7 acres per house in 1994; this represents a 50 percent increase in density in 19 years (Boutard 1994).

The amount of rural residential land in the Willamette Valley is not stable. Each year in Oregon, counties rezone additional forest and farm lands for rural residential development on the grounds that new development on those lands, or near them, makes them unusable for forestry or farming.

Statewide (the only readily available statistics), between 1987 and 1995, 3,637 acres (net) of land were rezoned from forest use zones to rural residential zones. Another 257 acres of forest land were rezoned for rural commercial, or industrial uses, i.e., “exceptions” (Oregon Department of Land Conservation and Development 1997). Together these represent rezoning of 735 acres of forest land per year.

Rural homesite development

Just as disturbing as the trends in urbanization and rural sprawl is the steady proliferation of homes and homesites in forest zones. In the 7 years beginning in 1990 and ending in 1996, the 10 counties of the Willamette River Valley approved 1,832 new, permanent homes in their forest zones (Oregon Department of Land Conservation and Development 1997). Clackamas County alone approved 569 of these new homes. Lane County approved 429. In contrast, Washington County, the state’s most rapidly growing coun-

ty, approved only 53 new homes in its forest zones during those 7 years. Although this performance in the Willamette Valley was far better than the appalling 2,248 new homes approved in Douglas, Jackson, and Josephine counties during the same period, it still represents a very rapid proliferation of homes in the middle of some of Oregon's best forest lands (Oregon Department of Land Conservation and Development 1997).

Because of our concern about the cumulative effect of these approvals on people in the business of growing trees, livestock, and crops, 1000 Friends of Oregon commissioned a map to show rural zoning and housing density in the 10 Willamette Valley counties. In 1990, virtually all of the Willamette Valley floor and much of the timbered foothills already had densities of more than one house per 80 acres. A large share of forest zones in Clackamas, Multnomah, and Columbia counties, which have highly productive forest lands, had a density of more than one house for every 40 acres.

Other maps we have prepared show the density in Washington County's forest zone increasing from 316 acres per house in 1975 to 240 acres per house in 1994, although the houses were much less evenly distributed in the forest zones than in the farm zones (Boutard 1994). Yamhill County's Agriculture-Forestry Zone, despite its name, represents almost entirely forested lands in the Coast Range foothills and along streams. In that zone, the density increased from one house for every 118 acres to one house for every 65 acres between 1975 and 1993 (1000 Friends of Oregon 1996).

It would be nice to imagine that the persons living in the new houses in the woods were engaged in forest management, and that small parcels were benefiting from intensive management. Unfortunately, despite superb management by a minority of these landowners, research has shown that most owners of small parcels, resident or nonresident, are not interested, or engaged, in forestry.

A 1974 survey of nonindustrial private forest (NIPF) landowner attitudes in Lane County revealed that only 15 percent listed timber production as their primary goal, and less than 5 percent indicated any interest in investing in forest management (Martin 1974). With respect to management practices, the study found:

Owners who identified timber production as a goal for their lands did not necessarily intend to practice silvicultural treatments. Many owners considered the "let it grow" method as a technique for timber production. Only...15 percent of respondents...had at least a fair knowledge of timber management practices.

A 1985 survey of NIPF landowners in Linn, Benton, Lane, and Lincoln counties revealed that, among those persons owning 20 acres or less, 42 percent listed “peace and solitude” as their primary reason for owning forest lands; in contrast, only 2 percent of the owners of 120 acres or more listed this as their primary reason for owning forest land (Oregon Department of Forestry 1985). Not surprisingly, these differences in attitude are reflected in differences in behavior.

The 1989 Oregon Legislature commissioned a study of counties’ implementation of the forest and farmland conservation elements of the planning program. Among other things, the research examined just how much management was undertaken by persons who requested permission to build a house, in order to carry out forest management. The research combined survey information with ground inspections and a review of forest operations reported pursuant to the Forest Practices Act (FPA). The study (Pacific Meridian Resources 1991) concluded:

- Whereas some private forest landowners are interested in harvesting timber, many others regard harvest to be incompatible with their reasons for owning forest land.
- The highest incidence of forest management is done by landowners with no new dwellings. Overall, receiving a dwelling approval appears to have essentially no effect to cause landowners to engage in forest management on their lands.
- About 33 percent of forest operations which received approval for a dwelling between 1985 and 1987 were *not* being managed by the landowner for timber production in 1990 [even though forest management was a condition of approval of the dwelling or land divisions].

These large-lot forest homesites may not change the landscape very much, but this research shows that the creation of these new small parcels and the construction of new houses are taking most of these forest lands out of production, just as surely as though they had been developed as a subdivision.

Consequences of forest land loss

The loss of the Willamette Valley’s forest lands to urbanization, to rural residential sprawl, and to forest homesite development is going to hurt the forest products industry. In addition to the direct conversion of the forest land base to urban or rural residential uses, the increases in residential density in and near commercial harvest lands are going to constrain the types of forest management that can be practiced on nearby lands.

Commercial wood fiber production, similar to farming, is often incompatible with residential uses (Miller and Rose 1983). The residents of forested areas often object to common forestry practices, such as the aerial application of pesticides or road building, which can contaminate the rural resident's drinking water; the burning of slash, which produces large quantities of smoke; or the use of clear-cutting as a harvest method (Atkinson 1984).

And then there is the problem of fire. Rural residents account for about one-fourth of all human-caused fires (Oregon Department of Forestry 1988). There is a direct and measurable relationship between housing density in forested areas and the risk of forest fires. Building one house on every 40 acres in a 160-acre area increases the risk of human-caused forest fires by 160 percent, compared to the same area *without* houses. At a density of one house on every 20 acres, the risk of human-caused forest fires increases by 370 percent (Oregon Department of Forestry 1993).

More than just timber production is going to suffer as a result of the conversion of forest lands. Homesite clearings in the forest introduce invasive pest species of plants and animals. Houses in the forest fragment the forests, and thereby disrupt big game migration patterns. Wildlife biologists who advise counties on their forest zones recommend limiting residential density to no more than one house for every 80–160 acres, in order to avoid disrupting elk and deer migration (Jackson County is an example; Oregon Land Conservation and Development Commission 1982). In addition, road networks for houses increase the amount of runoff and impervious surfaces.

Growth is threatening the private forests of the Willamette Valley Basin. Their utility, as well as their beauty, is at stake.

I believe the forests surrounding the Valley must be protected from growth, for both economic and noneconomic values. At the end of the 21st century, our grandchildren should be able to lift their eyes to the horizon and still see the dark blue hedge surrounding their Garden of Eden. For many of us the question is not *whether* to do it, but *how* to do it.

Maintaining the Hedge: Protecting the Forests of the Willamette Valley Rim through the 21st Century

Changes in Oregon's planning program

The place to begin to protect the Willamette Valley's private forest lands is with Oregon's statewide planning program. I will address how to respond to the threats to the forest land base in the reverse order I presented them: forest homesite development, rural residential development, and urbanization.

1. Decreasing the numbers of new houses and land divisions in forest zones.

The state of Oregon has said in many different ways and on many different occasions that the planning laws are essential for the protection of the lands needed for forestry. As long ago as 1982, the Forestry Program for Oregon (Oregon Department of Forestry 1982) stated that the Department of Forestry's objective was to "Promote and support land use planning as a critical tool in Oregon to conserve the forest land base...."

Today, this policy has the support of the forest industry, as well as the government. But, if protecting the forest land base is government policy and has the support of timber companies, why are so many homes being built on good forest land? Why has there been so much parcelization of forest land?

Because state law allows it. The Oregon Legislature has adopted good general policies for protecting the forest land base, but it has also authorized a lot of houses in the forests. In 1993, the Legislature threw out a decade of hard work in developing a coherent regulatory framework governing development and land divisions on forest lands, and substituted a completely different system of forest zoning, as part of House Bill 3661.

House Bill 3661 enacted an extremely complicated set of new rules governing when houses may be built in the forest. The legislative changes were part of a major revision of the land use laws, which were supposed to provide increased protection for the best forest and farm lands, while allowing more houses on less productive lands in central and eastern Oregon. But the results do not fit this stated intent.

In 1990, 1991, and 1992, before HB 3661 was passed, 669 new houses were approved in forest zones in Willamette Valley counties. In 1994, 1995, and 1996, after HB 3661 went into effect, a total of 767 dwellings were approved in Willamette Valley forest lands. In contrast, between 1994 and 1996, the number of homes approved in the six counties just east of the Cascades *decreased by two-thirds* over the earlier period. The result of HB 3661 has been an *increase* in dwellings in the parts of the state with the most productive forest lands (Oregon Department of Land Conservation and Development 1997).

House Bill 3661 also established two minimum parcel sizes of 80 and 160 acres for land divisions in forest zones (an improvement). But,

despite the masses of information showing that, as parcel sizes decline, the economic efficiency of forest management and actual management both decrease, the 1993 Legislature also allowed the Land Conservation and Development Commission (LCDC) to approve smaller minimum parcel sizes in forest zones.

The first two counties to seek LCDC's permission to authorize the creation of smaller parcels in their forest zones were counties with good forest lands—Douglas and Yamhill counties. In both cases, LCDC approved a 20-acre parcel size in parts of those counties' productive forests. Once again, the supposed justification for regional differences in land use standards incorporated into HB 3661 is being used to allow *more* divisions and *more* houses in counties with the most productive forest land.

Anyone who knows the history of HB 3661 should not be surprised by this outcome. This is the outcome sought by powerful officials in Lane County who have had a long-term agenda to allow large-scale rezoning of the private forest lands in that county for low-density development. Even as we speak, Lane County is proposing to open up a half-million acres of industrial timber land in the Cascade foothills to homesite development, where the county had previously chosen to prohibit it.

It is time to undo the mistakes of HB 3661 and to rethink our entire philosophy of forest land zoning. Are the forests of the Willamette Valley going to be conserved for forest uses—from timber production to wildlife habitat—or are they destined for residential development?

If forest lands are to be kept in forest use, then at some point there needs to be an end to building houses in the forests. At some point there must be an end to dividing up the forest land into smaller and smaller pieces.

If we aren't willing to make this commitment, then we aren't committed to forests or forestry in the 21st century. By the end of the 21st century, forestry could cease to be an industry and become a "lifestyle." Oregon State University's College of Forestry can replace its extension foresters with recreation specialists.

If Oregon's policy is going to be that its private forest lands are not worth maintaining to provide fiber for mills or habitat for wildlife, then what right do we have to ask the federal government to manage the national forests and the Bureau of Land Management lands for these uses? As essential first steps to maintaining the Willamette

Valley's forests for the long term, the 1999 Oregon Legislature needs to reform the standards governing "template dwellings" in forest zones and to eliminate the provision that allows counties to create smaller than 80-acre parcels.

2. Reducing the rezoning of forest lands to other uses.

It won't be enough to crack down on the parcelization and building of new houses in forest zones. We must also make it harder to rezone forest lands for rural residential use.

As I described previously, rezoning forest land to rural residential use requires what is known as a "developed" or "committed" exception to the state's forest land goal. The applicant for the rezoning must show that development on, or near, the forest land makes forest management "impracticable."

Today, these decisions about the practicality of forest management are usually based on reams of written materials and tax lot maps submitted by the applicant, rather than on site inspections or professional opinions of unbiased foresters.

Better information will make for better decisions. Before a rezoning is approved, decision-makers should either make a visit to the site, or be provided with ground-level and aerial photographs of the property and the surrounding area. In addition, decision-makers should be provided with the public records regarding forest use assessment of the property.

Under existing law, in order to qualify for the Western Oregon Forestland Assessment Program, the landowner must submit a statement, which he or she affirms to be true, to hold the land "for the predominant purpose of growing and harvesting trees of merchantable species." Obviously, these sworn statements are directly relevant to the claims made by landowners regarding the impracticality of forestry. But they are rarely, if ever, considered by local governments, even though the records are available at their own assessors' offices. Often the only information regarding the suitability of land for continued timber production is that provided by the applicant. Systematic review of these applications by unbiased experts provided by the Department of Forestry or by consulting foresters on retainer to county governments would make a difference.

Last, we need to research the consequences of the regular and significant rezoning of forest lands into exclusive farm use (EFU)

zones. A close review of these rezonings may reveal that they are made in order to avoid the reforestation requirements of the Forest Practices Act, and are often a prelude to more land divisions and houses under the different, and sometimes weaker, laws and rules governing EFU zones.

3. Increasing the efficiency of urban development.

In order to save forest lands (and farmland), our cities must grow more efficiently. The declining land efficiency of urban development is a national scandal.

Between 1970 and 1990, Chicago's metropolitan population grew by 4 percent, but its land area grew by 55 percent. Between 1970 and 1990, the Kansas City metropolitan area grew by 29 percent in population, but 110 percent in land area (*The Kansas City Star* 1995; Rusk 1996). Cleveland's metropolitan population shrunk, but its land area grew by 20 percent (Rusk 1996). In the Willamette Valley as a whole, between 1970 and 1990, the population grew by 30 percent, but the urbanized area grew by 91 percent (Oregon Progress Board 1994).

Today some cities in the Valley show signs of growing more efficiently than other American cities. Between 1980 and 1990, the population density in the Salem urbanized area *increased* by about 6 percent, making it significantly more dense than many cities of comparable size—e.g., Anchorage, one-half as dense, and Boise, 15 percent less dense (Rusk 1996).

The Portland metropolitan area is showing signs that it has begun to greatly increase the efficiency of its urban development. In 1960, the density of metropolitan Portland was 3,412 people per square mile, and the density of metropolitan Atlanta was 3,122 people per square mile (Rusk 1996). In 1990, the density of the Oregon part of the Portland metropolitan area rose to 3,734 people per square mile (Barney 1996), whereas Atlanta's had dropped to 1,898 people per square mile (Rusk 1996). In 1994, the Oregon portion of the Portland metropolitan area reached a density of 3,885 people per square mile (Barney 1996).

If the Atlanta metropolitan region had been able to grow during the 1980s as efficiently as the Portland, Oregon, metropolitan area has been able to grow in the early 1990s, Georgia would have saved 93,000 acres of rural land—pine forests, farm land, and rural homesites.

Between 1980 and 1994, the Oregon portion of the urbanized Portland metropolitan area increased by 25.4 percent in population and only 16.3 percent in land area—a ratio of about 1:0.64. That ratio is much better than the national average ratio for the 1980–1990 period, and vastly better than those of some other urban areas.

In the last year, 29 percent of all residential development inside the Portland metropolitan urban growth boundary has come from infill and redevelopment, in contrast to about 4 percent in the Cleveland metropolitan area (Metro 1997; H. Tregonning, personal communication). These results demonstrate the feasibility of Metro’s 2040 Plan to accommodate an additional 600,000 new residents inside the urban growth boundary in the Oregon portion of the metropolitan area (a 50 percent increase in population), while increasing the urban growth boundary by only 8 percent (18,600 acres).

How was this accomplished? Much of it was accomplished by *reducing* regulatory barriers to denser and more affordable housing. In the Portland metropolitan area, the average minimum residential lot size on vacant land in 1978 was 12,800 square feet. Because of Oregon’s land use laws, that minimum was reduced to an average of 8,280 square feet by 1982, thereby reducing the cost of the land for a home by \$7,000–\$10,000 in 1982 dollars (Greenfield 1982).

Between 1977 and 1982, the amount of land zoned for multifamily residential development in the Portland area almost quadrupled, from 7.6 percent to 27 percent of net buildable acreage. Overall, easing zoning restrictions allowed the maximum number of buildable units in the metropolitan area to increase from 129,000 to over 301,000, while the amount of land zoned for residential development increased by only 10 percent (Greenfield 1982).

If Beaverton and Gresham and Forest Grove can promote more compact growth and return to *traditional* densities, then so can Corvallis, Estacada, and Oakridge. To aide them, the state of Oregon needs to provide these communities with solid, specific information on the development and redevelopment potential of land inside *current* urban growth boundaries. And the State can help make sure that development actually occurs on those sites by helping to finance such critical infrastructure as roads, sewers, and stormwater management facilities.

4. Using density-related pricing for urban infrastructure and services.

One of the reasons for inefficient urban development is the way we price government infrastructure, e.g., roads or street lighting, and the

way we pay for services, e.g., school transportation or fire protection. The per capita price of many improvements and many services is directly related to density; the same length of road could serve five houses or 50 houses. The differences for taxpayers can be significant.

The American Farmland Trust analyzed two different potential development patterns for the projected tripling of the population in California's Central Valley between 1990 and 2040. By distributing that growth over about 0.5 million acres, instead of 1 million acres, the cumulative savings in the cost of taxpayer-financed services for compact growth would be \$29 billion. The low-density growth pattern would produce significant local government deficits, whereas the compact growth pattern would produce budget surpluses (American Farmland Trust 1995).

We might become a lot more efficient in how we use urban lands if taxpayers were given information about the consequences of different development patterns. We need taxpayer impact statements for major urban growth boundary expansions and extensions of urban services. These statements would highlight the fiscal advantages of compact urban growth. Let us complement our appeal to reason with an appeal to pocketbooks.

5. Rethinking roads to and through forest lands.

In addition to changing state laws governing growth and land use, we also must reconsider the kinds of decisions being made about roads. It is almost a reflex in Oregon to support good roads—local and state. Good roads reduce the cost of bringing logs to mills. But roads are the armatures for development.

Economists tell us that it is possible to plot land values against travel time to services, housing, and employment (Moore 1994). By constantly expanding the road network up into the foothills of the Cascades and the Coast Range, by allowing dirt roads to be graveled and then paved, we are greatly increasing the attractiveness of these lands for residential development. Once the roads are improved, it becomes very difficult to resist pressures for development. And, once the development occurs, we have more conflict with forest uses and more pressure for development.

We ought to use the current period, when funds for road improvements are in short supply, to broaden our analysis of state highways and local road systems beyond simply providing transportation

for freight and people, and to consider effects on development patterns. This would be consistent with Governor Kitzhaber's call to transform the Oregon Department of Transportation into a growth management agency.

Changes in forest use assessment programs

In addition to making changes in our land use and transportation planning systems, we need to make changes in the property tax laws governing forest lands. If the forest zoning provisions in state law are understood to be the "stick" needed to protect the forest land base, then the forest use assessment programs are supposed to be the "carrot." But, in order for a carrot to be an effective incentive, it must reward actual performance—not be handed out to everyone, regardless of performance.

Under existing interpretations of Oregon's forest assessment laws, far too many woodland owners are getting the benefit of large reductions in their property tax assessments without furthering the purposes of that legislation. Under existing practice, preferential forest assessment excludes the house itself and a small area around it, but the remainder of the land, even very small forest lots of less than 10 acres, are regularly given preferential forest use assessments. The studies I mentioned previously and my own research show direct correlations between parcel size and the probability and intensity of management. By granting significant tax reductions to what are no more than rural homesites in forest zones, the forest land assessment programs actually create an economic incentive to build houses in the forests.

Another consequence of the current system is that other property taxpayers in the same taxing district are carrying the burden of property taxation that the forest homesite owners (who enjoy reduced property tax rates) should be sharing. The nonperforming landowners have shifted their tax burden without delivering any of the public purposes the forest assessment program was intended to achieve.

It would make sense to change the administration of these laws to disqualify all parcels of less than 10 acres that are not part of a much larger forest holding. Another approach would be to have a sliding assessment based on the size of the parcel; this would reflect the relationship between management and parcel size, while creating an economic incentive to consolidate parcels. Another simple reform would be to shift the burden of proof onto the applicant to prove qualification of smaller parcels, instead of placing the burden of proof on the assessor to prove disqualification.

The assessment program should be integrated with the Forest Practices Act's reporting requirements. When the stand age would normally require a FPA-regulated activity, such as logging, thinning, or road building, if no such management activity is recorded, the property should be disqualified from the forest use assessment. The assessment program also needs to be integrated with the laws regulating the rezoning of forest lands under the "developed" and "committed" exceptions provisions.

As described previously, in order to get forest land assessment, a landowner signs a statement that he or she owns and holds forest land for the "predominant purpose of growing and harvesting merchantable tree species." Some of these same landowners also submit signed statements to county officials that they *cannot* practically manage their land for timber production, and therefore are entitled to have it rezoned for residential development.

One doesn't need a degree in law or planning to know that it is not only wrong, but stupid, to have our land use laws and property tax laws working at cross purposes, and for landowners to exploit this conflict by making contradictory statements about their lands. This contradiction could be resolved, without legislation, by administrative action by the Departments of Revenue, Forestry, or Land Conservation and Development, or by local governments and assessors. So far, these governments have not taken any action.

Creating effective programs that yield income to passive owners of nonindustrial private forest lands

In addition to revising our tax incentives, we need to create other economic reasons for NIPF landowners to maintain their forest land in forest uses. Nine years ago my predecessor, Henry Richmond, delivered a Starker Lecture on the subject of NIPF lands. These lands were highly productive, but were receiving little management. Thus, they weren't generating the kind of timber supply that could have offset reductions in harvest from federal lands and provided needed rural employment. The lack of an annual economic return from these lands made it easier for the owners to consider ways to develop them. Harvests from NIPF lands have increased greatly since Henry presented his lecture, but the level of investment in these lands remains low.

Ideally we need a system which requires owners of NIPF to do no more than cash a check every 6 months or year, based on the current value of the timber to be later harvested from their land. The income for the annual payment would be derived from the sales of timber on other lands being

managed as part of the same program, on a sustained yield basis. The entity (whether public or private) doing the actual management would have a rock-solid security interest in the timber and the land, for the value of their investments in forest management.

Given NIPF landowners' mixed motives for owning their land, this kind of NIPF land management program should provide landowners with a menu of management options that give greater or lesser weight to natural resource protection measures—a choice of clear-cutting versus selective cutting, of wide, no-cut buffers along streams or the minimum buffers required by the Oregon Forest Practices Act, and so forth. Their annual payment would be reduced accordingly, but they would be able to honor the various noneconomic values for holding their land.

The structure for this solution is already in place, thanks to the work of Henry Richmond and our former Staff Forester, Anthony Boutard. All of these provisions can be found in the Forest Resource Trust established by the 1993 Legislature. But the Trust has not received the funding it requires to meet its goal of reforesting 250,000 acres by 2010. Another problem is that the Forest Resources Trust may also demand too much involvement by the landowners. We need to refine and, most importantly, to fund this program as a necessary complement to a strong forest zoning program, to ensure that landowners with lands zoned for forest use derive an income from that use.

Public education and public and private sector research

Not everything that will help protect the forests of the Willamette Valley requires changes to *government* programs. A great deal can be done through educating the public about the threats to the Willamette Valley forests, and through research about the alternatives.

The first priority for public education involves the value of, and threats to, Oregon's forest lands. It is curious that public concern about the loss of *farmland* in Oregon dwarfs the level of concern about the loss of *forest land*. From a national perspective, Oregon's forest lands have far more economic impact than its farmlands.

Very few elected officials who deal with planning issues have the slightest idea of the unique productivity of Oregon's forest lands. For example, Lane County has consistently proposed that forest lands which produce less than 120 cubic feet per acre at mean annual increment should be classified as "secondary" and opened up for development. How many of the County Commissioners, or members of the press or public in Lane County, understand that any forest land with a productive capacity of 85 cubic feet per

acre per year is considered to be “prime” under the federal definition? “Prime” farmland is almost sacrosanct in Oregon; prime forest land is not.

Business and professional associations and academics could perform valuable public service by providing simple information about the value and productivity of Oregon’s forest lands. These same institutions can also carry out the kinds of basic research which government doesn’t have the money or political will to undertake.

We at 1000 Friends of Oregon are engaged in a research effort in partnership with other groups sharing a common concern about the Willamette Valley’s future. Representatives from the Oregon Forest Industry Council, Oregon Small Woodlands Association, 1000 Friends of Oregon, Oregon Farm Bureau Federation, Livable Oregon, and Oregon Trout, as well as the mayor of Corvallis and Marion County Commissioner Randy Franke, have formed a Steering Committee for a project to analyze where current trends are taking the Willamette Valley, and to propose an alternative pattern for growth.

The first phase of the Willamette Valley Alternative Futures Research Project began this fall. It will estimate the amount of forest and farmland that will be converted by urbanization, rural residential development, and rural homesites over the next 40–50 years, if current development trends continue. The second phase will analyze the consequences of the projected continuation of current trends for (1) agriculture, (2) wood fiber production, and (3) taxpayers. During the third phase, the Project will compare these consequences with the consequences of a more compact, but realistic, alternative pattern of growth that conserves forest and farm lands, and shifts the development around to make better use of undeveloped and partially developed land. If funded, subsequent research will examine the consequences of current and alternative development patterns on the transportation network, air quality, and the economic and social health of existing downtowns and main streets in small towns and bigger cities in the Valley.

A recently completed study, entitled “Possible Futures for the Muddy Creek Watershed, Benton County, Oregon,” was carried out by researchers at Oregon State University, the University of Oregon, and private sector consultants (Hulse et al. 1996). The study examines, in impressive detail, the consequences for wildlife and water quality of a continuation of current growth patterns, and several alternative growth patterns in the Muddy Creek Watershed. The multidisciplinary and collaborative nature of this research is exciting.

Equally interesting is the way in which the residents of the area helped provide critical factual information, and helped shape the development of the alternatives. This is a model for citizen involvement in long-term planning efforts.

These kinds of research efforts, approaching the issue of growth from different perspectives and examining alternatives, are being coordinated and disseminated through the Governor's Willamette Valley Livability Forum. The Forum reflects a gradually emerging recognition that the problems of growth in the Willamette Valley must be addressed in an integrated fashion and approached on a regional basis. That broadening of perspectives is the last, and most visionary element, of my recommendations for actions we must take if we are to preserve the hedge around our Garden of Eden.

Creating long-term regional awareness and working on regional solutions

In Oregon, land use planning has traditionally used a 20-year planning horizon. This is derived from the custom that our urban growth boundaries were created with a 20-year supply of land.

But 20 years is not a very long time, even judged against the relative youthfulness of white settlement in Oregon. Since the first wagon trains arrived on the Oregon Trail, there have been more than seven 20-year intervals. Foresters in Oregon think in terms of rotations of 60 or 80 or 100 years. If private enterprise or federal agencies can make decisions based on 60- or 80-year rotations, then surely a city or region can use a century.

If we plan for a century, I believe we will start thinking differently about what our short-term decisions will mean when continued for a hundred years. Similarly, when discussing issues like the restoration of salmon runs, the task doesn't look so daunting if we think in terms of a century's worth of small but steady incremental changes to the way land is used around the Basin.

In addition to broadening our temporal horizons for planning, we must also broaden our geographical horizons. The problem is that the Willamette Valley is a unity, but no one thinks of it that way. It is, obviously, one watershed. It is also one airshed, as we know from the days of field burning. And, today, it is increasingly a single economy, made up of an interlocking network of communities.

There are now more than 27,000 commuter trips per day between Portland and Salem. Many people live in Lebanon or Albany or Philomath,

and commute to work in Corvallis. In fact, the average commute time in 1990 in Philomath was 2 minutes longer than the average commute time for residents of the city of Portland.

Of course, any discussion of regional planning stimulates local officials to rally to the defense of “local control.” What does “local control” mean when people live in one city, work in another, and shop in still another? How much “local control” is there when the siting of an electronic fabrication plant in one city causes growth and new commuting patterns in other cities? How much “local control” is there over the pollution being breathed by residents of Mollala, when its source lies in the automobiles stalled on the Sunset Highway, 25 miles away?

Today 90 cities and 10 counties and probably hundreds of special districts operate in the Willamette Valley. It is almost impossible to do anything at a regional scale, while trying to involve and satisfy 100 separate governments. Imagine how much time it would take to schedule just one meeting for the mayors of 90 cities.

Our social and economic patterns have outgrown our institutions of government. In the age of e-mail and the space shuttle, we are relying on units of government designed for the age of telegraphs and steamboats. And we tell ourselves that these units of government, the city and the county, are immutable.

The Soviet Union has collapsed, China is promoting free enterprise, Germany has been unified, and apartheid has been abolished in South Africa, but we can't restructure local government in the United States...? Why shouldn't there be some kind of political institution which fits the Willamette Valley, which reflects the unity of a single watershed, a single airshed, a single economy? Why can't we address the problems common to our Valley from a common perspective, instead of as 100 separate fragments?

The citizens of the Willamette Valley deserve to be given a choice about their future. They deserve the opportunity to make decisions about those choices. After all, that is the essence of democracy. Right now we have neither choices nor decisions, because, under the current system, no one is in charge and no one is accountable. However it is done, we will never be able to address the problems of continued growth in the Willamette Valley, and consequences for the forests, without creating new political institutions with long-term views, multidisciplinary perspectives, and real authority and accountability over how growth occurs.

Closing

To help us appreciate what is at stake for the future, I close by reading from an account of the pioneer Ford family who arrived in Oregon late in 1844:

[I]n February, 1845, they moved up the Valley and located on the Rickreall in Polk county, near the village now known by that name. The short journey from Oregon City to the Rickreall Valley was filled with buoyant hopes and cheered by romantic scenes. Upon reaching the summit of the eastern Polk county hills, a lovely vista lay spread out before the eyes of the newcomers; in the distance, to the right of them was the lovely Yamhill Valley and its waving prairies; immediately in front of them were the green foothills and the blue Coast Range and off to the left of them was the loveliest gem of all, the beautiful valley of the Rickreall. Young [Marcus] Ford was in advance, and as his party came up, with a wave of his hand and in a voice thrilled with emotion, he exclaimed: "Behold, God's last and best work lies before you!"

Ford 1927

We, the residents of the Willamette Valley are privileged to live in an earthly Garden of Eden. We have the knowledge, the institutions, the experience, and the support of our fellow citizens to do a better job of tending that garden, and the forest hedge around it, so that at the end of the 21st century our descendants can still say, "Behold, God's last and best work lies before you!" The question is not whether we *can*, but whether we *will*.

Thank you.

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Question and Answer Session

Question: Do you see the possibility that protecting forest lands from urban sprawl will come into conflict with protecting the lowland wetlands from urban sprawl?

Liberty: Not the way we're trending now. We'll lose both of them. Right now, the evidence I've seen is that, nationally, we're doing a much better job of protecting wetlands, but we still have a significant erosion of them. I see, right now, a lot more risk to the forest land than I do to wetlands. And the reason is that wetlands have a very strong, though not perfect, institutional structure for their protection. A lot of them have been converted. But wetlands have a lot of guardians now, and a strong regulatory system, at least in theory.

We don't have anything like that for forest lands. In fact, Metro, the regional government up in the north part of the Valley, doesn't even have a discussion of forest land protection; they do of wetlands. I bring this up and say, "Why don't you have anything addressing forest lands?" The response is, "That's covered under farmlands." Really? Forest lands involve different management techniques, different landscapes, different effects with conversion. So, I think the statistics I've just presented are really chilling. We waste land in America and we've lost our sense of frugality. We have done such a terrible job in wasting land for development during the last 20 years that, if we can get back to being mediocre, we'll never have to touch another wetland.

Question: What is your vision for changing boundaries and looking at land on a watershed basis? Right now, different land uses have different levels of environmental protection. So, in the forest land, there are buffers set aside.... In your vision, what would you see in terms of environmental protection across the different lands uses?

Liberty: I'm not going to be able to give you a very satisfying answer. And the reason for that involves the policy of our organization. We do not take positions on management practices for forest land and agriculture. We have a very important working relationship, really an alliance, with the Farm Bureau Federation and the Forest Industry Council in protecting the land base. If those other groups had not been with us and with the citizens in 1995, we'd be in a very different position today, because laws protecting those areas would have been rolled back. This was a very serious threat. And I found that it's much too hard to develop a working relationship with someone on one important issue, while jabbing them with a sharp stick on

another issue. So, we have chosen—that was my decision and the recommendation of the Board—to avoid making recommendations generally.

I will say, though, that I believe both the kind of research that was done on the Muddy Creek Watershed here in Benton County and that done elsewhere suggest that we're learning ways to reconcile competing objectives, and to protect the environment much more effectively than we have in the past. Many of the farmers I talk to take pride in how they have reduced sediment running off their lands and how they're managing it. I think there have been improvements, some spurred by government, some spurred by conscience. I think that will continue to be true.

The most challenging part, though, is in thinking about the Valley's system, rather than about the individual pieces. Thinking only about one piece or issue leads to a very different conclusion about where growth should occur, or how long it should be managed. I won't say that I think that we're going to have it all, but I think a good job would mean that we would have land available for farming and forestry, at a level comparable to what we have now, at the end of the century—and better protection for wildlife and water quality. But I think that's highly contingent. We could end up in a very different situation.

Question: Right now, we actually have regional population management goals that are dictated down to the local areas. We have to provide the facilities to facilitate so much of the population growth. How would you manage population growth?

Liberty: Well, I'm going to summarize your question as, is our land use planning system based on just accommodating population growth? If so, how effective can it be long-term, given continued population growth? Is that fair, or am I missing something?

Response: Yes, it is.

Liberty: Obviously, if you have lower growth rates, you can do a better job and have less to manage. Any rapid change is very stressful on a community and on a natural system. When you have rapid population growth, which we are experiencing now according to our standards.... (But, let me tell you, our growth is nothing like that in other places. The city of Las Vegas is growing faster than the state of Oregon. Historically, Oregon has not had that kind of boom, except during the first 10 years of this century. And I think that we're better as a result of it. So, the prospect of an increase or

acceleration in population growth is frightening to me.) If this is the challenge, the only way we're going to protect Oregon is by stopping population growth. I don't know how we'd do it, because we can't close our borders. A lot of the population growth in Oregon, a third of it now, is from our children. And we can still have development without population growth. That's what happened in Cleveland, and that's what happened in Oregon between 1982 and 1984. Our population was reduced and we still had development, new development. I guess my answer is that, as an organization that deals with planning, we haven't stepped up to the plate to deal with limiting world population growth.

Whether we grow fast or slowly or not at all, we'd still want to use the land in the same way. And to use land wisely. I think that, if we tell ourselves that we needn't worry about development patterns because we have to get to the root problem, we are not going to get to the root problem. We are going to have the dreadful consequences of the way we use our land, regardless of the rate of population growth. I guess what I'm telling you is that I'm very pessimistic that there's anything significant we can do to limit the rate of population growth at the local or state level.

Question: Robert, one of the things that we wonder about is the length of land tenure, and how that affects the very issues you're talking about. What is the relationship between development patterns and the length of tenure on forest parcels? What can be done to lengthen tenure?

Liberty: My predecessor, Henry Richmond, gave one of these lectures in 1988, and his focus was nonindustrial private forest lands. His lecture had even more statistics in it than mine does. And was even more complicated than mine. His point was that we have to generate some kind of economic return, or have a system that generates an economic return, so that people don't hold the land for no purpose, and then, for example, all of a sudden find that it's time for the daughter to go to veterinary school, and divide it up and put houses on it. All at once. No management; then a clear-cut and houses. We see a lot of that.

The solution that Henry Richmond devised, and that other people had been thinking about, was to say, "Let's put these lands into a management regime that's outside the control, or partly outside the control, of the landowner. They can opt in, and then they can have this long-term management that will generate income. The solution contains more details than that, and was given a structure in 1993, thanks to Henry's work and the work of Anthony Boutard, Staff Forester at 1000 Friends, and a lot of

other people around the state. The structure is the Forest Resource Trust. The objective of the trust, as I understand it, is to reforest 250,000 acres by 2010. Unfortunately, the trust hasn't been funded. In addition to lack of funding, another problem with the trust is that we really have to have something that allows landowners to be totally passive.

My view of the ideal program, and I think this will help with tenure, is that someone explains the advantages of the program to the landowner, and the only activity the landowner has to do is to cash a check. The research papers about why these lands aren't managed more go back 50 years, and they're all the same. It doesn't matter what program you have. I think you have to enter the program and say, "You sign this, on the dotted line, and we're going to manage your land. You don't have to lift a finger, and you get a check."

My preference is that landowners be given a menu about the level of environmental protection that they want for their lands. They can choose a 200-foot, no-cut buffer and no clear-cutting. They can choose selective logging, for example. Then you indicate to them that their return is reduced, but that they can choose that menu. Then it is locked in, regardless of tenure, and is a covenant with the land. I think that would help.

Americans, however, are restless people. We move, on the average, once every 6 years, and think it is a real threat. I think we could also change the tax system a bit to really make the roll-back recovery of deferred property taxes significant. Then at least people will believe they're selling for development, even if it's not allowed; if they try to do that, there's a real sting in the tax penalty. What we have now is a theoretical sting that really doesn't amount to very much money. And I think, maybe instead of tenure, we might have a duration of management that's provided through an incentive program.

Question: When you're talking about environmental effects, which is worse, industrial forestry or homesites?

Liberty: Well, I'll put it to you this way: I'd rather have the environmentalists and timber industry going at it in a mud wrestle in 2097 than have the issue made moot by having houses on the land. I know that this issue came up in a neighborhood on the edge of Portland. The neighborhood had the opportunity to change the zoning of land to allow residential development or leave it in forest, and it would be clear-cut. The neighborhood association preferred the clear-cut. The forest will come back. With houses, though, the forest doesn't come back. And it's not just one house for 40 acres, it's one house for 40 acres now. Later it will be one house for 20 acres.

I'm not a forester—I don't have a silviculture background. As I understand clear-cutting, you have a big impact for a short period, and then, over a long interval, you don't have any impact. I think that with houses you have more continuous impacts. It's not just the impervious surfaces that go with houses. There's also the road building for the houses, there's the risk of fire, and there's species loss. The kitty cats and other pets are actually pretty destructive of wildlife. Development creates openings in the forest and changes the plant species present. One of the things I'm interested in learning more about is the cumulative effects of low-density developments scattered through forest lands. We have a lot of this kind of data on the environmental effects of forestry. We focus a lot of public attention on those issues. We don't have nearly the same information on scattered, low-density development. And that is happening all over America. That's why this Muddy Creek Watershed study is so interesting to me.

I think the impacts can be greater than what I've described. I took a fishing trip with my father on the McKenzie River 2 years ago. It was a beautiful day. The fishing was actually pretty indifferent, but I didn't really notice that, because I was so mad. I was looking at the new houses built on the banks of the McKenzie. They all have lawns and riprap and no vegetation. Now that would get you a big fine under the Forest Practices Act. And it's happening along all our rivers. So, a part of what's happening is that the timber industry is going to be asked, I think, to make up for part of the consequences of that kind of development pattern. I think that is pretty serious. It's not going to grow back. People pay a premium to live on the river, but the view from the houses is of a lawn.

As I was telling your Dean of Forestry, it's hard for me to travel in Oregon, except at night, because I see things and I get upset. So, on this fishing trip I'm grinding my teeth and this guide, whom I suspect is no friend of 1000 Friends, warmed up to the subject and said, "Well, you know, we've made all of these people an offer. We'll give them a day of guided fishing, for free, just so we can get them in the boat and talk about what they're doing to their land." Well, for those of you who have had the rare opportunity to pay for a guide, you know that is quite a substantial offer. And I said, "That's wonderful, that's very generous. What a great idea." I asked him, "How many people have taken you up on your offer?" And he said, "None."

Phil Keisling made a remark last year that 29 percent of Oregonians today weren't here 5 years ago. I'm worried about a state where the newcomers don't fish and don't hunt. What kind of connection do they have with

environmental issues if they've never tried to catch a steelhead or a trout? I find that almost as disturbing, because we had a sense in Oregon, for quite a while, about who we are and how we relate to the landscape. With this influx in population, I think that our culture is getting diluted. And that, I think, is going to be a big educational challenge. I guess the answer is, the timber industry, whether it wants to or not, is being obliged to address a lot of issues about the effects of forest management on wildlife and water quality. I think other people need to be in the hot water with them.

Question: You've lived in England. You undoubtedly remember the green and pleasant countryside. And England's land use regulation is all run out of London. There's no local regulation whatsoever, and this means that local developers cannot create any pressure to get their developments through. Wouldn't we be better off, if, instead of having counties, we had the land organized and run from the state? Is this your objective?

Liberty: I drafted legislation in 1989, partly because I was so tired of people saying, "Your secret agenda is to take away county control over farm and forest lands. You're not telling people that that's what you're really after." And I said, "What's secret about it?" So, I finally decided that we sponsor legislation to do exactly that. And someone actually gave me a copy of the bill and said, "We understand that you *secretly* support that." And I said, "No, it's not secret. We *drafted* it."

People naturally want to have a government that's close to them. But that government, under the current arrangement, is susceptible to so much pressure. Development interests are the largest source of contributions for local officials in the United States, and we certainly see it in Oregon. I think that having a state system would make government less susceptible to pressure. It would not make it *free* from pressure, and it would not be perfect.

I think the better approach is to recognize that we have now a system of forest zoning, state forest zoning, which doesn't exist elsewhere in the country. We need to get away from these very complicated standards, which not only are weak in themselves, but also lend themselves to creative interpretations. And I think we need to get to a point, sometime in the future, where it isn't administered. These forest lands are finished. No more houses, no more land divisions. You don't have to have anyone to administer that. And part of what happens over time is that people have a sense about the landscape being permanent. I don't think Americans have any sense of the landscape being permanent, and, in many cases, any sense of the landscape at all.

A friend of mine was taking his family to the coast last summer. He stopped at a restaurant, in one of those suburbs in Washington County. And when he was there he cheerfully asked the waitress, “What city am I in?” There was a long silence, and then she said, “I don’t know.” Well, if we can’t even tell what place we’re in, obviously there’s not a strong link to local government or sense of place. It all looks the same. In fact, unless you had a thermometer and a calendar, you couldn’t tell where you were in the United States most of the time. It looks much the same. So, Oregonians like to pride themselves, like the people in other states, in their uniqueness, yet everything is beginning to look the same. Part of this is because we keep lowering our expectations about the kinds of communities we live in. That’s why a trip to Europe is often eye-opening.

Jim Kunstler, who wrote the *Geography of Nowhere* and *Home from Nowhere*, recently described U.S. urban development patterns as “the national automobile slum.” We have more parking spaces than people in our cities, more land that is devoted to cars than to houses. So, the whole community is built around vehicles. That’s why they’re getting so big—you’re going to be spending a lot of time in them. Look for the bunk bed in the Explorer next to you. Obviously, we can do better than this. And part of what we need to do is to have good examples. I hope the good examples aren’t just in Britain, but rather are here, at home.

Thank you very much.

Pacific Spirit—The Forest Reborn



Patrick Moore, PhD
Author, Founder of
Greenspirit,
Co-founder of
Greenpeace,
Vancouver, B.C.
Canada

It's a great pleasure and honor to be invited to give this Starker lecture. I hope to give you a different perspective on some of the forest issues that we've all read and learned about over the past years. My thesis is that the main thrust of most of the environmental movement's position on the subject of forestry is logically inconsistent, and runs counter to more reasonable positions on biodiversity protection and climate change. Of course, these are the three main environmental issues on the international agenda. If we look at what came out of the Earth Summit in Rio, and out of the recent New York Summit Plus 5, we find that climate change, biodiversity, and forests are without a doubt the top three issues in the world today. Most people have focused on one or the other of these three subjects, yet they are inextricably linked, one with the other. It's these important linkages among the subjects that will

lead us to a logically consistent approach to land use, energy use, resource policy, agriculture policy, fisheries policy, and forestry policy.

Trees

Consider the image of a single tree. Trees are the individual units—the individual organisms—that make up a forest. We need to remind ourselves that it was about 350 million years ago that plants evolved the ability to grow long wooden stems, and hence became what we call “trees.” When they did that, they weren't thinking about our desire to cut them up into two-by-fours. They actually had only one purpose in mind. That was to get the crown of the tree, with its needles or leaves, up above the other plants, where the tree could then monopolize the sun's energy for photosynthesis.

Foresters create clearings in the forest so that the new tree seedlings can be in full sunlight. A tree is basically a plant that wants to be in the sun. With few exceptions, this is the case. If trees had wanted to grow in the shade, they would have been shrubs instead. They would not have bothered to develop this long wooden stem to get their “heads” up high.

Biodiversity

I believe the most important general biological fact about forests is that forested ecosystems—not the oceans, not the plains, not the deserts—are home to the majority of all known living species. There's a simple reason for



this. The living bodies of trees create an environment that doesn't exist if trees aren't present. The canopy is home to millions of birds and insects, and beneath the canopy, in the interior of the forest, the environment is protected from frost in cold climates, from hot sun in warm climates, and from wind in all climates. In combination with living trees, this creates thousands of new habitats, niches, in which species can evolve. These species could not have existed were it not for the existence of the trees themselves.

When my Granddad came to the rainforest at Winter Harbor on the north end of Vancouver Island just after the turn of the century, he settled as a logger. And he began in the 1930s to clear-cut everything that can be seen from my house by the sea. It's all grown back since then by natural regeneration. More recently, a 15-year-old clear-cut in the rainforest of northern Vancouver Island, where the moist mild climate creates a vegetation which is thick and lush, grows back quickly. We can't make a desert out of the rainforest just by cutting the trees down.

A common belief is that forestry, by its very nature, results in a loss of biodiversity, a reduction in the number of species on the landscape. That's certainly easy to do. If we cut down a native forest, replace it with a monoculture of exotic trees all planted in rows, and spray pesticides on it to kill the "bugs," we will reduce the biodiversity of that landscape. But sustainable forestry with native tree species and a good understanding of other native species in that forest can result in an increase in biodiversity across many landscapes. This is because we can plan for a finer mosaic of forest age classes and ecosystem types than would normally occur in the absence of human intervention.

One of the reasons for this is that many species of flowering plants in particular just don't grow in the shade. We can't walk into a forest and find fireweed or pearly everlasting growing there, but we will find them in open sunlight. Therefore, a landscape that has all different age classes, including newly cleared areas, young forests, medium forests, and old forests, tends to have a higher biodiversity than a landscape that has a single age class of forest across an entire area.

Inevitably, though, as forests grow back from clearing, whether by fire or by logging, the plants that require sunlight die out. The ones that do well in shade—the same species that were in the original forest—come back in again. This is a cyclical process called "forest ecological succession," in which the composition of species changes through time as a forest grows back from a cleared area to a new closed-canopy forest again.

The Spirit of the Forest

Second-growth, or new forests, are commonly portrayed as not only lacking the biodiversity of mature forests, but also lacking their very beauty — indeed, the spirit of the forest. Now that the evil men have come with their chainsaws and cut the trees, God has left the land, and will never return. All manner of biblical metaphors are brought forward about sacrilege, desecration, rape, pillage, and plunder to describe the cutting of trees. This makes excellent headlines, but, fortunately, there isn't any truth in it. I know this, because I can walk through forests which my Granddad clear-cut logged in the 1930s. When he logged them, he didn't know the word "biodiversity," because it hadn't been invented yet. And he didn't talk about ecology at the breakfast table, before he went out in the pouring December rain to drag the huge trees that were growing there down to the sea, half the time taking the soil with them. And yet, without any reforestation or any intervention at all, the forest is growing back thickly and quickly. There are ravens and deer and wolves and owls and bears living in that forest today. The spirit of the forest has returned, in 60 short years. The beauty has, too.

Monoculture

Unfortunately, the word "monoculture" has been borrowed from agriculture and applied to forestry as if it meant the same thing, but it usually means something very different. In farming, a monoculture usually means that we clear away the original ecosystem, usually a forest, pile all the debris into a heap and light it on fire, plow the soil every year, and plant the seeds of an exotic food crop such as corn or wheat. That never happens in the absence of human intervention.

In forestry, a monoculture is a forest which is dominated by a single species of tree. Monocultures occur in nature quite frequently. In my home province of British Columbia, about 30 percent of the original forest would be described to us as natural monoculture—lodgepole pine, Douglas-fir, some of the spruces, western hemlock. A Douglas-fir monoculture forest is a perfectly full-functioning ecosystem. Shrubs and plants grow below the canopy; nobody weeds them out. Birds and insects and squirrels live in the canopy above; nobody sprays them to kill them. There's nothing unnatural about monoculture forests of this type. And yet, because of the association with wheat fields and farming, it is easy to use the term "monoculture" in a propagandist way.

Old Growth

I've looked into it very carefully and there's no getting around the fact that it takes 500 years for a tree to get to be 500 years old. That is what we call a "law" of nature. Fortunately, it doesn't take 500 years for the characteristics required by species described as old growth-dependent to reemerge in forests growing back from clearing.

Take, for example, a 90-year-old, second-growth forest on the south end of Vancouver Island. It already has all or most of the characteristics needed by old-growth-dependent species. Let's use cavity-nesting birds as a fairly extreme example. These birds need standing dead trees, large enough and rotten enough to allow them to dig a hole and go in to have their babies out of the rain. That doesn't happen automatically after a forest is cleared. It takes some time. But it doesn't take 500 years—50–100 years will do just fine.

There's another side to this, though. You can't do everything in 100 years. A huge cathedral-top cedar snag was left standing, already dead, when my Granddad clear-cut the surrounding forest in the early 1940s. When the cedar died, it was about 1,500 years old. (It's about 14 feet in diameter.) When it falls over, if people leave it alone, it will take about 1,000 years to decay into an unrecognizable form. That's 2,500 years for a tiny cedar seed to germinate on the forest floor and grow into this incredibly complex and beautiful form, and then die and decay—all the while providing habitat for millions of individuals of hundreds of species of insects, birds, and plants.

We can't expect foresters to plan on 2,500-year cycles. Cycles on the order of 250 years are hard enough to think about—never mind what we're going to do next week-end. Therefore, if we want some of the long-term natural cycles to continue across landscapes, there's no real option other than to set aside large areas as protected parks and wilderness. That's why I'm very happy that in my province of British Columbia we are now embarked on a process of doubling the amount of land in protected parks and wilderness, and we're doing it on as representative an ecosystem basis as we possibly can.

Long-term cycles cannot coexist over landscapes with intensive forest management, in which we cut trees every 40–100 years. We need to have wilderness set aside if we want the long-term cycles to continue.

Ecology and Aesthetics

Most of our moms taught us not to judge a book by its cover, or, to say it another way, beauty is only skin deep. Nonetheless, we are easily tricked into thinking that, if we like what we see with our eyes, it is good, and, if we

don't like what we see with our eyes, it is bad. We tend to link our visual aesthetic to our ethical or moral judgment of things, particularly landscapes.

The Sierra Club helps us make this linkage by saying in their book, *Clearcut: The Tragedy of Industrial Forestry*, "You don't have to be a professional forester to tell if a forest is mismanaged anymore than you have to be a doctor to tell if a person has ill health. If a forest looks mismanaged, it is mismanaged." Of course, they're wrong on both counts. You do have to be a doctor in many cases to tell what a person is infected with, and you do have to be a professional forester to tell if a forest is healthy. The Sierra Club says that, because they want us to think that a recently logged area is bad, because it is ugly, wasted looking, and dead. There's no question that it's ugly. But what is it *really*? It's actually just large lumps of dead wood lying on beautifully fertile forest soil. It's not toxic waste. It isn't nuclear. It's 100 percent organic. And, in fact, many types of forests require site disturbance in order to grow back quickly and healthily. But, we're told, we should judge clear-cuts to be wrong, because they look ugly to our eyes.

Taken in the right light, even clear-cuts can look pretty. Think for a moment, metaphorically, of the clear-cut as a temporary meadow. It's temporary because it's not going to stay this way. It's going to grow back into a forest again. But it's meadowlike for the time being. The trees have been removed, and light can stream in to the ground and foster the growth of plants and other species unable to grow in the shade of the forest.

Meadow and clear-cut used in the same sentence? That's ridiculous. Meadows are beautiful, pleasant places. Clear-cuts are ugly, awful places. Our judgment of meadows and clear-cuts has nothing to do with biodiversity. Meadows are nice places, because they are easy to walk across, sunny, and we can lay our picnic blankets down for a nice time. Clear-cuts are awful places, because we're likely to break a leg within the first 10 feet of trying to get through the jumbled-up, broken limbs and tops and stumps.

Meadows are actually small deserts. The reason most of them exist is that the site is too dry to support trees. That's why it's easy to walk across meadows. In contrast, clear-cuts are full of trees, because they are wetter environments. Clear-cuts will, in fact, support a far higher amount of biodiversity, a much wider range of species, than will meadows, which can only support drought-tolerant species such as grasses.

Sometimes our eyes tell us the truth about our values. A young Douglas-fir seedling growing in a logged-over area looks beautiful. It is good, because we want it to be there. Sometimes our eyes tell us the truth, and sometimes they lie. That's why we can't trust them.

Fifteen years after clear-cutting, even as the trees begin to come up and dominate the land, the land still “thinks” it’s a meadow. The sun still reaches the ground, and fosters the growth of beautiful flowers. As those trees continue to grow up and gradually shade the land, as the trees in older forests have done, all of that beautiful biodiversity will perish in the shade. All of those flowers will die. Would it make sense to go out now, quickly, and snip off those trees with a chainsaw to save the flowers from certain death? Well, no, because we want a new forest to grow there. But you can go to some places in this world—Sweden, Germany, Scotland, New Zealand, even Canada—where people are campaigning in the name of conservation to prevent the reforestation of land that was cleared for agriculture centuries ago, because they want to maintain the natural character of the landscape as they have known it since they were born. They don’t want a dark spruce forest shading out all the wildflowers on the sheep pasture.

It’s important for us to differentiate whether or not the way we think the land should look is based on social, cultural, and personal values as opposed to anything to do with biodiversity or science. There’d be nothing wrong with cutting trees down and leaving a piece of land in a meadowlike state. It’s perfectly biodiverse and beautiful in its own right. There’s also nothing wrong with letting the trees grow back and shade out the flowers, because there are other species that would rather have the trees there. There is no perfect ecosystem for any given piece of land. In fact, there are many different assemblages of biodiversity that are perfectly sustainable on any given piece of land.

Species Extinction

To listen to some groups, particularly my friends in Greenpeace and the World Wildlife Fund, we’d think that species were going extinct by the hundreds every day in the forests of the world. Last year in Geneva, the World Wildlife Fund used, as a platform, the first meeting of the Intergovernmental Panel on Forests to make a big press announcement that was carried around the world on AP wire. They said that 50,000 species were now going extinct each year as a result of human activity. Most importantly, they said the main cause of that rate of species extinction is commercial logging. Those are the words they used. Since then, I have challenged them to name a single species that has gone extinct in Canada as a result of forestry activities, where forestry is the main use of the land, and they have not provided me with a single Latin name. They have suggested that the ivory billed woodpecker is a species that went extinct because of forestry in the southeast United States. They haven’t been able to name one species for the Pacific Northwest.

Extensive clearance of land for agriculture in the U.S. Southeast is no doubt the main cause of habitat loss and destruction, and probably the main cause of the ivory billed woodpecker's demise. Forestry may have had a small amount to do with it. But where are the lists of thousands? If 50,000 species a year are going extinct and the main cause is logging, surely we can require that more than one species of bird, which had a questionable relationship with logging, is named.

The spotted owl is one of the species that I do not believe is endangered with extinction because of logging. But in the early 1990s, as you probably know, 30,000 people lost their jobs in the Pacific Northwest as a result of the concern that the northern spotted owl might go extinct if forestry were allowed to continue in the public forests in this part of the world. Since that time, in a short 5 years, a number of things have been discovered. For example, the reassessment of owls on public forests in Washington state has shown, by actual field observation, that there are more than twice as many of these creatures as were thought possible to exist theoretically. It has also now been shown that the belief that spotted owls can grow only in pristine ancient forests is a myth.

Over 350 recorded spotted owls have been found to live on Simpson's Redwood Timbers property in northern California, where no old growth, except a few remnant trees, remains. All of these owls are happily mated and breeding in various ages of second-growth redwood. Even though we've gained knowledge that there are far more owls than we thought there were, and that they can live in landscapes that have a large component of second growth, the policy hasn't changed. The public still believes that the owl is threatened with extinction as a result of the far more limited logging that is occurring today than was in the early 1990s.

A species that is truly endangered, one that we don't hear much about, is the Vancouver Island marmot, endemic to Vancouver Island. Only 220 of these animals exist, and only 20 of these are breeding females. This animal is so close to extinction that six of them have been taken out of the wild for a captive breeding program. That way, if the marmot does go extinct, we will be able to do reintroductions. You don't hear people campaigning, in huge fund-raising efforts, to save this species from extinction, yet the spotted owl is on the front page of every newspaper in the nation.

There is a simple reason why forestry generally does not cause extinction. We tend to think that forests need our help to grow back after logging. Of course, they don't. Forests have been recovering from destruction far worse than logging ever since forests began. Ten thousand years ago, 30 percent of

the existing forests in the world didn't exist—Russia, 20 percent; Canada, 10 percent. All were covered by a sheet of ice right down to mineral and bedrock, with nothing living there. Yet, when the ice retreated, the forest grew back. The same occurs after fires, volcanoes, floods, landslides, and so forth.

If forests were not capable of recovering from total destruction, they wouldn't have been there in the first place. The corollary to this statement is that every single species in the forest must be capable of recolonizing areas of land that have been devoid of forest as the forest renews itself—or they wouldn't have been there in the first place either.

Forest renewal is the sum total of each of the individual species reoccupying that piece of land, as the land becomes suitable for each of them, in turn. It takes a while for cavity-nesting birds to be able to breed in a new forest, but most of them can feed there very quickly, as berries grow back in the sunshine. This is really why forestry doesn't generally cause the extinction of species. As long as we let the forests grow back, the species will come back into and recolonize those areas.

Fire

Fire has been the major agent of forest destruction—or disturbance, as ecologists like to call it—since forests began. That's OK, we're told, because fire is natural; it does not destroy the forest ecosystem. Logging is unnatural. Nature never comes in with logging trucks to take the trees away.

But nature does come in and take the trees away. The black smoke that blows downwind when fire goes through a forest is the carbon that came out of the trees. All the ash that remains on the forest floor, and washes into the streams with the first rainfall, contains the minerals that were in the trees. Every day, as litter on the forest floor decomposes, the silt washes into creeks and rivers, and goes downstream to form fertile deltas where we grow most of our good food. Those deltas are made out of the bodies of the trees that were living farther upstream and farther up the hillside. Nature does take the trees away. Every day. And sometimes in a cataclysmic fashion, as with fire. Just not with logging trucks.

If you think fire doesn't destroy the ecosystem, count the species after a hot forest fire. Not only are all living things above the ground killed, but, in very hot fires, the soil is sterilized right down to bedrock or mineral. The seeds are killed, too. So, basically we're left with a sterilized landscape, something that forestry rarely, if ever, accomplishes.

A good example of this can be found in the Grand Prismatic Basin in Yellowstone National Park, where fire burned a million acres and resulted in

the biggest effort—U.S.\$125 million—to put out a forest fire in the world’s history. Seven years after that fire, there are no young pine trees growing up under the dead ones, because the soil was damaged so badly.

There are some green plants growing there, but not from seeds that were in the soil after the fire—rather from seeds that have blown in subsequently on the wind. Seeds of species such as cottonwood, dandelion, and fireweed, i.e., seeds that will travel for 100 miles on light air, will settle out on a place like this, germinate, and begin the process of healing the soil and getting some carbon and organic matter back into it again. But it will be a long time before pine trees grow there again, because there are no seeds around, and pine seeds don’t travel 100 miles on a light wind. Yet, they may come back quicker than we think. It was Thoreau, in fact, who figured out over 100 years ago, being about 100 years ahead of his time in understanding forest ecological succession, that pine trees hold onto many of their seeds right into the dead of winter, and don’t let them go until February. What kind of crazy tree would drop its seeds onto the snow? A tree that “knows” that those seeds will blow across the slick surface of the snow for miles, across frozen lakes and frozen rivers, and disseminate far wider than they ever could if they simply fell on the ground and got stuck there.

Close by, a healthy new pine forest is coming up quickly. Here the soil is wet, because it’s a seepage site, and, even though everything aboveground was burned to death, the seeds survived the fires. Up comes a new forest, thicker than the hair on a dog’s back.

Fire can be extremely destructive, and result in a tremendous set-back in ecological succession. Fire can also be less destructive, and result in a rapid renewal of the forest. And, of course, on many occasions, fire just burns the lower vegetation and doesn’t even kill the trees.

Logging is no different in that sense. If we do forestry in a way that damages the soil severely and causes erosion and the like, we will cause a set-back in ecological succession similar to that caused by fire. But, if we do forestry properly, we may have rapid recovery of the forest, and no set-back in the productivity of the site.

Insects

In British Columbia, insects are the next major cause of forest death after fire. The bark beetle is one insect that is completely uncontrollable, and sometimes, in the period of a few years, will kill thousands of hectares of trees over broad areas of the landscape. We have a choice when this happens. We can do what they did in northern Idaho, where there was a campaign

against salvaging timber, and just let the dead trees dry out in the sun. Soon lightning will strike, and the whole thing will go up in a conflagration, damaging soils, killing millions of creatures, and usually taking out adjacent areas of healthy forest. At the end of that process, we have a damaged ecosystem and no money.

We take a different approach in British Columbia. We do what's called "chasing beetles." As a forest is infested with beetles, we quickly change our forest plans. Quite often we can refocus within a period of weeks or months, and start cutting the trees as they die. That way we get some jobs. And we make some wood. And we get some chips for pulp. And we make some money. We use some of that money to reforest the area cut—quickly. The soil has not been damaged. Not as many creatures have lost their lives. And the surrounding forest is intact. This approach makes more sense to me.

The Sierra Club has a picture of a particular clear-cut in the Matthew River Valley on the western slopes of the Caribou Mountains in British Columbia in the book, *Clearcut: The Tragedy of Industrial Forestry*. The area was logged after beetles killed the trees. The caption for the picture talks about the greed of the multinational forest corporations and the destruction of the temperate forests of North America. The Sierra Club conveniently forgot to mention the beetle.

Beetles refuse to recognize the maximum clear-cut size of 60 hectares in B.C.'s Forest Practices Code. And so we do sometimes end up with rather large openings as a result. It doesn't make much sense to us to leave big strips of dead trees in the middle. But it's not fair to characterize this as forest policy in British Columbia unless the beetle is mentioned. The beetle is the reason we do this, not because we favor 2,000-hectare clear-cuts.

Volcanoes

Of course, one of the best places around here to go to see the effects of nature, and the destruction of the forest by nature, is Mount St. Helens. When St. Helens blew up in 1980, the mountain took out 150,000 acres of adjacent forest to the north of the cone. Interestingly, that forest was in two main jurisdictions: federal forest, part of the Gifford Pinchot National Forest controlled from Washington, DC, and private forest, owned by Weyerhaeuser. The U.S. government redesignated their part the Mount St. Helens National Volcanic Monument, where "nature would be permitted to recover, uninhibited by human beings, for the study of science." Sixteen years after the volcano erupted, nature, recovering uninhibited by human beings, still looks pretty much like a wasteland. Dead trees lie where they

were blown over or had their tops ripped off by the blast, and there is a 1–2-foot thick layer of volcanic ash, which makes a very sterile seed bed. Only a bit of slide alder, which is a nitrogen-fixing plant, has been able to come in and establish itself in those number of years.

Weyerhaeuser took a completely different approach. First, they salvaged all the dead timber. Sites on Weyerhaeuser land originally looked just like those on federal land. Eighty-five thousand three-bedroom homes' worth of timber was taken off during two hot summers of intensive salvage operations. They had to invent a carbide-tipped chainsaw, because the ash was so abrasive to normal chains they couldn't use them. They had to put a breathing apparatus on all their workers, because of the dust. But they did it.

Almost inadvertently, bringing in the heavy equipment and dragging around the old-growth timber, they disturbed the site so dramatically that it stirred the underlying organic soil to the surface. This classic case of site disturbance, or "site preparation," as it's called when it's done on purpose, created a more fertile and productive area than would have been there with no disturbance. Of course, every farmer knows that plowing the field makes the crops grow better.

Then Weyerhaeuser planted 2-year-old Douglas-fir and noble fir, nice big seedlings, which were able to get their roots established before they died of drought or starvation. In 2024, there'll be a crop of timber off this land, while the national volcanic monument will still be barely recovering.

I'm not making a value judgment about which approach is good or bad. It's interesting to see how nature works, too. But isn't this dramatic evidence that a couple of interventions by human beings can make a really big difference in the way in which an ecosystem recovers after a natural disaster?

Native Tree Species

With all the talk about monoculture pulp plantations and fiber farms, we might easily forget that people in many countries don't even use native tree species for commercial forestry. The classic case is New Zealand, where almost 100 percent of the forestry is done with exotics, mostly radiata pine from California. What's the matter with the kiwis? Don't they like their own trees?

They do, actually, like their own trees. Their own trees have very good wood qualities. Unfortunately, not a single species of native New Zealand tree grows fast enough to be useful for commercial purposes. They can't wait 150 years for an 8-inch sawlog. That's why 80 percent of New Zealand was

deforested before they started their exotic reforestation program. When they cleared forests in New Zealand, it wasn't worthwhile to put new trees on that site, if they were native species. New Zealanders turned these sites into sheep farms, instead. Now they are reforesting 100,000 hectares a year with exotic species, and creating the underpinnings of the economic turnaround in New Zealand. Those new forests aren't very similar to the native forests that once grew there.

In Scotland, people use larch from China, Douglas-fir from Oregon, and spruce from the Queen Charlotte Islands for most of their reforestation. In Sweden, they are using lodgepole pine from British Columbia. They like it a lot. It grows faster than the native Scots pine. And straighter, too. In Brazil, they use *Eucalyptus* from Australia for most of their pulp and paper plantations.

Now I'm not against those things. But surely we should examine, in perspective, what we're doing here, where we do use native tree species, and where more and more we use seed from the same place and try to create the same types of mixtures that were present in the original forests. The point is, managed forests in North America are more similar to the original forests than are those in nearly any other place in the world.

Deforestation

My core message is about deforestation. Deforestation is described by the United Nations as “the permanent removal of the forest and the conversion of the land to another use, such as agriculture or human settlement.” But, combined with the aesthetic problem, people are easily convinced that a recent clear-cut is a scene of deforestation. For some reason, our eyes don't like jumbled up, unorganized bits of woody debris lying about on the land. Of course, when the new forest grows back up above the jumble of wood, and provides a constancy of green across the land, it'll look fine to us. But, for now, we're easily convinced that an ugly clear-cut is deforestation.

Most people find farm fields quite pleasant—pastoral and lovely. Yet farm fields are a scene of deforestation. All that land was in native forest before the farms came in. If people were to stop plowing those fields for 5 years, seeds from the surrounding trees would blanket the area with new tree seedlings. Eighty years later we'd never know that a farm had been there.

Deforestation is not an event that just happens, and then is over. Deforestation is an on-going process of interfering with forest recovery, and preventing the forest from coming back. The commonest form of that interference is what we call “agriculture.” That's why deforestation is seldom

caused by evil corporate overlords in multinational forestry headquarters. Deforestation is nearly always caused by friendly farmers growing our food, and by nice carpenters building our cities and towns.

Remember when McDonald's promised they would never buy another tropical cow because of fears of deforestation in Central and South America? I'm sure the North American cattle industry thought that was a good idea. Do we have a higher caliber of deforestation up here than they do down there? Of course, we don't. A temperate rainforest turned into a cattle farm has lost its native biodiversity in a way no different than that in which a forest in Costa Rica or Brazil loses its biodiversity when it is converted to a cattle ranch. Those who don't eat meat have to have vegetables, and will cause the creation of monoculture cabbage plantations throughout the land. They look nicer than clear-cuts. They're quite pretty, in fact. But where is the biodiversity? All in the surrounding forests.

I'm not against farming, of course. I know that we have to clear part of the forest away in order to grow our food and house our population. But wouldn't it be a good idea if the first principle of biodiversity conservation were to minimize the amount of forest cleared for farms and towns, thus maximizing the amount of land that remains in forest, whether for timber production or protection? We don't do this. Instead, we sprawl our cities and towns across the land, as if it were endless. We usually cover up the best soils in the process, thus making it necessary to go deeper into the native forest to clear it in order to grow our food. We don't do what we should be doing to protect biodiversity. It has nothing to do with ending logging. It has everything to do with retaining forest cover.

Bales of hay are pleasant looking in the late afternoon light, but what are they really? Large lumps of dead cellulose, lying on a deforested piece of land. The native biodiversity will be found in a nondescript scrub hardwood in the background vegetation. Monoculture is often pretty; biodiversity is often nondescript.

A *Zinnia* plantation in Australia is gorgeous. Beautiful. Colorful. Yet it's also a monoculture, requiring pesticides every day. A nearby gray-green *Eucalyptus* forest has over 20 species of *Eucalyptus* and other hardwoods, and hundreds of species of shrubs and herbs and insects and birds. The monoculture is gorgeous; the biodiversity is gray-green and bland.

Land Use and Biodiversity

The automobile is arguably the most destructive technology ever invented by the human species, in terms of its impact on biodiversity. This is especially

true when we consider the side effects, such as the black stuff we roll around on asphalt. Why is it legal to take the toxic waste out of oil refineries, mix it with gravel, and spread it all over the surface of the Earth so that cars and trucks can roam about freely? Think about it.

We put crude oil in an oil refinery. We take the propane off the top to run the taxi fleets, gasoline off next to run the cars, diesel from a little lower to run the trucks and trains, and bunker sea crude from near the bottom to run the big ships across the sea. Remaining on the very bottom is a black gooey crud—that's what we make asphalt from. If this material were taken to a government-approved landfill, it would be turned away at the gate. It's hazardous, toxic, and, in fact, carcinogenic. It's illegal to bury it, yet perfectly OK to spread it in a thin layer over the surface of the planet, killing everything in its path in the process. There's no EPA guideline for going out to stop trucks from dumping this material all over the surface of the Earth. If it were taken into a lab and tested, the rats would all die from a small dose of it. Funny double standard we have. It's very cozy for the oil industry, because the more asphalt we lay down, the more gas and diesel we need for more cars and trucks, and the more cars and trucks we have, the more pavement we need. It's a cyclical process, but not quite the same as forest ecological succession.

Think of biodiversity on a scale of zero to 100. You'd have to agree with me that asphalt is close to zero. Modern agriculture is maybe 5, 10, we'd be pushing it at 20, in terms of the number of species that were on that landscape before the original forest was taken down. Forestry, the way it's practiced in the Pacific Northwest in particular, is 96, 98, 100—102, if we increase landscape biodiversity through planning. All this argument and political heat over 2 percent, as far as I can see. It's time we took a broader view of land use and the impact of civilization on biodiversity. We've got to take more into account than a snapshot of a clear-cut 5 minutes after the trees are cut down, when in fact that area is going to grow back into a forest again. It's very unlikely that the asphalt parking lot will grow back; it's probably going to stay like that for a long, long time. That's why I'm glad I'm in wood, rather than in oil.

People are often surprised to learn that wood is, in fact, the most renewable of all the materials we use in human civilization. Why is it so renewable? First, and most people also find this hard to believe, wood is 99 percent air and water. Fifty percent from CO₂ in the air, 49 percent H₂O that falls as rain, and only 1 percent mineral that comes from the Earth's crust, which is very thick and not likely to wear out anytime soon.

And then there's sunlight. Apparently we have 5 billion years of that left over. That's why wood is so renewable, and why, when we remove a tree from a forest, we're not removing very much of the soil or the nutrient content. Only 1 percent of the tree is composed of those things. Mostly what we're taking away is air and water.

Wood and Paper

I carry this little wedge of wood around with me to illustrate that every day, every person in the world uses this much wood—1.6 kilograms. All six billion of us. Six billion times 1.6 kilograms are taken every day from the world's forests. Think of this in terms of how much food we eat, and it's clear that we use far more wood than any other single type of crop or organic material. Just because we don't get hungry for wood every 3–4 hours doesn't mean that it isn't absolutely necessary for our daily existence. In fact, I think it's easier to go a day without food than it is to go a day without wood.

Nonetheless, it's a lot of wood. In North America we use four times that much every day per person. A family of four in the United States uses 40 pounds of wood every day, 365 days a year. So, you might say, there's the answer: *use less wood*. And this is where the thrust of the environmental movement comes in.

The Rainforest Action Network has a wood use reduction program to reduce the use of wood in the United States 75 percent by the year 2010. Sounds good. Use less wood, save more forests. Wouldn't that be wonderful? Unfortunately, it sounds good and it sounds logical, when in fact it is not. People are generally surprised to learn that over half of the wood used in the world is not for building things, but for energy—for cooking and heating, mostly in tropical, developing countries. Unfortunately, unregulated fuel-wood gathering is a major cause of deforestation in the Tropics. If we were to take wood away from these people, they would die by the hundreds of millions. They depend on wood for their survival. People in these countries make less than \$500 per capita per year, and cannot afford to buy energy substitutes. What are the substitutes? They are fossil fuels, so maybe it wouldn't be such a good idea, even if they could afford them. Switching from wood to fossil fuels would only exacerbate greenhouse gas emissions, and increase the amount of CO₂ in the atmosphere.

Thirty-five percent of all the wood used in industrial countries is for construction, solid wood of one sort or another. All the substitutes, and they are steel, cement, plastic, and brick, require a lot more energy to produce.

“A lot more energy to produce” translates, almost invariably, into increased greenhouse gas emissions. Industrial countries have had an almost impossible time as it is in stabilizing greenhouse gas emissions. If we were to start fooling around with the 85 percent of the wood we use every year for fuelwood and solid wood construction, we’re only going to make that problem worse.

Only 15 percent of wood use in the world is for pulp and paper. According to Greenpeace, when people blow their noses in England, they’re blowing away the ancient rainforests of the Pacific Northwest. The Rainforest Action Network’s goal of reducing wood use is to save the forests and save the planet. Most of the pulp and paper in the world is made from sawmill residues and from pulp plantations, most of which are established on land that was already cleared. A component of pulp and paper is made from native forests. There’s no doubt of that. In northern Canada, for example, in the boreal forests, we’re now basing large pulp mills on aspen in native forests. But most of it comes from these other sources.

If we don’t make paper out of wood, what are we going to make it out of? There’s a major movement, led by David Brower and others in the environmental movement, to substitute fibers other than wood for paper. “Tree-free paper” it’s called, or “wood-free pulp.” Again, this sounds like a great idea. If we use an alternative fiber, such as hemp or kanaf, we won’t have to cut the trees. One small problem: where are we going to grow the hemp and kanaf? We can’t grow it on Mars. It has to be grown on the Earth. In particular, it has to be grown where we could be growing trees. Those crops won’t grow in places where we can’t grow some kind of woody vegetation, especially in this part of the world.

Why would an organization whose main purpose in life is stated as “the protection of biodiversity” advocate massive monoculture plantations of exotic annual farm crops such as hemp to produce paper when we could be growing trees? Everybody knows that birds and squirrels prefer trees to hemp farms. There is no sense to it at all.

The position against using wood to make pulp and paper runs logically inconsistent and contrary to the position of protecting biodiversity. A couple of quotes from David Brower will indicate that this, in fact, is the thrust of the movement’s position. First he says, “Now I’m not saying that we should never cut trees; I’m saying that we have probably overdone it. It’s about time we did something else.” I think he’s saying that we should cut fewer trees. The next quote is, “I have nothing against greater forest growth; I have something against planting trees. Growing forests is quite different from planting trees.”

I believe that the environmental movement's position on forestry is in fact antienvironmental in the sense that it runs counter to policies that would promote the protection of biodiversity and reduce the amount of greenhouse gas emissions. We cannot pretend that there are not six billion people waking up in the world every day with real needs for material, energy, and food. Those needs have to be satisfied somehow. In my estimation, the best way to satisfy them is not to reduce wood use and the cutting of trees, but to plant more trees, reverse deforestation, and help developing countries create sustainable fuelwood plantations close to the towns so that women don't have to walk 5 miles every day to collect enough twigs to cook food at night. Essentially, the best way is to increase the world's forest estate, to take some of the land that's been converted to agriculture and put it back into forest again. Densify the urban environment. Intensify food production. Make more land available for trees.

Closing

We're very fortunate in British Columbia, as you are here in the Pacific Northwest, to have wild native forests growing right by our cities. They are not botanical gardens, which somebody visits with clippers and prunes the shrubs every year. They are native forests of Douglas-fir, cedar, hemlock, birch, alder, maple, cherry, and so forth—all growing beautifully wild as ever. Nobody is interfering. People who come to Pacific Spirit Park, 800 hectares or 2,000 acres of beautiful wild forest right in the heart of Vancouver, would never suspect that in 1914 that very area was clear-cut to feed the sawmills that helped build the city of Vancouver. The men who cut the forest with double-bitted axes and crosscut saws didn't know the words "biodiversity" or "ecology" any more than my Granddad did. They did this and moved on. There was absolutely no reforestation afterwards. All the forest has returned—some in hardwood, some in softwood. All the beauty has come back to the area, as has the spirit and the fertility of the land. All the biodiversity, all the little things—the bugs, the fungi, the liverworts, mosses, and ferns. The only things missing are the large four-legged mammals, like bear, deer, cougar, and wolf. They've been replaced by the two-legged variety of mammals who come for a stroll by the thousands on a sunny Sunday afternoon. This is an urban park. If Pacific Spirit Park were located farther out in the woods, though, it would provide perfectly good habitat for all those large mammals as well. It is what could be called "a forest reborn," reborn from what today is routinely described as "the total and irreversible destruction of the ecosystem." Because it is a park now, in 100 years from now, our great grandchildren will see an old-growth forest there again.

I believe that, given the tremendous increase in knowledge of biodiversity, conservation biology, forest science, protected areas, soils, and nutrition, we can continue to use our forests as a major source of wood and income base for families and communities, and at the same time make sure that those forests provide a home for all of the many species that require them for their survival.

May the Forest be with you!

Question and Answer Session

Question: British Columbia has a woodlot program that they are trying to increase?

Moore: A very small woodlot program, yes. They say that they are.

Question: Would you compare that program with others in social and ecological aspects?

Moore: One of the problems with small holdings is the difficulty of landscape planning. This is what we're finding, particularly in European forests, where they are trying to use the Forest Stewardship Council guidelines. In Sweden, for example, the big companies recently accepted the Forest Stewardship Council, but the 300,000 private landholders said, "Sorry, we just can't deal with this." Part of the reason for this is the difficulty of coordinating landscape planning when land is divided up in small holdings, particularly when they are in private ownership. Quite often large holdings, such as those owned by Weyerhaeuser, more easily accommodate integrated landscape planning on a rational basis. With small holdings on private land, when the timber market goes up, the landowners cut their trees down all at once, instead of maintaining a coordinated effort across the land. It's difficult to say, "Sorry, even though the market is high now, we've designated your parcel as one that's not allowed to be cut for the next 10 years." Large companies operating on a sustained yield basis over large landscapes are able to do that kind of planning. This doesn't mean that I'm not in favor of private ownership. I think a healthy mix of private ownership, public ownership, and large and small private ownership creates a better conversation at a social and political level, and a much better approach to policy and management. But there are a lot of problems with the checkerboard approach in terms of actually doing watershed and landscape management.

Question: What's your position on the cutting of ancient forests?

Moore: My position on the cutting of ancient forests is that, where we designate the land for commercial forestry, we cut the ancient forests, and, where we designate the land for the protection of ancient forests, we don't. I believe it's a land use issue, and that we don't have too much choice, in lands that are being managed for timber production, other than to at least remove a large percentage of the ancient forest characteristics from that land. It is possible, and certainly desirable—and we are moving more toward it—to at least leave features and remnants and some characteristics of the old-growth forest on the landscape, whether that be in patches of old growth or individual old trees or snags or downed woody debris or wind-fall. But, once we decide that a particular piece of land is going to be managed for timber production, we have decided that it's not going to be an ancient forest any longer, at least not for the foreseeable future. I certainly am in favor of the protection of large areas of ancient forest.

Large is a relative term, of course. In British Columbia, we've decided that 12 percent of the total landscape under protection is a reasonable social goal. It's not a scientific figure. In Tasmania, 24 percent of the land base is protected under wilderness designation. In Sweden, less than one percent is protected, I believe. So, there's a broad range across the world in terms of what people consider to be a reasonable amount of land to take out of economic production, to preserve in protected status. The southern part of Brazil is all privately owned, and every landowner is required to chart on a map 20 percent of the land that will not be used for economic purposes, i.e., that will be retained in native environment. In the Amazon, 80 percent of the land must be retained in native vegetation; only 20 percent of a holding can be developed. In the Atlantic rainforest, no cutting of any native forest that is in a reasonable intact state is permitted, because only 4 percent of the Atlantic rainforest remains. The rest has been converted to agriculture and cities by the 100 million people who live there. It's a complex question, but an extremely valuable one in terms of maintaining the broadest possible range of attributes across landscapes to make sure that a major component of that landscape is "older" in succession. In some ecosystems it doesn't apply that much. In dry lodgepole pine country in the interior of the continent, where there are frequent stand-destroying fire events every 30–50 years, or even 100 years, very little of the landscape is ever in anything that could be called "old growth." There may be areas in riparian zones and wetlands that are passed over by fire for 200–300 years, and thus we end up with longer-term cycles in these areas. In general, though, the greater ecosystem doesn't have those long-range cycles. We need to recognize that.

Question: The first half of your talk focused mainly on clear-cutting. And the biodiversity guidelines established by various groups, including the Panel on Sustainable Forestry at Clayoquot Sound, have some other guidelines. For example, they include retaining live and dead trees, and clumps of live trees, as structural legacy important for maintaining the integrity of the habitat for many species, and for maintaining some processes that might not be maintained with clear-cutting. Perhaps you could talk about that.

Moore: You're correct. But the word "clear-cutting" is a term that nobody wants to own. The Swedes several years ago invented a new way of forestry called "Select Area Felling." First you select an area, then you cut down all the trees in it. The Clayoquot Sound Scientific Panel came up with "variable retention silvicultural system." Zero retention is one of the options. I think we call that clear-cutting. In fact, the interpretation of the Scientific Panel's recommendations has resulted in exactly that—what we today call "modified clear-cuts" or "clear-cuts with reserves." You named a number of the other components that we need to preserve—clumps of trees, standing individual trees, wildlife trees, downed timber, riparian reserve zones—there's a whole pile of issues that add up to the fact that it's not clear-cutting *per se* that's the problem. Rather, it's the way in which it is done, and the boundaries within which it is contained, and the features that are required.

Don't get me wrong. I'm not a clear-cut advocate, except in those types of forests where it's the most effective way to harvest and regenerate a new forest. There are many types of forests, particularly broad-leaved forests, forests that are closer to the Tropics, many drier and higher elevation forests, where some form of selective logging is by far preferable to clear-cutting. The three kinds of forests are: those in which clear-cutting is the best way to harvest and regenerate, those in which selection is the best way, and those in which either can be done and it doesn't seem to matter too much, which. Clear-cutting is often chosen in those cases, because it is generally economically preferable.

Selection harvest also has detrimental aspects, including damage to the remaining trees. The damage is caused by felling of the ones that are taken; by repeated entries into the same stand, needed if the area is allowed to regrow for a long time; and by increased soil compaction and road building required to access trees in and amongst other living trees—equipment has to be taken off-road to get to the trees that have been selected. Unfortunately, the public has been given the impression that, on the one hand there's clear-cutting, and on the other there's single-tree selection. It is, in fact, a continuum, with a single tree selected at one extreme and complete clear-cut at the other extreme. In between are small patch selection, mini-clear-cuts, and all kinds of retention systems.

An area of forest the size of this auditorium would not normally be called a clear-cut if every single tree in it were cut; yet, of course, it would be a clear-cut. How many contiguous stumps does a clear-cut make? This is not a question to which there is a given scientific answer. If we do use the clear-cutting method, we need to be doing it in a way in which we retain certain features on the site. It's imminently possible to do that. Even 10 years ago, nobody was thinking about that. Back when my Granddad was logging, they didn't even know the words with which to think about it.

Question: You've pointed out some of the inconsistencies in many of the environmental organizations' arguments about conservation, preservation, and so forth. How does your message play to that audience?

Moore: I haven't had a clear response to this challenge of logical inconsistency among the three main headings. Every time I publish an editorial that points that out, I get a following editorial that fails to answer that question, but rather goes on about deforestation, species extinction, and all the other arguments. The two main planks in the anteforestry argument are that it causes species extinction and that it causes deforestation. There's also that it's ugly, but I don't think that that's a good enough reason to stop doing it myself. We can make it less ugly and that would be nice, but it's impossible to make a cut-down tree look pretty. Stumps for some reason don't look nice to us. My thesis is that environmental organizations are wrong on those two main points.

Forestry is not a major cause of deforestation, because it causes reforestation. That's its main purpose in life. And forestry that causes deforestation is failed, bad forestry. I've seen that. I saw it in Jari, in the Amazon, where the early attempts to establish plantations in the tropical forests were dismal failures. They've actually overcome those failures now, and are doing an excellent job of plantation forestry right in the central Amazon, on the equator. At the same time, they are retaining networks of native forest and vegetation throughout the plantations.

If forestry is implicated in species extinction, it plays such a minor role that it's not right that we should say, "OK. That's why we should stop doing so much of this." Then, of course, there are the arguments about climate change and biodiversity, and the linkages between them. I have not had a coherent response on that point. I think it deserves one, because it makes sense to start at the highest levels on these issues of global environmental policy. It's one thing to say, "Don't cut that particular forest, because I want to save it." There's nothing wrong with that. Maybe the community wants that particular forest to be saved. But, in terms of developing a logically consistent and

coherent global environmental policy, we have to have consistency among these things. Trees are the greatest absorbers of CO₂ from the atmosphere of anything that is alive. The oceans may be absorbing a bit more. We can't really influence the rate at which the oceans absorb CO₂, except that some suggest that, by spraying iron over them at night, we might foster the growth of plankton. That's really theoretical stuff, however.

Growing trees is not theoretical. We know that we can grow trees and sequester carbon. So, the relationship between forests and climate change is inescapable. The relationship between forests and biodiversity is also fundamental. Forests harbor the majority of living species; therefore, the retention of forest cover over as large an area as possible, particularly if that forest cover is somewhat close in nature to the original forest cover, will foster the widest range of biodiversity. If we make those three areas logically inconsistent, we have what amounts to a detrimental or a retrograde policy at the international level.

Question: You mentioned that the Vancouver Island marmot is what you considered to be a truly endangered species, but I don't recall that you ever said what had contributed to, or caused, the population declines.

Moore: We don't know. We do know that the Vancouver Island marmot occupied a far larger number of mountaintops in the fairly recent past, e.g., 100 years ago, than it does today. The remains of their colonies and, in particular, the remains of their bones are located where the aboriginal peoples went up into the mountains 6,000 feet high to kill the marmots. We think they used them for their fat, which may have had medicinal properties. A study in Russia has demonstrated that the marmots that live there have a bioactive chemical in their fatty tissue. So, probably it was for medicine. We know they were all over the place.

Climate change is the most logical possibility for their decline, in that the glaciers are receding and the forests are climbing up the mountains. The marmot is not a forest-dwelling animal, but lives in the avalanche bowls, which are grassy, on the tops of the mountains. This animal was already in a major, long-term decline before people ever started developing Vancouver Island. It is almost certain that high-elevation logging is now playing a role in the marmot's continued demise. When a population of marmots gets too large on a mountaintop, the animals disperse by going down through the valley and up to another mountaintop to live. Today when they go down, they run into clear-cuts, which are full of beautiful, lush vegetation. They don't keep going. They say, "This looks good." They hibernate and breed in the clear-cuts. These are called the clear-cut colonies of the Vancouver Island

marmot. They get fatter, in fact, than the marmots up in the grass, because they are eating lush vegetation. Unfortunately, the clear-cut colonies have a lower survival rate than do the native habitat colonies, either as a result of predation, which is definitely part of the problem—cougar, or because the snowpack over the top of their dens is thinner at the lower elevation sites. They hibernate for the longest period of any animal in the world. For 7 months of the year they are underground. They have to store a lot of fat, and they have to be very efficient in their utilization of fat over the winter. Not only is the snowpack deeper in the avalanche bowls, but the pack avalanches down over their dens in the bowls. Sometimes they get 12–14 feet of snow, which, as you know, is a thermal blanket. It's theorized that the marmots hibernating under shallow snow are being exposed to more fluctuating temperatures throughout their hibernation. Marmots use the least amount of energy at 4°C. Below that temperature they use more energy to stay warm and not freeze to death, and above 4°C they use more energy, because their metabolism increases. That's the theory about clear-cut marmots. Nobody knows whether or not that's the reason for certain. We do seem to have reliable statistical information that the marmot colonies that are established in the clear-cuts have a lower survival rate than the ones established higher up. And they were already in a long-term decline. So, we'll take them to a zoo and make them breed there in a plastic pipe. They do it very well.

Just one more quick story about marmots. There's an analogous species in the Alps, an alpine marmot. The alpine marmot in the Alps became nearly extinct during the Second World War, because people ate most of them. People in the alpine villages during the war were hungry. Many, many mountaintops no longer had marmots. This is a species that is similar to the Vancouver Island marmot. Later, people started breeding them and putting them back on the tops of the mountains, and it has worked perfectly. Marmots are all over the Alps now. Our head researcher, Andy Bryant on Vancouver Island, is quite confident that, if we have the will and the program, which we do, we can keep these animals from going extinct in the wild.

Question: What brought about the change in your politics in going from Greenpeace to the Forest Alliance?

Moore: My politics have changed more in terms of my approach than in terms of my particular beliefs. In other words, it's not as if I've decided I want nuclear testing and to kill off all the whales. I'm definitely an environmentalist. I believe that what I'm trying to do is bring environmental policies and issues into a more logical and coherent framework. Yes, I've changed from the politics of confrontation, which I did for 15 years by getting in front of everything imaginable to stop it, to the politics of consensus-

building and solution-finding. Every social movement goes through a maturation. I like to use the example of the apartheid movement in South Africa, where Mandela was jailed by his white oppressors for over 20 years, while an armed struggle ensued outside. That was a far more severe confrontation than has ever occurred in the environmental movement. Yet, when Mandela was released from jail, he did not go into the assembly of government and machine-gun all those white oppressors. He went to a table, sat down with them, peacefully worked out a new constitution, and became the president. That is the evolution of a social movement, whether it's the women's movement, or the peace movement, or the anti-child labor movement. Any movement goes through this kind of progression. Once the majority of the public accepts the new value, or new set of values, one has to move from confrontation to consensus. It's no use continuing to beat people over the head when they agree with you. That's why my politics have changed. I've made that transition along with the rest of the movement. It was around 1985–1987 that the transition occurred.

Question: What is the harvest period in British Columbia? I've driven through, and have seen massive clear-cuts.

Moore: We in British Columbia are not fortunate enough to have the fast-growing sites you have down here. We can't cut our trees every 50 years. British Columbia is on 80–120 year rotations. Of course, as the future unfolds, and we allow less old-growth to be cut, people will start growing trees over longer rotations in order to get the types of quality wood that we can only get from older trees.

I know what you mean, though. When you look at a landscape that appears to be denuded, you wonder what's happened to what used to be the bird habitat. We used to allow up to 250 acres to be clear-cut; it's now at a maximum of 40 hectares, which is 100 acres. That's the maximum size permitted under the Forest Practices Code. There are areas, ones that you saw, that are much larger than that. They were cut in the 1980s. I've spent a lot of my life in clear-cuts, particularly 2–15 years after the cut, and there's a tremendous amount of bird life in those areas, whether its cedar waxwings or bluejays or towhees or chickadees....

Question: Cavity-nesters?

Moore: No, not cavity-nesters. But come to Vancouver Island if you think we don't have enough cavity-nesting trees, and you can see tract after tract of cedar spike top country, where nearly every tree is a suitable tree for cavity-nesters. There's definitely no need to worry about cavity-nesters on Vancouver Island.

It is true, though, that the species composition does get shifted by logging in forests, with long cycles that are infrequently disturbed by major catastrophes, such as fire. There's no doubt about it. There will be more deer, because there's more browse and less shade. There will be more bear, more cougar, more wolf, which is what we have on Vancouver Island today compared to 50 years ago. But there are less of some other species with the change in the landscape. I do not believe that these other species are under threat of extinction, as some people suggest. Many Neotropical bird species are being severely impacted by land use practices in the Tropics. But there is no evidence that they are being severely impacted by land use practices in British Columbia. I don't know what the situation is here, but I see that you have too many geese. There are a number of species that have actually benefited from the land use practices in the Pacific Northwest. Even in the northeast United States, where there are so many people, there are far more forests now than there were 100 years ago. Farmlands were abandoned and trees grew back. The same is true of the southeast United States. A lot of habitat has been improved in many areas during the last 50–100 years. A lot of habitat has been damaged, as well. It's not all one way.

Many of the areas that were clear-cut and looked as though they'd never have another living thing on them again are going to be allowed to grow back into forests again. They are not going to be turned into shopping malls or wheat fields. One of the most interesting studies I've seen was done in England. The study showed conclusively that there is far more biodiversity in the urban environment than there is in the farm environment. This is because of the street trees, the gardens, and our basic desire to have a biodiverse greenery about us in our urban settings. It fosters the survival of far more bird and other species, including native and exotic plants as well. So, the urban environment is, in fact, fairly diverse. It may not be the kind we like, but by whatever measure there's a lot of biodiversity. The urban environment is surrounded by this big ring of agricultural land which is generally fairly low in biodiversity. As long as large chunks of forest are interspersed among farmland areas, the biodiversity will continue to be fairly high. If we mow the whole forest down for miles and miles, as has been done in places in California and the Midwest, then we're going to severely compromise the biodiversity of that landscape.

I'm not saying we shouldn't worry about the impact of forestry on biodiversity. But I don't see any evidence that anything as severe as extinction or even extirpation is going to occur on those landscapes as a result of the level of development happening there today.

Question: What's the timber industry paying you?

Moore: I'm actually a consultant for a large number of industries. I'm not actually employed by the forest industry. I'm employed by the Forest Alliance as a consultant. It's a nonprofit NGO, supported mainly by the forest industry of British Columbia. But that's not all I do.

Question: Would you comment on forest practices that can be improved upon?

Moore: We've touched on a number of them, which have to do with the features that should be left in the landscape even though some form of clearing is used. The key is road-building and overall infrastructure development in watersheds. The most serious impact of forestry is from the roads. The clear-cuts themselves are not generally a big problem. Now, soils slump in clear-cuts occasionally. Considering the total landscape, however, over 90 percent of all the soil problems is from road-building.

I know you're dealing with that here in a big way, and so are we in British Columbia. The answer to that is, first, don't build roads where there's a high chance of failure. Use helicopters, use cable systems, or don't log at all. The second thing is, where you do build roads, make sure you do thorough geotechnical surveys. Make sure you do full-bench cuts with end hauling of the material. Make sure you have drainage systems that are maintained properly and don't plug up. And make sure that, if you can, you put that road to bed if you're not going to need it for a generation, and recontour the slope and plant trees on it. That's a huge part of our program in British Columbia. I would say that that's where the emphasis belongs today—in continuous improvement in access, and in making sure that we stop the impact of road-building on soils in slides, debris torrents, and so forth. These are caused by a lack of decent engineering.

In the forest industry I grew up in, you could learn to run a D8 cat from your uncle, and go out the next day and follow the ribbons up a side hill, thus bulldozing a road through the forest. That is not acceptable practice. In fact, the person running that machine should have more training than anyone else in the woods, because the people running the big hydraulic and excavating machines are actually making the largest impact on the environment. They should know about the fish in the streams, and about the birds in the trees. They should have knowledge of the environment, as well as how to monkey wrench the machine. They should be more sensitive to the environmental considerations of the impact they are making.

We're not just allowing only professional foresters to design roads any more. In many situations, professional engineering credentials are required for the sign-off on the design and development of logging roads. This is something that the professional foresters fought quite hard, because they saw it as their domain. Yet professional foresters don't often have the basis and grounding in geology, slope stability, and the kind of information needed. So, we brought the engineering profession in, in a big way. Hopefully, that will continue the improvement.

Thank you very much.

Fish Habitat in the Intermountain West

Cows and their culture have more drastically reduced the quality of more salmonid habitat than any other agent in the Intermountain West. I make that strong statement, even with knowledge of the hundreds and thousands of miles of streams that logging roads, mining, and channelization have damaged. Degradation in the cattle culture is ubiquitous, insidious, and continuous. I use the word “insidious” because the cowboy culture so invasively affects politics in the West.

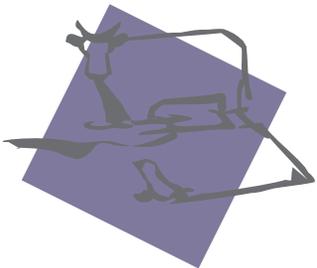
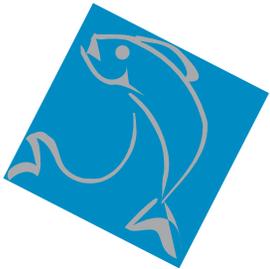
Requirements of Salmon and Trout

Before I develop a case against the Marlboro Man, I want to describe briefly what salmon and trout require to prosper in the Intermountain West. I confine my remarks to streams, the habitat of most of the threatened, endangered, and petitioned salmonids; of bull trout, redband, cutthroat, spring chinook salmon, and steelhead; and of introduced brown and eastern brook trout. These are all cold-water species. They do best at water temperatures below about 19°C for rearing. They die when long-exposed to water warmer than about 24°C. The water in which they live must contain low quantities of such toxics as heavy metals, and must be well-oxygenated, for of course these fish absorb oxygen through gill filaments. We sometimes use the term “macrohabitat” to encompass such variables. Macrohabitat refers to habitat characteristics that extend over miles of stream channel.

Salmonids must eat. With the exception of large bull and brown trout, these species all consume macroinvertebrates—mostly insects that fall in from the terrestrial world, or insects that the stream itself produces. They must evade predators—both cold-blooded (e.g., the large bull and brown trout), and warm-blooded (e.g., mergansers, kingfishers, otters, raccoons, and humans). The focal points and territorial requirements for feeding and predator evasion are complex mixes of cover, water velocity, and water depth. The term “microhabitat” describes the site-specific few meters or centimeters most directly important for focal points and cover.



Don Chapman, PhD
President,
BioAnalysts, Inc.
Boise, Idaho



Salmonids in streams optimize their use of microhabitat, and fish size and evolutionary adaptations strongly influence the mix of microhabitat features selected. For example, we would expect to see very young salmon and trout in shallow, low-velocity sites with access to cover. That cover might consist of interstices in gravels, or such feathery vegetation as flooded brush or grasses. As salmonids in streams grow, they move into deeper and faster water, and use depth, turbulence, and nearby woody debris or rock interstices for cover. They move as they grow, because the stream of food that passes, whether of aquatic or terrestrial origin, increases in quantity per unit of time and volume of passing water in faster, deeper flows nearer the main thrust of the current.

Salmonids spend most of their lives from spring to fall in search of food. If the biological imperative is to ensure that one's offspring contribute to the future gene pool, the maxim for stream salmonids is "grow or die." Predators take smaller members of the population, in part because size directly affects burst speed. Smaller fish cannot flee as rapidly as can larger fish. The smaller fish often are the less-successful competitors in a given cohort, and lack the secure microhabitat needed for optimized feeding and escape cover. Growth reduces exposure to predation.

Stream salmonids are all energy optimizers. They seek maximum energy intake in food for minimal energy expenditure. In-coming energy goes to maintenance and tissue growth. Positions in which fish can optimize their intake during the warmer months lie very close to a passing stream of food-bearing water, but at a slower focal or nose point. Again, that optimal position changes as fish grow. The social mechanisms that fish use to compete for, and to hold, optimal focal points are both complex and subtle. Stream salmon and trout form social hierarchies or territories. For a given year class of juveniles that emerges from nests, or redds, in spring, the largest and fastest-growing individuals have dominant or subdominant social positions. The slowest-growing, smallest cohort members, i.e., the subordinates, lie at the lower portions of the hierarchy or lack optimal territories. Dominant individuals tend to have sharply defined markings and colors, whereas subordinates usually lack these bright definitions.

Trout and salmon must reproduce. They require flowing water at a depth sufficient to permit the female to hydraulically cleanse a gravel mix appropriate for her size as she builds a redd. In that redd she deposits her fertilized eggs and covers them with gravel for protection against freezing, scouring, and predation. Cutthroat, redband, and rainbow (including steelhead) all spawn in spring. Brown, eastern brook, bull trout, and Pacific salmon, such as spring chinook, all spawn in fall. The water that bathes the incubating

embryos for both spring and fall spawners must have high dissolved-oxygen levels, cannot freeze, and must be able to carry away metabolites (e.g., ammonia) produced during respiration.

During the cold months in streams in the Intermountain West, small salmonids mostly go underground. When temperatures drop in September, salmon and trout begin to change their behavior. Although they may actively feed when diurnal temperatures rise, at lower temperatures they hide in the substrate or under debris. Large salmonids move until they find suitable winter habitat. Some bull trout and cutthroat move 60–100 kilometers, often returning the following spring. Anadromous presmolts often move downstream to overwinter in larger streams. Small resident fish must find cover closer to summer habitat for the cold months. We have found them as deep as 25 centimeters in rubble. They may come to the top of the substrate at night, but are invisible during the day. Winter habitat ensures protection from warm-blooded predators, minimizes energy expenditure during a period when metabolic processes ebb, and protects fish from scour during rain-on-snow freshets.

Streams of the Intermountain West

We all know that the Intermountain West is dry. Much of it lies in the rainshadows of the mountain ranges of the West—the Cascades, Sierras, Bitterroots, Rubies, and Whites. Hydrographs are snow-controlled, and winters are severe. We can expect air temperatures to reach well below freezing; in some higher areas, air temperatures are -20°C for extended periods. Stream ice is common. It takes the form of surface ice, drifting frazil ice (tiny spicules of ice in flowing water), and anchor ice that forms as cold seeps through the substrate around the stream. In good years, snow is abundant enough to bridge over smaller streams, thus insulating them from low-temperature extremes and ice.

Lowest flows usually occur in winter in the Intermountain West—a major distinction from coastal watersheds. However, at lower elevations within the zones used by trout, and sometimes in the higher ones, warm periods of rain on snow can cause ice to break up into drifting, scouring masses. Flooding may be so severe that only fish in the best of cover survive.

Macrohabitat suitability requires water with suitable summer and winter temperatures and high dissolved oxygen, and without toxic chemicals. Microhabitat suitability through the year requires in-stream habitat diversity in depth, velocity, and cover. Spawning habitat must have a correct range of sediment size, without excessive proportions of small fines that impede oxygen interchange and exit of fry from the spawning site.

Cattle and their Effects on Streams

If I had to typify the difference between the habitats used by stream salmon and trout in the Intermountain West and in areas more coastal, I would say that it consists of the interior's snow-dominated hydrograph with low flows and ice in winter, and higher temperatures in summer. It also consists of competition between fish and people for water in summer, and often between cattle and fish for a healthy stream riparian system.

What is a healthy, high-country stream riparian system, especially in the alluvial valleys so favored by salmonids? We can, of course, find fish in incised canyons. However, the best stream habitats in the Intermountain region lie in alluvial valleys with gradients less than about 2 percent. Healthy stream-riparian systems have a robust vegetation community, usually with heavy willow growth, possibly cottonwood, with lots of mature root structure. In small streams, the overhanging vegetation helps snow to bridge over the stream in winter. The communities extend well away from the stream margin. Root wads stabilize banks. The stream meanders about the floodplain, and has basically a rectangular cross-section with frequent undercuts and overhanging willows and grasses. Unfortunately, these same low gradients and alluvial soils produce environments favored by cattle. In warm weather, cattle "love" areas close to water, and tend to underuse higher ground. They wallow, trample, and feed in the riparian zone. The consequence of these activities is a progression of stream state from natural to degraded, from boxy to dish-shaped in cross-section. Summer temperatures rise, water quality declines, microhabitat diversity decreases, and proportions of fine material in the substrate increase.

In most of the Intermountain West, streams on private lands in alluvial valleys are heavily or overly appropriated for irrigation withdrawals. That diverted water usually grows crops canted to hay for cattle feeding in winter, or irrigates summer pasture. Thus, an artificial hydrograph is created in the stream—one in which summer flow may actually be lower than the natural low of winter. In some streams, no water flows during most average-flow summers or during any low-flow year, because the entire stream goes to crop production and pasture. In other streams, the residual water within the stream is subjected to warming as the sun works on a lower total stream volume. Where irrigation water is returned to the stream, it arrives warm and with augmented nutrient and sediment loading.

In public lands of the Intermountain West, lands managed by the USDA Forest Service, USDI Bureau of Land Management, or state departments of land, effects of cattle are more direct. I emphasize these lands, because the public can affect their condition more directly than that of private lands.

Cattle began to arrive in the Intermountain West in the mid-1800s. Great herds were driven into the region, and promptly destroyed fragile, high-desert riparian systems by physical damage and overgrazing. A system of public land use developed in which many operators used the public domain for summer forage, and took cattle back to the homestead or onto lower elevation lands for winter. In the summer, the operators harvested grass hay from irrigated meadows for winter feeding. Today, many operators truck-haul cattle to summer range on public range (and private pasture), and remove them for wintering in lowland feeding sites—or even haul them to California.

How important is grazing on the public domain? The public domain has been estimated to provide for less than 2 percent of the cattle produced in the United States. Lands managed by BLM produce the greatest amount of this—about 1.4 percent.

Public grazing has small relative importance to state economies, as indicated in Table 1, which summarizes the importance of public land livestock grazing to several western states. The livestock industry would like us to accept that cattle on public lands support the well-being of the Intermountain states. A nonprofit group, The Idaho Watersheds Project, points out that tourism and service industries for recreation already far surpass public lands grazing in state economies. Yet rural-dominated agricultural legislatures and western members of Congress protect and subsidize grazing on public lands. In Idaho, for example, the State Land Board is charged constitutionally with managing state lands for the highest return for education funding. When The Idaho Watersheds Project bids for grazing allotments on those lands, outbidding cattlemen for grazing rights, the Board has so far managed to evade awarding leases to the Project.

Table 1. Employment and income from public land grazing (from Table 8-2, Power 1996).

Variable	ID	MT	NV	OR	WY	AZ
<i>Employment</i>						
Agriculture (% total)	6.18	7.01	0.65	3.83	4.55	1.07
Livestock (% total)	2.11	3.53	0.38	0.91	3.47	0.10
Federal grazing						
(% total)	0.30	0.25	0.16	0.10	0.56	0.11
(number)	1,636	1,085	1,228	1,630	1,503	2,132
<i>Income</i>						
Agriculture (% total)	4.86	3.87	0.37	1.71	2.08	1.01
Federal grazing (% total)	0.23	0.14	0.09	0.04	0.25	0.11
Growth to replace federal jobs (days)	57	30	8	10	—	18

The Project bids on badly damaged allotments, and states openly that it would remove cattle from grazing on them until the stream riparian systems recover from generations of over-grazing. Court challenges to this preferential treatment of cattle operators are wending their way through the court system. The outcome is important. Grazing on public lands produces a small fraction of state income, and of meat nationally; it has a large negative effect on fish habitat, because of the close correspondence between cattle use and limited riparian areas.

Alternatives

Can't ways be found to protect riparian systems from cattle damage without fully removing livestock from public lands? Surely fencing cattle off the floodplain, rest-rotation grazing, or some other management plan would work? Well, fencing can work, even where alleys are left periodically for cattle to reach water. This confines animal damage, if the fence allows room for the stream to move onto its floodplain. This, in effect, creates a "riparian pasture," wording that the livestock industry finds more acceptable than "enclosure."

On the Wood River system upstream from Agency Lake, near Chiloquin, after 5 years of enclosure, the streambanks have moved into the channel by over 5 meters, sediments are building banks, and water velocities and depths have increased in the main thread of the current. The stream has a substantial source of fine sediments for bank building. Occasional trespass occurs when electric fences fail or are cut, but the stream reach is recovering (Craig Bienz, personal communication). Enclosures do work, especially where upstream land husbandry supports reduced cattle damage. But fencing costs about \$12,000–\$14,000 per stream mile in capital outlay. To be most effective, fencing needs to encompass the entire floodplain so that the stream can meander naturally. And then the fences must be maintained annually after trees fall across them, or snows break them down.

Will rest-rotation grazing work? In theory, this practice would give streams an extended period during which to recover from long-term grazing damage, and then permit extremely limited grazing for very brief time periods every third year or so. In this way, willow, grasses, and cottonwood seedlings would have an opportunity to get ahead of forage use. Such limited use may be uneconomical for livestock operators in most cases. Rest-rotation grazing would have to be combined with fencing of the "riparian pasture" for temporal control of cattle use. Herding is not a feasible option for controlling pasture use, as it is with sheep. Even the uplands continue to suffer from public lands grazing. Juniper and cheatgrass invade overgrazed

uplands. In addition, native wildlife suffer. For example, native sharp-tailed grouse occupy about 10 percent of their former range, because their food source of perennial grass seed has been decimated.

In another alternative, the public owners of Forest Service, BLM, and state lands can terminate, either suddenly or gradually, cattle and sheep use of public lands. Long-time federal agency employees, retired after exposure to decades of little demonstrated regard for riparian systems, believe the best way to solve damage problems and to promote fish, wildlife, and other resources is to eliminate cattle completely (see, for example, Dimick 1990).

Won't this mean loss of a way of life? The cattle industry has been extremely effective with the Marlboro image, partly as promoted through four generations of Hollywood enshrinement of the cowboy myth. The cowboy culture has convinced many people that the cowboy is the ultimate environmentalist, and "knows what is best for the land." The cowboy culture has a pipeline to Congress. However, the condition of public lands should be more important to society than is perpetuating the cowboy culture. Loss of cowboys and cattle on public lands would, after all, not be precedent-setting in social evolution. We did not pamper blacksmiths or mule-skinners when we switched to the internal combustion engine, and we are not overly solicitous of commercial fishermen when we close oceans and rivers to fishing to protect salmon. Why should we subsidize degradation of stream riparian systems by permitting livestock damage to persist on public lands? Damage is not confined to riparian areas, because overgrazing permits invasion of juniper, sagebrush, and undesirable weeds on uplands.

This degradation is not just my impression. According to the Forest Service (1980), "...of all man's activities, grazing by livestock has been the most widespread and prolonged use and has had the most profound effect upon the Nation's ranges." In addition, the Council on Environmental Quality (1981) notes, "Improvident grazing, or overgrazing, as it has come to be known, has been the most potent desertification force, in terms of total acreage affected, within the United States."

An Animal Unit Month (AUM) is use by one cow and calf of public range for 1 month. Five sheep equal one cattle AUM. On federal lands in 1996 and 1997, the AUM went for \$1.35. Attempts to bring grazing fees into the real world on public lands have met with resounding defeat by the cowboy lobby and their friends in Congress. Fees that incorporate damages to public resources would be several-fold greater. Bills now pending in Congress would raise fees to about \$1.85 in 1998—still far below the externalized costs borne by society for land, stream, and riparian damage.

Is there still another possibility? Can we fix stream damage by adding complexity in the form of large woody debris, boulders, log sill dams, or artificial undercuts? In spring-fed streams, with less flashy flows than normal snow hydrographs yield, structural modifications might increase habitat carrying capacity and remain in place. In habitat damaged severely by decades of poor land husbandry, we should not expect structural modifications to remain in place in the face of 100-year flood events that seem to occur every 15 or 20 years.

It is more economically efficient and lasting to bring land husbandry under control on public (and, in fact, on many private) lands, to get the cattle out of stream riparian systems, and to let nature return stream morphology and the riparian community to health. As long as sediments are available for streams to build banks, and with natural seed sources, we can expect rapid improvements.

Where we do employ engineering fixes, those alterations ought to comport with the natural system state. It seems inappropriate to place meter-diameter boulders in a stream that never moved such particles in the past, for example.

In some drainages, like the Sprague River of the Klamath Basin, the floodplain was once filled with willows and supported an alluvial meandering stream. Damage from cattle and stream diversions would take decades to repair were we to begin today. Roughly 50 miles of the main Sprague River are too warm in summer for salmonids. Riparian shading is gone, fine sediments have accumulated, and irrigation return waters bear nutrients that support filamentous algae that absorb heat from the sun, thus adding further to the temperature load. To bring this formerly salmonid-friendly system back to productivity will require huge changes, including fencing cattle out of most of the floodplain, switching to sprinkler irrigation to reduce water withdrawals, and time.

The Sprague River lies in the former reservation of the Klamath tribes. Water rights adjudication is underway, and the Indians possess a time-immemorial right to hunt and fish and gather. The Adair Supreme Court decision that upheld Indian water rights to support fishing, hunting, and gathering may offer hope here. Because that right predates all other water rights, the adjudication may bring about major changes in land husbandry in the system.

Elsewhere, the trend for small livestock operators is away from agrarian life. Grazing allotments go begging in some national forests. The Winema

National Forest is a case in point. Cattle use is declining in those areas. Sport ranching is on the increase. And small holdings are sprouting from subdivided large ranches. Organizations like The Idaho Watersheds Project are questioning, probing, and exposing the wounded grazing allotments of the Intermountain West. The movement of affluent individuals from urban areas to more rural ones helps the power base of such groups. Traditional cowboy-oriented government range administrators and specialists are gradually fading out as conservation groups bring more pressure to bear.

I confess that many fishery biologists don't get excited about livestock-damaged stream systems, partly because many streams have looked the way they do for two lifetimes, and it takes some careful looking to determine their potential. State governments and commissions do not encourage attacks on the livestock industry. And biologists in management agencies have full plates today, what with budget restrictions and personnel cuts. That is really no excuse, however. They are going to have to become involved again, as must the concerned public owners of rangeland resources.

The Lords of Yesterday, as Charles Wilkinson (1992) terms them, persist. They use the following justification: "I am a rancher, and I will live like a rancher, even if the ecologist doesn't agree.... We ranchers are the biggest ecologists!" This line was used by an Amazonian stockman, but is heard frequently on western U.S. circuits. In Idaho Cattle Association literature, we find: "Time was solutions to many of our problems were a bit simpler. A Winchester, a hard fist, or hard work went a long way when it came to protecting your own [public lands ranching operation]. Today, things aren't that simple." The key words here are "your own." Too many of the livestock operators who graze cattle on western public lands believe the land belongs to them.

Closing

The concept of an "allottee," a right that comes before other public rights, lies behind the Sagebrush Rebellion that persists in Nevada and elsewhere. The rebellion blames "the government" for such things as wolf reintroductions and reductions in grazing to restore riparian communities. Somehow "the government" and "the bureaucrats" are easier to attack than the social changes that beset the Lords of Yesterday.

The public is beginning to work its will through "the government," which of course is "us," not "them." The process is slow. Many people interested in better land management do not get excited at the ubiquitous damage caused by livestock on public (or private) lands. It is easy to decry logging of old

growth and roading of *de facto* wilderness, and to be appalled at degradation caused by mining. But who wants to attack the Marlboro Man?

The idealist view (from Brown 1991) is, “If the public wants to assert ownership of its land, it will have to take it away from ranchers. That won’t be easy. Nobody wants to take on John Wayne.... But that’s the way the game is played. That’s how the West must be won—again.” Conceivably, the public could move to terminate all grazing on public lands over a short time span. Political reality and fairness may dictate another approach: permitting allottees to sell allotments to other ranchers, to conservation groups, or to the government, while the latter reserves the right to dictate the intensity and timing of animal use. Allotments sold to the government would be retired permanently. This system would, I suggest, reduce overgrazing as permit holders attempt to maintain a high market value.

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Question and Answer Session

Question: If you reduced or eliminated grazing on public land, often upstream from private land, what do you think would be the effect on the riparian area downstream? Would it increase a little bit?

Chapman: Negligibly. It would seem to me that it’s necessary to take some other route with private lands. We’re going to have to have tax incentives. We may have to purchase conservation easements, so that the riparian zone can be fenced and protected. We may have to do that with some government aid. There are ways to approach this. From the regulatory point of

view, it may be that the Clean Water Act is what has been called the “soft underbelly of private land livestock control.” Fecal bacteria and the other nutrients that enter streams from livestock use may be an avenue to approach a more rational use of private land for grazing.

Question: Among the habitat suitability criteria were a number that have had a channel-centric view to them. In a lot of the usable area calculations, an assumption is made that during high discharge the habitat on the origins, floodplains and the lower terraces, will be equal to the loss of suitable habitat in the channel. Could you comment on that assumption, and maybe follow up with some possible research areas involving function process of the floodplains?

Chapman: I believe that to be an unwarranted assumption. We lack the studies necessary to demonstrate that. The idea here is that, even in a dish-shaped stream, if you’ve lost diversity within the channel, when the water is high enough, fish have access to pockets and areas outside. It is true, they would. The equality of those two hasn’t been proven.

Question: Do you have an opinion about the limiting factors for salmonids in the Coast Range, where the regional mammal is the blacktail deer versus cattle. Is there a limiting factor in the Coast Range, in your opinion?

Chapman: I’ve worked in the Coast Range for a long time. I’m not sure we know at this point what the limiting factor is on salmonids in the Coast Range. But, certainly, they’ve got to have habitat diversity, just as the animals on the Eastside do. We also have to throw in the variable of ocean conditions. When we talk about the Coast Range, we’re almost inevitably talking about salmon. I think we have woefully neglected the role of the sea, and its productivity, and survival in evaluating freshwater habitats. These fish spend from half to two-thirds of their lives in the sea, where events and productivity certainly are changing over time. I think the sea is the biggest single limiting factor in the ecology of coastal salmonids. But, at the same time, these fish have to have the diversity, the habitat, and protection from winter flooding. The difference in the coastal streams, of course, is that you’ve got high water—a lot of high water—in the winter. Most fish have to have wall-base channels, and they’ve got to have backwaters to get into and places to hide from those floods. So, we’ve got lots of things to think about on limiting factors. I don’t know that we know what the limiting factor is on stream salmonids in Westside streams. I don’t mean to say that we don’t know that sediment is bad and we don’t know that we’ve got to have lots of

habitat diversity. We've got to have riparian cover, and we can't have too warm a stream. But the actual limiting factor that puts the lid on the population at any one time—that's a more elusive characteristic.

Question: Don, you've talked about the structural fixes on Eastside streams. We are putting a lot of effort into structural activity on the Westside. What's your feeling about that?

Chapman: I like to see the structure come from the natural vegetation, where it can happen. Unfortunately there are times and circumstances in which, if the wood necessary for that structure is not present in the riparian zone, and it isn't going to be present for 100 years, we might want to do something artificial—especially where it can be done cheaply by the right placement of logs and heavy debris, large debris. But I think that we have to realize that *that* kind of effort has to be well planned and well placed. I understand that in Fish Creek, for example, this last winter on the North Fork of the Clackamas, we lost 83 percent of the structures that had been placed in that stream. I think that is the figure I heard yesterday. Eighty-three percent of those structures went downstream. Now, if those structures were to have remained within Fish Creek, then we could be said to have helped Fish Creek. But, if the structures end up in the North Fork Clackamas, or in the main Clackamas, or in Portland Harbor, then we cannot be so sanguine. As you can gather, I'm not much a believer in structural fixes for streams. I don't think technology is much of an answer here, except in certain isolated circumstances, and where we've got a show place, where we want to take people and show them. It seems to me that we ought to be after better land husbandry, just as we should be on the Eastside.

Question: Do you think there needs to be continued research into establishing a link between riparian vegetation and stream warming, or has that case been made?

Chapman: What's the fallacy? As far as I'm concerned, the relationship between riparian vegetation and stream warming is a proven one. If we take the riparian vegetation off, we've got a warmer stream in summer and we've got one that's colder in the winter. That's a fact.

Question: I was just wondering why there's continued research into that. It seems as though the case has been made.

Chapman: Well, the case has been made on exclosures, too. Exclosures have been put in streams in the Intermountain West for 40 years. But the group that you're trying to convince—it's a tough sell.

Question: Do you eat red meat?

Chapman: Red meat? Of course, but I only eat the 98 percent produced on nonpublic lands! Actually, I've got colleagues who refuse to eat beef on the grounds that they're willow fed.

Thank you.

Buzzwords, Buzzsaws, and Buzzards: Refining Directions for the 21st Century



Fred Bunnell, PhD
Centre for Applied
Conservation Biology,
Faculty of Forestry
University of
British Columbia
Vancouver, B.C.
Canada

I am grateful to the Starker family for this opportunity. I have reviewed past lectures, and appreciate the range of experience and points of view this lecture series brings to you. My experience is primarily with forestry and biological diversity, and that is—trust me—reflected in the title. I believe that “buzzwords, buzzsaws, and buzzards” encompass my purposes.

My dictionary defines “buzzword” as “a word or phrase, often sounding authoritative or technical, that is a vogue term in a particular profession, field of study, popular culture, etc.” Such definition does nicely for the three buzzwords I have in mind: biodiversity, natural disturbance regime, and ecosystem management. Richly technical. Long enough to be authoritative. Definitely vogue. Perfect.

The same dictionary defines “buzzsaw” as a “power operated circular saw, so named because of the noise it makes.” And there are three modern meanings given under the word “buzzard”: (1) any of several broad-winged, soaring hawks of the genus *Buteo*, (2) any of several New World vultures of the family Cathartidae, and (3) a contemptible or cantankerous person, often preceded by “old.” The delightful feature of the title is that all of these meanings apply. Whilst being a cantankerous old buzzard—a role I perform effortlessly, I’ll consider feathered buzzards and other critters, as well as buzzwords and buzzsaws.

There is a wonderfully precarious compromise between direct simplicity and nature’s awesome complexity. The elegance of simplicity beckons, but promises a smooth though painful slide down Occam’s razor. Conversely, settling ourselves among the gnarly dimensions of many buzzwords is akin to sitting on a buzzsaw.

I have three loosely defined themes. I’ll begin by looking at the gnarly dimensions or complexities embedded in our buzzwords. Then I’ll consider how some of our efforts to deal with these complexities are too simplistic. I’m going to say that this slide down Occam’s razor may be tidier, but it is just as dangerous as sitting on a buzzsaw. I just love the biodiversity stuff—mostly because it is so hard to be wrong. So, I’ll offer my cantankerous ponderings around biodiversity, buzzards, and their friends. I warn you that my approach to balance is to bother everybody equally. Finally, and because no one ever heard of a *cowardly* old buzzard, I’ll offer some steps towards solution—a compromise between our buzzwords and simplicity.

A Very Tiny History

First, a very tiny history of the last five or six years of resource management, preparatory to our leap into the 21st century. One doesn't have to be a very old buzzard to remember when forestry was about growing trees, and when wildlife managers were concerned about things big enough to blow holes in, or slow enough to photograph. We lived in a kind of incomplete grey world, like Dorothy's Kansas. Then along came the cyclone, and it wasn't Kansas anymore. It looked more like UNCED '92: *The Convention on Biological Diversity, Agenda 21, Guiding Principles on Forests, Framework Convention on Climate Change*. But resource practitioners and researchers didn't emerge from this cyclone into the Technicolor world of biological diversity to find themselves surrounded by a bunch of grateful munchkins delighted that the wicked witch was dead. No. Instead, as professionals shepherding natural resources, we stood charged with pursuing a Wizard-of-Oz approach to management: no heart, no brains, no courage.

Similar to the scarecrow with no brains, we can't grapple with the complexities of the issue. As the tin woodsman with no heart, or at least with too little heart, we find it difficult to grapple with the challenges. And, as the cowardly lion, we have insufficient courage to do what's right.

In this brand-new Technicolor world with its motorized goal posts, we attempted to capture our fears and solutions in terms too brief to hold the complexity involved. In many instances, it mattered little to practitioners or researchers, because they were captured or enthralled by practices too simple to address the complexity involved.

Researchers are quite prepared to use buzzwords, if it helps them obtain funding. Yet, when we have funding firmly in hand, we retreat to the simplicity of Occam's razor and to the perfect experimental design or sampling scheme.

Some Buzzwords

I don't think it is an accident that the three big buzzwords—biodiversity, natural disturbance regime, and ecosystem management—all appeared at about the same time. I believe they are interrelated, both in the public mind and in their scientific underpinnings. We can see this by taking a little popular culture quiz (see Figure 1).

My guess is that most of us would join almost any buzzword with any of the quotes provided. In truth, each quote was applied to only one buzzword, but they work more or less well for all of them. They involve interrelated concepts.

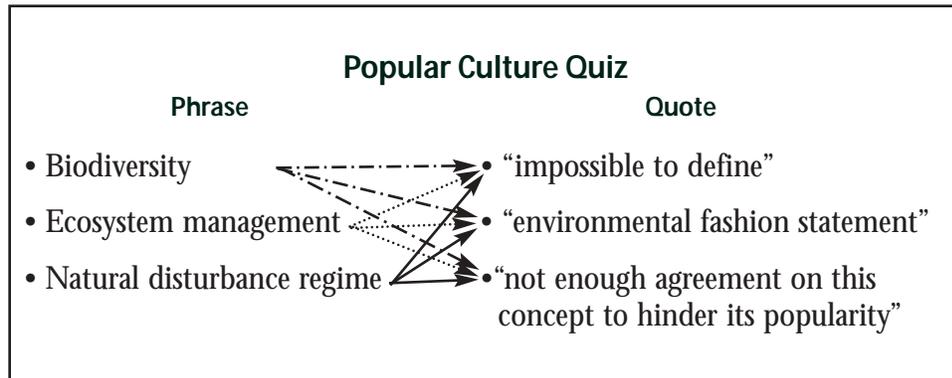


Figure 1. Popular culture quiz. Join the phrase to the correct quote.

Policy-makers are not usually moved to craft international agreements, unless encouraged to do so by strongly felt public concerns. If we carefully read the agreements that came out of UNCED '92, especially the *Convention on Biological Diversity*, we see that there are four main public concerns:

- Loss of species
- Loss of productivity
- Loss of future options
- Loss of economic opportunities

The Convention is quite clear on this. Given the scope of elements encompassed by biological diversity—the closest we get to infinity in the living world—it is clear that we don't know how to sustain all species. We haven't even identified them all.

Enter natural disturbance regime, stage right. If we don't know what we're doing, be natural. It's cool. Walker (1995) notes that the relationship between natural disturbance regimes and biological diversity is something like this: “Given inadequate understanding of most species, the best way of conserving them all is to ensure that the system continues to have the same overall structure and function.”

If we are going to sustain biological diversity, natural patterns provide us with the best existing models. But some concerns entangled with keeping species are social concerns, i.e., they involve limiting future options or economic opportunities.

Enter ecosystem management, stage left. Grumbine (1994) observes that ecosystem management “integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystems' integrity over the long term.”

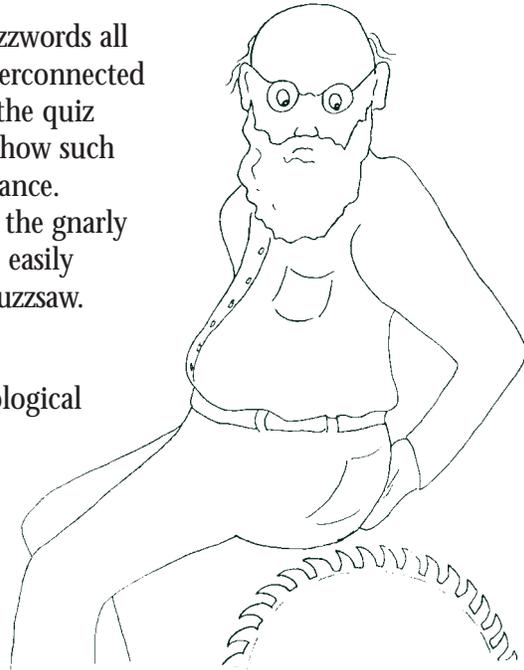
There it is. Keep the species and maintain ecosystem integrity (I guess that's natural), and weave them into the complex sociopolitical and values framework. This actually defines the process quite well, but, because there are no specifics, a 1993 U.S. Congress research report (GAO 1994) notes, "There is not enough agreement on the meaning of this concept to hinder its popularity."

So, they are interrelated: the buzzwords all reflect the same concerns. All is interconnected and that could be good, but recall the quiz (Figure 1). It is difficult to see just how such terms can provide operational guidance. Practitioners walking unaware into the gnarly dimensions of these buzzwords can easily get themselves chewed up by the buzzsaw.

Biodiversity

Some folk feel that the phrase "biological diversity" has synonyms. Merriam (1998) terms it "an environmental fashion statement." (Did you match that right on the quiz?) Bowman (1993) calls it a "brilliant piece of wordsmithing," and many simply term it "undefinable." In recent papers, Don DeLong and I review about 90 definitions of biological diversity—almost all of them include at least genes, species, and ecosystems or communities (DeLong 1996; Bunnell 1998). When practitioners attempt to create operational definitions of biological diversity that consider all the entities encompassed by the *concept* biological diversity, they become mired in a kind of *paralysis by complexity*.

A lot of definitions copy older ones. Many copy that of the U.S. Office of Technological Assessment (OTA 1987). Among other things, that definition, and its successors, includes "the number of species and their abundance." That, good buddies, is ecological diversity—a theoretical construct describing the average rarity of species. Thanks to OTA we now have a small industry publishing indices of ecological diversity, at least 99 percent of which never address the theoretical constructs they are fooling with. *Popular isn't right*. I may not know what biological diversity is, but I do know that it isn't a theoretical construct describing the average rarity of species, about which there has been unending argument for the past 54 years. That noise you hear is the buzzsaw—chewing away.



In our haste to create operational definitions of biological diversity, we *lose the scientific content*, almost certainly to our long-term misfortune. Consider one example of the paradoxes created. I think we all know and accept the compelling scientific evidence that genetic diversity and new species arise primarily through isolation. We also know that most biodiversity guidelines confront that evidence head on by adamantly striving for connectivity, thus eliminating the major mechanism for creating diversity. Buzzzzz. The paradox is one of time frames and spatial scales; it is important, but immaterial here.

My points are simple. First, interim targets are absolutely essential for management actions. Second, failure to distinguish those interim targets from the scientific content of biological diversity (which will take much longer to understand) will have us trading in absolute falsehoods. We obviously wouldn't have the biodiversity we have today without lack of connectivity and isolation.

A longer list would be easy to generate, but overkill. It is enough that we encounter practitioners, paralyzed by complexity, cutting through to operational simplicity by losing the underlying scientific content, while researchers study a totally unrelated topic as if it had something to contribute.

Natural disturbance regime

Somewhere in this process *humans became unnatural*. I don't know if that made us gods. Can't have. If we were gods, we wouldn't be in so much trouble. Could this be Greece?

Although there is a growing literature pondering the philosophical issues embedded in the notion that we are somehow beyond the scope of naturalness, that too is not the point. The point is that the notion creates a false dichotomy that serves to disconnect us and our actions (including research and management) from the rest of nature.

Even that disconnection might not be so bad, if attempting to define a natural disturbance regime weren't equivalent to entering Alice's road race: running as fast as we can to stay in the same spot. Because we have entered the road race with heroic enthusiasm, we already have quantified that some natural disturbance regimes are undefinable (they change utterly with spatial scale, and do not repeat themselves), and change equally dramatically depending on what period of definition we choose. In short, the variation across space and through time *makes definition of many natural disturbance regimes an unending quest*—Alice's road race.

I've done some daft things in my time, but I don't think I would ever be daft enough to stand up before a cross-section of the public and define

nature. I recognize the dilemma here. We often are charged with assessing the effects of management actions against some background variability. But those background rates fill an expansive envelope of change, are wonderfully unpredictable, and many will prove socially unacceptable once defined (some disturbance regimes—completely unaided by our assistance—are simply too large, too rapid, and too disruptive to willfully incorporate into any planning system). That is, *natural in many instances is not the social goal*. We know full well that we are going to truncate the natural disturbance regime *well* short of the larger disturbances that serve to characterize the ecosystem.

In short, the implications of this buzzword have us pursuing a goal that is often undefinable, and that we usually wouldn't implement if we *could* define it. In the meantime, its pursuit serves to disconnect our actions and thinking from the systems we live in and depend upon.

Ecosystem management

Ecosystem management is a little tidier than biodiversity or natural disturbance regime. This is because it is a process, rather than a concept cluster. But ecosystem management, too, is laden with danger.

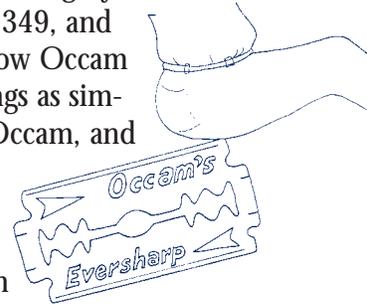
Naturally, ecosystem management has *different meanings in different places*. It has different intents in different places. It is used with different intents, because it employs the regional sociopolitical framework. In the Pacific Northwest, ecosystem management often has to do with how to get some joint direction out of the totally different management regimes on federal and private land. In Ontario, it seems to approximate emulating the natural disturbance regime (we saw how well defined that was). In New Brunswick, it has more to do with better silviculture and jobs. These differences aren't dangerous, unless you think you know what ecosystem management means, or that it has a common meaning. And, of course, the public thinks so.

As the U.S. Congress research report states, "There is not enough agreement on the meaning of this concept to hinder its popularity." That has been one of its primary values, rather like "sustainable development"—a truly brilliant piece of wordsmithing. When closely examined, sustainable development fell from grace as a buzzword. So, practitioners and policy-makers walked smack dab into "expectation management." In doing so, they were offering the same promise of jam on both sides as sustainable development offered, but this was worse, because we should have learned something from the first effort. We can't even agree on what an ecosystem is. Promising that we'll manage ecosystems seems to me to be the height of hubris.

I am not going to belabor the *dangers of science for human values*. There be dragons. The notion enters as soon as we promise to mix science with sociopolitical values. Science is a wonderful means, but has absolutely no role as an end. As a research director for the Centre for Applied Conservation Biology, I am frustratingly aware of the dangers. Conservation Biology could be a simple descriptor of a kind of field, but all too often the end (conservation) influences the methodology and interpretation. Ecosystem management implicitly or explicitly contains the same dangers by incorporating social values. I am convinced that this is not a trivial concern.

In summary, although the process of ecosystem management is well defined, the intended outcomes are not, and this raises the specter of expectation management. Moreover, the process merges the distinct activities of pursuit of knowledge and pursuit of outcomes in ways that are potentially dangerous.

That almost ends our ride on the buzzsaws, a brief review of the dangers in our buzzwords. Although researchers use buzzwords with remarkable aplomb, they really proceed much more simply. Although you have likely heard of his razor, William Occam died in 1349, and we can't blame him for what has followed. Somehow Occam gets credit for the notion that we should keep things as simple as possible. The notion is actually older than Occam, and for many centuries was expressed, "*Entia non sunt multipli-canda praeter necessitateum.*" For those who have forgotten the Latin they learned in dendrology or vertebrate biology, the literal translation is, "No more things should be presumed to exist than are absolutely necessary." That is a fair enough notion. But one might ask whether or not the tooth fairy or Santa Claus is necessary.



As an academic and occasional scholar, I can't resist telling you that Occam never did write that. But he did champion the idea of keeping things simple, was our first major proponent of the KISS principle, and, as a result, has contributed his name to efforts to cut to the simplest core of issues. Simplicity is a wonderful concept, a lofty challenge, a worthy goal, and a disastrous trap. I believe researchers and practitioners have wandered into the trap, big time.

The Razor and the Buzzsaw

Before we think about how seeking simplicity confuses researchers and practitioners, let's consider the scales nature gives us and the scales we make.

The scales we find and create

Most of us have seen attempts to illustrate the temporal and spatial domains of elements comprising forests and natural disturbances. They are tidy and simple—too simple. For one thing, time has metrics of duration or life span (e.g., conifer needles or crowns) AND frequency of occurrence (e.g., natural disturbances—fires and insect outbreaks). Many have envisioned disturbances as the combined duration of event (short), frequency of return interval (variable), and duration of consequences (long lasting). Abundance of organisms is influenced by common events, whereas their presence or absence is influenced by rare events, such as major disturbances or long-distance dispersal. Rare events do not enter into simple concepts.

We could then impose on this the time and space domains of forest-dwelling organisms, and processes affecting them. A lot of the relevant concepts (e.g., home range and generation time) are generic and loose—they slide around temporal and spatial scales quite differently than do forests or stands. We need to recognize that there is no single correct scale.

If we then overlay this with concepts describing biological diversity, we find a wonderful maze of intersecting entities, processes, and concepts relevant to sustaining biological diversity in forested systems. This maze indicates that:

- Entities and processes influencing biodiversity cross temporal and spatial scales.
- Patterns at different scales influence each other.
- Tidy hierarchies don't work well in nature, because temporal and spatial scales don't match, and few phenomena are functionally nested.
- There is no single correct scale: different species respond to different scales, and events at one scale influence events at another.

Buzzzz. By and large this messy, real-world stuff just won't let itself be lodged in our simplistic research frameworks and conventional wisdoms. We ignore the continua, we let the generic concepts slide around only loosely specified, and we impose hierarchical concepts that exist only in our minds. In a profound way, it does not matter whether our simplified concepts are isomorphic with "real world" entities or not.

Most significant concepts are little more than Einstein's cloakroom tickets. The ticket works perfectly well to retrieve a coat from the cloakroom (even though it does not look, smell, taste, or feel like a coat). Yet we cannot go into the woods and find a bucketful of competition or natural

selection. Competition and natural selection are cloakroom tickets, not things in themselves. We cannot find a bucketful of biodiversity or natural disturbance either.

The important issue is this: do our simplifications and looseness lead to misleading outcomes in research or management? I believe they do. We tend to research and manage the cloakroom tickets, not the coats. For one thing, we usually assume that the patterns or parameters we measure are universal. But studying a process at fine scales does not necessarily explain what is happening at broad scales. The approach works for billiards (universal laws of motion and geometry), or for physics generally, but muons don't get hungry and I don't think they have evolved. Stated differently, because of an ill-spent youth, I can tell you, "red ball, side pocket," and usually be right—regardless of whether a green, yellow, or 8-ball is near that pocket. Not so with biodiversity. What is in the actual location counts—is it a competitor, a predator, or a nest parasite?

We aren't playing billiards, but rather romping about a wonderland of mixed-up, crisscrossing, spatial and temporal scales. How are researchers and practitioners faring? Are they finding problems?

The problems we find and create

Yes, we are finding problems. Researchers have exposed two large ones. First, no single scale of measurement (or management) is correct for all species. Second, for a given species, we obtain different results when we measure things at different scales. Now that is not helpful. For example, there have been a lot of studies that have looked at stream reaches to evaluate the impacts of logging on tailed frog populations. Actually, the major effects on tailed frogs are at much broader scales—underlying rock type, mean precipitation, and elevation.

Just finding such problems would be bad enough. Researchers create problems, too—through their methodology and their psychology. In terms of our methodologies, we are good truth-preserving Popperians pursuing the hypothetico-deductive method that is intersubjectively testable. Some of you learned that in your research methods courses. You may have discussed how it encourages risk-adverse reductionism. We discover a pattern at one level, then burrow down to find the "causal mechanism," thus ignoring what is going on at broader scales, e.g., the impact of regional geology on tailed frogs. Too bad. This approach creates four big problems:

1. A particular observation cannot falsify a hypothesis unless relations are universally applicable. And they are not. Geology can be important.

Edges are important in some places, and not in others.

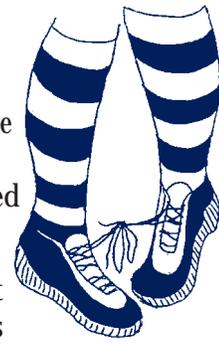
2. Broad-scale patterns are important, but we don't study broad scales because they're too tough. Our nemesis of pseudoreplication awaits to strike us down. We limit our questions strictly to squash out effects of physical contingency, yet nature is under no mandate to do things the same way everywhere. And nature does not do the same thing everywhere, every time. So, we miss broad-scale patterns.
3. Searching inwardly and downwards for the causal mechanism likewise ignores physical contingency and the influences of the physical setting on the broad scale.
4. We can't get there from here. Such finely tuned, rigorously conducted research rarely scales back up, so it is generally not much help to the manager.

The psychology of researchers creates different problems. Good researchers have maverick personalities committed to challenging ideas and doing things their way. Some consequences are unfortunate. For example, in 11 studies reporting habitat relations of shrews in western North America, 120 different habitat variables were measured—91 or 76 percent of the habitat variables were unique to a single study; only 8 percent were measured by more than two investigators. In 16 different models of forest-dwelling birds, 61 habitat variables were measured; 75 percent of the variables were unique to a single study. Each model was based on a single scale unique to that study (Bunnell and Huggard, in press).

Cerebral anarchy does not just reign, it pours. And this makes it almost impossible to extract general relations, or the pattern of patterns, from the seemingly relevant literature. Our maverick nature murders meta-analysis. May it rest in peace. The major consequence is that we cannot separate site-specific consequences from general relations, and so cannot effectively guide management actions.

Practitioners find the same problems as do researchers, in part because they sometimes attempt to use the researchers' findings. They also find themselves in a dance of multiple rhythms and scales when they know only one step. And they often try to do it with their shoelaces tied together. Events relevant to biological diversity are occurring over a huge variety of scales, while foresters dance the one-step, called a "treatment unit." Moreover, practitioners often find that society has tied their shoelaces through a variety of rules that constrain the sizes of cutblocks or the period between logging adjacent cutblocks—or whatever. This stuttering, rather

boring one-step is indeed choreographed over much larger areas, but that doesn't change much on the landscape. There is only so much creativity that we can incorporate into a one-step. Even bowing is dangerous if your shoelaces are tied together.



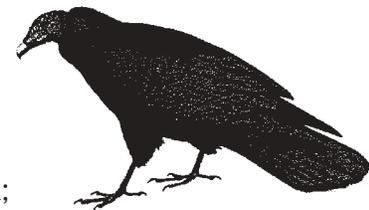
It is important to acknowledge that, even if society didn't sneak up and tie their shoelaces together, many practitioners would tie them together themselves. It makes for convenient simplicity.

The major problem that all of this creates is one of rather marked heterogeneity at the scale of a few treatment units, but near homogeneous patterns over larger management units. It does not much matter what you do at the treatment level—it could be quite complex. If that treatment is repeatedly applied over a forest, it will create relatively homogeneous broad-scale patterns.

So, what's happening here? We have this wonderful dance of life—events occurring over spatial scales of a few meters to several hundred thousand hectares, temporal scales of months to millennia, and the scales influencing and interacting with each other. A researcher can be found on his or her knees, magnifying glass in hand, peering down and inward, with a Popperian white hat firmly in place. It helps to shield the researcher from broader scale events that will determine the outcome of the study. And over there, shoelaces firmly knotted together, a forester is shuffling across the landscape (often with black hat firmly in place). The forester gradually homogenizes the landscape, but at a broader, thus invisible, scale than the researcher will detect. The very simplicity of Occam's razor has us right back into the buzzsaw.

Reflections of an Old Buzzard

We have some terms that aren't helping us much; they are too fuzzy and too buzzy. And the buzzsaw is waiting to chew us up if we aren't clear on our meanings and intent. Further, we have an approach to research that isn't helping us much, because it is too simple. I think the trick is to hoist ourselves off the buzzsaw without setting off for a slide down Occam's razor. Mother Nature is too complex and capricious for that to be easy.



There is an old saying, "Never cross a chasm with two steps." The problem is that I can't see how we can do this without two steps, or at least two

kinds of thought processes. The first step is to get some of the buzz out of the buzzwords. The second is to embrace complexity more adequately. Here we go: two steps and a leap.

Step 1: Deleting the buzz from the buzzwords

We have three buzzwords to deal with here, to try to define more clearly. Things can be defined or described in a number of ways. We could describe Bunnell simply and factually as bald; choose a politically correct academic description and term him, “cephalo-follicularly challenged”; or invoke the legal terminology, “too tall for his hair.” We are after something simple and accurate that works.

I’ve suggested that the public became concerned about biological diversity because of fears of losses, initially of species. Some of the public, and a larger proportion of scientists, appreciate that fears of other losses are related to loss of species. I believe that fears of losing species, productivity, future options, and economic opportunities are the main concerns of the public. Biodiversity is most simply the differences among living entities and an attribute of life (Bunnell 1997). Not a thing, but an attribute that emerges when a number of living things are combined. The strong scientific basis for this is that these differences within and among organisms permit continued adaptability, creation of more diversity, sustained productivity in a changing environment, and thus future economic opportunities. They are all connected.

Natural disturbance is vogue, a buzzword, because emulating natural disturbance, such as fire, appears to promise a way of avoiding further losses. After all, Mother Nature couldn’t be so “mean” as to cause losses. Or could she? For many, natural means productive; moreover, natural must be the way that all this present diversity came to be and to survive. But we had better be clear about why we are attempting to quantify natural variability. For most forest systems, it certainly isn’t because we want to emulate that regime as a goal. We couldn’t. Nor would society let us. Our real concern is about losses. Too few snags. Too little downed wood. Not enough nitrogen. Insufficient disturbance for its generative capacity. Knowing natural disturbance appeals to us as a model for knowing what might be too much of this or too little of that.

If we ask the question, “How much is enough?” instead of, “What is natural?” our research strategies and tactics will be totally different. We will explain our actions very differently to the public. And, I expect, we will explain our actions in ways that connect much more directly with public fears and concerns.

The same considerations apply to ecosystem management. What is embodied in the term is *not new technological and management wizardry*, but rather a simple confession, “OK, you buggers, you’ve moved the goal posts and we’re trying to figure out how to score.” I believe the chances of scoring are greatly improved by connecting simply and directly to informed public concerns. I’ve already noted what I believe to be the big concerns. The connection is dangerous only if we let public concerns determine the interpretation of results, instead of the direction of questioning.

I think that the way to get the buzz out of buzzwords is to consider the concerns in simple terms. What are we afraid of losing—six smoke-free days or a couple of species? Natural disturbance, like fire, is one way of getting things done, but there are other ways. And it likely profits all of us to look at what we are afraid of losing, as opposed to what is or isn’t “natural.” Ecosystem management simply uses whatever tools we have, including fire and logging, to make gains and avoid losses.

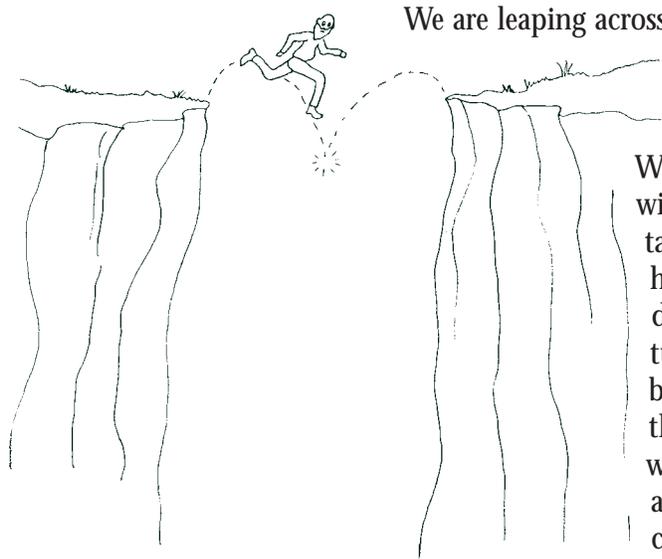
Step 2: Embracing complexity

Both researchers and practitioners can embrace complexity, and move toward solutions. One approach is to recognize that we have a tool kit of statistical techniques available to help us extract patterns across several scales simultaneously, or to expose the relevant scale within data. These techniques include: classification and regression tree analysis, semivariograms, correlograms, logistic regression across scales, and principal components analysis—*provided* data have been collected at more than one scale.

Another step toward solutions is to acknowledge the powerful role of tradition, and quit fiddling on the roof. Thus, we might avoid the association of certain taxa with certain concepts. Researchers accustomed to thinking about connectivity for large carnivores should consider how the concept applies to beetles or to lichens; researchers familiar with community composition in songbirds should think about communities of collembolans or large carnivores. Without breadth of thinking, management recommendations may be based on a narrow data set, potentially at great cost to the rest of biological diversity.

The forester or practitioner can enter the fray through communication. The researcher needs to ask just what kind of system the manager is managing. It will not be a theoretical ideal system. The manager, in turn, must be honest and willing to devote the time necessary to reach, with researchers, a practically appropriate trade-off amongst the generality of application, functional realism, and precision of expression. Currently, the

researchers' quest for precision permits little overlap with the managers' quest for generality of application. We need more overlap. And our practices certainly should not be the same everywhere.



We are leaping across a chasm in two steps, with one foot on the buzzsaw and the other on the razor.

We need to be careful with the terms we use. We talk blithely about fire, hurricanes, and insect damage as natural disturbances. But what is being disturbed—other than a mean state that we know does not exist, an average state that could be meaningless in

a Poisson distribution, or some

balance of nature that we've never found? Nature evolves through tension, not balance. Some normal or "natural" condition might be changed with disturbance, but that would make the disturbance unnatural. I don't think of fire as a disturbance, but rather view the fire regime as an ever-changing attribute of the system—similar to species composition. Fire might also be considered to be a function of weather, topography, and flammability of components. But that is more complex than much of our theory.

At least two major views exist about the conduct of science. According to the first view, the researcher is intrigued by a question, explores the appropriate theory, and then proceeds to develop an effective approach for answering the question. According to the second, which has roots in Thomas Kuhn's work (e.g., Kuhn 1970), the researcher believes that the theory, world view, or paradigm is essential at the outset. At present, almost no theory is relevant to cross-scale phenomena. This essentially dooms us to a tidy, Popperian approach inward, away from our questions. The manager doesn't have that luxury. The problem is specified, but no theory is available to aide understanding. Managers *must* begin with the problem, whereas researchers tend to begin with the theory, even though the theory is lacking or restrictive for cross-scale questions. Researchers can avoid this trap by leaving secure tradition behind, i.e., by getting "messy."

The idealized systems that match current theory are tidy, but unrealistic. We need to be less fearful of pseudoreplication and other phenomena that encourage us to research ideal systems, and embrace the wonderful untidiness of the natural world. Then we'll create the appropriately untidy theory.

Closing

The major natural disturbance in most of British Columbia's forests is fire; conditions must be similar here. There is evidence that native vertebrate fauna (a part of biodiversity) are adapted to the fire regime (Bunnell 1995). Even so, we cannot allow all natural fires. Enter ecosystem management, stage left again, to thunderous applause. First, it allows us to relax. We don't have to figure out how to clear-cut 20,000 hectares in 2 weeks, which is socially unacceptable. Ecosystem management allows us to focus on public concerns, such as the concerns I've noted. That, of course, means we need to focus our attention, not on describing some fire pattern, but on understanding how fire modifies our concerns and perceived losses. It may have us trading off a few smoky days to create a bit more open habitat for the buzzards. Simple terms. I can capture much of what I have tried to say about connections in three big points.

1. Scale matters. Real time and real space count. This isn't billiards, and somehow we must grapple with that.
2. Reach outwards. Robert Browning tells us that Andrea del Sarto's credo was that a man's reach should exceed his grasp. Researchers need to reach outwards in their studies (to broader scales), in their thinking (to more expansive theory), and to practitioners (to encounter real, not idealized, systems). Practitioners need to reach out to researchers (to explain practitioners' needs), and past any simple, easily applied set of rules (to maintain heterogeneity that is admittedly difficult to manage).
3. Expand the range. We need to expand our range of thought and communication, and especially our range of practice. The worst possible thing we could do for biological diversity is to do the same thing everywhere, or to let specific rules gradually homogenize the landscape at some scale.

Each of the steps toward solutions encourages us to look up and outward—to perceive broad-scale patterns, and the patterns within patterns that will lead to better understanding of just what is general and what is contingent on different physical settings. This will enable us to contribute more effectively to management.

We hasten to accept that any management, and especially ecosystem management, is only short-term steering toward long-term goals. The scientific content of biological diversity is still poorly expressed. This leads to paradoxes, and makes it difficult to create operational goals. Although we don't know exactly what to do, short-term maintenance of heterogeneity across scales will allow long-term learning and flexibility for the future. We are part of this exercise, and logging is as natural as fire.

The cyclone has come and gone. We are off down the yellow brick road together. Our challenge is to stay on the road and out of the ditch. We'll get to the wonderful land of Oz, where all is green, when we have the courage to admit that we can't get there from here, the heart to change our thinking and practices, and the brains to develop the relevant theory.

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Question and Answer Session

Question: Your summary involves researchers and practitioners, but you don't discuss the public. How is the public being engaged in this kind of thinking?

Bunnell: I have only 45 or 50 minutes...! We need to engage the public, but how we do this depends hugely on the history of the area, and the social-political parameters of the area. I know the things that seem to work in British Columbia, but we don't have the same situation as you people have here in Oregon.

We have found some things that work to bring the public into the process. For example, respect is a huge part of the process. You know, Arethra Franklin had it correct. R·E·S·P·E·C·T. Negotiating tactics are another key element. We have to somehow create an environment within planning processes: “land resource use plans,” “land management resource use plans,” and a bunch of other things. When the public gets together with other stakeholders around the table, the things that work tend to work because of the environment we create at the table. Air time is necessary for everybody. It's tough. And, you see, we're not nearly as litigious as you are down here. For example, we try to work things out in the planning process. We try to manage resources, whereas you folks seem to believe that judges and lawyers can manage land just as well. We don't have your history of litigation.

We have different problems. My experience doesn't count much as an answer. I am not really trying to encourage the forestry students here to go into law.

Question: Are you saying that a variety of different owners doing a variety of different things could end up yielding a good result?

Bunnell: Yes, it could. But you might want to plan for it instead of waiting to see if it happens.

Question: If everyone were to do what FEMAT suggested, the result might not be very good?

Bunnell: Actually, I'm convinced it would be a disaster—and not because it wasn't well-intentioned. But I think it happened in a bit too much of a

hurry and in a bit too much of a spotlight. Only recently have we developed anything approximating any kind of accuracy or reliability in spatially explicit models of forest practices. We can't keep accounting systems of time and space in our heads. It's only as we develop these models further, and our comfort level is higher, that we can often see that, by god, that was not what we meant to do.

I think that that might have been the biggest part of what I perceive as a failing—just an inability to project consequences. Reliable approaches weren't available to them.

Question: I would like you to justify your talk in terms of the Clayoquot Sound report. That report said that one-third of the biomass was on the ground. It also said that, when you harvest trees and get windthrow, you must not take the windthrow, because you need the material for the forest, for its woody debris. How does that sort of rationalization, reasoning, match up with what you just said?

Bunnell: The Clayoquot Sound is probably the most contentious piece of forest land anywhere in the world. It's the only place, it's the only time, I think, that any Western government has arrested as many as 800 people. I was the independent chair of the scientific panel that was supposed to create a calm environment. And I had a panel of 18 other members, including two cultures—Nuu-Chah-Nulth and white.

Question: But there were no scientists?

Bunnell: Most of us were scientists, actually. We worked by consensus, the only way we could get the two cultures to work together. Two members of the panel had relatives that had been arrested in Clayoquot. We prepared a report based on a review of all of the international agreements that came out of UNCED.

The Premier, when he announced the panel, had said, "This will be the best forest practices in the world." I knew very well that was political hyperbole, but I thought, "Well, let's hold them to it." He had said it publicly, at a press conference. So, we tried to create an approach to forestry that would meet every principle that was in the international agreements. Now, when you do that, the allowable cut falls, big time. But we did it. And we did it, in part, because about 40 percent of B.C.'s forest is old growth. We are never going to be out of the spotlight, because we have big trees. The protest industry will always find forests in British Columbia a good place to raise money. There's no way around that.

My choice was to play jujitsu with the international community and try and create a kind of forestry that would be really exemplary. They'd see just what was involved in trying to meet every principle that was coming out of international agreements. We accomplished that, but we were going where nobody had ever gone. We also tried to stress adaptive management and adaptive policy. As a result, some amazing things are happening on the ground now, things that the practitioners initially claimed were impossible. Our guesses at some things were informed guesses, but they were still guesses. And some were wrong. We didn't know, for example, what volume we could retain and still log on fairly steep terrain. At Clayoquot Sound, 83 percent of the terrain has more than a 60 percent gradient. So, we're talking steep terrain. We didn't know how much of the old growth forests we could safely remove. And our priorities were: first, safety; second, retain productivity; and, third, operational feasibility. Because none of us was involved in operation, we figured that the guys on the ground would figure out how to do it. They usually do. Our fourth priority was aesthetics.

Now what we've hit is safety, so we cannot attain some of our targets. Some of our guesses were wrong. But the framework we created was meant to evaluate those guesses. And practices are changing. So, MacMillan Bloedel is pretty proud, and so is InterFor, of how they managed to figure out ways of keeping the soil on the slopes and getting the wood out. It's completely unclear how much wood we'll eventually get out of there. In part, it'll depend on what happens, probably in the international arena, in terms of how much old growth we can actually convert to managed forests. If it's all tied up, then we're hosed in terms of cut, so it doesn't matter. So, we're learning new systems. If you get up there, Stan Coleman is wonderfully proud of the job the Wyssen system has done. And so are the fallers, so are the guys on the ground, which is really neat. There's an ownership that's being taken. And some things will work and some things won't.

Question: What were you wrong about?

Bunnell: Well, all I know is what we've exposed so far. We're probably wrong about a number of things. As I wrote the report, I was trying to evade using definite numbers as much as possible. Even as old as I am, there are times when I'm hopelessly bloody naive. In some of our suggestions, I wrote, "use common sense" and "use good judgment." Well, things are so polarized in British Columbia now that we never use common sense or good judgment; it often comes down to who yells the loudest. So, that didn't work. That meant that I had to come out publicly, and give numbers to things I did not want to give numbers to, because I didn't see how I could

defend any particular number. I gave the numbers eventually, and some of them weren't feasible. In some forest types, it's not possible to retain as much as 70 percent. We created a target. I thought, "Let's see whether or not the guys can do it on the ground." They couldn't. They can get to 40 percent in some of the old growth, and no higher. The effort was to see what can we make work, how far can we go. We were wrong on road width, too. Those are the only two things I know about so far.

Question: You've mentioned that a lot of Canadians have now advocated copying the natural disturbance regime as a way to solve problems. Do you think they're heading down the wrong path?

Bunnell: Sure. Our mean fire size, in boreal white and black spruce, is 6,500 hectares, so we multiply that by 2.47 to get acres. It's true that the fire doesn't burn everything, but 6,500 hectares, or let's say 16,000 acres, constitute a fairly sizable clear-cut. And in some of our forest types, it is sometimes larger. Now, that's not what the public meant by natural disturbance. I think what they meant was that they were afraid of losing some things. And that's what I've been trying to say—we've got to get back to our fundamental concerns. What are we going to lose, and then how do we meet those concerns and avoid losses? And when we've met them in natural....

Natural? See the damn phrase drives me crazy, because it implies I'm unnatural. I am part of this thing. Our indigenous people and the activities that I help to create are just as natural. Sure, the rates of timber removal are different from what was happening previously. But, if we look at some of what's gone on, where do we define natural? You know, when we take pollen cores, we see that disturbance regimes change dramatically through time, and they're going to change again. Right now, we're not logging. This is true in much of northern British Columbia and Alberta. We're not logging because the ground is still muddy, hasn't frozen yet. El Nino screwed us up. We should be in there logging right now. Now, if climate warming continues, what are we going to do? What's the period in which we're going to define "natural"? The climate has been warmer than it is now. Who's going to be a part of natural? I think we can tell a lot from what pieces of the system we term "natural."

We have some marvelous places, and portions of the public want to keep those places. They want to put them into protected areas. Somehow, it hasn't gotten into their heads that there are reasons that those areas are so rich in wildlife.... In the past they burned every 7 years. You know, I think it's pointless for us to talk about what's natural and what's unnatural. What we should be talking about is, what do we really want out of this piece of land?

Or where are we afraid that we are going to lose something?

I think many are afraid of losing the species—that's what drove so many of the international agreements. And site productivity. Future options—we want to retain our flexibility. And some of us feel a moral obligation—we just want to be a good ancestor. And current and future economic opportunities. And that's what's in the international agreements. So, we aren't doing anything illegal...if those four concerns are what we tried to go back to. And I think we've been doing what's right, too. Ontario just passed a law. They are going to mimic natural disturbance regimes.... Of course, they're in the boreal forest. That's where fire is big. They're going to mimic it for 3 days, probably, before the public says, "Yeah...."

Question: How do we effectively monitor the sustainability of our forests over time? Do you have any thoughts on that?

Bunnell: Well, first we have to decide what we're going to sustain. We're going to sustain different things from a highly domesticated forest. The Swedes, you know, have been practicing fairly intensive forestry for 300 years. Now, they don't have the option of sustaining some things that we can sustain in B.C., so we've got to get past regional differences. For example, we know that our obligation in the new plantations that are just coming to harvest age in the United Kingdom is to not ship them wolves. They've already decided to get rid of their wolves. Wolves are a natural part of the system, but they don't want them back.

We've got to decide what we're trying to sustain. And I think that we kind of get screwed up there. We can link the four big concerns to applicable knowledge. When we stay with our buzzwords, we find it really difficult to connect with our history, with our experience, and with the available knowledge. But, if we talk about things like productivity, for example, we could do fairly extensive surveys just on internodal growth. And we could probably convince the public that the internodal growth hadn't shortened, under the surmise that we do this study long enough. But it's not going to be long before the goal posts move again. And then, then we may be trapped. We'll have figured out how to hold a sustained collection of values, but the values will have changed.

That's what makes forestry so exciting. So, don't go into law after all!